



[4621] – 202

Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 602 : General Topology (Credit System)
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

N.B. : i) Attempt **any five** questions.
ii) **All** questions carry **equal** marks.

1. a) Let X be a non-empty set and \mathcal{B} is a basis for a topology τ on X . Show that τ is equal to collection of all unions of members of \mathcal{B} . 4
b) Define usual topology and lower limit topology on \mathbb{R} and establish relation between them. 3
c) Let $\mathcal{B}_1 = \{(a,b) / a, b \in \mathbb{R}, a < b\}$
 $\mathcal{B}_2 = \{(a,b] / a, b \in \mathbb{R}, a < b\}$
Show that \mathcal{B}_1 and \mathcal{B}_2 forms a basis and compare the topologies generated by them. 3
2. a) Let \mathcal{B} and \mathcal{C} be basis for topologies on sets X and Y respectively then prove the collection $\mathcal{D} = \{B \times C / B \in \mathcal{B}, C \in \mathcal{C}\}$ forms a basis for product topology on $X \times Y$. 4
b) Let \mathcal{B} be a basis for a topology on a set X , $Y \subset X$, then show that $\mathcal{B}_Y = \{B \cap Y / B \in \mathcal{B}\}$ forms a basis for subspace topology on Y . 3
c) Define open maps and projection maps and show that projection maps are open and continuous. 3
3. a) In a topological space (X, \mathcal{T}) prove that
i) ϕ and X are closed
ii) Arbitrary intersection of closed sets is closed
iii) Finite union of closed sets is closed. 6
b) Let A be a subset of a topological space (X, \mathcal{T}) with usual notations prove that $\bar{A} = A \cup A'$. 2
c) Find closures of
i) Set of rational numbers
ii) Set of integers. 2
4. a) Define Hausdorff space. If X is Hausdorff space, $A \subset X$ and x is a limit point of A then show that every neighbourhood of x contains infinitely many points. 4

P.T.O.



- b) Define boundary of a set A in (X, \mathfrak{T})
 Prove that i) $\bar{A} = (\text{interior of } A) \cup \text{Boundary of } (A)$
 ii) $\text{Bd}(A) = \emptyset$ iff A is both open and closed. 3
- c) Find boundary and interior and closure of $C \subset \mathbb{R}^2$ where $C = A \cup B$
 $A = \{(x, y) / y = 0\}, B = \{(x, y) / x > 0, y \neq 0\}$ 3
5. a) If X and Y are two topological spaces and $f : X \rightarrow Y$ then prove that following are equivalent. 4
 i) f is continuous
 ii) $f(\bar{A}) \subset \overline{f(A)}$ for every $A \subset X$
 iii) For every closed set B in Y , the set $f^{-1}(B)$ is closed in X .
- b) State and prove pasting lemma. 3
- c) If $n \in \mathbb{Z}_+$ then define topology in an set of real numbers by adjoining to usual basis of open sets, the one point set $\{n\}$. Show that (\mathbb{R}, τ_1) and (\mathbb{R}, τ_2) are homeomorphic though
 $\tau_1 \neq \tau_2$ 3
6. a) If A is a connected subset of a topological space X and if $A \subset B \subset \bar{A}$ then show that B is connected. 4
 b) Give an example of connected space which is not path connected. 3
 c) Define $g : \mathbb{R}^2 \rightarrow \mathbb{R}$ as $g(x, y) = x + y^2$ show that g is a quotient map. 3
7. a) Prove that image of a compact space is compact under continuous map. 4
 b) Show that finite union of compact sets is compact. 3
 c) Prove that every compact Hausdorff space is normal. 3
8. a) State and prove Urysohn's lemma. 8
 b) State Tietze Extension theorem. 2



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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT – 501 : Real Analysis – I
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

*N.B. : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.*

1. A) If $E \subset \mathbb{R}^d$ then prove that $m_*(E) = \inf m_*(O)$, where the infimum is taken over all open sets O containing E . 5
- B) Show that a countable union of measurable sets is measurable. 3
- C) If F is differentiable at every point and F' is bounded then prove that F is of bounded variation. 2
2. A) If E is bounded subset of \mathbb{R} with $m_*(E) > 0$, then prove that a subset of E is non-measurable. 5
- B) Prove that a real-valued function F on $[a, b]$ is of bounded variation iff F is the difference of two increasing bounded functions. 3
- C) If f is integrable function on \mathbb{R} , then show that $F(x) = \int_{-\infty}^x f(t) dt$ is uniformly continuous. 2
3. A) State and prove Egorov theorem. 5
- B) If f is measurable function on \mathbb{R}^d then prove that there exists a sequence of simple function $\{\phi_k\}_{k=1}^{\infty}$ that satisfies $|\phi_k^{(x)}| \leq |\phi_{k+1}^{(x)}|$ and $\lim_{k \rightarrow \infty} \phi_k^{(x)} = f(x)$ for all x . 3
- C) If f be non-negative, bounded measurable and supported on set of finite measure and $\int f = 0$ then prove that $f = 0$ a.e. 2
4. A) Suppose $\{f_n\}_{n=1}^{\infty}$ is sequence of non-negative measurable functions with $f_n \rightarrow f$ then prove that $\lim_{n \rightarrow \infty} \int f_n = \int f$. Hence, prove that $\int \sum_{k=1}^{\infty} a_k^{(x)} dx = \sum_{k=1}^{\infty} \int a_k^{(x)} dx$, where $\{a_k^{(x)}\}$ be sequence of non-negative measurable functions. 5
- B) Show that Lebesgue measure is translation invariant. 3

P.T.O.



- C) If f is measurable function then prove that f^2 is measurable function. 2
5. A) State Fubini's theorem. If f be a measurable finite valued function on $[0,1]$ and $|f(x) - f(y)|$ is integrable on $[0,1] \times [0,1]$ then show that $f(x)$ is integrable on $[0,1]$. 4
- B) If f and g are non-negative measurable function then prove that $\int (f+g) = \int f + \int g$. 4
- C) Prove that $f(x) = \begin{cases} x^{-1/2} & , \quad 0 < x \leq 1 \\ 0 & , \quad \text{otherwise} \end{cases}$ is integrable over \mathbb{R} . 2
6. A) If f is absolutely continuous on $[a, b]$ and $f' = 0$ a.e. then show that f is constant function. 5
- B) If $\{f_n\}_{n=1}^{\infty}$ be sequence of measurable function and $\lim_{n \rightarrow \infty} f_n(x) = f(x)$ a.e. x then show that f is measurable function. 3
- C) Show that f is integrable iff f^+ and f^- are integrable functions. 2
7. A) State and prove Lebesgue differentiation theorem. 5
- B) Define support of a measurable function. Prove that, if f be a bounded function supported on a set E of finite measure and $\{\phi_n\}_{n=1}^{\infty}$ be any sequence of simple function bounded by M supported on E and $\phi_n \rightarrow f$ a.e. then $\lim_{n \rightarrow \infty} \int \phi_n$ exist. 5
8. A) State and prove Rising Sun Lemma. 5
- B) If F and G are absolutely continuous on $[a, b]$ then prove that their product FG is also absolutely continuous on $[a, b]$. 5



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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT – 501 : Real Analysis – I
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.
2) **All** questions carry **equal** marks.

1. a) Define a metric space (M, d) and if $M = \{(x_i) \in \mathbb{R}^n / x_i = 0 \text{ or } 1 \ i = 1, 2, \dots, n\}$ and for $x, y \in M$
 $d(x, y) =$ number of places in which x and y differ. Then show that (M, d) is a metric space. 6
- b) State and prove Cauchy-Schwarz inequality. 5
- c) In $e [0, 1]$ with supnorm, compute $d(f, g)$ where $f(x) = 1$ and $g(x) = x$. 5
2. a) Show that a subset of a metric space is compact iff it is sequentially compact. 6
- b) Show that Reals with discrete metric is not separable. 5
- c) Give an open cover of $(-10, 10]$ which does not have a finite subcover in Reals with usual metric. 5
3. a) Show that finite intersection of open sets is open in a metric space. Give an example to show that the word “finite” can not be omitted. 6
- b) If A and B are subsets of a metric space (M, d) then prove or disprove
 - i) $\text{Int}(A \cup B) = \text{Int}(A) \cup \text{Int}(B)$
 - ii) $\text{Int}(A \cap B) = \text{Int}(A) \cap \text{Int}(B)$. 5
- c) Find limit points of $A = \left\{ \frac{1}{n} / n \in \mathbb{Z}^+ \right\}$ and Q in reals with usual metric. 5
4. a) With usual notations define $m^*(A)$ where $A \subset \mathbb{R}^n$ and show that m^* is additive on M_f . 6
- b) If f and g are measurable functions then show that their product is also measurable. 5

P.T.O.



- c) If f and g are Lebesgue integrable functions on \mathbb{R}^n then prove that
- i) $\int cf \, d\mu = c \int f \, d\mu, c \in \mathbb{R}$
 - ii) $\int (f + g) \, d\mu = \int f \, d\mu + \int g \, d\mu.$ 5
5. a) State and prove Fatou's lemma. 6
- b) Show that a Riemann integrable function is Lebesgue integrable but converse is not true. 5
- c) Let $A = [0, 4] \times (1, 10], B = (0, 1] \times [0, 2]$ in \mathbb{R}^2 . Draw picture of $S(A, B)$ and find $D(A, B)$. 5
6. a) For $1 \leq p < \infty$ prove that $L^p(\mu)$ is a normed linear space with norm, $\|f\|_p = \left[\int_x |f|^p \, d\mu \right]^{1/p}.$ 6
- b) Show that step functions are dense in $L^p(\mu)$. 5
- c) State Holder's inequality and Riesz theorem. 5
7. a) Define an orthonormal sequence in an inner product space. Show that $\frac{1}{\sqrt{2\pi}}, \frac{\cos(nx)}{\sqrt{\pi}}, \frac{\sin(mx)}{\sqrt{\pi}}$ $n, m = 1, 2, \dots$ is orthonormal sequence in $L^2([-\pi, \pi], m)$. 8
- b) State and prove Bessel's inequality. 8
8. a) Let $f(x) = x^2$. Show that its classical Fourier series in $\frac{\pi^2}{3} + 4 \sum_{n=1}^{\infty} \frac{(-1)^n}{n^2} \cos(nx)$. 8
- b) Apply Gram-Smidt process to functions $1, x, x^2, \dots$ to obtain formulas for first three Legendre polynomials $\sqrt{\frac{2n+1}{2}} \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 - 1)^n$ for $n = 1, 2, 3$. 8



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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 605 : Partial Differential Equations
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.

1. a) Eliminate the arbitrary function F from the equation $x + y + z = F(x^2 + y^2 + z^2)$. 5
b) Find the general integral of $z(xp - yq) = y^2 - x^2$. 6
c) Explain the method of solving the following first order partial differential equations
i) $z = px + qy + g(p, q)$
ii) $g(x, p) = h(y, q)$ 5
2. a) Prove that the Pfaffian differential equation
 $\vec{x}.d\vec{r} = P(x, y, z)dx + Q(x, y, z)dy + R(x, y, z)dz = 0$ is integrable if and only if
 $\vec{x}.\text{curl } \vec{x} = 0$ 8
b) Show that following equations are compatible and find one parameter family of their common solutions $f = xp - yq - x = 0$, $g = x^2p + q - xz = 0$ 4
c) Solve the non-linear partial differential equation $zpq - p - q = 0$ 4
3. a) Find the complete integral of : $px + qy = pq$ by Charpit's method. 8
b) Find the characteristic strip of the equation $pq = ny$ and obtain the equation of integral surface through the curve : $z = x, y = 0$. 8
4. a) Reduce the equation :
 $y^2 u_{xx} - 2xy u_{xy} + x^2 u_{yy} = \frac{y^2}{x} u_x + \frac{x^2}{y} u_y$ in to cononical form and solve it. 8
b) Find the complete integral of the equation :
 $f = p^2x + q^2y - z = 0$ by Jacobi's method. 8

P.T.O.



5. a) State Dirichlet's problem for rectangle and find it's solutions. 8
 b) Using D-Alembert's solution of infinite string find solution of :

$$\frac{\partial^2 y}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 y}{\partial t^2}, \quad 0 < x < \infty, \quad t > 0$$

$$y(x, 0) = u(x), \quad u_t(x, 0) = v(x), \quad x \geq 0$$

$$y(0, t) = 0, \quad t \geq 0 \quad \text{8}$$

6. a) State and prove Kelvin's inversion theorem. 8
 b) Find the solution of the Heat-equation in an infinite rod which is defined as :

$$u_t = k u_{xx}, \quad -\infty < x < \infty, \quad t > 0$$

$$u(x, 0) = f(x), \quad -\infty < x < \infty \quad \text{8}$$

7. a) Solve the following diffusion equation using Fourier transform technique :

$$u_t = k u_{xx}, \quad -\infty < x < \infty, \quad t > 0$$

$$u(x, 0) = f(x), \quad -\infty < x < \infty \quad \text{8}$$

- b) Is the surfaces : $x^2 + y^2 + z^2 = cx^{2/3}$ equipotential ? If yes, find the potential function. 4
 c) Prove that the solution of the Neumann problem is unique upto addition of a constant. 4
8. a) State and prove Harnack theorem. 8

- b) Classify the following equations in to Hyperbolic, parabolic or elliptic type :

i) $7u_{xx} - 10u_{xy} - 22u_{yz} + 7u_{yy} - 16u_{xz} - 5u_{zz} = 0$

ii) $e^z u_{xy} - u_{xx} = \log(x^2 + y^2 + z^2 + 1)$ 8



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg – 222 : Industrial Geography
(2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

Instructions : 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question 5 and 6 are **compulsory**.
3) Draw figures/maps **wherever** necessary.
4) Figures to the right side indicate **full** marks.
5) **Use** of map stencils and calculator is allowed.

- | | |
|--|---|
| 1. a) What is regional economics ? | 2 |
| b) Describe the impact of economical factors on industrial location. | 4 |
| c) Critically examine the Israd's model. | 4 |
| 2. a) What do you mean by centralization ? | 2 |
| b) Explain the problems of cotton textile industries. | 4 |
| c) Describe the scope of industrial Geography. | 4 |
| 3. a) What is K7 model ? | 2 |
| b) What are the characteristics of industrial regions ? | 4 |
| c) Write a note on agglomeration of industries. | 4 |
| 4. a) State two names of Anglo-American industrial regions. | 2 |
| b) Discuss the favorable situation for industrial linkage. | 4 |
| c) Explain the influence of geographical factors on chemical industry. | 4 |
| 5. a) Describe 'Western European industrial region'. | 4 |
| b) Explain the nature of software industries. | 5 |
| 6. a) Explain the assumptions of Weber's industrial location theory. | 4 |
| b) Discuss the development of software industries in India. | 5 |



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Seat No.	
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M.A./ M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg – 205 : Geograpy of Disaster Management
(2013 Pattern)

Time : 2 ½ Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Questions **5 and 6** are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) Use of map stencils and Calculator is **allowed**.

- | | |
|---|---|
| 1. a) What do you mean by vulnerability ? | 2 |
| b) Discuss the nature of the hazards associated with fairs and festivals of India. | 4 |
| c) What do you mean by Pandemics ? | 4 |
| 2. a) What is a stampede ? How can it be averted ? | 2 |
| b) Identify the role of home guard in disaster management and mitigation. | 4 |
| c) Discuss the different causes of food poisoning and the nature of the disaster it creates. | 4 |
| 3. a) What do you mean by disaster resilience ? | 2 |
| b) Discuss the broad spectrum of psychological impacts of disasters. | 4 |
| c) Explain how fire is a manmade disaster. | 4 |
| 4. a) How can you relate earthquakes with landslides ? | 2 |
| b) Explain how and why fire is a manmade disaster ? | 4 |
| c) Is it possible to avert natural disasters ? Illustrate your answer with suitable examples. | 4 |
| 5. a) Differentiate risk and disaster. | 4 |
| b) What are the causes of earthquakes and volcanoes ? | 5 |
| 6. a) How do cyclones originate ? | 4 |
| b) Discuss the application of modern technologies in the management of disasters. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 301 : Geography of India with Special Reference to Maharashtra
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question No. 1 to 4.
2) Question No. 5 and 6 are **compulsory**.
3) Figures to the **right** indicate marks.
4) **Use** of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) What do you mean by Geographical location ? | 2 |
| b) State the geographical location of India. | 4 |
| c) Discuss the economic position of India with respect to the world. | 4 |
| 2. a) Illustrate the major drainage system of Maharashtra. | 2 |
| b) Describe the major west flowing rivers in India. | 4 |
| c) Describe the northern mountain division. | 4 |
| 3. a) What is weather ? | 2 |
| b) Describe the climatic regions in India. | 4 |
| c) Discuss the causes of soil degradation. | 4 |
| 4. a) Mention various types of forest. | 2 |
| b) Describe the distribution of forest in India. | 4 |
| c) Discuss the causes of deforestation. | 4 |
| 5. a) Describe the major hydro power projects in Maharashtra. | 4 |
| b) Give an account of distribution and production of wheat in India. | 5 |
| 6. a) Describe the cotton textile industry in India. | 4 |
| b) Discuss the industrial development in Maharashtra. | 5 |



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Seat No.	
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M.A./ M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 320 : Multivariate Statistics
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of calculators, statistical tables etc. is **allowed**.

1. a) Explain with suitable examples, major types of matrices. 6
b) Find the product of A*B 6

$$A = \begin{bmatrix} 120 & 131 & 325 \\ 10 & 59 & 30 \\ 78 & 99 & 250 \end{bmatrix} \quad B = \begin{bmatrix} 3 & 8 & 6 \\ 15 & 22 & 15 \\ 16 & 10 & 35 \end{bmatrix}$$

- c) Find the unknowns in the following simultaneous equations using the matrix solution. 8

$$2a - b + c = 18$$

$$a + 8b - 4c = 25$$

$$10a + 6b - 8c = 30$$

2. a) Describe in brief the nature of bivariate non-linear relationships. 5
b) For the given data fit an appropriate bivariate equation and interpret the results. 15

X	1	2	3	4	5	6	7
Y	0.3	0.6	0.9	0.5	0.6	0.2	0.1

3. Compute multiple correlation and regression from the data given below and interpret the results. 20

Y	1	4	6	9	2	3	7	10	1	7	10
X1	1	1.2	0.5	0.8	2	2.5	3.0	3.0	3.0	4.0	3.5
X2	1.8	1.7	1.6	1.5	1.8	1.6	2.0	2.0	2.0	2.2	2.5

P.T.O.



4. The following table depicts the variations in temperature of ponds developed in a region. Obtain the equation and plot the linear trend surface for the given data. 20

X	1	4	6	9	2	3	7	10	1	7	10
Y	1	1.2	0.5	0.8	2	3	7	10	1	7	10
Z (temp in °C)	18	17	16	15	18	16	20	20	20	22	25

5. Find the first two principal components from the given correlation matrix and interpret the results. 20

	X1	X2	X3	X4	X5
X1	1.0	0.7	0.3	0.5	0.7
X2		1.0	0.1	0.2	0.5
X3			1.0	0.9	0.3
X4				1.0	0.8
X5					1.0

6. Extract first factor of loadings, calculate Eigen vector and explained variance for the data given in Q. 5. Interpret the results. 20
7. Write notes on **any two**. 20
- i) Trend surface Analysis
 - ii) Factor scores
 - iii) Applications of FA in human geography.



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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg – 103 : Principles of Economic Geography
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

- Instructions :** 1) Attempt **any three** questions from Q. 1 to Q. 6.
2) Questions 7 and 8 are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

1. a) What do you mean by economic geography ? 2
- b) Describe the scope of study of economic geography. 4
- c) Describe the nature of economic geography. 4
2. a) What do you mean by homestead economy ? 2
- b) Describe the characteristics of village economy. 4
- c) Explain the Weber's model of industrial location. 4
3. a) What do you mean by economies of scale ? 2
- b) How are the countries classified according to economic development ? 4
- c) Explain the Rostow's Model of economic development. 4
4. a) Define international trade. 2
- b) Explain the economic factors influencing the international trade. 4
- c) Discuss the problems and prospects of international trade. 4
5. a) How is the level of economic development measured ? 2
- b) Give a brief history of economic development post-independent India. 4
- c) Explain the role of privatization and globalization in the economic development of India. 4

P.T.O.



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|---|---|
| 6. a) What do you mean by hypothesis ? | 2 |
| b) What are the types of hypothesis in economic geography ? | 4 |
| c) Write a note on formation of hypothesis. | 4 |
| 7. a) Give the importance of natural resources in Economic development. | 5 |
| b) What are the attributes of human resources ? What role they play in economic development ? | 5 |
| 8. a) 'Land, labour and capital are the basic elements of production'. Discuss. | 5 |
| b) Explain the external economies of scale. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg – 201 : Quantitative Techniques in Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- N.B. :** 1) Attempt **any four** questions.
2) **Use** of calculator and statistical table is **allowed**.
3) Figures to the **right** indicate **full** marks.

1. a) Write a note on inferential statistics. 6
- b) Calculate mean and median for the following data. The table shows the annual floods discharge (Q 000 m³/s) of a river. Comment. 14

Class (Q 000 m ³ /s)	2 – 4	4 – 6	6 – 8	8 – 10	10 – 12	12 – 14	14 – 16	16 – 18	18 – 20
Frequency	18	28	16	17	04	01	03	02	01

2. a) Write a note on skewness. 6
- b) Calculate variance for the following data of size of pebbles in mm in a pot hole. 14

Class	1– 50	51– 100	101 – 150	151– 200	201– 250	251– 300
Frequency	5	10	21	10	6	5

3. a) Write properties of normal probability distribution. 6
- b) Probability of failure of students in a theory paper is 0.3. If 6 students appear for examination, find out the probability that 14
- i) 4 students would pass
- ii) 5 students would pass
- iii) 6 students would pass

P.T.O.



4. a) Define time series and write its meaning. 6
- b) Calculate 5-year moving average for the following data of annual rainfall totals in cm for Stanly Moor (England). Plot the data and interpret. 14

Year	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942
Rainfall in cm	106	138	125	103	128	132	118	117	120	114
Year	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952
Rainfall in cm	130	104	144	108	152	119	135	155	134	116

5. a) What is explained variance ? 6
- b) The following table gives the data of elevation in meter and average annual rainfall (AAR) in cm in an area. Obtain the linear regression equation. Plot the regression line and scatter gram. 14

Elevation (m)	250	440	430	480	310	160	530	470	320	430
AAR (mm)	173	233	206	188	170	126	212	300	174	205

6. Apply the Chi-square test to find out whether there is difference between in their opinion regarding construction of dam across a river. A significance level of 0.05 is to be tested. 20

Opinion →	Yes	No	No Opioon
Category ↓			
Farmers	12	30	40
Farm workers	6	70	23
Service persons	25	15	04

7. Write short notes on **any two**. 20
- a) Nature of Geographical data
- b) Null and Alternate Hypothesis
- c) Population and Sample.



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 306 : Geoinformatics – III
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question numbers 1 to 4.
2) Question numbers **5 and 6** are **compulsory**.
3) Figures to the **right** indicate **full** marks.
4) **Use of map stencils and calculator is allowed.**

- | | |
|--|---|
| 1. a) Define Digital Terrain Model. | 2 |
| b) What is global operation ? | 4 |
| c) Explain simple grid operations in data analysis. | 4 |
| 2. a) Explain any two analytical tasks in spatial analysis. | 2 |
| b) Highlight the importance of DEM. | 4 |
| c) Explain complex grid operations in data analysis. | 4 |
| 3. a) What do you understand by systematic errors in Digital Image Processing (DIP) ? | 2 |
| b) Explain radiometric sources of distortions in acquisition of satellite image. | 4 |
| c) Describe the procedure of georeferencing the satellite image. | 4 |
| 4. a) What do you understand by non systematic errors in DIP ? | 2 |
| b) What do you understand by confusion matrix ? | 4 |
| c) Distinguish between parallel piped and MXL classifiers. | 4 |
| 5. a) Give a brief account of mapping accuracy in DIP. | 4 |
| b) Give a brief account of spatial modeling as an analytical task in spatial analysis. | 5 |
| 6. a) Describe the importance of supervised classification in DIP. | 4 |
| b) Give a brief account of Image enhancement in DIP. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 313 : Urban Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use of map stencils is allowed.**

1. Explain the nature and scope of Urban Geography in details.
2. Describe the contemporary factors of urbanization.
3. Explain the functional classification of American cities by C.D. Harris.
4. Describe the general characteristics of rural-urban fringe.
5. Discuss the rank-size relationship and hierarchy of urban settlements.
6. Discuss the urban transport problem.
7. Write notes on **any two** :
 - a) Demarcation of CBD
 - b) Age-sex structure of urban population
 - c) Urban development and policy in India.

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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 601 : General Topology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : 1) Attempt **any five** questions.
 2) Figures to the **right** indicates **full** marks.

1. a) Let X be a set. Let $\tau_f = \{U \subseteq X : X \setminus U \text{ either is finite or is all of } X\}$. Prove that τ_f is a topology on X . 6
- b) Let X be a set. Prove that the collection of one point subsets of X is a basis for the discrete topology on X . 6
- c) Prove that the topology \mathbb{R}_l on \mathbb{R} is strictly finer than the standard topology on \mathbb{R} . 4
2. a) If $\{\tau_\alpha\}$ is a family of topologies on X , show that $\bigcap \tau_\alpha$ is a topology on X . Is $\bigcup \tau_\alpha$ a topology on X ? Justify. 6
- b) Let $X = \{a, b, c\}$. Let $\tau_1 = \{\phi, X, \{a\}, \{a, b\}\}$ and $\tau_2 = \{\phi, X, \{a\}, \{b, c\}\}$. Find the smallest topology containing τ_1 and τ_2 . Also find the largest topology contained in τ_1 and τ_2 . 5
- c) Prove that the order topology on \mathbb{Z}_+ is the discrete topology on \mathbb{Z}_+ . 5
3. a) If \mathcal{B} is a basis for the topology of X and \mathcal{C} is a basis for the topology of Y , then prove that the collection $\mathcal{D} = \{B \times C : B \in \mathcal{B} \text{ and } C \in \mathcal{C}\}$ is a basis for the topology of $X \times Y$. 6
- b) Let Y be a subspace of X . If U is open in Y and Y is open in X , then prove that U is open in X . 4
- c) Let A be a subset of the topological space τ . Prove that $x \in \bar{A}$ if and only if every open set U containing x intersects A . 6
4. a) Prove that every finite point set in a Hausdorff space X is closed. 6
- b) Show that the topological space X is Hausdorff if and only if the diagonal $\Delta = \{x \times x \mid x \in X\}$ is closed in $X \times X$. 6
- c) If the sets C and D forms a separation of a topological space X , and if Y is a connected subspace of X then prove that Y lies entirely within either C or D . 4
5. a) State and prove pasting lemma. 6
- b) Prove that the image of a connected space under a continuous map is connected. 6
- c) Let $\{A_n\}$ be a sequence of connected subspaces of X , such that $A_n \cap A_{n+1} \neq \phi$, for all n , show that $\bigcup_n A_n$ is connected. 4

P.T.O.



6. a) Prove that a topological space X is locally connected if and only if for every open set U of X , each component of U is open in X . **6**
- b) Show that the compact subspace of a Hausdorff space is closed. **6**
- c) Let $f : X \rightarrow Y$ be a bijective continuous function. If X is compact and Y is Hausdorff, then prove that f is a homeomorphism. **4**
7. a) Let X be a topological space. Then prove that X is compact if and only if for every collection \mathcal{C} of closed sets in X having the finite intersection property, the intersection $\bigcap_{C \in \mathcal{C}} C$ of all elements of \mathcal{C} is non empty. **8**
- b) Prove that compactness implies limit point compactness. Is converse true ? Justify. **5**
- c) Show that not every first countable space is second countable. **3**
8. a) State and prove Tychonoff theorem. **10**
- b) State Tietze extension theorem and Urysohn lemma. **4**
- c) Define the following terms with examples : **2**
- i) Limit point compactness
 - ii) Local compactness.



[4621] – 301

Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT – 701 : Combinatorics
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. A) Find ordinary generating function whose coefficient a_r equals $3r^2$. Hence, evaluate the sum $0 + 3 + 12 + \dots + 3n^2$. 5
- B) How many non-negative integer solutions are there to the inequalities $x_1 + x_2 + x_3 + \dots + x_6 \leq 20$ and $x_1 + x_2 + x_3 \leq 7$? 3
- C) Solve the recurrence relation $a_n = 2a_{n/2} + 5$, with $a_2 = 1$
[Assume that, n is a power of 2]. 2
2. A) Find a recurrence relation for the number of ways to arrange flags on an n -foot flagpole, using three types of flags : red flags two feet high, yellow flags one foot high and blue flags one foot high. 5
- B) How many arrangements of letters in REPETITION are there with the first E occurring before the first T ? 3
- C) Find the rook polynomial for a full $n \times n$ board. 2
3. A) Prove by combinatorial argument that
$$\binom{r}{r} + \binom{r+1}{r} + \binom{r+2}{r} + \dots + \binom{n}{r} = \binom{n+1}{r+1}.$$
 4
- B) In a class of 30 children, 20 take Latin, 14 take Greek, and 10 take Hebrew. If no child takes all three languages and 8 children take no language, how many children take Greek and Hebrew ? 4
- C) Find a generating function for the number of ways to write the integer r as a sum of positive integers in which no integer appears more than three times. 2
4. A) How many arrangements are there of MATHEMATICS with both T's before both A's or both A's before both M's or both M's before the E ?
[By "before", we mean anywhere before, not just immediately before.] 5
- B) How many sequences of length 5 can be formed using the digits 0, 1, 2, ... 9 with the property that exactly two of the 10 digits appear. (e.g. 05550) 3
- C) How many subsets of three different integers between 1 and 90 inclusive are there whose sum is an even number ? 2

P.T.O.



5. A) How many ways are there to divide five pears, five apples, five doughnuts, five lollipops, five chocolate cats and five candy rocks into two (unordered) piles of 15 (fifteen) objects each ? 5
- B) How many arrangements of 1, 1, 1, 1, 2, 3, 3 are there with the 2 not beside either 3 ? 3
- C) Find a generating function for the number of integers between 0 and 9, 99, 999 whose sum of digits is r. 2
6. A) How many ways are there to make an r-arrangement of pennies, nickels, dimes and quarters with at least one penny and an odd number of quarters ?
[Coins of the same denomination are identical] 5
- B) Solve the recurrence relation 3
 $a_n = a_{n-1} + 3n^2, a_0 = 10$
- C) Find the coefficient of x^{25} in $(1 + x^3 + x^8)^{10}$. 2
7. A) Find recurrence relations for the number of n-digit ternary sequences with an even number of 0's and an even number of 1's. 5
- B) How many ways are there to distribute 25 identical balls into six distinct boxes with at most 6 balls in any of the first three boxes ? 5
8. A) A computer dating service wants to match six men, denoted $M_1, M_2, M_3, M_4, M_5, M_6$ each with one of six women, denoted $W_1, W_2, W_3, W_4, W_5, W_6$.
 If man M_1 is incompatible with women W_2 and W_4 , man M_2 is incompatible with W_1 and W_5 , man M_3 is compatible with all womens, man M_4 is incompatible with women W_2 and W_5 , man M_5 is incompatible with woman W_4 and man M_6 is incompatible with woman W_6 , how many matches of the six men are there ? 5
- B) Using generating function, solve the recurrence relation : 5
 $a_n = 3a_{n-1} - 2a_{n-2} + 2$ with $a_0 = a_1 = 1$.
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Seat No.	
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M.A. / M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT – 701 : Functional Analysis
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.

1. a) State and prove Hahn – Banach theorem. 8
b) Show that an operator T on a finite dimensional Hilbert space H is normal if and only if its adjoint T^* is a polynomial in T . 6
c) Show that the norm of an isometry is one. 2
2. a) Let H be a Hilbert space and f be a functional on H . Prove that there exists a unique vector $y \in H$ such that $f(x) = \langle x, y \rangle$ for every $x \in H$. 8
b) Let X be a normed space over \mathbb{C} . Let $0 \neq a \in X$. Show that there is some functional f on X such that $f(a) = \|a\|$ and $\|f\| = 1$. 6
c) Find M^\perp if $M = \{(x, y) : x + y = 0\} \subset \mathbb{R}^2$. 2
3. a) Show that a closed convex subset C of a Hilbert space H contains a unique vector of smallest norm. 6
b) i) Let X and Y be normed spaces. If X is finite dimensional, then show that every linear transformation from X to Y is continuous. 4
ii) Give an example of a discontinuous linear transformation. 4
c) A linear operator $T : l^2 \rightarrow l^2$ is defined by

$$T(x_1, x_2, x_3, \dots, x_n, \dots) = \left(x_1, \frac{x_2}{2}, \frac{x_3}{3}, \dots, \frac{x_n}{n}, \dots\right) \text{ Find } T^* . \quad 2$$

P.T.O.



4. a) If T is an operator on a Hilbert space H , then prove that T is normal if and only if its real and imaginary parts commute. 6
- b) If T is any operator on a Hilbert space H and if α, β are scalars such that $|\alpha| = |\beta|$, then show that $\alpha T + \beta T^*$ is normal. 4
- c) If T is an operator on a Hilbert space H for which $\langle T x, x \rangle = 0$ for all $x \in H$, then prove that $T = 0$. 6
5. a) State and prove the uniform boundedness principle. 8
- b) Show that the unitary operators on a Hilbert space H form a group. 4
- c) Let $\{A_n\}$ be a sequence in $B(H)$ and $A \in B(H)$ such that $\|A_n - A\| \rightarrow 0$ as $n \rightarrow \infty$. If each A_n is self-adjoint, then show that A is self-adjoint. 4
6. a) Let Y be a closed subspace of a normed linear space X . Show that a sequence $\{x_n + Y\}$ converges to $X + Y$ in X/Y if and only if there is a sequence $\{y_n\}$ in Y such that $\{x_n + y_n\}$ converges to x in X . 8
- b) Show that every positive operator on a finite dimensional Hilbert space has a positive square root. 4
- c) Let T be an operator on H . If T is non-singular then show that $\lambda \in \sigma(T)$ if and only if $\lambda^{-1} \in \sigma(T^{-1})$. 4
7. a) State and prove the closed Graph Theorem. 8
- b) Let $X = C^1[a, b]$ with norm given by $\|f\| = \|f\|_\infty + \|f'\|_\infty$ and $Y = C^0[a, b]$ with sup norm. Let $F : X \rightarrow Y$ be defined as identity map. Show that F is continuous but F^{-1} is discontinuous. Why open mapping theorem fails? Justify. 8
8. a) Let T be a normal operator on H with spectrum $\{\lambda_1, \lambda_2, \dots, \lambda_m\}$. Show that T is self-adjoint if and only if each λ_i is real. 4
- b) Let M be a closed linear subspace of a normed linear space N and T be a natural mapping of N on to N/M defined by $T(x) = x + M$. Show that $\|T\| \leq 1$. 4
- c) Prove that every finite dimensional subspace of a normed linear space X is closed. Give an example of a subspace which is not closed. 8



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M.A./M.Sc. (Semester – IV) Examination, 2014
MATHEMATICS
MT-802 : Combinatorics
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. A) a) How many even five-digit numbers (leading zeros not allowed) are there ? 6
b) How many five-digit numbers are there with exactly one 3 ?
c) How many five digit numbers are there that are the same when the order of their digits is inverted (e.g. 15251) ?

- B) Prove by combinatorial argument that $\binom{r}{r} + \binom{r+1}{r} + \binom{r+2}{r} + \dots + \binom{n}{r} = \binom{n+1}{r+1}$. Hence, evaluate the sum $1^2 + 2^2 + \dots + n^2$. 6
- C) Find two different chessboards (not row or column rearrangements of one another) that have the same rook polynomial. Also, write the rook polynomial. 4
2. A) What fraction of all arrangements of INSTRUCTOR have three consecutive vowels ? 7
B) How many arrangements are there of TAMELY with either T before A, or A before M or M before E ? (By before, we mean anywhere before, not just immediately before) 5
C) How many non-negative integer solutions are there to the pair of equations $x_1 + x_2 + \dots + x_6 = 20$ and $x_1 + x_2 + x_3 = 7$? 4
3. A) How many ways are there to place an order for 12 chocolate sundaes if there are 5 types of sundaes and at most 4 sundaes of one type are allowed ? 6
B) Find ordinary generating function whose coefficient a_r equals r . Hence evaluate the sum $0 + 1 + 2 + \dots + n$. 6
C) How many distributions of 24 different objects into three different boxes are there with twice as many objects in one box as in the other two combined ? 4
4. A) How many ways are there to collect \$24 from 4 children and 6 adults if each person gives atleast \$1, but each child can give at most \$4 and each adult at most \$7 ? 6
B) Using generating function, find the number of distributions of 18 chocolate bunny rabbits into four Easter baskets with atleast 3 rabbits in each basket. 6
C) Show that if $n + 1$ distinct numbers are chosen from $1, 2, \dots, 2n$, then two of the numbers must always be consecutive integers. 4

P.T.O.



5. A) How many ways are there to distribute eight different toys among four children if the first child gets atleast two toys ? 6
- B) How many n-digit decimal sequences (using digits 0, 1, 2, ..., 9) are there in which digits 1, 2, 3 all appear ? 6
- C) Solve the recurrence relation $a_n = 2a_{n/2} + 2$, $n \geq 4$ with $a_2 = 1$. 4
6. A) Using generating functions, solve the recurrence relation $a_n = a_{n-1} + 2$ with $a_0 = 1$. 6
- B) How many ways are there to assign 20 different people to three different rooms with atleast one person in each room ? 6
- C) Solve the recurrence relation $a_n = 3a_{n-1} + n^2 - 3$, with $a_0 = 1$. 4
7. A) Find recurrence relation for the number of n-digit binary sequences with an even number of zeros. 6
- B) Solve the recurrence relation $a_n = a_{n-1} + n(n-1)$ with $a_0 = 3$. 6
- C) How many arrangements of the letters in MATHEMATICS are there in which TH appear together but the TH is not immediately followed by an E ? 4
8. A) How many ways are there to send six birthday cards, denoted $C_1, C_2, C_3, C_4, C_5, C_6$ to three aunts and three uncles, denoted $A_1, A_2, A_3, U_1, U_2, U_3$; if aunt A_1 would not like cards C_2 and C_4 ; if A_2 would not like C_1 or C_5 ; if A_3 likes all cards; if U_1 would not like C_1 or C_5 ; if U_2 would not like C_4 ; and if U_3 would not like C_6 ? 8
- B) Solve the recurrence relation $a_n^2 = 2a_{n-1}^2 + 1$ with $a_0 = 1$. 4
- C) Show that in any set of n integers, $n \geq 3$, there always exists a pair of integers whose difference is divisible by $n - 1$. 4



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M.A./M.Sc. (Semester – IV) Examination, 2014
MT – 805 : LATTICE THEORY
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

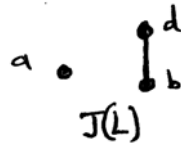
N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. a) Let the poset $L = \langle L; \leq \rangle$ be a lattice. Set $a \wedge b = \inf \{a, b\}$ and $a \vee b = \sup \{a, b\}$. Prove that the algebra $L^a = \langle L; \wedge, \vee \rangle$ is a lattice. 5
- b) Prove that I is a prime ideal of a lattice L if and only if there is a homomorphism ϕ of L onto C_2 with $I = \phi^{-1} \{0\}$. 5
- c) Let I be an ideal and let D be a dual ideal. If $I \cap D \neq \phi$ then show that $I \cap D$ is a convex sublattice, and every convex sublattice can be expressed in this form in one and only one way. 6
2. a) Prove that a lattice is distributive if and only if every element has at most one relative complement in any interval containing it. 5
- b) Prove that a lattice L is distributive if and only if the identity $(x \wedge y) \vee (y \wedge z) \vee (z \wedge x) = (x \vee y) \wedge (y \vee z) \wedge (z \vee x)$ holds in L . 5
- c) Let L be lattice and $\text{Con}(L)$ be the set of all its congruences. Prove that $\text{Con}(L)$ is a lattice. 6
3. a) Let L be a distributive lattice with 0 . Show that $\text{Id}(L)$ is pseudocomplemented. Is the converse true ? Justify. 5
- b) Let P be a poset and $H(P)$ be the set of all hereditary subsets of P . Prove that $H(P)$ is a distributive lattice. 5
- c) Let $I = \{a_1, \dots, a_n\}$ be a set of n atoms of a semimodular lattice. Prove that the following conditions are equivalent. 6
 - 1) I is independent.
 - 2) $(a_1 \vee \dots \vee a_i) \wedge a_{i+1} = 0$, for $i = 1, 2, \dots, n - 1$.
 - 3) $(a_1 \vee \dots \vee a_n) = n$.
4. a) Prove that if a lattice L is finite then L and $\text{Id}(L)$ are isomorphic. 5
- b) Prove that in a distributive lattice L , an element j is join-irreducible if and only if $L - (j)$ is a prime ideal. 5

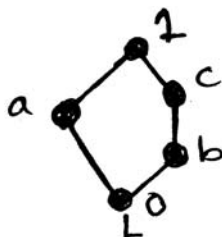
P.T.O.



- c) Let L be a finite distributive lattice with the set of join-irreducibles $J(L)$ as a subset of L depicted in the following figure. Construct L , using the fact that $L \cong H(J(L))$. 6



5. a) Prove that in a distributive lattice every maximal ideal is prime. 5
 b) Let L be a lattice and $a, b \in L$. If aMb and bM^*a (that is, dual of bMa) hold in L then prove that $[a \wedge b, b] \cong [a, a \vee b]$. 5
 c) Prove a lattice is a chain if and only if every ideal is a prime ideal. 6
6. a) Let L be a bounded distributive lattice with $0 \neq 1$. Then prove that L is Boolean if and only if $P(L)$, the set of prime ideals of L is unordered. 8
 b) Let L be a lattice of finite length. If L is semimodular then prove that any two maximal chains of L are of the same length. 8
7. a) Prove a lattice is modular if and only if it does not contain a pentagon. 8
 b) Let L be a distributive lattice and let I and D be ideal and dual ideal of L respectively such that $I \cap D = \phi$. Prove that there is a prime ideal P such that $I \subseteq P$ and $P \cap D = \phi$. 8
8. a) Prove that a lattice L is distributive if and only if for any two ideals I and J of L ;
 $I \vee J = \{i \vee j \mid i \in I, j \in J\}$. 8
 b) Find a set of all congruence relations on a lattice L shown in the following figure. 8





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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT – 502 : Advanced Calculus
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

Instructions : 1) Attempt **any five** questions.

2) Figures to the **right** indicate **full** marks.

1. a) Let the partial derivatives $D_1f, \dots, D_n f$ of scalar field f exist in some n -ball $B(\bar{a})$ and are continuous at \bar{a} . Prove that f is differentiable at \bar{a} . 5
- b) Let \bar{f} be a vector field having the values in \mathbb{R}^m . Prove that \bar{f} is continuous at a point if and only if each component $f_k, k = 1, \dots, m$ is continuous at that point. 3
- c) State the Inverse function Theorem. 2
2. a) State and prove chain rule for derivatives of vector fields. 5
- b) Let $\bar{f} : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ and $\bar{g} : \mathbb{R}^3 \rightarrow \mathbb{R}^2$ be two vector fields defined as follows.
 $\bar{f}(x, y) = e^{(x+2y)}\bar{i} + \sin(y + 2x)\bar{j}$ $\bar{g}(u, v, w) = (u + 2v^2 + 3w^2)\bar{i} + (2v - u^2)\bar{j}$ compute the Jacobian matrix $D\bar{h}(1, -1, 1)$. Where $\bar{h} = \bar{f} \circ \bar{g}$. 3
- c) Find the directional derivative of the scalar field $f(x, y) = x^2 - 3xy$ along the parabola $y = x^2 - x + 2$ at the point $(1, 2)$. 2
3. a) State and prove second fundamental theorem of calculus for line integrals. 5
- b) Let \bar{f} be a vector field continuous on an open connected set S in \mathbb{R}^n . If the line integral of \bar{f} is zero around every piecewise smooth closed path in S then prove that the line integral of \bar{f} is independent of the path in S . 3
- c) Determine whether or not the vector field $\bar{f}(x, y) = 3x^2y\bar{i} + x^3y\bar{j}$ is a gradient on any subset of \mathbb{R}^2 . 2
4. a) Let $\bar{\alpha}$ and $\bar{\beta}$ be equivalent piecewise smooth paths. Prove that $\int_C \bar{f} \cdot d\bar{\alpha} = \int_C \bar{f} \cdot d\bar{\beta}$ if $\bar{\alpha}$ and $\bar{\beta}$ trace out C in the same direction and $\int_C \bar{f} \cdot d\bar{\alpha} = -\int_C \bar{f} \cdot d\bar{\beta}$ if $\bar{\alpha}$ and $\bar{\beta}$ trace out C in the opposite directions. 4
- b) Compute the value of the line integral $\int_C \frac{dx + dy}{|x| + |y|}$ where C is the square with vertices $(1, 0), (0, 1), (-1, 0)$ and $(0, -1)$ transversed once in a clockwise direction. 4



- c) Compute the mass M of one coil of a spring having the shape of the helix whose vector equation is $\vec{\alpha}(t) = a \cos t \vec{i} + a \sin t \vec{j} + bt \vec{k}$ if density at (x, y, z) is $x^2 + y^2 + z^2$. 2
5. a) Define step function over rectangle θ . Define double integral of a step function over rectangle θ . If f is constant function on interior of rectangle θ find the double integral of f over θ . 4
- b) Evaluate the double integral $\iint_{\theta} (x^3 + 3x^2y + y^3) dx dy$ where $\theta = [0,1] \times [0,1]$. 3
- c) Transform the integral to polar co-ordinates and compute its value.
- $$\int_0^1 \left[\int_{x^2}^x (x^2 + y^2)^{-1/2} dy \right] dx .$$
- 3
6. a) Let $\vec{r}(T)$ be a smooth parametric surface, C^* be a smooth curve in T and $C = \vec{r}(C^*)$ is a smooth curve lying on the surface. Prove that at each point of C the fundamental vector product is normal to C . 4
- b) Compute the fundamental vector product of $\vec{r}(u, v) = (x_0 + a_1u + b_1v) \vec{i} + (y_0 + a_2u + b_2v) \vec{j} + (z_0 + a_3u + b_3v) \vec{k}$. 3
- c) Compute the surface area of a hemisphere of radius 'a' using surface integral. 3
7. a) Let $\vec{f}(x, y) = P(x, y) \vec{i} + Q(x, y) \vec{j}$ be a vector field that is continuously differentiable on an open simply connected set S in the plane. Prove that \vec{f} is a gradient on S if and only if $\frac{\partial P}{\partial y} = \frac{\partial Q}{\partial x}$ everywhere on S . 5
- b) Consider the mapping defined by the equations $x = u + v, y = v - u^2$
- i) Compute the Jacobian determinant $J(u, v)$.
 - ii) A triangle T in the uv -plane has vertices $(0, 0), (2, 0), (0, 2)$. Describe, by means of a sketch, its image S in the xy -plane.
 - iii) Calculate the area of S by a double integral extended over S and also by a double integral extended over T .
- iv) Evaluate $\iint_S (x - y + 1)^{-2} dx dy$. 5
8. a) State and prove Stokes Theorem. 5
- b) Determine the Jacobian matrix and compute the curl and divergence of \vec{F} where $\vec{F}(x, y, z) = x^2 \sin y \vec{i} + y^2 \sin(xz) \vec{j} + xy \sin(\cos z) \vec{k}$. 5



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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT-503 : Group Theory (Credit System)
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

N.B. : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.

1. a) State the converse of Lagrange's theorem for finite groups. 5
Prove that the converse of Lagrange's theorem holds for finite cyclic groups.
- b) Find the order of the element $A = \begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix}$ in the group $SL(z, \mathbb{R})$. If we view A as a member of $SL(z, \mathbb{Z}_p)$, p is prime, then what is the order of A ? 5
2. a) If the pair of cycles $\alpha = (a_1, a_2, \dots, a_m)$ and $\beta = (b_1, b_2, \dots, b_n)$ have no entries in common then prove that $\alpha\beta = \beta\alpha$. 5
- b) Show that every element in A_n for $n \geq 3$ can be expressed as a 3-cycle or a product of three cycles. 5
3. a) With usual notation prove that $\text{Aut}(z_n) \simeq U(n)$. 5
- b) With usual notation, prove or disprove $(\mathbb{Q}, +) \simeq (\mathbb{R}^+, \times)$. 5
4. a) If G and H are finite cyclic groups then prove that $G \oplus H$ is cyclic if and only if $|G|$ and $|H|$ are relatively prime. 5
- b) The group $S_3 \oplus Z_2$ is isomorphic to one of the following groups. 5
 $Z_{12}, Z_6 \oplus Z_2, A_4, D_6$. Determine which one by elimination?
5. a) Let G be a group and let $z(G)$ be the centre of G . If $\frac{G}{z(G)}$ is cyclic then prove that G is abelian. 5
- b) i) Prove or disprove
The group S_3 is the internal direct product of its two proper subgroups. 5
- ii) If G is non-abelian group of order p^3 (p is prime) and $z(G) \neq \{e\}$ then prove that $|z(G)| = p$.

P.T.O.



6. a) Let $\phi: G \rightarrow \overline{G}$ be a group homomorphism and let $g \in G$. 5
 If $\phi(g) = g' \in \overline{G}$ then prove that $\phi^{-1}(g') = g \ker \phi$.
- b) Determine all homomorphic images of D_4 (upto isomorphism). 5
7. a) Let G be a finite abelian group of order $p^n m$ where p is prime that does not divide m . Then
 prove that $G = H \times K$ where $H = \{x \in G \mid x^{p^n} = e\}$ and $K = \{x \in G \mid x^m = e\}$. 5
- b) Find all abelian groups of order 360. 5
8. a) For any finite group G , prove that

$$|G| = |Z(G)| + \sum |G : (\sigma a)|$$
 5
 Where the sum runs over representatives of all conjugacy classes with more than one element.
- b) i) State Sylow's theorems.
 ii) Prove that a group of order 175 is abelian. 5



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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT – 505 : Ordinary Differential Equations
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

N.B. : 1) Attempt **any five** questions.

2) Figures to the **right** indicate **full** marks.

1. a) Let $y_1(x)$ and $y_2(x)$ be two solutions of the equation $y'' + P(x)y' + Q(x)y = 0$ on the interval $[a, b]$. Prove that $y_1(x)$ and $y_2(x)$ are linearly dependent on $[a, b]$ if and only if their Wronskian is identically zero. 5
- b) Find the general solution of differential equation $y'' - y' - 6y = 20e^{-2x}$ by using method of undetermined coefficients. 3
- c) Show that $y = c_1e^x + c_2e^{-x}$ is the general solution of $y'' - y = 0$ on any interval. 2
2. a) Explain the method of solving the linear non-homogeneous differential equation $y'' + P(x)y' + Q(x)y = R(x)$ by using variation of parameters. 5
- b) If $y_1 = x$ is one solution of $x^2y'' + xy' - y = 0$, then find y_2 and the general solution. 3
- c) Replace the differential equation $\frac{d^2x}{dt^2} + P(t)\frac{dx}{dt} + Q(t)x = 0$ by an equivalent system of first order equations. 2
3. a) State and prove Sturm comparison theorem. 5
- b) Find the normal form of the equation $x^2y'' + xy' + \left(x^2 - \frac{1}{4}\right)y = 0$. 3
- c) Locate and classify the singular points on the x-axis of $(3x + 1)xy'' - (x + 1)y' + 2y = 0$. 2



4. a) Find two independent Frobenius series solutions of differential equation $2x^2y'' + xy' - (x + 1)y = 0$ about regular singular point 0. 5
- b) Find the indicial equation and its root for the following differential equation $4x^2y'' + (2x^4 - 5x)y' + (3x^2 + 2)y = 0$. 3
- c) Find the power series solution of differential equation $xy' = y$. 2
5. a) Solve the system
- $$\frac{dx}{dt} = -3x + 4y$$
- $$\frac{dy}{dt} = -2x + 3y.$$
- 5
- b) Determine the nature of point $x = \infty$ for the equation $x^2y'' + 4xy' + 2y = 0$. 3
- c) Find the critical point of
- $$\frac{dx}{dt} = y^2 - 5x + 6$$
- $$\frac{dy}{dt} = x - y.$$
- 2
6. a) Find the general solution of differential equation $x(1-x)y'' + \left(\frac{3}{2} - 2x\right)y' + 2y = 0$ about regular singular point 0. 5
- b) Find all solutions of the nonautonomous system
- $$\frac{dx}{dt} = x$$
- $$\frac{dy}{dt} = x + e^t.$$
- 3
- c) Show that the function $E(x, y) = 2x^2 - 3xy + 3y^2$ is positive definite. 2



7. a) If m_1 and m_2 are roots of auxiliary equation of the system

$$\frac{dx}{dt} = a_1x + b_1y$$

$$\frac{dy}{dt} = a_2x + b_2y$$

which are conjugate complex but not pure imaginary, then prove that the critical point $(0, 0)$ is a spiral.

5

b) Find the general solution of $(1 - x^2)y'' - 2xy' + p(p + 1)y = 0$ about $x = 0$ by power series method.

5

8. a) Find the exact solution of initial value problem $y' = y^2$, $y(0) = 1$ starting with $y_0(x) = 1$. Apply Picard's method to calculate $y_1(x)$, $y_2(x)$, $y_3(x)$ and compare these results with the exact solution.

5

b) Let $f(x, y)$ be a continuous function that satisfies a Lipschitz condition $|f(x, y_1) - f(x, y_2)| \leq k|y_1 - y_2|$ on a strip defined by $a \leq x \leq b$ and $-\infty < y < \infty$. If (x_0, y_0) is any point on the strip, then prove that the initial value problem $y' = f(x, y)$, $y(x_0) = y_0$ has one and only one solution $y = f(x)$ on the interval $[a, b]$.

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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT-502 : Advanced Calculus
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.

2) Figures to the **right** indicate **full** marks.

1. a) Define directional derivative of a scalar field, show that the existence of directional derivative at point need not imply the continuity of the function. 8
- b) Let $f(x, y) = \frac{x^2y^2}{x^2y^2 + (x-y)^2}$ where $x^2y^2 + (x-y)^2 \neq 0$. Show that iterated limits of $f(x, y)$ exists but $f(x, y)$ does not tend to a limit as $(x, y) \rightarrow (0, 0)$. 4
- c) Give an example to show that the existence of all partial derivative of a scalar field f at a point does not necessarily imply that f is differentiable at that point. 4
2. a) Let f be a scalar field defined on an open set S in \mathbb{R}^n and let \bar{r} be a vector valued function which maps an interval $J \subseteq \mathbb{R}$ into S . Define the composite function $g = f \circ \bar{r}$ on J by the equation $g(t) = f(\bar{r}(t))$ $t \in J$. If for $t \in J$, $\bar{r}'(t)$ exists and if f is differentiable at $\bar{r}(t)$ then prove that $g'(t)$ exists. 6
- b) Let z be a function of u and v where $u = x^2 - y^2 - 2xy$ and $v = y$. Find $(x+y)\frac{\partial z}{\partial x} + (x-y)\frac{\partial z}{\partial y}$. 5
- c) If a vector field \bar{f} is differentiable at \bar{a} then prove that \bar{f} is continuous at \bar{a} . 5
3. a) Define the line integral. State the basic properties of line integral. 6
- b) Evaluate the directional derivative of scalar field $f(x, y, z) = 3x - 5y + 2z$ at $(2, 2, 1)$ in the direction of the outward normal to the sphere $x^2 + y^2 + z^2 = 9$. 5
- c) Calculate the line integral of $\int_C (x^2 - 2xy)dx + (y^2 - 2xy)dy$ where C is a path from $(-2, 4)$ to $(1, 1)$ along the parabola $y = x^2$. 5

P.T.O.



4. a) State and prove first fundamental theorem of calculus for line integral. 8
- b) Find the amount of work done by the force $f(x, y) = (x^2 - y^2)\bar{i} + 2xy\bar{j}$ in moving a particle in a counter-clockwise direction once around a square bounded by the co-ordinate axis and the lines $x = a$ and $y = a$ $a > 0$. 4
- c) Let S be the set of all $(x, y) \neq (0, 0)$ in \mathbb{R}^2 and let \bar{f} be the vector field defined on S by the equation
- $$\bar{f}(x, y) = \frac{-y}{x^2 + y^2} \bar{i} + \frac{x}{x^2 + y^2} \bar{j}. \text{ Show that } D_1 f_2 = D_2 f_1 \text{ everywhere on } S \text{ but } \bar{f} \text{ is not a gradient on } S. \quad 4$$
5. a) Define double integral of a bounded function over a rectangle, prove that every function which is bounded on a rectangle θ has a lower integral $\underline{\int} f$ and an upper integral $\bar{\int} f$, further prove that f is integrable over θ if and only if its upper and lower integrals are equal. 8
- b) Evaluate $\iint_{\theta} \sin^2 x \sin^2 y \, dx \, dy$
- Where $\theta = [0, \pi] \times [0, \pi]$. 4
- c) State only the general formula for change of variable in double integrals. Explain the notation used. 4
6. a) State and prove the Green's theorem for plane regions bounded by piecewise smooth Jordan curve. 8
- b) Use Green's theorem to compute the work done by the force field $f(x, y) = (y + 3x)\bar{i} + (2y - x)\bar{j}$ in moving a particle once around the ellipse $4x^2 + y^2 = 4$ in the counter clockwise direction. 4
- c) Evaluate $\iiint_S xy^2 z^3 \, dx \, dy \, dz$ where S is the solid bounded by the surface $z = xy$ and the plane $y = x$, $x = 1$ and $z = 0$. 4



7. a) Discuss the independence of the surface integral under change of parametric representation. 6
- b) Consider the hemisphere given by $\vec{r}(u, v) = a \cos u \cos v \vec{i} + a \sin u \cos v \vec{j} + a \sin v \vec{k}$ where $T = [0, 2\pi] \times \left[0, \frac{\pi}{2}\right]$. Find $\frac{\partial \vec{r}}{\partial u} \times \frac{\partial \vec{r}}{\partial v}$ and what are the singular point of this surface. 5
- c) Transform the surface integral $\iint_S (\text{curl } \vec{F}) \cdot \vec{n} \, ds$ to a line integral by the use of Stoke's theorem and then evaluate the line integral $\vec{F}(x, y, z) = y\vec{i} + z\vec{j} + x\vec{k}$ where S is the portion of the paraboloid $z = 1 - x^2 - y^2$ with $z \geq 0$ and \vec{n} is the unit normal with a non negative z component. 5
8. a) State and prove Divergence Theorem. 8
- b) Determine the Jacobian matrix and compute the curl and divergence of vector field $F(x, y, z) = xy^2z^2\vec{i} + z^2 \sin y\vec{j} + x^2e^y\vec{k}$. 5
- c) In usual notation show that $\text{Curl } \vec{F} = \nabla \times \vec{F}$. 3
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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT-503 : Linear Algebra
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.

2) **All** questions carry **equal** marks.

1. a) Let V and W be finite dimensional vector spaces over a field K . Prove that V is isomorphic to W if and only if $\dim V = \dim W$. Hence deduce that the vector space of polynomials of degree up to n over \mathbb{R} is isomorphic to \mathbb{R}^{n+1} . 6
- b) Find the basis and dimension of the following subspaces of the vector space V of $n \times n$ matrices over \mathbb{R} : 5
 - i) the set of all symmetric matrices.
 - ii) the set of all skew-symmetric matrices.
- c) Prove that if A is an $n \times n$ nilpotent matrix over \mathbb{R} , then $A^n = 0$. 5
2. a) Let V be a finite dimensional vector space and W be a subspace of V . Prove that $\dim V = \dim W + \dim V/W$. Give an example of an infinite dimensional vector space V for which $\dim V = \dim W = \dim V/W$, 6
- b) Let V be a $2n$ -dimensional vector space and let W_1 and W_2 be $(n + 1)$ dimensional subspaces of V . Prove that $\dim(W_1 \cap W_2) \geq 2$. 5
- c) Let V be a vector space over \mathbb{R} and let $V = W \oplus X$. Let R be a linear operator on V defined by $R(w + x) = w - x$ for $w \in W, x \in X$. Prove that 5
 - i) $R^2 = I$;
 - ii) R is diagonalizable.

P.T.O.



3. a) Define the direct sum of the vector spaces, Let V_1, V_2, \dots, V_m be finite dimensional vector spaces over K . Prove that the vector space $V_1 \oplus V_2 \oplus \dots \oplus V_m$ is finite dimensional if and only if each V_i is finite dimensional. In this case, show that
- $$\dim (V_1 \oplus V_2 \oplus \dots \oplus V_m) = \dim V_1 \oplus \dim V_2 \oplus \dots \oplus \dim V_m. \quad 6$$
- b) Let T be a linear operator on a finite dimensional vector space V over K . Prove that if the matrix representation of T with respect to all bases of V is the same, then $T = \alpha I$ for some scalar α . 5
- c) Let $T : \mathbb{R}^3 \rightarrow \mathbb{R}^2$ be given by $T(x, y, z) = (2x + 4y - 2z, x - y + z)$. Write the matrix representation of T with respect to the ordered bases $\{(0, 1, 1), (1, 0, 1), (1, 1, 0)\}$ and $\{(1, 1), (1, -1)\}$. 5
4. a) Let T be a linear operator on a vector space of dimension n . Define an eigenvalue and an eigenvector of T . Prove that eigenvalues of T may not exist. Find all eigenvalues and eigenvectors of identity operator. 6
- b) Prove that similar matrices have the same characteristic polynomial but the converse is not true. 5
- c) State the Cayley Hamilton Theorem. Using this theorem, find all possible minimal polynomials if the characteristic polynomial is $x^2(x-1)^3(x+1)$. 5
5. a) Let T be a linear operator on an n -dimensional vector space V over K . Prove that the characteristic polynomial of T splits over K if and only if T is triangulable. 6
- b) Let T be a linear operator on a finite dimensional vector space V . Prove that if T is diagonalizable, then $V = \ker T \oplus \text{im } T$. 5
- c) Find the minimal and characteristic polynomials of the following two matrices: 5

$$\begin{pmatrix} 1 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{pmatrix} \quad \begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$



6. a) Let T be a triangulable linear operator on a finite dimensional vector space V over K .
Prove that if T is nilpotent, then V has a Jordan basis. 6
- b) Define the rational canonical form of a linear operator. Give all possible rational canonical forms if the characteristic polynomial is $(x^2 + 1)(x - 1)^3$. 5
- c) Write all possible Jordan canonical forms if the characteristic polynomial is $(x - 2)^3(x - 3)^2$. 5
7. a) Prove that multiplication of two $n \times n$ upper triangular matrices over \mathbb{R} is an upper triangular matrix. Also, prove that the inverse of an upper triangular matrix over \mathbb{R} is an upper triangular matrix. 6
- b) Let V be an inner product space over \mathbb{R} . Prove that $\|u + v\| \leq \|u\| + \|v\|$ for any $u, v \in V$.
When does equality occur? Justify your answer. 5
- c) Find W^\perp if W is a subspace of \mathbb{R}^4 generated by the two vectors $(2, 1, 2, 0)$ and $(3, 1, 1, 1)$. 5
8. a) Let T be a self adjoint operator on a finite dimensional inner product space V . Prove that T is positive definite if and only if all eigenvalues of T are positive. Hence deduce that if T is a positive definite operator, then so is T^{-1} . 6
- b) Find the unitary matrix whose first two columns are $\left(\frac{1}{\sqrt{3}}, \frac{-1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$ and $\left(0, \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$. 5
- c) Prove that the eigenvalues of a self adjoint operator are real. Also prove that a normal operator with all real eigenvalues is self adjoint. 5
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M.A./M.Sc. (Semester – I) Examination, 2014
MATHEMATICS
MT-505 : Ordinary Differential Equations
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.

1. a) If $y_1(x)$ is one solution of the differential equation $y'' + P(x)y' + Q(x)y = 0$, then find the other solution y_2 . 5
- b) Verify that $y_1 = 1$ and $y_2 = \log x$ are linearly independent solutions of a equation $y'' + (y')^2 = 0$ on any interval to the right of origin. 5
- c) Find the general solution of $y'' + 10y' + 25y = 14e^{-5x}$ by method of undetermined coefficients. 6
2. a) State and prove Sturm separation theorem. 8
- b) Find the particular solution of differential equation $y'' + y = f(x)$ by using method of variation of parameters. 8
3. a) Find normal form of equation $y'' + P(x)y' + Q(x)y = 0$. 5
- b) Show that $y = C_1e^x + C_2e^{2x}$ is the general solution of $y'' - 3y' + 2y = 0$ on any interval. 3
- c) If $y_1(x)$ and $y_2(x)$ are any two solutions of equation $y'' + P(x)y' + Q(x)y = 0$ on $[a, b]$, then prove that their Wronskian $W(y_1, y_2)$ is either identically zero or never zero on $[a, b]$. 8
4. a) Verify that origin is a regular singular point and calculate two independent Frobenius series solution for the equation $2x^2y'' + x(2x + 1)y' - y = 0$. 8
- b) Let $u(x)$ be any non-trivial solution of $u'' + q(x)u = 0$ where $q(x) > 0$ for all $x > 0$. If $\int_1^{\infty} q(x)dx = \infty$, then prove that $u(x)$ has infinitely many zeros on the positive x-axis. 8
5. a) Find the general solution of the system 8
$$\frac{dx}{dt} = 3x - 4y$$
$$\frac{dy}{dt} = x - y$$



- b) Locate and classify the singular points on the x-axis of $x^3(x-1)y'' - 2(x-1)y' + 3xy = 0$. 4
- c) Prove that the function $E(x, y) = ax^2 + bxy + cy^2$ is positive definite if and only if $a > 0$ and $b^2 - 4ac < 0$. 4
6. a) Find the general solution near $x = 0$ of hypergeometric equation $x(1-x)y'' + [c - (a+b+1)x]y' - aby = 0$ where a, b, c are constants. 8
- b) Find the exact solution of initial value problem $y' = y^2, y(0) = 1$, starting with $y_0(x) = 1$. Apply Picard's method to calculate $y_1(x), y_2(x), y_3(x)$ and compare these with exact value. 8
7. a) If m_1 and m_2 are roots of the auxiliary equation of the system
- $$\frac{dx}{dt} = a_1x + b_1y$$
- $$\frac{dy}{dt} = a_2x + b_2y$$
- Which are real, distinct and of opposite sign, then prove that critical point $(0, 0)$ is a saddle point. 8
- b) For the system
- $$\frac{dx}{dt} = -y$$
- $$\frac{dy}{dt} = x$$
- i) Find the critical points.
 ii) Find the differential equation of the path.
 iii) Solve this equation to find the paths.
 iv) Sketch any two of the paths. 8
8. a) Find the general solution of $y'' + xy' + y = 0$ about $x = 0$ by power series method. 8
- b) Show that the function $f(x, y) = xy^2$ satisfies Lipschitz condition on any rectangle $a \leq x \leq b$ and $c \leq y \leq d$, but it does not satisfy a Lipschitz condition on any strip $a \leq x \leq b$ and $-\infty < y < \infty$. 8



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT-601 : Complex Analysis
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

N.B. : i) Attempt **any five** questions.

ii) Figures to the **right** indicate **full** marks.

1. a) Suppose $f = u + iv$ is complex-valued function defined on an open set Ω . If u and v are continuously differentiable and satisfy the Cauchy-Riemann equations on Ω , then prove that f is holomorphic on Ω and $f'(z) = \frac{\partial f}{\partial z}$. 5
- b) If f is holomorphic in a region Ω and $f' = 0$, then prove that f is constant. 3
- c) If $\frac{\partial}{\partial z} = \frac{1}{2} \left(\frac{\partial}{\partial x} + i \frac{\partial}{\partial y} \right)$ and $\frac{\partial}{\partial \bar{z}} = \frac{1}{2} \left(\frac{\partial}{\partial x} - i \frac{\partial}{\partial y} \right)$, then show that $4 \frac{\partial}{\partial z} \frac{\partial}{\partial \bar{z}} = 4 \frac{\partial}{\partial \bar{z}} \frac{\partial}{\partial z} = \Delta$ where Δ is the Laplacian $\Delta = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$. 2
2. a) If f and g are holomorphic in Ω , then prove that fg is holomorphic in Ω . Also prove that $(fg)' = f'g + fg'$. 5
- b) Prove that a holomorphic function in an open disc has a primitive in the disc. 3
- c) Determine the radius of convergence of the series $\sum_{n=1}^{\infty} a_n z^n$ where $a_n = n!$. 2
3. a) If f is holomorphic in an open set Ω and $C \in \Omega$ is a circle whose interior is also contained in Ω , then prove that $f_{(z)}^{(n)} = \frac{n!}{2\pi i} \int_C \frac{f(\xi)}{(\xi - z)^{n+1}} d\xi$ for all z in the interior of C . 5
- b) State and prove Cauchy inequalities. 3
- c) State symmetry principle. 2

P.T.O.



4. a) Suppose f is holomorphic in an open set Ω , and $K \subset \Omega$ is compact. Then prove that

there exists finitely many segments $\gamma_1, \gamma_2, \dots, \gamma_N$ in $\Omega - K$ such that $f(z) = \sum_{n=1}^N \frac{1}{2\pi i} \int_{\gamma_n} \frac{f(\xi)d\xi}{\xi - z}$

for all $z \in K$.

5

b) Prove that every non constant polynomial $P(z) = a_n z^n + a_{n-1} z^{n-1} + \dots + a_1 z + a_0$ with complex coefficients has a root in \mathbb{C} .

3

c) Show that if $|a| < r < |b|$, then $\int_r \frac{dz}{(z-a)(z-b)} = \frac{2\pi i}{a-b}$ where γ denotes the circle centered at the origin of radius r . with positive orientation.

2

5. a) If f has a pole of order n at z_0 , then prove that

$$f(z) = \frac{a_{-n}}{(z-z_0)^n} + \frac{a_{-n+1}}{(z-z_0)^{n-1}} + \dots + \frac{a_{-1}}{z-z_0} + G(z)$$

where G is a holomorphic function in a neighbourhood of z_0 .

5

b) Suppose that f is holomorphic in an open set containing a circle C and its interior, inside C .

Then prove that $\int_C f(z) dz = \sum_{k=1}^N \text{res}(f)$.

3

c) State argument principle.

2

6. a) State and prove Riemann's theorem on removable singularities.

4

b) Suppose that f has an isolated singularity at the point z_0 . Then prove that z_0 is a pole of f if and only if $|f(z)| \rightarrow \infty$ as $z \rightarrow z_0$.

4

c) Find the residue of $f(z) = \frac{e^{az}}{1+e^z}$ at $z = \pi i$.

2

7. a) State and prove open mapping theorem.

5

b) Prove that $\int_{-\infty}^{\infty} \frac{1-\cos x}{x^2} = \pi$.

5

8. a) If f is a nowhere vanishing holomorphic function in a simply connected region Ω , then prove that there exists holomorphic function g on Ω such that $f(z) = e^{g(z)}$.

5

b) If f is holomorphic in a disc $D_R(z_0)$, then prove that $f(z_0) = \frac{1}{2\pi} \int_0^{2\pi} f(z_0 + re^{i\theta}) d\theta$ for any $0 < r < R$.

5



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 604 : Linear Algebra
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

N.B. : 1) Answer **any five** questions.

2) Figures to the **right** indicate **full** marks.

3) **Use** of non-programmable, scientific calculator is **allowed**.

1. A) Let V be a vector space over F and a subset B of V be a basis of V then show that every element in V has a unique expression as a linear combination of elements of B . 5
- B) Find a basis of the subspace of \mathbb{R}^3 generated by the vectors $V_1 = (1, 0, -1)$; $V_2 = (1, 2, 1)$; $V_3 = (0, -3, 2)$. 3
- C) Let $F^{2 \times 2}$ be the vector space of all 2×2 matrices over F and $W_1 = \left\{ \begin{pmatrix} X & Y \\ Z & O \end{pmatrix} \mid X, Y, Z \in F \right\}$.
Show that W_1 is subspace of $F^{2 \times 2}$. 2
2. A) If V and U are vector spaces over F and $f : V \rightarrow U$ is a linear mapping from V onto U , with Kernel K then show that $U \cong V/K$. Further, there is a one-to-one correspondence between the set of subspaces of V containing K and the set of subspaces of U . 5
- B) Let $f : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear mapping defined by $f(a, b, c) = (a, a+b, 0)$. Find the matrices A and B respectively of the linear mapping f with respect to the standard basis (e_1, e_2, e_3) and the basis (e'_1, e'_2, e'_3) where $e'_1 = (1, 1, 0)$, $e'_2 = (0, 1, 1)$, $e'_3 = (1, 1, 1)$. 5
3. A) If U, V are finite-dimensional vector spaces over F and $\phi : V \rightarrow U$ is a linear mapping, A is the matrix of ϕ with respect to some given bases B, C of U, V respectively then prove that $\text{rank } A = \text{rank } \phi$. 5
- B) Let $f : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ be a Linear mapping, where $f(a, b) = (2a + b, 3a - 5b)$. Find a basis for a range of f and hence determine the rank of f . 3
- C) Let $f : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be defined by $f(x_1, x_2, x_3) = (x_1, x_1 + x_2, x_1 + x_2 + x_3)$. Show that f is linear mapping. 2

P.T.O.



4. A) If $A \in F^{n \times n}$ matrix has n distinct eigen values $\lambda_1, \lambda_2, \dots, \lambda_n$ then show that there exists an invertible matrix P such that $P^{-1}AP = \text{diag}(\lambda_1, \lambda_2, \dots, \lambda_n)$. 5

B) The three eigen vectors $\begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 \\ -1 \\ 0 \end{pmatrix}$ of a 3×3 matrix A are associated respectively with eigen values $1, -1$ and 0 . Find matrix A . 3

C) Determine the eigen values of the matrix $A = \begin{bmatrix} 1 & 2 & 1 \\ 1 & -1 & 1 \\ 2 & 0 & 1 \end{bmatrix}$, if exist. 2

5. A) Reduce the following matrix into triangular form

$$A = \begin{bmatrix} 1 & -3 & 3 \\ 0 & -1 & 2 \\ 0 & -3 & 4 \end{bmatrix} \quad \text{5}$$

B) Find the Jordan Canonical form of

$$A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 1 \\ 0 & 1 & 3 \end{bmatrix} \quad \text{5}$$

6. A) Let B be a non-degenerate form on V then prove that the following 6

i) $(T+U)^* = T^* + U^*$

ii) $(TU)^* = U^* T^*$

iii) $T^{**} = T$

B) If B is a symmetric bilinear form on a vector space V over field F and $\text{char}(F) \neq 2$ then prove that there exists an orthogonal basis of V relative to B . 4

7. A) Prove that, if T is a self-adjoint operator on a finite-dimensional euclidean vector space E then there is an orthonormal basis E consisting of eigen vectors of T . 5

B) Show that if λ is an eigen value of a normal operator T , then $\bar{\lambda}$ is an eigen value of T^* . 5

8. A) State and prove Sylvester's theorem. 6

B) If matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ -1 & 2 & 1 \\ 0 & 1 & 3 \end{bmatrix}$ then find a matrix P such that

$$P^{-1}AP = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \quad \text{4}$$



Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MT-605 : PARTIAL DIFFERENTIAL EQUATIONS
(2013 Pattern) (Credit System)

Time : 3 Hours

Max. Marks : 50

N.B. : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.

1. a) Find the complete integral of the equation $y^2p - xyq = x(z - 2y)$. 5
b) Eliminate the parameters a and b from the equation $2z = (ax + y)^2 + b$. 3
c) State the condition for the equations $f(x, y, z, p, q) = 0$ and $g(x, y, z, p, q) = 0$ to be compatible on domain D. 2
2. a) Verify that the following Pfaffian differential equation is integrable and find its primitive $(y^2 + yz) dx + (xz + z^2) dy + (y^2 - xy) dz = 0$. 5
b) Explain the method of solving the first order partial differential equation, $f(x, y, z, p, q) = 0$. 3
c) Solve : $yz dx + xz dy + xy dz = 0$. 2
3. a) If $h_1 = 0$ and $h_2 = 0$ are compatible with $f = 0$ then prove that h_1 and h_2 satisfy
$$\frac{\partial(f, h_1)}{\partial(x, u_x)} + \frac{\partial(f, h_1)}{\partial(y, u_y)} + \frac{\partial(f, h_1)}{\partial(z, u_z)} = 0.$$
 5
b) Find the complete integral of the equation : 3
$$U_x^2 + U_y^2 + U_z = 1,$$
 by Jacobi's method.
c) Derive the analytic expression for Monge Cone at (x_0, y_0, z_0) . 2
4. a) Find the complete integral of partial differential equation $z^2(p^2 + q^2) = 1$ by Charpit's method. 5
b) Find the two initial strip for the equation
$$z = \frac{1}{2}(p^2 + q^2) + (p - x)(q - y)$$
 which passes through the x-axis. 3
c) State Harnack's theorem. 2

P.T.O.



5. a) Find the integral surface of the equation : $pq = z$ passing through curve $c : x_0 = 0, y_0 = s, z_0 = s^2$. 5
- b) Reduce the equation : $U_{xx} + x U_{yy} = 0$ in the region $x < 0$ to canonical forms. 3
- c) Is the surface $x^2 + y^2 + z^2 = c x^{2/3}$ equipotential ? If yes, then find potential function. 2

6. a) If $u(x, y)$ is harmonic in bounded domain D and continuous in $\bar{D} = D \cup B$, then u attains its maximum on the boundary B of D . 5
- b) Prove that if the solution of following problem exist, then it is unique. 5

$$u_{tt} - c^2 u_{xx} = F(x, t), \quad 0 < x < t, t > 0$$

$$u(n, 0) = f(x), \quad 0 \leq x \leq e$$

$$u_t(x, 0) = g(x)$$

$$u(0, t) = u(e, t), \quad t \geq 0.$$

7. a) State and prove Kelvin's Inversion theorem. 5
- b) Prove that for the equation :

$$L_U = U_{xy} + \frac{1}{4} U = 0$$

the Riemann function is :

$$V(x, y, \alpha, \beta) = J_0(\sqrt{(x - \alpha)(y - \beta)})$$

where J_0 denote the Bessel's function of the first kind of order zero. 5

8. a) Using Duhamel's principle, find the solution of non-homogenous heat equation : 5

$$u_t + K u_{xx} = F(x, t), \quad -\infty < x < \infty, t > 0$$

$$u(x, 0) = 0, \quad -\infty < x < \infty.$$

- b) Classify the following equation into Hyperbolic Parabolic or Elliptic type.

$$u_{xx} + 2u_{yz} + \cos x u_z - e^{y^2} u = \cosh z. \quad \text{5}$$



Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 602 : Differential Geometry
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : i) Attempt **any five** questions.

ii) Figures to the **right** indicate **full** marks.

1. a) Let S be an n -surface in \mathbb{R}^{n+1} , let $\alpha : I \rightarrow S$ be a parametrized curve in S , let $t_0 \in I$ and $V \in S_{\alpha(t_0)}$. Prove that there exists a unique vector field V tangent to S along α , which is parallel and has $V_{(t_0)} = V$. 6
- b) Sketch the following vector fields on $\mathbb{R}^2 : X(p) = (p, X(p))$ where
 - i) $X(p) = -p$
 - ii) $X(x_1, x_2) = (-x_2, x_1)$. 4
- c) Consider a vector field $X(x_1, x_2) = (x_1, x_2, 1, 0)$ on \mathbb{R}^2 . For $t \in \mathbb{R}$ and $p \in \mathbb{R}^2$, let $\phi_t(p) = \alpha_p(t)$ where α is the maximal integral curve of X through P . Show that $F(t) = \phi_t$ is a homo-morphism of additive group of real numbers into the invertible linear maps of the plane. 6
2. a) Let S be a connected n -surface in \mathbb{R}^{n+1} . Show that on S , there exists exactly two smooth unit normal vector fields N_1 and N_2 . 6
- b) Show that the Weingarten map of the n -sphere of radius r oriented by inward normal is multiplication by $\frac{1}{r}$. 5
- c) Show that the graph of any smooth function $f : \mathbb{R}^n \rightarrow \mathbb{R}$ is an n -surface in \mathbb{R}^{n+1} . 5



3. a) Show that the covariant differentiation has the following property : $(X \cdot Y)' = X' \cdot Y + X \cdot Y'$. 5
- b) Let $a, b, c, d \in \mathbb{R}$ be such that $ac - b^2 > 0$. Show that the maximum and minimum values of the function $g(x_1, x_2) = ax_1^2 + 2bx_1x_2 + cx_2^2$ on the unit circle $x_1^2 + x_2^2 = 1$ are eigen values of the matrix $\begin{pmatrix} a & b \\ b & c \end{pmatrix}$. 6
- c) Show that the 1-form η on $\mathbb{R}^2 - \{0\}$ defined by $\eta = \frac{-x_2}{x_1^2 + x_2^2} dx_1 + \frac{x_1}{x_1^2 + x_2^2} dx_2$ is not exact. 5
4. a) Let U be an open subset of \mathbb{R}^{n+1} and $f: U \rightarrow \mathbb{R}$ be a smooth function. Let $S = f^{-1}(c)$ $c \in \mathbb{R}$ and $\nabla f(q) \neq 0 \forall q \in S$. If $g: U \rightarrow \mathbb{R}$ is smooth function and $p \in S$ is an extreme point of g on S , then show that there exists a real number λ such that $\nabla g(p) = \lambda \nabla f(p)$. 6
- b) Let S denote the cylinder $x_1^2 + x_2^2 = r^2$ of radius r in \mathbb{R}^3 . Show that α is a geodesic of S if and only if α is of the form $\alpha(t) = (r \cos(at + b), r \sin(at + b), (t + d))$ for some real numbers a, b, c, d . 6
- c) Find the velocity, acceleration and speed of the curve $\alpha(t) = (\cos t, \sin t)$. 4
5. a) Let U be an open subset in \mathbb{R}^{n+1} and $f: U \rightarrow \mathbb{R}$ be a smooth function. Let $p \in U$ be a regular point of f and let $c = f(p)$. Show that the set of all vectors tangent to $f^{-1}(c)$ at p is equal to $[\nabla f(p)]^\perp$. 6
- b) Find the curvature of the circle with centre (a, b) and radius r , oriented by the outward normal. 5
- c) Let $\alpha(t) = (x(t), y(t))$ be a local parametrization of the oriented plane curve C . Show that $k \circ \alpha = \frac{x'y'' - y'x''}{(x'^2 + y'^2)^{3/2}}$. 5
6. a) Prove that on each compact oriented n -surface S in \mathbb{R}^{n+1} there exists a point p such that the second fundamental form at p is definite. 6
- b) Show that the speed of a geodesic is constant. 5
- c) If an n -surface S contains a straight line segment, then show that it is geodesic in S . 5



7. a) Show that the Weingarten map L_p is self-adjoint (that is $L_p(v) \cdot W = V \cdot L_p(w)$ for all $v, w \in S_p$). 6

b) Let C be a connected oriented plane curve and $\beta: I \rightarrow C$ be a unit speed global parametrization of C . Show that β is either one to one or periodic. 5

c) Find the integral curve of the vector field X given by $X(x_1, x_2) = (x_1, x_2, -x_2, x_1)$ through the point $(1, 0)$. 5

8. a) Let S be an n -surface in \mathbb{R}^{n+1} and $P \in S$. Prove that there exists an open set V about P in \mathbb{R}^{n+1} and a parametrized n -surface $\phi: U \rightarrow \mathbb{R}^{n+1}$ such that ϕ is one to one map from U onto $V \cap S$. 8

b) Let S be the ellipsoid $\frac{x_1^2}{a^2} + \frac{x_2^2}{b^2} + \frac{x_3^2}{c^2} = 1$ a, b, c all non-zero, oriented by the outward normal. Show that the Gaussian curvature of S is $k(p) = \frac{1}{a^2 b^2 c^2 \left(\frac{x_1^2}{a^4} + \frac{x_2^2}{b^4} + \frac{x_3^2}{c^4} \right)^2}$. 8



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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 604 : Complex Analysis
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. a) If $\sum_{n=0}^{\infty} a_n z^n$ is a given power series with radius of convergence R, then prove that

$$R = \lim_{n \rightarrow \infty} \left| \frac{a_n}{a_{n+1}} \right|, \text{ if this limit exists.} \quad 6$$

- b) Find the radius of convergence of the power series $\sum_{n=0}^{\infty} k^n z^n$, where k is integer $\neq 0$. 5
- c) Define an analytic function. If $f : G \rightarrow \mathbb{C}$ is differentiable at a point 'a' in G, then prove that f is continuous at a. 5

2. a) If z and z' are points in the extended complex plane \mathbb{C}_{∞} and d (z, z') denote distance

between z and z', then derive the expression $d(z, z') = \frac{2|z - z'|}{\left[(1 + |z|^2)(1 + |z'|^2) \right]^{1/2}}$. 8

- b) Define Möbius transformation. Prove that every Möbius transformation maps circles of \mathbb{C}_{∞} onto circles of \mathbb{C}_{∞} . 5
- c) Evaluate the cross ratio (i - 1, ∞ , 1 + i, 0). 3

3. a) If G is open and connected and $f : G \rightarrow \mathbb{C}$ is differentiable with $f'(z) = 0$ for all z in G, then prove that f is constant. 6

- b) Let f be analytic in the disk B (a ; R) and suppose that γ is any closed rectifiable curve in B (a ; R). Then prove that $\int_{\gamma} f = 0$. 5

- c) Let $\gamma_{(t)} = e^{it}$ for $0 \leq t \leq 2\pi$. Then find $\int_{\gamma} \frac{dz}{z^2 + 1}$. 5

P.T.O.



4. a) Let $f : G \rightarrow \mathbb{C}$ be analytic and suppose $\overline{B(a; r)} \subset G$ ($r > 0$). If $\gamma(t) = a + re^{it}$, $0 \leq t \leq 2\pi$, then prove that $f(z) = \frac{1}{2\pi i} \int_{\gamma} \frac{f(w)}{w-z} dw$ for $|z-a| < r$. 8
- b) State and prove Cauchy's estimate. 4
- c) Evaluate the integral $\int_{\gamma} \frac{\sin z}{z^3} dz$, $\gamma(t) = e^{it}$, $0 \leq t \leq 2\pi$. 4
5. a) State and prove Fundamental theorem of algebra. 6
- b) If $\gamma : [0, 1] \rightarrow \mathbb{C}$ is a closed rectifiable curve and $a \notin \{\gamma\}$, then prove that $\frac{1}{2\pi i} \int_{\gamma} \frac{dz}{z-a}$ is an integer. 5
- c) Let $f(z) = |z|^2 = x^2 + y^2$ for $z = x + iy \in \mathbb{C}$. Show that f is continuous. Also show that f does not have a primitive. 5
6. a) Let G be connected open set and let $f : G \rightarrow \mathbb{C}$ be an analytic function. Then prove that the following are equivalent statements 8
- i) $f \equiv 0$
 - ii) there is a point a in G such that $f_{(a)}^{(n)} = 0$ for each $n \geq 0$.
 - iii) $\{z \in G : f(z) = 0\}$ has a limit point in G .
- b) State and prove Goursat's theorem. 8
7. a) State and prove Casorati Weierstrass theorem. 6
- b) If f has a pole of order m at $z = a$ and let $g(z) = (z-a)^m f(z)$, then prove that $\text{Res}(f; a) = \frac{1}{(m-1)!} g_{(a)}^{(m-1)}$. 5
- c) Show that for $a > 1$, $\int_0^{\pi} \frac{d\theta}{a + \cos \theta} = \frac{\pi}{\sqrt{a^2 - 1}}$. 5
8. a) State and prove Rouché's theorem. 6
- b) State and prove Schwarz's Lemma. 5
- c) Let $f(z) = \frac{1}{z(z-1)(z-2)}$, give the Laurent series expansion of $f(z)$ for annulus ann $(0; 0, 1)$. 5



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
MATHEMATICS
MT – 606 : Object Oriented Programming with C++
(2008 Pattern)

Time : 2 Hours

Max. Marks : 50

- N.B :** i) Question **one** is **compulsory**.
ii) Attempt **any two** questions from Q.2, Q.3 , and Q. 4.
iii) Figures to the **right** indicate **full** marks.

1. Attempt **any ten** of the following : **20**
- i) What are drawbacks of procedure oriented programming languages ?
 - ii) Write a function to read a matrix of size 5 x 6 from the keyboard using “for” loop.
 - iii) Write a program to multiply and divide two real numbers a = 3.5 and b = 2.5 using inline functions.
 - iv) Give an example of structure in C++.
 - v) Define friend function.
 - vi) Define hybrid inheritance.
 - vii) Identify the error in the following program

```
# include < iostream. h >
Void main ( )
{
int num [ ] = { 1, 2, 3, 4, 5, 6 } ;
num [ 1 ] = = [ 1 ] num ? Cout << “Success”
Cout << “Error” ;
}
```
 - viii) Write down the steps of operator over loading.
 - ix) What is reference variable ?
 - x) Interpret the following statement

```
int * inarray [ 10 ] ;
```
 - xi) When do we need to use default arguments in a function ?
 - xii) What is data encapsulation ?
2. a) Write a C ++ program to sort given array of integers in ascending order. **5**
- b) Compare dynamic memory management in C and C ++ **5**
- c) Write a note on local classes. **5**

P.T.O.



- | | |
|---|---|
| 3. a) What is difference between constructor and destructor ? | 5 |
| b) Write a note on general form of class declaration. | 5 |
| c) Write a program in C ++ to find simple interest. | 5 |
| 4. a) State the difference between if else statement and switch statement. | 5 |
| b) Write benefits of OOP (Object Oriented Programming). | 5 |
| c) Write a program to find square root of the number using inline function. | 5 |



[4621] – 302

Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT-702 : Field Theory (Credit System)
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

- N.B. :** i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.
iii) F, K denote the fields.

1. a) Let $p(x) \in F[x]$ be an irreducible polynomial over a field F . Prove that there exist an extension $K = \frac{F(x)}{\langle p(x) \rangle}$ of F in which $f(x)$ has a root. 5
- b) Show that $p(x) = x^3 + 9x + 6$ is irreducible in $\mathbb{Q}[x]$. Let θ be a root of $P(x)$. Find the inverse of $1 + \theta$ in $\mathbb{Q}(\theta)$ (\mathbb{Q} = set of all rational numbers). 5
2. a) Prove that the element α is algebraic over the field F if and only if the simple extension $F(\alpha)/F$ is finite. 5
- b) Prove that if $[F(\alpha):F]$ is odd then $F(\alpha) = F(\alpha^2)$. 5
3. a) Let K_1 and K_2 be two finite extensions of a field F contained in K . Prove that $[K_1K_2 : F] \leq [K_1 : F][K_2 : F]$. Under what condition (s), the above equality hold ? 5
- b) Find the smallest integer angle in terms of degree which is constructable by ruler and compass. 5
4. a) Prove that a splitting field of a polynomial of degree n over F is of degree at most $n!$ over F . 5
- b) Determine the splitting field and its degree over \mathbb{Q} for $x^3 - 2$. 5
5. a) Prove that every irreducible polynomial over a field of characteristic 0 is separable. 5
Also prove that a polynomial over such a field is separable if and only if it is the product of distinct irreducible polynomials.
- b) i) Examine whether $x^4 + x + 1 \in \mathbb{Q}[x]$ is a separable polynomial. 3
ii) Illustrate by an example that a normal extension of a normal extension need not be a normal extension. 2

P.T.O.



6. a) State the fundamental theorem of Galois Theory. Also state any 3 properties which hold under the correspondence of the above theorem. **5**
- b) Verify the fundamental theorem of Galois Theory for the splitting field of $x^4 - 5x^2 + 6 \in \mathbb{Q}[x]$. **5**
7. a) Prove that the finite field F_{p^n} (with p^n elements) is the splitting field over the field F_p of the polynomial $x^{p^n} - x$, with cyclic Galois group of order n , generated by the Frobenius automorphism σ_p . **5**
- b) i) Write down the multiplication table for F_4 . **3**
ii) Prove that an algebraically closed field must be infinite. **2**
8. a) Define the following terms : **5**
i) Cyclic extension
ii) Root extension of F
Show the Galois group of the polynomial $x^3 - x + 1 = 0$ is solvable.
- b) Prove that the irreducible polynomial $x^4 + 1 \in \mathbb{Z}[x]$ is reducible modulo every prime p . **5**
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[4621] – 303

Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT – 703 : Functional Analysis
(Credit System) (2013 Pattern)

Time : 3 Hours

Max. Marks : 50

N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. a) Let H be a Hilbert space and M be a closed subspace of H . Prove that $(M^\perp)^\perp = M$. 4
- b) Give an example of an isometry on a Hilbert space that is not surjective. 4
- c) State Hahn-Banach theorem. 2
2. a) For an operator A on a Hilbert space H , if $A = A^*$ and $\langle Ah, h \rangle = 0$ for all $h \in H$, then prove that $A = 0$. 4
- b) If $\{x_n\}$ is a sequence in a Banach space X such that $\sum_{n=1}^{\infty} \|x_n\| < \infty$, then prove that the series $\sum_{n=1}^{\infty} x_n$ converges in X . 4
- c) Give an example of an orthonormal basis of $L^2 [0, 2\pi]$. 2
3. a) If A is a normal operator on a Hilbert space and λ, μ are distinct eigen values of A , then prove that $\ker (A - \lambda) \perp \ker (A - \mu)$. 4
- b) Prove that if $p \geq q \geq 1$, then $l_q \subseteq l_p$. 3
- c) Give an example of an operator A on a Hilbert space and a subspace M that is invariant under A but not reducing for A . 3
4. a) If X is a normed space and $x \in X$, then prove that $\|x\| = \sup \{ |f(x)| : f \in X^*, \|f\| \leq 1 \}$. 5
- b) Let H be a separable Hilbert space with basis $\{e_n\}$. If A is an operator defined by $Ae_n = \frac{1}{n} e_n$, then show that A is a compact operator. 3
- c) Give an example of a Banach space which is not a Hilbert space. 2

P.T.O.



5. a) Let X be a normed space and f be a linear functional on X . If $\ker f$ is closed, then prove that f is continuous. 4
- b) Let $M = \{(x_n) \in l^2 : \sum_{n=1}^{\infty} \frac{1}{n} x_n = 0\}$. Is M a closed subspace of l^2 ? Justify. 3
- c) Prove that the identity operator on an infinite dimensional Hilbert space is not a compact operator. 3
6. a) State open mapping theorem and use it to prove that the inverse of an invertible, bounded linear map from a Banach space X to a Banach space Y is bounded. 4
- b) If T is a finite rank operator on a Hilbert space, then prove that T^* is also a finite rank operator. 4
- c) Define a reflexive space and give an example. 2
7. a) State and prove Riesz representation theorem for a Hilbert space. 5
- b) On $C[0, 1]$, define $\|f\| = \int_0^1 |f(t)| dt$. Let $L(f) = f\left(\frac{1}{2}\right)$. Is L a bounded linear functional on $C[0, 1]$? Justify. 5
8. a) If T is a compact, self-adjoint operator on a Hilbert space, then prove that either $\pm\|T\|$ is an eigen value of T . 5
- b) Prove that $l_1^* = l_\infty$. 5



Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT – 702 : Ring Theory
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : i) Attempt **any five** questions.
ii) Figures to **right** indicate **full** marks.

1. a) Let R be a ring with identity 1 and let S be a subring of R containing the identity 1. Prove that if u is a unit in S then u is a unit in R . Show by example that the converse is false. 6
- b) Prove that the only Boolean ring that is an integral domain is Z_2 . 5
- c) Prove that any subring of a field which contains the identity is an integral domain. 5
2. a) If $\phi : R \rightarrow S$ is a homomorphism of rings then prove that Kernel of ϕ is an ideal of R and image of ϕ is a subring of S . Further prove that $\frac{R}{\text{Ker}\phi} \simeq \phi(R)$. 8
- b) Let R be the ring of all continuous real valued functions on the closed interval $[0, 1]$. Prove that the map $\phi : R \rightarrow \mathbb{R}$, defined by $\phi(f) = \int_0^1 f(t) dt$ is a homomorphism of additive groups but not a ring homomorphism. 5
- c) Prove that the ring $2x$ and $3f$ are not isomorphic. 3
3. a) Assume the ring R is commutative prove that an ideal M of the ring R is maximal ideal if and only if the quotient ring $\frac{R}{M}$ is field. 8
- b) Assume R is commutative. Let I and J be ideals of R and assume P is a prime ideal of R that contains $I \cap J$. Prove that either I or J is contained in P . 5
- c) Prove that an ideal $I = (z, x)$ is maximal ideal in $Z[x]$. 3
4. a) Let F be a field. Prove that F contains a unique smallest sub field F_0 and that F_0 is isomorphic to ϕ or Z_p for some prime P . 8
- b) Let R be a commutative ring with unity 1 and I and J be ideals co-prime to each other. Prove that $I \cap J = IJ$ and 8

$$\frac{R}{I} \times \frac{R}{J} \simeq \frac{R}{I \cap J}$$

P.T.O.



5. a) If F is a field then prove that the polynomial ring $F[x]$ is a Euclidean domain with norm given by $N(p(x)) = \text{degree of } p(x)$. 8
- b) Prove or disprove 8
- i) The ring $R = \mathbb{Z}[\sqrt{-5}]$ is a Euclidean domain.
- ii) The ring $R = \mathbb{Z}[\sqrt{-5}]$ is a PID.
6. a) If R is a principal ideal domain and I is a non-zero ideal in R . Then prove that I is prime if and only if I is maximal ideal. 8
- b) Prove that a quotient of a PID by a prime ideal is again a PID. 8
7. a) Show that each irreducible element in a UFD is prime. 8
- b) Prove or disprove
- i) A subring of UFD is UFD
- ii) Quotient of UFD is UFD. 8
8. a) Let I be a proper ideal in the integral domain R and let $p(x)$ be a nonconstant monic polynomial in $R[x]$. If the image of $p(x)$ in $\left(\frac{R}{I}\right)[x]$ cannot be factored in $\left(\frac{R}{I}\right)[x]$ into two polynomials of smaller degree then prove that $p(x)$ is irreducible in $R[x]$. 8
- Is the converse of the above result hold ?
- b) Find all monic irreducible polynomials of degree ≤ 3 in $F_2[x]$. 8



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT-703 : Mechanics
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : i) Attempt **any five** questions.
ii) Figures to the **right** indicate **full** marks.

1. a) Explain the following terms. 6
i) holonomic and rheonomic constraints.
ii) generalized momentum.
iii) angular momentum.
- b) Show that the Lagrange's equation of motion can also be written as 5
$$\frac{\partial L}{\partial t} - \frac{d}{dt} \left(L - \sum_j \dot{q}_j \frac{\partial L}{\partial \dot{q}_j} \right) = 0.$$
- c) A particle of mass m moves in one dimension such that it has the Lagrangian 5
$$L = \frac{m^2 \dot{x}^4}{12} + m \dot{x}^2 v(x) - v^2(x)$$
 where V is some differentiable function of x . Find equation of motion for $x(t)$.
2. a) Use D' Alembert's principle to determine the equation of motion of a simple pendulum. 6
b) Explain the D' Alembert's principle and derive Lagrange's equations of motion using the same. 10
3. a) A particle is constrained to move on the plane curve $xy = c$, where c is a constant, under gravity, obtain the Lagrangian and hence the equation of motion. 5
b) Explain Atwood Machine and discuss its motion. 5
c) If the cyclic generalized co-ordinate q_j is such that dq_j represents the translation of the system, then prove that the total linear momentum is conserved. 6
4. a) Show that the geodesic in a Euclidean plane is a straight line. 7
b) Show that the curve is a catenary for which the area of surface of revolution is minimum when revolved about y -axis. 5
c) Find the extremal of the functional $I = \int_1^2 \left(\frac{x^3}{y'^2} \right) dx$, subject to the condition that $y(1) = 0$, $y(2) = 3$. 4

P.T.O.



5. a) Show that the Euler-Lagrange's equation of the functional $I(y(x)) = \int_{x_1}^{x_2} f(x, y, y') dx$ has the first integral $f - y' \frac{\partial f}{\partial y'} = \text{constant}$, if the integrand does not depend on x . 5
- b) Obtain the differential equation, which is satisfied by the functional $f(x, y, y')$ which extremizes the integral $I(y/x) = \int_{x_1}^{x_2} f(x, y, y') dx$ subject to the conditions $y(x_1) = y_1, y(x_2) = y_2$, and the integral $J = \int_{x_1}^{x_2} g(x, y, y') dx = \text{const}$. 7
- c) Deduce from D' Alembert's principle the Hamilton's principle for conservative system. 4
6. a) Derive Hamilton's principle for non-conservative system from D' Alembert's principle and hence deduce from it the Hamilton's principle for conservative system. 8
- b) Use Hamilton's principle to find the equation of motion of a simple pendulum. 8
7. a) Describe the Routh's procedure to solve the problem involving cyclic and non-cyclic co-ordinates. 8
- b) A Hamiltonian of one degree of freedom has the form
- $$H = \frac{\beta}{2\alpha} - bpqe^{-\alpha t} + \frac{ab}{2} q^2 e^{-\alpha t} (\alpha + be^{-\alpha t}) + \frac{kq^2}{2},$$
- where a, b, α and k are constant.
- 1) Find a Lagrangian corresponding to this Hamiltonian.
- 2) Find an equivalent-Lagrangian that is not explicitly dependent of time. 8
8. a) A particle describes a circular orbit under the influence of an attractive central force directed to a point on the circle. Show that the force varies as the inverse fifth power of the distance. 4
- b) Show that, the determinant of an orthogonal matrix is equal to ± 1 . 4
- c) State and prove the rotation formula. 4
- d) State and prove the Jacobi identity for Poisson brackets. 4



[4621] – 35

Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
MATHEMATICS
MT 705 : Graph Theory
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

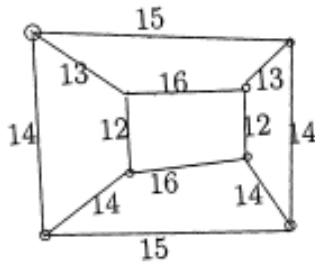
N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. a) Prove that a k regular graph of girth four has at least $2k$ vertices, with equality only for $K_{k,k}$. 6
b) Prove that every u, v -walk contains a u, v -path. 4
c) Prove that a 3 regular graph G has a decomposition into claws if and only if G is bipartite. 6
2. a) Prove that an edge is a cut-edge if and only if it belongs to no cycle. 6
b) Prove that the edges of a connected simple graph with $2k$ edges can be partitioned into paths of length 2. 6
c) Prove that if P and Q are two paths of maximum length in a connected graph G , then P and Q have a common vertex. 4
3. a) State and prove the Havel-Hakimi theorem. 10
b) Prove that a graph G is bipartite if and only if for every subgraph H of G , there is an independent set containing at least half of the vertices of H . 6
4. a) Prove that for an n -vertex graph G with $n \geq 1$, G has $n - 1$ edges and no cycles if and only if G has no loops and has, for each $u, v \in V(G)$, exactly one u, v -path. 4
b) Prove that a maximal acyclic subgraph of a graph G consists of a spanning tree from each component of G . 6
c) Prove that if T is a tree with k edges and G is a simple graph with $\delta(G) \geq k$, then T is a subgraph of G . 6
5. a) Let $\alpha'(G)$, $\beta'(G)$ and $n(G)$ denotes maximum size of a matching, minimum size of edge cover and number of vertices in a graph G , respectively. Prove that if G is a graph without isolated vertices, then $\alpha'(G) + \beta'(G) = n(G)$. 8
b) Prove that every component of the symmetric difference of two matchings is a path or an even cycle. 4
c) Show that the hypercube Q_3 has nine perfect matchings. 4

P.T.O.



- 6. a) Explain the Augmenting Path Algorithm for matching. 6
- b) Prove that the Hungarian algorithm finds a maximum weight matching and a minimum cost cover. 10
- 7. a) Using Kruskal's algorithm in the following graph, construct a minimum weight spanning tree. 4



- b) Prove that the number of spanning trees of a connected graph is the product of the numbers of spanning trees of each of its blocks. 6
- c) Prove that the connectivity of the hypercube Q_k is k . 6
- 8. a) Let $k(G)$, $k'(G)$ and $\delta(G)$ denotes vertex connectivity, edge connectivity and minimum vertex degree in a graph G , respectively. Prove that if G is a simple graph, then $k(G) \leq k'(G) \leq \delta(G)$. 6
- b) Prove that if x and y are distinct vertices of a graph G , then the minimum size of an x, y -disconnecting set of edges equals the maximum number of pairwise edge-disjoint x, y paths. 6
- c) Prove that if P is an f -augmenting path with tolerance z , then changing flow by $+z$ on edges followed forward by P and by $-z$ on edges followed backward by P produces a feasible flow f' with $\text{val}(f') = \text{val}(f) + z$. 4



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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
MATHEMATICS
MT – 801 : Field Theory
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. a) Let $f(x)$ be a polynomial over a field F , prove that there exists an extension E of F in which $f(x)$ has a root. 6
- b) Show that $p(x) = x^2 - x - 1$ in $\mathbb{Z}_3[x]$ is irreducible over \mathbb{Z}_3 . Show that there exists an extension K of \mathbb{Z}_3 with nine elements having all roots of $p(x)$. 6
- c) Find the minimal polynomial over \mathbb{Q} of $\sqrt{-1+\sqrt{2}}$. 4
2. a) Show that every finite extension is algebraic extension. What about the converse? Justify your answer. 8
- b) Let F be a field and let $\sigma: F \rightarrow L$ be an embedding of F into an algebraically closed field L . Let $E = F(\alpha)$ be an algebraic extension of F . Then prove that σ can be extended to an embedding $\eta: E \rightarrow L$, and the number of such extensions is equal to the number of distinct roots of the minimal polynomial of α . 8
3. a) Prove that the splitting field of a polynomial over a given field is unique (upto isomorphism) if it exists. 8
- b) Find the splitting field of $f(x) = x^4 - 2 \in \mathbb{Q}[x]$ over \mathbb{Q} also find its degree over \mathbb{Q} . 8
4. a) Show that any finite field F with p^n elements is the splitting field of $x^{p^n} - x \in \mathbb{F}_p[x]$. Hence or otherwise prove that any two fields with p^n elements are isomorphic. 8
- b) Find the smallest normal extension (upto isomorphism) of $\mathbb{Q}(\sqrt[4]{2}, \sqrt[4]{3})$ in $\overline{\mathbb{Q}}$. 4
- c) Let E be an extension of a field F . If $a \in E$ has a minimal polynomial of odd degree over F , show that $F(a) = F(a^2)$. 4
5. a) Prove that if the multiplicative group F^* of non-zero elements of a field F is cyclic, then F is finite. 6
- b) If F is a finite field of characteristic p , then show that each element a of F has a unique p^{th} root $\sqrt[p]{a}$ in F . 6
- c) Show that $\mathbb{Q}(\sqrt{2}, \sqrt{3}) = \mathbb{Q}(\sqrt{2} + \sqrt{3})$. 4

P.T.O.



6. a) Show that a finite separable extension E of a field F , then E is simple extension. **8**
- b) Let F and E be fields, and let $\sigma_1, \sigma_2, \dots, \sigma_n$ be distinct embeddings of F into E . Suppose $a_1, a_2, \dots, a_n \in E$, $\sum_{i=1}^n a_i \sigma_i(a) = 0$ for all $a \in F$. Then prove that $a_i = 0$, for all $i = 1, 2, \dots, n$. **8**
7. a) Let E be a Galois extension of F . Let K be any subfield of E containing F . Then prove that K is normal extension of F if and only if $G(E/K)$ is normal subgroup of $G(E/F)$. **8**
- b) Let E be splitting field of $x^3 - 2 \in \mathbb{Q}[x]$ over \mathbb{Q} and $K = \mathbb{Q}(\omega)$ be the subfield of E , where ω is cube root of unity $\omega \neq 1$. Verify the result in (a) above. **8**
8. a) Show that it is impossible to trisect the angle of 60° . **6**
- b) Show that the polynomial $x^7 - 10x^5 + 15x + 5$ is not solvable by radicals over \mathbb{Q} . **6**
- c) Show that Galois extension of a Galois extension need not be Galois. **4**
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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
MATHEMATICS
MT – 803 : Differentiable Manifolds
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.
2) Figures to the **right** indicate **full** marks.

1. a) Let M be a k -manifold in \mathbb{R}^n . If ∂M is nonempty, then prove that ∂M is a $(k - 1)$ manifold without boundary. 7
- b) Show that $g(x, y, z) = \det \begin{pmatrix} x_i & y_i & z_i \\ x_j & y_j & z_j \\ x_k & y_k & z_k \end{pmatrix}$ is an alternating 3-tensor on \mathbb{R}^n .
Further, express g as a combination of elementary tensors. 6
- c) Define volume of a parameterized surface in \mathbb{R}^n . 3
2. a) Let U be an open set in \mathbb{R}^n and $f : U \rightarrow \mathbb{R}^n$ be of class C^1 . Let $M = \{x : f(x) = 0\}$ and $N = \{x : f(x) \geq 0\}$. If M is nonempty and $Df(x)$ has rank one at each point of M , then prove that N is an n -manifold in \mathbb{R}^n and $\partial N = M$. 8
- b) Define a closed form and give an example of it. 4
- c) Give an example of a z -manifold in \mathbb{R}^3 without boundary. 4
3. a) Let F be a k -tensor with usual notation, if $AF = \sum_{\sigma \in S_k} (\text{sign } \sigma) F^\sigma$, then prove that AF is an alternating tensor. Find AF if F is already alternating. 7
- b) If $w = x^2 y z dx + 2 y \sin z dy + e^z dz$, then find dw . 5
- c) Find the tangent plane $T_p(S^2)$ where $P \equiv \left(\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}, 0 \right)$. 4



4. a) Define the differential operator d and for any K -form w , show that $d(dw) = 0$. 7
- b) If $w = xz dx + y dy + e^x z dz$ and $\eta = y \cos x dx + x dy + 2xy dz$, then find $(w \wedge \eta)$. 5
- c) Define exact form and give an example of it. 4
5. a) Define orientation of a manifold M and induced orientation on ∂M . 6
- b) State Stokes's theorem. 5
- c) Let $w = yz dx + xz dy + xy dz$ and $\alpha(u, v) = (u - v, uv, u^2)$. Find $\alpha^*(dw)$. 5
6. a) Let M be an orientable k -manifold with nonempty boundary. Prove that ∂M is orientable. 7
- b) State Green's theorem for compact, oriented z -manifold. 5
- c) Show that a unit n -ball B^n is an n -manifold in \mathbb{R}^n . What is its boundary? 4
7. a) With usual notation, show that $\alpha^*(dw) = d(\alpha^* w)$. 8
- b) Let $\alpha: (0, 1)^2 \rightarrow \mathbb{R}^3$ be given by $\alpha(u, v) = (u, v, u^2 + v^2 + 1)$. Let Y be the image set of α .
Evaluate $\int_Y x_2 dx_2 \wedge dx_3 + x_1 x_3 dx_1 \wedge dx_3$. 8
8. a) If w and η are k and l forms respectively, then prove that
 $d(w \wedge \eta) = dw \wedge \eta + (-1)^k w \wedge d\eta$. 8
- b) Let $A = \mathbb{R}^2 - \{0\}$. If $w = \frac{-y dx + x dy}{x^2 + y^2}$, then show that w is not exact in A . 8



[4621] – 44

Seat
No.

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M.A./M.Sc. (Semester – IV) Examination, 2014
MATHEMATICS
MT-804 : Algebraic Topology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

N.B. : 1) Attempt **any five** questions.

2) Figures to the **right** indicate **full** marks.

1. a) When are two maps $f_0, f_1 : X \rightarrow Y$ said to be homotopic ? 4
b) Prove that there exists a map $f : B^n \rightarrow S^{n-1}$ with $f \circ i = I$, where $i : S^{n-1} \rightarrow B^n$ is the inclusion map and $I : S^{n-1} \rightarrow S^{n-1}$ the identity map if and only if $I : S^{n-1} \rightarrow S^{n-1}$ is homotopic to the constant map. 8
c) Let $f, g : X \rightarrow S^n$ be continuous maps such that $f(x) \neq -g(x)$ for all $x \in X$. Show that f is homotopic to g . 4
2. a) If Y is contractible, prove that every continuous map $f : X \rightarrow Y$ is homotopic to a constant. 8
b) Define a strong deformation retract. 4
c) Give an example of a strong deformation retract. 4
3. a) Is S^2 path connected ? Why ? 6
b) If \bar{f} is a path which is inverse to f , prove that $f * \bar{f}$ is homotopic to null path. 6
c) Give an example of a set in \mathbb{R}^2 which is connected but not path connected. 4
4. a) Define the fundamental group $\Pi_1(X, x_0)$. 4
b) If $f : X \rightarrow Y$ is continuous, show that there exists a homomorphism $f^* : \Pi_1(X, x_0) \rightarrow \Pi_1(Y, f(x_0))$. 8
c) Find the fundamental group of \mathbb{R}^n . 4

P.T.O.



5. a) Prove that S^1 is not a retract of B^2 . 8
- b) Prove that $\mathbb{R}^{n+1} \setminus \{0\}$ has the same homotopy type of S^n . 8
6. a) Let X be a set and G a group. When is G said to act on X ? 4
- b) Give an example of such action as in (a). 4
- c) Prove that any covering map is an open map. 8
7. a) When does $p : E \rightarrow B$ said to have the homotopy lifting property? 4
- b) Give an example of such map p defined as in (a). 4
- c) Prove that a fibration has unique path. 8
8. a) When a set of $p + 1$ points in \mathbb{R}^n , $p \leq n$ said to be geometrically independent. 4
- b) Give an example as in (a). 4
- c) Give an example of a 2 simplex in \mathbb{R}^3 . Find all vertices, edges and faces. 8
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Total No. of Questions : 8]

SEAT No. :

P1562

[Total No. of Pages : 3

[4622] - 1001
M.Sc. (Semester - I)
PHYSICS (Credit System)
PHYUT - 501 : Classical Mechanics
(2013 Pattern) (4 Credits)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) *Answer any Five questions out of eight questions.*
- 2) *Neat diagram must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*

- Q1)** a) Find the Lagrangian and equation of motion for an electric circuit comprising an inductor 'L' and capacitance 'C'. The capacitor is charged to 'q' coulombs and the current flowing in the circuit is 'i' amperes. **[4]**
- b) Prove that Poisson bracket of two constant of motion itself is a constant of motion. **[3]**
- c) Define : **[3]**
- i) Configuration space
 - ii) Phase space
 - iii) State space
- Q2)** a) A cylinder of radius 'a' and mass 'm' rolls down on an incline plane making an angle 'θ' with horizontal. Set up Lagrangian and find the equation of motion. **[4]**
- b) A particle moves with velocity in an elliptical path in an inverse fixed. Prove that $v^2 = \frac{k}{\mu} \left[\frac{2}{r} - \frac{1}{a} \right]$. **[3]**
- c) Using Poisson Bracket, prove that $[L_x, L_y] = L_z$. **[3]**

P.T.O.

- Q3)** a) Show that the transformation $Q = (e^{-2q} - p^2)^{1/2}$ and $P = \cos^{-1}(p.e^q)$ is a canonical. [4]
- b) Write the type of constraints for [3]
- i) Simple pendulum with rigid support
- ii) Deformable bodies
- c) Obtain the Lagrangian and equation of motion for Atwood's Machine. [3]
- Q4)** a) Using variational principle, show that the shortest distance between two point in a plane is a straight line. [4]
- b) Write down the Hamiltonian and equation of motion for Harmonic oscillator. [3]
- c) Calculate the reduced mass of CO molecules. Given atomic number of carbon C and oxygen O are 12 and 16 respectively. [3]
- Q5)** a) Prove that reduction of two body central force problem to the equivalent one body problem. [4]
- b) Obtain the Lagrangian and equation of motion for a simple pendulum. [3]
- c) Show that the function $F = - \sum_i Q_i P_i$ generates the identity transformation. [3]
- Q6)** a) Prove that the transformation $P = q \cot p$ and $Q = \log \frac{\sin p}{q}$ is a canonical. [4]
- b) Show that, A function whose Poisson bracket with Hamiltonian vanishes is a constant of motion. [3]
- c) A particle of mass 'm' moves on a plane in the field of force given by $F = -kr \cos\theta \hat{r}$ where k is constant and \hat{r} is the radial unit vector. Show that the angular momentum of the particle about the origin be conserved. [3]

Q7) a) A particle moving in a central force field located at $r = 0$, describes a spiral $r = e^{-\theta}$. Prove that the magnitude of force is inversely proportional to r^3 . [5]

b) Explain Brachistochrone problem. [5]

Q8) a) Find the central force under the action of which a particle will follow an orbit described by $r = a(1 + \cos \theta)$. [5]

b) Show that, the geodesic of spherical surface are great circle i.e the circles having centers at the center of the sphere. [5]



Total No. of Questions : 8]

SEAT No. :

P1551

[Total No. of Pages : 3

[4622] - 101

M.Sc. PHYSICS (Semester - I)

**PHY UT- 501 : Classical Mechanics
(2013 Pattern) (Credit System) (5 Credits)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions out of eight questions.*
- 2) *Draw neat diagram wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables and electronic calculators is allowed.*

Q1) a) A cylinder of radius 'a' and mass 'm' rolls down an inclined plane making an angle θ with the horizontal. Set up lagrangian and find equation of motion. **[4]**

b) Calculate the reduced mass of HCL. Given AMU for hydrogen and chlorine are 1 and 35.5 respectively **[3]**

c) State and prove poisson's theorem. **[3]**

Q2) a) Using variational principle, obtain the equation of motion for stable equilibrium configuration of a uniform heavy flexible string fixed between two points A(x_1, y_1) and B (x_2, y_2) in the constant gravity field of the earth. **[4]**

b) What are generalised coordinates? Obtain generalised coordinates for a system of two masses connected by an inextensible rod and free to move in a space. **[3]**

c) Show that the transformation. **[3]**

$$P = q \cot p$$

$$Q = \log\left(\frac{\sin p}{q}\right) \text{ is canonical.}$$

P.T.O.

- Q3)** a) Explain the concept of symmetry. Show that homogeneity of space leads to conservation of linear momentum. [4]
- b) State Hamilton's variational principle. Deduce the modified Hamilton's principle. [3]
- c) Prove the identity [3]

$$\frac{d}{dt}[F, G] = \left[\frac{dF}{dt}, G \right] + \left[F, \frac{dG}{dt} \right]$$

- Q4)** a) What is Foucault's pendulum? Obtain equation of motion for such a pendulum. [4]
- b) Discuss a two body problem reduced into a one body problem. Hence, explain the concept of reduced mass. [3]
- c) Using poisson's bracket, show that the transformation. [3]

$$Q = (e^{-2q} - p^2)^{\frac{1}{2}}$$

$$P = \cos^{-1}(p.e^q) \text{ is canonical.}$$

- Q5)** a) For what values of m and n do the transformation equation. [4]

$$Q = q^m \cdot (\cos np)$$

$$P = q^m \cdot (\sin np)$$

Presents a canonical transformation.

- b) Set up Hamiltonian and obtain equation of motion for simple pendulum. [3]
- c) Show that a coordinate cyclic in Lagrangian is also cyclic in Hamiltonian. [3]

- Q6)** a) Show that poisson bracket of two constants of motion is a constant of motion. [4]

- b) Show that the plane of oscillation of Foucault's pendulum rotates $15^\circ \sin \phi$ per hour where ϕ is latitude of the place. [3]
- c) Show that angular momentum of a particle moving in a central force field is conserved. [3]

Q7) a) Derive Hamiltonian function H and Hamilton's canonical equations of motion. [5]

b) Obtain the equation of motion of a particle in space by Lagrangian method in Cartesian coordinates. [5]

Q8) a) Discuss the effect of Coriolis force on [5]

i) Flow of river

ii) Cyclones.

b) Obtain differential equation of orbit in the form [5]

$$\frac{d^2u}{d\theta^2} + u = -\frac{m}{l^2u^2} f\left(\frac{1}{u}\right)$$

Where, $u = \frac{1}{r}$, l is angular momentum and $f(r)$ is central force.



Total No. of Questions : 7]

SEAT No. :

P1541

[Total No. of Pages : 3

[4622] - 11
M. Sc. (Semester - I)
PHYSICS
PHYUTN - 501 : Classical Mechanics
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Question No. 1 is compulsory and solve four from remaining.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of calculator is allowed.*

Q1) Attempt any four of the following :

a) Explain homogeneity of space and obtain law of conservation of linear momentum. [4]

b) A bead moves on circular wire-specify the type of constraint and constraint force. [4]

c) If $[\phi, \psi]$ be the poisson bracket of ϕ and ψ , then prove that

$$\frac{\partial}{\partial t}[\phi, \psi] = \left[\frac{\partial \phi}{\partial t}, \psi \right] + \left[\phi, \frac{\partial \psi}{\partial t} \right] \quad [4]$$

d) Show that transformation is canonical.

$$P = \frac{1}{2}(p^2 + q^2)$$

$$Q = \tan^{-1} \frac{q}{p} \quad [4]$$

P.T.O.

- e) Apply variational principle to find equation of one dimensional harmonic oscillator. [4]
- f) Draw phase space diagram for a stone thrown vertically up in the field of uniform gravity. [4]

Q2) a) Show that for a particle moving under central force $f(r)$, the equation of

orbit is given by
$$\frac{d^2u}{d\theta^2} + u = -\frac{m^2}{l^2u^2} \cdot f\left(\frac{1}{u}\right).$$

Here, $u = \left(\frac{1}{r}\right)$ and l - is angular momentum. [8]

- b) Obtain an expression for coriolis acceleration for rotating co-ordinate system. [8]

Q3) a) Show that the transformation.

$$Q = \ln \frac{\sin p}{q}$$

$$P = q \cot p$$

are canonical.

Also show that generating function is , $F = e^{-Q}(1 - q^2 e^{2Q}) = q \sin^{-1}(q e^Q)$. [8]

- b) Distinguish between holonomic and nonholonomic constraints with suitable examples. [4]

- c) Show that the generating function for the transformation

$$P = \frac{1}{Q}, q = PQ^2 \text{ is } F = \frac{q}{Q}. \quad [4]$$

Q4) a) A point mass moves in a vertical plane along a given curve in a gravitational field. The equation of motion in parametric form is

$$x = x(s), z = z(s).$$

Write down Lagrange's equation. [8]

b) Using Euler-Lagrange equation determine the path which requires least time to travel from a point at higher level to a point at lower level in plane under uniform gravitational field. [8]

Q5) a) Obtain Hamiltonian and equations of motion for a projectile near the surface of the earth. [8]

b) For what values of m and n do the transformation equations

$$Q = q^m \cos np$$

$$P = q^m \sin np$$

Present canonical transformation. Also obtain generating function. [8]

Q6) a) Show that Coriolis force acting on a body of mass m in a rotating frame is $-2m(\vec{\omega} \times \vec{v}')$,

where $\vec{\omega}$ - is angular velocity of rotating frame and

\vec{v}' - is the velocity of body in rotating frame

[8]

b) Set up Lagrangian and obtain equation of motion for compound pendulum oscillating in vertical plane. [8]

Q7) a) Prove that under canonical transformation (q, p) to (Q, P) [8]

$$[F, G]_{q, p} = [F, G]_{Q, p}$$

b) Explain with example conservative, dissipative, unilateral and bilateral constraints. [4]

c) Obtain Lagrange's equations of motion for an electrical circuit comprising of an inductance L and capacitance C . The condenser is charged to q coulombs and the current flowing in the circuit is i amperes. [4]



Total No. of Questions : 8]

SEAT No. :

P1555

[Total No. of Pages : 2

[4622] - 201
M.Sc. (Semester - II)
PHYSICS
PHY UT - 601 : Electro Dynamics
(2013 Pattern) (Credit System) (5 Credits)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Attempt any five questions out of eight questions.*
- 2) Draw neat labeled diagrams wherever necessary.*
- 3) Figures to the right indicate full marks.*
- 4) Use of logarithmic tables and calculator is allowed.*

- Q1)** a) Obtain an expression for E. M. field tensor F_{uv} . **[4]**
- b) Starting from Maxwell's equation, establish the equation of continuity. **[3]**
- c) Derive Faraday's law of induction for moving medium. **[3]**
-
- Q2)** a) State and prove poynting's theorem. **[4]**
- b) Explain the term 'skin effect and skin depth'. **[3]**
- c) Explain the term 'Radiation Damping'. **[3]**
-
- Q3)** a) Derive the expression for potential at a distant point using multipole expansion for a totalized charge distribution in free space. **[4]**
- b) Explain Minkowski's space - time diagram. **[3]**
- c) Find the rest mass of an electron in ev if its rest mass is 9.11×10^{-31} kg. **[3]**

P.T.O.

- Q4)** a) Prove that the space time interval $x^2 + y^2 + z^2$ is not invariant under Lorentz transformations while the combined space-time interval $x^2 + y^2 + z^2 - c^2t^2$ is Lorentz invariant. [4]
- b) Show that $(C^2B^2 - E^2)$ is invariant under lorentz transformation. [3]
- c) Show that the ratio of electrostatic and magnetostatic energy densities is equal to unity. [3]
- Q5)** a) Write Maxwell's equation in differential and integral form. [4]
- b) Describe Lorentz force on a charged particle. [3]
- c) Describe magnetic interaction between two current loops. [3]
- Q6)** a) Explain the term 'Four Vector Potential'. [4]
- b) Explain the term 'Multiple Moments'. [3]
- c) Explain the concept of 'vacuum displacement current'. [3]
- Q7)** a) Describe the Michelson-Morley experiment and discuss the results obtained by it. [5]
- b) Show that the square of four wave vector K_μ is Zero. [5]
- Q8)** a) A plane e-m wave is incident obliquely on an interface between the two non-conducting dielectrics media. Obtain the equation for snell's law. [5]
- b) Derive the Lorentz relativistic transformations equations. [5]



Total No. of Questions : 8]

SEAT No. :

P1556

[Total No. of Pages : 3

[4622]-202
M.Sc. (Semester - II)
PHYSICS
PHYUT - 602 : Solid State Physics
(2013 Pattern) (5 Credits)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *Attempt any five questions.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic table and calculator is allowed.*

Constants:

- | | |
|----------------------------------|--|
| i) Boltzmann constant | $K_B = 1.38 \times 10^{-23} \text{ J/K}$ |
| ii) Plank's constant | $h = 6.623 \times 10^{-34} \text{ Js.}$ |
| iii) Avogadro's number | $N = 6.023 \times 10^{23} / \text{gm mole}$ |
| iv) Mass of electron | $m_e = 9.1 \times 10^{-31} \text{ Kg}$ |
| v) Charge on electron | $e = 1.6 \times 10^{-19} \text{ C}$ |
| vi) Velocity of light | $c = 3 \times 10^8 \text{ m/s}$ |
| vii) Bohr magneton | $\mu_B = 9.27 \times 10^{-24} \text{ A-m}^2$ |
| viii) Permeability of free space | $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$ |
| ix) Gas constant | $R = 1.987 \text{ cal / mole-k}$ |

- Q1)** a) Evaluate geometrical structure factor F_{hkl} for reflection from the (hkl) planes in an f_{cc} lattice and show that the factor vanishes unless the numbers h,k and l are all even or all odd. **[4]**
- b) State the Bloch theorem. What are Bloch functions? State the property of Bloch functions. **[3]**
- c) Explain type-I and type-II superconductors. **[3]**

P.T.O.

- Q2)** a) Derive an expression for diamagnetic susceptibility using Langevin theory. [4]
- b) Explain Meissner effect in superconductors and show that perfect diamagnetism is an essential property of the superconducting state. [3]
- c) The unit cell parameter of NaCl crystal is 5.6 \AA and the modulus of elasticity along [100] direction is $5 \times 10^{10} \text{ N/m}^2$. Estimate the wavelength at which an electromagnetic radiation is strongly reflected by the crystal. Atomic weight of Na = 23 and of Cl = 37 [3]
- Q3)** a) Give an account of Weiss theory of ferromagnetism, Hence obtain Curie - Weiss law. [4]
- b) Explain the phenomenon of antiferro magnetism with example. Also define the Neel temperature. [3]
- c) A paramagnetic salt contains 10^{28} ions/ m^3 with magnetic moment of one Bohr magneton. Calculate the paramagnetic susceptibility and the magnetization produced in a uniform magnetic field of 10^6 A/m , at room temperature. [3]
- Q4)** a) How does the band theory of solids lead to the classification of solids into conductors, semi conductors and insulators. [4]
- b) Distinguish between reduced zone, extended zone and periodic zone schemes of representing energy bands. [3]
- c) Show that for a simple square lattice, the kinetic energy of a free electron at a corner of the first zone is higher than that of an electron at mid point of a side face of zone by a factor of 2. [3]

- Q5) a)** Show that electron orbits are quantized in constant magnetic field in such a way that the flux through the orbit in real space is

$$\phi = \frac{2\pi\hbar}{e} \left(n + \frac{1}{2} \right) \text{ Where 'n' is integer.} \quad [4]$$

- b) What are Normal and Umklapp processes? Explain with the help of vector diagrams. [3]
- c) Derive an expression for London penetration depth in a superconductor. [3]
- Q6) a)** Draw a typical M-H curve for ferro magnetic material and explain different stages of magnetization process on the basis of domain theory. [4]
- b) What is exchange interaction? How does it help to explain magnetism in iron group of atoms. [3]
- c) Estimate the diamagnetic susceptibility of copper by assuming that only one electron per atom makes the contribution. The radius of copper atom is 1 \AA and the lattice parameter is 3.608 \AA . [3]

- Q7) a)** Obtain the dispersion relation for a monoatomic linear lattice of identical atoms. Hence find the maximum frequency that can be propagated through the lattice. Also plot the dispersion curve. [5]
- b) What is atomic scattering factor? Derive the expression for the atomic scattering factor using spherical polar coordinates. [5]

- Q8) a)** Explain cyclotron resonance. Obtain expression for cyclotron frequency of Bloch electrons. [5]
- b) Explain the following properties of superconductors:
- i) Electrical resistance
 - ii) Magnetic field
 - iii) Isotope effect

[5]



Total No. of Questions : 8]

SEAT No. :

P1557

[Total No. of Pages : 3

[4622] - 203
M.Sc. (Semester - II)
PHYSICS
PHY UT - 603 : Experimental Techniques in Physics
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) *Attempt any five questions.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic table and calculator is allowed.*

Constants:

Boltzmann constant	K_B	=	1.38×10^{-23} J/K
Planck's constant	h	=	6.63×10^{-34} Js
Avogadro's number	N	=	6.02×10^{23} / gm mole
Mass of electron	m_e	=	9.1×10^{-31} kg
Charge on electron	e	=	1.6×10^{-19} C
Velocity of light	C	=	3×10^8 m/s

Q1) a) Explain principle, construction and working of Scanning Electron Microscope. **[4]**

b) Calculate Energy in eV for photon having wavelength 500 nm. **[3]**

c) What are different flow regimes? Explain in brief. **[3]**

Q2) a) Give principle, instrumentation and working of UV - Visible Spectrometer. **[4]**

b) Describe auto and cross correlation functions. **[3]**

c) Write short note on different types of radiations (such as X- rays, UV - Vis, γ - rays). **[3]**

P.T.O.

- Q3)** a) Explain construction and working of Rotary pump. [4]
- b) If for first order diffraction of some nanomaterial, $\theta=30^\circ$, calculate the inter - planar distance in nm.
[Given : Wavelength used for diffraction is $\text{Cu K}\alpha-0.154\text{nm}$]. [3]
- c) With the help of graphical representation, explain different types of signals. [3]
- Q4)** a) Define sensor. Explain various characteristics of sensors in brief. [4]
- b) What is mean free path? For air at ambient temperature with pressure 10^{-5} Torr, calculate the mean free path. [3]
- c) Write short note on Electron Spin Resonance (ESR). [3]
- Q5)** a) Calculate the average nanoparticle size using Scherrer formula.
[Given : Wavelength used for diffraction is $\text{Cu K}\alpha-0.154\text{nm}$, full width at half maxima (FWHM) $\beta=0.05, \theta_B=60^\circ$] [4]
- b) Write note on different operating principles used in different types of sensors. [3]
- c) Write short note on errors. [3]
- Q6)** a) Write note on microwave generator. [4]
- b) Explain vacuum system design with the help of schematic diagram. [3]
- c) Write a short note on spectral analysis. [3]

- Q7)** a) Explain principle, construction and working of Scanning Tunnelling Microscope. [5]
- b) Discuss the operating principle and instrumentation of Fourier Transform Infrared (FTIR) spectroscopy with the help of schematic diagram. [5]
- Q8)** a) Draw the schematic of Bayard - Alpert ionization gauge. Explain its working. [5]
- b) Discuss basic principle and applications of optical tweezers. [5]



Total No. of Questions : 8]

SEAT No. :

P1558

[Total No. of Pages : 3

[4622] - 204

M.Sc. PHYSICS (Semester - II)

PHYUT 604 : Quantum Mechanics - I

(2013 Pattern) (5 Credits)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates :

- 1) Attempt any five out of eight questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables and electronic calculator is allowed.

Q1) a) Consider an operator $A \phi_a = a \phi_a$ and an arbitrary state $\psi = \sum C_a \phi_a$ where C_a is a constant show that $\langle A \rangle = \sum_a |C_a|^2 a$. Interpret your result. [4]

b) Show that the momentum operator is self - adjoint. [3]

c) For a particle in infinitely deep potential well

i) Draw potential well diagram

ii) Write schrodinger equation for a particle in this well, with boundary conditions and

iii) Write expression for energy E_n

[3]

Q2) a) Using uncertainty principle prove that free electron cannot exist in the nucleus. Given :Maximum kinetic energy of electron emitted by radioactive nucleus is ~ 4 MeV. [4]

b) Let $\alpha = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$ and $\beta = \begin{pmatrix} 0 \\ 1 \end{pmatrix}$. Show that α and β are the eigenvectors of pauli spin matrix σ_z . what are the eigenvalues in both cases? [3]

c) Show that two commuting operators have a common set of eigenvectors. [3]

P.T.O.

- Q3)** a) Consider a linear operator \hat{F} and let $\hat{F}|\psi\rangle = |\chi\rangle$ where $|\psi\rangle$ & $|\chi\rangle$ are arbitrary vectors. Represent \hat{F} as a matrix in A - representation. [4]
- b) Using Dirac notations define self - adjoint operator \hat{A} . prove that the eigenvalues of such an operator are real. [3]
- c) What is the condition for validity of WKB approximation? [3]
- Q4)** a) The operator $L^+ = L_x + iL_y$ show that L^+ is raising angular momentum operator. [4]
- b) Define the quantities in Hilbert space [3]
 i) Basis ii) Norm of a vector iii) Scalar product
- c) Define the projection operator \hat{P}_a and hence define unit operator - I. [3]
- Q5)** a) Find the eigenvalue matrices for the operators L^2 and L_z for $l = 1$. [4]
- b) Derive 0th, 1st and 2nd ordered fundamental equations used in time independent perturbation theory. [3]
- c) Show that the variation method gives upper-bound on the ground state energy. [3]
- Q6)** a) For a particle of mass m in 1 - dimensional box with walls at $x = 0$ and $x = L$ estimate the ground state energy using variation method. [4]
- b) For time dependent perturbation theory, write expression for first order transition amplitude $a_f^{(1)}(t)$. Using it write a note on selection rule. [3]
- c) Compare the assumptions of constant perturbation and harmonic perturbation in case of time dependent perturbation theory. Write $a_f^{(1)}(t)$ in both cases. [3]

- Q7)** a) Obtain the C.G. coefficients for a system having $j_1 = \frac{1}{2}$ and $j_2 = \frac{1}{2}$. [5]
- b) For simple Harmonic oscillator, define the operators a & a^+ . Using them obtain the expression for the eigenvalues of SHO. [5]
- Q8)** a) For non-degenerate case in time independent perturbation theory, show that the first order energy correction $W^{(1)}$ is the expectation value of perturbation taken with respect to unperturbed wavefunction. [5]
- b) State and prove the closure property for the functions $\{\phi_a\}$ which are orthonormal and form a complete set. [5]



Total No. of Questions : 7]

SEAT No. :

P1545

[Total No. of Pages : 3

[4622] - 21

M.Sc. (Semester - II)

PHYSICS

PHY UTN - 601 : Electrodynamics
(2008 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Question No. 1 is compulsory. Attempt any four questions from the remaining.*
- 2) *Draw neat labelled diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables and calculator is allowed.*

Q1) Attempt any four of the following:

- a) Determine skin- depth for copper at 1 MHz.
Given : $\mu = \mu_0 = 4\pi \times 10^{-7}$ Wb/A-m and $\sigma = 5.8 \times 10^7$ mho/m. [4]
- b) Two identical bodies move towards each other, the speed of each being 0.9c. Find their speed relative to each other. [4]
- c) Find the rest-mass energy of an electron in eV if its rest-mass is 9.1×10^{-31} kg. [4]
- d) Describe magnetic interaction between two current-loops. [4]
- e) Compute electric-field associated with a LASER beam having 100 J/m³ of energy per unit volume. [4]
- f) Calculate wave-impedance of an e.m. wave travelling through free space.

Given : $\mu = \mu_0 = 4\pi \times 10^{-7}$ Wb/A-m and $\epsilon = \epsilon_0 = 8.85 \times 10^{-12}$ C²/Nm². [4]

P.T.O.

Q2) a) Prove the relativistic addition theorem for velocities :

$$u_x = \frac{u'_x + v}{1 + \frac{u'_x v}{c^2}} \text{ where } u'_x = \frac{dx'}{dt'} \text{ and } u_x = \frac{dx}{dt} . \quad [8]$$

b) A plane e.m. wave is incident obliquely on an interface between two non-conducting media. Obtain Fresnel's equations if the dielectric-field vectors are perpendicular to the plane of incidence. [8]

Q3) a) Explain the term 'multipole moments'. Derive an expression for potential at a distant point using multipole expansion for a localized charge distribution in free-space. [8]

b) Obtain Faraday's Law of induction in differential form for a stationary medium and show how it can be modified when the medium moves with velocity \vec{u} . [8]

Q4) a) Using the concept of e.m. energy show that power transferred to the e.m. field through the motion of charge in volume V is given by :

$$-\int (\vec{j} \cdot \vec{E}) dv = \frac{d}{dt} \int_V \frac{1}{2} (\vec{E} \cdot \vec{D} + \vec{B} \cdot \vec{H}) dv + \int_{cs} (\vec{E} \times \vec{H}) \cdot \vec{ds} . \quad [8]$$

b) Show that: $C^2 B^2 - E^2$ and $\vec{E} \cdot \vec{B}$ are invariant under Lorentz transformations. [8]

Q5) a) Derive the Lorentz relativistic transformation equations : [8]

b) The magnetic field intensity \vec{B} at a point is given by : [8]

$$\vec{B} = \left(\frac{\mu_0}{4\pi} \right) \int \frac{\vec{j} \times \vec{r}}{r^3} d\tau . \text{ Show that : } \vec{\nabla} \times \vec{B} = \mu_0 \vec{j} .$$

- Q6)** a) Explain the term ‘electromagnetic field tensor’. Hence obtain an expression for the e.m. field-tensor $F_{\mu\nu}$. [8]
- b) State and prove Poynting’s Theorem. [8]
- Q7)** a) Explain the term ‘Four Vector Potential’. [4]
- b) Explain Minkowski’s space-time diagram. [4]
- c) A radiator approximates to an electric-dipole of length 250m at a frequency of 60kHz. Assuming that the current is maintained over the length, evaluate the radiation resistance of the radiator. [4]
- d) Determine the velocity at which the mass of a particle is double its rest-mass. $C = 3 \times 10^8$ m/s. [4]



Total No. of Questions: 7]

SEAT No. :

P1546

[Total No. of Pages : 3

[4622] - 22
M.Sc. (Semester - II)
PHYSICS
PHYUTN - 602 : Atoms Molecules and solids
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Question no.1 is compulsory. solve any four questions of the remaining*
- 2) Draw neat diagrams wherever necessary.*
- 3) Figure to the right indicate full marks.*
- 4) Use of Logarithmic tables and electronic pocket calculator is allowed.*

Given:-	Rest mass of electron	:	$9.109 \times 10^{-31} \text{kg}$
	Charge on the electron	:	$1.6021 \times 10^{-19} \text{columb}$
	Planks constant	:	$6.626 \times 10^{-34} \text{Js.}$
	Boltzmann constant	:	$1.38054 \times 10^{-23} \text{Jk}^{-1}.$
	Avogadro's number	:	$6.022 \times 10^{26} (\text{kmole})^{-1}$
	Bohr Magneton	:	$9.27 \times 10^{-24} \text{amp.m}^2$
	1 ev	:	$1.6021 \times 10^{-19} \text{J.}$

Q1) Attempt any four of the following.

[16]

- a) The concentration of schottly defects in an ionic crystal is 1 in 10^{10} at temp book. Estimate the energy of the vacancy pair.
- b) Calculate the highest possible frequency for silicon if the Debye temperature is 570k.
- c) Find the minimum magnetic field needed for Zeeman effect to be observed in a spectral line of 400nm wavelength. when a spectrometer where resolution is 0.010 nm is used.
- d) Determine Lande's g Factor for $2f_{5/2}$.

P.T.O.

- e) An NMR signal for a compound is found to be 180 Hz downward from TMS peak using a spectrometer operating at 60 MHz. calculate shift in ppm.
- f) The value of x_c for lower and upper states of C_2 are 0.00711 & 0.00919 respectively. Find the number of levels in the upper and lower states.
- Q2)** a) Explain normal Zeeman effect. Derive the formula for Change in wavelength $d\lambda$. [8]
- b) On the basis of lane diffraction theory. Obtain the condition for diffraction maxima. [8]
- Q3)** a) State and explain frank condon principle. [8]
- b) Explain the theory of geometrical structure factor and derive expression for FCC Lattice. [8]
- Q4)** a) Explain the interpretation of quantum numbers. n , l , m_l , and m_s for electron atoms. [8]
- b) Write note on. [8]
- i) Screw dislocation
- ii) Edge dislocation
- Q5)** a) Write a note on vibrational course. Structure explaining γ porgression. Explain with the help of necessary diagrams. [8]
- b) Derive an expression for the specific heat of solid based on Einstein model. What are the drawbacks of this model? [8]
- Q6)** a) Derive the relation between W& K for vibrational modes in 1D monoatomic lattice of identical atom. [8]
- b) Explain with the help of suitable diagrams band head and band origin in case of rotational fine structure of electronic vibration spcetrum. [8]

- Q7)** a) Calculate the magnetic field if the resonance frequency of 9530 MHz is observed in same ESR experiment given $g = 2.0023$. [4]
- b) What are normal and Umklapp processes? [4]
- c) Explain what do you mean by configurational entropy. [4]
- d) Explain the concept of phonon with reference to quantization of elastic waves in solids. [4]



Total No. of Questions :7]

SEAT No. :

P1547

[4622] - 23

[Total No. of Pages : 3

M.Sc. (Semester - II)

PHYSICS

**PHYUTN -603 : Statistical Mechanics in Physics
(2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to candidates:

- 1) *Question No. 1 is compulsory, attempt any four questions from the remaining questions.*
- 2) *Draw neat diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables and electronic pocket calculator is allowed.*

Constants :

- 1) Boltzmann constant $K_B = 1.38 \times 10^{-23} \text{ Joule / } ^\circ\text{K}$
- 2) Planck's constant $h = 6.625 \times 10^{-34} \text{ Joule. sec.}$
- 3) Avogadro's number $N = 6.023 \times 10^{23} \text{ mole}^{-1}$
- 4) Mass of electron $m_e = 9.1 \times 10^{-31} \text{ kg}$
- 5) Velocity of light $C = 3 \times 10^8 \text{ m/s}$

Q1) Attempt any four of the following :

- a) What do you mean by
 - i) Phase space
 - ii) Phase point [4]
- b) Determine the phase trajectory of a bullet of unit mass fired straight upwards with an initial speed of 392 m/s . (Given $g = 9.8 \text{ m/s}^2$) [4]

P.T.O.

- c) For canonical ensemble, show that the mean energy $\bar{E} = \frac{-\partial \ln z}{\partial \beta}$ [4]
- d) Show that at high temperature Bose - Einstein and Fermi - Dirac distributions reduce to Maxwell - Boltzmann distribution. [4]
- e) The table given below shows the energy parameters and accessible states for two systems 1 and 2.

System 1	System 2
$E_1 = 2, 3, 4$ units	$E_2 = 5, 6, 7$ units
$\Omega_1 = 5, 25, 75$	$\Omega_2 = 100, 150, 250$

The systems are kept in contact and undergo thermal interactions only. Obtain the distribution for 9 units of energy in the equilibrium state. [4]

- Q2)** a) Show that for classical monatomic ideal gas having N particles contained in volume V, the number of accessible states $\Omega(E)$ to the system in the energy range E to E + δE is given by $\Omega(E) = BV^N E^{3N/2}$ [8]
- b) On the basis of canonical distribution obtain the law of atmosphere. [8]
- Q3)** a) Obtain the Maxwell - Boltzmann velocity distribution and hence show the ratio of r.m.s. speed V_{rms} to the mean speed \bar{v} to the most probable speed \tilde{v} is given by $v_{rms} : \bar{v} : \tilde{v} = \sqrt{3} : \sqrt{\frac{8}{\pi}} : \sqrt{2}$ [8]
- b) Consider the system of N diatomic molecules each having vibrational energy levels $E = (n + \frac{1}{2})\hbar\omega$ $n = 0, 1, 2, \dots$. Write the partition function and derive the expression for mean energy. Also show that at low temperature, specific heat C_v is given by $C_v = 3R \left(\frac{\theta_v}{T}\right)^2 e^{-\theta_v/T}$ where
- $$\theta_v = \frac{\hbar\omega}{K} \quad [8]$$

- Q4) a)** Derive the expression for compressibility of Fermi gas at absolute zero. [8]
- b) Two macroscopic systems A and A' are in thermal interaction with each other forming a combined system A° .

Show that entropy $S = K \ln \Omega(E)$ where symbols have their usual meaning. [8]

- Q5) a)** For grand canonical ensemble, show that the probability of finding the system in a particular microstate r with energy E_r is given by

$$P_r = \frac{e^{-\beta E_r - \alpha N_r}}{\sum_r e^{-\beta E_r - \alpha N_r}} \quad [8]$$

- b) Obtain the expression for Planck's radiation law for photon gas. Hence deduce the Rayleigh- Jean's law and Wien's law. [8]

- Q6) a)** Using the canonical ensemble, discuss the behavior of paramagnetic substance placed in an external magnetic field \vec{H} . Hence obtain the curie law. [10]

- b) The atomic weight of Lithium is 6.94 and density is given by 0.53 gm/cc. Calculate the Fermi energy and Fermi temperature of the electrons. [6]

- Q7) a)** Write a short note on "Gibbs Paradox". [8]

- b) Obtain the Fermi - Dirac distribution in the form $\bar{n}_s = \frac{1}{e^{\beta(\epsilon_s - \mu)} + 1}$ [8]



Total No. of Questions : 7]

SEAT No. :

P1548

[Total No. of Pages : 3

[4622] - 24

M.Sc. (Semester - II)

PHYSICS

PHYUT - 604 : Quantum Mechanics - II

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates :

- 1) *Question No. 1 is compulsory.*
- 2) *Attempt any four from the remaining.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of mathematical tables and calculators allowed.*

Q1) Attempt any four of the following :

- a) Using Born Approximation, calculate the differential cross-section for the potential.

$$V(r) = -V_0 \text{ for } r < a$$

$$V(r) = 0 \text{ for } r > a \quad [4]$$

- b) Show that first order correction to energy is zero for Harmonic oscillator in the ground state when perturbation is $H' = ax$. [4]
- c) Using WKB approximation explain field emission. [4]
- d) Explain Laboratory frame and CM frame of reference. [4]
- e) Discuss the selection rules for electric dipole transitions. [4]
- f) Construct symmetric and antisymmetric wave functions for system of two particles. [4]

Q2) a) Develop time dependent perturbation theory to obtain first order correction to the amplitude $a_m^{(1)}(t)$. [8]

- b) Using WKB approximation, obtain expression for transition probability through a barrier potential. [8]

P.T.O.

Q3) a) Using partial wave analysis obtain the expression for scattering amplitude $f(\theta)$. [10]

b) Using variational principle, obtain the ground state energy of hydrogen. Take trial wave function $\psi(r) = e^{-\alpha r}$ where α is variational parameter. [6]

Q4) a) Consider a one - dimensional charged harmonic oscillator placed in a uniform electric field. The field can be considered as a small perturbation and depends on time according to

$$\varepsilon(t) = \frac{A}{\sqrt{\pi}} e^{-t^2/\tau^2}$$

Find the probability of transition from ground state to first excited state. [8]

b) Apply first order time independent equation to a doubly degenerate system and show that perturbation removes degeneracy. [8]

Q5) a) Calculate the first order energy correction for one dimensional perturbed Harmonic oscillator whose Hamiltonian is

$$H = \frac{p^2}{2m} + \frac{1}{2}kx^2 + ax^4$$

in the ground state. [8]

b) Using partial wave analysis, show that scattering cross section for rigid sphere is $4\pi a^2$ (a – radius). [8]

Q6) a) Using WKB approximation obtain the equation of wave function for $E > V$. [8]

b) What is Pauli's exclusion principle? Obtain symmetric and antisymmetric wave function for system of two fermions. [8]

Q7) a) Show that scattering angles in laboratory and CM frame are related as

$$\tan\theta_{lab} = \frac{\sin\theta_{cm}}{\frac{m_1}{m_2} + \cos\theta_{cm}} \quad [4]$$

b) Explain : i) Spontaneous emission ii) Stimulated emission. [4]

c) Explain the scattering of identical particles. [4]

d) State conditions for validity of Born Approximation. [4]



Total No. of Questions : 8]

SEAT No. :

P1559

[Total No. of Pages : 3

[4622] - 301

M.Sc. (Semester - III)

PHYSICS

PHY UT - 701 : Statistical Mechanics in Physics
(2013 Pattern - 4 Credits) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:-

- 1) Attempt any five questions out of eight questions.
- 2) Draw neat diagrams wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables and pocket calculators is allowed.

Constants :

- 1) Boltzmann constant $K_B = 1.38 \times 10^{-23}$ J/K
- 2) Planck's constant $h = 6.623 \times 10^{-34}$ J-sec
- 3) Avogadro's number $N = 6.023 \times 10^{23}$ /gm-mole
- 4) Mass of electron $m_e = 9.1 \times 10^{-31}$ kg
- 5) Velocity of light $C = 3 \times 10^8$ m/s
- 6) Charge on electron $e = 1.6 \times 10^{-19}$ C

Q1) a) Show that for classical mono atomic ideal gas having particles contained in volume V , the number of states $\Omega(E)$ for the system in the energy range E and $E + \delta E$ is given by $\Omega(E) = Br^N E^{3N/2}$. [4]

b) Probability that a system is in state s with energy E_s is given by

$S = -K \sum_s P_s \ln P_s$. Using this equation show that probability of a composite system is $S = S_1 + S_2$. [3]

P.T.O.

c) The partition function for ideal gas is given by $Z = \frac{V^N}{N! h^{3N}} \left(\frac{2m\pi}{\beta} \right)^{3N/2}$

show that Sackur - Tetrode equation may also be written in the form

$$S = NK \left[-\ln p + \frac{5}{2} \ln T + \frac{3}{2} \ln \frac{2m\pi}{h^2} + \frac{5}{2} (\ln K + 1) \right]. \quad [3]$$

Q2) a) Using canonical ensemble, show that paramagnetic susceptibility is inversely proportional to the temperature at high temperature. [4]

b) Show that when $T \ll \theta_r$, where θ_r is rotational characteristic temperature,

in the lowest approximation $(C_r)_{rot} = 12NK \left(\frac{\theta_r}{T} \right)^2 e^{-2\theta_r/T}$. [3]

c) Find the average number of photons in an enclosure of 22.4 litre at 273K. [3]

Q3) a) What are classical limits? Explain how quantum distribution laws are reduced to classical MB distribution. [4]

b) Write a note on white dwarf. [3]

c) The equation of motion of classical harmonic oscillator is expressed by $x = a \sin \omega t$. Show that probability of finding the particle between x and

$x + dx$ is given by $P(x)dx = \frac{dx}{\pi\sqrt{a^2 - x^2}}$. [3]

Q4) a) Calculate mean energy of fermions at 0K. Hence write ground state pressure. [4]

b) Write the postulate of equal a priori probability. [3]

c) A small system has just two states of energy $E_1 = 0J$ and $E_2 = 10^{-22}J$. Assuming Boltzmann distribution calculate the temperature when mean energy \bar{E} of the system is equal to $0.5 E_2$. [3]

- Q5)** a) Explain the concept of phase space. Also explain μ -space and Γ -space. [4]
 b) Show that dispersion in enthalpy (H) in a canonical ensemble is given by

$$\overline{(\Delta H)^2} = KT^2 C_p. \quad [3]$$

 c) The rms velocity of molecule of H_2 gas at certain temperature is 1600 m/s. What will be the rms velocity of molecules of oxygen at the same temperature? (Given : Molecular weight of $H_2 = 2$ amu, Molecular weight of $O_2 = 32$ amu) [3]

- Q6)** a) When chemical potential $\mu = 0$, show that Base temperature

$$T_b = \frac{h^2}{2\pi mk} \left(\frac{N}{2.612V} \right)^{2/3}. \quad [4]$$

- b) State and prove equipartition theorem. [3]
 c) Helmholtz free energy $\bar{F} = -KT \ln Z = \bar{E} - TS$ show that

$$E = \frac{\partial}{\partial \beta}(\beta F) \text{ and } C_r = -K\beta^2 \left[\frac{\partial^2(\beta F)}{\partial \beta^2} \right]_r. \quad [3]$$

- Q7)** a) State and prove Liouville's theorem. [5]
 b) What is black body emissivity? Show that total energy radiated per unit area is proportional to the fourth power of absolute temperature. [5]

- Q8)** a) Derive the relation for average no. of particles in F-D distribution in the form $\bar{n}_r = \frac{1}{e^{\beta(\epsilon_r - \mu)} + 1}$ where μ is chemical potential. Hence obtain the dispersion relation $\overline{(\Delta n_r)^2} = \bar{n}_r(1 - \bar{n}_r)$. [5]

- b) Using cononical ensemble show that fluctuation in energy $F = \left(\frac{2}{3N} \right)^{1/2}$. [5]



Total No. of Questions :7]

SEAT No. :

P1549

[4622] - 31

[Total No. of Pages : 3

M.Sc. (Semester - III)

PHYSICS

PHYUTN - 701 : SOLID STATE OF PHYSICS

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Question No. 1 is compulsory and solve any four questions from the remaining.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat labelled diagrams wherever necessary.*
- 4) *Use of logarithmic table and Pocket calculator is allowed.*

Given:

- 1) Mass of electron = 9.1×10^{-31} kg
- 2) Charge of electron = 1.6×10^{-19} C
- 3) Plank's constant = 6.626×10^{-34} J-s
- 4) Boltzmann constant = 1.38×10^{-23} J/K
- 5) Avogadro's number = 6.023×10^{26} /K mol
- 6) Bohr magneton = 9.27×10^{-24} A-m²
- 7) Permeability of free space = $4\pi \times 10^{-7}$ Henry/m
- 8) Permittivity of free space = 8.85×10^{-12} C² / N - m²

P.T.O.

Q1) Attempt any four of the following :

[16]

- a) Compute the average kinetic energy of a gen molecule at 27°C in eV. If the gas is hydrogen, calculate the velocity of molecules at 27°C .
- b) Calculate critical current density for 1mm diameter wire of lead at 4.2 K.
Given : Tc for lead = 7.18 K and Ho for lead = 6.5×10^4 amp / m
- c) The saturation magnetic induction of nickel is 0.65 wb/m². If the density of nickel is 8906 kg /m³ and its atomic weight is 58.7, calculate the magnetic moment of nickel atom is Bohr magneton.
- d) A magnetic material has a magnetization of 3300 amp/m and flux density 0.0044 wb/m². Calculate the magnetizing force and the relative permeability of the material.
- e) An atom of oxygen on being polarized produces a dipole moment of 0.5×10^{-22} c-m. If the distance of centre of negative charge cloud from the nucleus be 4×10^{-15} cm. Calculate the polarizability of the oxygen atoms.
- f) For a simple 2-D square lattice. show that kinetic energy of a free electron at the centre of 1st Brillouin zone is higher than that of the electron at the midpoint of a side face of a zone by a factor of 2.

Q2) a) Use the equation $m \left(\frac{d\vartheta}{dt} + \frac{\vartheta}{\tau} \right) = -eE$ for the electron drift velocity ϑ to

show that the conductivity at frequency ω is $\sigma(\omega) = \sigma(0) \left(\frac{1+i\omega\tau}{1+\omega^2\tau^2} \right)$

where $\sigma(0) = \frac{ne^2\tau}{m}$, symbols have their usual meaning. **[8]**

- b) Explain the paramagnetic phenomenon. Derive an expression for paramagnetic susceptibility using Langevin theory of paramagnetism. **[8]**

- Q3)** a) Discuss the Kronig - Penny model for the motion of an electron in periodic potential. [8]
- b) From the thermodynamics of super conductivity, Show that entropy of a super conducting state is less than normal conducting state. [8]
- Q4)** a) Explain hysteresis curve in ferromagnetism on the basis of domain theory. [8]
- b) Explain the phenomenon of electric polarization in dielectrics. Define polarizability and explain different types of polarizabilities. [8]
- Q5)** a) Derive the expression for paramagnetic susceptibility of conduction electrons. [8]
- b) State and prove Bloch theorem. [8]
- Q6)** a) Discuss the phenomenon of BCS theory [8]
- b) i) At what temperature we can expect 10% Probability that electron in silver have an energy which is 1% above the Fermi energy? [4]
- Given E_f of silver = 5.5 eV.
- ii) Calculate the value of London penetration depth λ_0 at 0K for lead where density is $11.3 \times 10^3 \text{ kg / m}^3$ and atomic weight is 207.19. [4]
- Q7)** a) Explain the concept of anisotropy energy in ferromagnetic material. [4]
- b) Explain the concept of flux quantization in super conductors. [4]
- c) Plot the first three energy bands of a linear lattice in the extended, reduced and periodic zone schemes. [4]
- d) Explain type I and type II super conductors with examples. [4]



Total No. of Questions : 7]

SEAT No. :

P1550

[Total No. of Pages : 3

[4622] - 41
M.Sc. PHYSICS
PHYUTN - 801 : Nuclear Physics
(2008 Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Question No. 1 is compulsory. Attempt any four questions from the remaining.*
- 2) *Draw neat Figures wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables and pocket calculator is allowed.*

Q1) Attempt any four of the following

[16]

- a) In a Bainbridge mass spectrograph singly ionized atoms of neon - 20 pass into the deflection on chamber with a velocity of 10^5 m/sec. If they are deflected by a magnetic field of flux density 0.08 tesla, calculate the radius of their path and where neon - 22 i am would fall if they had the same initial velocity.

Given : mass of proton = 1.67×10^{-27} kg, $e = 1.6 \times 10^{-19}$ C

- b) Compute the maximum energy of the compton recoil electrons resulting from the absorption in Al of 2.19 Mev r-rays.

Given : $m_e = 9.109 \times 10^{-31}$ kg.

- c) Calculate the total cross - section for n - p scattering at neutron energy 2 Mev (lab)

Given : $a_t = 5.38$ F $a_s = -23.7$ F

$r_{ot} = 1.70$ F $r_{os} = 2.40$ F

$M = 1.6748 \times 10^{-27}$ kg $\hbar = 1.0549 \times 10^{-34}$ J - s

- d) Show that the Gamow factor can be written as $G = e^{-\pi kb}$, k is the wave number and b is the collision diameter.

Given : Probability of transmission of s - wave $T = e^{-\gamma}$ $\gamma = \frac{2\sqrt{2m}}{\hbar} \int_R^{\gamma_1} [V(r) - E]^{\frac{1}{2}} dr$

P.T.O.

- e) Show that the pion decay, muon decay, neutron decay and pair production conserve the lepton numbers L_e and L_μ

$$\text{pion decay } \bar{\pi} \rightarrow \bar{\mu} + \bar{\nu}_\mu$$

$$\text{muon decay } \bar{\mu} \rightarrow \bar{e} + \nu_\mu + \bar{\nu}_e$$

$$\text{Pair production } \gamma \rightarrow \bar{e} + e^+$$

$$\text{Neutron decay } n^0 \rightarrow p^+ + \bar{e} + \bar{\nu}_e$$

- f) Calculate k_∞ for a homogeneous natural uranium heavy water moderated assembly which contains 50 molecules of moderator per molecule of uranium. Assume natural uranium to contain one part of U^{235} to 139 parts of U^{238} and use following constants for Uranium $\sigma_a(u) = 7.68$ barns $\sigma_s(u) = 8.3$ barns for D_2O $\sigma_a = 0.00092$ barn $\sigma_s = 10.6$ barn and $\xi = 0.570$

- Q2) a)** Explain the concept of nuclear magnetic moment and show that for a nucleus of mass number A nuclear magnetic moment

$$\mu = \frac{e}{2m} \left[\sum_{k=1}^A g_s s_k + \sum_{k=1}^Z g_l l_k \right] \quad [8]$$

- b) Discuss the theory of microtron. Show that increase in energy after each orbit is given by $\Delta E = \frac{E_0 r}{\mu - r}$, where symbols are in their usual meaning. [8]

- Q3) a)** By using Schrodinger equation obtain an expression for phase shift and scattering cross section in case of low energy n-p scattering. [8]

- b) Describe the vector design w.r.t.

i) fuel

ii) Moderators and reflectors

iii) Reactor coolants

iv) Control materials and reactor shielding. [8]

- Q4)** a) What is straggling? Describe the formula for a straggling when a particle is moving through matter. [8]
- b) Give the classification of elementary particle interactions and explain each in brief w.r.t. following points:
- i) Particles affected
 - ii) Range
 - iii) Relative strength
 - iv) Particles exchanged
 - v) Role in universe. [8]
- Q5)** a) State important features of fermi theory decay and find the probability of emission per unit time for the electron. [8]
- b) Explain coherent scattering of slow neutrons by ortho and para hydrogen molecules and explain the spin of neutron. [8]
- Q6)** a) In case of gamma decay explain multipole radiations and state selection rules. [8]
- b) Derive Bethes formula for stopping power of charged particles moving through the matter. write the expression for relativistic effects. [8]
- Q7)** a) Explain why experimentally the study of p - p scattering is capable of much higher accuracy than n - p scattering. [4]
- b) Write a note on graphite moderated research reactor. [4]
- c) Write a note on intermediate Bosons w.r.t. following points: [4]
- i) mass
 - ii) Spin
 - iii) electric charge
 - iv) principal decay mode.
- d) Explain concept of strangeness and hypercharge associated with elementary particles. [4]



Total No. of Questions :6]

SEAT No. :

P2103

[4623]-101

[Total No. of Pages :3

M.Sc.

PHYSICAL CHEMISTRY

CHP-110: Fundamentals of Physical Chemistry -I

(2013 Pattern) (New) (Semester - I)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *All questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic table/calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	$N = 6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	$k = 1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	$h = 6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	$e = 4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV	$= 23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	$R = 8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	$F = 96487 \text{ C equiv}^{-1}$
8. Speed of light	$c = 2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal	$= 4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu	$= 1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	$\beta_e = -9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	$\beta_n = 5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION -I

Q1) Attempt the following: **[10]**

- a) State and explain the second law thermodynamics giving the Kelvin statement.
- b) Deduce and explain the Clapeyron equation.
- c) State Raoult's and Henry's laws.
- d) Explain reverse osmosis and its applications.
- e) State Heisenberg's uncertainty principle.

Q2) Attempt any two of the following: **[10]**

- a) Derive the expression for the work done in the adiabatic expansion of one mole of an ideal gas.
- b) Explain methods to determine partial molar volume.
- c) Explain Vant-Hoff factor.
- d) Compare Planck's and Rayleigh - Jeans expressions for radiant energy of a heated black body. How was ultra-violet catastrophe overcome by Planck's hypothesis?

Q3) Solve any one of the following: **[5]**

- a) Calculate the change in entropy when 2 moles of nitrogen are mixed with 8 g chlorine gas at 25°C. [At. wts: nitrogen = 14, chlorine: 35.5]
- b) Evaluate the uncertainty in position of an electron moving with an uncertainty of 400 km s⁻¹ velocity.

SECTION -II

Q4) Attempt the following: **[10]**

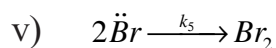
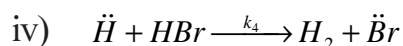
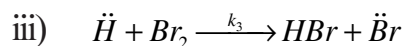
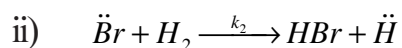
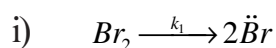
- a) Write a short note on Lineweaver-Burk plot for enzyme catalysed reactions.
- b) For certain reaction following data are observed, show that the reaction is first order

Time	0	t	2t	3t -----
Concentration of reactant remaining	a	αa	$\alpha^2 a$	$\alpha^3 a$ ----

- c) Calculate the energy of activation for a reaction if rate of the reaction is doubled by changing the temperature from 27°C to 37°C.
- d) Define consecutive and parallel reaction with suitable examples.
- e) What is the difference between unstable intermediate and an activated complex?

Q5) Attempt any two of the following: **[10]**

- a) Obtain the relation between equilibrium constant and partition function.
- b) The Bodenstein-Lind mechanism for formation of HBr is given below



Show that above mechanism is consistent with experimental rate law

$$\frac{d[HBr]}{dt} = \frac{k[H_2][Br_2]^{1/2}}{1 + k' \left(\frac{[HBr]}{[Br_2]} \right)}$$

- c) Explain how ionic strength affects the rates of reaction?

Q6) Solve any one of the following: **[5]**

- a) Calculate the vibrational partition function at 300K, when vibrational frequency of a diatomic molecule is 1600 cm⁻¹.
- b) Estimate the diffusion controlled rate constant for the recombination of iodine atoms in n-hexane at 25°C, given that coefficient of viscosity (η) for hexane is 0.325 cP.

EEE

Total No. of Questions : 6]

SEAT No. :

P2066

[Total No. of Pages :4

[4623]-11

M.Sc.

Physical Chemistry
CH-110:Physical Chemistry-I
(2008 Pattern)(Semester-I)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *ALL questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic table/ calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	$N = 6.022 \times 10^{23} \text{ mol}^{-1}$
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3. Planck Constant	$h = 6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	$e = 4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV	$= 23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
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7. Faraday Constant	$F = 96487 \text{ C equiv}^{-1}$
8. Speed of light	$c = 2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
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10. 1 amu	$= 1.673 \times 10^{-27} \text{ kg}$
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12. Nuclear magneton	$\beta_n = 5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$

P.T.O

SECTION-I

Q1) Attempt any three of the following: **[15]**

- a) Write and explain the terms in the three dimensional time independent Schrödinger equation. What is Laplacian operator?
- b) Sketch the first four eigen functions for the particle in a box and compare these with the probability density curves.
- c) Write a note on steam distillation.
- d) What is chemical potential? Obtain an expression for the free energy of mixing of ideal gases.
- e) Derive the Clayperon equation and give its applications.

Q2) Attempt any three of the following: **[15]**

- a) Explain Raoults and Henry's law.
- b) Explain Vant Hoff factor and give its significance.
- c) What is residual entropy? Explain with example of the N_2O molecule. Write the corollary of the third law of thermodynamics .
- d) Derive the work done in a reversible adiabatic expansion of an ideal gas.
- e) What are exact and inexact differentials? State Euler's theorem.

Q3) Solve any two of the following: **[10]**

- a) Calculate the degeneracy of energy level $\frac{86h^2}{8ma^2}$ for a particle in cubic box.
- b) Light of wavelength 300nm is incident on a metal ($\phi=2.26$ eV). Calculate the velocity of the ejected electron.
- c) Calculate the osmotic pressure at 25 °C for a solute concentration of 0.5 mol per litre in a body cell that is impermeable to the solute molecules.

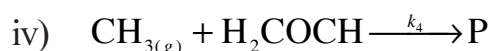
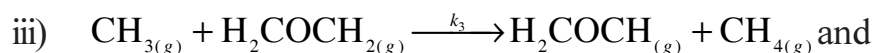
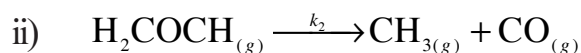
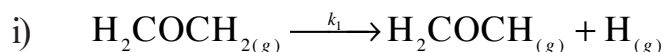
SECTION-II

Q4) Attempt any three of the following: **[15]**

- a) Explain flash photolysis to study kinetics of fast reactions.
- b) How does the concentration of intermediate be obtained in the case of consecutive reaction $A \rightarrow B \rightarrow C$?
- c) Explain lindemann theory for unimolecular reactions in gas phase.
- d) Obtain the expression for rate constant for a second order reaction when reactants differ in concentration.
- e) For reversible reactions, show that $\frac{K_1}{K_{-1}} = \frac{\{B\}_{eq}}{\{A\}_{eq}} = K_c$.

Q5) Attempt any three of the following: **[15]**

- a) Thermal decomposition of ethylene oxide occurs by the mechanism.



Apply steady state approximation to show that $\frac{d\{P\}}{dt} \propto [H_2COCH_2]$

- b) Explain lineweaver -burk plots for enzymolysis.
- c) Obtain the expression for rate constant using collision theory.
- d) Distinguish between Maxwell-boltzmann and Bose-Einstein statistics.
- e) Discuss the vibrational contribution to the entropy of a system consisting of diatomic molecules.

Q6) Solve any two of the following:

[10]

- a) Show that in every first order reaction, the time required for 75% completion of reaction is double the half life period.
- b) Calculate the rotational contributions to entropy and free energy for oxygen gas at 25°C and 1atmosphere pressure. The moment of inertia of O₂ gas is 1.9373×10^{-46} kgm².
- c) Calculate the vibrational partition function at 300K and 500 K when vibrational frequency of the diatomic molecule is 1600 cm⁻¹.

□□□

Total No. of Questions :6]

SEAT No. :

P2107

[4623]-201

[Total No. of Pages :3

M.Sc.

PHYSICAL CHEMISTRY

CHP-210: Fundamentals of Physical Chemistry - II

(2013 Pattern) (New) (Semester - II)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *All questions are COMPULSORY.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of logarithmic table/calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	$N = 6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	$k = 1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	$h = 6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	$e = 4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV	$= 23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	$R = 8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	$F = 96487 \text{ C equiv}^{-1}$
8. Speed of light	$c = 2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal	$= 4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu	$= 1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	$\beta_e = -9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	$\beta_n = 5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	$m_e = 9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION -I

Q1) Attempt the following: **[10]**

- a) Explain the role of Doppler effect in spectral widths.
- b) Write a note on signal to noise ratio.
- c) State Franck -Condon principle.
- d) Explain the converse rule of mutual exclusion.
- e) Write the selection rules for pure rotational Raman activity in a linear molecule.

Q2) Attempt any two of the following: **[10]**

- a) Explain the Birge-Sponer method to determine dissociation energies of diatomic molecules.
- b) Sketch and explain the polarizability ellipsoids for the H₂O molecule.
- c) Explain factors determining intensity of spectral lines.
- d) Write a note on NMR spectra applications.

Q3) Solve any one of the following: **[5]**

- a) HCl is irradiated with 436 nm radiation. Calculate the wavelength of the first Stokes line. [Fundamental frequency for HCl = 87 THz]
- b) Find V_{\max} for $x = 0.0174$.

SECTION -II

Q4) Attempt the following: **[10]**

- a) What is α -decay? Give one example of it.
- b) Give preparation of sulphur -35.
- c) Define unit cell.
- d) State law of crystallography.
- e) What is the wave function for H₂ molecule in valence bond theory.

Q5) Attempt any two of the following: **[10]**

a) Show that the bonding and antibonding wave function of H_2 molecule is

$$\text{given by } \psi_B = \frac{1}{\sqrt{2(1+S)}} (\phi_1 + \phi_2) \text{ and } \psi_{AB} = \frac{1}{\sqrt{2(1-S)}} (\phi_1 - \phi_2)$$

where ϕ_1 and ϕ_2 are the atomic wave functions using MOT.

- b) What are the assumptions of Huckel molecular orbital theory.
- c) Discuss the principle of neutron activation analysis. What is saturation activity? Explain comparator method.
- d) Discuss briefly, use of radio isotopes in agriculture.

Q6) Solve any one of the following: **[5]**

- a) Calculate the half-life of radium -226 if 1g of it emits 3.7×10^{10} alpha particles per second.
- b) The unit cell of an element of atomic mass 96 and density 10.3 g cm^{-3} is a cube with edge length of 314 pm. find the structure of crystal lattice, simple cubic, fecc or bcc [$N = 6.023 \times 10^{23} \text{ atoms mole}^{-1}$].

EEE

Total No. of Questions :6]

SEAT No. :

P2108

[4623]-202

[Total No. of Pages :6

M.Sc. -I

INORGANIC CHEMISTRY

**CHO - 230: Coordination and Bioinorganic Chemistry
(2013 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat and labelled diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION - I

Q1) Answer the following questions:

[10]

- a) Determine the full spectroscopic term symbol for the following free ions (Any two):
 - i) CO^{2+} ($z = 27$)
 - ii) Yb^{3+} ($z = 70$)
 - iii) Fe^{3+} ($z = 26$)
- b) Calculate the total degeneracy for the following terms / states / configurations.
 - i) $2(p^2d^4)$
 - ii) 5_H
- c) Explain why $[\text{CoCl}_4]^{2-}$ shows a deep blue colour.
- d) Give the appropriate term symbol for the states with the following values of L and S. Find the possible values of T also.
 - i) $L = 3$ $S = \frac{3}{2}$
 - ii) $L = 5$ $S = 1$
- e) State and explain Hund's rule to determine the ground state term symbols.

P.T.O.

Q2) Attempt any two of the following:

[10]

- a) In the following pair of transition in octahedral complex which would you expect to be more intense?
- i) $3_{A_{2g}} \rightarrow 3_{T_{2g}}$ OR $3_{A_{2g}} \rightarrow 1_{E_g}$
- ii) $A_{2u} \rightarrow T_{2g}$ OR $A_{1g} \rightarrow T_{2u}$
- b) Give the splitting of 6_D R.S. term in weak cubic field using character table for pure rotational point group.

Give: Character Table for O rotational group

O	E	$6C_4$	$3C_2(\equiv C_4^2)$	$8C_3$	$6C_2$	
A_1	1	1	1	1	1	$x^2+y^2+z^2$
A_2	1	-1	1	1	-1	
E	2	0	2	-1	0	$(2z^2-x^2-y^2, x^2-y^2)$
T_1	3	1	-1	0	-1	(R_x, R_y, R_z) (x, y, z)
T_2	3	-1	-1	0	1	(xy, xz, yz)

- c) Prepare microstate table for s^1d^1 configuration.
- d) Explain whether the following complexes exhibit orbital contribution to the magnetic moment. Justify your answer.
- i) $[(C_2H_5)_4N]_2[FeCl_4]$
- ii) $[Mn(H_2O)_6]^{2+}$

Q3) Attempt any one of the following:

[5]

- a) For $[Cr(ox)_3]^{3-}$ (ox= oxalato) complex μ_{eff} is 3.79 BM. γ_1 transition is observed at $17,000\text{ cm}^{-1}$. Calculate spin orbit coupling constant.
- b) Hexa-aquo Ni(II) complex shows three absorption bands at 356.8 nm, 571.2 nm and 891.2 nm. Calculate the spectrochemical parameter Dq and Nephelauxetic parameter B and β with the help of following data. Comment on the nature of M-L bonding. Given:

i) $B_0 = 1030\text{ cm}^{-1}$

ii) $B = \frac{2\gamma_1^2 + \gamma_2^2 - 3\gamma_1\gamma_2}{15\gamma_2 - 27\gamma_1}$

SECTION - II

Q4) Answer the following: **[10]**

- a) Give the biological function of following elements : Ca, Fe, p, Co.
- b) Enlist the functions of metalloenzymes and name metals involved in it.
- c) Give the names of enzymes involved in mercury detoxification.
- d) Give functions of copper Type I proteins.
- e) Why iron is suitable for redox processes in biological systems?

Q5) Attempt any two of the following: **[10]**

- a) Write a short note on transferrin.
- b) Discuss in detail HSAB concept as applicable to bioinorganic chemistry.
- c) What are model complexes and the concept of spontaneous self assembly?
- d) Discuss the role of manganese in photosynthesis.

Q6) Draw the structures of the following (any five): **[5]**

- a) Thymine
- b) Oxyhaemoglobin
- c) Aurinofin
- d) Kubredoxin
- e) Vitamin B₁₂
- f) MECAM

Character Table for O rotational group

O	E	6C ₄	3C ₂ (=C ₄ ²)	8C ₃	6C ₂		
A ₁	1	1	1	1	1		$x^2+y^2+z^2$
A ₂	1	-1	1	1	-1		$(2z^2-x^2-y^2)$
E	2	0	2	-1	0		x^2-y^2
T ₁	3	1	-1	0	-1	(R _x , R _y , R _z); (x, y, z)	
T ₂	3	-1	-1	0	1		(xy, xz, yz)

Correlation Table for the Group O_h

O _h	O	T _d	D _{4h}	D _{2d}	C _{4v}	C _{2v}	D _{2d}	D ₂	C _{2h}
A _{1g}	A ₁	A ₁	A _{1g}	A ₁	A ₁	A ₁	A _{1g}	A ₁	A _g
A _{2g}	A ₂	A ₂	B _{1g}	B ₁	B ₁	A ₂	A _{2g}	A ₂	B _g
E _g	E	E	A _{1g} +B _{1g}	A ₁ +B ₁	A ₁ +B ₁	A ₁ +A ₂	E _g	E	A _g +B _g
T _{1g}	T ₁	T ₁	A _{1g} +E _g	A ₁ +E	A ₁ +E	A ₁ +B ₁ +B ₂	A _{1g} +E _g	A ₁ +E	A _g +2B _g
T _{2g}	T ₂	T ₂	B _{1g} +E _g	B ₂ +E	B ₂ +E	A ₁ +B ₁ +B ₂	A _{2g} +E _g	A ₂ +E	2A _g +B _g
A _{1u}	A ₁	A ₂	A _{1u}	B ₁	A ₂	A ₁	A _{1u}	A ₁	A _u
A _{2u}	A ₂	A ₁	B _{1u}	A ₂	B ₂	A ₂	A _{2u}	A ₂	B _u
E _u	E	E	A _{1u} +B _{1u}	A ₁ +B ₁	A ₁ +B ₁	A ₁ +A ₂	E _u	E	A _u +B _u
T _{1u}	T ₁	T ₂	A _{1u} +E _u	B ₂ +E	A ₂ +E	A ₁ +B ₁ +B ₂	A _{1u} +E _u	A ₁ +E	A _u +2B _u
T _{2u}	T ₂	T ₁	B _{1u} +E _u	A ₂ +E	B ₁ +E	A ₁ +B ₁ +B ₂	A _{2u} +E _u	A ₂ +E	2A _u +B _u

DIRECT PRODUCTS

1. Groups of the form $G \times I$ or $G \times \sigma_2$:
 The g, u or $'$, $''$ additions to the IR symbols in these groups satisfy
 $g \times g = u \times u = g, g \times u = u, 'x' = 'x'' = ', 'x'' = 'x'$.
2. Products of the form $A \times A, B \times B, A \times B$:
 For all groups :
 Letter symbols : $A \times A = A, B \times B = A, A \times B = B$.
 Subscripts : $1 \times 1 = 1, 2 \times 2 = 1, 1 \times 2 = 2$
 except for the B representations of D_2 and D_{2h} where
 $B \times B = B$ and $1 \times 2 = 3, 2 \times 3 = 1, 3 \times 1 = 2$.
3. Products of the form $A \times E, B \times E$:
 (a) For all groups : $A \times E_1 = E_1$ irrespective of the suffix on A.
 (b) For all groups except D_{2h}, D_{4h}, S_4 :
 $B \times E_1 = E_2, B \times E_2 = E_1$
 irrespective of the suffix on B. (If the group has only one B representative put $E_1 = E_2 = E$.)
 (c) For D_{2h} :
 $B \times E_1 = E_2, B \times E_2 = E_3, B \times E_3 = E_1, B \times E_4 = E_2, B \times E_5 = E_3$
 irrespective of the suffix on B.
 (d) For D_{4h}, S_4 :
 $B \times E_1 = E_2, B \times E_2 = E_3, B \times E_3 = E_1$
 irrespective of the suffix on B.
4. Products of the form $E \times E$:
 (For groups which have A, B or E symbols without suffixes put $A_1 = A_2 = A$, etc. in the equations below)
 (a) For $O_h, O, T_d, D_{2h}, D_2, C_{2v}, C_{2h}, C_{2v}, S_4, D_{3h}, D_{3d}, D_3, C_{3v}, C_{3h}, C_3$:
 $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2; E_1 \times E_2 = E_1 + E_2 + E_1$
 (b) For $D_{4h}, D_4, C_{2v}, C_{4h}, C_4, S_4, D_{2d}$:
 $B \times E = A_1 + A_2 + B_1 + B_2$
 (c) For D_{2h} :
 $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$
 $E_2 \times E_2 = E_3 \times E_3 = A_1 + A_2 + E_2$
 $E_3 \times E_3 = A_1 + A_2 + B_1 + B_2$
 $E_1 \times E_2 = E_3 \times E_3 = E_1 + E_2, E_1 \times E_3 = E_2 \times E_2 = E_2 + E_3$
 $E_2 \times E_3 = E_1 \times E_1 = E_2 + E_3, E_2 \times E_2 = E_3 \times E_3 = E_1 + E_2$
 $E_1 \times E_3 = E_2 \times E_2 = E_1 + E_2, E_2 \times E_3 = E_3 \times E_1 = E_1 + E_2$
 $E_1 \times E_3 = E_2 \times E_2 = E_1 + E_2, E_2 \times E_3 = E_3 \times E_1 = E_1 + E_2$

(d) $D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3$

$$E_1 \times E_1 = A_1 + A_2 + E_2, E_2 \times E_2 = A_1 + A_2 + E_1,$$

$$E_1 \times E_2 = E_1 + E_2.$$

(e) For D_{4d}, S_8 .

$$E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2,$$

$$E_2 \times E_2 = A_1 + A_2 + B_1 + B_2$$

$$E_1 \times E_2 = E_2 \times E_1 = E_1 + E_2, E_1 \times E_3 = B_1 + B_2 + E_1.$$

5. Products involving the T (or F) representations of O_h, O and T_d

$$A_1 \times T_1 = T_1, A_1 \times T_2 = T_2, A_2 \times T_1 = T_2, A_2 \times T_2 = T_1,$$

$$E \times T_1 = E \times T_2 = T_1 + T_2,$$

$$T_1 \times T_1 = T_2 \times T_2 = A_1 + E + T_1 + T_2,$$

$$T_1 \times T_2 = A_2 + E + T_1 + T_2.$$

6. The complete results for O are :

O	A_1	A_2	E	T_1	T_2
A_1	A_1	A_2	E	T_1	T_2
A_2	A_2	A_1	E	T_2	T_1
E	E	E	$A_1 + A_2 + E$	$T_1 + T_2$	$T_1 + T_2$
T_1	T_1	T_2	$T_1 + T_2$	$A_1 + E + T_1 + T_2$	$A_2 + E + T_1 + T_2$
T_2	T_2	T_1	$T_1 + T_2$	$A_2 + E + T_1 + T_2$	$A_1 + E + T_1 + T_2$

EEE

Total No. of Questions :6]

SEAT No. :

P2109

[4623]-203

[Total No. of Pages :4

M.Sc. -I

ORGANIC CHEMISTRY

**CHO - 250:Synthetic Organic Chemistry and Spectroscopy
(2013 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *All questions are compulsory.*
- 3) *Figures to the right indicate full marks.*

SECTION -I

Q1) Attempt any three of the following: **[9]**

- a) What are phosphorus ylides? Give a method of preparation and its use in organic synthesis.
- b) Write a short note on organozinc reagents.
- c) Explain the use of SeO_2 in organic synthesis.
- d) Why is Hoffmann rearrangement used for step-down synthesis?

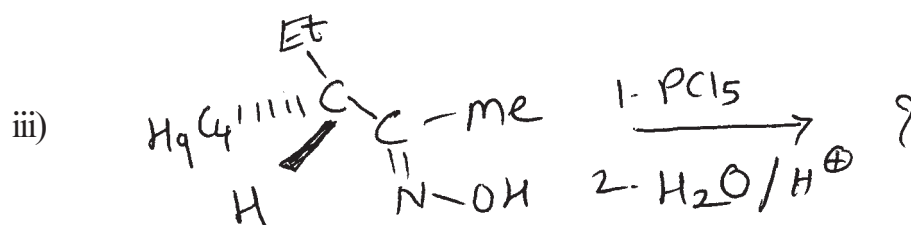
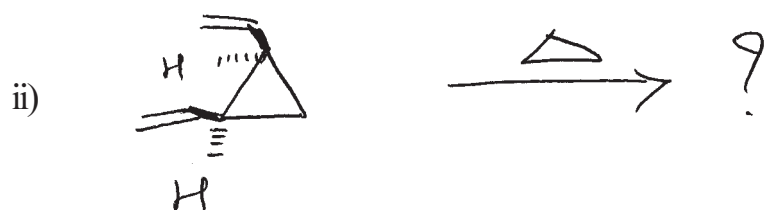
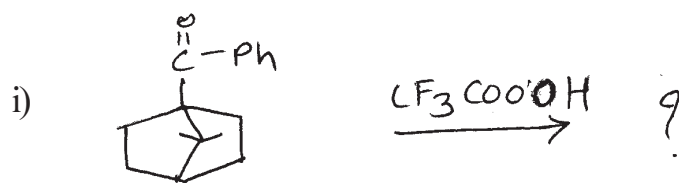
Q2) Explain any four of the following: **[8]**

- a) Oxime of ethyl methyl ketone gives two products on treatment with H_2SO_4 whereas cyclohexanone gives one under similar conditions.
- b) Explain the reactions of organolithium reagent and Grignard reagent on α, β -unsaturated ketone.
- c) Write a note on Claisen rearrangement.
- d) Explain the use of Bu_3SnH in organic synthesis.
- e) Write a note on Wilkinson's catalyst.

P.T.O.

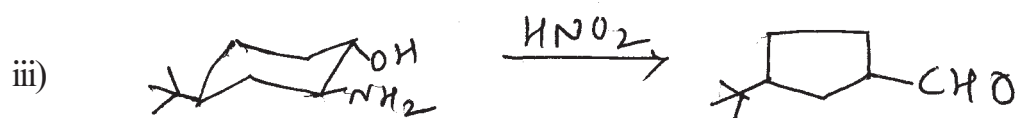
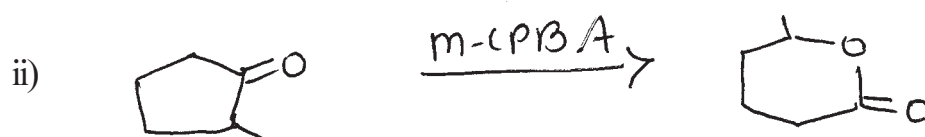
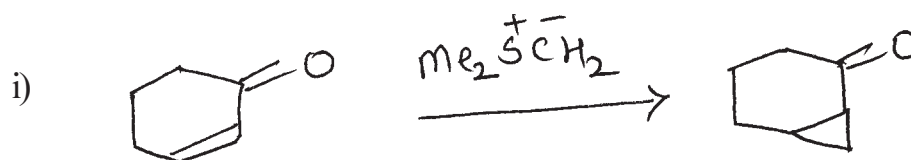
Q3) a) Predict the products (Any Two):

[4]



b) Suggest the mechanism(Any Two):

[4]



SECTION -II

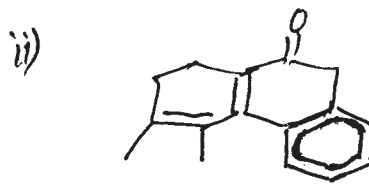
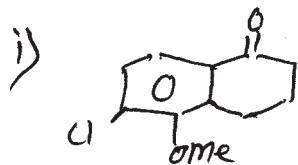
Q4) Deduce the structure from spectral data and justify your answer (Any three):[9]

- a) $C_7H_7O_3N$
U.V. : 265 nm ($\epsilon = 15000$)
I.R. : 3600, 1600, 1530, 1495, 1360 cm^{-1}
P.M.R. : 2.90 δ (s, exchangeable, 10 mm)
 5.00 δ (s, 20 mm)
 7.60 δ (m, 30 mm)
 8.15 δ (dd, J = 2 and 7 Hz, 10 mm)
- b) $C_7H_{14}O$
U.V. : Featureless above 220 nm.
I.R. : 1720 cm^{-1} .
P.M.R. : 0.9 δ (t, 30 mm)
 1.6 δ (sextet, 20 mm)
 2.4 δ (t, 20 mm)
- c) $C_{12}H_{14}O_4$
U.V. : 220 nm ($\epsilon = 11000$)
I.R. : 1735, 1600, 1490, 990 cm^{-1}
P.M.R. : 1.25 δ (t, J = 6 Hz, 6H)
 4.25 δ (q, J = 6 Hz, 4H)
 7.45 δ (dd, J = 2 and 8Hz, 2H)
 7.65 δ (dd, J = 2 and 8Hz, 2H)
- d) $C_{10}H_{13}ON$
U.V. : Not significant
I.R. : 1680, 1610, 1530, 730, 690 cm^{-1}
P.M.R. : 7.25 δ (m, 50 mm)
 5.00 δ (s, exchangeable, 10 mm)
 3.00 δ (s, 20 mm)
 2.30 δ (q, J = 6Hz, 20 mm)
 1.10 δ (t, J = 6Hz, 30 mm)

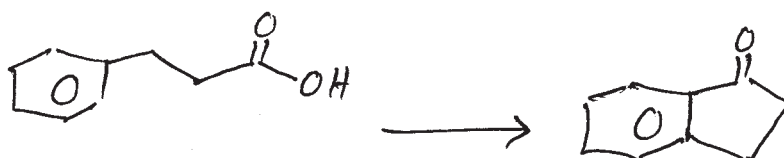
Q5) Attempt any four of the following:

[8]

a) Calculate λ_{\max} of the following:



b) How will you follow the reaction using IR spectroscopy?



c) Draw structure of compound $C_5H_{11}Br$ having two singlets in its PMR spectrum around 1.1 and 3.3 δ .

d) A compound $C_8H_{14}O$ shows positive iodoform test. Its λ_{\max} is at 250 nm in UV. Suggest structure.

e) How PMR is useful in distinguishing methylbenzoate and phenyl acetate?

Q6) Attempt any four of the following:

[8]

a) What are the applications of U.V.?

b) Discuss in brief "Mass Spectrometry".

c) Explain importance of "Integration" in PMR.

d) Nitrobenzene is not used as a solvent for recording U.V. spectrum of a compound.

e) Why CMR peaks are weak as compared to PMR?

EEE

Total No. of Questions : 3]

SEAT No. :

P2110

[Total No. of Pages : 2

[4623]-204

M.Sc.-I (Semester-II)

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

New Course Based on Credit & Semester System

PART - A : Modern Separation Methods and Hyphenated Techniques (2.5 Credit / 25 marks)

PART - B : Basic Biochemistry (5.0 Credit / 50 marks)

PART - C : Concept of Analytical Chemistry (2.5 Credit / 25 marks)

PART - D : Industrial Methods of Analysis (2.5 Credit / 25 marks)

PART - E : Organometallic and Inorganic Reaction Mechanism (2.5 Credit / 25 marks)

PART - F : Mathematics for Chemists (2.5 Credit / 25 marks)

PART - G : Pericyclic, Photochemistry and Free Radical Reactions (2.5 Credit / 25 marks)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions of respective section / part are compulsory.*
- 2) *Figures to right hand side indicate full marks.*
- 3) *Neat labelled diagram must be drawn wherever necessary.*
- 4) *Use of log table / non programmable calculator is allowed.*
- 5) *Students should attempt any two parts from Part-A, C, D, E, F and G or full paper of biochemistry (Part-B) of 5 credit / 50 marks.*
- 6) *Write the answers of two parts on separate answer books.*

PART-A

Modern Separation Methods and Hyphenated Techniques

Q1) Answer the following:

[10]

- a) What is 'base peak' in mass spectrum? Give its analytical importance.

P.T.O.

- b) How the resolving power of HPLC column is increased?
- c) What types of sample species can be separated by HPLC but not by GC.
- d) What is the fundamental difference between adsorption and partition chromatography?
- e) Explain the term selectivity factor, α . Write its equation in terms of retention and dead time.

Q2) Answer any two of the following: **[10]**

- a) Draw the schematic diagram of mass spectrometer. Give its analytical working.
- b) Classify the different HPLC detectors. Explain the working and drawbacks of refractive index detector.
- c) With the help of EI ionization method show the fragmentation of gaseous methanol and represent the mass spectrum of the ion fragments thus generated.
- d) Explain the isocratic elution and gradient elution process used in HPLC.

Q3) Answer any one of the following: **[5]**

- a) Draw the schematic diagram of GC apparatus and explain its instrumentation with the components involved in it.
- b) The following data was obtained by a gas - liquid chromatography on a 40 cm packed column.

compound	t_R (min)	W (min)
i) Air	1.9	—
ii) Methyl cyclohexane	10.0	0.76
iii) Methyl cyclohexene	10.9	0.82
iv) Toluene	13.4	1.06

Calculate:

- i) An average number of plates from the data.
- ii) The column resolution
- iii) The plate height.

EEE

Total No. of Questions : 6]

SEAT No. :

P2110

[Total No. of Pages : 2

[4623]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-B
Basic Biochemistry

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Figures to the right indicate maximum marks.*
- 3) Answers to the two sections should be written on separate answer sheets.*

SECTION-I

Q1) Answer ANY THREE of the following: **[9]**

- a) Discuss the methods for determining 'N' & 'C' terminal amino acid.
- b) What are ribosomes? Explain prokaryotic & Eukaryotic ribosomes.
- c) Give the structure of Glycogen & starch.
- d) Comment on Globular proteins.

Q2) Discuss ANY TWO of the following: **[8]**

- a) What are the components of cell membrane? Give function of each.
- b) Reactions of TCA cycle.
- c) i) Hair can be set into different shapes justify the statement.
ii) Formation of peptide bond.

Q3) Attempt any two of the following: **[8]**

- a) Enlist the types of membrane transport and explain facilitated transport.
- b) Classify proteins.
- c) Discuss in brief:
 - i) Essential aminoacids.
 - ii) Different types of fatty acids.

P.T.O.

SECTION-II

Q4) Answer any three of the following: **[9]**

- a) Give an overview of diseases related to nutritional deficiencies.
- b) What are double reciprocal plots? Give their importance.
- c) What is gene expression? What are the factors involved in gene expression.
- d) Give Therapeutic uses of enzymes.

Q5) Discuss any two of the following: **[8]**

- a) Discuss different types of inhibition.
- b) Discuss in brief:
 - i) DNA as genetic material
 - ii) Transcription bubble.
- c) Characteristics of genetic code. Add a note on wobble hypothesis.

Q6) Attempt any two of the following: **[8]**

- a) Give the structure and function of vitamin B6.
- b) What do you mean by enzyme Immobilization? Discuss different methods of enzyme immobilization.
- c) Discuss in brief
 - i) Structure and function of vitamin A.
 - ii) Post translational modification of proteins.

EEE

Total No. of Questions : 3]

SEAT No. :

P2110

[Total No. of Pages : 2

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M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-C
Concept of Analytical Chemistry

Q1) Answer the following:

[10]

- a) Calculate the absolute standard deviations of the result of the following calculations

$$Y = \text{antilog} [1.200 (\pm 0.003)] = 15.849 \pm ?$$

- b) Distinguish between accuracy and precision.
- c) What is the difference between batch and continuous extraction?
- d) What do you mean by test of significance?
- e) Mention any two properties of nano materials.

Q2) Attempt any two of the following:

[10]

- a) Write a note on rejection of result: The Q test.
- b) Give the principle of separation of ions by ion exchange process. What are ion-exchange resin? Explain with examples.
- c) Describe the synthesis of nano materials by sol-gel method.
- d) Explain th factors affecting solvent extraction.

P.T.O.

Q3) Attempt any one of the following: **[5]**

- a) a New automated procedure for determining glucose in serum (method A) is to be compared with the established method (method B). Both methods are performed on serum from the same 6 patients to eliminate patient to patient variability. Do the following results confirm a difference in the two methods at the 95% confidence level? [Given: 't' value at 95% confidence level and 5 degrees of freedom = 2.57]

↓ method/patient →	1	2	3	4	5	6
Method A :	1044	720	845	800	957	650
Method B :	1028	711	820	795	935	639

- b) Write a note on salt induced precipitation of proteins.

EEE

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M.Sc.-I (Semester-II)

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

PART-D

Industrial Methods of Analysis

Q1) Answer the following: **[10]**

- a) How is the common ion effect is useful in separation of groups in qualitative analysis?
- b) Explain the concept of stepwise formation constants.
- c) What are the benefits of quality system for chemical laboratory?
- d) Calculate the number of millimoles present in 0.2 gm of CaCO_3 ? (Given At.wt. Ca = 40, C = 12, O = 16)
- e) 0.02 gm of NaOH is dissolved in 100 ml water. What is the concentration of the solution in ppm?

Q2) Answer any two of the following: **[10]**

- a) NiCl_2 is converted into $[\text{Ni}(\text{NH}_3)_6]\text{Cl}_2$. Calculate the percentage of Ni and nitrogen in the complex. (Given: At.wts: Ni = 58.6, N = 14, Cl = 35.5, H = 1).
- b) What is basic buffer? Explain the buffer action of a basic buffer with a suitable example.
- c) Write a note on automatic elemental analyzer.
- d) What is chromatography? Explain the technique of gas chromatography.

Q3) Answer any ONE of the following: **[5]**

- a) Write a note on continuous online process control.
- b) 0.250 g of steel sample was dissolved by acid treatment. The solution was diluted 100 ml. From an aliquot of 25 ml, Fe (III) ions are precipitated as $\text{Fe}(\text{OH})_3$. The PPt. of $\text{Fe}(\text{OH})_3$ was ignited, when it gave 0.085 gm of Fe_2O_3 . Calculate the percentage of Fe in the sample.
(Given: At.wt. Fe = 55.85, O= 16)

EEE

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M.Sc.-I (Semester-II)

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

PART-E**Organometallic & Inorganic Reaction Mechanism****Q1) Answer the following: [10]**

- Trans Ir (CO) Cl (PPh₃)₂ + CH₃I →?
- Explain dissociative and associative mechanism with suitable example.
- Explain the term outersphere reaction with suitable example.
- State [Cr (Co)₆] complex obeys 18 e[⊖] rule or not.
- Give two environmental aspects of organometallic compounds.

Q2) Answer any two of the following: [10]

- Explain formation of aldehyde by Hydroformylation process.
- What is trans effect? Give its synthetic applications. Design two step synthesis of cis and trans isomer of [Pt Cl₂ (NO₂) (NH₃)] starting from [Pt Cl₄]⁻² ion. Justify your answer.
- Write note on base hydrolysis.
- Explain electron counting in the following complexes by neutral ligand method.
 - (η⁵ - C₅ H₅) Fe (CO)₅ Cl.
 - (CO)₅ Mn - Mn (CO)₅

Q3) Answer any one of the following: [5]

- Draw the following structures.
 - [Co (H) (N₂) (PPh₃)₂]
 - [(C₇⁵ - C₅H₅) Fe (CO)₂]₂
 - [Cp.Mn (CO)₃]
 - [Pt Cl₂ (PPh₃) (NH₃)]
 - [Co₂ (CO)₈]
- Explain the difference in IR spectra of:
 - Mo (PF₃)₃ (CO)₃ Vs Mo (PMe₃)₃ (CO)₃.
 - Mn Cp (CO)₃ Vs M_n C_p* (CO)₃.

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M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-F
Mathematics for Chemists

Q1) Answer the following: **[10]**

- a) Give the product rule and the chain rule of differentiation.
- b) Twenty different metals are to be combined in alloys regard less of relative compositions. How many different binary alloys (containing two metals) are possible?
- c) State whether the following differential equations are exact or inexact
 - i) $(x^2y + x) dy + (xy^2 - y) dx = 0$
 - ii) $x^2 dy - y^2 dx - xydx = 0$
- d) What is a unit matrix and diagonal matrix? Give examples.
- e) Give the transpose of the following matrices.

i) $\begin{bmatrix} 2 & 7 & 5 \\ 6 & 8 & 1 \end{bmatrix}$

ii) $\begin{bmatrix} 8 & 2 & 3 \\ 4 & 1 & 1 \\ 1 & 5 & 6 \end{bmatrix}$

Q2) Attempt any two of the following: **[10]**

- a) Solve the following:

i) $6^{-\frac{1}{2}}$

ii) $25^{\frac{1}{3}}$

iii) $(5.8)^2$

iv) 16^{-1}

v) $3^3 \cdot 3^5$

- b) i) Find the determinant of:

$$\begin{bmatrix} 3 & 5 & 6 \\ 2 & 1 & 6 \\ 8 & 9 & 6 \end{bmatrix}$$

- ii) Find out the cofactor of:

$$\begin{bmatrix} 9 & 8 & 2 \\ 4 & 4 & 4 \\ 1 & 1 & 1 \end{bmatrix}$$

- c) Solve the following:

- i) The readings recorded on a polarograph for diffusion current are given below. What is the average error, most probable error and mean square error.

25.7, 25.5, 25.3, 25.6, 25.9, 25.1.

- ii) The probability of success of three students A, B and C in one examination are $\frac{1}{5}$, $\frac{1}{4}$ and $\frac{1}{3}$ respectively. Find the probability of success of at least two.

- d) Solve the following:

A radioactive sample when measured using a scintillation counter five times, showed the activity 1200, 1205, 1220, 1205 cpm. Find the average activity and standard deviation.

Q3) Attempt any one of the following:

[5]

- a) Solve the following:

- i) Differentiate with respect to x $y = 3x^3 + 2x^2 + 5$.

- ii) Integrate $\int_0^2 (x+1)(x^3-3) dx$

- iii) Find the derivative of $f(x) = x^4 + x^2 + x + 2$.

- b) Solve the following:

- i) Find the derivative of $\frac{d 5x^3}{dx}$

- ii) Find $f'(x)$ if $f(x) = \sqrt[3]{(x^2-1)^2}$

- iii) Evaluate $\frac{d}{dx} [3(x^2+2)^2]$

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M.Sc.-I (Semester-II)

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

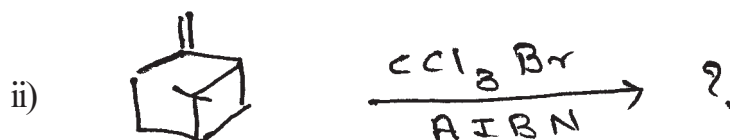
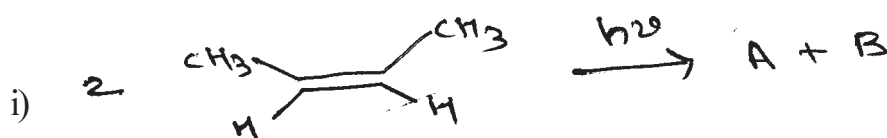
PART-G

Pericyclic, Photochemistry and Free Radicals

Q1) Attempt any three of the following: [9]

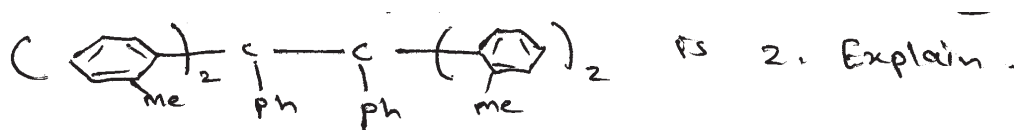
- Irradiation of benzophenone in the presence of $(\text{Ph})_2\text{CHOH}$ gives benzpinacol as the only product. Explain.
- Discuss the mechanism of the Norrish type I process of 2, 2 - dimethyl cyclohexanone and predict the products formed.
- Draw correlation diagram for DIS rotatory cyclization of butadiene to cyclobutene.
- Distinguish between homolytic and heterolytic reactions.

Q2) a) Predict the product/s and explain (any two): [4]



b) Answer any two of the following: [4]

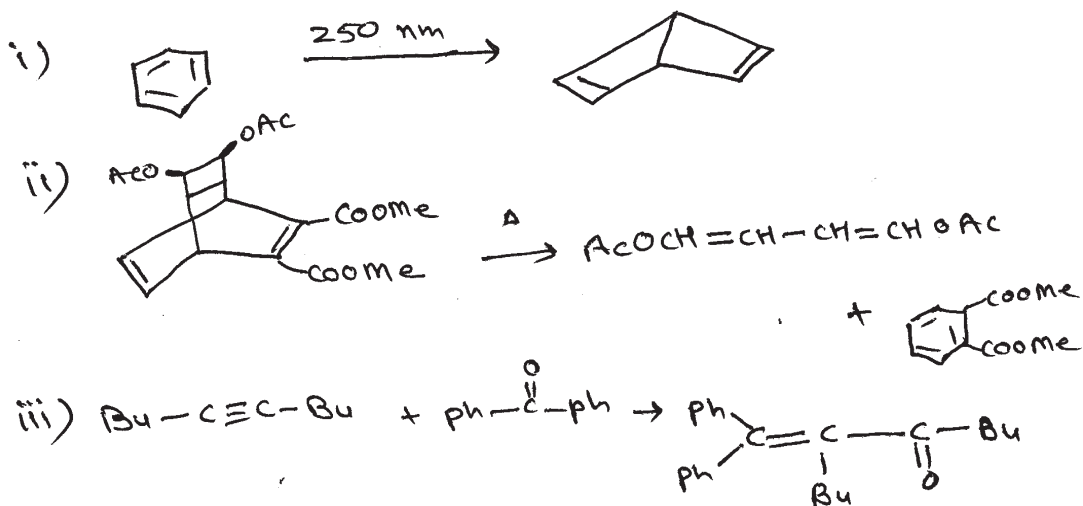
- $K_{\text{dissociation}}$ for $\text{Ph}_3\text{C} - \text{CPh}_3$ is 0.002 where as $K_{\text{dissociation}}$ for



P.T.O.

- ii) Discuss the phenomenon of phosphorescence in photochemical reactions.
- iii) Explain the product formation after thermal reaction of 2E, 4z, 6E-octatriene and comment on its stereochemistry.

Q3) a) Explain the mechanism for the following reactions (any two): **[4]**



b) Attempt any two of the following: **[4]**

- i) Free radical chlorination of both n-propyl and isopropyl bromide give the same product, 1-bromo-2-chloropropane. Explain.
- ii) Discuss cope rearrangement with suitable example.
- iii) Explain the use of photosensitizers in photochemical reactions with one example.

EEE

Total No. of Questions : 6]

SEAT No. :

P2069

[Total No. of Pages :3

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M.Sc.

PHYSICAL CHEMISTRY

CH-210:Physical Chemistry-II

(Semester-II) (2008 Pattern)(Old)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *All questions are compulsory.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic table and calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	N	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O

SECTION-I

Q1) Answer any Three of the following: **[15]**

- a) Explain the hyperfine structure of esr spectra.
- b) What are the ways of de-excitation of an excited molecule?
- c) Explain the Born- Oppenheimer effect.
- d) Write a note on NMR spectroscopy.
- e) Deduce the relation $I = \mu r^2$ for a rigid diatomic molecule.

Q2) Answer any three of the following: **[15]**

- a) Discuss the Frank-Condon principle.
- b) Explain the quantum theory of Raman effect.
- c) Write a note on predissociation spectra.
- d) Explain the factors determining width of spectral lines.
- e) Discuss the advantages of FTIRS.

Q3) Solve any two of the following: **[10]**

- a) Determine J_{\max} at 500K for molecule having $I=1.5 \times 10^{-46} \text{ kgm}^2$.
- b) The exciting Raman frequency for a molecule is 2900 cm^{-1} . Find the first two stokes lines [$B = 10 \text{ cm}^{-1}$]
- c) Calculate the dissociation energy for a molecule. The continuum is found at $5.7 \times 10^6 \text{ m}^{-1}$ and $E_{\text{exc}} = 1.59 \times 10^4 \text{ cm}^{-1}$.

SECTION-II

Q4) Attempt any three of the following: **[15]**

- a) Explain the construction and working of G.M.counter.
- b) What is dosimetry? Explain how the dose due to gamma source is measured using Fricke dosimeter.
- c) Explain the terms, half- life, average life, and S-ray track.
- d) Give an account photoelectric effect.
- e) Discuss the Breeder reactor at Kalpakkam.

Q5) Attempt any three of the following:

[15]

- a) Discuss the general principles of using radiotracers.
- b) What is radiation gauging? How thickness of a moving sheet be measured and controlled with the help of radioisotopes.
- c) Discuss the use of radiotracers in assessing the volume of blood in patient.
- d) Discuss the use of radiotracers in diagnosis and therapy of thyroiditis.
- e) Explain the technique of gamma radiography. Which radioisotopes are used for this purpose?

Q6) Solve any two of the following:

[10]

- a) Calculate molecular, mass, and linear absorption coefficient of benzene. If density of benzene is 0.879 gm-cm^{-3} and $e\mu = 0.21\text{b/electron}$.
- b) 5g sample containing 1% germanium was irradiated in a neutron flux of $5 \times 10^8 \text{ n cm}^{-2}\text{s}^{-1}$ for 5 min. Find out the activity of sample at the end of irradiation in dpm.

[Given $\gamma=7.8\%$, $\sigma=3.28\text{mb}$ and $t_{\frac{1}{2}}$ of $^{77}\text{Ge}=1\text{min}$]

- c) The half life period of radon is 3.8days. After how many days will one twentieth of radon sample be left over?

□□□

Total No. of Questions : 6]

SEAT No. :

P2070

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[Total No. of Pages : 6

M.Sc. - I

INORGANIC CHEMISTRY

CH - 230 : Inorganic Chemistry - II

(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer sheet.*
- 3) *Neat diagrams must be drawn whenever necessary.*
- 4) *Use of logtables & calculators is allowed.*
- 5) *Given atomic numbers.*

SECTION - I

Q1) Attempt any three of the following: **[15]**

- a) Prepare the microstate table and obtain R.S. Term symbol for P^3 configuration.
- b) Assign the spin multiplicities to the state arising from t_{2g}^2 configuration when infinitely strong Oh field is relaxed to strong field using Bethe's method of descending symmetry, correlation table and direct product table.
- c) Assign the following transitions in Oh field complex according to the increasing intensity. Justify your answer.
 - i) $A_{2g} \rightarrow T_{2g}$
 - ii) $A_{1g} \rightarrow T_{2u}$
 - iii) $A_{2u} \rightarrow T_{2g}$
- d) Calculate the degeneracy of the following terms / configuration.
 - i) d^2F^3
 - ii) $^4T_{1g}$
 - iii) 6I
 - iv) $2. ^3E_2$
 - v) $t_{2g}^3 eg^3$
- e) Write a note on factors affecting on band width of electronic spectra.

Q2) Answer the following (Any three):

[15]

- a) Arrange the following R.S. Term in increasing order of energy. Justify your answer.
- i) $5_D, 4_P, 2_F, 2_H, 1_S$
- ii) $3_F, 1_G, 3_P, 1_D, 1_S$
- b) Explain which of the following complexes shows orbital contribution to the magnetic moment. Justify your answer.
- i) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ $\mu_{\text{eff}} = 1.84$ BM.
- ii) $[\text{CoCl}_4]^{2-}$ $\mu_{\text{eff}} = 4.71$ B.M.
- c) Predict the electronic spectra of $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$.
- d) For a complex three absorption bands were observed at 7728cm^{-1} , 12970cm^{-1} and 24038cm^{-1} . Calculate B_0 , B and β . Comment on nature of M-L bonding.
- Given $B_0 = 1030\text{cm}^{-1}$
- e) Write a note on Tanabe-sugano Diagram.

Q3) Attempt any two of the following:

[10]

- a) For a complex $[\text{Cr}(\text{OX})_3]^{3-}$ the ν_1 transition is observed at 17000cm^{-1} . The spin orbit coupling constant for Cr^{3+} ion in this complex is $+92\text{cm}^{-1}$. Calculate effective magnetic moment of the complex.
- b) Write a note on Quenching of orbital angular momentum.
- c) Explain the following :
- i) T_d complexes always show max intense color than their octahedral counterpart.
- ii) In electronic spectra of $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ complex a shoulder is observed in main transition band.

SECTION - II

Q4) Answer any three of the following: **[15]**

- a) Give an account of acetylcholine receptors.
- b) Comment on the natural selection of elements used in bioinorganic chemistry.
- c) Comment on the intracellular uptake of chromate ion.
- d) Describe the mechanism for cleavage of Hg-C bonds at the active site of organomercurial lyase.
- e) Give an account of the principles of coordination chemistry utilised in bio-inorganic chemistry with respect to hard and soft acids and bases.

Q5) Write short notes on any three:- **[15]**

- a) Metals in medicine.
- b) Amino acids as ligands.
- c) Zinc fingers.
- d) Dioxygen transport.
- e) Transferrin.

Q6) Draw structures of any five:- **[10]**

- a) Enterobactin.
- b) Flavin.
- c) Cyanocobalamin.
- d) 3Fe-4S.
- e) Pterin.

Character Table for O rotational group

O	E	6C ₄	3C ₂ (=C ₄ ²)	8C ₃	6C ₂	
A ₁	1	1	1	1	1	(R _x , R _y , R _z); (x, y, z)
A ₂	1	-1	1	1	-1	
E	2	0	2	-1	0	
T ₁	3	1	-1	0	-1	
T ₂	3	-1	-1	0	1	

						$x^2 + y^2 + z^2$
						$(2z^2 - x^2 - y^2)$
						$x^2 - y^2$
						(xy, xz, yz)

Correlation Table for the Group O_h

O _h	O	T _d	D _{4h}	D _{2d}	C _{4v}	C _{2v}	D _{2h}	D ₂	C _{2h}
A _{1g}	A ₁	A ₁	A _{1g}	A ₁	A ₁	A ₁	A _{1g}	A ₁	A _g
A _{2g}	A ₂	A ₂	B _{1g}	B ₁	B ₁	A ₂	A _{2g}	A ₂	B _g
E _g	E	E	A _{1g} +B _{1g}	A ₁ +B ₁	A ₁ +B ₁	A ₁ +A ₂	E _g	E	A _g +B _g
T _{1g}	T ₁	T ₁	A _{2g} +E _g	A ₂ +E	A ₂ +E	A ₁ +B ₁ +B ₂	A _{2g} +E _g	A ₂ +E	A _g +2B _g
T _{2g}	T ₂	T	B _{2g} +E _g	B ₂ +E	B ₂ +E	A ₁ +B ₁ +B ₂	A _{2g} +E _g	A ₁ +E	2A _g +B _g
A _{1u}	A ₁	A ₂	A _{1u}	B ₁	A ₂	A ₁	A _{1u}	A ₁	A _u
A _{2u}	A ₂	A ₁	B _{1u}	A ₂	B ₂	A ₂	A _{2u}	A ₂	B _u
E _u	E	E	A _{1u} +B _{1u}	A ₁ +B ₁	A ₂ +B ₂	A ₁ +A ₂	E _u	E	A _u +B _u
T _{1u}	T ₁	T ₂	A _{2u} +E _u	B ₂ +E	A ₁ +E	A ₁ +B ₁ +B ₂	A _{2u} +E _u	A ₂ +E	A _u +2B _u
T _{2u}	T ₂	T ₁	B _{2u} +E _u	A ₂ +E	B ₁ +E	A ₂ +B ₁ +B ₂	A _{1u} +E _u	A ₁ +E	2A _u +B _u

DIRECT PRODUCTS

1. Groups of the form $G \times I$ or $G \times \sigma_1$:
 The g, u or $'$, $''$ additions to the IR symbols in these groups satisfy
 $g \times g = u \times u = g, g \times u = u, ' \times ' = '' \times '' = ', ' \times '' = ''$.
2. Products of the form $A \times A, B \times B, A \times B$:
 For all groups:
 Letter symbols: $A \times A = A, B \times B = A, A \times B = B$.
 Subscripts: $1 \times 1 = 1, 2 \times 2 = 1, 1 \times 2 = 2$
 except for the B representations of D_2 and D_{2h} where
 $B \times B = B$ and $1 \times 2 = 3, 2 \times 3 = 1, 3 \times 1 = 2$.
3. Products of the form $A \times E, B \times E$:
 - (a) For all groups: $A \times E_1 = E_1$ irrespective of the suffix on A.
 - (b) For all groups except D_{4h}, D_{4d}, S_8 :
 $B \times E_1 = E_{21}, B \times E_2 = E_1$
 irrespective of the suffix on B. (If the group has only one B representative put $E_1 = E_2 = E$.)
 - (c) For D_{4h} :
 $B \times E_1 = E_2, B \times E_2 = E_4, B \times E_3 = E_1, B \times E_4 = E_2, B \times E_5 = E_1$
 irrespective of the suffix on B.
 - (d) For D_{4d}, S_8 :
 $B \times E_1 = E_2, B \times E_2 = E_2, B \times E_3 = E_1$
 irrespective of the suffix on B.
4. Products of the form $E \times E$:
 (For groups which have A, B or E symbols without suffixes put $A_1 = A_2 = A$, etc. in the equations below)
 - (a) For $O_h, O, T_d, D_{4h}, D_{6h}, C_{4v}, C_{6v}, C_{2v}, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{2h}, C_2$:
 $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2; E_1 \times E_2 = B_1 + B_2 + E_1$.
 - (b) For $D_{4h}, D_4, C_{2v}, C_{4h}, C_4, S_4, D_{2d}$:
 $E \times E = A_1 + A_2 + B_1 + B_2$.
 - (c) For D_{4d} :
 $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$
 $E_3 \times E_3 = E_4 \times E_4 = A_1 + A_2 + E_4$
 $E_1 \times E_2 = A_1 + A_2 + B_1 + B_2$
 $E_1 \times E_3 = E_4 \times E_3 = B_1 + E_1, E_1 \times E_4 = E_2 \times E_3 = E_2 + E_4$
 $E_3 \times E_4 = E_2 \times E_3 = E_2 + E_2, E_2 \times E_3 = E_2 \times E_4 = E_1 + E_2$
 $E_1 \times E_4 = B_1 + B_2 + E_4, E_2 \times E_4 = B_1 + B_2 + E_1$.

(d) $D_{3d}, D_{3h}, D_3, C_{3v}, C_{2h}, C_3$
 $E_1 \times E_1 = A_1 + A_2 + E_2, E_2 \times E_2 = A_1 + A_2 + E_1,$
 $E_1 \times E_2 = E_1 + E_2.$

(e) For D_{2d}, S_8 .
 $E_1 \times E_1 = E_3 \times E_3 = A_1 + A_2 + E_2,$
 $E_2 \times E_2 = A_1 + A_2 + B_1 + B_2$
 $E_1 \times E_2 = E_2 \times E_3 = E_1 + E_3, E_1 \times E_3 = B_1 + B_2 + E_2.$

5. Products involving the T (or F) representations of O_h, O and T_d

$A_1 \times T_1 = T_1, A_1 \times T_2 = T_2, A_2 \times T_1 = T_2, A_2 \times T_2 = T_1,$

$E \times T_1 = E \times T_2 = T_1 + T_2.$

$T_1 \times T_1 = T_2 \times T_2 = A_1 + E + T_1 + T_2.$

$T_1 \times T_2 = A_2 + E + T_1 + T_2.$

6. The complete results for O are :

O	A_1	A_2	E	T_1	T_2
A_1	A_1	A_2	E	T_1	T_2
A_2	A_2	A_1	E	T_2	T_1
E	E	E	$A_1 + A_2 + E$	$T_1 + T_2$	$T_1 + T_2$
T_1	T_1	T_2	$T_1 + T_2$	$A_1 + E + T_1 + T_2$	$A_2 + E + T_1 + T_2$
T_2	T_2	T_1	$T_1 + T_2$	$A_2 + E + T_1 + T_2$	$A_1 + E + T_1 + T_2$

Total No. of Questions : 6]

SEAT No. :

P2071

[4623]-23

[Total No. of Pages : 5

M.Sc. - I

ORGANIC CHEMISTRY

**CH - 250 : Synthetic Organic Chemistry and Spectroscopy
(2008 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Figures to the right indicates full marks.*
- 3) Answers to the two sections should be written in separate answer books.*

SECTION - I

Q1) Explain any Four of the following: [16]

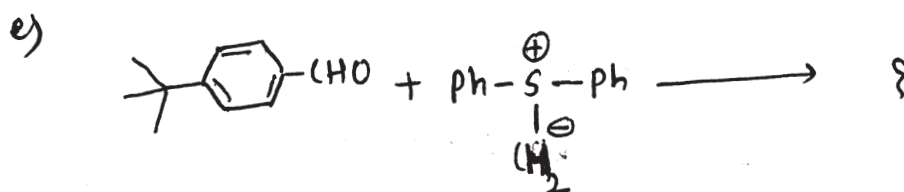
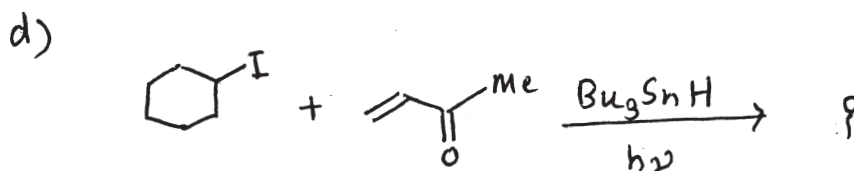
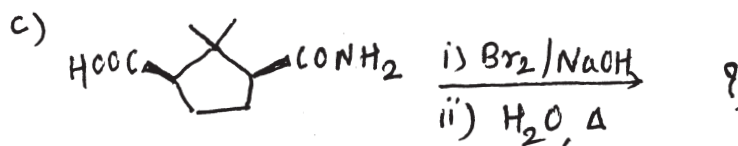
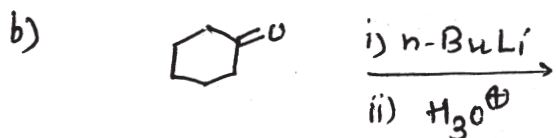
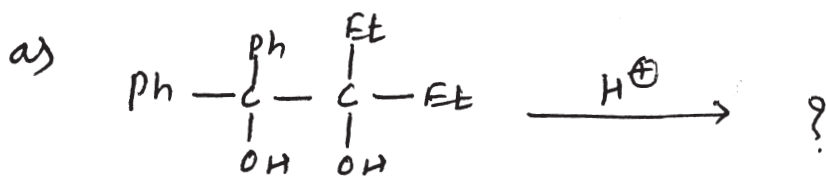
- a) Cyclohexene on treatment with OsO_4 gives Cis-diol while with mCPBA followed by hydrolysis gives trans-diol. Explain.
- b) Give the significance of Reformatsky reaction.
- c) The reduction of Chiral carbonyl compounds with NaBH_4 proceeds without racemisation.
- d) Oxime of ethyl methyl ketone gives two products on treatment with H_2SO_4 whereas, cyclohexanone gives only one product under similar conditions.
- e) What are sulfur-ylides? Explain the significance with suitable examples.

Q2) Write short note on any three of the following: [12]

- a) Refo Modified witting Reaction.
- b) Use of Oxide (SeO_2) in organic synthesis.
- c) Claisen rearrangement.
- d) MVP reduction.

P.T.O.

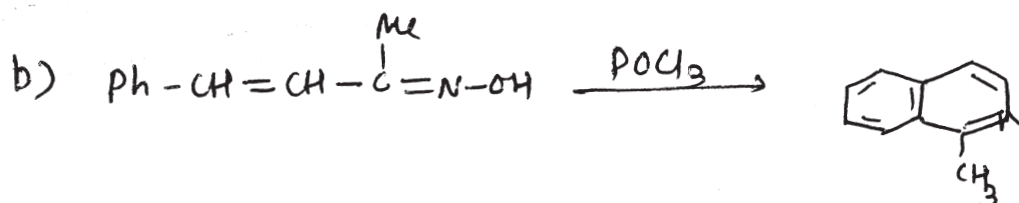
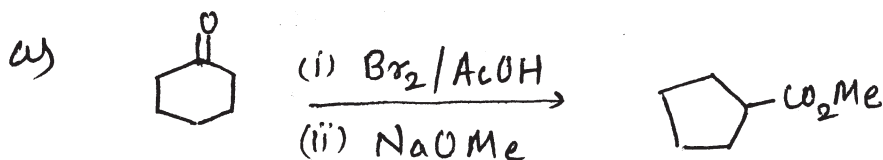
Q3) Predict the product and suggest the mechanism for any four of the following: [12]

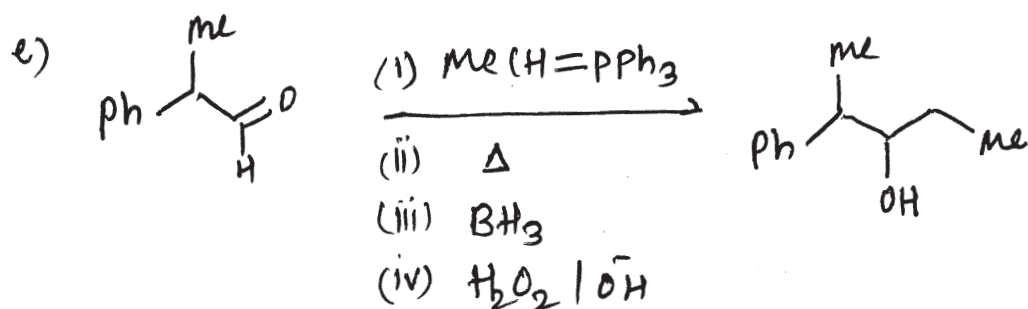
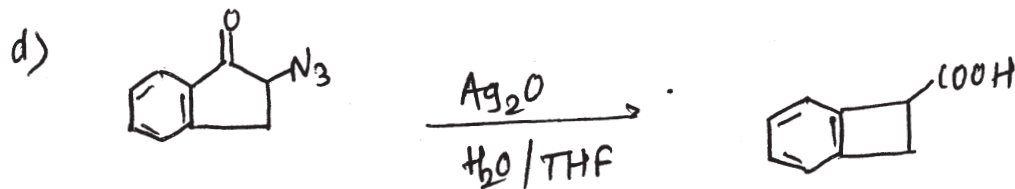
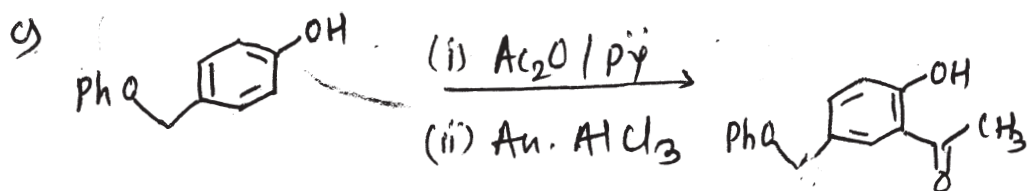


SECTION - II

Q4) Suggest mechanism for any four of the following :

[12]

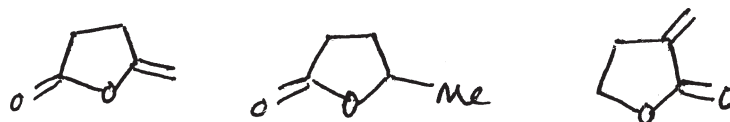




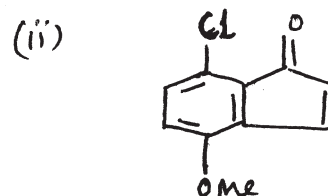
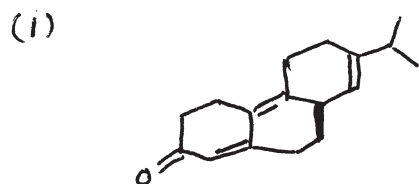
Q5) Attempt any Four of the following:

[16]

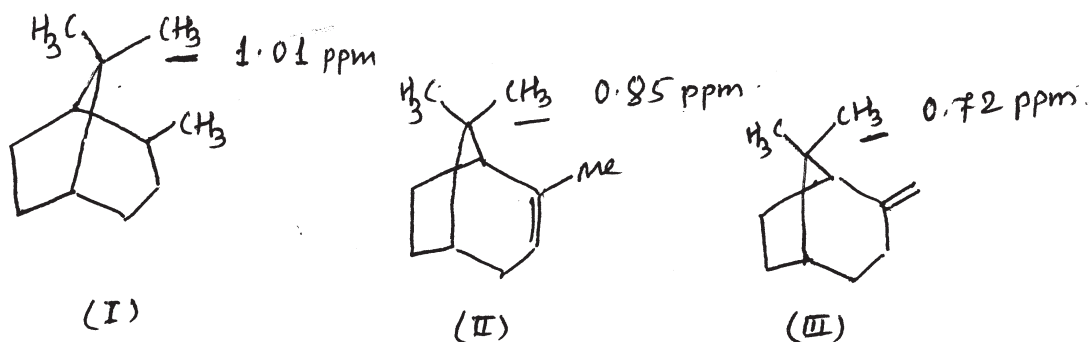
- a) Assign the IR absorption values 1761 , 1773 and 1810 cm^{-1} to the following compounds with proper justification.



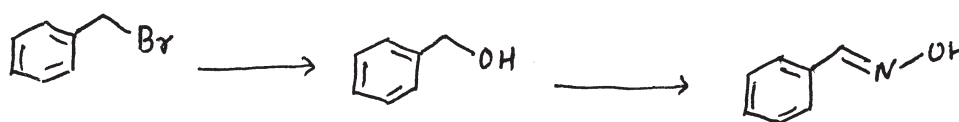
- b) Calculate λ_{max} for the following compounds clearly show your calculations:



c) Discuss the δ values of highlighted protons in the following compounds.



d) How will you monitor the following reaction sequence by IR suggest the reagents.



e) Explain:

- i) Bathochromic Shift.
- ii) α -haloketo rule.

Q6) Deduce the structures of any three of the following compounds using spectral data and justify your answer. [12]

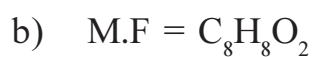
a) M.F = $C_5H_{10}O_3$

IR : 1730cm^{-1}

PMR : 2.1δ (S, 3H)

3.35δ (S, 6H)

4.60δ (S, 1H)



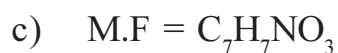
UV : 260, 265 nm ($\epsilon = 220, 250, 200$)

IR : 3300-2700, 1700, 1600, 910 cm^{-1}

PMR: 3.5 δ (S, 20mm)

7.2 δ (S, 50mm)

12.3 δ (S, 10mm)



UV = 265 nm ($\epsilon = 15000$)

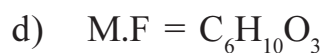
IR = 3600, 1520, 1360 cm^{-1}

PMR = 7.6 (m, 18mm)

8.15(dd, J = 2 & 7Hz, 6mm)

2.9 (S, 6mm, exchangeable with D_2O)

5.0 (S, 12 mm)



IR = 1745, 1710 cm^{-1}

PMR = 1.27 (t, J = 7Hz, 3H)

2.23(S, 3H)

3.24 (S, 2H)

4.30 (q, 7Hz, 2H)



Total No. of Questions : 6]

SEAT No. :

P2111

[Total No. of Pages :3

[4623]-301

M.Sc.

PHYSICAL CHEMISTRY

**CHP-310:Quantum Chemistry and Solid State Chemistry (New)
(2013 Pattern)(Semester-III)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *All questions are compulsory.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic table , calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	N	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O

SECTION-I

Q1) Attempt the following: **[10]**

- a) Write the operators for linear and angular momentum.
- b) State the condition for an operator to be Hermitian. Give one example.
- c) Write the Schrodinger time-dependent equation and give the significance of the terms in it.
- d) What is the principle of the variation method?
- e) Find $\left[\frac{d}{dx}, x \right]$.

Q2) Attempt any two of the following: **[10]**

- a) Obtain an expression for the ground state energy of the helium atom using the variation method.
- b) Explain:
 - i) non degenerate states
 - ii) Expansion theorem
 - iii) Perturbation method
- c) Explain the Hess-Schaad modifications in the Huckel method.
- d) Deduce the secular equation for butadiene and sketch the occupancy of the molecular orbitals.

Q3) Attempt any one of the following: **[5]**

- a) Calculate β for naphthalene given $\Delta x = 1.236$ and the frequency for transition from highest occupied to lowest vacant energy level is 1.04 PHz.
- b) If \hat{A} and \hat{B} are two operators such that $[\hat{A}, \hat{B}] = 1$, then determine the value of $[\hat{A}, \hat{B}^2]$.

SECTION-II

Q4) Attempt the following: **[10]**

- a) State Kirkendall effect.
- b) What are point defects? Give their classification.
- c) State the principle of photographic process.
- d) Give the functions of McLeod gauge and Pirani gauge.
- e) State Barkhausen effect.

Q5) Attempt any two of the following: **[10]**

- a) Discuss the mechanism of diffusion in solids.
- b) Explain electrical breakdown mechanism in insulators.
- c) Fast growing faces are eliminated while slow growing faces persist in a crystal. Justify on geometric considerations.
- d) Deduce $E_o = \frac{E_v + E_c}{2}$ for intrinsic semiconductors.

Q6) Attempt any one of the following: **[5]**

- a) The density of Schottky defects in a sample of NaCl is 5×10^{11} per m^3 at 25°C . What is the average energy required to create one Schottky defect if the interionic distance is 2.82 \AA ?
- b) Calculate the specific heat capacity for Pb at 1K [$\theta_D = 88 \text{ K}$]

□□□

Total No. of Questions : 4]

SEAT No. :

P2116

[Total No. of Pages :2

[4623]-306

M.Sc.-II: Inorganic Chemistry

**CHI-326:ORGANOMETALLIC CHEMISTRY AND
HOMOGENEOUS CATALYSIS
(Semester-III) (2013 Pattern)**

Time : 3 Hours]

[Max. Marks :50

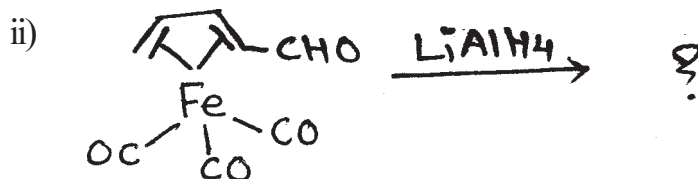
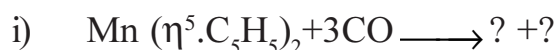
Instructions to the candidates:

- 1) *All questions to the compulsory.*
- 2) *Figures to the right indicate full marks.*

Q1) Attempt the following:

[20]

- a) Define catalysis and the give basic principle underlying catalysis.
- b) Give catalytic cycle for Negeshi reaction.
- c) What is insertion reaction? Give example.
- d) Write the favourable factors for the oxidativeaddition reaction.
- e) Give industrial applications of Heck reaction.
- f) What do you mean by cross-coupling reaction?
- g) Predict the product-



- h) Describe in short the reactivity of metal-allyl compounds.
- i) Give the general features of chiral ligands.
- j) What is epoxidation reaction? Give example.

P.T.O

Q2) Attempt any two of the following: [10]

- a) Compare proton NMR spectral resonances for each pair of compounds shown below.
 - i) $\eta^1\text{-C}_3\text{H}_5$ and $\eta^3\text{-C}_3\text{H}_5$ ligand.
 - ii) Free and complexed ethylene.
- b) Give systematic classification of σ -bonded T.M. hydrocarbyls.
- c) Give catalytic cycle for cativa process and explain each step involved in it.

Q3) Attempt any two of the following: [10]

- a) Explain with the help of suitable examples the role of OMC” S as protecting and activating agents.
- b) Provide short account of the preparation and reactions of metal-cyclobutadienes.
- c) Draw the following structures-
 - i) $[\text{Mo}_2((\text{CH}_2)\text{SiMe}_3)_6]$
 - ii) $\text{Fe}_2(\text{CO})_9$
 - iii) $\text{Os}_6(\text{CO})_{18}$
 - iv) $\text{Ir}_4(\text{CO})_{12}$
 - v) $[\text{Os}_2(\eta^5\text{-C}_5\text{H}_5)_2(\text{CO})_4]$

Q4) Write short notes any two: [10]

- a) Tollman’s catalytic cycle.
- b) Metallocene.
- c) Fluxional behaviour of organometallics.



Total No. of Questions : 5]

SEAT No. :

P2072

[4623]-31

[Total No. of Pages : 3

M.Sc.

PHYSICAL CHEMISTRY

**CH - 310 : Quantum Chemistry & Solid State Chemistry
(2008 Pattern) (Semester - III) (Old)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *All questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate full marks.*
- 4) *Use of logarithmic table, calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1) Avogadro Number	N	= $6.022 \times 10^{23} \text{ mol}^{-1}$
2) Boltzmann Constant	k	= $1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ = $1.38 \times 10^{-23} \text{ JK}^{-1} \text{ molecule}^{-1}$
3) Planck Constant	h	= $6.626 \times 10^{-27} \text{ erg s}$ = $6.626 \times 10^{-34} \text{ J s}$
4) Electronic Charge	e	= $4.803 \times 10^{-10} \text{ esu}$ = $1.602 \times 10^{-19} \text{ C}$
5) 1 eV		= $23.06 \text{ k cal mol}^{-1}$ = $1.602 \times 10^{-12} \text{ erg}$ = $1.602 \times 10^{-19} \text{ J}$ = 8065.5 cm^{-1}
6) Gas Constant	R	= $8.314 \times 10^7 \text{ ergK}^{-1} \text{ mol}^{-1}$ = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ = $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7) Faraday Constant	F	= $96487 \text{ C equiv}^{-1}$
8) Speed of light	c	= $2.997 \times 10^{10} \text{ cm s}^{-1}$ = $2.997 \times 10^8 \text{ m s}^{-1}$
9) 1 cal		= $4.184 \times 10^7 \text{ erg}$ = 4.184 J
10) 1 amu		= $1.673 \times 10^{-27} \text{ kg}$
11) Bohr magneton	β_e	= $-9.274 \times 10^{-24} \text{ J T}^{-1}$
12) Nuclear magneton	β_n	= $5.051 \times 10^{-27} \text{ J T}^{-1}$
13) Mass of an electron	m_e	= $9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

Q1) Attempt any four of the following: **[20]**

- a) State briefly the postulates of quantum mechanics.
- b) Explain the properties of the raising and lowering operators.
- c) Formulate the Hamiltonian operation for
 - i) Be^{+2} ion and
 - ii) H_2^- ion

State the terms involved in each of these.

- d) Show that

$$[\hat{L}_x, \hat{L}_y] = i\hbar\hat{L}_z$$

for a set of angular momentum operators \hat{L}_x , \hat{L}_y and \hat{L}_z

- e) Which of the following functions are eigen functions of the operator d^2/dx^2 ?
 - i) $\sin 3x$
 - ii) $6 \cos 4x$
 - iii) x^{-2}

Give the corresponding eigenvalues.

- f) State and prove the variation theorem.

Q2) Attempt any four of the following: **[20]**

- a) Apply Huckel's theory to the cyclobutadiene molecule and estimate the magnitude of the delocalization energy.
- b) Explain how Hess and Schaad improved Huckel's calculations for M.O. energies.
- c) Discuss Huckel's $4m+2$ rule citing benzene and cyclo-octatetraene as examples.
- d) Show that Hermitian operators have real eigen values.
- e) Compare perturbation method with the variation method on the basis of the principle, precision and convergence.
- f) Comment giving examples on the positive or negative nature of REPE value for a molecule.

SECTION - II

Q3) Attempt any three of the following: **[15]**

- a) Compare the resistivities of annealed and unannealed Cu-Au alloys.
- b) Comment on the effect of temperature on carrier density and conductivity of n-type extrinsic conductor.
- c) Discuss the mechanism of diffusion in crystalline solids.
- d) Derive the expression for the Frenkel defects in a crystal at a given temperature.
- e) Explain the mechanism of a photographic process.

Q4) Attempt any three of the following: **[15]**

- a) Discuss the factors that affect the progress of a chemical change in solid-solid reactions.
- b) Explain the origin of colour centres in ionic crystals.
- c) Write a note on Brillouin zones.
- d) Draw and explain the sigmoid shape curve obtained in thermal decomposition of a single solid.
- e) Discuss the conditions of crystal growth from a molten salt.

Q5) Solve any two of the following: **[10]**

- a) Calculate the number of electrons per cm^3 in the conduction band of semiconductor having a bandgap of 0.72 eV at 300K.
- b) The intrinsic resistivity of semiconductor at 300K is $50\ \Omega\text{cm}$. What is the intrinsic carrier concentration. When electron and hole mobilities at 300K are $3900\text{cm}^2\text{v}^{-1}\text{s}^{-1}$ and $1900\text{cm}^2\text{v}^{-1}\text{s}^{-1}$.
- c) If 2eV is the energy required for the pair of ions to move from the crystal's interior to the surface, what is the proportion of vacancies $\left(\frac{n}{N}\right)$ present at 500K?



Total No. of Questions : 6]

SEAT No. :

P2120

[4623]-310

[Total No. of Pages : 3

M.Sc. - II

ORGANIC CHEMISTRY

CHO - 350 : Organic Reaction Mechanism

(2013 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Answers to the two sections should be written in separate answer books.*

SECTION - I

Q1) Attempt any three of the following: **[9]**

- a) Ethyl acetate undergoes claisen condensation in presence of NaOEt whereas $(\text{CH}_3)_3\text{C-COOEt}$ doesnot undergo the same reaction under Similar Condition. Explain.
- b) Ethanolysis of $\text{Ph-CH}_2\text{-Cl}^+\text{-OTs}$ proceeds with total inversion whereas
$$\begin{array}{c} | \\ \text{CH}_3 \end{array}$$
formolysis proceeds with retention. Explain.
- c) Give the mechanism of formation of ATP from ADP using phosphoenol pyruvate.
- d) Explain the use of tributyltin hydride in free radical cydisation.

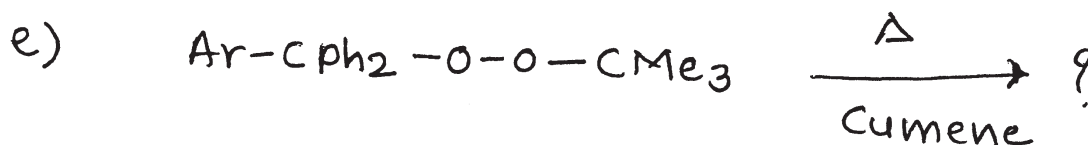
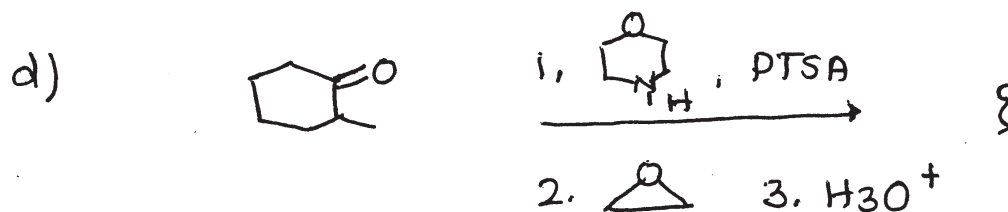
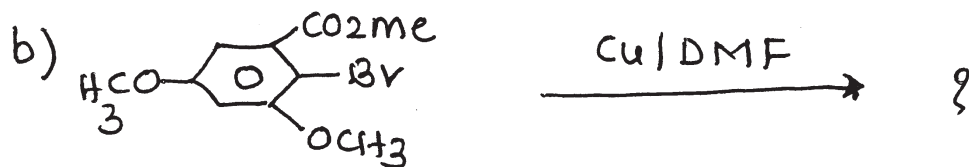
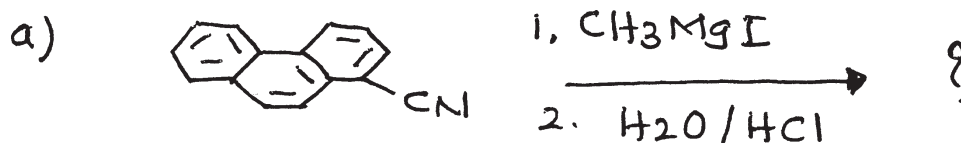
Q2) Write short notes on any two of the following: **[8]**

- a) Differnet ways of making carbene.
- b) Factors affecting stability of carbon radicals.
- c) Synthetic uses of ethyl acetoacetate.

P.T.O.

Q3) Predict the products for any four of the following:

[8]



SECTION - II

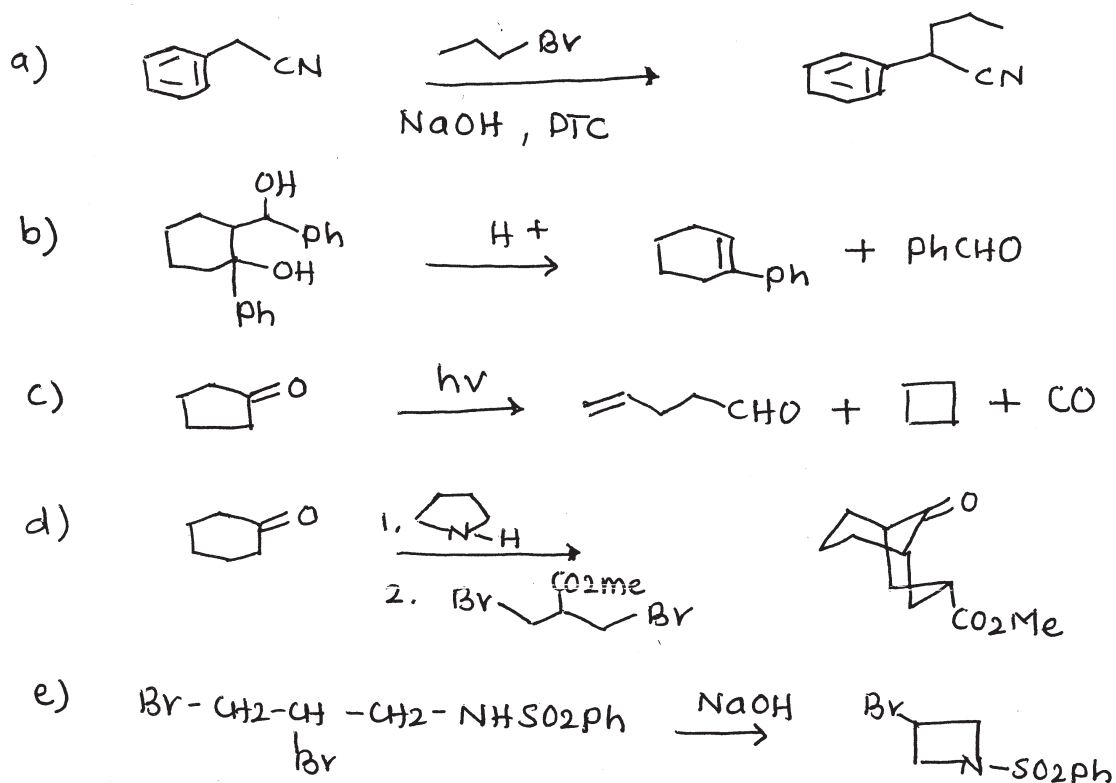
Q4) Explain any three of the following:

[9]

- Transannular rearrangement.
- Stability of carbanions.
- Role of AIBN in free radical chemistry.
- Blue colour is observed when the solution of cumene and tetramethyl-p-phenylene diamine is treated with oxygen.

Q5) Suggest mechanism for any four of the following:

[8]



Q6) Answer any two of the following:

[8]

- The acetolysis of both 4-methoxy-1-pentyl tosylate and 5-methoxy-2-pentyl brosylate give the same mixture of products. Explain with mechanism.
- Pyruvic acid when reduced with NaBH_4 yields racemic lactic acid but reduction with NADH gives optically active lactic acid. Explain.
- Elemental oxygen may act as an initiator when no better initiator is available, but in the presence of more effective initiators, oxygen may act as a retarder. Explain.



Total No. of Questions : 6]

SEAT No. :

P2124

[4623]-314

[Total No. of Pages : 3

M.Sc. - II

ANALYTICAL CHEMISTRY (Credit System)

**CHA - 390 : Electro-analytical and Radio Analytical Methods of Analysis
(Semester - III) (2013 Pattern)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) Figures to the right side indicate full marks.*
- 4) Use of logarithmic table / calculator is allowed.*
- 5) Neat diagrams must be drawn wherever necessary.*

SECTION - I

Q1) Answer the following:

[10]

- a) State Koutecky equation and give meaning of each term involved in it.
- b) Explain the role of supporting electrolyte in polarographic analysis.
- c) State and explain Faradays Second law of electrolysis.
- d) Explain interference due to dissolved oxygen in polarography.
- e) Sketch the cyclic voltammogram of potassium Ferricyanide.

Q2) Attempt any two of the following:

[10]

- a) Distinguish between voltammetry and polarography.
- b) Explain the instrumentation and applications of potentiostatic coulometry.
- c) state the principle of amperometric titration. Draw and describe nature of amperometric titration curve when only one titrant is electroactive.
- d) Write note on applications of cyclic voltammetry.

P.T.O.

Q3) Solve any one of the following: **[5]**

- a) A sample of copper weighing 3.325 gm is dissolved in acid and the copper is electrolysed using constant current of 2.5 amp for 7.5 min. Calculate percentage of copper in are.

(Given : At. wt. of Cu = 63.54)

- b) The diffusion coefficient, of oxygen at 25°C in aqueous solution is $2.65 \times 10^{-5} \text{ cm}^2/\text{S}$. The DME with mercury flow rate 1.85mg per sec and drop time is 3.6 s/drop. The instantaneous diffusion current of First oxygen was $2.3 \mu \text{ A}$. Calculate the concentration of dissolved oxygen in water.

SECTION - II

Q4) Answer the following: **[10]**

- a) What are the advantages of NAA technique?
- b) Explain the radiometric titration curve for the estimation of ions from their mixtures.
- c) State and explain the principle of isotope dilution analysis.
- d) Distinguish between DTA and DSC.
- e) Explain the principle of differential scanning calorimetry.

Q5) Attempt any two of the following: **[10]**

- a) Discuss the neutron activation analysis technique. Give it's applications.
- b) Draw a schematic diagram of DTA apparatus and explain the functions of different components of the technique.
- c) What do you mean by TGA curve? Discuss with suitable example the factors affecting the nature of TGA curve.
- d) Discuss the principle of radiometric titration and technique based on precipitation and complex formation titration.

Q6) Solve any one of the following:

[5]

- a) The radioactive penicilline in the mixture has a specific activity of 4600 cpm mg^{-1} . On addition of 10mg of inactive penicilline to 160mg of radioactive penicilline mixture on separation gave the specific activity of 2600 cpm mg^{-1} . Calculate percentage of penicilline in the mixture.
- b) Calculate the percentage of MgCO_3 and CaCO_3 in 95mg of unknown sample that exhibits thermogram showing weight 78mg at 500°C & 53mg at 900°C .

(At. wt of Ca = 40, Mg = 24, C = 12, O = 16).



Total No. of Questions : 4]

SEAT No. :

P2078

[4623]-37

[Total No. of Pages : 3

M.Sc. - II

INORGANIC CHEMISTRY

**CH - 330 : Coordination Chemistry, Magnetism and
Reaction Mechanism
(2008 Pattern) (Semester - III)**

Time : 3 Hours]

[Max. Marks : 80

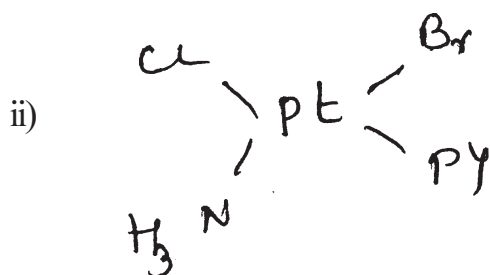
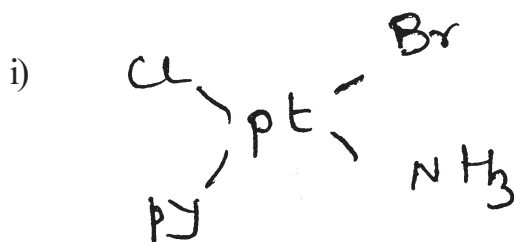
Instructions to the candidates:

- 1) All questions are compulsory and carry equal marks.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Use of Logarithmic tables and calculators is allowed.

Q1) Attempt the following: (any four)

[20]

- a) Discuss the mechanism of oxidative addition with suitable examples.
- b) Metal - halogen bonds are more labile than metal - nitrogen bonds. Use this information and trans effect to devise the synthesis of the following geometrical isomers from $[\text{PtCl}_4]^{2-}$



P.T.O.

- c) Consider the following electron-transfer reactions:
- r
 - Which reaction will be faster? Explain.
 - $[\text{Cr}(\text{H}_2\text{O})_6]^{3+} + [\text{Co}(\text{NH}_3)_6]^{3+} \rightarrow [\text{Cr}(\text{H}_2\text{O})_6]^{2+} + [\text{Co}(\text{NH}_3)_6]^{2+}$
 - $[\text{Cr}(\text{H}_2\text{O})_6]^{2+} + [\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+} \rightarrow [\text{Cr}(\text{H}_2\text{O})_6]^{3+} + [\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{2+}$
- d) With the help of suitable examples explain what is meant by SN^1 mechanism.
- e) The magnetic susceptibility data for $[\text{Cu}(\text{salicylaldehyde} - \text{salicylhydrazide})_2]$ at different temperatures is given below. Using appropriate equation calculate the average $2J$ value and indicate whether the complex is involved in ferro magnetic or antiferromagnetic exchange.

$\chi_M^{\text{corr.}} \times 10^6 \text{ cgs unit}$	Temp ($^\circ\text{K}$)
653	295
508	211
431	154
231	97

(given $g = 2.1$, $N_\alpha = 60 \times 10^{-6} \text{ cgs units}$)

Q2) Attempt the following (any four):

[20]

- a) Put in order of increasing rate of substitution by H_2O the following complexes and give reasons in support of your answer.
- $[\text{Co}(\text{NH}_3)_6]^{3+}$; $[\text{Ru}(\text{NH}_3)_6]^{3+}$; $[\text{Ir}(\text{NH}_3)_6]^{3+}$;
 $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$; $[\text{Ni}(\text{H}_2\text{O})]^{2+}$
- b) Predict the products:
- $[\text{Pt}(\text{PR}_3)]^{2+} + 2\text{Cl}^- \rightarrow ?$
 - $[\text{Pt}(\text{Cl}_4)]^{2-} + 2\text{PR}_3 \rightarrow ?$
 - $\text{Cis-Pt}(\text{NH}_3)_2\text{Py}_2 + 2\text{Cl}^- \rightarrow ?$
 - $[\text{Co}(\text{N}_3)(\text{NH}_3)_5]^{2+} + [\text{V}(\text{H}_2\text{O})_6] \rightarrow ?$
 - $[\text{Ni}(\text{CN})_4]^{2-} + \text{CN}^- \rightarrow ?$

- c) Define the following terms giving examples:
- Magnetically dilute system.
 - Magnetically concentrated system.
 - Ferromagnetism.
 - anomalous magnetic behaviour.
- d) For a d^6 – low spin complex the ground state term is $^1A_{1g}$ and there is no Zeeman effect ($J=S=O$). Explain why magnetic susceptibility is positive in the complex.
- e) Explain Franck - Condon Principle with suitable examples.

Q3) Answer the following (any four): **[20]**

- Explain how magnetic and spectral data can be used to distinguish between Co(II) complexes having tetrahedral and octahedral geometries.
- A Nickel (II) complex registers a magnetic moment 2.05 B.M. Assuming spin-state equilibrium, Octahedral magnetic moment as 3.20 B.M. and square planar magnetic moment as zero BM, calculate the spin - state equilibrium constant.
- Explain the following observation.
Nickel complexes undergo substitution much faster than platinum complexes.
- Give an account of photochemistry of metal complexes.
- What is meant by “Aeration Reaction”, explain with suitable examples.

Q4) Write short notes on (any four): **[20]**

- Marcus Equation.
- Magnetic Exchange interactions.
- Effect of Spin Orbit Coupling on magnetic moments.
- Substitution reactions of octahedral complexes.
- Thermodynamic and kinetic stability of metal complexes.



Total No. of Questions : 6]

SEAT No. :

[Total No. of Pages : 3

P2081

[4623] - 40

M.Sc. (II)

ORGANIC CHEMISTRY

CH - 350 : Organic Reaction Mechanism

(2008 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Answers to the two sections should be written in separate answer books.*

SECTION - I

Q1) Attempt any three of the following: **[12]**

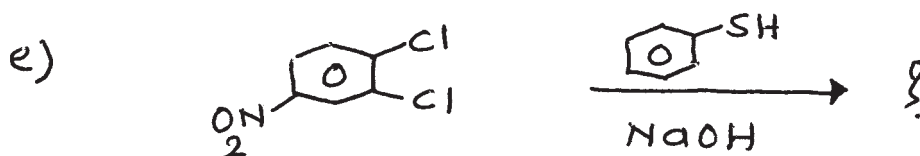
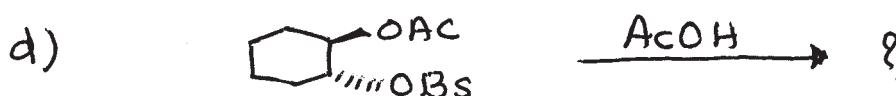
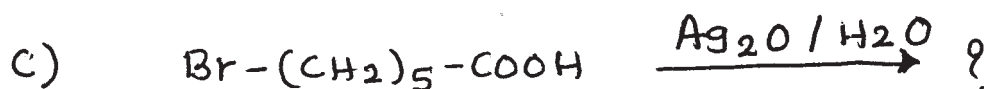
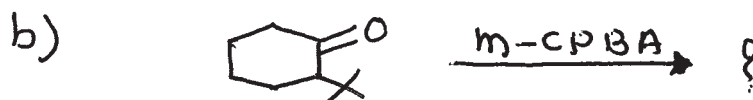
- a) The ionisation constant of 3 and 4 cyanobenzoic acids are 2.51×10^{-4} and 2.82×10^{-4} at 30°C respectively. Benzoic acid has the ionisation constant $k_a = 6.76 \times 10^{-8}$ at 30°C. Calculate σ_m and σ_p for the cyano substituent.
- b) Explain the role of biotin as a CO₂ Carrier.
- c) ArCHClAr undergoes solvolysis in ethanol by SN¹ mechanism with $\delta = -5.09$. What would be the effect of electron withdrawing and electron donating group on the rate of reaction?
- d) Explain the kinetic and Thermodynamic control of the reaction.

Q2) Write short notes on any three of the following: **[12]**

- a) BAL₂ mechanism.
- b) Neighbouring group participation by an aryl group.
- c) Reactions of carbenes.
- d) Claisen - Schmidt reaction.

P.T.O.

Q3) Predict the products with mechanism for any four of the following: [16]

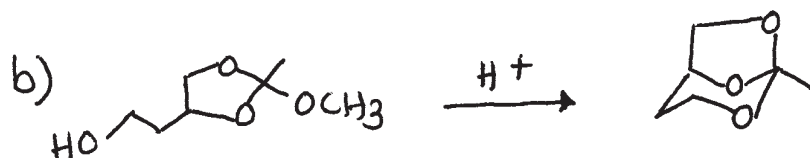
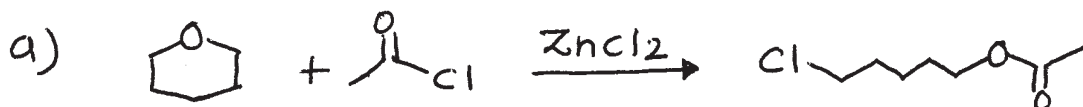


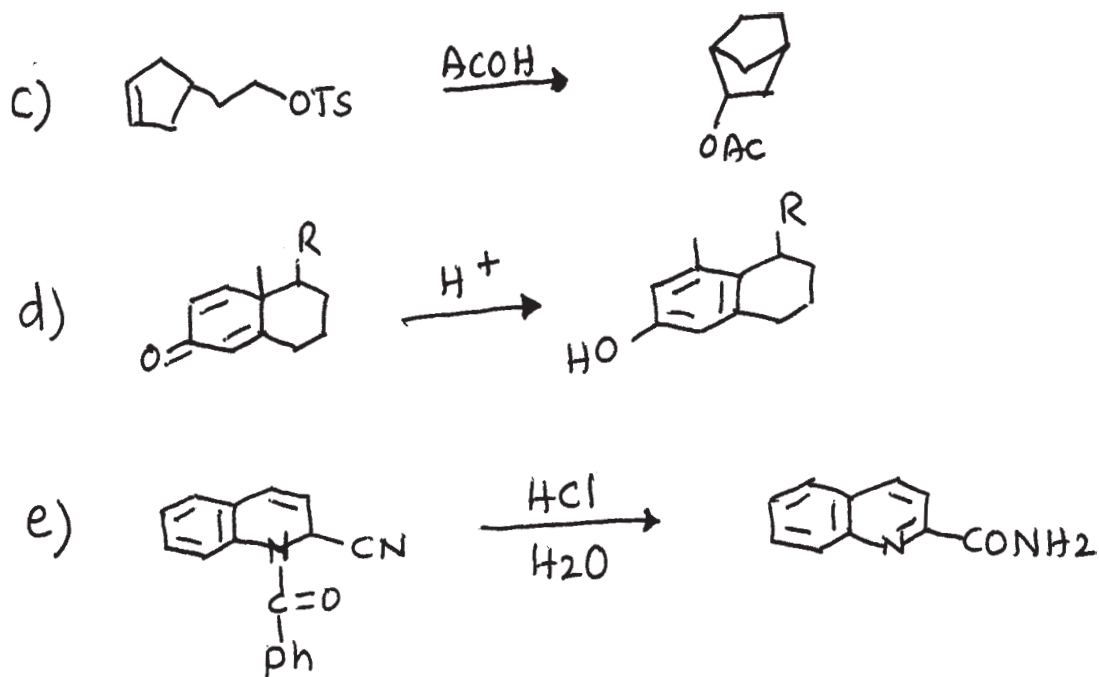
SECTION - II

Q4) Explain any three of the following: [12]

- Testing of possible intermediates.
- Substitution at β -position reduces the rate of hydrolysis in AAC² mechanism.
- Applications of Hammett equation.
- Biotransformation of pyruvic acid to (S) lactic acid.

Q5) Suggest the mechanism in any four of the following: [16]





Q6) Answer any three of the following:

[12]

- Explain stork enamine synthesis.
- Explain the biotransformation of oxaloacetic acid to citric acid.
- What are nitrenes, Give their synthetic uses.
- Ester hydrolysis by BAL² mechanism is very rare. Explain.



Total No. of Questions : 4]

SEAT No. :

P2085

[Total No. of Pages : 3

[4623] - 44

M.Sc. (II)

ANALYTICAL CHEMISTRY

CH - 390 : Electro Analytical and Current Analytical Methods in Industries

(2008 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory and carry equal marks.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Use of logarithmic tables, calculators (non - programmable) is allowed.*

SECTION - I

Q1) Attempt any four of the following:

[20]

- a) Explain construction and working of rotating platinum microelectrode. What are the advantages of rotating platinum microelectrode over DME?
- b) Draw a labelled polarographic curve. Explain the role of maximum suppressor and nitrogen gas bubbling through the solution in polarographic analysis.
- c) Write a critical note on cyclic voltammetry.
- d) A current of 0.8A was used to deposit copper at cathode and oxygen at the anode of an electrolytic cell. If the electrolysis was carried out for 15.2 minutes, calculate the grams of copper and ml. of O₂ at STP that were produced.
[At. wt. of cu = 63.55].
- e) A peak current of 22.5 μA was observed at a scan rate of 0.240 v/s at a disk electrode during the forward scan of a triangular wave voltammogram. Calculate the peak current at a scan rate of 50.0m v/s assuming a reversible electrochemical reaction.

P.T.O.

Q2) Attempt any four of the following: [20]

- Discuss the analytical applications of anodic stripping voltammetry.
- Write a critical note on chrono - amperometry.
- Draw schematic diagram of cell used in coulometric titration. Discuss the application of coulometry for the complexometric titrations.
- State the principle of electrogravimetric analysis. Explain, how electrogravimetric method differs from potentiometric method?
- The purity of a sample of $\text{Na}_2\text{S}_2\text{O}_3$ was determined by coulometric titration. A sample weighing 0.1342 g. is transferred to a 100 ml volumetric flask and diluted to volume with distilled water. A 10 ml portion is transferred to an electrochemical cell along with KI, phosphate buffer and starch indicator. Electrolysis at a constant current of 36.45 mA required 221.8 s to reach the end point. Determine the purity of the sample. [Mol. wt $\text{Na}_2\text{S}_2\text{O}_3 = 158.1$]

SECTION - II

Q3) Attempt any four of the following: [20]

- Explain the principle of neutron activation analysis and how it is used for quantitative analysis of a sample.
- Explain the principle and technique of inverse isotope dilution analysis with suitable example.
- Write a critical note on radiometric titrations.
- 10 mg of manganese powder was irradiated in a neutron flux of $1 \times 10^8 \text{ ncm}^{-2}\text{s}^{-1}$ for a period of 20 min. Calculate the activity after a cooling period of 10 min.
Given :
 - $t_{1/2} (^{56}\text{Mn}) = 2.58 \text{ hrs}$
 - Capture cross section, $^{55}\text{Mn} = 13.3 \text{ barn}$.
 - Isotopic abundance of Mn = 100%.
 - At.wt. of Mn = 54.93.
- The radioactive penicillin in the mixture has a specific activity of 4600 cpm mg^{-1} on addition of 10 mg of inactive penicillin to 160 mg of radioactive penicillin mixture on separation gave the specific activity 2600 cpm mg^{-1} . Calculate the percentage of radioactive penicillin in the mixture.

Q4) Attempt any four of the following:

[20]

- a) What is thermogravimetric analysis? Discuss the factors affecting on TGA.
- b) Discuss the principle of 'Differential Scanning Calorimetry'. Distinguish between differential thermal analysis and differential scanning calorimetry.
- c) Explain the principle of Nephelometry. Discuss it's applications.
- d) Write a critical note on electrochemical sensors.
- e) Calculate the percentage of MgCO_3 and CaCO_3 in 95 mg of unknown sample that exhibits thermogram showing weight 78 mg at 500°C and 63 mg at 900°C .

[At. wt. of Ca = 40. Mg = 24, C = 12, O = 16].



Total No. of Questions : 4]

SEAT No. :

P2090

[Total No. of Pages : 3

[4623] - 51

M.Sc.

PHYSICAL CHEMISTRY

CH - 410 : Molecular Structure and Spectroscopy

(2008 Pattern) (Semester - IV) (Old)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *ALL questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic tables, calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1.	Avogadro Number	N	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2.	Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3.	Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4.	Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5.	1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6.	Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7.	Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8.	Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9.	1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10.	1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11.	Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12.	Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13.	Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

Q1) Attempt any four of the following: **[20]**

- a) Explain chemical shift in NMR. Distinguish between δ and τ giving examples.
- b) Why is esr recorded in the first derivative mode?
- c) Predict esr spectra structure for interaction among an unpaired electron and three equivalent protons.
- d) State and explain Kramer's theorem.
- e) Calculate the magnetic field strength required for a transition frequency of 6×10^7 Hz for F.

Q2) Attempt any four of the following: **[20]**

- a) Predict the NMR of benzene and ethanol.
- b) A free electron resonates at 9.5 GHz at a field strength of 0.34 T. Estimate resonance frequency ($B = 1.3$ T).
- c) Calculate the difference in energies of protons oriented with and against a field strength of 2T. What is the radiation frequency?
- d) Draw and explain the esr spectra of $(CF_2H)^\bullet$ and $(^{13}CF_2H)$ radicals.
- e) Sketch and explain the energy level diagram for the odd electron of the free radical in $(SO_3)NO^-$

SECTION - II

Q3) Attempt any four of the following: **[20]**

- a) Explain pascal constants and give their applications.
- b) Derive Van-Vleck's equation for magnetic susceptibility.
- c) Discuss the Gouy technique and give its limitations.
- d) Explain the Faraday technique to determine magnetic susceptibility.
- e) State and explain the DCM equation. Discuss the drawbacks of the Debye theory.

Q4) Attempt any four of the following:

[20]

- a) Define Onsager field, orientation polarization and dielectric constant. Give the significance of a high dielectric constant for a medium.
- b) How is molecular radius estimated from refractive index?
- c) Differentiate between antiferromagnetism and ferromagnetism.
- d) Calculate the spin only moment for a metal complex with 3 unpaired electrons.
- e) The dipole moment of D_2O is 1.85 D. The bond angle is 104.5° . Calculate the D-O bond moment.



Total No. of Questions : 6]

SEAT No. :

P2091

[Total No. of Pages : 3

[4623]-52

M.Sc.

PHYSICAL CHEMISTRY

CH - 411 : Surface Chemistry and Electro-Chemistry

(2008 Pattern) (Old) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *ALL questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic tables, calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	N	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION-I

Q1) Attempt Any Three of the following: **[15]**

- a) What is Gibbs monolayer? Show that it obeys two dimensional ideal gas law for dilute solutions.
- b) Explain the wetting phenomenon using young equation.
- c) Describe with a neat sketch, the gravimetric method for the study of gas adsorption.
- d) Derive the expression for energy of adsorption.
- e) Discuss the Polanyi theory of multilayer adsorption.

Q2) Attempt Any Three of the following: **[15]**

- a) Give the comparison between B.E.T. and Harkins - Jura equation.
- b) Discuss the adsorption behaviour of porous solids.
- c) Discuss briefly the theories of catalysis.
- d) What is catalyst deactivation. Discuss in brief the causes of deactivation.
- e) What are zeolites? Give the structural difference between A, X and Y types of zeolites.

Q3) Solve Any Two of the following: **[10]**

- a) The surface tension of ethanol-water mixture follows the equation -

$$\gamma = 72 - 0.4C + 0.15C^2$$

where C is the ethanol concentration in moles lit⁻¹. If the temperature of measurement is 25°C, calculate the surface excess of ethanol in moles cm⁻² for 0.2M solution.

- b) A monomolecular film containing 8.2×10^{-4} g protein per m² gave the surface tension lowering of 0.036 dyne cm⁻¹ at 300K. Calculate the molecular weight of the protein.
- c) The adsorption of butane vapour on 1.85g of catalyst was studied at 0°C. The data when fitted in BET equation, yielded a linear plot with the slope of 38.95×10^{-3} ml⁻¹ and intercept of 1.85×10^{-3} ml⁻¹. The area occupied per molecule of butane is 44.6 \AA^2 . Determine the specific surface area of the catalyst.

SECTION-II

Q4) Attempt Any Three of the following: [15]

- a) Explain the terms: i) Faradic efficiency, ii) Voltage efficiency iii) Overall efficiency and iv) Maximum efficiency.
- b) Describe the structure of water when a charged ion is present in it.
- c) Discuss the electrical double layer theory using Helmholtz model.
- d) State the Debye Huckel limiting law and explain the terms involved in it. How can it be modified for appreciable concentration?
- e) Explain the term ionic strength. How does it affect thickness of ionic atmosphere and the mean activity coefficient of an electrolyte?

Q5) Attempt Any Three of the following: [15]

- a) What are the three methods of ion transport in solution? Derive Fick's first law of steady state diffusion.
- b) Explain the terms - electrochemical potential, standard electrode potential, Galvani potential, surface potential and outer potential.
- c) Explain the Wagner and Traud mechanism for corrosion of ultrapure metal.
- d) Write the Butler-Volmer equation explaining the terms involved in it.
- e) Derive Einstein relation between the absolute ionic mobility and diffusion coefficient.

Q6) Solve Any Two of the following: [10]

- a) If the mobility of the silver ion in aqueous solution at 25°C is $6.5 \times 10^{-4} \text{ cm}^2 \text{ s}^{-1} \text{ V}^{-1}$. Calculate the diffusion coefficient and equivalent conductivity of the silver ion.
- b) Calculate the constants A and B in Debye-Huckel equation for a solvent with dielectric constant 2.6 at 20°C.
- c) The diffusion coefficient of K^+ and Cl^- ion in 0.02M KCl solution at 20°C was measured as $D_{\text{Na}^+} = 1.25 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$ and $D_{\text{Cl}^-} = 0.20 \times 10^{-9} \text{ m}^2 \text{ s}^{-1}$. Calculate the equivalent conductance of solution.



Total No. of Questions : 4]

SEAT No. :

P2092

[Total No. of Pages : 2

[4623]-53

M.Sc.

PHYSICAL CHEMISTRY

**CH - 414 : Biophysical Chemistry and Related Techniques
(Old) (2008 Pattern) (Semester-IV) (Optional)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *ALL questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate full marks.*
- 4) *Use of logarithmic table, calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	N	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
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3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION-I

Q1) Attempt Any Four of the following: **[20]**

- a) Explain the Corey-Pauling concept of the structure of proteins.
- b) Write a note on the tests for proteins.
- c) Calculate R_{rms} for a polymer having 260 monomers and 500nm long.
- d) Write a note on chaperones and protein folding.
- e) Define and explain R_{rms} and R_{rmp} . Discuss the randomly coiled polymer chain.

Q2) Attempt Any Four of the following: **[20]**

- a) Explain the buffering mechanism of human blood.
- b) Discuss the role of reverse osmosis in bio-cells.
- c) Write the role of Caldesmon in Smooth muscle contraction.
- d) Derive the Henderson-Hassalbalch equation.
- e) Calculate the pH of a 0.4M sodium acetate solution containing 0.14M acetic acid [$pK_a = 4.744$]

SECTION-II

Q3) Attempt Any Four of the following: **[20]**

- a) Explain the significance of Donnan membrane equilibrium.
- b) Discuss helixcell transitions.
- c) Explain types of electrophoresis.
- d) How is the molecular wt of a biopolymer determined by sedimentation method?
- e) Explain the mechanism of conduction of a nerve impulse.

Q4) Attempt Any Four of the following: **[20]**

- a) Explain oscillatory reactions.
- b) Derive the Michaelis-Menton equation.
- c) Discuss the mechanism of ion transport through cell membranes.
- d) Describe the Fluid mosaic model of cell membrane.
- e) Explain the light scattering method to determine molecular wt of a biopolymer.



Total No. of Questions : 4]

SEAT No. :

P2093

[Total No. of Pages : 2

[4623]-54

M.Sc.

PHYSICAL CHEMISTRY

CH - 415 : Special Topics in Nuclear Radiation Chemistry

(Old 2008 Pattern) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the TWO sections should be written in SEPARATE answer books.*
- 2) *ALL questions are COMPULSORY.*
- 3) *Figures to the RIGHT SIDE indicate FULL marks.*
- 4) *Use of logarithmic tables, calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

1. Avogadro Number	N	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION-I

Q1) Attempt Any Four of the following: **[20]**

- a) Define in vivo diagnosis. How is it achieved using radioisotopes?
- b) Explain the working of a technicium generator.
- c) Explain how are Uranium isotopes separated.
- d) Discuss the methods of isotope separation.
- e) Explain the methods of food separation using radiations.

Q2) Attempt Any Four of the following: **[20]**

- a) Write the PP I, PP II, PP III process reactions.
- b) Complete
 - i) $^{203}\text{Tl}(P, 3n) \rightarrow \square \xrightarrow{\beta^+} \square \xrightarrow{E_c} \square$.
 - ii) $^{124}\text{Xe}(n, r) \rightarrow \square \xrightarrow{E_c} \square \xrightarrow{E_c} \square$.
- c) Explain CNO bicycle.
- d) Explain solar neutrino problem.
- e) Write an account of radioactive waste management.

SECTION-II

Q3) Attempt Any Four of the following: **[20]**

- a) Discuss applications of radiometric titrations.
- b) State possible radiolysis reactions for organic compounds.
- c) Write a note on radiolysis of ethanol.
- d) Explain why thin targets are needed and how are they prepared?
- e) Write a note on carriers.

Q4) Attempt Any Four of the following: **[20]**

- a) Discuss Duncan-Thomas set-up used to study radiometric titrations.
- b) Define chain types and chain reactions.
- c) Explain competition technique giving examples.
- d) Enlist the applications of radiometric titrations.
- e) Discuss the effect of solute concentration on the molecular yields of H_2 and H_2O_2 .

Total No. of Questions : 4]

SEAT No. :

P2094

[Total No. of Pages : 2

[4623]-55

M.Sc.-II (Inorganic Chemistry)
CH - 430 : INORGANIC SOLIDS AND
HETEROGENEOUS CATALYSIS
(2008 Pattern) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams should be drawn whenever necessary.*

Q1) Attempt Any Four of the following:

[20]

- a) What are zeolites? Give their classification.
- b) Write a note on P-N compound.
- c) Explain the role of promoters, modifiers & poisons on the activity of heterogeneous catalyst.
- d) Explain Fischer-Tropsch synthesis.
- e) What are days? Give their types and application as a catalyst.

Q2) Attempt Any Four of the following:

[20]

- a) Discuss the effect of pH and $\text{SiO}_2/\text{Al}_2\text{O}_3$ ratio on the zeolite synthesis.
- b) Explain the use of diborane in hydroboration.
- c) Why transition metal acts as a good catalyst? Explain.
- d) Explain How MCM-41 is proposed? Comment on their acidic properties.
- e) Explain the role of semiconductors as catalyst.

P.T.O.

Q3) Answer the following (Any Four): **[20]**

- a) Explain the application of zeolite as shape selective catalyst.
- b) Give an account on various post treatments given to the heterogeneous catalysts.
- c) What are the different methods that are employed for the synthesis of metal nanoparticles.
- d) Explain various methods of anchoring / grafting of transition metal complexes on solid support.
- e) Give an account on the surface characterisation methods used for the characterisation of supported metal catalysts.

Q4) Write a note on (Any Four): **[20]**

- a) MFI and MEL type zeolites.
- b) Silicones.
- c) Bimetallic nanoparticles.
- d) Catalytic converter.
- e) SN compounds.



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

P2095

[4623]-56

M.Sc.-II

**INORGANIC CHEMISTRY
CH - 431 : Material Science
(2008 Pattern) (Semester- IV)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn whenever necessary.*
- 3) *Figures to the right indicates full marks.*
- 4) *Use of logarithmic table and calculator is allowed.*

Q1) Attempt Any Four of the following:

[20]

- a) What are biomolecules? Give its classification.
- b) What is portland cement? Give its types.
- c) What are the different types of magnetism.
- d) Discuss the various applications of superconductors.
- e) Explain difference between the intrinsic and extrinsic semiconductors.

Q2) Attempt Any Four of the following:

[20]

- a) What is asphalt? What are the chemical composition ranges for asphalt? When is asphalt obtained?
- b) Explain sol-gel process for cement manufacture.
- c) Define superconductivity. Discuss types of superconductors.
- d) Explain the types of "Hysteresis loops".
- e) What is defect? What are different type of defects.

P.T.O.

Q3) Answer the following (Any Four): **[20]**

- a) Calculate number of atoms per unit cell of FCC Fe and net magnetic moment per Fe atom in crystal (Given: lattice parameters of BCC Fe = 2087 \AA , saturation magnetisation of BCC Fe = 1700 KA/m^2).
- b) Calculate what is minimum wavelength absorbed by Ge ($E_g = 0.67 \text{ eV}$).
- c) What is piezoelectricity? Give an example of piezoelectric materials.
- d) Derive the expression $x = \frac{c}{T - \theta}$.
- e) Distinguish between normal spinel and inverse spinel.

Q4) Write a short notes on (Any Four): **[20]**

- a) Thermocouple.
- b) Photovoltaic effect.
- c) Peltier and Seebeck effect.
- d) The Kirkendall effect.
- e) Glass transition temperature.



Total No. of Questions : 9]

SEAT No. :

P2096

[Total No. of Pages : 4

[4623]-57

M.Sc.-II

INORGANIC CHEMISTRY

**CH - 445 : Inorganic Applications in Industry, Biotechnology and
Environmental Chemistry
(2008 Pattern) (Semester-IV)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt any two sections from the following.*
- 2) *Both sections should be written in the same answer book.*
- 3) *All questions are compulsory.*
- 4) *Figures to the right indicates full marks.*
- 5) *Neat diagrams must be drawn wherever necessary.*
- 6) *Use of logarithmic table / calculator is allowed.*

SECTION-I

Inorganic Applications in Industry

Q1) Attempt Any Three of the following:

[15]

- a) What is meant by term pigments? Explain the following properties of Inorganic pigments.
 - i) Colour & tints.
 - ii) Pigment size & shape.
 - iii) Resistance to light.
 - iv) Chemical resistance.
- b) Discuss the different processes available for electrodeposition of zinc.
- c) Which type of isomerism are seen in Cr & Co complexes of tridentate azo compounds? Explain any one of them.
- d) Explain the microstructure of soft and hard wood.

P.T.O.

Q2) Attempt Any Three of the following: **[15]**

- a) Explain, two methods of electroplating of Tin.
- b) Explain the production and properties of glass fibers for reinforcing plastic resin.
- c) Give an account of preparation of copper dyes from Ortho-hydroxy diaryl azocompounds and orthohalogeno-ortho-hydroxy diaryl azo compounds.
- d) Give an detail production of portland cement.

Q3) Write notes on (Any Two): **[10]**

- a) Phthalocyanins.
- b) Luminous and Fluorescent pigments.
- c) Alloy plating.

SECTION-II

Environmental Chemistry

Q4) Attempt Any Three of the following: **[15]**

- a) What are the maximum contaminant level (MCL) of the safe drinking water Act?
- b) What does tertiary treatment in a sewage treatment plant remove from the waste stream?
- c) What is powerball? Draw a schematic diagram of plant for producing powerball. How is the hydrogen gas liberated from a powerball.
- d) Will geothermal energy ever be major source of energy world wide? Explain.

Q5) Attempt Any Three of the following: **[15]**

- a) What is meant by point and non point sources of pollution? Give an example of each.
- b) Determine pE for waste water that contains 5×10^{-4} M. S^{-2} does this waste water Favour oxidation or reduction? $S + 2e^- \rightarrow S^{-2}$, $pE^\circ = -8.47$.
- c) Draw a schematic diagram of a phosphoric acid fuel cell (PAFC). What reactions are occurring at the cathode and anode? Show overall reaction.
- d) List the trace element pollution in natural water with sources, effect and significance.

Q6) Write short notes on (Any Two): **[10]**

- a) Primary and secondary sludge.
- b) Wind power.
- c) Electrodialysis.

SECTION-III

Biotechnology

Q7) Answer Any Three: **[15]**

- a) Describe the method of production of Lactic acid.
- b) Explain in detail the fermentation route to glycerol. What are the side products of the reactions?
- c) Write a comparative account on waste water treatment by conventional and other biotechnological processes.
- d) Describe the steps involved in the synthesis of insulin from clone DNA segment.
- e) Name and compare the different methodologies of food production.

Q8) Attempt the following (Any Three):

[15]

- a) What are monoclonal antibodies? How do they work?
- b) “Bacteria can act as a source of food”. Justify the statement.
- c) What is meant by “antibiotics”? Name three groups of antibiotics. Which are commonly used any give examples of the diseases they can cure.
- d) Discuss how biotechnology can contribute to food technology.
- e) What is the starting material for making vinegar? Explain the different steps involved in making vinegar.

Q9) Write short notes on (Any Two):

[10]

- a) Vaccines.
- b) Tissue culture.
- c) Gasoholes.



[4623]-58

M.Sc.-II

ORGANIC CHEMISTRY

CH - 450 : Chemistry of Natural Products

(2008 Pattern) (Semester-IV)

Time : 3 Hours]

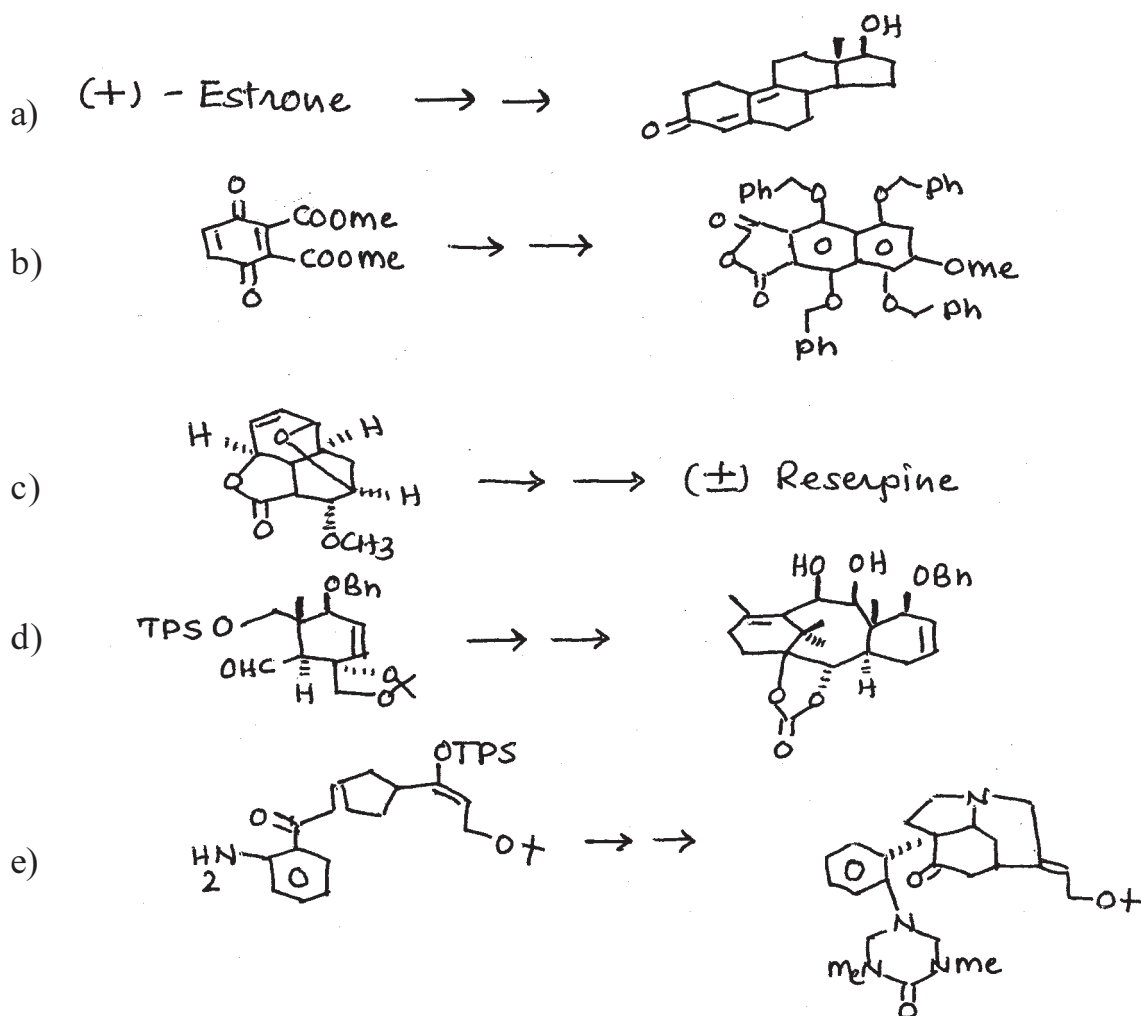
[Max. Marks : 80

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Answers to the two sections should be written in separate answer books.

SECTION-I

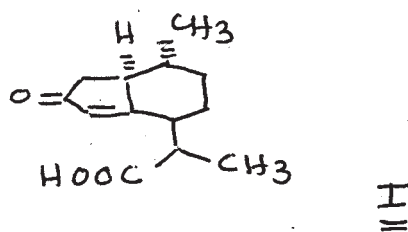
Q1) Outline the steps in Any Four of the following sequences. Indicate the reagents used and discuss the mechanism and stereochemistry involved. [16]



Q2) Answer Any Three of the following:

[12]

- a) Give evidences to establish the following in Hardwickiic acid.
 - i) The presence of β -substituted furan ring.
 - ii) Presence and stereochemistry of C-9 methyl group.
- b) Give the evidences to establish the relationship between Podophyllotoxin and Picropodophyllin.
- c) How can you determine the position of phenolic-OH group in hydroxycamptothecin?
- d) Give evidences to detect an α , β -unsaturated carbonyl group and a carboxyl group in compound I.

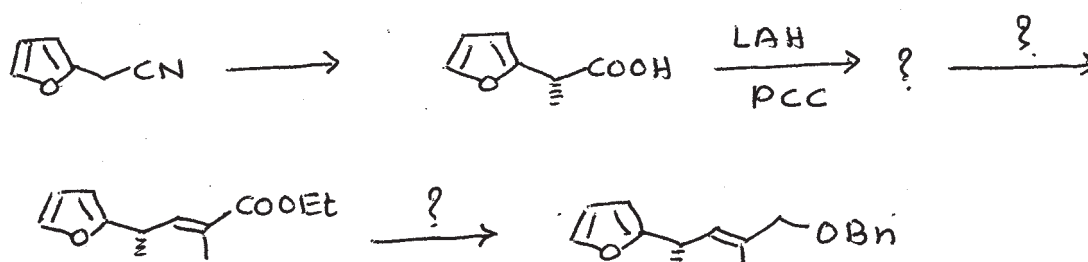


Q3) a) Nuciferal A was synthesised from B.

[6]



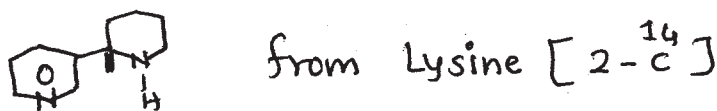
- i) Suggest the synthesis of B.
 - ii) Explain the steps in the conversion of B to A.
- b) Complete the following synthesis. [6]



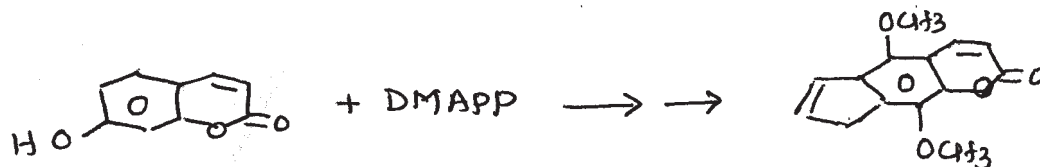
SECTION-II

Q4) a) Explain the role of SAM in biogenesis. [4]

b) Discuss the biogenesis of [6]



c) Explain the steps involved in the following biogenetic sequence. [6]



Q5) Answer Any Three of the following: [12]

a) Explain the formation of squalene from FPP.

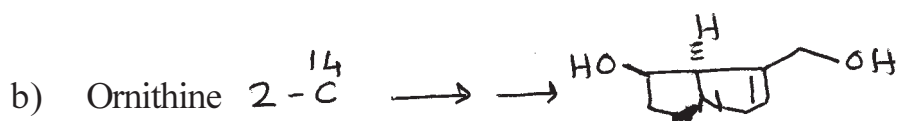
b) Write all steps in the following conversion.



c) Explain the role of Schiff base formation and Mannich reaction in the synthesis of alkaloids.

d) Give the steps involved in the conversion of phosphoenol pyruvate to shikimic acid.

Q6) a) GPP, NPP and LPP are precursors of monoterpenes. Explain. [6]



Indicate the position of label in each step and final product. [6]

●●●●●

Total No. of Questions : 6]

SEAT No. :

P2099

[Total No. of Pages : 4

[4623]-60

M.Sc.

ORGANIC CHEMISTRY

**CH - 452 : Heterocyclic Chemistry, Chiron Approach and
Medicinal Chemistry
(2008 Pattern) (Semester-IV)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Answers to the two sections should be written in separate answer books.*

SECTION-I

Q1) A) Explain the following (Any Three): **[6]**

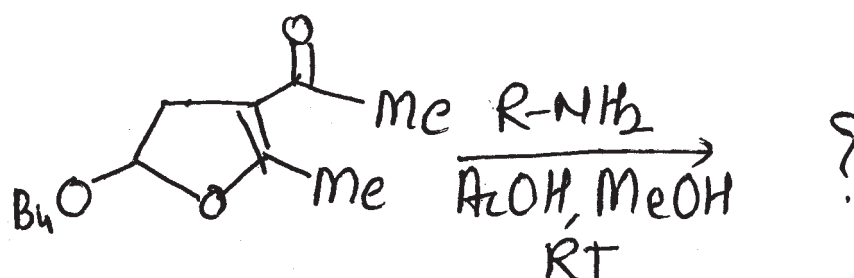
- a) Suggest appropriate reagents for synthesis of 2, 5-dialkyl furan.
- b) How do uridine, thymidine and cytidine differ?
- c) Pyridine can undergo electrophilic substitution however pyrrole cannot.
- d) Aromaticity of pyrrolizine.

B) Answer the following (Any Three): **[9]**

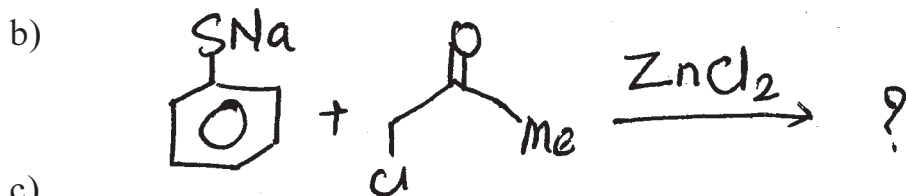
- a) How will you convert furan to puridozine?
- b) Deduce the structure of 1, 3-azoles; which are produced from the following reactant combinations.
 - i) 1-chlorobutan-2-one and thiourea
 - ii) thiobenzamide and chloroethanal
 - iii) Thioformamide and ethyl bromoacetate.
- c) What factors favour 1H-isoindoles over 2-H-isoindoles?
- d) Describe how 5, 6-dihydro-2-pyrone can be utilised to prepare either 2-pyrone, and 3-bromo pyrone and 5-bromo-pyrone.

Q2) A) Predict the products in Any Four of the following reactions. **[8]**

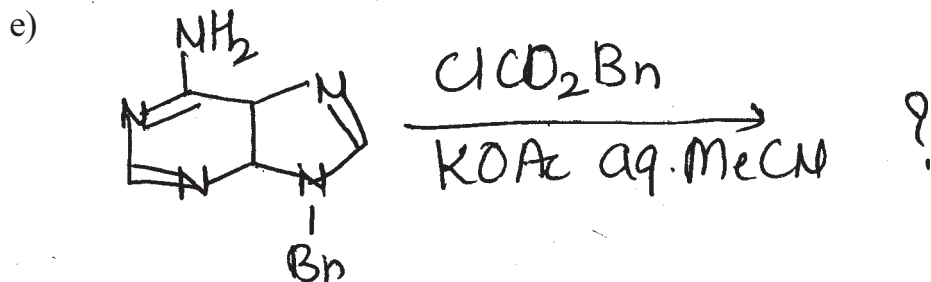
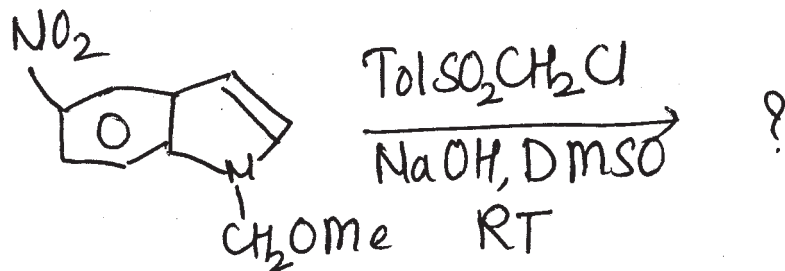
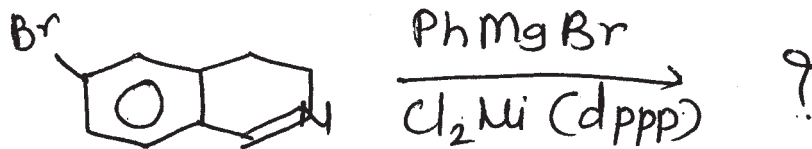
a)



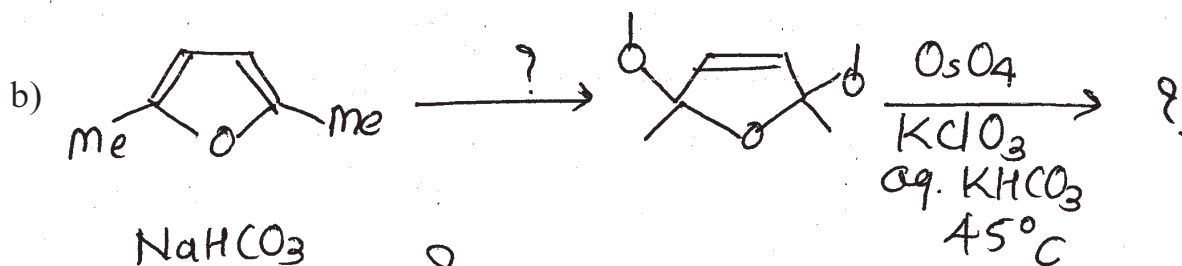
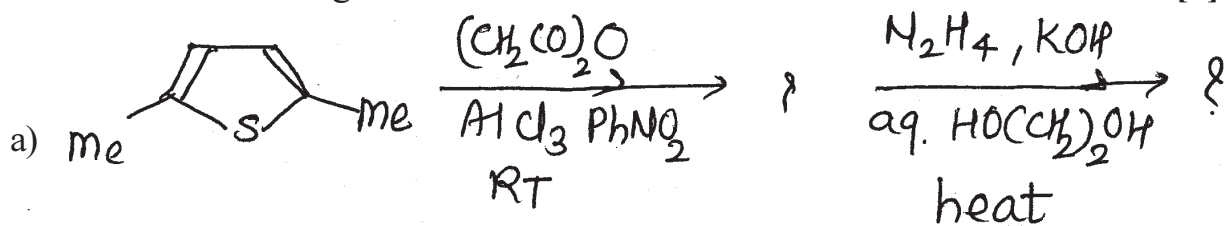
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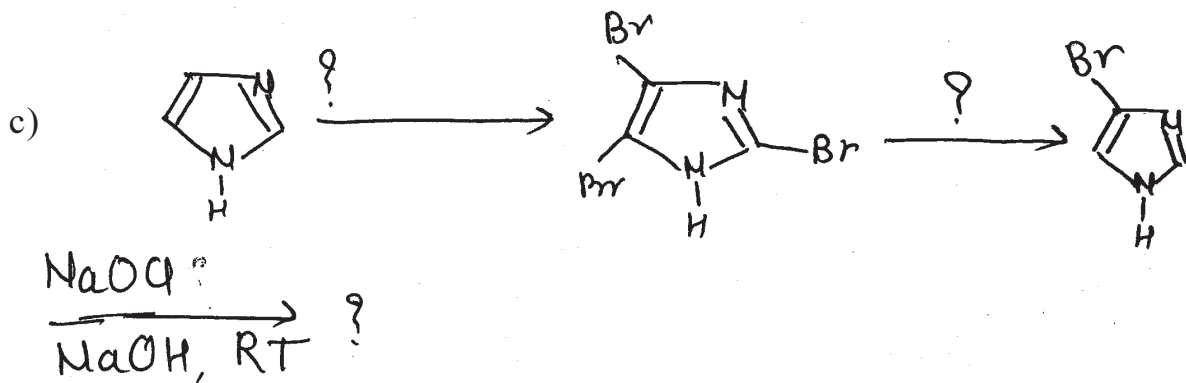


c)

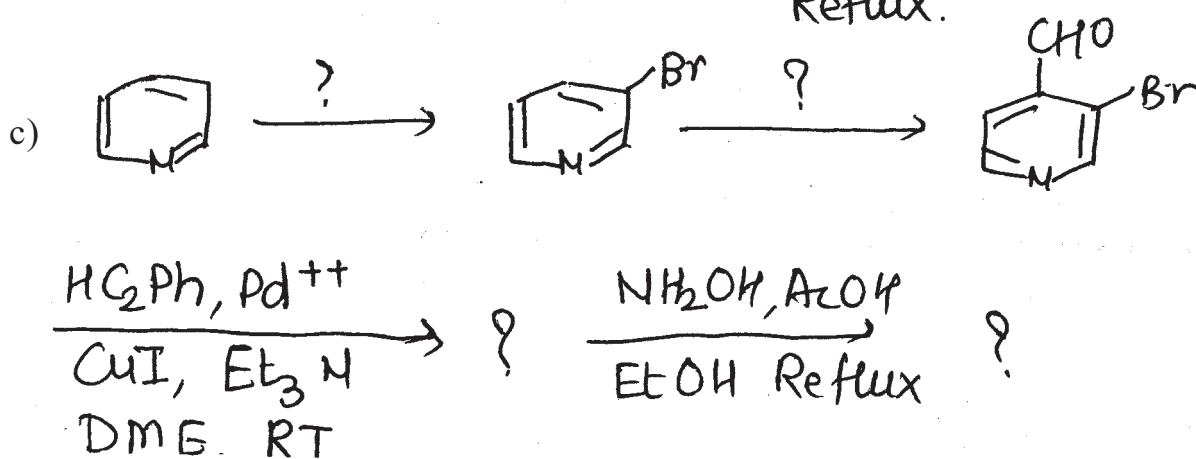
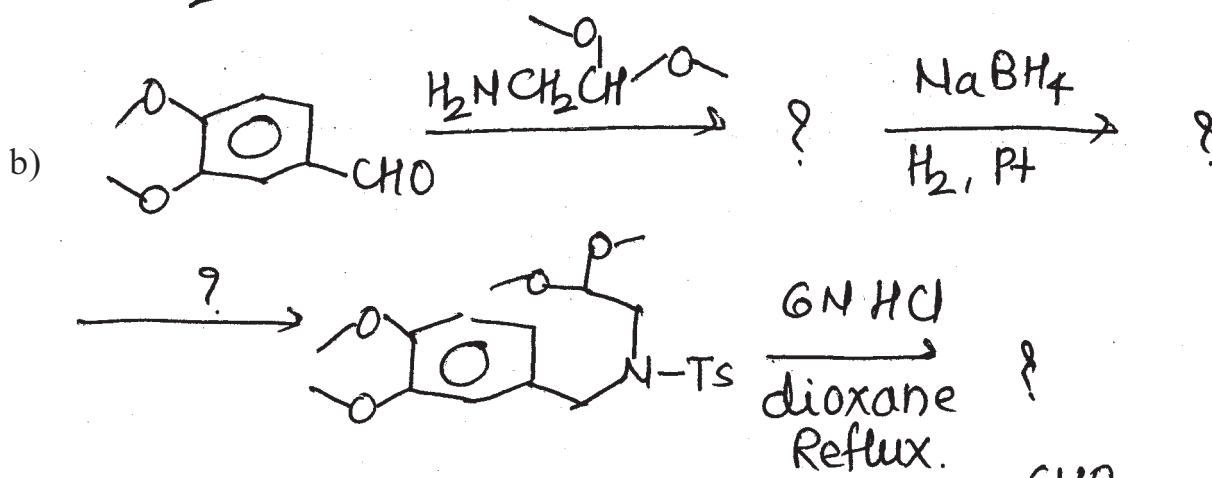
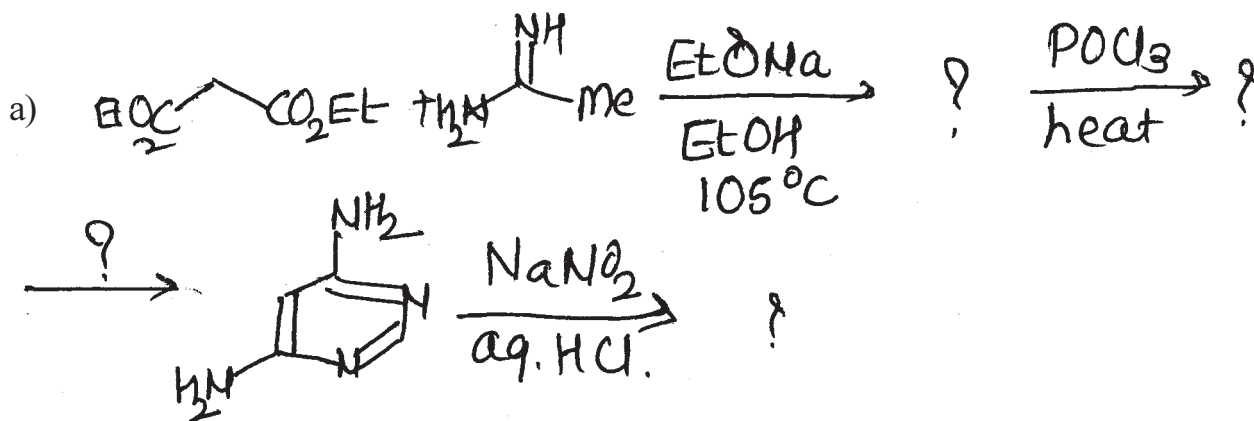


B) Suggest the suitable reagents and reasonable mechanism for Any Two of the following: [5]






Q3) A) Complete the following sequence of reactions Any Two and suggest the mechanism. [6]



- B) Write short note on Any Two of the followings: [6]
- Click reaction in synthesis of heterocyclic compounds.
 - Friedländer synthesis of quinoline.
 - Electrophilic substitution reactions in indoles.

- Q4) a) Explain the stability of α -D-glucopyranose over β -D-glucopyranose using a nomic effect. [4]
- b) What is the importance of NaIO_4 oxidation in carbohydrate chemistry? How it is useful in determination of structure of a sugar molecule? [4]
- c) D(+)-mannose which is a C-2 epimer of D(+)-Glucose undergoes oxidation with HNO_3 to produce a dicarboxylic acid. Predict the product, comment on optical activity of the acid. Write the reaction. [4]
- d) Write a note on Hanessian-Hullar reaction. [4]

- Q5) a) Give retrosynthetic analysis of (S)-epichlorohydrin  [4]
- b) Write short note on Any One of the following: [4]
- Rule of five.
 - Transfer of chirality.
- c) Write complete synthetic sequence for synthesis of (-)-shikimic acid from D-arabinose. [4]

- Q6) Answer Any Three of the following: [12]
- How physical properties and biological activity are related?
 - Write a brief note on historical developments in drug discovery.
 - Calculate the atom economy for the following reaction.



- d) Write a note on applications of supramolecular chemistry.

•••••

Total No. of Questions : 4]

SEAT No. :

P2100

[Total No. of Pages : 2

[4623]-61

M.Sc.-II

ANALYTICAL CHEMISTRY

CH - 481 : Bioanalytical and Forensic Science

(Semester-IV) (2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answer to the two sections should be written in separate answer books.*
- 2) *All questions are compulsory and carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of logarithmic table / non-programmable calculator is allowed.*

SECTION-I

Q1) Attempt Any Four of the following: [20]

- a) Describe the tanner method used for estimation of sulphite.
- b) Define rancidity. Outline analytical method for estimation of peroxide value.
- c) Explain the method used for estimation of Tannin from tea sample using Lowenthal permanganate Oxidation process.
- d) Write short note on organic preservatives used in food.
- e) Calculate the percentage of tannin in sample of 5.20g tea. If requires 16.0 ml of 0.2M KMnO_4 .
(Given: mol. wt. of tannic acid = 208).

Q2) Attempt Any Four of the following: [20]

- a) How is total carbohydrate estimated?
- b) Describe the method used for estimation of Riboflavin in food samples.
- c) Discuss the chemistry of vitamin A with respect to structure, source and biochemical functions.
- d) Write note on "Microneutriants".
- e) Calculate the HMF content of sample of jam. The absorbance in unit path length was 0.1771.

P.T.O.

SECTION-II

Q3) Attempt Any Four of the following: **[20]**

- a) How heroin is isolated from urine sample? Give detail procedure for absorption and elution.
- b) Outline the procedure for determination of benzodiazapines.
- c) State the principle for determination of caffeine. Discuss procedure in detail.
- d) How barbiturates are isolated? Explain procedure C in detail.
- e) A sample containing barbiturate was analyzed by gas chromatographic method. It has following observations.
 - i) Concentration of known barbiturate = 2.6 µg/ml.
 - ii) Peak area of drug in sample = 5.2 min.
 - iii) Peak area for internal standard = 3.6 min.
 - iv) Peak area for known drug sample = 2.7 min.
 - v) Peak area for internal standard in reference barbiturate solution = 6.9 min.

Calculate concentration of barbiturate in given sample.

Q4) Attempt Any Four of the following: **[20]**

- a) Define the terms:
 - i) Opium
 - ii) Manufacture
 - iii) Dutiable goods
 - iv) Addict
- b) Explain the rules under narcotic and Psychotropic substances related to cultivation of opium poppy and production of poppy straw.
- c) Give the rules related to export of medicinal and toilet preparation containing alcohol.
- d) Give a process for obtaining rectified spirit from non-bonded manufactory.
- e) Write note on “bonded manufactory”.



Total No. of Questions :4]

SEAT No. :

P2101

[4623]-62

[Total No. of Pages :3

M.Sc. -II

ANALYTICAL CHEMISTRY
CH -490:Analytical Spectroscopy
(2008 Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *All questions are compulsory and carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of logarithmic table/non programmable calculator is allowed.*

SECTION -I

Q1) Attempt any four of the following:

[20]

- a) State and explain the limiting law in visible spectroscopy. Give its instrumental cause for deviation from limiting law.
- b) What are monochromators? Explain with suitable diagram the working of prism.
- c) What are filters? Distinguish between absorptive and interference filters. Give its limitations.
- d) Calculate the molar extinction coefficient of 1×10^{-4} M chromophore solution, shows 50% transmittance in a 0.5 cm cell at a certain wavelength.
- e) The accelerating potential in a X-ray tube was 25.0 kV. Calculate the short wavelength cutoff of the lamp.

[Given: Planck constant = 6.625×10^{-34} , Js,

Velocity of light = 3×10^8 m/s &

Charge of electron = 1.602×10^{-19} C]

P.T.O.

Q2) Attempt any four of the following: **[20]**

- a) Explain the principle of chemiluminescence. Describe its analytical applications.
- b) Enlist the diffraction methods of crystal analysis. Describe Bragg's method of crystal analysis.
- c) What is meant by ESCA satellite peaks? Explain the mechanism of ESCA satellite peak for neon.
- d) State and explain principle of UV photoelectron spectroscopy. Why UV photoelectron spectroscopy is not used to study inner shell orbitals.
- e) Calculate the 1'S' electron binding energy of Nitrogen atom in tetramethyl ammonium ion from the incident X-ray photon that was used to create innershell vacancy had a wavelength of 950 pm. The work function of spectrometer was 7.12 eV and the kinetic energy of measured electron was 898.6 eV. [Given $h = 6.625 \times 10^{-34}$ Js]

SECTION -II

Q3) Attempt any four of the following: **[20]**

- a) What is meant by Larmor precession? Explain the principle of NMR spectroscopy based on classical theory.
- b) What is meant by relaxation? Explain spin-spin and spin-lattice relaxations.
- c) Write a critical note on 2-D NMR spectroscopy.
- d) A proton appears at sextet at $\delta = 4.2$ ppm and $J = 8$ Hz. Calculate the line position for each line of the multiplet in Hz, if instrument frequency is 300 MHz.
- e) In the NMR spectrum of ^{14}N with $I = 1$, how many spectral lines will be observed? Calculate the frequency required for the NMR lines at an external magnetic field of 1.4 T.

[Given: $g_{\text{N}} = 0.403$, $\mu_{\text{N}} = 5.05 \times 10^{-27}$ JT⁻¹]

Q4) Attempt any four of the following:

[20]

- a) Give the significance of the following terms & expression in epr spectroscopy

$$h\nu = g \mu_B B_0$$

- b) Define and explain hyperfine splitting in EPR.
- c) Explain with the help of example the use of spin-label technique in EPR.
- d) With neat labelled diagram explain scanning electron Microscope.
- e) If a resonance was observed for an unpaired electron at a magnetic flux density 0.35 T. Calculate the resonance frequency of ESR line.

[Given $g_e = 2.0023$, $h = 6.625 \times 10^{-34}$ Js]

$$\beta_e = \text{Bohr's Magnetron} = 9.275 \times 10^{-24} \text{ J T}^{-1}$$

EEE

Total No. of Questions :4]

SEAT No. :

P2102

[4623]-63

[Total No. of Pages :3

M.Sc. II

ANALYTICAL CHEMISTRY
CH -491: Polymer Technology
(2008 Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *All questions are compulsory and carry equal marks.*
- 2) *Answers to the two sections should be written in separate answer books.*

SECTION -I

Q1) Attempt any four of the following: **[20]**

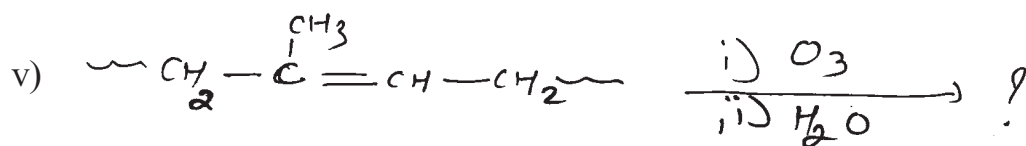
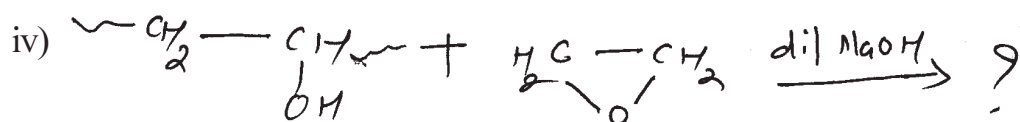
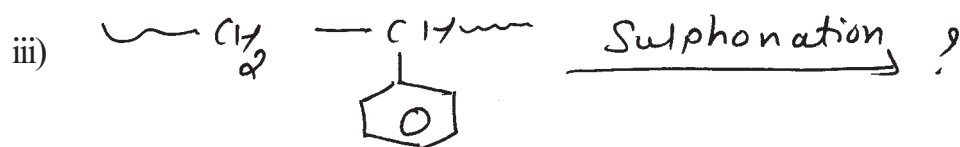
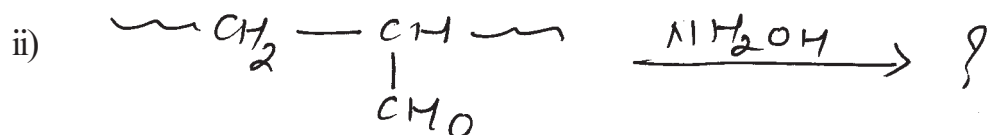
- a) Differentiate between chain-growth and step-growth polymerisation.
- b) Give salient features of emulsion polymerisation.
- c) Discuss the kinetics of cationic polymerisation.
- d) Give the method of preparation and uses of the following polymers
 - i) Teflon
 - ii) Polyurethane
- e) Explain vulcanisation process in elastomers.

Q2) Attempt any four of the following: **[20]**

- a) Explain mechanism of anionic polymerisation.
- b) Define and explain the following terms with suitable examples
 - i) initiator
 - ii) inhibitors
- c) Write a note on photodegradation of polymers.

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- d) Explain ring-opening polymerisation.
- e) Complete the following polymeric reactions.



SECTION -II

Q3) Attempt any four of the following:

[20]

- a) Explain the terms:
- i) Haze
 - ii) Fillers
 - iii) Resistivity
 - iv) Colorants
 - v) Vapour permeability
- b) Explain the term Sol-gel and gelation. Give a brief account of aqueous chemistry of metal oxide.
- c) Describe the experimental method of viscosity measurement to determine the molecular weight of the polymer.

- d) Explain the terms:
- i) Impact test
 - ii) Tear and abrasion resistance
- e) Solve the following:
- i) Find the molecular weight of polymer whose degree of polymerisation is 980. (Polymer given is polystyrene)
 - ii) Determine percentage elongation of a 30 cm polymethyl methacrylate which shows change in length of 3.6 mm when subjected to a tensile stress.

Q4) Attempt any four of the following: **[20]**

- a) Define the term polymer processing. Write an account of injection moulding.
- b) Describe with a neat diagram, the dry spinning process.
- c) Give an account of electrical properties of polymeric materials.
- d) Enlist different polymer processing techniques. Explain the calendaring process with a neat diagram.
- e) Calculate \bar{M}_n, \bar{M}_w for a polydispersed polymer composed of the following mixture of fractions (mass% and Mol.wt: of each of the fraction) are given below

Mass %	20	30	50
Mol.wt.	50,000	1,00,000	2,00,000

EEE

Total No. of Questions : 8]

SEAT No. :

P1967

[Total No. of Pages : 2

[4624] - 101
M.Sc. (Semester - I)
BIOCHEMISTRY
BCH - 170 : Biomolecules
(Credit System) (2013 Pattern)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Question nos. 4 and 8 are compulsory. Out of the remaining attempt 2 questions from section I and 2 questions from section II.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION - I

Q1) Answer the following:

- a) Write a note on amphipathic Lipids. [3]
- b) Explain the reaction of osazone formation of sugars. [3]
- c) Discuss the structure and function of lipoproteins. [4]

Q2) Answer the following:

- a) What are deoxy sugars? Give an examples. [2]
- b) Give the structure and function of Triacylglycerol and Glycogen. [3]
- c) Discuss the structure, Biochemical functions & deficiency of Vitamin D. [5]

Q3) Answer the following:

- a) Draw the basic structure of phospholipid. [2]
- b) Write a note on lipid bilayer with suitable diagram [4]
- c) Give the classification of fatty acids with suitable examples. [4]

Q4) Answer any one of the following: [5]

- a) Elaborate on the various classes of carbohydrates & their features.
- b) Explain the significance of storage lipid in our body.

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SECTION - II

Q5) Answer the following:

- a) Write a note on α -helix. [3]
- b) Write a note on conjugated proteins. Give examples. [3]
- c) Describe the super secondary structure of proteins. [4]

Q6) Answer the following:

- a) What is peptide bond? [2]
- b) Describe the sangers method of protein sequencing. [4]
- c) Describe the Tertiary structure of proteins. [4]

Q7) Answer the following:

- a) Give structure of any two aromatic amino acids. [2]
- b) Write a note on Ramachandran plot. [3]
- c) Elaborate on the biological functions of proteins. [5]

Q8) Answer any one of the following: [5]

- a) Peptide bond is rigid and planer. Justify.
- b) Classify amino acids on the basis of their 'R' groups.



Total No. of Questions : 6]

SEAT No. :

P1954

[Total No. of Pages : 2

[4624] - 11

M.Sc. (Semester - I)

BIOCHEMISTRY

BCH - 170 : BIOMOLECULES

(2008 & 2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to both sections should be written on separate answer sheets.*
- 2) *All questions are compulsory.*
- 3) *Figures to the right indicate full marks.*

SECTION - I

Q1) Answer any five of the following : **[15]**

- a) Write in short about ionization properties of water.
- b) Give structure of a heterodisaccharide, a steroid and an unsaturated fatty acid.
- c) Write note on linkage that are seen in macromolecules.
- d) Differentiate between Iodine number and Saponification number.
- e) What is HDL/LDL ratio? Give its significance.
- f) What are anomers and epimers? Give examples.

Q2) Answer any three of the following : **[15]**

- a) Tabulate the coenzymes of vitamin B-complex and their metabolic role.
- b) Explain the reactions that lead to the formation of various sugar acids and their significance.
- c) Discuss the chemical unity in diverse living organisms.
- d) Discuss various classes of lipids and their features.

P.T.O.

Q3) Write note on any two of following : **[10]**

- a) Derived sugars.
- b) Ascorbic acid and its deficiency.
- c) Lipoproteins.

SECTION - II

Q4) Answer any five of following : **[15]**

- a) What are prosthetic groups? Give their biological role.
- b) Give the significance of Ramchandran plot.
- c) Differentiate between simple and conjugated proteins.
- d) Explain the reactions of aminoacids with Ninhydrin and Sanger's reagents and their significance.
- e) Give the features of peptide bond.
- f) Give the cleavage site of enzymes in partialysis reaction.

Q5) Answer any three of following : **[15]**

- a) Interpret features of titration curve of Glycine.
- b) Discuss biochemical functions of proteins.
- c) Elaborate steps involved in determination of primary structure of proteins.
- d) Discuss steps involved in in-vitro synthesis of oligopeptides using a resin.

Q6) Write note on any two of following : **[10]**

- a) Structure of hemoglobin.
- b) Protein denaturation.
- c) Secondary structures of protein.



Total No. of Questions : 8]

SEAT No. :

P1970

[Total No. of Pages : 2

[4624] - 201

M.Sc. (Semester - II)

BIOCHEMISTRY

BCH-270 : Bioenergetics and Metabolism

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to both the sections should be written on separate answer sheets.*
- 2) *Question no. 4 and 8 are compulsory.*
- 3) *Attempt any two questions from Q.1 to Q.3 and any two from Q.5 to Q.7.*
- 4) *Figures to the right side indicate full marks.*

SECTION - I

Q1) Answer the following :

- a) Show the steps involved in synthesis of triacylglycerol. [3]
- b) How is cholesterol synthesis regulated by allosteric mechanism. [3]
- c) Give the structure and significance of ATP. [4]

Q2) Answer the following :

- a) Define ketogenesis. [2]
- b) What are ketone bodies? How are they formed? [4]
- c) Explain in detail the mechanism of oxidative phosphorylation. [4]

Q3) Attempt the following :

- a) What is pasteur effect? [2]
- b) What is glycogenolysis? Name the key enzymes & their role in the pathway. [3]
- c) Elucidate the glycolysis pathway and its significance in detail. [5]

Q4) Answer any one of the following : [5]

- a) Write a note on enzymers and coenzymers involved in the conversion of pyruvate to acetyl CoA.
- b) Explain the β -oxidation of an unsaturated fatty acid.

P.T.O.

SECTION - II

Q5) Answer the following :

- a) What are polyaminer? Give their significance. [3]
- b) Elucidate glutathione biosynthesis. [3]
- c) Write note on transaminases. [4]

Q6) Answer the following :

- a) What is the significance of adenosine deaminase. [2]
- b) Give the significance of tetrahydrofolate in one carbon transfer reaction. [3]
- c) Discuss the formation of succinyl CoA from Methionine. [5]

Q7) Attempt the following :

- a) What is Gouty arthritis? [2]
- b) Write note on biosynthesis of methionine. [4]
- c) Discuss the steps involved in urea cycle and give its significance. [4]

Q8) Answer any one of the following : [5]

- a) Explain the precursor functions of amino acids.
- b) Explain pyrimidine biosynthesis by denovo pathway.



Total No. of Questions : 8]

SEAT No. :

P1971

[Total No. of Pages : 2

[4624] - 202

M.Sc. (Semester - II)

BIOCHEMISTRY

BCH-271 : Techniques in Characterization of Biomolecules

(Credit System) (2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to both the sections should be written on separate answer sheets.*
- 2) *Question no. 4 and 8 are compulsory.*
- 3) *Attempt any two questions from Q.1 to Q.3 and any two from Q.5 to Q.7.*
- 4) *Figures to the right side indicate full marks.*

SECTION - I

Biophysical Methods

Q1) Answer the following :

- a) Give the significance of sedimentation coefficient. [2]
- b) Describe the use of X-ray diffraction techniques. [4]
- c) Distinguish between boundary and band sedimentation [4]

Q2) Attempt the following :

- a) Explain the principle of Ostwald capillary viscometer. Give its application in Biochemistry. [3]
- b) Describe the Meselson-Stahl experiment demonstration by density gradient centrifugation. [3]
- c) Explain stripping film method of autoradiography. [4]

Q3) Answer the following :

- a) Enlist the factors affecting sedimentation velocity. [2]
- b) Explain why liquid scintillation counter is more efficient than GM counter? [3]
- c) Draw a net diagram of atomic absorption spectrometer. Describe the theory of in brief. [5]

P.T.O.

Q4) Attempt any one of the following

- a) Define and give applications of partial specific volume. [5]
- b) What are the applications of liquid scintillation counter? [5]

SECTION - II

Structure Determination of Biomolecules

Q5) Answer the following :

- a) Enlist the applications of infrared spectroscopy. [2]
- b) Describe the special uses of fluorescence in biology and biochemistry. [4]
- c) “Electronic response is proportional to biological response of analyte.” Discuss this statement with reference to MM graph. [4]

Q6) Attempt the following

- a) Write any one application of MALDI-TOP-MS in brief. [3]
- b) Explain the theory of fluorescence. [3]
- c) What is LC-MS? Explain the mobile phases used in LC-MS. [4]

Q7) Answer the following

- a) Give any one applications of NMR in the study of polynucleotide structure. [2]
- b) Describe the advantages of atmospheric pressure photoionization. [3]
- c) What are the components of MALDI-TOF-MS. Write the function of any four components in brief? [5]

Q8) Attempt any one the following

- a) Describe briefly the theory of NMR spectrometry. What information can be obtained from NMR absorption peaks? [5]
- b) Explain any one application of ORD or CD. [5]



Total No. of Questions : 8]

SEAT No. :

P1972

[Total No. of Pages : 3

[4624] - 203

M.Sc. (Semester - II)

BIOCHEMISTRY (Credit System)

BCH : 272 - Biostatistics, Computer and Bioinformatics

(2013 Pattern)

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) Answer to both the sections should be written on separate answer sheets.
- 2) Question No. 4 and 8 are compulsory.
- 3) Attempt any two questions from Q1 to Q3 and any two from Q 5 to Q 7.
- 4) Figures to the right indicate full marks.
- 5) Supplementary will be provided for checking P - values.
- 6) Graph papers will be provided.

SECTION - I

Q1) Answer the following :

- a) Represent the following data graphically. [3]
- i) Histogram
 - ii) Frequency polygon
 - iii) Histogram and Frequency polygon

Plant height (cms)	0-6	6-12	12-18	18-24	24-30	30-36	36-42	42-48	48-54
Number of plants	3	12	42	51	56	48	35	15	6

- b) Calculate the mode from the following data recorded on the erectoid mutants in barley : [3]

Number of mutants	7	8	9	10	11	12	13	14	15	16	17	18
No. of plants	47	52	56	60	63	64	65	50	52	41	57	64

(Note : Use grouping table method and draw analysis table)

- c) The data recorded on 100 - seed weight (gms.) of a greengram variety (PS - 16) are given below. [4]

100-seed weight (gms.) = 3.1, 3.2, 3.4, 3.5, 3.6, 3.8, 4.0, 4.0, 4.0, 4.1,

Calculate (i) mean (ii) variance (iii) standard deviation (iv) coefficient of variation.

P.T.O.

Q2) Answer the following

- a) Data recorded on the number of mites per leaf are given in the following table. Calculate the arithmetic mean. [2]

No. of mites per leaf	0	1	2	3	4	5	6	7	8
No. of leaves	35	15	20	25	9	17	3	4	7

- b) What is the probability of getting 0, 1, 2, 3 and 4 heads when a coin is tossed four times? [3]
(Note : calculate using Binomial expansion formula)

- c) Data recorded on the primary and the secondary branches of a pulse variety are given below. [5]

No. of primary branches	10	8	10	9	10	10	9	11	13	9
No. of secondary branches	11	16	18	19	16	11	17	18	25	19

Calculate correlation coefficient, regression coefficient (b), and test their level of significance by *t* test.

Q3) Answer the following :

- a) From the following data, compute the values of coefficient of variation. Compare the two series for the data consistency. [2]

Series A : $\bar{x} = 34.6$, $s = 14.0$

Series b : $\bar{x} = 27.1$, $s = 8.0$

- b) The following results obtained in a dihybrid cross, involving shape of the seeds and the colour of the pods.

Round/yellow = 317, Round/green = 109, Wrinkled/yellow = 102, Wrinkled/green = 32.

If the dihybrid ratio is 9 : 3 : 3 : 1, the plants should have been : 315 round/yellow, 105 round/green, 105 wrinkled/yellow and 35 wrinkled/green. Calculate the chi - square value. [4]

- c) Differentiate between population and sample. Also explain random sampling method. [4]

Q4) Answer any one of the following : [5]

- a) Data recorded on pod length (cms) in two varieties of blackgram are given below. Does the pod length of variety 1 significantly differ from variety 2?

Variety 1	5.0	4.9	5.2	5.4	6.0	6.1	5.8	5.7	6.4	6.3
Variety 2	6.2	6.4	6.0	7.0	6.5	5.9	6.4	6.2	6.8	6.7

- b) Calculate arithmetic mean from the following data by both the methods :

Plant height (cms)	0-10	10-20	20-30	30-40	40-50	50-60
No. of varieties	10	25	30	40	15	20

SECTION - II

Q5) Answer the following :

- a) What is pair wise sequence alignment? Write the significance of pair wise sequence alignment. [3]
- b) What are specialized database? Explain with example. [3]
- c) Write a note on *Expressed Sequence Tapes database* at NCBI. [4]

Q6) Answer the following :

- a) What is E - value? Write its significance in BLAST analysis. [2]
- b) Write a note on GenBank flat file. [3]
- c) Discuss with example what are primary and secondary databases are [5]

Q7) Answer the following :

- a) Explain the concept of Point Accepted Mutations. [2]
- b) What is Entrez? Describe why Entrez is most powerful tool to retrieve the biological data. [4]
- c) Explain different components of Uniprot. Write an account on Swiss - Prot database. [4]

Q8) Answer any one of the following : [5]

- a) What are the merits of multiple sequence alignment (MSA) over the pair wise sequence alignment? Explain the usefulness of Clustal W in MSA.
- b) You are provided with two DNA sequences:

Seq1 : GCTGAGCTGG

Seq2 : GCAGACCTGG

Perform pair wise alignment using dot matrix method to qualitatively show the similarity between these sequences.



Total No. of Questions : 8]

SEAT No. :

P1973

[Total No. of Pages : 2

[4624] - 204

M.Sc. (Semester - II)

BIOCHEMISTRY

BCH-273 : Membrane Biochemistry and Genetics

(Credit System) (2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Answers to both the sections should be written on separate answer sheets.*
- 2) *Question no. 4 and 8 are compulsory.*
- 3) *Attempt any two questions from Q.1 to Q.3 and any two from Q.5 to Q.7.*
- 4) *Figures to the right side indicate full marks.*

SECTION - I

Membrane Biochemistry

Q1) Answer the following :

- a) Discuss in detail the membrane phospholipids. **[3]**
- b) Describe the various models proposed to affirm the membrane structure. **[4]**
- c) Differentiate between transverse and lateral diffusion. **[3]**

Q2) Answer the following :

- a) Explain conophors. **[2]**
- b) Write about valinocycin and grancicidin. **[4]**
- c) How antimicrobial agents and liposomes reach their targets. Explain. **[4]**

Q3) a) What is lateral diffusion of lipid molecules? **[2]**

- b) Elucidate the working of sodium-potassium ATPase. **[4]**
- c) Explain with one example each voltage gates and ligand ion channels. **[4]**

P.T.O.

- Q4)** Answer any one of the following : [5]
- a) Depict the winds of ATP powered pumps with one example each.
 - b) Elaborate on various models used to explain membrane structure.

SECTION - II

Genetics

- Q5)** Answer the following :
- a) What is genotype and phenotype. [2]
 - b) Elaborate on messelson and shaft experiment and its interpretation.[4]
 - c) Elaborate on specialized transduction. How does it differ from generalized transduction. [4]

- Q6)** Answer the following :
- a) Give Mendel's principle of law of segregation. [2]
 - b) Give the features of genetic code. [5]
 - c) What are auxotroph, prototroph and conditional reactants. [3]

- Q7)** Answer the following :
- a) Discuss the structure of A, B and Z form of DNA. [3]
 - b) Write a note on complementation test. [3]
 - c) Write the different types of mutation and how it can be repaired. [4]

- Q8)** Answer any one of the following : [5]
- a) Discuss the experimental evidence that proved DNA as genetic material.
 - b) Elaborate on bacterial conjugation.



Total No. of Questions : 6]

SEAT No. :

P1957

[Total No. of Pages : 2

[4624] - 21

M.Sc. (Semester - II)

BIOCHEMISTRY

BCH - 270 : Bioenergetics and Metabolism

(2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to both the sections should be written on separate answer sheets.*
- 2) *All questions are compulsory.*
- 3) *Figures to the right indicate full marks.*

SECTION - I

Q1) Answer any five of the following : **[15]**

- a) Give the principle of chemosmotic hypothesis.
- b) Write note on amphibolic nature of TCA cycle.
- c) Give the energetics of Glycolysis.
- d) Write note on enzymes and coenzymes involved in pyruvate to Acetyl CoA conversion.
- e) What is role of Carnitine in Fatty acid oxidation.
- f) Write note on importance of TCA cycle.

Q2) Answer any three of the following : **[15]**

- a) Discuss the process of oxidative phosphorylation.
- b) Explain β -oxidation of stearic acid with energetics.
- c) Explain phospholipid biosynthesis.
- d) Explain cyclic and non-cyclic photophosphorylation.

P.T.O.

Q3) Write note on any two of following : **[10]**

- a) Glucuronic acid pathway.
- b) ETC in mitochondria.
- c) Respiratory chain in Mitochondria.

SECTION - II

Q4) Answer any five of the following : **[15]**

- a) What is the fate of Glycine in mammal.
- b) How purines are degraded?
- c) What is Gouty arthritis?
- d) Describe fate of amino group of amino acids.
- e) What are cause of Alkaptonuria?
- f) Write note on rubonucleotide reductase.

Q5) Answer any three of the following : **[15]**

- a) Discuss the regulation of Urea cycle.
- b) Explain role of PRPP in Purine Nucleotide synthesis.
- c) Discuss the formation of aromatic amino acids.
- d) Explain the pathway of tryptophan degradation.

Q6) Write note on any two of the following : **[10]**

- a) Gamma Glutamyl cycle.
- b) Glutathione biosynthesis.
- c) Purine degradation.



Total No. of Questions : 4]

SEAT No. :

P1958

[Total No. of Pages : 2

[4624] - 22

M.Sc. (Semester - II)

BIOCHEMISTRY

BCH - 271 : Techniques for Characterization of Biomolecules

(2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right side indicate full marks.*

Q1) Answer any four of the following :

[20]

- a) Differentiate between preparative & analytical ultracentrifuges.
- b) Which staper are required for measurement of the concentration distribution in an analytical cell?
- c) What are the basic components of biosensor? Describe their functions in detail.
- d) Define viscosity. Discuss in detail measurement of viscosity by any one type of viscometer.
- e) Write a note on immunosensor.

Q2) Attempt any four of the following :

[20]

- a) How will you come to conclusion whether E.coli. DNA is linear or circular by viscosity analysis?
- b) What is meant by quenching? Explain different factors that are involved in quenching?
- c) Which cell is used for measurement of the concentration distribution? Explain its working principle.
- d) How will you measure viscosity by Zimm Crother's viscometer.
- e) What is autoradiography? Explain its principle & applications.

P.T.O.

Q3) Answer any two of the following : **[20]**

- a) Explain the phenomenon & instrumentation of fluorescence.
- b) Which transducer system is suitable for development of urea biosensor? Explain the basic principle & sensitivity of biosensor.
- c) Describe the principle & working of ESR.

Q4) Write short notes (Attempt any four) **[20]**

- a) Chemical shift.
- b) Principle of ORD & CD.
- c) Glucose biosensor.
- d) Electron spray assisted ionization.
- e) MALDI - TOP - MS.



Total No. of Questions : 6]

SEAT No. :

P1959

[Total No. of Pages : 2

[4624] - 23

M.Sc. (Semester - II)

BIOCHEMISTRY

BCH - 273 : Membrane Biochemistry and Genetics

(2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instruction to the candidates:

- 1) Answers to both the sections should be written on separate answer sheets.*
- 2) All questions are compulsory.*
- 3) Figures to the right indicate full marks.*

SECTION - I

(Membrane Biochemistry)

Q1) Answer any three of the following : **[15]**

- a) Write the structure and function of sodium channel.
- b) What are Nuclear pores? Give their significance.
- c) What are Ionophores? List their types with examples.
- d) What is carrier type transport antibiotic.

Q2) Answer any three of the following : **[15]**

- a) What are the types and properties of membrane lipids.
- b) Write the role of proton gradient in energy generation.
- c) Differentiate between Exo and Endocytosis.
- d) What is carrier type transport antibiotic.

Q3) Write note on any two of the following : **[10]**

- a) Symport and Antiport.
- b) Nuclear pore.
- c) Calcium ATPase activity.

P.T.O.

SECTION - II

Genetics

Q4) Answer any three of the following : **[15]**

- a) Compare the structure of A, B and Z forms of DNA.
- b) How the mutants are isolated? Give its significance.
- c) Explain Nearest neighbour analysis
- d) Diagrammatically explain bacterial conjugation.

Q5) Answer any three of the following : **[15]**

- a) Write a note on clover leaf structure of tRNA.
- b) Explain complementation test and give its application.
- c) Explain control of lactose operon.
- d) Write a note on Hershey and chase experiment and its interpretation.

Q6) Write note on any two of the following : **[10]**

- a) Genetic code.
- b) DNA repair.
- c) Hemoglobins.



Total No. of Questions : 6]

SEAT No. :

P1974

[Total No. of Pages : 2

[4624] - 301
M.Sc. (Semester - III)
BIOCHEMISTRY
BCH-370 : Molecular Biology
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right side indicate full marks.*
- 3) *Solve any three questions from Q1 to Q4.*
- 4) *Question 5 and 6 are compulsory.*

Q1) Answer the following :

- a) What are Okazaki fragments? [2]
- b) Explain SOS repair system. [3]
- c) What is transposition? [2]
- d) Why are t-RNAs called as adaptor molecule. [3]

Q2) Answer the following :

- a) Explain Holliday junction model. [3]
- b) Explain steps involved in charging of t-RNA. [3]
- c) Write note on Composite & non-composite transposons. [4]

Q3) Answer the following :

- a) Explain nucleotide excision repair mechanism. [3]
- b) Explain Signal hypothesis for protein targeting. [3]
- c) What is alternative splicing? [4]

Q4) Answer the following :

- a) Give the role of topoisomerase in DNA replication. [2]
- b) What role glycosylation plays in protein targeting. [3]
- c) What are spliceosome? [2]
- d) What is RNA editing? [3]

P.T.O.

Q5) Attempt any two :

- a) Describe two mechanisms by which genetic elements are able to move from one site to the other in the genome? [5]
- b) How does methylation of DNA affect gene expression? How is related to histone acetylation or methylation? [5]
- c) How does mRNA differ functionally in eukaryotes & prokaryotes.[5]

Q6) Attempt any two :

- a) Explain the need for post transcriptional modifications. [5]
- b) Explain chromatin remodeling. [5]
- c) Explain the mitochondrial transportation of protein. [5]



Total No. of Questions : 4]

SEAT No. :

P1960

[Total No. of Pages : 2

[4624] - 31

M.Sc. (Semester - III)

BIOCHEMISTRY

BCH - 370 : Molecular Biology

(2008 and 2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

Q1) Answer any four of the following :

[20]

- a) Many times you cannot correlate the sequence of DNA and actual sequences of aminoacids in a given peptide. Explain why?
- b) Give the importance of initiation factors (IF1, IF2, IF3) in translation in E.coli.
- c) What will happen if E.coli are exposed to mild UV radiation? Give biochemical reactions taking place during such exposures.
- d) Explain the importance of GTP in translation in E.coli.
- e) Give the importance of 30s and 50s subunit of Ribosome in E.coli translation.

Q2) Attempt any two :

[20]

- a) Discuss the post transcriptional modification of mRNA.
- b) What is promoter? Describe promoters present in the gene that are transcribed by RNA polymerase I
- c) What is protein targeting? Explain the pathways of protein targeting to mitochondria, lysosomes and Chloroplast.

P.T.O.

Q3) Answer any two of following : **[20]**

- a) Write note on SOS response.
- b) With the help of labelled diagram describe various active sites present on ribosome that play important roles during protein synthesis.
- c) Differentiate between DNA polymerase I, II and III with respect to their catalytic activity, subunit structure and abundance in the cell.

Q4) Write short note on (any four) : **[20]**

- a) Distinguish between prokaryotic and eukaryotic chromosome.
- b) Okazaki fragments.
- c) Holiday structure.
- d) Clover leaf structure of t.RNA.
- e) Histone protein.



Total No. of Questions : 6]

SEAT No. :

P1964

[Total No. of Pages : 2

[4624] - 41

M.Sc. (Semester - IV)

BIOCHEMISTRY

BCH - 470 : Biochemical Endocrinology and Plant Biochemistry

(2012 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer book.*
- 2) *All questions are compulsory.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*

SECTION - I

Biochemical Endocrinology

Q1) Answer any three of the following: **[15]**

- a) Describe the metabolic conversions that are required to produce the active form of parathyroid hormone.
- b) What hormone functions to stimulate uterine contraction and also the release of milk from the mammary glands? What is the advantage of having a single hormone for both of these functions?
- c) Justify the assertion that G.H. and prolactin are members of the same “family” of pituitary hormones.
- d) Hypothalamic hormones are an important link between the nervous and endocrine systems. Explain

Q2) Answer any three of the following : **[15]**

- a) Discuss the steps involved in the biosynthesis of mineralocorticoids.
- b) What are the general effects caused by thyroxine (T4), triiodothyronine (T3) in the body?
- c) Write a note on “hormonal interrelationship” Explain with physiological response of target cells.
- d) Elaborate on mode of action of steroid hormones in regulation of gene expression.

P.T.O.

Q3) Write note on any two of the following : **[10]**

- a) Explain the mode of action of cAMP as second messenger.
- b) Discuss the role of Insulin and Glucagon in regulation of blood sugar level.
- c) Explain the structural features of insulin during its synthesis.

SECTION - II

Plant Biochemistry

Q4) Answer any three of the following: **[15]**

- a) What are secondary metabolites? Elaborate on their various functions giving examples.
- b) Write a detailed note on various physiological roles of cytokinins.
- c) Elucidate the C4 pathway of carbon fixation. Describe its significance.
- d) What are the events taking place during Fruit ripening?

Q5) Answer any three of the following : **[15]**

- a) Discuss in detail plant to plant signaling.
- b) Explain how plants counter drought stress.
- c) Describe in detail the phenomenon of allelopathy.
- d) Cyclic electron flow through Photosystem I.

Q6) Write note on any two of the following : **[10]**

- a) Abscisic Acid.
- b) Systemic acquired resistance.
- c) Seed Germination.



Total No. of Questions : 6]

SEAT No. :

P1965

[Total No. of Pages : 2

[4624] - 42

M.Sc. (Semester - IV)

BIOCHEMISTRY

BCH - 471 : Fermentation Technology and Food Technology

(2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Answers to the two sections should be written on separate answer sheets.*
- 2) All questions are compulsory.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right side indicate full marks.*

SECTION - I

Fermentation Technology

Q1) Answer any three of the following:

[15]

- a) What is meant by fed batch culture?
- b) What are the different methods of enzyme immobilization?
- c) What are different techniques used for product recovery?
- d) How will you proceed for isolation of resistant mutants?
- e) Differentiate between continuous sterilization and batch sterilization.

Q2) Answer any three of the following :

[15]

- a) Effect of pH control on fermentation.
- b) Methods for drying product.
- c) Development of stains for new product.
- d) Waste water treatment.
- e) Importance of inoculums development process.

P.T.O.

Q3) Answer any two of the following : **[10]**

- a) Write note on design of fermenter.
- b) Improvement of industrially important strain. Explain.
- c) What will be the strategy for production of secondary metabolite.

SECTION - II

Food Technology

Q4) Answer any three of the following: **[15]**

- a) Explain the various techniques in food analysis.
- b) What are the various types of artificial sweeteners? Give their feature.
- c) Justify the need for monitoring food quality.
- d) List out different types of food colors and their uses.

Q5) Answer any three of the following : **[15]**

- a) Discuss the role of enzymes in fruit juice technology.
- b) Classify food based on plant and animal origin.
- c) Discuss the principle of food preservation.
- d) Write note on single cell protein and its significance.

Q6) Write note on any two of the following : **[10]**

- a) Genetically modified food.
- b) Analysis of food toxins.
- c) Primary feed stock.



Total No. of Questions : 4]

SEAT No. :

P1966

[Total No. of Pages : 2

[4624] - 43

M.Sc. (Semester - IV)

BIOCHEMISTRY

BCH - 472 : Genetic Engineering

(2008 and 2010 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right hand side indicate full marks.*

Q1) Answer any four of the following :

[20]

- a) Define vector. Briefly describe the various kinds of vectors for cloning in E.coli.
- b) Explain the various methods to identify the clones having recombinant DNAs.
- c) Describe the construction of C-DNA Library.
- d) Discuss in detail the role of different enzymes used in genetic engineering.
- e) What are transgenic animals? Explain the various approaches in transfection.

Q2) Answer any four of the following :

[20]

- a) What is invitro mutagenesis? Explain the single primer extention method.
- b) Discuss various types of microarray and its application.
- c) Discuss the mechanism of RNA interference.
- d) Explain the Maxam - Gilbert method of DNA sequencing.
- e) What is PCR? Give its types.

P.T.O.

Q3) Answer any four of the following : **[20]**

- a) Explain the strategy to develop herbicide resistant crop.
- b) What is genomic library? Explain construction of cDNA library.
- c) What are λ phage vectors? Give its importance.
- d) Describe in detail southern blotting.
- e) Write a note on colony hybridization.

Q4) Write note on any four of the following : **[20]**

- a) YAC.
- b) pBR 322.
- c) Blue - white screening.
- d) Northern blotting.
- e) DDGE.



Total No. of Questions : 6]

SEAT No. :

P1537

[4625]-301

[Total No. of Pages :4

M.Sc.

DRUG CHEMISTRY

**CHD-361: Chemistry of Heterocycles and Drug synthesis
(2013 Pattern) (Credit & Semester-III)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Answers to the two sections should be written in separate answer books.*

SECTION-I

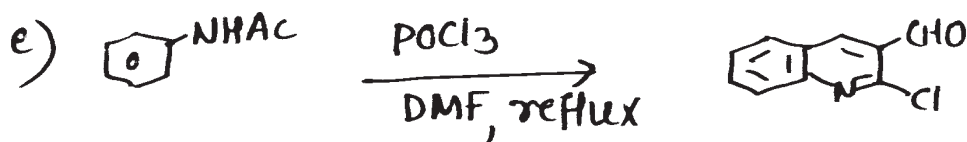
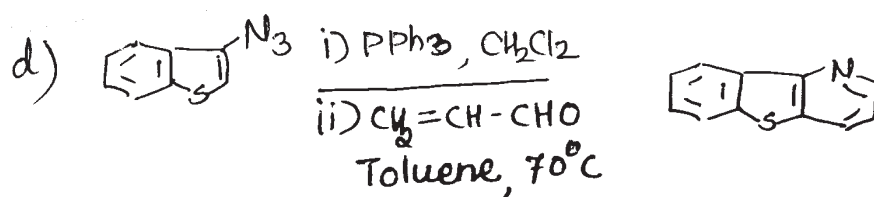
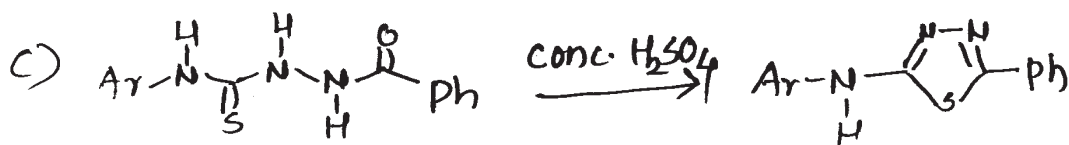
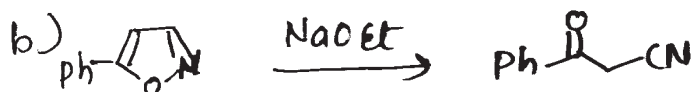
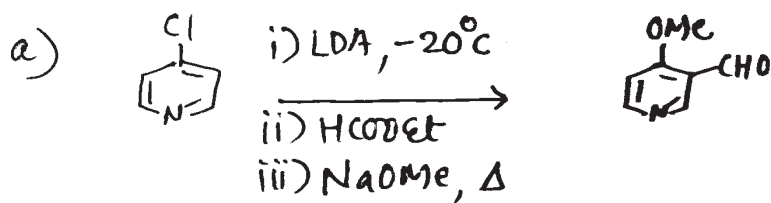
Q1) Explain any four of the following: [8]

- a) 2- Chloro pyridine can be converted easily into 2-methoxy pyridine using NaOMe/MeOH, but under similar conditions 3-chloropyridine is unreactive.
- b) 2-methoxy 1,4-benzoquinone upon Nenitzescu indole synthesis gives 6-methoxy indole derivative but not 7-methoxy and 4-methoxy indole derivatives.
- c) Benzofuran is more stable than furan towards acids.
- d) The relative reactivity of different positions in 9-substituted purines is $8 > 6 > 2$ while that of 9 H-purines is $6 > 8 > 2$.
- e) Thiamine could be used as catalyst in aldol condensation reaction.

P.T.O

Q2) Suggest the suitable mechanism for any four of the following:

[8]



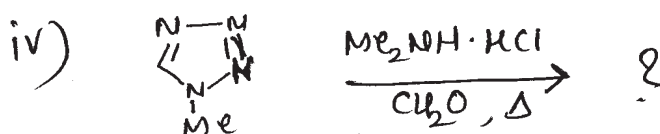
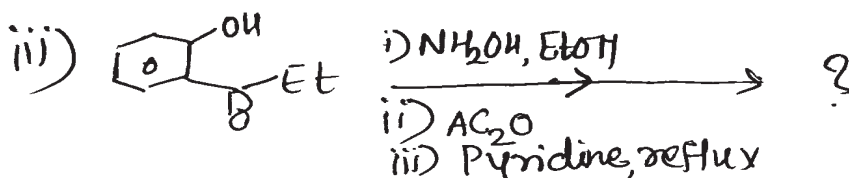
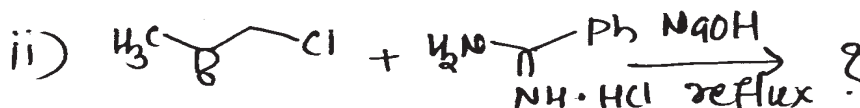
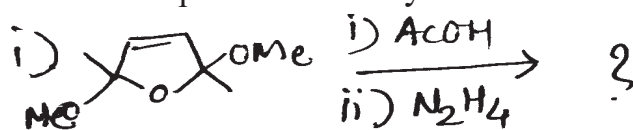
Q3) a) Write short notes on any two of the following:

[4]

- Knorr- Pyrrole synthesis.
- Madelung Indole synthesis.
- Pomeranz -Fritsch synthesis.

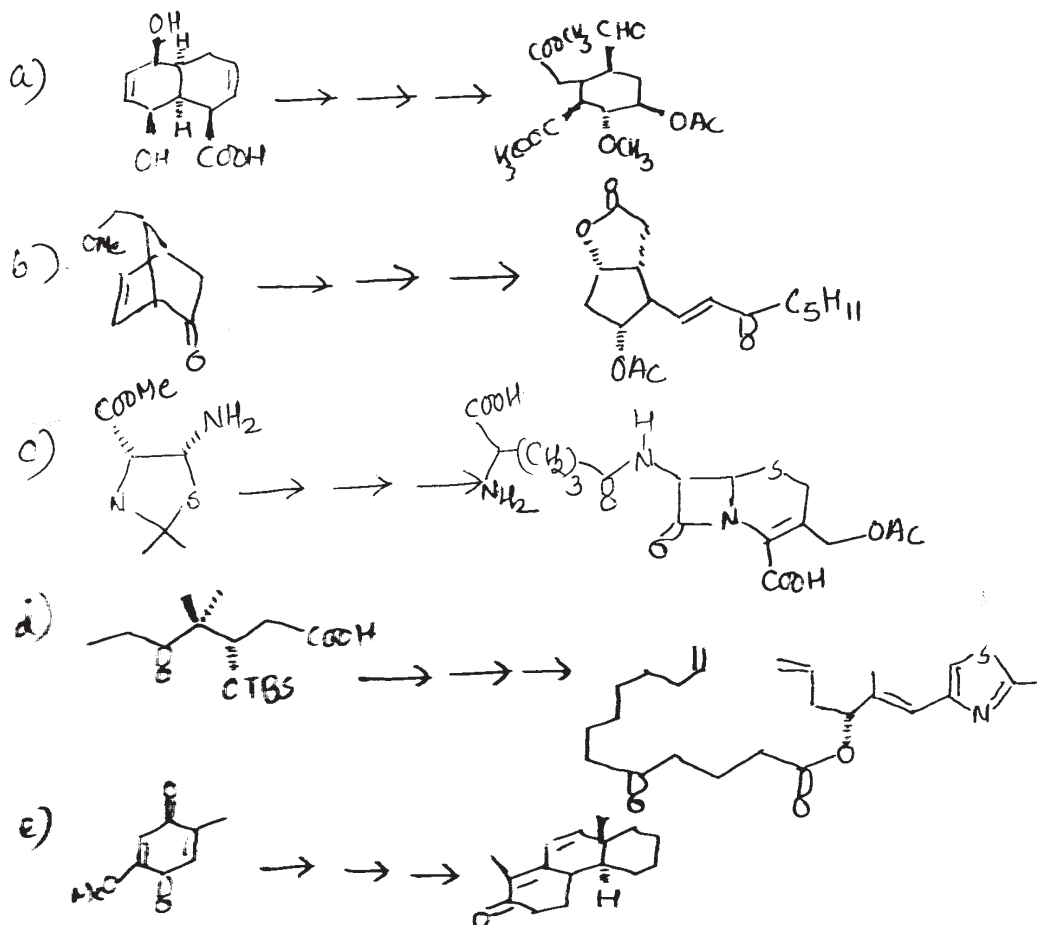
b) Predict the products for any two of the following:

[5]

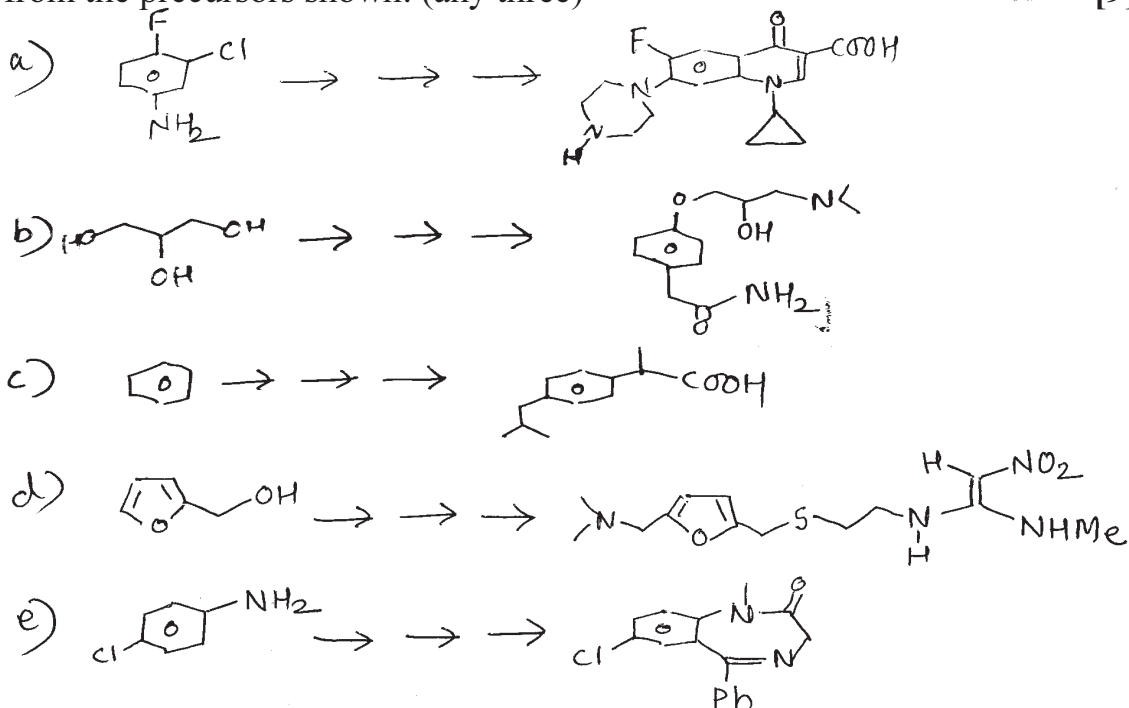


SECTION-II

Q4) Discuss the steps involved in the following transformations comment on steps indicating mechanisms and reagents used (any three): [12]



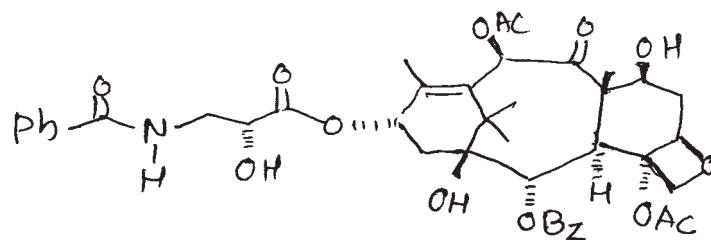
Q5) Discuss the steps involved in the synthesis of the following drug molecules from the precursors shown: (any three) [9]



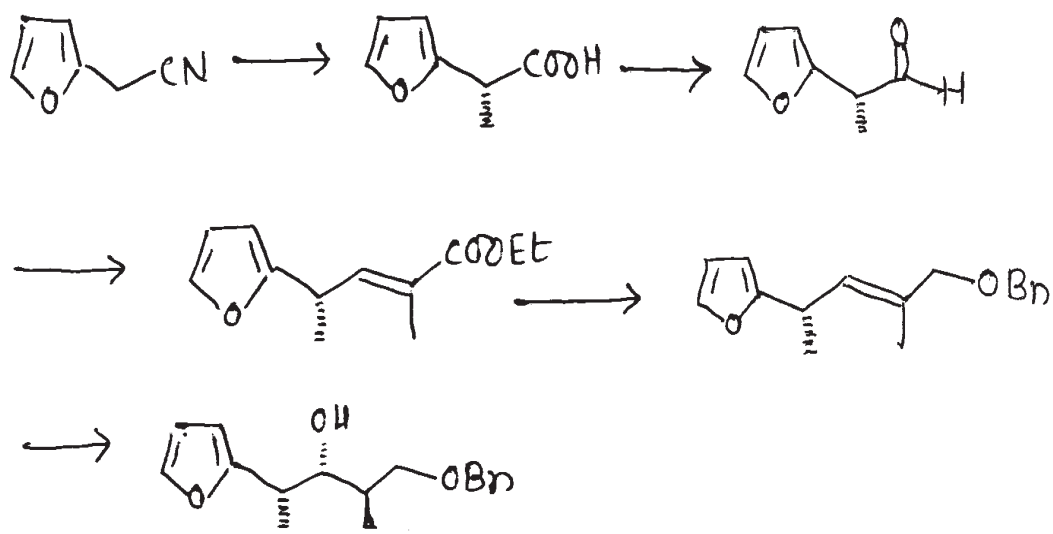
Q6) Answer any one of the following:

[4]

- a) Do a retrosynthetic analysis of taxol and discuss the important reactions



- b) Complete the following reaction sequence by inserting the relevant reagents in proper places. Explain the steps with suitable mechanism.



□□□

Total No. of Questions : 6]

SEAT No. :

P1530

[4625]-31

[Total No. of Pages :4

M.Sc. (Semester-III)
DRUG CHEMISTRY

CH-361: Chemistry of Heterocycles and Biologically Active Compounds
(2008 Pattern)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

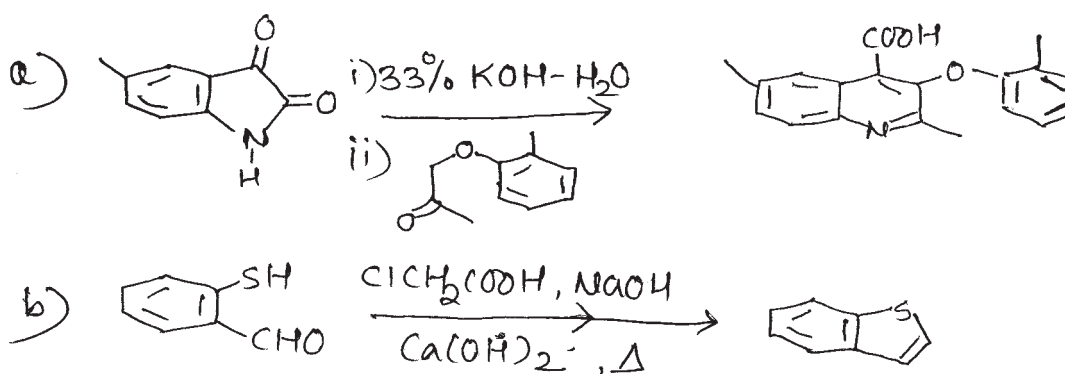
- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Answers to the two sections should be written in separate answer books.

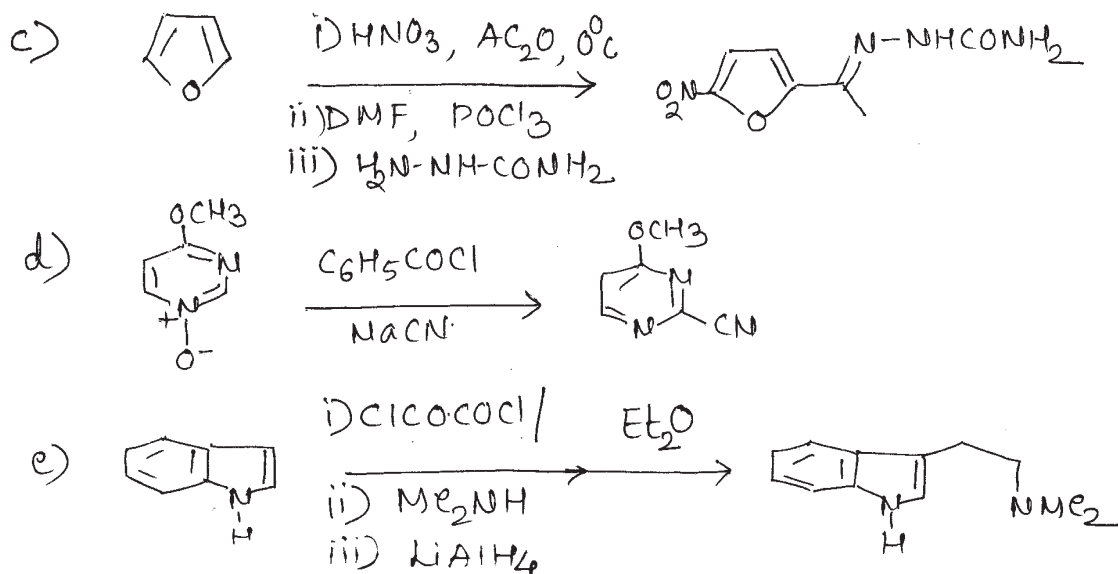
SECTION-I

Q1) Explain any four of the following: [12]

- a) 2-acyl pyrrole undergoes nitration at 4-position and not at the vacant 5-position.
- b) Coumarin is easily attacked by electrophilic as well as nucleophilic reagents.
- c) Oxazole is less basic than imidazole.
- d) 5- methoxy quinoline can't be synthesized using Skraup method.
- e) 2, 6, 8- trichloropurine on reaction with aq. NH_3 at 100°C gives 2,8 dichloro-6-amino purine.

Q2) Suggest the suitable mechanism for any four of the following conversions.[12]

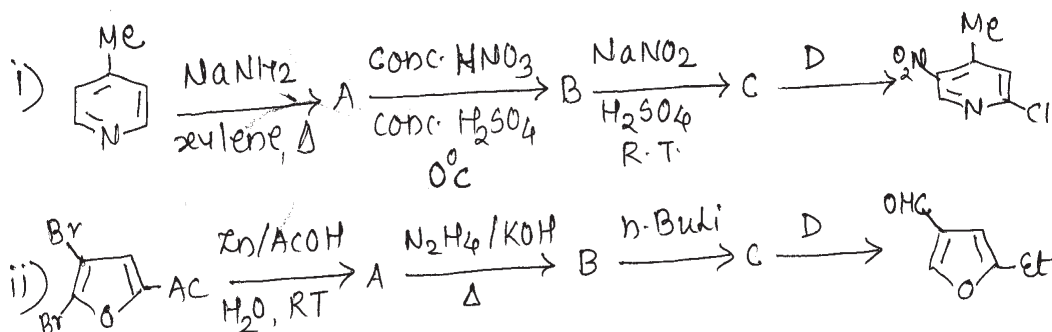




Q3) a) Write short notes on any three of the following: [9]

- Hinsberg Thiophene synthesis.
- Bischler Napieralski synthesis.
- Madelung Indole synthesis.
- Hantzsch pyridine synthesis.

b) Complete the following reaction sequences by filling the blanks with suitable reagents and products (any one): [4]

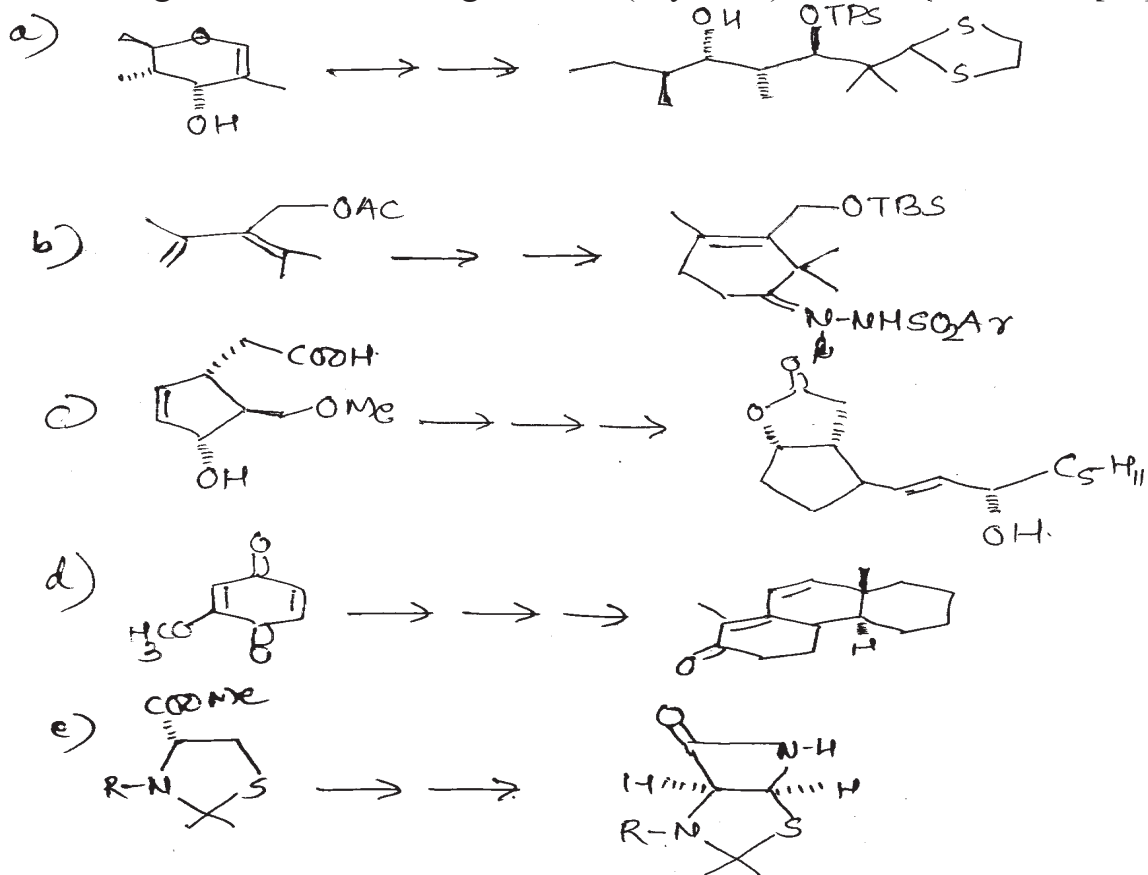


c) Give the use of any two of the following reagents in the heterocyclic synthesis. Give mechanism. [3]

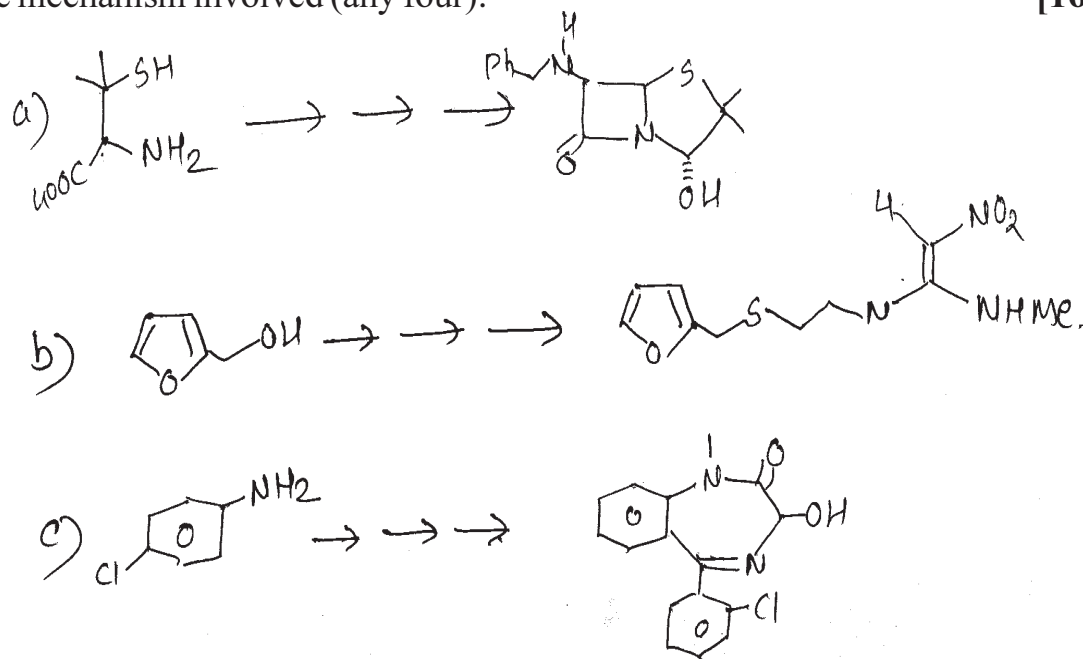
- $\text{Pd}(\text{PPh}_3)_4$ in arylation of pyridine
- $\text{Cl-Si}(\text{i-Pr})_3$ in the synthesis of 3-bromopyrrole.
- $n\text{-BuLi}$ in formylation of furan.

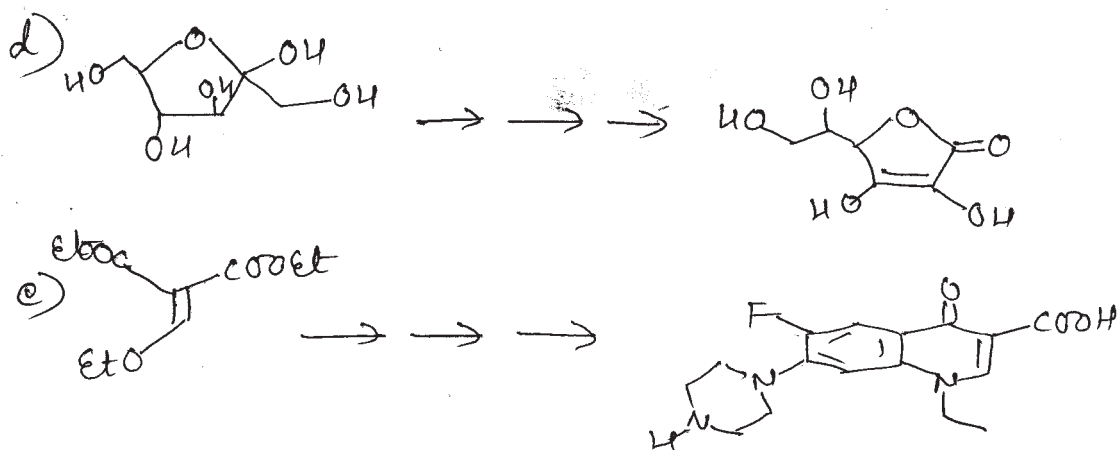
SECTION-II

Q4) Discuss the steps involved in the following transformations comment on steps indicating mechanism and reagents used (any three): [15]

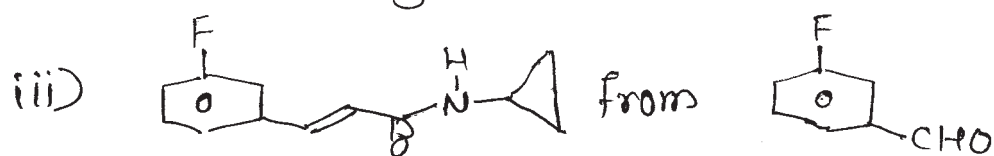
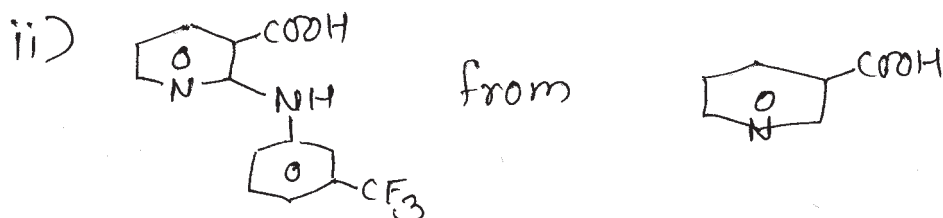
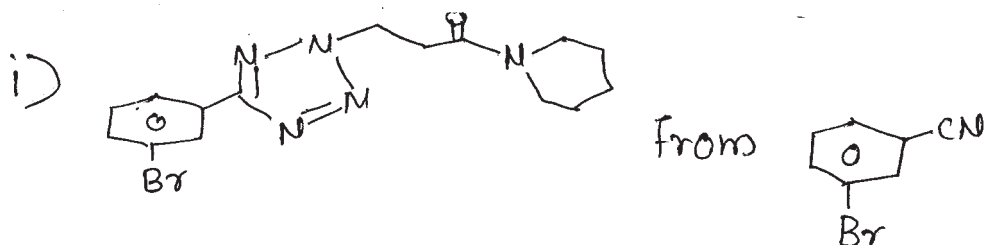


Q5) Discuss the steps involved in the synthesis of following drug molecules. Explain the mechanism involved (any four): [16]





Q6) a) Devise a synthetic pathway for any two of the following from the starting compound shown. [6]



b) Discuss the retrosynthetic analysis of Epothilone and use of Suzuki coupling in Epothilone synthesis. [3]

□□□

Total No. of Questions : 6]

SEAT No. :

P1534

[4625] - 41

[Total No. of Pages : 5

M.Sc.

DRUG CHEMISTRY

**CH - 461: Synthetic Methods in Organic Chemistry
(2008 Pattern) (Semester - IV)**

Time : 3 Hours]

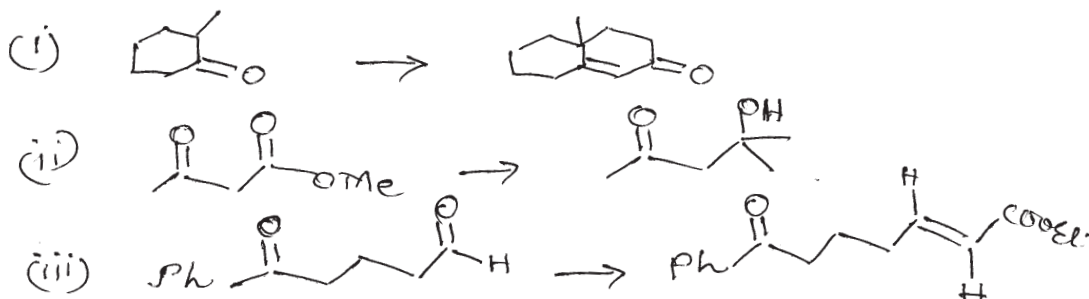
[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*

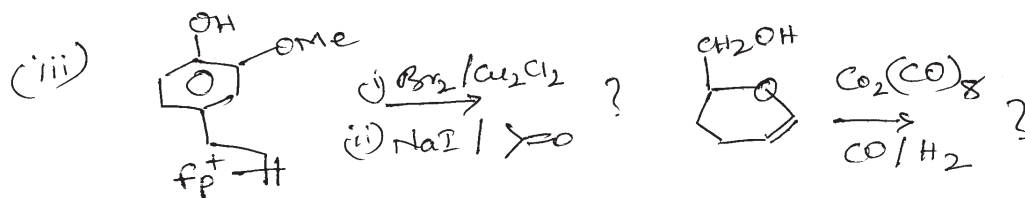
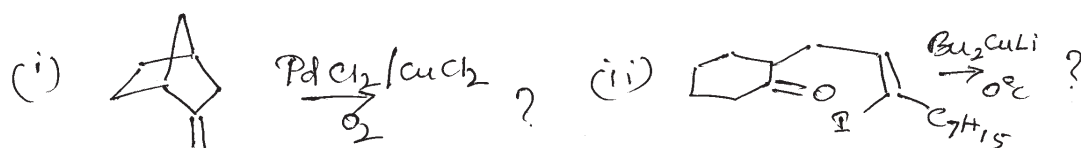
SECTION - I

- Q1) a)** Explain any three of the following with an example. **[9]**
- i) Enamine approach can be used for the synthesis of 2,6- disubstituted cyclohexanones.
 - ii) Formation of benzoin from benzaldehyde involves reagent having umpolung of reactivity.
 - iii) Organo boranes can be used to synthesize chiral alcohols.
 - iv) Explain the strategies used for disconnection of 1,4; 1,5 and 1,6 dicarbonyl compounds with one example each.
- b)** Complete the following transformation and justify your answer (any two). **[6]**



P.T.O.

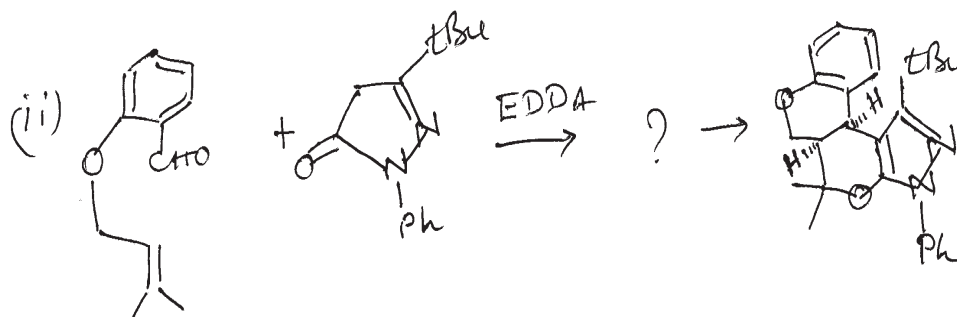
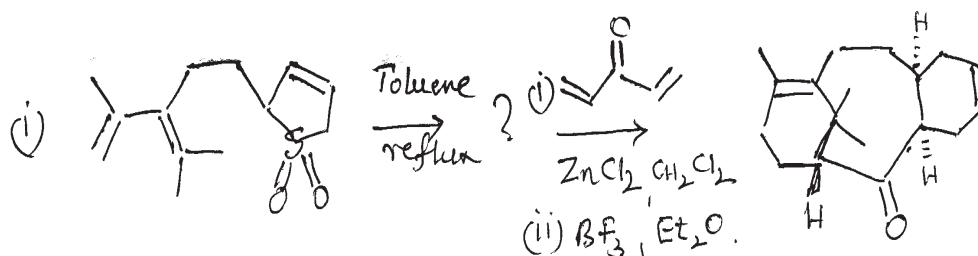
Q2) a) Predict the product explaining the mechanism of transition metal complex (any three). [9]



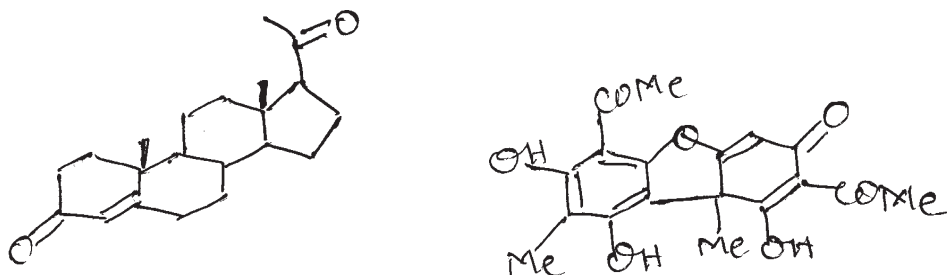
b) Explain any two of the following. [6]

- Role of transition metal complexes to synthesize unstable organic molecule.
- Carbonylation reactions of organo boranes.
- Heck coupling reactions using organo Pd.

Q3) a) What is a domino reaction? Complete the following reaction sequences and explain the steps involved, in any one of the reaction. [5]

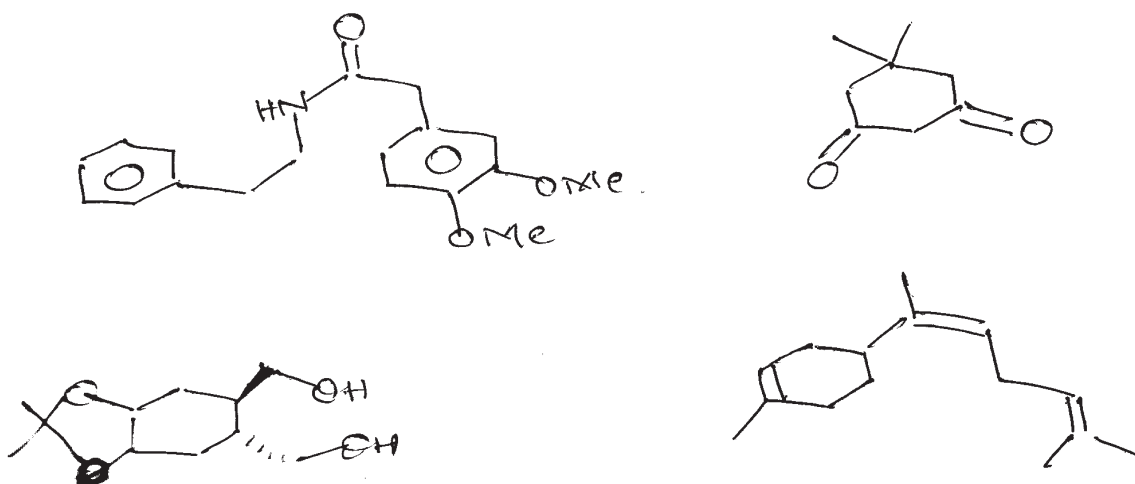


- b) What is meant by biomimetic synthesis? How this strategy is useful to increase the yield and efficiency of an organic reaction carryout biomimetic synthesis of any one of the following. [5]

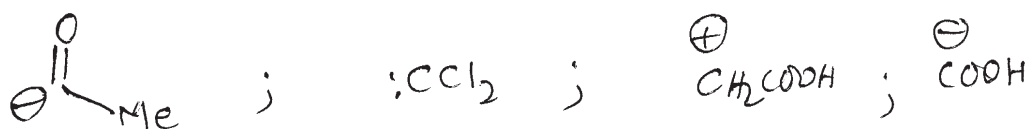


SECTION - II

- Q4) Using retrosynthetic analysis, suggest the suitable method to synthesize any three of the following compounds. [12]

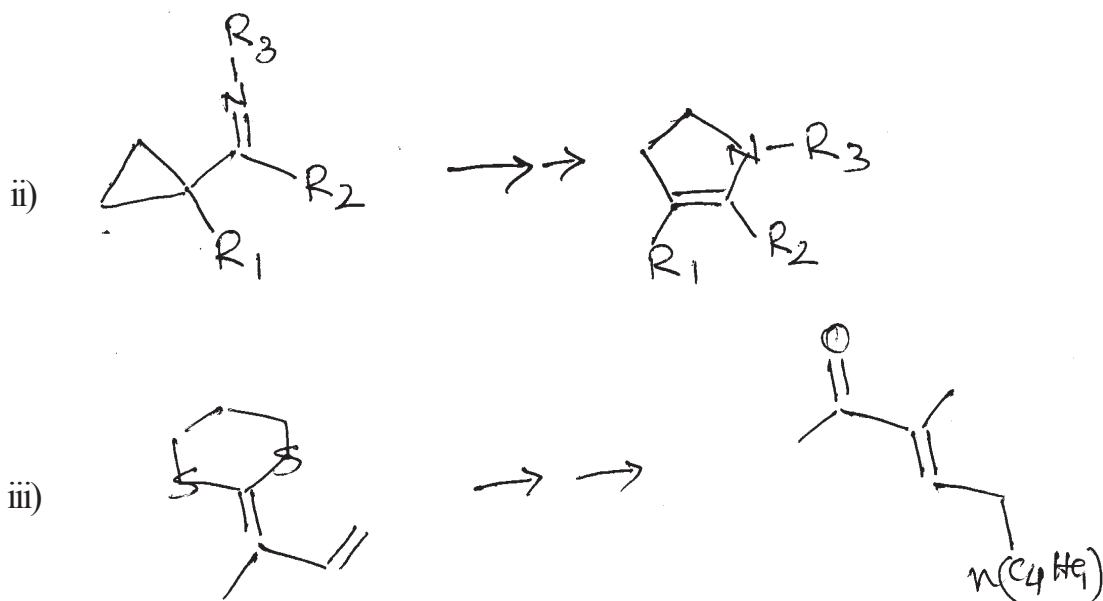


- Q5) a) Give one reaction with reagent, for each synthon given below [6]



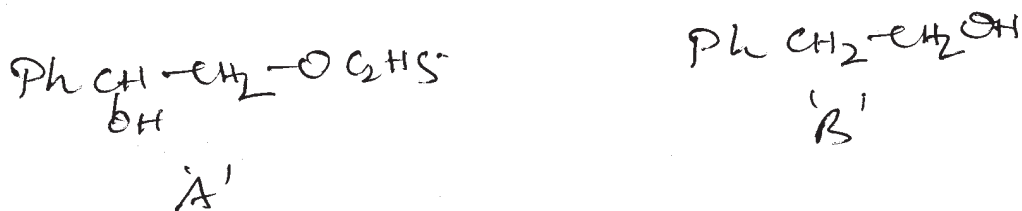
- b) Using the method of umpolung carryout the following conversion (any two). [6]

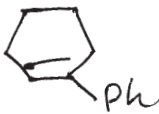


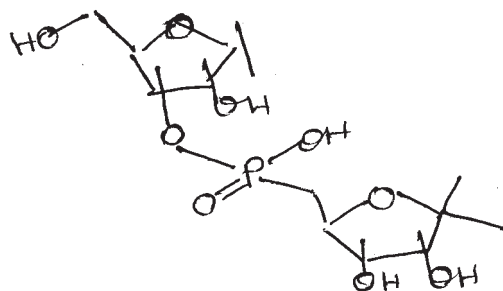


Q6) a) Answer any four of the following. [12]

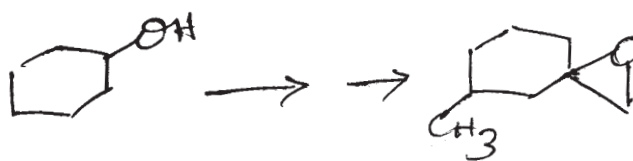
- i) Hydroboration followed by oxidation of compound $\text{PhCH}=\text{CH}-\text{OC}_2\text{H}_5$ gives 'A' as the major product, if hydroboration step is of short duration, but comp 'B' as the major product, if hydroboration is allowed to proceed for a longer time. Explain.



- ii) Why is the protection of the functional groups like $-\text{CHO}$; $-\text{NH}_2$, $-\text{OH}$ necessary during organic synthesis? Give one method each to protect the above mentioned functional groups.
- iii) Suggest the best strategy to synthesize an olefin  from alcohol.
- iv) Discuss the steps involved in the synthesis of dinucleotide.



- v) Complete the following transformation, arranging the reagents in proper sequence. Comment on each steps.



$\text{Ph}_3\text{P}=\text{CH}_2$, Br_2 , pyridine, AcOH , mCPBA
 Me_2CuLi , CrO_3 .

- b) Give brief account of any one of the following. [4]
- What is Green Chemistry? Discuss briefly the twelve principles in it.
 - Explain super critical fluids & their use in extraction process in organic synthesis.



Total No. of Questions : 6]

SEAT No. :

P1535

[4625] - 42

[Total No. of Pages : 3

M.Sc. (Drug Chemistry)
CH-462: CHEMOTHERAPY
(2008 Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections to be written in separate answer books.*
- 3) *Figures to right indicate maximum marks.*

SECTION - I

Q1) Answer any three of the following. [18]

- a) What are antibiotics? How are they classified? What are the characteristics expected of an ideal antibiotic? How do aminoglycosides exhibit their action?
- b) β -lactam antibiotics are most popular why? How do they exhibit their antibiotic activity? Why most of these antibiotics are more popular in their semisynthetic version-explain.
- c) Describe in brief the step in purine & pyrimidine biosynthesis How do these studies help in understanding of Anticancer & Antivirals which act at the early stages of DNA & RNA synthesis?
- d) Explain the phenomenon of drug resistance with the molecular mechanisms. Discuss the strategies involved in combatting resistance with examples.

Q2) Answer any two of the following. [12]

- a) What are the common gastrointestinal disorders? Discuss the mechanism involved in Hyper acidity & vomiting & the drugs of choice to drugs to manage them.
- b) Discuss in brief sleep cycle. Explain how some popular sedatives exhibit their effect.

P.T.O.

- c) Explain the phenomenon of neuronal transmission, clearly indicate the role of excitatory & inhibitory neurotransmitters. What happens in depression & convulsions?

Q3) Answer any two of the following. **[10]**

- a) Give a brief commentary on development of Macrolides starting from Erythromycin obtained from *Streptomyces erythreus*.
- b) Give the mode of action & uses of Quinolone antibacterials. What are the benefits of fluoroquinolones over the earlier quinolones.
- c) Give an account of fungal infections & explain the role of itraconazole & 5-flucytosine in antifungal management.

SECTION - II

Q4) Answer any three of the following. **[18]**

- a) What are the strategies to combat cancer? Describe in brief the various classes of Anticancer drugs? Elaborate the mechanism of action & utility of Antimitotics.
- b) Give a brief overview of endocrine glands & the hormones they secrete & functions of some important hormones. How is the secretion regulated?
- c) Explain the following.
- i) Cardiac cycle.
 - ii) Regulation & role of Ca^{++} in Cardiomyocytes
 - iii) Renin-Angiotensin pathway.
- d) Give a brief account of development of Alkylating agents used in cancer chemotherapy.

Q5) Answer any two of the following. **[12]**

- a) Discuss the management of any two of the following.
- i) Hypertension
 - ii) Congestive Heart failure.
 - iii) Breast cancer.
- b) Explain Pain & discuss the pain pathway & the pain receptors. Discuss how morphine & Aspirin exhibit their effect.
- c) Give a brief account of diabetes management.

Q6) Discuss the mode of action & uses of any four of the following drugs. [10]

- a) Doxycycline.
- b) Doxorubicin.
- c) AZT
- d) Methotrexate
- e) 5-Flurouracil
- f) Metoprolol



Total No. of Questions : 6]

SEAT No. :

P1536

[4625]-43

[Total No. of Pages :3

M.Sc.

DRUG CHEMISTRY

CH-463: Drug Design

(Semester-IV) (2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections to be written in separate answer books.*
- 3) *Figures to right indicate maximum marks.*

SECTION-I

Q1) Answer any two of the following: [12]

- a) What is the use of standard deviation. Compute the same for the price of gold /gm for 10 consecutive days in Rs.1500, 1525, 1635, 1488, 1490, 1515, 1585, 1608, 1616, 1550.
- b) In an experiment of pea breeding out of 1600 seeds 915 were round & green , 294 were wrinkled green, 306 were round & yellow & 85 were wrinkled yellow. Test whether this fits the Mendel's ratio of 9:3:3:1 at 5% level of significance ($\chi^2_{3,5\%} = 7.815$)
- c) Define probability of an event. The probability that 2 persons A&B solve a problem independently are 0.5 & 0.6 respectively. Find the probability that
 - i) Exactly one solve the problem.
 - ii) The problem is solved.
 - iii) The problem is not solved.

Q2) Answer any two of the following: [14]

- a) Draw a ray diagram showing different steps involved in preparing a recombinant DNA molecule.

P.T.O.

- b) Explain any two:
- Antisense nucleic acids as drugs.
 - DNA vaccines.
 - Monoclonal antibodies as drugs against cancer
- c) Give a brief overview of micro arrays & micro chips. Discuss their uses.

Q3) Answer any two of the following: **[14]**

- Give a diagrammatic representation of GPCR. Explain the steps involved in signal transduction. How does this information help in drug designing.
- Give a brief account of prodrugs. Explain the basic philosophy involved. Discuss the concept of Bodor approach & targeted drug delivery using prodrugs.
- Discuss the following:
 - Passive diffusion & active transport.
 - Role of membrane lipids.
 - Mechanism of Na^+/K^+ pump.

SECTION-II

Q4) Answer any three of the following: **[18]**

- How is Hansch analysis performed? What precautions are to be taken for substituent selection? How is the output of Hansch equation utilised for designing a better candidate?
- What are the various methods of structure based drug design? Give examples of how these methods have been used to design some useful drugs.
- Describe the various drug receptor interactions important for drug action? How the knowledge of these interactions help in drug designing?
- Write all the terms in standard molecular mechanics forcefield. Discuss how this energy differs from the one calculated by quantum mechanical calculations.

Q5) Answer any two of the following: **[12]**

- a) Discuss the methods used to construct combinatorial libraries, explain with examples. How does this aid in drug discovery?
- b) Discuss the basic principles of molecular dynamics simulation & the methods applied to generate conformations of low energy?
- c) AIDS is a deadly disease caused by HIV. The mechanism of infection is well understood & a lot of literature is available on the action of anti AIDS drugs. Most of these drugs have toxic side effects. How will you approach to design Novel drugs for AIDS or make an improvement in the current drugs. Explain your approach with proper reasons.

Q6) Discuss the following in brief - explain the methodologies & applications (any three): **[10]**

- a) Free Wilson Analysis.
- b) 3D Pharmacophore.
- c) High throughput screening.
- d) Bioinformatics.

□□□

Total No. of Questions : 4]

SEAT No. :

P3116

[Total No. of Pages : 1

[4629] - 204A
M.Sc. (Semester - II)
ZOOLOGY
ZY - 204 - T : Endocrinology
(2013 Pattern) (Credit System)

Time : 1½ Hour]

[Maximum Marks : 25

Instructions to the candidates:

- 1) *Attempt any two questions from question No. 1, 2 & 3.*
- 2) *Question No. 4 is compulsory.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) Explain the role of hormones in vitellogenesis of amphibians. [5]
b) What is the role of osmoregulatory hormones. [3]
c) Enlist the gastrointestinal hormones. [2]
- Q2)** a) Define hormones. Explain different types of hormones with the receptors. [4]
b) Explain the role of hormones in chromatophore control. [3]
c) Explain how hormones control insect metamorphosis. [3]
- Q3)** a) How do hormones regulate reproduction in molluscs and echinoderms. [4]
b) Write a note on hypothalamic - hypophysiotropins. [3]
c) Explain hormonal regulation of protein and lipid metabolism. [3]
- Q4)** Write short note on any one of the following : [5]
a) Renin - angiotensin system.
b) Second messenger system.



Total No. of Questions : 6]

SEAT No. :

P1996

[Total No. of Pages : 2

[4629] - 201
M.Sc. (Semester - II)
ZOOLOGY
ZY 201 : Biochemistry - II (3 credits)
(2013 Pattern)

Time : 2½ Hours]

[Max. Marks : 38

Instructions to the candidates :

- 1) *Attempt any three questions from Q. No. 1 to Q. No. 5.*
- 2) *Q. No. 6 is compulsory*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*

- Q1)** a) How is glucose converted to pyruvic acid. **[4]**
- b) What is oxidative phosphorylation? Give its significance. **[4]**
- c) Define energy of activation. **[2]**
-
- Q2)** a) Explain the reactions in glycogen breakdown. **[5]**
- b) Describe the β -oxidation of fatty acid **[3]**
- c) ATP is high energy molecule. Explain. **[2]**
-
- Q3)** a) Explain the oxidative decarboxylation of pyruvate. **[3]**
- b) Explain the conversion L-arginine to L-ornithine **[3]**
- c) How are ketone bodies? Explain their significance. **[4]**

P.T.O.

- Q4)** a) Explain in brief the steps of gluconeogenesis. [4]
b) Explain the mechanism of transdeamination [4]
c) Define IInd law of thermodynamics. [2]
- Q5)** a) Explain the synthesis of cytidine triphosphate starting from orotidine-5-Phosphate. [5]
b) Explain the purine degradation reactions. [5]
- Q6)** Attempt any two of the following reactions: [8]
- a) Enzymatic breakdown of starch.
b) Isocitrate -----→ α ketoglutarate
c) Pyruvic Acid -----→ Ethanol
d) Fumarate -----→ Oxaloacetate



Total No. of Questions : 6]

SEAT No. :

P1997

[Total No. of Pages : 2

[4629] - 202

M.Sc. (Semester - II)

ZOOLOGY

ZY 202 - T : Molecular Biology (3 Credits)

(2013 Pattern)

Time : 2½ Hours]

[Max. Marks : 38

Instructions to the candidates :

- 1) *Attempt any three questions from Q.No. 1 to Q.No. 5.*
- 2) *Q. No. 6 is compulsory*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the rightside indicate full marks.*

Q1) a) Explain the function of various proteins involved in initiation of DNA replication. [4]

b) Explain the structure and function of DNA pol III in E. coli. [4]

c) Explain the lagging strand synthesis. [2]

Q2) a) What are histones? Explain their role in DNA packaging. [5]

b) Explain the temperature melting of DNA. [3]

c) What is DNA supercoiling? [2]

Q3) a) What are retroposons? [3]

b) What is Genetic code? Explain the properties of genetic code. [3]

c) Explain the Watson-Crick model of DNA. [4]

P.T.O.

- Q4)** a) What are Promoters and Enhancers? Explain their role in bacterial transcription. [4]
b) "Alkylating agents cause mutation". Explain. [4]
c) Define Phosphodiester bond. [2]
- Q5)** a) Explain the initiation of transcription by RNA pol-II. [5]
b) Explain the elongation of prokaryotic translation. [5]
- Q6)** Write notes on any two of the following: [8]
a) mRNA splicing.
b) Inhibitors of Translation.
c) Photoreactivation mechanism
d) C-value paradox.



Total No. of Questions : 4]

SEAT No. :

P1999

[Total No. of Pages : 1

[4629] - 204
M.Sc. (Semester - II)
ZOOLOGY
Z Y - 204 : Endocrinology
(2013 Pattern) (Credit System)

Time : 1½ Hours]

[Max. Marks : 25

Instructions to the candidates :

- 1) *Attempt any two questions from question No 1, 2 & 3.*
- 2) *Questions No. 4 is compulsory.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Draw neat labelled diagrams wherever necessary.*

- Q1)** a) Write a note on chemical messengers. [5]
b) Explain hormonal regulation of carbohydrate metabolism. [3]
c) Enlists the hormones involved in calcium and phosphate metabolism. [2]
- Q2)** a) What is JG complex? Explain its role in osmoregulation. [4]
b) Describe vitellogenesis in amphibians. [3]
c) How does pituitary regulate control of chromatophores? [3]
- Q3)** a) Explain how X and Y organs are involved in regulation of heart rate and reproduction in crustaceans. [4]
b) Explain the role of PRL and STH. [3]
c) Write a note on Gastrointestinal hormones. [3]
- Q4)** Write short note on any one of the following : [5]
a) Hormonal regulation of insect metamorphosis.
b) Plasma membrane hormone receptors.



Total No. of Questions : 4]

SEAT No. :

P2000

[Total No. of Pages : 1

[4629] - 205
M.Sc. (Semester - II)
ZOOLOGY
Z Y - 205 : Comparative Animal Physiology
(2013 Pattern)

Time : 1½ Hour]

[Max. Marks : 25

Instructions to the candidates :

- 1) *Attempt any two questions from question no. 1, 2 & 3.*
- 2) *Question No. 4 is compulsory.*
- 3) *Figures to the right indicate full marks.*
- 4) *Draw neat labeled diagrams wherever necessary.*

- Q1)** a) Give the significance of gastric digestion. [4]
b) Explain the role of actin and myosin in muscle contraction. [4]
c) Explain the terms Tolerance and Resistance. [2]
- Q2)** a) Explain the effect of low temperature on poikilotherms. [5]
b) Describe the electron microscopic structure of skeletal muscle. [3]
c) Enlist the hormones of adenohipophysis. [2]
- Q3)** a) Describe physiological dissociation curve. [3]
b) Enlist any three sensory organs. [3]
c) Describe biokinetic zones. [4]
- Q4)** Describe different types of respiratory pigments in brief. [5]

OR

Explain the renal pressure system and write note on process of urine formation. [5]



Total No. of Questions : 8]

SEAT No. :

P1981

[Total No. of Pages : 2

[4629] - 21

M.Sc. (Semester - II)

ZOOLOGY

ZY - 201 : A) Developmental Biology

B) Comparative Animal Physiology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Attempt any two questions from each section.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) All questions carry equal marks.*
- 4) Draw neat labelled diagrams wherever necessary.*

SECTION - I

A) Developmental Biology

Q1) Describe the changes occurring in the sperm head during acrosome reaction and comment upon the molecular strategy to ensure monospermy. **[20]**

Q2) What is neural competence? Describe the molecular signalling during neural induction. **[20]**

Q3) Describe pattern formation in *Drosophila*. **[20]**

Q4) Write notes on any two of the following : **[20]**

- a) Cell Ageing
- b) Hensen's node in birds
- c) Lens development
- d) Programmed cell death

P.T.O.

SECTION - II

B) Comparative Animal Physiology

- Q5)** Explain the mechanism of hormonal action. Add a note on the chemistry of vertebrate hormones. **[20]**
- Q6)** a) Explain excretory modes of various animals and add a note on urea cycle. **[10]**
b) What are sense organs? Add a note on photoreception. **[10]**
- Q7)** What are respiratory pigments? Explain the role of haemoglobin in the transport of gases. **[20]**
- Q8)** Write notes on the following : **[20]**
- a) Cardiac output
 - b) Poikilotherms and homiotherms
 - c) Neurohaemal organs
 - d) Dietary requirements in animals.



Total No. of Questions : 8]

SEAT No. :

P1982

[Total No. of Pages : 2

[4629] - 22

M.Sc. (Semester - II)

ZOOLOGY

ZY - 202 : A) Molecular Biology

B) Cell Biology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt two sections.*
- 2) *Answer any two questions from each section.*
- 3) *Answer to the two sections should be written in separate answer books.*
- 4) *All questions carry equal marks.*
- 5) *Neat diagrams must be drawn wherever necessary.*

SECTION - I

A) Molecular Biology

Q1) Describe the structure and functions of RNA polymerases in prokaryotes. [20]

Q2) a) Explain any two DNA repair mechanisms. [10]

b) Explain in brief higher order chromatin structure. [10]

Q3) Explain the role of various protein molecules required for DNA replication. [20]

Q4) Write notes on the following : [20]

- a) Hypochromicity
- b) Prokaryotic genome
- c) mRNA splicing
- d) Genetic Code

P.T.O.

SECTION - II

B) Cell Biology

Q5) Describe the ultrastructure of nucleus and organisation of nuclear lamina. Add a note on role of nuclear pore complex. **[20]**

Q6) Give the structure and functions of ribosomes. **[20]**

Q7) Describe the role of cytoskeleton in cell architecture and cell motility. **[20]**

Q8) Write notes on : **[20]**

- a) Go phase of cell cycle
- b) Polymorphism in lysosomes
- c) Molecular organisation of centriole
- d) Peroxisomes



Total No. of Questions : 12]

SEAT No. :

P1983

[Total No. of Pages : 3

[4629] - 23

M.Sc. (Semester - II)

ZOOLOGY

ZY - 203 : A) Biochemical Technique

OR

Ichthyology

B) Endocrinology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt any two sections.*
- 2) *Answer any two questions from each section.*
- 3) *Answer to the two sections should be written in separate answer books.*
- 4) *All questions carry equal marks.*
- 5) *Neat diagrams must be drawn wherever necessary.*

SECTION - I

ZY - 203 : A) Biochemical Technique

Q1) Give the principle, working and application of DNA agarose gel electrophoresis. [20]

Q2) a) Explain any two reactions at N-terminal used in protein sequencing. [10]

b) Explain the applications of Isotopes in biology. [10]

Q3) a) Give detail account of ultracentrifuge and its application. [10]

b) Explain principle and working of Manometry. [10]

P.T.O.

Q4) Write short note on:

[20]

- a) SDS - PAGE.
- b) Affinity chromatography.
- c) Spectrophotometry and its application.
- d) DNA sequencing.

OR

A) Ichthyology

Q5) Give an account of Osmoregulation in fishes.

Q6) Describe nervous system of fishes and add a note on lateral line organs and chemoreceptors.

Q7) Describe the anatomical modifications of digestive system in fishes. Add a note on food & feeding habits of fishes.

Q8) Write short notes on:

- a) Chondrichthyes.
- b) Cyclostomata.
- c) Role of swim bladder in fishes.
- d) Anadromous migration.

SECTION - II

ZY - 203 : B) Endocrinology

Q9) Explain the role of ADH and mineralcorticoids in osmoregulation. Add a note on renin - angiotensin system. **[20]**

Q10) a) Explain the role of pituitary and pineal body on control of chromatophores. **[10]**

b) Explain the role of hormones involved in regulation of protein metabolism. **[10]**

Q11) Explain signal transduction cascade with respect to hormone action. **[20]**

Q12) Write notes on: **[20]**

- a) Hormone receptors.
- b) Hormonal regulation of yolk synthesis.
- c) X and Y organ in crustacea.
- d) Role of hormones in calcium metabolism.



Total No. of Questions : 4]

SEAT No. :

P2010

[Total No. of Pages : 1

[4629] - 309
M.Sc. (Semester - III)
ZOOLOGY
ZY - 309 : Toxicology - I (2 Credits)
(2013 Pattern)

Time : 1½ Hour]

[Maximum Marks : 25

Instructions to the candidates:

- 1) *Attempt any two questions from Q. No. 1 to Q. No. 3.*
- 2) *Question No. 4 is compulsory.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

- Q1)** a) What is toxicology? Explain how toxicants are classified. [5]
b) Describe organo phosphate pesticides. [3]
c) Define biomagnification. [2]
- Q2)** a) What are different routes of excretion of toxicants. [4]
b) Describe mode of action of organo chloride pesticides. [4]
c) What are toxins? [2]
- Q3)** a) Describe the process of excretion of xenobiotics. [4]
b) Explain in brief the detoxification of pesticides. [3]
c) Explain the problems associated with heavy metal pollution. [3]
- Q4)** Write short note on any one of the following : [5]
a) Conjugation reactions involved in phase II biotransformation reactions.
b) Sources, mode of action and toxic effect of mercury.



Total No. of Questions : 8]

SEAT No. :

P1987

[Total No. of Pages : 5

[4629] - 41
M.Sc. (Semester - IV)
ZOOLOGY
ZY - 411 : Entomology - II
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt any four questions.*
- 2) *Neat and labelled diagrams must be drawn wherever necessary.*
- 3) *All questions carry equal marks.*

Q1) What is gametogenesis? Describe the process of oogenesis in polytrophic ovarioles.

Q2) Describe metamorphosis in insects. Add a note on types of metamorphosis.

Q3) Describe the development of nervous system in insects.

Q4) Write short notes on (any two):

- a) Gastrulation in insects.
- b) Types of larvae.
- c) Regeneration in insects.
- d) Vitellogenesis.

Q5) Describe Integrated pest control & it's importance.

Q6) What is insecticide? Classify the insecticides according to mode of action.

P.T.O.

Q7) Write an essay on biological control.

Q8) Write short notes on (any two):

- a) Male sterile technique.
- b) Pesticide hazards.
- c) Economics of pest control.
- d) Repellants.



Total No. of Questions : 8]

P1987

[4629] - 41
M.Sc. (Semester - IV)
ZOOLOGY
ZY - 412 : Genetics - II
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Attempt any four questions.*
- 2) All questions carry equal marks.*
- 3) Draw neat labelled diagrams wherever necessary.*

Q1) What are the Haemoglobinopathies? Explain any two disorders related to Haemoglobin. Add a note on tertiary structure of Haemoglobin.

Q2) Explain the role of cancer critical genes in cancer formation.

Q3) Describe the various check points involved in control of cell division.

Q4) Describe the use of cell hybrids in generation of physical maps.

Q5) What are Pre-Natal Diagnostic tests? Add a note on its importance.

Q6) Write short notes on:

- a) QTL analysis.
- b) Genetic markers.
- c) Guardian of genome.
- d) Recombination activating genes.

Q7) Explain the mutations that lead to formation of hypercholesterolemia.

Q8) Explain in brief:

- a) Mitochondrial DNA disorders.
- b) Any one disorder of carbohydrate metabolism.



Total No. of Questions : 8]

P1987

[4629] - 41

M.Sc. (Semester - IV)

ZOOLOGY

ZY - 413 : Physiology - II

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Attempt any four questions.*
- 2) All questions carry equal marks.*
- 3) Draw neat diagrams wherever necessary.*

Q1) Describe the anatomy of heart. Comment on electrical activity of pace maker and add a note on electrocardiography.

Q2) Explain the types of sensory receptors, receptive potential mechanism of receptive adaptation.

Q3) Describe the role of central and peripheral receptors during respiration. Add a note on abnormalities in blood gas content.

Q4) What is digestion? Explain the components of the digestive system and add a note on mechanism of digestion.

Q5) Describe the Contractile Machinery of Smooth Muscles. Explain how it differs from Skeletal Muscles.

Q6) Explain the transmission of impulse through synapse. Add a note on impact of drug on it.

Q7) Describe the molecular mechanism of blood clotting.

Q8) Write notes on:

- a) Functions of respiratory system.
- b) Olfactory receptors.
- c) BMR.
- d) Physiology of hearing.



Total No. of Questions : 20]

SEAT No. :

P1988

[Total No. of Pages : 3

[4629] - 42

M.Sc. (Semester - IV)

ZOOLOGY

ZY - 421 - Animal Tissue Culture

ZY - 422 - Pollution Biology

ZY - 423 - Marine Biology

ZY - 424 - Bacterial and Phage Genetics

ZY - 425 - Medical Entomology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt any two sections.*
- 2) *Attempt any two questions from each section.*
- 3) *All questions carry equal marks.*
- 4) *Answers to the two sections should be written in separate answer book.*

SECTION - I

ZY 421 : Animal Tissue Culture

Q1) What is cell suspension culture? Explain batch and continuous culture.

Q2) Describe the biochemical and genetic characterization of cell lines.

- Q3)** a) Explain the working and applications of laminar air flow.
b) Define complete media. Give its components and their importance.

Q4) Write Notes on :

- a) Lymphocyte culture.
- b) Insect cell lines and its applications.

P.T.O.

SECTION - II

ZY 422 : Pollution Biology

- Q5)** Define pollution, types of pollution and their sources with examples.
- Q6)** Describe biomagnification and algal blooms as important phenomenon of water pollution.
- Q7)** Describe various factors responsible for sound pollution.
- Q8)** Write short notes on :
- Pesticide pollution.
 - Green house effect.
 - Radio active substances as pollutants.
 - Ozone layer depletion.

SECTION - III

ZY 423 : Marine Biology

- Q9)** Give an account of animal resources in marine environment.
- Q10)** What is a marine environment? Classify and describe the oceanic zones.
- Q11)** What is biofouling? Describe the economic importance and control measures.
- Q12)** Write notes on :
- Typical Indian Estuary.
 - Primary productivity in sea.
 - Culturing marine organisms.
 - Estuarine food web.

SECTION - IV

ZY 424 : Bacterial and Phage Genetics

- Q13)** Explain morphology, genome and life cycle of T₂ phages.
- Q14)** Explain the transposable elements in prokaryotes and give their significance.
- Q15)** a) Explain the experiment of transduction in bacteria.
b) Write a note on chromosome mapping.
- Q16)** Write short notes on :
- Bacteriophage Mu.
 - Griffith's experiment.
 - Concept of cistron.
 - Life cycle of RNA phage.

SECTION - V

ZY 425 : Medical Entomology

- Q17)** What is medical entomology? Describe the life cycle, symptoms, pathogenicity and control measures of trypanosomiasis and carrion diseases.
- Q18)** What is vector? Explain the role of vectors from family Reduviidae and Pediculidae in the transmission of diseases.
- Q19)** With suitable examples describe the importance of household insects to human.
- Q20)** Write short notes on :
- Malaria.
 - Xenopsylla cheopis.
 - Rickettsia.
 - Veterinary entomology.



Total No. of Questions : 16]

SEAT No. :

P1989

[Total No. of Pages : 3

[4629] - 43

M.Sc. (Semester - IV)

ZOOLOGY

ZY - 431 - Physiology of Mammalian Reproduction

ZY - 432 - Comparative Invertebrate Histology and Histochemistry

ZY - 433 - Biodiversity Assessment

ZY - 435 - Apiculture

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Attempt any two sections.*
- 2) Answer any two questions from each section.*
- 3) Answers to the two sections should be written in separate answer books.*
- 4) All questions carry equal marks.*
- 5) Neat labeled diagrams must be drawn wherever necessary.*

SECTION - I

ZY - 431 : Physiology of Mammalian Reproduction

Q1) Explain male reproductive system and add a note on testicular hormones.

Q2) a) Discuss oestrous cycle in mammals.

b) Explain types and functions of placenta.

Q3) a) Explain hormonal control during lactation.

b) What are contraceptive devices? Mention its role in control of reproduction.

P.T.O.

Q4) Write note on (any two) :

- a) In vitro fertilization.
- b) Puberty.
- c) Genetic disorders in reproduction.
- d) Hormones in pregnancy.

SECTION - II

ZY - 432 : Comparative Invertebrate Histology and Histochemistry

Q5) Explain the various problems in tissue sectioning and suggest the remedies. **[20]**

Q6) Explain the principle of histochemical detection of enzymes? Give the procedure of detection of phosphatases. **[20]**

Q7) Explain in detail the various types of epithelial tissue. **[20]**

Q8) Write notes on : **[20]**

- a) Detection of carbohydrates.
- b) Immunohistochemistry.

SECTION - III

ZY - 433 : Biodiversity Assessment

Q9) Describe biocommunities and their inter-relationships.

Q10) What are key stone species? Explain why it is necessary to conserve.

Q11) What are the different zoogeographical realms of the world? Mention the main characteristics of the fauna of any two regions.

Q12) Write short notes on :

- a) Hotspots.
- b) Protista.
- c) Biosphere.
- d) Techniques to assess biodiversity.

SECTION - IV

ZY - 435 : Apiculture

Q13) Describe bee box with a schematic diagram. Add a note on bee space. [20]

Q14) Describe in detail reproductive system of queen. [20]

Q15) Describe caste system and division of labour in honey bees. [20]

Q16) Write short notes on : [20]

- a) Architecture of bee hive.
- b) Apitoxin.
- c) *Apis dorsata*.
- d) Bee plant relationship.



Total No. of Questions : 8]

SEAT No. :

P1685

[Total No. of Pages : 3

[4630] - 101

M.Sc. (Semester - I)

MICROBIOLOGY

MB-501 : Microbial Diversity & Taxonomy

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt five questions.
- 2) Attempt any 3 questions from Q.1 to Q.4 (core credits).
- 3) Attempt atleast 2 questions from Q.5 to Q.8 (Non-core credits).
- 4) Figures to the right indicates marks.
- 5) Draw diagrams wherever necessary.
- 6) All questions carry equal marks.
- 7) Use of the logarithmic electronic pocket calculator is allowed.
- 8) Assume suitable data, if necessary.

Q1) Attempt any two of the following :

- a) What is a phylogenetic tree? Construct phylogenic tree considering suitable example. [5]
- b) Explain the concept of species in prokaryotes. [5]
- c) Discuss the concept of evolutionary r and k selection. [5]

Q2) Attempt any two of the following :

- a) Explain in brief the great plate count anomalies with suitable example.[5]
- b) From the given data calculate the Simpson's diversity index for the river water sample. Total number of colonies is 184×10^7 [5]

Sr. No.	Types of colonies	Number of colonies
1	Pinpoint colonies	50
2	Pigmented colonies	61
3	Colonies larger than 1 mm	73

- c) Justify why Shannon index is better than the Simpson's index for expressing bacterial diversity in an ecological sample. [5]

P.T.O.

Q3) Attempt any two of the following :

- a) Describe the taxonomic significance of steps involved in gene transfer. [5]
- b) Write short note on 3 domain classification system. [5]
- c) Define and explain the phenetic approach of classification with suitable example. [5]

Q4) Attempt any two of the following :

- a) Differentiate between the species concept of sexual and asexual organisms. [5]
- b) Write note on estimates of total number of microbial species. [5]
- c) Explain the physiological characters of microbes used in microbial systematics. [5]

Q5) Attempt any two of the following :

- a) Differentiate between Basidiomycetes and Ascomycetes classes of fungi. [5]
- b) Discuss the importance of morphological features used in differentiation of fungi. [5]
- c) Give silent features of zygomycetes. [5]

Q6) Attempt any two of the following :

- a) Write note on Applications of FISH in bacterial taxonomy. [5]
- b) Explain any one method of molecular technique used in identification of microbes. [5]
- c) Explain strategies used for culturing unculturable bacteria. [5]

Q7) Attempt any two of the following.

- a) Explain molecular evolution of protein. [5]
- b) What are secondary metabolites? Explain the diversity in evolution of secondary metabolites. [5]
- c) Explain the origin and stability of diversity. [5]

Q8) Attempt any two of the following :

- a) Enlist the objectives of gene sequencing. **[5]**
- b) Write a note on whole genome shotgun sequencing. **[5]**
- c) Outline the procedure of Ion torrent gene sequencing? **[5]**



Total No. of Questions : 8]

SEAT No. :

P1686

[Total No. of Pages : 5

[4630] - 102

M.Sc. (Semester - I)

MICROBIOLOGY

MB-502 : Quantitative Biology

(Credit System) (2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any THREE questions from 1 to 4 (Core credits).
- 2) Attempt any two questions from 5 to 8 (Non-core credits).
- 3) All questions carry equal marks.
- 4) Draw neat diagrams wherever necessary.
- 5) Figures to the right indicate full marks.
- 6) Use of logarithmic tables / Scientific Calculator is allowed.
- 7) Assume suitable data if necessary.

Q1) Attempt any two of the following :

[10]

- a) Data recorded on number of mites per leaf is given in the following table. Calculate the arithmetic mean.

Number of mites per leaf	0	1	2	3	4	5	6	7	8	9	10
Number of Leaves	5	8	10	15	25	28	23	20	14	9	7

- b) Calculate the standard deviation from following data.

Waxy endospermic plants	7	8	9	10	11	12
No. of plants	12	13	19	17	15	14

- c) Calculate Karl Pearson's coefficient of skewness from following data.

Measurement	10	11	12	13	14	15
Frequency	2	4	10	8	5	1

P.T.O.

Q2) Attempt any two of the following :

[10]

- a) Write a short note on one tailed and two tailed tests.
- b) The following data relate to the days of flowering in two varieties of mungbean, G-65 and PS-16. Determine whether the two means are significantly different (table value of z at 5% l.o.s. is 1.96).

	G-65	PS - 16
n	32	35
Mean	34	38
variance	9.62	14.23

- c) Two types of drugs were used on 5 and 7 patients for reducing their weight. The drug A was imported and drug B indigenous. The decrease in the weight after using the drugs for six months was as follows :

Drug A	10	12	13	11	14		
Drug B	8	9	12	14	15	10	9

Test whether there is a significant difference in the efficacy of the two drugs (table value of t for 10 d.f. at 5% l.o.s. is 2.228).

Q3) Attempt any two of the following :

[10]

- a) A milk producers union wishes to test whether the preference pattern of consumers for its products is dependent on income level. A random sample of 500 individuals gives the following data. Test whether the preference patterns are independent of income levels (tabulated chi square at 5% l.o.s. for 4 d.f. is 9.488).

Income	Product preferred		
	Product A	Product B	Product C
Low	85	15	40
Medium	25	13	30
High	10	5	27

- b) The data recorded on four F_1 plants of *Pisum sativum* segregation for round and wrinkled shape of the seed are given below. Test the homogeneity of four plants for the 3:1 ratio (tabulated chi square at 5% l.o.s. for 4 d.f. is 9.488).

Plants	Round Seeds	Wrinkled Seeds
1	29	10
2	35	12
3	18	6
4	70	23

- c) The data on heights of male and female students is given to you. Test with the help of 'Mann-Whitney test' whether height of male and female students is same (Critical value $U_{0.05(2),7,5} = 30$)

Height of Males (cm)	Height of Females (cm)
193	176
188	174
186	168
183	165
179	163
177	
171	

Q4) Attempt any two of the following: **[10]**

- a) From the following data, compute the value of Harmonic mean.

Value(x)	5	10	15	20	25
Frequency(f)	11	25	32	28	25

- b) Write a short note on null hypothesis and alternate hypothesis.
- c) Two varieties of Snapdragons, one with red flowers and other with white flowers were crossed. The result obtained in F_2 generation are 22 red, 52 pink and 23 white flowered plants. Test that whether these figures show that segregation occurs in the simple Mendelian ratio of 1:2:1 (tabulated chi square at 5% l.o.s. for 2 d.f. is 5.99).

Q5) Attempt any two of the following:

[10]

- Enlist the sampling methods and explain any one with example.
- Draw the histogram on the following data recorded on number of tillers of the wheat varieties.

Number of tillers per plant	Number of plants
0-2	4
2-4	8
4-6	15
6-8	20
8-10	12
10-12	6

- Represent the following data by Pie diagram.

Countries	Production of sugar in a certain year in quintals
Cuba	32
Australia	30
India	20
Japan	5
Java	1
Egypt	1

Q6) Attempt any two of the following :

[10]

- The incidence of occupational disease in an industry is such that the workers have a 20% chance of suffering it. What is the probability that out of six workmen, 5 or more will contract the disease?
- Alpha particles are emitted by a radioactive element at the rate of three per minute on an average. The number of particles is distributed according to the poisson distribution. Calculate the probability of getting exactly 4 emissions in one minute.
- If the height of the sorghum varieties are approximately normally distributed with a mean of 68.22 inches and a variance of 10.8 inches. How many in a field of 100 varieties would you expect to be over 73 inches tall?

Q7) Attempt any two of the following : **[10]**

- a) Diagrammatically explain in brief different epidemiological study designs.
- b) Explain use of Plackett Burman design in microbiology with example?
- c) In laboratory experiment two samples gave the following results.

Sample	Size	Sample mean	Sum of squares of deviation from the mean
1	10	15	90
2	12	14	108

Test the equality of sample variances using F-test at 5% level of significance.

Q8) Attempt any two of the following : **[10]**

- a) Describe the chemostat model with its significance.
- b) Write a short note on Susceptible Infected recovery (SIR) model.
- c) The distribution of MN blood types in a population of 1000 individuals is as follows :

Blood type	Geno type	No. of individuals
M	MM	490
MN	MN	420
N	NN	90

Find out the Genotypic and allele frequency.



Total No. of Questions : 5]

SEAT No. :

P1673

[Total No. of Pages : 2

[4630] - 11
M. Sc. (Semester - I)
MICROBIOLOGY
MB - 501 : Microbial Diversity and Taxonomy
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate marks.*
- 3) *Draw diagrams wherever necessary.*
- 4) *All questions carry equal marks.*
- 5) *Use of the logarithmic electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following. **[16]**

- a) Describe the morphological features used in identification and classification of bacteria.
- b) Describe the importance of FAME profiling in bacterial taxonomy.
- c) Describe the methods of extracting total bacterial DNA from a habitat.

Q2) Attempt any two of the following. **[16]**

- a) Describe the taxonomic significance of steps involved in gene transfer.
- b) Compare and contrast Local and Global alignment.
- c) Describe the major steps involved in rRNA sequencing with respect to bacterial taxonomy.

Q3) Attempt any two of the following. **[16]**

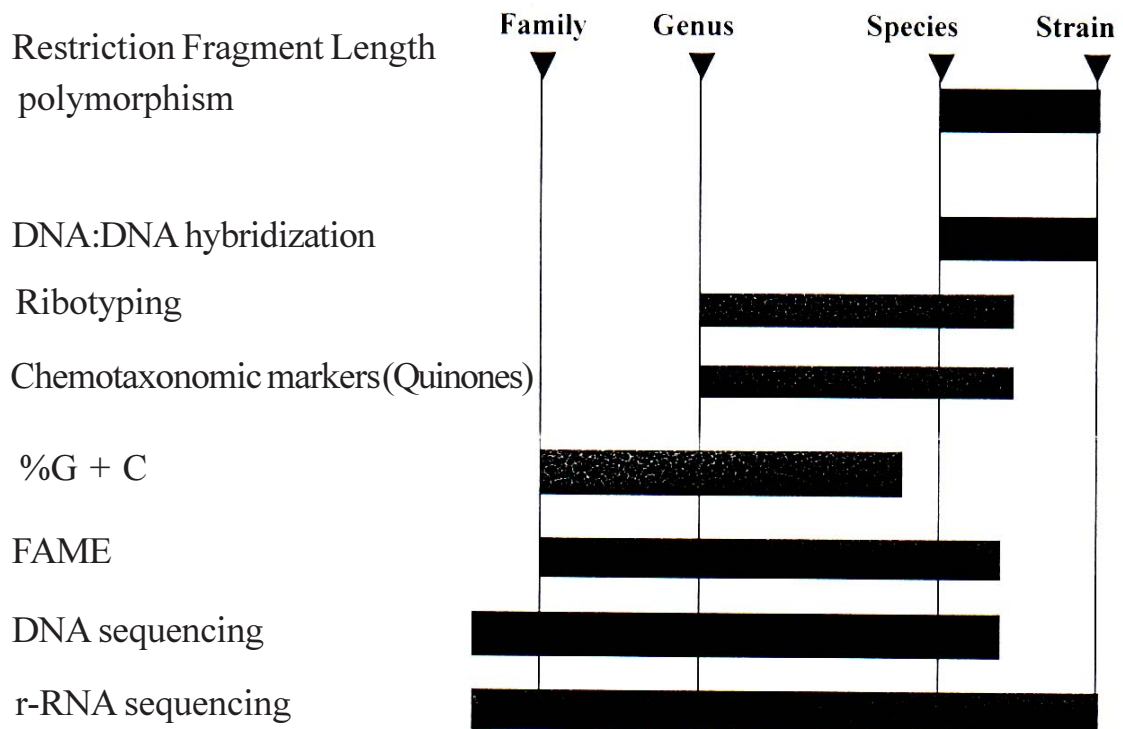
- a) Draw and explain the flow sheet for DNA sequencing.
- b) Explain why 16S rRNA is significant in systematics bacteriology.
- c) What is a phylogenetic tree? Explain how it is constructed.

P.T.O.

Q4) Attempt any two of the following. **[16]**

- a) Justify 'Chemotaxonomy is replacing gene sequencing in bacterial identification.
- b) Justify why Shannon index is better than the Simpson's index for expressing bacterial diversity in an ecological sample.
- c) Write short note on 'FASTA'.

Q5) The taxonomic resolution of some currently used techniques is shown below. Assess whether the resolutions are correct or not, If not, redraw the diagram with the correct resolutions, and explain your answer. **[16]**



Total No. of Questions : 5]

SEAT No. :

P1674

[Total No. of Pages : 3

[4630] - 12
M. Sc. (Semester - I)
MICROBIOLOGY
MB - 502 : Quantitative Biology
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat - labeled diagrams wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of the logarithmic tables and scientific calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following. [16]

- a) What are non parametric test? State their applications and limitations.
- b) Following is the data recorded on length of biological object. Calculate variance, standard deviation and coefficient of variation:

Length : 63,66,63,67,68,69,70,62,71,71

- c) Calculate mean and mode of the following distribution.

Height	130-140	140-150	150-160	160-170	170-180	180-190	190-200
Frequency	22	44	66	90	77	51	31

Q2) Attempt any two of the following. [16]

- a) Represent the following data by a pie diagram:

Country	Birth Rate
China	40
India	33
New Zealand	30
United Kingdom	20
Germany	16
Swedan	15

P.T.O.

- b) Ten rats were fed with certain food supplements over the period. Their body weights were recorded in first and second month as given below in table. Test the hypothesis that food supplement influence the weight of rats at 5% level of significance using paired t test

First month weight(gm)	50	60	58	52	51	62	58	55	50	65
Second Month Weight(gm)	56	58	68	61	56	59	64	60	50	62

- c) Explain in detail biological databases.

Q3) Attempt **any two** of the followings.

[16]

- a) On the basis of information given below about the treatment of 200 patients suffering from a disease, state whether the new treatment is comparatively superior to the conventional treatment using Chi square test.

	No.of patients	
	Favorable	Not Favorable
New	60	30
Conventional	40	70

- b) A biostatistical problem is given to three students A, B and C whose chances of solving it are $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{5}$ respectively. Find out the probability that the problem would be solved.
- c) Describe the population models of growth.

Q4) Write short notes on **any four** of the following:

[16]

- Survey design
- Poisson distribution
- Significance level
- Hypothesis testing
- Skewness

Q5) Attempt **any one** of the following

[16]

- a) Following is the data recorded on two variables in population. Calculate correlation and regression coefficient and comment on it.

X	10	8	10	9	10	10	9	11	13	9
Y	11	16	18	19	16	11	17	18	15	19

- b) The three strains of *Aspergillus niger* were grown in liquid medium of five different combination of nutrient components. The wet biomass yield per liter is given in below table. Test whether wet biomass yield depends on strain type and medium types using two factor analysis. (Level of significance = 5%)

	Aspergillus niger species		
Media type	A1	A2	A3
M1	35	50	42
M2	45	46	32
M3	40	45	29
M4	42	48	28
M5	38	43	32



Total No. of Questions : 8]

SEAT No. :

P1688

[Total No. of Pages : 2

[4630] - 201
M.Sc. (Semester - II)
MICROBIOLOGY
MB-601 : Instrumentation and Molecular Biophysics
(2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any THREE questions from 1 to 4 (Core credits).*
- 2) Attempt any TWO questions from 5 to 8 (Non-core credits).*
- 3) All questions carry equal marks.*
- 4) Draw neat diagrams wherever necessary.*
- 5) Figures to the right indicate full marks.*
- 6) Use of logarithmic tables / scientific calculator is allowed.*
- 7) Assume Suitable data if necessary.*

Q1) Attempt any two of the following: [10]

- a) Explain any two detectors of GC.
- b) Explain in brief principle and applications of SDS PAGE.
- c) An ultracentrifuge is operated at a speed of 55,000 r.p.m. Calculate the angular velocity and centrifugal field when radius is 6 cm.

Q2) Attempt any two of the following: [10]

- a) Explain Molar extinction coefficient and state the Beer and Lamberts law along with its limitations.
- b) Write a short note on Circular dichroism.
- c) If solution containing ATP is found to have absorbance of 0.17 in 1 cm cuvette and the molar extinction coefficient is 1.54×10^4 $(\text{mol dm}^{-3})^{-1}\text{cm}^{-1}$, what is the concentration and the transmission of ATP solution?

Q3) Attempt any two of the following: [10]

- a) Explain the instrumentation required for X-ray crystallography.
- b) What is the principle of NMR spectroscopy? Explain the term chemical shift.
- c) Write a short note on spin-spin coupling.

P.T.O.

Q4) Attempt **any two** of the following: [10]

- a) Write a short note on Affinity chromatography.
- b) Write a short note on MALDI-TOF.
- c) Write a short note on X-ray diffraction.

Q5) Attempt **any two** of the following : [10]

- a) Describe tertiary structure of globular protein with suitable example.
- b) Write a short on super secondary structure of protein.
- c) Explain the chemical properties of any two aromatic amino acids.

Q6) Attempt **any two** of the following : [10]

- a) Briefly describe the major steps in Needleman-Wunsch algorithm.
- b) With the help of dot matrix illustrate the principle of sequence alignment.
- c) Explain steps involved in BLAST.

Q7) Attempt **any two** of the following : [10]

- a) Comment on the use of magnetotactic bacteria in the synthesis of nanoparticles.
- b) Justify 'significance of the size and the shape of nanoparticles'.
- c) Explain the significance of EDAX in nanobiotechnology.

Q8) Attempt **any two** of the following : [10]

- a) Enlist the non-covalent interactions in protein and explain anyone.
- b) Write a short note on PDB.
- c) Write the approach to characterize the biogenic nanoparticles.



Total No. of Questions : 8]

SEAT No. :

P1689

[Total No. of Pages : 2

[4630] - 202
M.Sc. (Semester - II)
MICROBIOLOGY
MB-602 : Virology
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Attempt any THREE questions from 1 to 4 (Core credits).*
- 2) *Attempt any TWO questions from 5 to 8 (Non-core credits).*
- 3) *All questions carry equal marks.*
- 4) *Draw neat diagrams wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Use of logarithmic tables / scientific calculator is allowed.*
- 7) *Assume suitable data if necessary.*

Q1) Attempt any two of the following: [10]

- a) Explain the post transcriptional processing of viral RNA.
- b) Explain the significance of Lipoproteins proteins with suitable example.
- c) Give the significance of icosahedral and helical symmetry in viral structure determination.

Q2) Attempt any two of the following: [10]

- a) Describe microarray technique for diagnosis of viruses.
- b) In an animal infectivity assay, virus to be assayed is tenfold diluted and a fixed volume is inoculated in the test units. Following data is obtained. Calculate LD50 value using cumulative values.

Virus Dilution	Test Unit	
	Dead	Live
10^{-1}	8	0
10^{-2}	6	2
10^{-3}	1	7
10^{-4}	0	8
10^{-5}	0	8
10^{-6}	0	8

- c) Explain the use of secondary and suspension cell lines in the cultivation of viruses. Give examples of classification of viruses based on diseases.

P.T.O.

- Q3)** Attempt **any two** of the following: [10]
- Explain *in ovo* technique for cultivation of viruses.
 - Enlist the rules and principles of ICTV nomenclature system.
 - Give examples of classification of viruses based on animal host.
- Q4)** Attempt **any two** of the following: [10]
- Explain use of PCR in virus detection.
 - Mention the mechanism of viroid infection with examples.
 - If 10^7 bacterial cells are exposed to a virus, at the end of the adsorption period there are 10^5 infected bacterial cells. What is the multiplicity of infection?
- Q5)** Attempt **any two** of the following : [10]
- Compare between lytic and lysogenic cycle of phage lambda.
 - Explain life cycle of T odd phage.
 - Explain foot and mouth diseases.
- Q6)** Attempt any two of the following : [10]
- Comment on need of modern viral vaccines.
 - Explain the mechanism of action of antiviral nucleoside analogues.
 - Explain retro virus mediated oncogenesis
- Q7)** Attempt **any two** of the following: [10]
- Explain the genome structure and life cycle of SV40.
 - Explain pathophysiology of diseases caused by Prions with example.
 - Comment on fungi act as vectors for transmission of plant viruses
- Q8)** Attempt **any two** of the following: [10]
- Phage therapy for control of bacterial poultry diseases.
 - Explain any one method of prevention of crop losses due to virus infection.
 - Enlist histo pathological method for detection of plant viruses. Explain any one.



Total No. of Questions : 8]

SEAT No. :

P1690

[Total No. of Pages : 2

[4630] - 203

M.Sc. (Semester - II)

MICROBIOLOGY

MB-603 : Microbial Metabolism

(Credit System) (2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Q.1 to Q.3 is compulsory.*
- 2) *Attempt at least two from Q.4 to Q.8.*
- 3) *All questions are compulsory.*
- 4) *All questions carry equal marks.*
- 5) *Draw neat-labeled diagrams wherever necessary.*
- 6) *Use of logarithmic tables and scientific calculators is allowed.*
- 7) *Assume suitable data if necessary.*
- 8) *Figures to the right indicate full marks.*

Q1) Attempt any two of the following :

- a) Draw the secondary plots in case of noncompetitive inhibition to find out value of K_i . [5]
- b) Explain with the help of suitable example, the construction of enzyme purification chart. [5]
- c) Derive equation for Hill Plot in relation to allosteric enzymes. [5]

Q2) Attempt any two of the following :

- a) Explain the terms Entropy, Enthalpy & Free energy. [5]
- b) Justify, 'Phosphoenolpyruvate is a high energy compound.' [5]
- c) How the laws of thermodynamics are applied to biochemical systems?[5]

Q3) Attempt any two of the following :

- a) Describe the components of electron transfer system in NO_3 reducing bacteria. [5]
- b) Write a note on proton motive force. [5]
- c) Explain the mechanism of oxidative phosphorylation. [5]

P.T.O.

Q4) Attempt any two of the following :

- a) What are ligand gated ion channels? Explain with suitable example. [5]
- b) Differentiate between primary & secondary active transport. [5]
- c) Write a note on passive diffusion. [5]

Q5) Attempt any two of the following :

- a) Diagrammatically illustrate biochemistry of biological nitrogen fixation. [5]
- b) Describe the pathway leading to biosynthesis of pyrimidine. [5]
- c) Describe the regulation of nitrogenase enzyme. [5]

Q6) Attempt any two of the following :

- a) Describe structure of chloroplast. [5]
- b) Describe regulation of photosynthesis in plants. [5]
- c) Describe different groups of photosynthesis bacteria. [5]

Q7) Attempt any two of the following :

- a) Justify, 'Calvin cycle is energy demanding pathway.' [5]
- b) Schematically show integration of carbohydrate metabolism in plant cell. [5]
- c) Write a note on CAM Pathway. [5]

Q8) Attempt any two of the following :

- a) Describe steps involved in biosynthesis of triacylglycerols. [5]
- b) Write a note on acetyl CoA carboxylase enzyme. [5]
- c) Describe types of glycerophospholipids present in biological membrane. [5]



Total No. of Questions : 5]

SEAT No. :

P1676

[Total No. of Pages : 2

[4630] - 21

M.Sc (Semester - II)

MICROBIOLOGY

MB - 601 : Instrumentation and Molecular Biophysics

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following. **[16]**

- a) Explain principle of HPLC and detectors used in it.
- b) Explain the principle of Gel electrophoresis and write a short note on Agarose gel electrophoresis of DNA.
- c) Give the principle of centrifugation. Compare rate - zonal and isopycnic centrifugation.

Q2) Attempt any two of the following. **[16]**

- a) Give the Principle and Schematic diagrammatical representation of Fluorescence Spectroscopy.
- b) Explain the detection and measurement of radioactivity by liquid scintillation counting.
- c) Explain Principle and instrumentation required for the X - ray crystallography.

P.T.O.

Q3) Attempt any Two of the following. [16]

- a) Explain the partial double bond nature of peptide bond. Comment on phi and psi angles.
- b) What is the principle of NMR spectroscopy? Explain the term spin - spin coupling.
- c) Give the basic principle of Mass spectroscopy. Explain how a TOF works.

Q4) Write short note on any four of the following. [16]

- a) Ion exchange chromatography.
- b) Autoradiography.
- c) Ram chandran plot.
- d) MALDI.
- e) Quadrupole analyzer.

Q5) Attempt the following. [16]

- a) Explain how neural networks help in predicting secondary structure of proteins.
- b) An Ultracentrifuge is operated at a speed of 55,000 r.p.m. Calculate the angular velocity and centrifugal field when radius is 6 cm.

RRR

Total No. of Questions : 5]

SEAT No. :

P1677

[Total No. of Pages : 2

[4630] - 22

M.Sc. (Semester - II)

MICROBIOLOGY

MB - 602 : Evolution, Ecology and Environmental Microbiology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat labeled diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Attempt *any one* of the following: **[16]**

- a) Enlist the different anaerobic suspended and attached processes used in wastewater treatment. Describe the operating parameters for two - stage high rate digester.
- b) What is Neo - Darwinism. Describe the types of selection based on phenotype characteristics.

Q2) Attempt *any two* of the following: **[16]**

- a) Enlist the various chemical agents used in flocculation process. Explain how these chemicals manifest floccules formation.
- b) Describe in the strategies of organic matter utilization in marine environment.
- c) Explain the succession, competition and predation within the microbial communities of rhizosphere.

P.T.O.

Q3) Attempt *any two* of the following: [16]

- a) Explain the evolutionary stability of cooperation and sociality in microorganisms.
- b) Explain the various plant products as anti microbial agents.
- c) Describe the components of rhizosphere ecosystem. Explain the various control mechanisms operating within its microbial communities.

Q4) Write *short notes* on *any four* of the following: [16]

- a) Reuse of treated solid wastes.
- b) Bioremediation.
- c) Aerated lagoons.
- d) Speciation in sexual and asexual organisms.
- e) Industrial ETP layout for dairy industry.

Q5) A single - stage tricking filter has a diameter of 12.0 m and depth of 6.5 m. The characteristics of primary effluent wastewater to be treated by this filter are as follows: [16]

Flow rate: 3500 m³ / d

BOD: 110 mg / L

TSS: 75 mg / L

TKN: 20 mg / L

Determine the following:

- a) BOD loading rate.
- b) TKN loading rate.
- c) BOD removal efficiency.
- d) Can nitrification be expected?



Total No. of Questions : 5]

SEAT No. :

P1678

[Total No. of Pages : 2

[4630] - 23
M.Sc (Semester - II)
MICROBIOLOGY
MB - 603 : Microbial Metabolism
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Draw neat labelled diagrams wherever necessary.*
- 4) Figures to the right indicate full marks.*

Q1) Attempt any two of the following.

[16]

- a) Derive equation for Hill plot & state its significance in relation to allosteric enzymes.
- b) Describe various mechanisms operated in nitrogen fixing bacteria to protect nitrogenase from oxygen.
- c) Explain the concept of free energy of biochemical reaction in relation to feasibility of reaction.

Q2) Attempt any two of the following.

[16]

- a) Justify, 'during simple noncompetitive inhibition K_m remains unaltered but V_{max} decreases.'
- b) Describe the energy generation pathway in sulphate reducing bacteria.
- c) Diagrammatically illustrate 'Z' scheme of electron transport chain in plant.

P.T.O.

Q3) Attempt any two of the following. **[16]**

- a) Describe biosynthesis of glutamate family of amino acid.
- b) Describe the structure & function of bacterial ATPase.
- c) What are Liposomes? How are they useful?

Q4) Write short notes on any four of the following. **[16]**

- a) Glutamate dehydrogenase.
- b) Atkinson's energy charge.
- c) Electron donors other than water in photosynthetic bacteria.
- d) Passive diffusion.
- e) Cyclic photophosphorylation.

Q5) **[16]**

- a) Consider the following interconversion which occurs in sugar interconversion. $\text{Galactose} - 6 - \text{PO}_4 \rightleftharpoons \text{Glucose} - 6 - \text{PO}_4$.
($K_{eq} = 1.5$)
 - i) What is the ΔG° for the reaction (at 25°C)
 - ii) If the conc. of $\text{Galactose} - 6 - \text{PO}_4$ is adjusted to 1.5 m & that of $\text{Glucose} - 6 - \text{PO}_4$ is adjusted to 0.5M, What is ΔG ?
 - iii) Why are ΔG° & ΔG different?
- b) An enzyme catalysed reaction was investigated & following data was obtained.

S_o (M)	V_o (n moles / lit / min)
6.25×10^{-6}	15
7.5×10^{-5}	56.25
1.0×10^{-4}	60
1.0×10^{-3}	74.9
1.0×10^{-2}	75

- i) Estimate V_{max} & K_m
- ii) What would be V if the enzyme conc. was doubled?

☺☺☺

Total No. of Questions : 8]

SEAT No. :

P1691

[Total No. of Pages : 2

[4630] - 301

M.Sc. (Semester - III)

MICROBIOLOGY

MB-701 : Immunology

(Credit System) (2013 Pattern)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) Attempt any three questions from 1 to 4 (Core Credits).
- 2) Attempt any two questions from 5 to 8 (Non-core credits).
- 3) All questions carry equal marks.
- 4) Draw neat labeled diagrams wherever necessary.
- 5) Use of logarithmic tables and scientific calculator is allowed.
- 6) Figures to the right indicate full marks.

Q1) Attempt **any two** of the following : **[10]**

- a) Explain the structure and types of Toll-like receptors (TLRs).
- b) Explain the structure of B-cell receptor complex.
- c) With the help of diagram, explain role of adhesion molecules in activation of immune response.

Q2) Attempt **any two** of the following : **[10]**

- a) What is the role of cytokines in cross regulation of T_H cells?
- b) Diagrammatically represent regulation of classical complement pathway.
- c) Justify, "T cells and B cells differ in their susceptibility to tolerance induction".

Q3) Attempt **any two** of the following : **[10]**

- a) Explain the principles of functional assays for cytokines.
- b) Describe use of animal models for study of autoimmunity.
- c) Describe factors affecting animal cells in culture.

P.T.O.

Q4) Attempt **any two** of the following : [10]

- a) Describe the properties of G-Protein Coupled Receptors.
- b) Justify, “Antigen is not the only immune regulatory factor.”
- c) Explain use of transgenic animals in study of immunological tolerance.

Q5) Attempt **any two** of the following : [10]

- a) Describe different tumor markers used for diagnosis.
- b) Explain use of different cytokines for treatment of cancer.
- c) List tumor immunotherapeutic approaches, explain any one in detail.

Q6) Attempt **any two** of the following : [10]

- a) How host immune system responds to intracellular bacterial pathogens?
- b) Explain the pathophysiology of malarial infections.
- c) Describe prevention of *Salmonella* infections by active immunization.

Q7) Attempt **any two** of the following : [10]

- a) Explain the mechanism of symptom development in rheumatoid arthritis.
- b) How complement deficiency disorders are diagnosed?
- c) Discuss the immuno-therapeutic approaches for systemic lupus erythomatosus.

Q8) Attempt **any two** of the following : [10]

- a) Describe evolution of cellular defense mechanisms in invertebrate species.
- b) Justify, “Diversity and complexity of immune system components helps to determine scale of evolution in animal species.”
- c) Discuss the evolution of antibody molecule among vertebrates.



Total No. of Questions : 8]

SEAT No. :

P1692

[Total No. of Pages : 2

[4630] - 302

M.Sc. (Semester - III)

MICROBIOLOGY

MB-702 : Molecular Biology - I

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Attempt any three questions from 1 to 4 (Core Credits).*
- 2) *Attempt any two questions from 5 to 8 (Non-core credits).*
- 3) *All questions carry equal marks.*
- 4) *Draw neat diagrams wherever necessary.*
- 5) *Figures to the right indicate full marks.*
- 6) *Use of logarithmic tables/ scientific calculator is allowed.*
- 7) *Assume suitable data if necessary.*

Q1) Attempt **any two** of the following : **[10]**

- a) Explain the principle of DMS foot printing. Give its applications.
- b) Explain Yeast two and three hybrid cross as a tool in molecular biology.
- c) Explain RFLP with suitable example.

Q2) Attempt **any two** of the following : **[10]**

- a) Explain positive control of lac operon.
- b) How is attenuation defeated in trp operon.
- c) Explain role of repression loop in ara operon.

Q3) Draw neat well labeled diagram of **any two** of the following : **[10]**

- a) t-RNA processing
- b) RNA interference
- c) Splicing of mRNA by spliceosome

P.T.O.

Q4) Attempt **any two** of the following : [10]

- a) Give the protocol for designing a probe.
- b) Explain gene silencing with example.
- c) A pre-mRNA molecule produced from a coding gene has 200 bases long exon followed by 100 bases intron I, 30 bases exon II, 80 bases intron II, 60 bases exon III and 200 bases adanylated tail.
 - i) Draw the diagram of this pre mRNA molecule.
 - ii) Determine the size of fully matured mRNA.

Q5) Attempt **any two** of the following : [10]

- a) Describe the structure of composite transposon.
- b) Explain replicative transposition.
- c) Draw a neat well labeled diagram of retroposon.

Q6) Attempt **any two** of the following : [10]

- a) How are proteins separated by two dimensional gel electrophoresis.
- b) What is MALDI ? Give its applications in Proteomics.
- c) Explain the role of isoelectric focusing technique in protein fractionation.

Q7) Attempt **any two** of the following: [10]

- a) Draw diagram of first two cycles of PCR.
- b) Give applications of Reverse Transcription PCR.
- c) Explain DNA microarray technique with example.

Q8) Write short notes on **any two** of the following : [10]

- a) LINES.
- b) Flurochomes in PCR.
- c) Give the applications of proteomics in disease diagnosis.



Total No. of Questions : 5]

SEAT No. :

P1679

[Total No. of Pages : 2

[4630] - 31

M.Sc. (Semester - III)

MICROBIOLOGY

MB 701 : Immunology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat - labelled diagrams wherever necessary.*
- 4) *Use of logarithmic tables and scientific calculators is allowed.*
- 5) *Assume suitable data if necessary.*
- 6) *Figures to the right indicate full marks.*

Q1) Attempt *any two* of the following:

[16]

- a) Giving types of interferons, explain their role in immune mechanisms.
- b) Justify 'IL - 1 is involved in control of body temperature'.
- c) With the help of a suitable diagram, explain the role of super - antigen in pathogenesis.

Q2) Attempt *any two* of the following:

[16]

- a) Explain the gene organization and basis of diversity of TCR molecule.
- b) Describe characteristics and functions of RCA (Regulators of Complement Activation) Proteins.
- c) Explain Neil Jerne's idiotypic network theory.

P.T.O.

Q3) Attempt *any two* of the following: [16]

- a) How dialysis equilibrium studies help to understand antigen antibody reaction kinetics?
- b) Describe the animal models used to study autoimmunity.
- c) Explain use of tumor associated antigens in diagnosis of cancer.

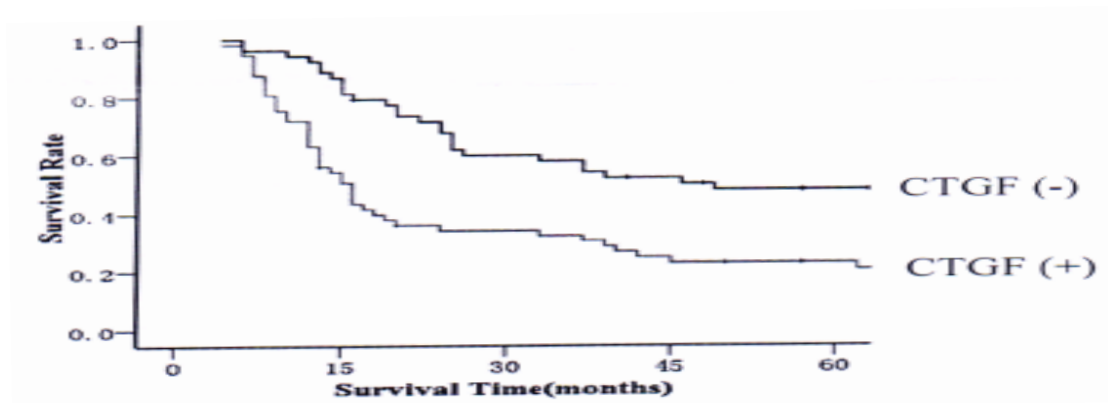
Q4) Write short notes on *any four* of the following: [16]

- a) Escape mechanisms of tumor from host immune system.
- b) Characteristics of benign and malignant tumors.
- c) Advantages of cancer immunotherapy.
- d) Immunity to intracellular bacterial pathogens.
- e) Symptoms of complement deficiency disorders.

Q5) Connective tissue growth factor (CTGF) has been shown to be implicated in tumor development and progression. However, the role of CTGF in gastric cancer was not clear.

The survival duration of the 110 patients was calculated by the Kaplan - Meier method in patients who featured CTGF - positive tumors and was compared with those patients who suffered from CTGF - negative tumors.

Kaplan - Meir survival curves for 110 patients with gastric cancer, grouped according to CTGF expression are given below:



- a) Based on the given data, discuss the association of CTGF and survival of gastric cancer patients. [6]
- b) Comment on possible use and limitations of CTGF expression analysis for diagnosis and monitoring of the gastric cancer. [6]
- c) What are other cytokines that are implicated and used for diagnosis of different types of cancers? [4]

☺☺☺

Total No. of Questions : 5]

SEAT No. :

P1680

[Total No. of Pages : 2

[4630] - 32

M.Sc. (Semester - III)

MICROBIOLOGY

MB - 702 : Molecular Biology I

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat and labelled diagrams wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of logarithmic tables and scientific calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Attempt **any two** of the following. **[16]**

- a) Explain the role of Rec A protein in recombination.
- b) Enlist the types of eukaryotic DNA polymerase with their functions.
- c) Comment on V - onc and C - onc genes.

Q2) Attempt **any two** of the following. **[16]**

- a) Write the characteristic features of Tn 10 transposons.
- b) Describe Cot $\frac{1}{2}$ and Rot $\frac{1}{2}$ values.
- c) Explain in brief replication features of linear double stranded phages.

Q3) Attempt **any two** of the following. **[16]**

- a) Elaborate the significance of origin of replication in prokaryotes.
- b) Justify "methylation of histones leads to inactivation".
- c) Describe the mechanism of base excision repair.

P.T.O.

Q4) Write short note on any four

[16]

- a) LINES
- b) Gene conversion
- c) Mu transposons
- d) Ras pathway
- e) Gene family

Q5) a) A viral DNA of molecular weight 120×10^6 contained in a phage head of 210 nm long. Calculate the length of the DNA assuming the molecular weight of the nucleotide pair is 650. **[8]**

b) Base pairing in DNA: In samples of DNA isolated from two unidentified species of bacteria, x and y, adenine makes up 32% and 17% resp. of the total bases. What relative proportions of adenine, guanine, thymine and cytosine would you find in the two DNA samples? Justify your answer. **[8]**



Total No. of Questions : 5]

SEAT No. :

P1682

[Total No. of Pages : 3

[4630] - 41

M.Sc. (Semester - IV)

MICROBIOLOGY

MB - 801 : Pharmaceutical and Medical Microbiology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat - labeled diagrams wherever necessary.*
- 4) *Use of logarithmic tables and scientific calculators is allowed.*
- 5) *Assume suitable data if necessary.*
- 6) *Figures to the right indicate full marks.*

Q1) Attempt *any two* of the following:

[16]

- a) How toxicological evaluation of a candidate drug is carried out?
- b) Explain the concepts and methodologies of rational drug discovery, giving suitable examples.
- c) Discuss the relevance of Paul Ehrlich's postulates in modern methods of drug discovery.

Q2) Attempt *any two* of the following:

[16]

- a) Describe the CLSI guidelines for susceptibility testing in solid nutrient media.
- b) How drug interactions can be studied *in vitro*?
- c) What are the objectives of clinical trials for a candidate drug?

P.T.O.

Q3) Attempt *any two* of the following: [16]

- a) How bacterial pathogens overcome phagocytic defenses of host?
- b) Explain assay of endotoxins of Gram negative bacteria.
- c) Describe role of bacterial extracellular enzymes in pathogenesis.

Q4) Write *short notes* on *any four* of the following: [16]

- a) Pyrogenicity studies.
- b) Pharmacokinetics.
- c) Bacterial adhesins.
- d) Virulence genes.
- e) Chronic toxicity tests.

Q5) To investigate sub - chronic oral toxicities of aqueous extract from the bark of *Ficus benghalensis* (AFB); male and female rats were treated with p.o. doses 500 and 1000 mg/kg/day for 28 days. Results of the hematological tests are given below:

Table 1	Parameters	Control	500mg/kg	1000mg/kg
Male rats	WBC ($\times 10^3/\mu\text{L}$)	7.40 ± 0.06	7.40 ± 0.35	$7.16 \pm 0.25^*$
	RBC ($\times 10^6/\mu\text{L}$)	7.10 ± 0.02	7.73 ± 0.04	7.92 ± 0.14
	HGB (g/dl)	13.25 ± 0.2	13.20 ± 0.51	13.1 ± 0.6
	HCT (%)	42.10 ± 0.41	43.18 ± 0.43	44.56 ± 0.52
	MCV (fl)	59.30 ± 0.19	55.88 ± 0.72	56.27 ± 1.12
	MCH (pg)	18.66 ± 0.12	17.11 ± 0.73	16.59 ± 0.83
	MCHC (g/dl)	31.47 ± 0.23	30.62 ± 1.10	29.49 ± 1.17
	Platelets ($\times 10^3/\mu\text{L}$)	830 ± 4.24	819.2 ± 4.30	845.4 ± 6.44

Table 2 Female rats	Parameters	Control	500mg/kg	1000mg/kg
	WBC ($\times 10^3/\mu\text{L}$)	7.32 ± 0.06	7.32 ± 0.43	7.22 ± 0.53
	RBC ($\times 10^6/\mu\text{L}$)	6.70 ± 0.02	$7.38 \pm 0.043^*$	$7.44 \pm 0.51^*$
	HGB (g/dl)	13.15 ± 0.2	13.50 ± 0.54	13.20 ± 0.61
	HCT (%)	40.10 ± 0.41	43.40 ± 2.54	43.40 ± 0.57
	MCV (fl)	59.85 ± 0.19	58.85 ± 6.13	58.38 ± 4.60
	MCH (pg)	19.63 ± 0.12	18.24 ± 1.19	17.75 ± 1.22
	MCHC (g/dl)	32.79 ± 0.23	31.02 ± 1.68	30.41 ± 1.47
	Platelets ($\times 10^3/\mu\text{L}$)	836 ± 3.31	830.0 ± 4.98	850.2 ± 5.33

Values are expressed as mean \pm S.E.M., n=5, control group were treated with vehicle and others groups two groups were treated daily with aqueous extract from the bark of AFB (500 & 1000mg/kg) for 28 days. * Significantly different from control, $p < 0.05$.

Bases on the given data, answer the following:

- Comment on the sub-acute toxicities of AFB bark extracts on hematological parameters. **[6]**
- Give the principles of solvent extract of bioactive compounds from plants. Comments on the nature of chemical compounds present in this extract? **[6]**
- What will be the further steps in developing AFB bark extract into therapeutic drug for general use? **[4]**



Total No. of Questions : 5]

SEAT No. :

P1683

[Total No. of Pages : 2

[4630] - 42

M.Sc (Semester - IV)

MICROBIOLOGY

MB - 802 : Molecular Biology - II

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat, labelled diagrams wherever necessary.*
- 4) *All questions carry equal marks.*
- 5) *Use of log tables, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Answer any four of the following with respect to translation in prokaryotes. **[16]**

- a) Structure of ribosome.
- b) Structure of t RNA.
- c) Initiation fo translation.
- d) Characteristics of genetic code.
- e) Molecular chaperons.
- f) Termination of translation.

Q2) Explain the principle and give applications of any two of the following techniques. **[16]**

- a) Northern blotting technique.
- b) Pulse field gel electrophoresis.
- c) Reverse transcription PCR.

P.T.O.

Q3) Draw diagrams of any two of the following. **[16]**

- a) Rho dependent termination of transcription.
- b) p^{BR322}.
- c) First two cycles in PCR.

Q4) Attempt any two of the following. **[16]**

- a) State the principle of Sanger's di-deoxy method of DNA sequencing and give its use.
- b) Comment on : x gal as selective marker for detection of recombinant DNA.
- c) Describe structure of bacterial RNA polymerase.

Q5) a) Schematically represent cutting, cloning and expression of a gene with a suitable example. **[8]**

b) Construct a restriction map of a 10 kb DNA fragment using following data. **[8]**

Enzymes used	Sizes of fragments (in kb)
Sal I	1, 4, 5
Sma I	4, 6
Sau 3 A I	0 - 8, 1 - 5, 7 - 7
Sal I + Sma I	1, 2, 3, 4
Sal I + Sau 3 A I	0 - 5, 0 - 8, 1, 3 - 2, 4 - 5
Sma I + Sau 3 A I	0 - 8, 1 - 5, 2 - 5, 5 - 2
Sal I + Sma I + Sau 3 A I	0 - 5, 0 - 8, 1, 2, 2 - 5, 3 - 2

☺☺☺

Total No. of Questions : 5]

SEAT No. :

P1684

[Total No. of Pages : 2

[4630] - 43

M.Sc. (Semester - IV)

MICROBIOLOGY

MB-803 : Microbial Technology

(2008 Pattern)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat labeled diagrams wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of logarithmic tables, electronic pocket calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Attempt any two of the following: **[16]**

- a) With the help of a diagram, describe the construction of a CSTR. State the situations in which such a bioreactor is used, and explain its advantages over an air-lift fermenter.
- b) What is N_{Re} ? Explain its significance in determining power requirements during a fermentation.
- c) Delineate the critical operating parameters for lipase production.

Q2) Attempt any two of the following : **[16]**

- a) Justify “Rheogram of -Newtonian fluids deviate from that of non - Newtonian Fluids” with examples.
- b) What is “ Process Validation” ? Explain with a suitable example.
- c) Explain the principle, construction and operation of a cell mass sensor.

Q3) Attempt any two of the following : **[16]**

- a) Describe Flow patterns associated with different types of impellers.
- b) Elaborate “In batch culture growth rate decreases due to depletion of essential nutrients”.
- c) Explain the use of fungi in promoting plant growth with appropriate examples.

P.T.O.

Q4) Write short notes on any four of the following:

[16]

- a) KLa
- b) Secondary metabolites and their control
- c) Limitations of continuous culture
- d) ISO certification
- e) OUR

Q5) Protease production by *Bacillus subtilis* with free and immobilized cells was examined in this study. Entrapment method of immobilization was used with gelatin, polyacrylamide, calcium alginate and agar matrices and protease production was studied compared to equivalent weight of free cells. Fig. given below represent the comparative protease production by different matrices over a time period of 48 h of incubation, [16]

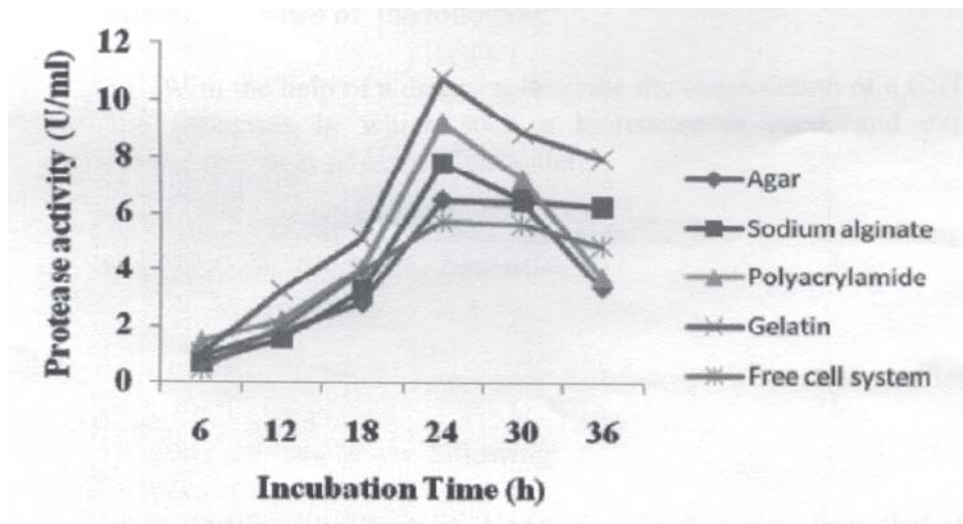


Fig 1. Time course of protease production by Immobilized cells of *Bacillus subtilis* in different matrices.

Interpret the results and answer the following:

- a) Is the process of immobilization beneficial for protease production? If yes explain how do you arrived at answer.
- b) Why agar shows less protease activity than the gelatin?
- c) How can you increase the efficiency of protease production by using which parameters?





[4631] – 101

Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg – 101 : Principles of Geomorphology
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

- Instructions :** 1) Attempt **any four** questions from Q. 1 to Q. 6.
2) Questions 7 and 8 are **compulsory**.
3) **Draw** figures/maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) Define geomorphology. | 2 |
| b) Explain the concept of time scale. | 4 |
| c) Describe the history of geomorphology. | 4 |
| 2. a) What is palaeomagnetism ? | 2 |
| b) Discuss the sources that enlight the knowledge of interior of the earth. | 4 |
| c) Give an account of seafloor spreading. | 4 |
| 3. a) What do you mean by weathering ? | 2 |
| b) Compare different types of weathering with respect to their mechanism. | 4 |
| c) Explain various types of mass movement. | 4 |
| 4. a) Define the term peneplanation. | 2 |
| b) Explain in brief, various types of drainage patterns with suitable diagram. | 4 |
| c) Elaborate the Davisian cycle of erosion. | 4 |
| 5. a) What is Fiord ? | 2 |
| b) Give the mechanism of glacial erosion. | 4 |
| c) Give an account of any two depositional landforms in glacial areas. | 4 |
| 6. a) Explain various erosional landforms in arid areas. | 5 |
| b) Describe in detail, the concept of pediplanation. | 5 |
| 7. a) What is the mechanism of erosion in coastal areas ? | 5 |
| b) Discuss the depositional work of waves and tides in coastal areas. | 5 |
| 8. a) Give an account of different elements of slope profile. | 5 |
| b) Write a note on Slope decline model. | 5 |



[4631] – 104

Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg 104 : Principles of Population and Settlement Geography
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

Instructions : 1) Attempt **any three** questions from Q. 1 to Q. 6.
2) Questions 7 and 8 are **compulsory**.
3) **Draw** figures/Maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) Define population geography. | 2 |
| b) Describe evolution of population geography. | 4 |
| c) Describe the approaches to the study of settlement geography. | 4 |
| 2. a) What is settlement pattern ? | 2 |
| b) Describe effect of technology on pattern of settlements. | 4 |
| c) Describe physical factors influencing the dispersion of settlements. | 4 |
| 3. a) What is centrality ? | 2 |
| b) Explain the concept of nodality. | 4 |
| c) Explain the concept of hierarchy. | 4 |
| 4. a) What is urban growth ? | 2 |
| b) Describe how improvement in transportation is responsible for urban growth. | 4 |
| c) Describe how industrialization is responsible for urban growth. | 4 |
| 5. a) Explain the term 'population distribution'. | 2 |
| b) Describe the economic factors influencing the distribution of population. | 4 |
| c) Describe the social factors influencing the distribution of population. | 4 |
| 6. a) What do you mean by Demographic Transition ? | 2 |
| b) Describe the stages of demographic transition model. | 4 |
| c) Discuss the relevance of demographic transition model. | 4 |
| 7. a) Explain the concept 'population as a resource'. | 5 |
| b) Explain level of education of population as a resource. | 5 |
| 8. a) Explain the scope of Ricardo's theory. | 5 |
| b) Describe the social factors influencing the nucleation of settlement. | 5 |



[4631] – 202

Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg–210 : Coastal Geomorphology
(2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question 5 and 6 are **compulsory**.
3) Draw figures / Maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) What is spatial scale in coastal geomorphology ? | 2 |
| b) What are swell waves and capillary waves ? | 4 |
| c) Explain the process of shoaling and wave breaking. | 4 |
| 2. a) Define surging and collapsing breakers. | 2 |
| b) What is wave diffraction ? | 4 |
| c) Write a note on river induced and tide induced currents. | 4 |
| 3. a) What is amphidromic point ? | 2 |
| b) Give the causes of sea level change. | 4 |
| c) Write a note on fossil beach ridge and beach rock. | 4 |
| 4. a) Define coastal sediments. | 2 |
| b) Write a note on morphodynamics of deltas. | 4 |
| c) Write a note on coastal sand dunes. | 4 |
| 5. a) Explain the formation and morphology of sea cliffs and caves. | 4 |
| b) Write a note on coral reefs. | 5 |
| 6. a) Explain in short equilibrium theory of tides. | 4 |
| b) Discuss sea level rise as a current coastal issue. | 5 |



[4631] – 205

Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-213 : Population Geography
(2013 Pattern)

Time : 2 Hours 30 Minutes

Max. Marks : 38

Instructions : 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question **5 and 6** are **compulsory**.
3) Draw figures/maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) Use of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) Define mortality. | 2 |
| b) Give an account of evolution of population geography. | 4 |
| c) Critically examine optimum population theory. | 4 |
| 2. a) Give the types of migration. | 2 |
| b) Discuss the factors affecting population growth. | 4 |
| c) Describe the demographic factors affecting distribution of world population. | 4 |
| 3. a) Give the areas of high fertility level in the world. | 2 |
| b) Discuss the consequences of migration. | 4 |
| c) Discuss the occupational composition of population. | 4 |
| 4. a) What is population policy ? | 2 |
| b) Explain the levels and trends of fertility in developed countries. | 4 |
| c) Explain the levels and trends of mortality in developing countries. | 4 |
| 5. a) Discuss the age and sex composition of population. | 4 |
| b) Describe the use of population projection in planning. | 5 |
| 6. a) Describe the factors affecting distribution of world population. | 4 |
| b) Critically examine the applicability of the Demographic Transition Theory. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-220 : Fluvial Geomorphology
(2013 Pattern)

Time : 2 Hours 30 Minutes

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question 5 and 6 are **compulsory**.
3) Draw figures/maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) Use of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) Give the definition of fluvial geomorphology. | 2 |
| b) State the scope of fluvial geomorphology. | 4 |
| c) State laws of allometric growth. | 4 |
| 2. a) What do you understand by shear stress in the channel ? | 2 |
| b) Describe uniform and non uniform flows in the channel. | 4 |
| c) Explain Horton's overland flow. | 4 |
| 3. a) What is competence of river ? | 2 |
| b) Distinguish between laminar and turbulent flow of a river. | 4 |
| c) Write in brief on sediment entrainment in the channel. | 4 |
| 4. a) What is form ratio ? | 2 |
| b) Write a note on sand bed, gravel bed and bedrock channels. | 4 |
| c) How alluvial fans are developed ? | 4 |
| 5. a) Distinguish between braided and anabranching channels. | 4 |
| b) Describe various erosional landforms produced by river. | 5 |
| 6. a) Write a note on meandering channel. | 4 |
| b) Describe river metamorphosis with reference to long term changes in the channel. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg. – 209 : Geoinformatics – II
(2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question 5 and 6 are **compulsory**.
3) **Draw** figures/Maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

1. a) Define the term spectral signature. 2
b) Give the historical perspective of remote sensing at international level. 4
c) Describe the factors that determine the spectral reflectance of soil and vegetation. 4
2. a) Define the term atmospheric window. 2
b) Write a note on interaction of EMR with reference to scattering and refraction. 4
c) Write a note on atmospheric window. 4
3. a) Differentiate the terms side overlap and forward overlap. 2
b) Explain the components of an aerial camera. 4
c) Explain with suitable diagram geometric characteristics of aerial photograph. 4
4. a) List the components of a GPS. 2
b) Explain any two GPS components in brief. 4
c) Write a note on spatial and spectral characteristics of Landsat TM and ETM data. 4
5. a) Define the term Orbit and give the characteristics of sun synchronous satellites. 4
b) Define the term resolution and explain any two types of resolutions used in satellite remote sensing. 5
6. a) Explain the mode of data formats for digital data. 4
b) Explain the factors governing the interpretability of satellite images. 5



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg – 221 : Monsoon Climatology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Define monsoon climatology and explain its development during recent time.
2. Give an account of classical theory of Indian monsoon.
3. Explain the role of surface winds and upper winds in summer monsoon.
4. Write an account of easterly jet and Tibetan anticyclone.
5. Explain decadal and centurial trends in Indian monsoon.
6. Explain role of cross equatorial flow and regional conditions in forecasting.
7. Write notes on **any two** :
 - i) Fohn's concept of monsoon origin.
 - ii) Winter monsoon.
 - iii) ENSO.

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Seat No.	
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M.A. / M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg. – 223 : Geography of Rural Settlements
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Describe evolution of settlements in different parts of the world.
2. What is nucleation ? Describe the factors influencing nucleation of rural settlements with suitable examples.
3. Explain centrality and hierarchy of service villages and trading centers.
4. Describe socio-economic transformation in rural areas.
5. Discuss the causes and consequences of rural-urban migration.
6. "Land use and transportation are the significant aspects of rural development planning". Discuss.
7. Write notes (**any two**) :
 - a) Ricardo's theory.
 - b) Morphogenesis of rural settlements.
 - c) Building material.

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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 311 : Applied Climatology
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question numbers **1 to 4**.
2) Question number **5 and 6** are **compulsory**.
3) Figures to the **right** indicate marks.
4) Use of map stencil and calculator is **allowed**.

- | | |
|---|---|
| 1. a) What do you mean by atmospheric concern and awareness ? | 2 |
| b) Discuss the 'climate impact assessment'. | 4 |
| c) Explain the distribution of incoming solar radiation. | 4 |
| 2. a) What do you mean by evapotranspiration ? | 2 |
| b) Describe the various forms of precipitation. | 4 |
| c) Discuss the turbulence and gustiness. | 4 |
| 3. a) What is urban heat island ? | 2 |
| b) Discuss the impact of urban climate on Global Environmental Change (GEC). | 4 |
| c) Explain the significance of climatic variables in construction operations. | 4 |
| 4. a) Define remote sensing. | 2 |
| b) Give details of satellite programming for crop condition. | 4 |
| c) Discuss the use of remote sensing in analysing canopy transpiration and crop stress. | 4 |
| 5. a) Discuss the impact of climate on pests and diseases. | 4 |
| b) Discuss the influence of climate on clothing and human control. | 5 |
| 6. a) Explain the effect of climate on air transport. | 4 |
| b) Explain the traction ability. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 322 : Geography of Soils
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** i) Attempt **any two** questions from Q. No. 1 to 4.
ii) Q. No. 5 and 6 are **compulsory**.
iii) Figures to the **right** indicate **full** marks.
iv) Draw figures/maps **wherever** necessary.
v) Use of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) What do you mean by productivity of soil ? | 2 |
| b) Describe how the parent material and topography affect soil formation. | 4 |
| c) Explain the importance of land capability classification. | 4 |
| 2. a) What is the importance of soil temperature as a soil physical properties ? | 2 |
| b) Explain the importance of Salinization and Acidification in the soil degradation. | 4 |
| c) Describe the process of Physical and Chemical weathering in soil formation. | 4 |
| 3. a) What do you mean by soil structure ? | 2 |
| b) Describe the importance of deforestation and overgrazing in the soil conservation. | 4 |
| c) Write an account of clay minerals and their distribution in the profile. | 4 |
| 4. a) Explain the importance of the study of soils. | 2 |
| b) What is the basis of soil degradation ? | 4 |
| c) Explain how the vegetation and climate affect soil formation. | 4 |
| 5. a) What is the importance of the morphological features of soil horizons ? | 4 |
| b) Write an account of biochemical properties of soils. | 5 |
| 6. a) What do you mean by bulk density, porosity and permeability of soils ? | 4 |
| b) What is the role played by soil pH and Cation-Anion exchange in the variation of chemical properties of soils ? | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg. – 301 : Theoretical and Applied Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use of map stencils is allowed.**

1. Give a brief account of contributions of Greek scholars in the development of geographical thought.
2. Give a brief account of contributions of Columbus and Vasco-Da-Gama in the development of geographical thoughts.
3. Explain the concept of dualism and dichotomies in Geography.
4. Define a system and describe its approaches in Geography.
5. Explain the importance of field survey and experimental studies in geography.
6. Define applied geography and discuss its need and significance.
7. Write notes on **any two** :
 - a) Application of geographical concepts in resource management.
 - b) Elements of a system.
 - c) Application of statistical techniques in geography.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg.-401 : Resource Management
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. What is resource management ? Describe the management of cultural resources.
2. Discuss the methods of conservation and management of mineral resources.
3. Write an account of application of remote sensing technique in resource appraisal and management.
4. How various aspects of population are important in the resource management ?
5. Write an essay on soil resources of India.
6. Describe the distribution and policies of development related to water resources of India.
7. Write notes on **any two** :
 - a) Physical resources.
 - b) Appraisal of water resources.
 - c) Integrated resource management.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. - 420 : Regional Planning and Development
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Define regional planning. Explain the concept and scope of regional planning.
2. 'Surveys for regional planning are very important'. Discuss.
3. Explain the concept of 'concentration versus dispersal' in regional planning.
4. Describe the policies for various regions in the Indian five year plans.
5. Discuss the planning strategies of various countries for regional development.
6. Describe the methodology and techniques adopted for regional planning of metropolitan region.
7. Write notes on **any two** :
 - a) Process of regional planning
 - b) Types of region
 - c) Regional disparities in India.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. – 431 : Computer Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Discuss the application of computer techniques in physical geography.
2. Describe the functions of Windows Operating System.
3. Explain the application of paint in map making.
4. Describe the functions available in the Corel photopaint.
5. Explain the application of GIS and S/WS in Geography.
6. Discuss the use of MS-Excel for analysis.
7. Write notes on **any two** :
 - a) Software
 - b) Editing and color fill in paint
 - c) Re-sampling.



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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. – 432 : Oceanography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Discuss the foundation of modern oceanography.
2. Discuss the evidences of continental drifting with reference to the origin of ocean basins.
3. Explain various relief features associated with ocean floor.
4. Define the term 'salinity' and explain the origin and composition of sea salts into the ocean.
5. Discuss the formation of ocean currents in the Pacific ocean.
6. Describe various types of marine sediments and various methods used to identify the age of marine sediments.
7. Write notes on **any two** :
 - a) Modern trends in oceanography.
 - b) Equilibrium Theory of Tides.
 - c) Wave refraction, reflection and diffraction.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg : 441 : Regional Geography of Europe
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Explain the relationship between relief and drainage in Europe.
2. Discuss the salient features of agriculture in Europe.
3. Give an account of major industries and their distribution in Europe.
4. Explain the international trade and trading partners of Europe.
5. Describe the growth and distribution of settlements in Europe with examples.
6. Explain the characteristics of European common market.
7. Write notes on **any two** :
 - a) Importance of tourism in Europe.
 - b) Migration in Europe.
 - c) Major vegetation types in Europe.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. – 444 : Geography of Japan
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Give an account of the geographical factors which control the development of Japan.
2. Explain the major vegetation types and their distribution in Japan.
3. Explain the major factors affecting agriculture of Japan.
4. Give an account of IT and electronic industries in Japan.
5. 'Trade of Japan depends on transport'. Discuss.
6. Discuss in brief the growth and distribution of settlements in Japan.
7. Write notes on **any two** :
 - a) Management of hazards in Japan.
 - b) Problems and prospects of fishing industry in Japan.
 - c) Indo-Japanese relationship.

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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg – 102 : Principles of Climatology
(2013 Pattern)

Time : 3 Hours

Max. Marks : 50

- Instructions :** 1) Attempt **any three** questions from Q. 1 to Q. 6.
2) Questions 6 and 8 are **compulsory**.
3) **Draw** figures/maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) What do you mean by weather and climate ? | 2 |
| b) Describe the gaseous components of the atmosphere. | 4 |
| c) Explain the layered structure of the atmosphere. | 4 |
| 2. a) What is electromagnetic spectrum ? | 2 |
| b) Explain the latitudinal variations in insolation. | 4 |
| c) Explain the latitudinal heat balance. | 4 |
| 3. a) What do you mean by general circulation of the atmosphere ? | 2 |
| b) Describe the role of the planetary winds in the global circulation. | 4 |
| c) Explain the jet streams. | 4 |
| 4. a) What do you mean by lapse rate ? | 2 |
| b) Explain the various types of lapse rate. | 4 |
| c) Explain the condition of absolute instability of the atmosphere. | 4 |
| 5. a) What is an airmass ? | 2 |
| b) Classify the various airmasses. | 4 |
| c) Explain the statistical method of weather forecasting. | 4 |

P.T.O.



- | | |
|---|---|
| 6. a) What are the subdivisions of climatology ? | 2 |
| b) Explain the nature climatology. | 4 |
| c) Give the development of modern climatology. | 4 |
| 7. a) Explain the effect of distance from the coast on atmospheric temperature. | 5 |
| b) Explain the various type of inversion of temperature. | 5 |
| 8. a) Describe the factors affecting atmospheric pressure. | 5 |
| b) Discuss the factors affecting evaporation. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg – 101 : Principles of Geomorphology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Define geomorphology. Discuss its nature and scope.
2. Give an account of 'Theory of Isostasy'.
3. Describes different types of folds with suitable diagrams.
4. Discuss the depositional landforms of fluvial processes.
5. Describe erosional landforms produced by wave action.
6. Discuss the concept of Pediplanation.
7. Write notes on **any two** :
 - a) Different types of drainage patterns.
 - b) Depositional landforms of wind action.
 - c) Parallel Retreat of slope.



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Seat No.	
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M.A./M.Sc.(Semester – I) Examination, 2014
GEOGRAPHY
Gg – 102 : Principles of Climatology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Discuss the structure and composition of atmosphere.
2. Describe the factors affecting horizontal distribution of atmospheric temperature.
3. What is Insolation ? Describe various processes that affect Insolation.
4. What is the difference between Absolute humidity and Relative humidity ? Discuss the factors affecting evaporation.
5. Describe the tri-cellular theory of atmospheric motion.
6. How are air masses identified and distinguished from one another ? Discuss them in detail.
7. Write notes on **any two** :
 - a) Types of fronts
 - b) Local winds
 - c) Weather forecasting



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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg-103 : Principles of Economic Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Discuss the testing of hypotheses in economic geography.
2. Describe the historical evolution of a tribal economic landscape.
3. Explain the role of natural and human resources in economic development.
4. Discuss the internal and external economies of scale.
5. Elaborate the Rostow's Model of economic development.
6. Discuss the history of economic development in Pre and Post-independent India.
7. Write notes on **any two** :
 - a) Nature of economic geography.
 - b) Weber's model of industrial location.
 - c) Structure of international trade.

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Seat No.	
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M.A./M.Sc. (Semester – I) Examination, 2014
GEOGRAPHY
Gg-104 : Principles of Population and Settlement Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Describe various approaches to the study of population and settlement.
2. Describe the effects of technology on patterns of settlement from Neolithic to Modern period.
3. Describe the social and economic factors influencing nucleation of settlements.
4. Critically examine the Malthus theory of population.
5. Explain the Christaller's theory of settlement.
6. Discuss the education and age aspects of population.
7. Write notes on **any two** :
 - a) Population as a resource.
 - b) Urbanization.
 - c) Political factors affecting population distribution.

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Seat No.	
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M.A. / M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg. 201 : Quantitative Techniques in Geography
(2013 Pattern)

Time : 2.30 Hours (150 min.)

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question number 1 to 4.
2) Question number 5 and 6 are **compulsory**.
3) Draw figures/maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) Use of map stencil and calculator is **allowed**.

1. a) Write a note on Kurtosis. 2
b) Calculate the standard deviation for the annual rainfall (in cm) of Surat, Gujarat (1971-1990). 4

92	56	121	63	166	230	116	122	151	102
126	121	199	53	17	65	100	224	50	84

- c) Calculate the variance for data given in question number 1 b. 4
2. a) What is Null and Alternate hypothesis ? 2
b) Apply the Student's t test for the data of amount of litter dropped by the public behind houses (X) and at the beauty spots (Y) of a city 4

X	6	13	7	8	7	10	12
Y	11	4	1	6	8	4	1

- c) Test the hypothesis at 0.05 level of significance for the t value calculated for the question number 2 b) to know whether the samples are taken from a common population. 4
3. a) What is descriptive statistics ? 2
b) Obtain the regression equation for rainfall (X) and cucumber yield (Y) data of a region. 4

X	22	6	93	62	84	14	52	69	104	100
Y	0.36	0.09	0.67	0.44	0.72	0.24	0.33	0.61	0.66	0.8

- c) Plot the scatter gram and the regression line for the data of the question No. 3 b). 4

P.T.O.



4. a) Write a note on grouped and ungrouped data. 2
 b) The following table provides the data of decadal population of India from 1951-2011 (X) in cores (Y). Derive the exponential regression equation for the data. 4

X	1(1951)	2(1961)	3(1971)	4(1981)	5(1991)	6(2001)	7(2011)
Y	36	44	55	68	85	103	121

- c) Plot the scatter diagram and the regression line for the data of the question No. 4 b). 4
 5. a) Write the characteristics of the normal probability distribution. 4
 b) In the Nashik District exceptionally heavy annual rainfall was experienced 20 times in 128 years i.e. from 1878 to 2005. If 10 years selected at random, what is the probability of exceptionally heavy annual rainfall for 2 times ? 5
 6. a) What is trend and periodicity in time series ? 4
 b) Calculate 3-years moving average for the annual rainfall data of the Multain station of the Betul district of Madhya Pradesh. 5

Year	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
Rainfall in cm	90	81	92	47	97	109	82	92	83	114
Year	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Rainfall in cm	79	72	100	99	102	176	108	43	114	73



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg. – 211 : Synoptic Climatology
(2013 Pattern)

Time : 2 Hours 30 min.

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q.1 to Q.4
2) Question 5 and 6 are **compulsory**.
3) Draw figures/maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) Mention any two systems of weather data collection by IMD. | 2 |
| b) Explain how analysis of weather charts is done by IMD. | 4 |
| c) Write a note on formation of tropical cyclone ? | 4 |
| 2. a) What do you understand by tropical cyclone. | 2 |
| b) Write a note on 'development of tornados. | 4 |
| c) Discuss environmental impact of severe weather phenomenon. | 4 |
| 3. a) What is hurricane ? | 2 |
| b) Explain the formation and decay of hurricanes. | 4 |
| c) Explain air masses of Asia and Europe. | 4 |
| 4. a) What is frontogenesis ? | 2 |
| b) Explain Rossby waves as extratropical cyclone. | 4 |
| c) Explain life cycle of wave cyclone. | 4 |
| 5. a) Explain methods of weather forecasting. | 4 |
| b) Discuss short, medium and long range forecasting. | 5 |
| 6. a) What do you understand by frontogenesis ? Explain the types of fronts. | 4 |
| b) Give a brief account of types of precipitation. | 5 |

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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-212 : Agricultural Geography
(2013 Pattern)

Time : 2 Hours 30 Minutes

Max. Marks : 38

Instructions : 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question 5 and 6 are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) Use of map stencils and Calculator is **allowed**.

- | | |
|---|---|
| 1. a) What is commodity approach ? | 2 |
| b) Discuss the significance of agricultural geography. | 4 |
| c) Explain the significance of agriculture in the world regions. | 4 |
| 2. a) What is the shifting cultivation ? | 2 |
| b) Discuss the influence of physical factors on agriculture. | 4 |
| c) Describe the influence of climate and soil on agriculture. | 4 |
| 3. a) What is drought ? | 2 |
| b) Explain the influence of land holding on agricultural pattern. | 4 |
| c) Give the characteristic of intensive subsistent farming. | 4 |
| 4. a) Give the types of agriculture. | 2 |
| b) Explain the crop combination method of Thomas. | 4 |
| c) Explain the Kendall's method of calculating agricultural efficiency. | 4 |
| 5. a) Discuss the prospects of agriculture in semi-arid regions. | 4 |
| b) Explain the role of irrigation in arid and semi-arid region. | 5 |
| 6. a) Discuss the land use surveys. | 4 |
| b) Discuss the land use classification in India. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-221 : Monsoon Climatology
(2013 Pattern)

Time : 2 Hours 30 Min.

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q.1 to Q.4.
2) Question 5 and 6 are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) Define Monsoon. | 2 |
| b) Explain the environmental and economic importance of monsoon. | 4 |
| c) Write a note on 'Development of monsoon climatology'. | 4 |
| 2. a) What is Tibetan anticyclone ? | 2 |
| b) Discuss long period trends in Indian rainfall. | 4 |
| c) What do you understand by monsoon depressions ? | 4 |
| 3. a) What is onset of Monsoon ? | 2 |
| b) Write a note on historical perspective of Monsoon. | 4 |
| c) Discuss the parametric and multiple power regression model used in forecasting. | 4 |
| 4. a) What is easterly jet ? | 2 |
| b) Write a note on withdrawal of monsoon. | 4 |
| c) Explain the significance of offshore trough development along the west coast of India. | 4 |
| 5. a) Describe Walker circulation. | 4 |
| b) Write a note on monsoon forecasting. | 5 |
| 6. a) Describe classical theory of Indian Monsoon. | 4 |
| b) Explain the driving mechanism of monsoon. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-223 : Geography of Rural Settlement
(2013 Pattern)

Time : 2 Hours 30 min.

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q. 1 to Q. 4.
2) Question 5 and 6 are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** side indicate **full** marks.
5) **Use** of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) What is nucleation ? | 2 |
| b) Describe the factors affecting nucleation. | 4 |
| c) Describe the site and situation of settlements. | 4 |
| 2. a) Explain the concept of Von Thunen Model. | 2 |
| b) Explain the influence of marketing of product on rural land use. | 4 |
| c) Discuss the relevance of Von Thunen Model. | 4 |
| 3. a) Define centrality of settlement. | 2 |
| b) Discuss the assumptions of Central Place Theory. | 4 |
| c) Explain functional analysis of service villages. | 4 |
| 4. a) What is seasonal migration ? | 2 |
| b) Describe the causes of rural-urban migration. | 4 |
| c) Describe the consequence of migration. | 4 |
| 5. a) Describe various patterns of settlements. | 4 |
| b) Describe transformation of rural house types in Maharashtra. | 5 |
| 6. a) Discuss the need of planning for providing amenities in rural areas. | 4 |
| b) Discuss the need of population planning in rural areas. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-204 : Geography of Tourism
(2013 Pattern)

Time : 2 Hours 30 min.

Max. Marks : 38

Instructions : 1) Attempt **any two** questions from Q.1 to Q.4.
2) Question **5 and 6** are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) Use of map stencils and calculator is **allowed**.

- | | |
|--|---|
| 1. a) Define tourist. | 2 |
| b) Explain with examples motivating factors for tourism. | 4 |
| c) Describe two types of tourism. | 4 |
| 2. a) What do you mean by recreation ? | 2 |
| b) Explain the impact of natural factors on tourism. | 4 |
| c) Discuss the role of religious centers in tourism. | 4 |
| 3. a) What is Spa ? | 2 |
| b) Explain the types of accommodation. | 4 |
| c) Discuss the role of different agencies in tourism development. | 4 |
| 4. a) What do you mean by adventure tourism ? | 2 |
| b) Write a note on 'Goa as a international tourist place'. | 4 |
| c) Discuss the current trends in tourism. | 4 |
| 5. a) Explain with examples any one tourist attraction in Maharashtra. | 4 |
| b) Describe role of foreign capital in tourism. | 5 |
| 6. a) 'Tourism is an economical activity'. Discuss. | 4 |
| b) Explain the impact of globalization on tourism. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg – 210 : Tropical Geomorphology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Discuss the peculiarities of tropical climate.
2. Explain the soil formation processes in the tropics and describe the tropical soils, giving suitable examples.
3. Define laterite and give an account of classification of laterites.
4. Explain the process of erosion and deposition by rivers in the tropics.
5. Discuss the characteristics of tropical coast.
6. Explain the formation and types of planation surfaces.
7. Write note on **any two** :
 - a) Morphogenetic regions.
 - b) Indurated laterite.
 - c) Boulder Inselbergs.

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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-211 : Synoptic Climatology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Describe the structure and dissipation of tropical cyclone.
2. Explain in detail various stages of development of thunderstorms and give environmental impact of severe weather systems.
3. Mention the different air masses of Europe and describe the principal zones of frontogenesis.
4. Differentiate between heat waves and cold waves and explain the mechanism of cloud formation.
5. Explain long range forecasting and importance of satellite in weather forecasting.
6. Give an account of benefits of weather forecasting in agriculture and Agro-climatological services.
7. Write notes on **any two** :
 - a) Nature of synoptic climatology
 - b) Life cycle of Extra-tropical cyclone
 - c) Analysis of weather charts.

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Seat No.	
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M.A./ M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg 212 : Agricultural Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Describe nature and scope of Agricultural Geography.
2. 'Agriculture plays significant role in Indian economy'. Explain with examples.
3. Explain the influence of physical factors on agricultural patterns.
4. Differentiate shifting cultivation and subsistence farming with suitable examples.
5. Explain with examples agricultural regions in India.
6. What do you mean by drought prone area ? Explain the role of irrigation in drought prone area.
7. Write notes on **any two** :
 - a) Agricultural efficiency.
 - b) Plantation agriculture.
 - c) Kendall's ranking coefficient.

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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg. – 213 : Population Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Define population geography and explain its relation with other disciplines.
2. Describe the population growth from historical to modern period.
3. Discuss the socio-economic and political factors affecting population distribution.
4. Describe the causes of low and high fertility level.
5. Discuss the factors and trends of mortality levels in developing countries.
6. Give a brief account of population composition.
7. Write notes on **any two** :
 - a) Recent trends in population geography.
 - b) Use of population projections in education.
 - c) Population policies in India.

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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-214 : Geoinformatics (Paper – I)
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Describe the history of GIS with suitable benchmark software innovations.
2. What is database ? Give a comparative account of functional and logical relationships.
3. Give the advantages of DBMS with suitable examples.
4. What is spatial data editing ? Give methods of errors in digitized spatial data with suitable remedies of corrections.
5. Elaborate the operations of set theory in GIS.
6. Give a comparative account of local and focal grid operations in GIS.
7. Write note on **any two** :
 - a) Query analysis
 - b) Layers and coverage
 - c) Tessellation.



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg0.-220 : Fluvial Geomorphology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Define fluvial geomorphology. Explain the scope and importance of fluvial geomorphology for river studies.
2. Discuss the mechanics of fluvial erosion with reference to overland flow.
3. Give an account of 'at-a-station hydraulic geometry'.
4. Write in detail about 'critical tractive force' for sediment transport.
5. Describe various parameters of river channel cross section with suitable diagram.
6. Explain various erosional features in a course of river with suitable diagrams.
7. Write notes on **any two** :
 - a) Glock's model of drainage development
 - b) Meandering channel
 - c) Quaternary fluvial systems.



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg : 222 : Industrial Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) Use of map stencils is **allowed**.

1. Explain the nature and scope of industrial geography.
2. Explain the characteristics of centralization of industries.
3. What is agglomeration of industries ? Explain the concept with suitable illustration.
4. Write an essay on changing pattern and distribution of automobile industry.
5. Explain various problems and prospects of industrial regions of Anglo-America.
6. Divide India into various industrial regions and describe their characteristics in detail.
7. Write notes on **any two** :
 - a) Greenhut's model.
 - b) Changing pattern of chemical industry.
 - c) Information Technology industry in India.

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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 310 : Tropical Geomorphology
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** i) Attempt **any two** questions from question numbers **1 to 4**.
ii) Question Numbers **5 and 6** are **compulsory**.
iii) Figures to the **right** indicate **full** marks.
iv) **Use of map stencils and calculator is allowed.**

- | | |
|--|---|
| 1. a) What is tropical weathering ? | 2 |
| b) Highlight the peculiarities of tropical climate. | 4 |
| c) Describe major secondary minerals found in the tropics. | 4 |
| 2. a) Define tropical environment. | 2 |
| b) Explain and describe the process of soil formation in the tropics. | 4 |
| c) What is duricrust ? Discuss the properties of indurated laterites. | 4 |
| 3. a) Distinguish between domed and boulder inselbergs. | 2 |
| b) Write an elaborative note on lateritic profiles. | 4 |
| c) Write a note on distribution of laterites in India. | 4 |
| 4. a) Mention various types of planation surfaces. | 2 |
| b) Mention and describe any four primary minerals found in the tropics. | 4 |
| c) Discuss the process of erosion and deposition with respect to tropical rivers. | 4 |
| 5. a) Discuss in short different theories of origin of iron in laterites. | 4 |
| b) Give a brief account of morphogenetic regions. | 5 |
| 6. a) Describe the nature and distribution of deep weathering profiles in the tropics. | 4 |
| b) Give an account of solubility and mobility of minerals in the tropics. | 5 |

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[4631] – 304

Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg 312 : Trade and Transport Geography
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question no. 1 to 4.
2) Question number 5 and 6 are **compulsory**.
3) Figures to the **right** indicate marks.
4) **Use** of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) What are the various approaches to the study of trade and transport geography ? | 2 |
| b) Explain the significance and transportation in regional economies. | 4 |
| c) Discuss the characteristics of waterways. | 4 |
| 2. a) Define hinterland. | 2 |
| b) Discuss the network structure. | 4 |
| c) Explain the political factors associated with location and growth of airports. | 4 |
| 3. a) What is balance of trade ? | 2 |
| b) Explain the economic factors associated with location and growth of sea ports. | 4 |
| c) Discuss the urban transport and urban pollution. | 4 |
| 4. a) What are trade areas ? | 2 |
| b) Discuss hierarchies of transport network. | 4 |
| c) Discuss the traffic flow. | 4 |
| 5. a) Discuss the neo-classical theory of trade. | 4 |
| b) Discuss the theory of comparative advantage. | 5 |
| 6. a) Discuss the trade areas and economic blocks. | 4 |
| b) Discuss the various treaties of trade at international level. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg-313 : Urban Geography
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from questions numbers **1 to 4**.
2) Question No. **5 and 6** are **compulsory**.
3) Figures to the **right** indicate marks.
4) **Use** of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) Define 'Urban Geography'. | 2 |
| b) Explain the scope of urban geography. | 4 |
| c) Take a brief review of spatio-temporal variations in world urbanisation. | 4 |
| 2. a) What do you mean by urban morphology ? | 2 |
| b) Describe the Park and Burgess model of urban structure. | 4 |
| c) Explain the method of functional classification of towns applied by H.J. Nelson. | 4 |
| 3. a) What do you mean by rural-urban fringe ? | 2 |
| b) Describe how the rural-urban fringe is demarcated. | 4 |
| c) Explain the criteria used to demarcate the city region. | 4 |
| 4. a) What is rank-size rule ? | 2 |
| b) Explain the hierarchy of urban settlements with reference to the central place theory. | 4 |
| c) Discuss the price of land versus vertical and horizontal growth of cities. | 4 |
| 5. a) Explain the density of population in cities. | 4 |
| b) Discuss the problems of civic amenities in cities. | 5 |
| 6. a) Explain the urbanization curve. | 4 |
| b) Discuss the elements of city plan. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg-320 : Multivariate Statistics
(Credit System) (2013 Pattern)

Time : 2 Hours 30 Min.

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from Q.1 to Q.4.
2) Question numbers **5 and 6** are **compulsory**.
3) Draw figures/Maps **wherever** necessary.
4) Figures to the **right** indicate **full** marks.
5) **Use of map stencils and calculator is allowed.**

1. a) Define the terms Determinant of a matrix and Transpose of a Matrix. 2
b) Find $A \cdot B$

$$A = \begin{pmatrix} 22 & 21 & 42 \\ 55 & 15 & 80 \\ 36 & 21 & 66 \end{pmatrix} \quad B = \begin{pmatrix} 34 & 101 & 58 \\ 99 & 91 & 101 \\ 67 & 121 & 410 \end{pmatrix}.$$

4

- c) Find the Inverse of Matrix 'A' given above. 4
2. a) List the objectives of multivariate statistics and define any one of them. 2
b) Obtain a variance-covariance matrix for the given data 4

X	5	8	12	15	16	19	22	24	27	30	33	35	38	40
Y	2	2.5	3.6	5	6.3	4.2	3.1	2.6	1.5	2.2	2.8	3.1	3.5	4

- c) Obtain an appropriate bivariate equation from the data given in Q.2 b. Interpret the results. 4

P.T.O.



- 3. a) Give reasons to support the use of multivariate equations in geographical research. 2
- b) Using the data given below find the A_0 , A_1 and A_2 determinants. 4

	Y	X_1	X_2	n
mean	10	4.083333	3.45	11
variance	10.79339	1.296529	0.079669	
covariance	X_1Y	X_2Y	X_1X_2	
	-16.75	-15.0833	-5.9225	

- c) Using the determinants obtained above compute a multiple regression equation, explained variance and interpret the results. 4
- 4. a) Define the terms Eigen vector and factor loadings. 2
- b) Using the following matrix obtain the first factor loadings matrix. 4

X_1	X_2	X_3	X_4	X_5
1.00				
0.82	1.00			
0.97	0.90	1.00		
0.52	0.81	0.65	1.00	
0.20	0.59	0.34	0.92	1.00

- c) Compute Eigen vector and the variance explained by the factor loadings from the above given data and interpret the results. 4
- 5. a) Fit a suitable trend surface equation for the given data. 4

X	10	15	20	20	25	30	40	40	40	45
Y	10	25	15	35	10	25	15	35	45	25
Z	25	27	26	29	25	30	27	32	35	31



- b) Obtain the explained variance, at 0.01 level of significance and interpret the results. Use data from Q.5 a. 5
- 6. a) Following table represents correlations between different morphometric characteristics of a drainage basin. Extract first principle component. 4

	X_1	X_2	X_3	X_4	X_5
X_1	1.00	0.08	0.34	0.14	-0.23
X_2	0.08	1.00	0.30	0.40	-0.45
X_3	0.34	0.30	1.00	0.36	-0.36
X_4	0.14	0.40	0.36	1.00	-0.59
X_5	-0.23	-0.45	-0.36	-0.59	1.00

X_1 – Absolute relief, X_2 – Relative relief, X_3 – Dissection index, X_4 – Drainage density, X_5 – Stream frequency.

- b) From the Principle loadings obtained in the Q. 6 a find Eigen value, explained variance and interpret the results. 5



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 321 : Political Geography
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question numbers 1 to 4.
2) Question Number 5 and 6 are **compulsory**.
3) Figures to the **right** side indicate marks.
4) **Use of Map stencils and calculator is allowed.**

- | | |
|---|---|
| 1. a) What are the various approaches to the study of Political geography ? | 2 |
| b) Explain Whittlesey's landscape approach. | 4 |
| c) Discuss the Unified Field Theory. | 4 |
| 2. a) Define frontiers. | 2 |
| b) How are the boundaries classified ? | 4 |
| c) Describe the morphological boundaries. | 4 |
| 3. a) What is national strategy ? | 2 |
| b) Classify the resources. | 4 |
| c) Discuss the relationship between resources and national strategy. | 4 |
| 4. a) What do you mean by unity in diversity ? | 2 |
| b) Give an overview of changing political map of India. | 4 |
| c) Discuss the problems of border states of India. | 4 |
| 5. a) Explain the scope of political geography. | 4 |
| b) Distinguish between nation and state. | 5 |
| 6. a) Discuss the geostrategic views of Mahan. | 4 |
| b) Discuss political geography of SAARC region. | 5 |

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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 303 : Research Methods in Geography (Elective)
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question numbers 1 to 4.
2) Question No. 5 and 6 are **compulsory**.
3) Figures to the **right** indicate marks.
4) **Use** of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) Define geodetic survey. | 2 |
| b) Explain principles of theodolite survey. | 4 |
| c) Describe method of theodolite survey. | 4 |
| 2. a) Define SOI toposheet map. | 2 |
| b) Explain data base creation of cultural features on SOI toposheet. | 4 |
| c) Explain drainage basin demarcation method. | 4 |
| 3. a) What is overlap ? | 2 |
| b) Explain the concept of stereoscopic view. | 4 |
| c) Explain data base creation from satellite images. | 4 |
| 4. a) What is parametric test ? | 2 |
| b) Explain inferential statistics. | 4 |
| c) Explain the concept of testing of hypothesis. | 4 |
| 5. a) Discuss the uses of GIS in spatial data analysis. | 4 |
| b) "Questionnaire is a major component of field work" discuss. | 5 |
| 6. a) Discuss the significance of research methods applied in report writing. | 4 |
| b) Discuss the significance of analysis in report writing. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – II) Examination, 2014
GEOGRAPHY
Gg-224 : Geoinformatics – II
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Differentiate between active and passive remote sensing and explain their application in the study of earth surface features.
2. Describe the interaction of EMR (Electromagnetic radiation) with the atmosphere and earth surface.
3. Give an account of 'Photogrammetry'.
4. Describe spectral and radiometric characteristics of satellite images and aerial photographs.
5. Give an account of 'visual interpretation of satellite images and aerial photographs'.
6. Describe components and type of GPS receivers.
7. Write notes on **any two**.
 - 1) IRS Programmes
 - 2) MSS
 - 3) Data formats of Remote Sensing.

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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg-304 : SOCIAL AND CULTURAL GEOGRAPHY
(Credit System) (2013 Pattern)

Time : 2.30 Hours

Max. Marks : 38

- Instructions :** 1) Attempt **any two** questions from question no. 1 to 4.
2) Question No. 5 and 6 are **compulsory**.
3) Figures to the **right** indicate **full** marks.
4) **Use** of map stencils and calculator is **allowed**.

- | | |
|---|---|
| 1. a) Define cultural geography. | 2 |
| b) Explain the nature of cultural geography. | 4 |
| c) Explain the scope of cultural geography. | 4 |
| 2. a) Explain the concept of idealism. | 2 |
| b) Explain the base and concept of radicalism. | 4 |
| c) Explain the base and concept of humanism. | 4 |
| 3. a) What is social space ? | 2 |
| b) Describe processes of social pattern. | 4 |
| c) Describe interaction and social relations in society. | 4 |
| 4. a) Define socio-cultural region. | 2 |
| b) Describe transformation of cultural regions. | 4 |
| c) Describe cultural regions of the world. | 4 |
| 5. a) Explain human development index. | 4 |
| b) Describe the components of socio-cultural well being. | 5 |
| 6. a) Discuss the significance of physical infrastructure in rural settlements. | 4 |
| b) Describe the rural-urban contrasts in housing health and education. | 5 |



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 310 : Coastal Geomorphology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- i) Attempt **any four** questions.
 - ii) **All** questions carry **equal** marks.
 - iii) Draw figures/maps **wherever** necessary.
 - iv) **Use** of map stencils is **allowed**.

1. Discuss the spatial and temporal scales in coastal geomorphology.
2. Discuss the equilibrium theory of tides.
3. Explain the causes and consequences of sea level changes.
4. Give an account of classification of coastal deltas.
5. Explain the process of Aeolian deposition on the coast with reference to formation and types of coastal sand dunes.
6. Discuss the sea level rise as a current coastal issue.
7. Write notes on **any two** :
 - a) Morphological classification of coast.
 - b) Corals and coral reefs.
 - c) Salt intrusion and subsidence of coastal aquifers.

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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg-311 : Applied Climatology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : 1) Attempt **any four** questions.

2) **All** questions carry **equal** marks.

3) **Use of map stencils is allowed.**

1. Describe various instruments used to measure precipitation and wind.
2. Elaborate the role of micro-meteorological changes and behavior of pests and diseases.
3. Explain the nature of global environmental change and urban air pollution problems.
4. Give in detail effect of climate on industrial and commercial activities.
5. Explain the importance of remote sensing in satellite programming for crop condition and crop stress study.
6. Discuss solar variabilities and Astronomical theory of Climatic Change.
7. Write notes on **any two** :
 - i) Climate and health
 - ii) Traction ability
 - iii) Effect of climate on land transport.



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 312 : Trade and Transport Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- i) Attempt **any four** questions.
 - ii) **All** questions are carry **equal** mark.
 - iii) **Use** of map stencils is **allowed**.

1. Explain in brief contribution of different scholars in transportation development.
2. Describe significance of air ways in economic development.
3. Physical factors are directly impact on transportation network. Elaborate in brief.
4. Explain the role of national highway authority in India.
5. Explain the significance trade in international development.
6. Describe the problems of international trade in globalization.
7. Write notes on **any two** :
 - a) Gravity model.
 - b) Railway and economic development.
 - c) Models of network change.

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Seat No.	
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M.A. / M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 314 : Geoinformatics – III
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Describe the significance of Multi-layer operations in spatial analysis.
 2. What do understand by the term 'topology' ? Give brief account of topological overlays.
 3. What do you understand by digital image processing ? Describe various types of errors and sources of distortions in digital image processing.
 4. What do you understand by spatial filtering in image enhancement ?
 5. Describe the process of unsupervised classification in digital image processing.
 6. Give an account of classification accuracy in digital image processing.
 7. Write notes on **any two** :
 - a) Edge enhancement.
 - b) Spectral rationing.
 - c) Geometric and noise distortions.
-

B/II/14/



[4631] – 38

Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg-321 : Political Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use of map stencils is allowed.**

1. Describe various approaches to study of political geography.
2. What is a nation ? Discuss nationalism and nation building.
3. Examine the global strategic views of Mackinder.
4. Classify resources and explain relationship between resource and national strategy.
5. Explain the political geography of SAARC region.
6. Discuss the problems of Border States of India.
7. Write notes on **any two**.
 - a) Scope of political geography
 - b) Genetic classification of boundaries
 - c) Unified Field Theory.



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Seat No.	
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M.A./M.Sc. (Semester – III) Examination, 2014
GEOGRAPHY
Gg – 322 : Soil Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. State the importance of study of the soils.
2. Discuss the relationship between human geography and soils.
3. 'Parent material and climate are the major soil forming factors'. Discuss.
4. Define weathering and explain the types of chemical and physical weathering.
5. Write an explanatory note on 'Development of soil profile'.
6. Discuss soil colour and soil structure as major morphological properties of soil.
7. Write notes on **any two**.
 - a) United States soil classification system
 - b) Land capability classification
 - c) Effects of deforestation on soil environment.

B/II/14/



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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. – 421 : Geography of Water Resources
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Explain various components of hydrological cycle with the help of suitable diagram.
2. Describe water supply and utilization methods for agricultural, industrial and domestic uses of water.
3. 'Agricultural requirement of water varies with soil types and cropping pattern'. Elaborate.
4. 'Planning, conservation and development of water resources is the need of the hour'. Discuss.
5. What is meant by drought ? Discuss the effects of droughts with suitable examples.
6. Write an account of different disputes, treaties and agreements related to river water allocation between India and neighbouring countries.
7. Write notes on **any two** :
 - a) Evapotranspiration.
 - b) Water harvesting techniques.
 - c) Flood management.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg.-422 : Biogeography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) Use of map stencils is **allowed**.

1. Discuss the role of biogeography in environmental studies.
2. Describe the basic pattern of the floral kingdom of the world.
3. Explain the bio-geographic process of evolution and adaptation.
4. Describe habitats and micro habitats. What are disjunction patterns.
5. What are environmental Gradients ? Discuss its role in physical limitations of life.
6. Discuss the different types of hazards affecting island life.
7. Write notes on **any two** :
 - a) Ecological succession
 - b) Opportunity for adaptive radiation
 - c) Pattern of biodiversity.

B/II/14/



[4631] – 45

Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. – 423 : Geography and Ecosystem
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- i) Attempt **any four** questions.*
 - ii) **All** questions carry **equal** marks.*
 - iii) **Use of map stencils is allowed.***

1. Explain the spatial and temporal dimensions of an ecosystem.
2. What is a biogeochemical cycle ? Describe the biogeochemical cycle with respect to carbon dioxide.
3. Discuss the function of the autotrophs, heterotrophs and decomposers in an ecosystem.
4. Give a description of the grassland ecosystems.
5. Examine the impact of the Sardar Sarovar dam on the environment and ecology of its surrounding regions.
6. What is ecotourism ? How does it help in conservation of ecology and environment ?
7. Write notes on **any two** :
 - a) Carrying capacity of the earth
 - b) The Stockholm conference
 - c) Ecology of tropical farming systems.



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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg – 430 : Social and Cultural Geography
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Explain the various approaches related to the study of social Geography.
2. Explain the nature and concept of cultural Geography.
3. Explain different types of 'Theoretical Space'.
4. Describe the role of industrialization and migration in the development of the modern society.
5. Explain the cultural regions of India with suitable examples.
6. Discuss the rural urban contrast in health, housing and education.
7. Write notes on **any two** :
 - a) Concept of social justice
 - b) Globalization
 - c) Concept of social well being.

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[4631] – 49

Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg. – 433 : Natural and Manmade Hazards
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use of map stencils is allowed.**

1. Define hazard and discuss disaster risk and vulnerability assessment.
 2. Discuss the causes, effects and areas affected by floods.
 3. Describe the causes, effects and areas affected by landslides.
 4. Write a geographical essay on 'Nuclear Hazards'.
 5. Give an account of 'forest fires'.
 6. Define disaster management and explain disaster prevention, mitigation and rehabilitation.
 7. Write notes on **any two** :
 - a) Causes and effects of lightning and hail.
 - b) Causes and effects of tsunami.
 - c) Effects of thermal and hydel power stations.
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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg.-442 : Regional Geography of South East Asia
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) Use of map stencils is **allowed**.

1. Discuss relief and drainage characteristics of South East Asia.
2. What is resource appraisal ? Describe water resources of South East Asia.
3. Give an account of distribution of population of South East Asia.
4. Describe the growth and distribution of settlements in South East Asia.
5. Explain development of transportation in South East Asia.
6. Explain major tourist centers and importance of tourism in South East Asia.
7. Write notes on **any two** :
 - a) Significance of location of South East Asia.
 - b) Prospects of industrialization in South East Asia.
 - c) Plantation agriculture in South East Asia.

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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg – 443 : Regional Geography of North America
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

Instructions : i) Attempt **any four** questions.
ii) **All** questions carry **equal** marks.
iii) **Use** of map stencils is **allowed**.

1. Discuss the geostrategic importance of North America.
2. Describe the chief characteristics of the natural drainage system of North America.
3. Give an appraisal of the resources of North America.
4. Describe the salient features of agriculture in North America.
5. Give a geographical account of the pattern of international trade of North America.
6. Give an account of the major industries of North America.
7. Write notes on **any two** :
 - a) Population resource of North America.
 - b) Political and Economic relation between North America and Canada.
 - c) Scope of tourism in North America.

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[4631] – 54

Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg.-445 : Geography of India
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- 1) Attempt **any four** questions.
 - 2) **All** questions carry **equal** marks.
 - 3) **Use** of map stencils is **allowed**.

1. Divide India into main physiographic regions and describe the peninsular plateau in detail.
2. Explain the weather conditions in summer season in India.
3. Discuss soil degradation and measures of soil conservation in India.
4. Give the distribution and production of iron and manganese ore in India.
5. Explain the green revolution in India and its socio-economic importance.
6. Explain the problems related to industrial development in India.
7. Write notes on **any two** :
 - a) Economic position of India in relation to world
 - b) Population composition in India.
 - c) Regional development in north eastern part of India.



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Seat No.	
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M.A./M.Sc. (Semester – IV) Examination, 2014
GEOGRAPHY
Gg.-424 : Research Methodology
(2008 Pattern)

Time : 3 Hours

Max. Marks : 80

- Instructions :** 1) Attempt **any four** questions.
2) **All** questions carry **equal** marks.
3) **Use** of map stencils is **allowed**.

1. Describe the principles and methods of theodolite survey.
2. Describe tentative scheme of interpretation of SOI toposheet.
3. Explain the data base creation from aerial photographs and satellite images.
4. Explain the parametric and non parametric tests used for testing the hypothesis.
5. Describe various components of field work.
6. Describe the significance of analysis, conclusions and references in report writing.
7. Write notes (**any two**) :
 - a) Descriptive and inferential statistics
 - b) Use of GIS in geography
 - c) UTM projection.

Total No. of Questions :8]

SEAT No. :

P1630

[4632]-11

[Total No. of Pages :2

M.Sc. (Botany)

**BO -1.1: SYSTEMATICS OF NON VASCULAR PLANTS
(2008 Pattern) (Semester - I)**

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *Attempt any five questions selecting at least two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *All questions carry equal marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

SECTION -I

Q1) Discuss the thallus structure, spore producing structure and life cycle patterns in myxomycotina? **[16]**

Q2) a) Explain inter relationship between ?Rhodophyta and phaeophyta. **[8]**

b) Describe pigmentation and reserve food material in algae. **[8]**

Q3) Solve Any Two of the following: **[16]**

a) Comment on sexual reproduction in Basidiomycotina.

b) Explain cell organisation in cyanophyta.

c) Give a brief account of sporophytes of Riceia and Anthoceros.

Q4) Write short notes on Any Two: **[16]**

a) Ceametophyte and sporophyte of sphagnales.

b) Morphology and reproductive structures in polytrichales.

c) Symbiotrophs and saprotrophs.

d) Chlorophyta.

P.T.O.

SECTION -II

Q5) Discuss various life cycles present in charophyta with suitable examples. [16]

Q6) a) Explain different types of ascocarps in Ascomycotina. [8]

b) Describe the classification of fungi proposed by Alexopoulos, Mims and Blackwell. [8]

Q7) Solve Any Two of the following: [16]

a) Comment on gametophyte of Marchantiales.

b) Explain sporophyte of Funariales.

c) Give a brief account of Takakiales.

Q8) Write short notes on (Any Two): [16]

a) Sexual reproduction in Bryophyta.

b) Significance of Bryophyta.

c) Biotrophs and Necrotrophs.

d) Sources of data for plant systematics.

EEE

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1658

[4632]-201

M.Sc. I

BOTANY

**BO.2.1: Cryptogamic Botany-II
(New) (Credit System) (2013 Pattern) (Semester-II)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat labelled diagrams must be drawn wherever necessary.*

- Q1)** a) Explain thallus structure in Rhodophyta. [4]
b) Write note on mycotoxins. [3]
c) Write on reproductive bodies in lichens. [3]
- Q2)** a) Give an account of fructifications in deuteromycotina. [4]
b) Give economic importance of Mycorrhizae. [3]
c) Mention economic aspects of fungi. [3]
- Q3)** a) Describe cell structure of Cyanophyta. [4]
b) Give an account of life cycle pattern in unicellular algae of chlorophyta. [3]
c) Write the position of algae in five kingdom system. [3]
- Q4)** a) Explain origin and evolution of sex and thallus in algae. [5]
b) Comment on algological studies in India. [5]
- Q5)** a) Explain the sexual reproduction in charophyta. [4]
b) Comment on concept of hamathecium and centrum in ascomycotina fungi. [4]
c) Write on algae as source of food. [2]

P.T.O

- Q6)** a) Discuss on basidiocarp . [4]
b) Comment on habit and habitat on chrysophyta. [4]
c) Write note on puffballs. [2]
- Q7)** a) Discuss life cycle pattern of Myxomycotina. [4]
b) Write note on Oomycetes. [4]
c) Sketch and lable the vegetative structure of Zygomycotina. [2]
- Q8)** a) Give contribution of any five mycologists from India and abroad. [5]
b) Comment on hyphal modifications in fungi. [5]



Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

P1659

[4632]-202

M.Sc.

BOTANY

**BO -2.2: Cell Biology and Evolution
(2013 Pattern) (Credit System) (Semester -II)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat labelled diagram wherever necessary.*

- Q1)** a) Explain molecular organisation and biogenesis of chloroplast. [4]
b) Describe ultra structure and function of cell wall. [3]
c) Explain the role of cyclins and protein kinase in cell cycle. [3]
- Q2)** a) What is MPF (maturity promoting factor)? Explain its role in cell cycle. [4]
b) Explain cell aging and cell senescence. [3]
c) Describe mechanism of stomatal guard signaling. [3]
- Q3)** a) Explain operon and Halden concept. [4]
b) Write note on Geological time scale. [3]
c) Describe gene duplication and divergence. [3]
- Q4)** a) Give an account of ethylene mediated two component system. [4]
b) Comment on PCD in response to stress. [3]
c) Explain molecular aspect of programmed cell death. [3]
- Q5)** a) What is stress? Give an detailed account specific signaling mechanisms with suitable examples of biotic and abiotic stress. [5]
b) Give an account of origin of cell and unicellular evolution. [5]

P.T.O.

- Q6)** a) Write note on ABA induced stomatal closure. [4]
b) Comment on “diversity in protein kinases. [4]
c) Define sympatric evolution. [2]
- Q7)** a) Explain the working of flow cytometry. [4]
b) Write note on ribosomes. [4]
c) State function of Golgi complex. [2]
- Q8)** a) What is molecular evolution? Describe molecular tool in phylogeny. [5]
b) What is gene frequency? Explain the role of change in gene frequency. [5]

EEE

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1660

[4632]-203

M.Sc.

BOTANY

BO - 2.3 : Molecular Biology & Genetic Engineering

(2013 Pattern) (Credit System) (New) (Semester-II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat labelled diagrams must be drawn wherever necessary.*

Q1) a) Discuss in detail about 'Operon' concept. [4]

b) Write about RNA polymerases & give their roles. [3]

c) Give an account on nucleosomes. [3]

Q2) a) How to screen the transformants? [4]

b) Write Briefly about prokaryotic translation. [3]

c) Give an account on negative control of prokaryotic genes. [3]

Q3) a) What is photoreactivation? How it occurs? [4]

b) Give comparative account on gene organization in prokaryotes & eukaryotes. [3]

c) Write a note on screening of plasmids as recombinants. [3]

Q4) a) Write the types of enzymes & their uses in genetic engineering. [5]

b) Explain gene transfer methods. [5]

Q5) a) How extrachromosomal replication occur? [4]

b) Write about kinases & phosphatases. [4]

c) Explain Dot Blot method. [2]

P.T.O.

- Q6)** a) What are YACs? How they are useful? [4]
b) Write the techniques used for DNA isolation. [4]
c) Comment on origin of replication. [2]
- Q7)** a) What is cot curve? Write about cot 1/2 values & its significance. [4]
b) Discuss about Ribonucleoproteins. [4]
c) Write important steps of rDNA construction. [2]
- Q8)** a) Write a note on transgenic plants developed for disease resistance. [5]
b) Discuss about physical & chemical properties of DNA. [5]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

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[4632] - 204

M.Sc. (BOTANY)

**BO 2.4 : PLANT ECOLOGY AND PHYTOGEOGRAPHY (New)
(2013 Pattern) (Credit System) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat labelled diagram must be drawn wherever necessary.*

Q1) a) How plant establishes relationship with water and precipitation as a climatic factors. Discuss. **[4]**

b) Discuss the relationship between plant and soil types as edaphic factor. **[3]**

c) Comment on the Impact of Air pollution. **[3]**

Q2) a) Write a note on water pollution and its impact. **[4]**

b) Discuss plant distribution with reference to topographic factors. **[3]**

c) Comment on soil microbes in relation to plants. **[3]**

Q3) a) What is phytogeography? Discuss any two floristic regions of India. **[4]**

b) Comment on EIA. **[3]**

c) Describe any two major plant communities of world. **[3]**

Q4) a) What is population? Comment on factors affecting population size and demes. **[5]**

b) Define extinction. Add a note on extinction events. **[5]**

P.T.O.

- Q5)** a) Draw and discuss energy flow of ecosystem. [4]
b) Comment on aquatic ecosystem with examples. [4]
c) Define Ecosystem. [2]
- Q6)** a) Discuss plant adaptive responses to variation with respect to light. [4]
b) Describe Autogenic succession. [4]
c) What is eco-physiology. [2]
- Q7)** a) Comment on species diversity. [4]
b) Write a note on population viability analysis. [4]
c) Define ecotone with respect to diversity. [2]
- Q8)** a) Write a note on phytogeographic regions of world. [5]
b) What are biomes? Discuss on its classification and components. [5]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1633

[4632]-21

M.Sc. -I

BOTANY

**BO-2.1: Systematics of Vascular Plants
(Semester-II) (2008 Pattern) (Old Course)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answer any five questions, selecting at least two questions from each section.*
- 2) *Answers to the two section should be written in separate answer books.*
- 3) *All questions carry equal marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

SECTION-I

Q1) Give an account of sporophyte and gametophyte of coniferales. **[16]**

Q2) a) Explain structure of gametophyte of osmundates. **[8]**

b) Describe Sporophyte of Isoetales. **[8]**

Q3) Solve any two of the following. **[16]**

- a) Comment on sporophyte in Marsileales.
- b) Explain male and female cones of Ginkgoales.
- c) Give brief account of gametophyte of cycadales.

Q4) Write short notes (any two): **[16]**

- a) Apospory and Apogamy.
- b) Alternation of generation in pteridophytes.
- c) Evolutionary significance of heterosporous pteridophytes.
- d) Gymnosperms as a prospective ancestors of angiosperms.

P.T.O

SECTION-II

Q5) Explain the merits and limitations of Cronquist's system of classification of angiosperms. **[16]**

Q6) a) Explain with suitable examples the role of phytochemistry in angiosperm systematics. **[8]**

b) Describe various taxonomic categories. **[8]**

Q7) Solve any two of the following: **[16]**

a) Comment on salient features of Liliopsida.

b) Explain the concept of family and genus w.r.t. Angiosperms.

c) Give brief account of Takhtajan's system of classification of angiosperms.

Q8) Write short notes (any two). **[16]**

a) Ecads and Ecotype.

b) Role of palynology in angiosperm systematics.

c) Genome analysis.

d) Angiosperms as highly evolved and dominant group of plants.

□□□

Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

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[4632]-22

M.Sc. I

BOTANY

**BO -2.2: Cell biology and Instrumentation
(Old 2008 Pattern) (Semester -II)**

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) Answer any five questions, selecting at least two questions from each section.*
- 2) Answer to the two sections should be written in separate answer books.*
- 3) All questions carry equal marks.*
- 4) Neat diagrams must be drawn wherever necessary.*

SECTION -I

Q1) Explain ultrastructure, biogenesis and functions of chloroplast.

Q2) a) Explain structural organization of plant cell.

b) Describe evolution of eukaryotic cell from prokaryotic cell.

Q3) Solve any Two of the following:

a) Explain different types of chromosomes.

b) Comment on fluid mosaic model of plasma membrane.

c) Give brief account on properties of cytoplasmic matrix.

Q4) Write notes on any two of the following:

a) Lysosomes.

b) Giant chromosomes.

c) Functions of mitochondria.

P.T.O.

SECTION -II

Q5) Explain principle, working of any one microscope. Giving at least four functions.

Q6) a) Explain Ethylene activated signaling pathway.

b) Describe Antigen - antibody interactions.

Q7) Solve any two of the following:

a) Comment on Apoptosis.

b) Describe the phases of cell cycle.

c) Give techniques of electrophoresis.

Q8) Write notes on any two of the following:

a) ELISA.

b) Photoproteins.

c) Role of cyclins in cell - cycle.

d) Autoradiography.

EEE

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

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[4632]-23

M.Sc.

BOTANY

BO - 2.3 : Molecular Biology & Genetic Engineering

(2008 Pattern) (Semester-II) (New Course)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Answer any five questions, selecting at least two questions from each section.*
- 2) Answers to the two sections should be written on separate answer book.*
- 3) All questions carry equal marks.*
- 4) Neat labelled diagram must be drawn wherever necessary.*

SECTION-I

Q1) Explain the mechanism of transcription in prokaryotes.

- Q2)** a) Describe the method of Agrobacterium mediated genetransfer in plants.
b) Write the procedure of southern blotting, give its applications.

Q3) Attempt Any Two of the following:

- a) Describe structure of BAC and YAC.
- b) Explain the role and structure of ribosomes in prokaryotes and eukaryotes.
- c) Give an account of excision repair mechanism.

Q4) Write note on Any Two:

- a) Rolling circle mechanism of replication.
- b) Structure of prokaryotic gene.
- c) Reverse transcription.

P.T.O.

SECTION-II

Q5) Explain the mechanism of operon concept in lactose sugar.

Q6) a) Give chemical and spectroscopic properties of DNA.

b) Describe the importance of transcription apparatus in the mechanism of replication.

Q7) Attempt Any Two of the following:

a) Describe the procedure for the production of insect tolerance plants.

b) Explain the mechanism of construction of C-DNA libraries.

c) Describe the structure of t-RNA & its roles in protein synthesis.

Q8) Write note on Any Two:

a) Tryptophan operon.

b) Cot 1/2 value and its significance.

c) Alkaline phosphatase.

d) Chaperons.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1662

[4632] -301

M.Sc. - II

**BO - 3.1 : SPERMATOPHYTIC BOTANY
(2013 Pattern) (Semester - III) (Credit System)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat labelled diagram must be drawn wherever necessary.*

- Q1)** a) Comment on affinities of Gymnosperms with pteridophytes. [4]
b) Write morphology of sporophyte of Ephedrales. [3]
c) Give merits and demerits of Cronquist system of classification. [3]
- Q2)** a) Write a short note on Pentoxylales. [4]
b) Give the systematic position of family Aponogetonaceae. [3]
c) Write on APG. [3]
- Q3)** a) Give general characters of Welwitschiales. [4]
b) Write on Williamsonia. [3]
c) Comment on Endemism in Western Ghats. [3]
- Q4)** a) What are pteridosperms? Comment on Lyginopteris. [5]
b) Explain taxonomic hierarchy. [5]
- Q5)** a) Comment on Male and Female cone of Ginkgo. [4]
b) Write rules & regulations of ICBN. [4]
c) What are appendices? [2]

P.T.O.

- Q6)** a) Write a note on the species concept. [4]
b) Describe Phytogeographic regions of India. [4]
c) Give economic aspects of Gymnosperms. [2]
- Q7)** a) Write shortly on Male cone of cycadales. [4]
b) Comment on Alpha and Omega Taxonomy. [4]
c) Give economic importance of family Aristolochiaceae. [2]
- Q8)** a) Write on sporophytes of coniferales. [5]
b) Discuss morphological variations of Family Magnoliaceae. [5]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1636

[4632] -31

M.Sc. - II

BOTANY

**BO - 3.1 : Developmental Botany and Planttissue Culture
(2008 Pattern) (Semester - III) (Old Course)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answer any five questions, selecting at least two questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *All question carry equal mraks.*
- 4) *Neat labelled diagrams must be drawn wherever necessary.*

SECTION - I

Q1) Describe structure and organization of seed embryo. **[16]**

Q2) a) Explain dedifferentiation and redifferentiation. **[8]**

b) Coordinated development. **[8]**

Q3) Write any two of the following: **[16]**

- a) Histochemical changes during transition of vegetative to flowering in shoot apex.
- b) Patterns of embryonal development.
- c) Gynogenesis.

Q4) Write short notes (Any two): **[16]**

- a) maturation of seed.
- b) Leaf development.
- c) Apomyxis.
- d) Cell fate mapping.

P.T.O.

SECTION - II

Q5) Explain the concept of totipotency and pluripotency. **[16]**

Q6) a) Organogenesis. **[8]**

b) Cell suspension culture. **[8]**

Q7) Write any two of the following: **[16]**

a) Somatic hybrids.

b) Anther and pollen culture.

c) Production of virus free plants.

Q8) Write short notes (Any two) **[16]**

a) Production of secondary metabolites.

b) Cryopreservation.

c) Conservation of medicinal plants through PTC.

d) Ovule culture.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1645

[4632]-41

M.Sc. II

BOTANY

**BO-4.1: Plant Resource and Evolution.
(Semester-IV) (Old course 2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answer any five questions, selecting at least two questions from each section.*
- 2) *Answer to the two sections should be written in separate answer books.*
- 3) *All question carry equal marks.*
- 4) *Neat labelled diagrams must be drawn wherever necessary.*

SECTION-I

Q1) How plants are best sources of medicine? Add a note on pharmacological activities of natural products. **[16]**

Q2) a) Comment on energy plantations. **[8]**

b) Briefly write on plants as source of perfumery and latex. **[8]**

Q3) Solve any two of the following. **[16]**

a) Write briefly on forensic botany.

b) Comment on plant insecticides.

c) Explain microscopic and physical evaluation of drugs.

Q4) Write short notes (any two): **[16]**

a) Vavilov's centers of origin.

b) Genetic drift.

c) Stem drugs.

d) Role of plant morphology and anatomy in criminology.

P.T.O

SECTION-II

Q5) Discuss in detail concept of microbial evolution. [16]

Q6) a) Comment on pentoxylales. [8]

b) What are calamitales. [8]

Q7) Solve any two of the following: [16]

a) Write on cordaitales.

b) Briefly comment on evolutionary time scale.

c) What is gene duplication and divergence?

Q8) Write short notes (any two). [16]

a) Darwin's concept of evolution.

b) Spontaneity of mutation and evolutionary synthesis.

c) Sexual selection and co-evolution.

d) Isolation mechanism.

□□□

Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

P1646

[4632]-42

M.Sc. (Part -II)

BOTANY

BO -4.2: Applied Botany

(Old Course 2008 Pattern) (Semester -IV)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) Attempt any five questions selecting minimum two from each section.*
- 2) All questions carry equal marks.*
- 3) Draw figures wherever necessary.*

SECTION -I

Q1) What are sea weeds? Comment on necessity, principles and methodology of sea farming.

Q2) a) How algae act as indicators of water quality?

b) Briefly write on algal blooms.

Q3) Solve any two of the following:

a) Write briefly on shallow and submerged fermentation.

b) Comment on role of fungi in fungal biotechnology.

c) Give brief account of ergot alkaloids & its applications.

Q4) Write short notes on (any two):

a) Mycofungicides.

b) Fungi in bioremediation.

c) Fungi in mineral biotechnology.

d) Fungal fermented foods.

P.T.O.

SECTION -II

Q5) What are dermatophytes? Add a note on ringworm and mycetoma.

Q6) a) Write on chisquare test.

b) Comment on motif analysis and presentation.

Q7) Solve any two of the following:

a) Comment on probability distribution.

b) Write on parametric and non parametric statistics.

c) Explain role of bioinformatics.

Q8) Write short notes on (any two):

a) Fungal allergy.

b) Candidiasis.

c) t-test.

d) Web based tools for sequence searches.

EEE

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1647

[4632]-44

M.Sc.

BOTANY

**BO - 4.42 : Mycology and Plant Pathology
(2008 Pattern) (Semester-IV) (Old Course) (Paper-II)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt any five questions selecting minimum two questions from each section.*
- 2) *All questions carry equal marks.*
- 3) *Draw figures wherever necessary.*

SECTION-I

Q1) Enlist fungal organic acids and antibiotics. Discuss organic acid and antibiotic fermentation.

- Q2)** a) Comment on antitumour and antiviral agents from fungi.
b) Write on fungal SCP.

Q3) Write Any Two of the following:

- a) Write on fungal lignocellulosic conversions in paper industry.
- b) Comment on fungi in homeopathic and Ayurvedic medicines.
- c) Explain mycomedicines and mycoinsecticides.

Q4) Write short notes on (Any Two):

- a) Immunoregulators.
- b) Fungi in mineral biotechnology and bioremediation.
- c) Gibberellins and ergot alkaloids.
- d) Fungi in industrial effluent treatment.

P.T.O.

SECTION-II

Q5) What is subcutaneous mycosis? Comment on clinical aspects of mycetoma and cryptococosis.

- Q6)** a) Write harmful aspects of fungi.
b) Give contributions of any two Indian plant pathologists.

Q7) Solve Any Two of the following:

- a) Give classification of plant diseases based on symptoms.
b) Comment on any four symptoms of plant diseases with suitable examples.
c) Write on biochemical defence mechanism.

Q8) Write short notes on (Any Two):

- a) Effects of plant diseases on respiration and osmoregulation.
b) Pathogenesis.
c) Downy mildews.
d) Toxins in plant diseases.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1648

[4632]-45

M.Sc.

BOTANY

BO - 4.43 : Angiosperm

(2008 Pattern) (Semester-IV) (Special Paper-II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answer any five questions from each section.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *All questions carry equal marks.*

SECTION-I

Q1) Explain the selection criteria for plantation of tree species with respect to growth and purpose. **[16]**

Q2) Answer the following: **[16]**

- a) Explain basic features of an arborescent form.
- b) Describe ultrastructure and biochemistry of any one wood element.

Q3) Solve Any Two: **[16]**

- a) Comment on properties and uses of wood.
- b) Explain anatomical features of arborescent monocotyledons.
- c) Give brief account on distribution of wood elements in L.S.

Q4) Write short notes on Any Two: **[16]**

- a) Somatic embryogenesis.
- b) Arboretum versus natural forest.
- c) Micropropagation and arboriculture.

P.T.O.

SECTION-II

Q5) What is Mellitopalynology? Comment on complementarity between floral organization and pollinator. [16]

Q6) Answer the following: [16]

- a) Explain Unifloral and multifloral honey.
- b) Describe Ultrastructure of pollen.

Q7) Solve Any Two: [16]

- a) Comment on Androgenesis and Gynogenesis.
- b) Explain embryogenesis.
- c) Give brief account on artificial pollination.

Q8) Write short notes on Any Two: [16]

- a) In vitro fertilization.
- b) Embryo rescue.
- c) Polyembryony.



Total No. of Questions : 8]

SEAT No. :

P1649

[Total No. of Pages : 2

[4632]-46

M.Sc.-II

BOTANY

BO - 4.44 : Plant Physiology

(Old 2008 Pattern) (Semester-IV) (Special Paper-II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt any five questions selecting minimum two from each section.*
- 2) *All questions carry equal marks.*
- 3) *Draw figures wherever necessary.*

SECTION-I

Q1) Write a detailed note on photochemical reaction & electron transport mechanism. **[16]**

Q2) a) What is the correlation between NAR & photorespiration? **[16]**

b) Discuss about current scenario of crop physiology in India.

Q3) Solve Any Two of the following: **[16]**

- a) Write a note on changing scenario of climate change & crop physiology.
- b) Give the types of chlorophylls & carotenoids present in plant chloroplast. Write their role in photochemical reaction.
- c) Write the limitations of photorespiration.
- d) How green house gases affect plant productivity?

Q4) Write short notes on Any Two of the following: **[16]**

- a) Ozone layer depletion & plant metabolism.
- b) Effect of elevated CO₂ level on crops.
- c) Chlorophyll pigments - Biosynthesis & their role.
- d) Electron transport chain in chloroplast.

P.T.O.

SECTION-II

Q5) Discuss in detail about transgenics produced for insect resistance. [16]

Q6) a) How soil health affects the Plant Productivity.

b) Give on account on the production of disease resistant plants through transgenics.

[16]

Q7) Solve Any Two of the following:

[16]

a) What are allelochemicals? Why they are important?

b) How mycoplasma infection affects plant metabolism.

c) Explain the role of R-genes in defense mechanism of plants.

d) Write an cryptochroms & their role in flowering.

Q8) Write short notes on Any Two of the following:

[16]

a) Role of defense chemicals in plants.

b) Fungal & Bacterial infection to plants.

c) Monoculturing.

d) HR.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1650

[4632]-47

M.Sc.-II

BOTANY

**BO - 4.45 : Genetics, Molecular Biology & Plant Breeding-II
(2008 Pattern) (Semester-IV) (Special Paper-II)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Answer any five questions taking atleast two questions from each section.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) All questions carry equal marks.*
- 4) Neat diagrams must be drawn wherever necessary.*

SECTION-I

Q1) Explain genetic mapping process in detail.

Q2) a) Explain Southern hybridization.

b) Describe microcloning.

Q3) Write Any Two of the following:

a) Working of genome project.

b) Chloroplast genome.

c) Amplification of plasmid in vivo.

Q4) Write short notes on Any Two:

a) Ligation mediated PCR.

b) Chromosome walking.

c) Restriction mapping.

d) Northern blotting.

P.T.O.

SECTION-II

Q5) Explain methodology of whole genome sequencing.

Q6) a) What are the different effects of drought on plants.

b) Drought escaping plants.

Q7) Write notes on Any Two of the following:

a) Nutritional quality of the crops.

b) Polygene inheritance.

Q8) a) Somaclonal variation for transgenic plants.

b) Suppression of endogenous genes.

c) Oil seed crops.

d) Biotechnological approaches for hybridization.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1651

[4632]-48

M.Sc.

BOTANY

**BO - 4.46 : Plant Biotechnology-II
(Semester-IV) (Old Course) (2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answer any five questions selecting atleast two questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *All questions carry equal marks.*

SECTION-I

Q1) Define gene amplification. Explain any two PCR based markers in detail.

- Q2)** a) Explain the principle and method of northern blotting.
b) Discuss applications of proteomics in drug development.

- Q3)** a) Explain use of various enzymes in recombinant DNA technology.
b) Describe the importance of DNA polymorphism in assessment of genetic variability.

Q4) Write short notes on Any Two of the following:

- a) Gene cloning vectors.
- b) DNA libraries.
- c) Bioethical principles of agricultural biotechnology.

SECTION-II

Q5) What is genomics? Discuss various sequencing strategies for whole genome analysis.

P.T.O.

- Q6)** a) Describe gene synthesis machines.
b) Explain the term genome annotation.

- Q7)** a) Explain role of biotechnology in waste water treatment.
b) Describe principle and method of RAPD and add a note on its applications.

Q8) Write notes on Any Two of the following:

- a) Ethical concerns of GM crops.
b) nif genes.
c) Use of biotechnology in pollution control.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1652

[4632]-49

M.Sc.-II

BOTANY

BO - 4.47 : Plant Biodiversity

(2008 Pattern) (Special Paper-II) (Old) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Answer any five questions, taking at least two questions from each section.*
- 2) Answer to the two sections should be written in separate answer books.*
- 3) All questions carry equal marks.*
- 4) Neat diagram must be drawn wherever necessary.*

SECTION-I

Q1) Explain loss of Agro-biodiversity and give reasons for loss in diversity of Mangrove Ecosystem.

Q2) a) Explain factors causing loss of Genetic diversity.

b) Describe in-situ Conservation in brief.

Q3) Solve Any Two:

a) Explain Ecosystem restoration.

b) Comment on role of ICSU and FAO in framing policies for management of plant biodiversity.

c) Give brief account on convention of Biological diversity.

Q4) Write short notes on Any Two:

a) Participatory Forest management.

b) CITES.

c) Role of Botanical Gardens in ex-situ conservation.

P.T.O.

SECTION-II

Q5) Explain environmental Protection Act 1986 and add a note on biodiversity rules & regulations.

Q6) a) Explain CDM.

b) Describe role of biotechnology in utilization of biodiversity.

Q7) Solve Any Two:

a) Explain methodologies for valuation of biodiversity.

b) Comment on Biopiracy.

c) Give brief account of wildlife Act.

Q8) Write short notes on Any Two:

a) Problems & prospects in participatory management of Biodiversity.

b) ITTA & ITTO.

c) Use of Biodiversity in eco-tourism.

d) Examples of biological invasions.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1653

[4632]-50

M.Sc.

BOTANY

**BO - 4.48 : Seed Technology (Special Paper-II)
(Semester-IV) (2008 Pattern) (Old Course)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) Answer any five questions taking atleast two from each section.*
- 2) Answers to the two sections should be written in separate answer books.*
- 3) All questions carry equal marks.*
- 4) Neat labelled diagrams must be drawn wherever required.*

SECTION-I

Q1) Give an account of seed production of pearl millet and onion.

Q2) Explain:

- a) Seed village concept.
- b) History of vegetable seed industry.

Q3) Describe:

- a) True potato seed production.
- b) Concepts and objectives of seed processing.

Q4) Write short notes on Any Two of the following:

- a) Seed drying.
- b) Preparation greed for processing.
- c) Electrostatic seed separators.

P.T.O.

SECTION-II

Q5) Give detail account of artificial seed production.

Q6) Explain:

- a) Sampling methods.
- b) DNA Finger printing and ELISA test.

Q7) Comment on:

- a) Seed certification boards.
- b) Seed inspectors powers and duties.

Q8) Write short notes on Any Two of the following:

- a) Grow out test.
- b) Bucket elevator and belt conveyor.
- c) General layout of seed processing plant.



Total No. of Questions :8]

SEAT No. :

P1614

[4633]-101

[Total No. of Pages :2

M.Sc.

ENVIRONMENTAL SCIENCE

EVSC - 101: Environmental Biology

(2013 Pattern) (Credit System) (Semester - I)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *Your are advised to attempt not more than 5 questions.*

- Q1)** a) Comment on Anthropogenic impact on the biosphere and its life support system. [4]
- b) Define ecosystem? Explain in brief structure and function of ecosystem. [4]
- c) Define population ecology. [2]
- Q2)** a) Discuss in brief various factors that regulates the population growth.[4]
- b) Write an essay on the attributes of 'γ' selected species with suitable examples. [4]
- c) How would you plan to study autecology of a species. [2]
- Q3)** a) Write an essay on 'Reproduction Behaviour'. [4]
- b) What are ecological pyramids? Explain pyramid of Biomass in detail.[4]
- c) What are plankton, nekton and benthos. [2]
- Q4)** a) What are biomes? Explain marine biome in detail. [5]
- b) Define succession? Give an account of detail process of succession in nature. [5]

P.T.O.

- Q5)** a) What is energy flow in Ecosystem? Explain various models of energy flow in detail. [4]
b) What are microbes? Give their classification in brief. [4]
c) Write short note on micro-organisms and their association with animals. [2]
- Q6)** a) What is food chain and food web? Discuss in detail giving suitable examples. [4]
b) Explain Heinrich Walter's Biome climate diagram in detail. [4]
c) Define community. Explain the difference between the concept of community and population. [2]
- Q7)** a) Discuss, scope & development of ecology. [4]
b) Explain interspecific and intraspecific ecological interaction with suitable examples. [4]
c) What is biotic potential. [2]
- Q8)** a) What are biogeo-chemical cycles? Explain Nitrogen cycle in detail. [5]
b) Write an account on population dynamics. [5]

EEE

Total No. of Questions :8]

SEAT No. :

P1596

[4633]-11

[Total No. of Pages :2

**M.Sc. (Environmental Science)
ENV-101: ENVIRONMENTAL GEOSCIENCE
(2008 Pattern) (Semester - I)**

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) Answer to the two sections should be written in separate books.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) All questions carry equal marks.*
- 4) All questions are compulsory.*

SECTION -I

Q1) Attempt any two from the following:

- a) Explain solar radiation? Add a note on its effects on atmosphere.
- b) Explain green house effect on heat budget.
- c) Explain with help of diagram about structure of Earth atmosphere.

Q2) Answer any two from the following:

- a) Describe in brief temperature measurements and its controls on atmosphere.
- b) Describe dry and wet adiabatic lapse rate with the help of suitable example.
- c) Describe inversion of temperature and atmospheric stability.

Q3) Answer any two of the following:

- a) Discuss the various factors affecting wind.
- b) Discuss various atmospheric pressure measurement and distribution.
- c) Discuss the model of general circulation of the atmosphere.

Q4) Write notes on any two of the following:

- a) Lightening.
- b) Forms of condensation.
- c) Geostrophic wind.

P.T.O.

SECTION -II

Q5) Answer any two of the following:

- a) Describe with help of diagram the internal structure of earth.
- b) Describe with suitable example about geological evolution.
- c) Describe with the help of diagram an ideal soil profile.

Q6) Attempt any two of the following:

- a) Write in brief about Global Water Balance.
- b) Write in detail about Human use of surface ground water.
- c) Write an account on origin and composition of seawater.

Q7) Answer any two of the following:

- a) Explain the concepts of major, trace and REE.
- b) Explain in short Geochemical Cycles.
- c) Explain the possible effects of imbalance of some trace elements on human health.

Q8) Write notes on any two of the following:

- a) Hazards associated with Landslides.
- b) Mobility of trace element.
- c) Mitigation measures in Tsunami.

EEE

Total No. of Questions : 8]

SEAT No. :

P1618

[4633]-201

[Total No. of Pages :2

M.Sc. (ENVIRONMENTAL SCIENCES)

**E.V.S.C -201: Environmental Pollution & Control -I (Water & Soil)
(2013 Pattern) (Semester-II) (Credit System)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary..*
- 2) *Figures to the right indicate full marks.*
- 3) *All question carry equal marks.*
- 4) *Your are advised to attempt not more than 5 questions.*

- Q1)** a) Discuss various effects on soil properties due to discharge of sugar industry waste. [4]
b) Write in detail about point and non-point sources of water pollution. [4]
c) Define humus. [2]
- Q2)** a) Explain about the heavy metals affecting water quality. [4]
b) Write a note on radioactive pollution. [4]
c) Define aquifer. [2]
- Q3)** a) Give the importance of reusing the waste water with respect to chemical industry. [4]
b) Give the stratification of lakes with respect to temperature and sunlight penetration. [4]
c) What is Plumbisum. [2]
- Q4)** a) Discuss about the impacts of hazardous solid waste disposal on land.[5]
b) Write in brief about soil sampling techniques. [5]

P.T.O

- Q5)** a) Explain the process of restoration of land degraded by mining activities. [4]
b) Discuss about Bioaccumulation of DDT in food chains. [4]
c) Write the examples of heavy metals (any three). [2]
- Q6)** a) Write different characteristics of domestic waste water. [4]
b) How biological pollutants affects the water quality and human health explain with examples. [4]
c) Define Passive restoration. [2]
- Q7)** a) Write with examples how waste of one industry can be used as raw material for other industry. [4]
b) Write the consequences of ballast water on marine ecosystem. [4]
c) Define Rhizosphere. [2]
- Q8)** a) Write the types, effects and control measures of marine water pollution. [5]
b) Discuss about the consequences of ground water pollution. [5]



Total No. of Questions :8]

SEAT No. :

P1619

[4633]-202

[Total No. of Pages :2

M.Sc. (Environmental Science)

**EVSC 202: BIODIVERSITY FORESTRY & NATURAL RESOURCES
(2013 Pattern) (Credit System) (Semester -II)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Figures to the right indicate full marks.*
- 2) *All questions carry equal marks.*
- 3) *You are advised to attempt not more than 5 questions.*
- 4) *Your answers will be valued as a whole.*

- Q1)** a) Give an account of characteristics & distribution of biodiversity in India. [4]
b) Explain the present & potential uses of biodiversity. [4]
c) Write in brief about insitu & oxsity approach of conservation. [2]
- Q2)** a) Write a note on use of plants in modern medicines. [4]
b) Explain the significance of microbes in scientific & technological research. [4]
c) Write a note on CITES. [2]
- Q3)** a) Explain role of ecotourism in wild life conservation. [4]
b) Write a note on traditional cultivars and its importance. [4]
c) Explain the terms exploitation and sustainability. [2]
- Q4)** a) Elaborate in detail, the economic value of natural ecosystems and its role in national economy. [5]
b) Write a note on assessment of biodiversity and its valuation. [5]
- Q5)** a) Write a note on Environment education in conservation action. [4]
b) Explain objectives of Ramsar convention. [4]
c) Define rare & endangered species. [2]

P.T.O.

- Q6)** a) Explain environmental cost of Human conflict. [4]
b) Write a note on role of NGOs in conservation of bio-resources. [4]
c) Write in brief about forest nursery. [2]
- Q7)** a) Explain role of community participation with the help of joint forest management. [4]
b) Write a note on role of youth in conservation education & action. [4]
c) What is working plan in forestry. [2]
- Q8)** a) Write a note on forest types of India. [5]
b) Write a note on national laws & policies focused on conservation of forests, wildlife, Biodiversity & marine resources. [5]

EEE

Total No. of Questions : 8]

SEAT No. :

P1620

[Total No. of Pages : 2

[4633]-203

M.Sc.

ENVIRONMENTAL SCIENCE

EVSC - 203 : Atmospheric Science

(2013 Pattern) (Semester-II) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *Your are advised to attempt not more than 5 questions.*

- Q1)** a) Discuss evaluation of atmospher in detail. [4]
b) Describe thermal structure of atmosphere with height. [4]
c) Differentiate between weather and climate. [2]
- Q2)** a) What is radiation? Sketch EMR. [4]
b) How earth radiation budget get balanced? Explain. [4]
c) What is urban heat Island? [2]
- Q3)** a) Explain radiation in detail. [4]
b) What is green house effect? [4]
c) Write a note on temperature gradient. [2]
- Q4)** a) What is atmospheric pressure? How it is measured. [4]
b) Explain in detail geostropic wind. [4]
c) Write a note on microscale wind. [2]

P.T.O.

- Q5)** a) Write in detail Ice-Crystal theory of precipitation. [4]
b) What is ITCZ? [4]
c) Write a note on hydrological cycle. [2]
- Q6)** a) How Laps Rate affect on stability of atmosphere? [4]
b) Classify the air masses in detail. [4]
c) Write a note on Jet stream. [2]
- Q7)** a) What is cyclone? Explain with example. [4]
b) What is thunderstrom? How it originate? Explain. [4]
c) What is plume? Sketch different plume behavior. [2]
- Q8)** a) Write a note on significance of ozone. [4]
b) Describe importance of API. [4]
c) What is air quality standards? [2]



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1621

[4633] - 204

M.Sc.

ENVIRONMENTAL SCIENCE

EVSC : 204-Remote Sensing and GIS

(2013 Pattern) (Credit System) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks,*
- 3) *All questions carry equal marks.*
- 4) *Your are advised to attempt not more than 5 questions.*

- Q1)** a) Describe the interaction EMR with the earth surface. [4]
b) Explain briefly about hyper spectral Remote sensing and its applications. [4]
c) Explain Passive remote sensing with suitable example. [2]
- Q2)** a) Describe the satellite orbital characteristics. [4]
b) Explain across the track scanning with examples. [4]
c) Explain briefly the different types of scattering. [2]
- Q3)** a) Write briefly on SPOT series of satellities. [4]
b) Write briefly on LISS sensors. [4]
c) What is IFOV? [2]
- Q4)** a) Describe the elements of image inter pretation. [5]
b) Explain the different types of image classification techniques. [5]

P.T.O.

- Q5)** a) Explain the basic entities of GIS. [4]
b) Explain the concept of datum and its importance. [4]
c) What is UTM system of projection. [2]
- Q6)** a) Enumerate the basic steps involved in the generation of thematic maps. [4]
b) Describe the different types of Data base system. [4]
c) List the basic steps for geo-referencing the map. [2]
- Q7)** a) Describe the concept and types of topology. [4]
b) Explain the buffer analysis process and its application. [4]
c) Explain the polygon-in-polygon operation. [2]
- Q8)** a) Describe the application of Remote sensing and GIS in water quality monitoring. [5]
b) Explain the role of RS and GIS in lithological and structural mapping. [5]



Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

P1600

[4633]-21

M.Sc.

ENVIRONMENTAL SCIENCE

ENV-201:Environmental Economics

(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*

SECTION -I

Q1) Discuss in details FDI and associated problems with sustainable development. **[10]**

Q2) Justify the statement (any 2): **[10]**

- a) Subsidies are essential to stabilize and propagation of environmental policies.
- b) Social cost priority parameter for env. policies.
- c) Economic policies support growth of economic and environmental sustainability.

Q3) Explain the following (any 2): **[10]**

- a) Explain the role of public participation in environmental programmes.
- b) Explain the methods of evaluation.
- c) Discuss the mitigatory measures to maintain the non-renewable resources.

Q4) Write short notes on any two: **[10]**

- a) Demand and supply.
- b) Carbon credit and Indian economy.
- c) Cost benefit analysis.

P.T.O.

SECTION -II

Q5) Attempt (any 2): **[10]**

- a) What are the recent challenges in environmental economics.
- b) With suitable example explain population vulnerability.
- c) Write a short note on Kuznets curve.

Q6) Justify the statement (any two): **[10]**

- a) Climatic change is responsible for regional vulnerability.
- b) International policies effects national economic policies.
- c) Strategic planning is necessary to achieve goal of sustainable development.

Q7) Answer any two of the following: **[10]**

- a) Mention the negative short term impact of climate change on Indian economy.
- b) How adaptive option are significant in combating climate change?
- c) Discuss the limiting factors for sustainable development.

Q8) Answer any two: **[10]**

- a) Write a short note on economic reforms.
- b) What is meant by population vulnerability.
- c) Long term and short term effects of climate change on economy.



Total No. of Questions :8]

SEAT No. :

P1601

[4633]-22

[Total No. of Pages :2

M.Sc. (Environmental Science)

ENV-202: WATER & WASTE WATER ENGINEERING

(2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) Answers to the two sections should be written in separate books.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) All questions carry equal marks.*
- 4) All questions are compulsory.*

SECTION -I

Q1) Answer any two of the following:

- a) How does the quality of life affect the requirement of water?
- b) What is the role of population forecast in determining water demand?
- c) Write about the different types of solids in water and their impact on water quality.

Q2) Attempt any two of the following:

- a) What are the IS standards for drinking water quality? Explain the significance of hardness and nitrates.
- b) Write about the interrelation between the source of water and its quality.
- c) List the various unit operations in water treatment and give their functions.

Q3) Answer any two of the following:

- a) Explain the theory of filtration in detail with its application in water treatment. Draw a neat labelled diagram of rapid sand filter.
- b) What is the role of flocculation in water treatment? Give examples of flocculating agents and application in water treatment.
- c) Why is it necessary to disinfect water? Explain any one process of disinfection.

P.T.O.

Q4) Write short notes on any two:

- a) Role of grit chamber.
- b) Firefighting demand.
- c) Chlorination.

SECTION -II

Q5) Answer any two of the following:

- a) Why is it necessary to treat wastewater prior to disposal.
- b) What are the different constituents of sewage? List the factors which impact sewage quality and quantity.
- c) Write a note on the collection and pumping of sewage.

Q6) Attempt any two of the following:

- a) Which is the first unit in a wastewater treatment plant and why?
- b) Explain the principle and working of dissolved air flotation unit.
- c) Write a note on the significance of oil & grease removal. Why is it necessary prior to secondary treatment.

Q7) Answer any two of the following:

- a) Explain with diagram the working of activated sludge process with merits & demerits.
- b) Write about the different stages in anaerobic digestion. What are the advantages of anaerobic treatment.
- c) Write a note on sludge treatment & disposal.

Q8) Write short notes on any two:

- a) Treatment of whey.
- b) Removal of cyanide.
- c) Anaerobic contact process.

EEE

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1602

[4633]-23

M.Sc.

ENVIRONMENTAL SCIENCES

ENV - 203 : Environmental Pollution-I

Water & Soil

(2008 Pattern) (Semester-II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figures to the right indicate full marks.*
- 3) *All questions carry equal marks.*
- 4) *All questions are compulsory.*

SECTION-I

Q1) Answer Any Two:

[10]

- a) Give a detail account on Fresh Water Pollution.
- b) Explain the impacts of organic & Inorganic pollutants on water quality.
- c) Explain in detail physical, chemical & Bacteriological parameters on water quality.

Q2) Answer Any Two:

[10]

- a) Explain in detail pollutants responsible for water pollution.
- b) Explain the significance & methods of water sampling.
- c) Explain the economical & health effects of water pollution.

Q3) Answer Any Two:

[10]

- a) Define Marine pollution? Add a note on sources & effects of Marine pollution.
- b) Give an account of specification of industrial waste water for disposal in sea.
- c) Explain the Impacts of pollution on Estuarine ecosystem.

P.T.O.

Q4) Answer Any Two: **[10]**

- a) Characteristics of domestic waste water.
- b) Methods involve in estimation of parameters.
- c) Radioactive pollution.

SECTION-II

Q5) Answer Any Two: **[10]**

- a) Justify, disposal of sewage & effluent on land leads to soil pollution.
- b) Explain the impacts of mining of soil quality.
- c) Enlist the problems associated with fly ash disposal.

Q6) Answer Any Two: **[10]**

- a) Explain in detail classification & collection of Hospital waste.
- b) Discuss the potential of Recovery, Reuse & Recycle.
- c) Explain the impacts of leachate on ground water quality.

Q7) Answer Any Two: **[10]**

- a) Explain in detail sources & effects of Radioactive pollution.
- b) Explain any one Technique of Radiation detection.
- c) Explain in detail Biological effects of Radiation.

Q8) Write a note on Any Two: **[10]**

- a) Collection & Transportation of solid waste.
- b) Impact of Iron tailing.
- c) ICPR Recommendations.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1603

[4633] - 24

M.Sc.

ENVIRONMENTAL SCIENCE

ENV - 204 : Environmental Law, Ethics and Policy

(Old 2008 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *All questions are compulsory.*

SECTION - I

Q1) Answer Any two of the following **[10]**

- a) Discuss the salient features of Factories Act.
- b) What are the constitutional provisions to protect environment?
- c) What are the outcomes of stockholm conference?

Q2) Answer Any two of the following **[10]**

- a) What are the important provisions of water Act, 1974 to protect environment?
- b) Discuss the fundamental rights and duties provided to Indian citizens.
- c) Write an account on various institutional mechanisms created under antipollution acts.

Q3) Answer Any two of the following **[10]**

- a) Write an account on Rio declaration.
- b) Why do we refer environment protection act, 1986 as umbrella act?
- c) Discuss the role of courts in protection of environment.

P.T.O.

- Q4)** Write short notes on Any two of the following **[10]**
- a) Global Multinational Agreements.
 - b) Motor Vehicle Act.
 - c) Ozone Depletion.

SECTION - II

- Q5)** Answer any two of the following **[10]**
- a) What are the salient features of National Environmental Policy?
 - b) How biodiversity conservation is necessary part of sustainable development?
 - c) Explain the importance of critical review of plan in relation with developmental activities.

- Q6)** Answer any two of the following **[10]**
- a) Discuss the concept of carrying capacity in relation with developmental activities.
 - b) How social upliftment is an integral part of sustainable development?
 - c) What are the drawbacks involved in traditional evaluation of development?

- Q7)** Answers any two of the following **[10]**
- a) What are the salient features of Municipal Solid Waste Management rules?
 - b) Differentiate between rate of utilization and resource generation.
 - c) Discuss the functions of pollution control boards to protect environment.

- Q8)** Write short notes on any two of the following **[10]**
- a) Survival need and protection of environment.
 - b) Requirements of environmental audit.
 - c) Importance of ecological growth.



Total No. of Questions :8]

SEAT No. :

P1622

[4633]-301

[Total No. of Pages :2

M.Sc. (Environmental Science)
EVSC 301: ENVIRONMENTAL IMPACT ANALYSIS &
ENVIRONMENTAL AUDIT
(2013 Pattern) (Credit System) (Semester -III)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *Figures to the right indicate full marks.*
- 2) *All questions carry equal marks.*
- 3) *Your are advised to attempt not more than 5 questions.*
- 4) *Your answers will be valued as a whole.*

- Q1)** a) Explain the concept of EIA & its general scope. [4]
b) In case of baseline data on air aspects, how the data is collected. [4]
c) Explain the term Environmental inventory. [2]
- Q2)** a) Discuss the process of EIA in India. [4]
b) While preparing an EIA report, which elements are used to describe the project activity? [4]
c) Ad-hoc method of impact assessment-write a short note. [2]
- Q3)** a) How the baseline data for socio-economic aspects is collected. [4]
b) Discuss the significance of land use data & data an Geology is important for mining project. [4]
c) Write a short note on project benefit analysis. [2]
- Q4)** a) Discuss the role of sugar factories in socio-economic development of rural Maharashtra. [5]
b) Describe the pollution sources & measures to prevent, control and mitigate pollutants from sponge iron industry. [5]

P.T.O.

- Q5)** a) Elaborate the impacts of mining activities. [4]
b) Explain check-list and network method of impact assessment. [4]
c) Note on 'Screening' stage of EIA notification 2006. [2]
- Q6)** a) Describe the important clauses covered under ISO 14000. [4]
b) Discuss positive and negative impacts of housing complexes. [4]
c) Write a note on consumption audit. [2]
- Q7)** a) Describe the components of environment audit statement. [4]
b) Explain types of audits and significance of environment audit. [4]
c) Write a note on scaling-weighting technique. [2]
- Q8)** a) Discuss in detail risk & disaster management plan for industrial activity. [5]
b) Prepare an impact assessment statement for highway project. [5]

EEE

Total No. of Questions :8]

SEAT No. :

P1604

[4633]-31

[Total No. of Pages :2

M.Sc. (Environmental Science)
ENV-301: AIR POLLUTION AND CLIMATE CHANGE
(2008 Pattern) (Semester - III)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *All questions carry equal marks.*
- 4) *All questions are compulsory.*

SECTION -I

Q1) Answer any two of the following: **[10]**

- a) What is the major factors contributing to air pollution?
- b) Discuss the reactions in the troposphere.
- c) Write in brief classification of air pollutant.

Q2) Attempt any two from the following: **[10]**

- a) Define air pollution and add a note on their effects on plants.
- b) Discuss in detail emission of air pollutant from vehicles.
- c) What are the effect of SPM on flora?

Q3) Answer any two of the following: **[10]**

- a) What are green gases? Discuss in detail green house effect.
- b) What are aerosoles? Write its role in cloud seeding.
- c) What are the causes of industrial pollution?

Q4) Write short notes (any two): **[10]**

- a) Monitoring of SO₂.
- b) Ozone depletion.
- c) Effect of air pollution on human.

P.T.O.

SECTION -II

Q5) Answer any two of the following: **[10]**

- a) Write in detail any two methods of air pollution control in industries.
- b) Describe the structure and working of cyclone collectors.
- c) Discuss different scrubbers available for particulate collection.

Q6) Attempt any two of the following: **[10]**

- a) What are the steps involved in adsorption of gases?
- b) How filters remove the particulate matter?
- c) Write principle and working of Inertial separators.

Q7) Answer any two of the following: **[10]**

- a) What is IPCC? Write its role in climate study.
- b) How does the carbon sequestration control the climate change?
- c) What is global warming? Enlist the reasons.

Q8) Write short notes (any two): **[10]**

- a) Advantage and disadvantage of ESP.
- b) Zoning of air pollution.
- c) Clean Development mechanism.

EEE

Total No. of Questions : 8]

SEAT No. :

P1609

[4633]-41

[Total No. of Pages :2

M.Sc.

ENVIRONMENTAL SCIENCE

**ENV -401: Environmental Toxicology Health & Safety
(2008 Pattern) (Semester-IV)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*

SECTION-I

Q1) Answer any two of the following:

- a) Explain the inter relationship between safety health and environment.
- b) What are the safety aspects to be considered in a development project?
- c) Write about industrial health safeguards.

Q2) Attempt any two of the following:

- a) Why is it necessary to have safety standards?
- b) Discuss the strategies for reduction of health hazards in industrial projects.
- c) Explain the guidelines in national policy for preparedness plan.

Q3) Answer any two of the following:

- a) Elaborate on how the environment is an ultimate beneficiary/ Loser in development projects.
- b) Write about the role of ESI in workers safety.
- c) Explain the measures for noise abatement in industries.

P.T.O

Q4) Write short notes on any two:

- a) Risk identification.
- b) Emission abatement.
- c) ISO 18000

SECTION-II

Q5) Answer any two of the following:

- a) Define toxicology. Explain the historical perspective of toxicology.
- b) What are the industrial toxicants? How is their toxicity measured.
- c) What are the toxic effects of organic solvents.

Q6) Attempt any two of the following:

- a) Explain the terms LC, TLV, acute toxicity, Carcinogen and chronic toxicity.
- b) What are the preventive measures for controlling water borne diseases?
- c) Explain the physiological and metabolic effects of arsenic toxicity.

Q7) Answer any two of the following:

- a) Write a note on measures to safeguard ambient air quality.
- b) What is the role of international agencies in public health projects? Explain with examples.
- c) Explain the significance of public awareness programmes in sanitation & hygiene

Q8) Write short notes on any two:

- a) Biological warfare.
- b) Mutagenicity.
- c) WHO and its role in malaria control.

□□□

Total No. of Questions :8]

SEAT No. :

[Total No. of Pages :2

P1610

[4633]-42

M.Sc.

ENVIRONMENTAL SCIENCE
ENV-402: Watershed Management
(2008 Pattern) (Semester - IV)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) Answers to the two sections should be written in separate books.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) All questions carry equal marks.*
- 4) All questions are compulsory.*

SECTION -I

Q1) Attempt any two of the following:

- a) Discuss the principles of watershed management.
- b) Explain the importance of Areal aspects in watershed management.
- c) Explain the importance of drainage density in watershed management.

Q2) Answer any two of the following:

- a) Describe land capability classification on the basis of effective soil depth and texture of surface soil.
- b) Discuss water conservation practices for cultivation lands.
- c) Explain the need of people's participation in watershed activities.

Q3) Answer any two of the following:

- a) Explain how environmental impacts of watershed can be assessed.
- b) Discuss the planning process of watershed protection.
- c) Describe land capability classification for Indian Ravine.

P.T.O.

Q4) Write notes on (Any two):

- a) Delineation of watershed.
- b) Environmental regeneration.
- c) Evapotranspiration.

SECTION -II

Q5) Answer any two of the following:

- a) Enumerate the different water erosion processes and discuss about Rill erosion.
- b) Explain the role of contour bunding in soil erosion.
- c) Explain how climatic factor affects wind erosion.

Q6) Attempt any two of the following:

- a) Discuss different techniques of water harvesting.
- b) Write a note on benefits of Agroforestry.
- c) What is sericulture? How it can be correlated with watershed management?

Q7) Answer any two of the following:

- a) Describe the measures taken to develop the watershed at Ralegaon Shiddhi.
- b) Explain how rehabilitation of mined lands can be carried out.
- c) Discuss about watershed based farming systems.

Q8) Write notes on (Any two):

- a) Dry land farming.
- b) Ecosystem management challenges.
- c) Conservation horticulture.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1611

[4633]-43

M.Sc. (Environmental Science)

ENV - 411 : FORESTRY AND HABITAT MANAGEMENT

(2008 Pattern) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *All questions are compulsory.*
- 4) *All questions carry equal marks.*

SECTION-I

Q1) Attempt Any Two from the following:

- a) Explain, culture, tradition and ethos in tribal for forest preservation.
- b) Describe the impact of mining activities and development project on forest.
- c) What are the scope and objectives of Agroforestry.

Q2) Solve Any Two from the following:

- a) Explain in in-situ conservation methods with its merits.
- b) Describe the forest types in India.
- c) Briefly explain the bioresources in India.

Q3) Attempt Any Two from the following:

- a) Discuss the importance and scope of habitat management.
- b) How biotechnological application will help in conservation of forest resources.
- c) Explain the ecological factors influencing forest ecosystem.

P.T.O.

Q4) Write a short notes on Any Two:

- a) Seed bank.
- b) Ethnobotany
- c) Buffer zone

SECTION-II

Q5) Attempt Any Two from the following:

- a) Write the importance of remote sensing techniques in forest management.
- b) Discuss the limitation of National forest policy, 1927.
- c) How storage, transportation influences forest resources market-value?

Q6) Solve Any Two from the following:

- a) Mention various methods of forest damage control.
- b) Discuss the advantage of wildlife protection act.
- c) Elaborate various methods for tree improvement.

Q7) Attempt Any Two from the following:

- a) Explain the various methods and its significance of ex-situ conservation.
- b) What are the merits and demerits of shifting cultivation.
- c) What are different measurement involved in the process of mensuration.

Q8) Write a short notes on Any Two:

- a) Forest engineering.
- b) Afforestation.
- c) Gene bank.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1612

[4633]-44

M.Sc.

ENVIRONMENTAL SCIENCE

**ENV - 412 : Environmental Planning and Management
(Old 2008 Pattern) (Semester-IV) (Optional)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to candidates:

- 1) *Answers to the two sections should be written in separate books.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *All questions carry equal marks.*
- 4) *All questions are compulsory.*

SECTION-I

Q1) Attempt Any Two of the following: [10]

- a) What is natural resources? Write their role in development?
- b) What is concept of planning? Discuss in short parameters of planning.
- c) “Willingness play important role in planning”. Justify.

Q2) Answer Any Two of the following: [10]

- a) “Population explosion is obstacle in development”. Justify the statement.
- b) Write in brief disadvantages of planning.
- c) Write in detail importance of rehabilitation.

Q3) Answer Any Two of the following: [10]

- a) Write in short role of Environmental planning in development.
- b) Write in brief parameter required for rural planning.
- c) “Industrial development depends on natural resources”. Justify.

P.T.O.

Q4) Write short notes (Any Two): **[10]**

- a) Urban planning.
- b) Advantages of Environmental planning.
- c) Importance of Law in planning.

SECTION-II

Q5) Answer Any Two of the following: **[10]**

- a) “Development gives problems to the Environment”. Discuss.
- b) Write in brief methods of EIA.
- c) How disposal of solid waste is achieved.

Q6) Answer Any Two of the following: **[10]**

- a) Write an essay on the “Importance of planning in development”.
- b) Highlight the need of sustainable development.
- c) Write in brief socio-economic issue in planning.

Q7) Attempt Any Two of the following: **[10]**

- a) Write in brief role of pollution control boards in protection of environment.
- b) What is conservation? Discuss the method of conservation.
- c) Enlist the laws for protection of environment.

Q8) Write short notes (Any Two): **[10]**

- a) Carrying capacity of environment.
- b) Role of sustainable development.
- c) Rehabilitation and Resettlement.



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1613

[4633]-45

M.Sc.

ENVIRONMENTAL SCIENCE

ENV - 413 : Environmental Management System

(Theory and Job Licensing)

(Old 2008 Pattern) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Answers to the two sections should be written in seperate books.*
- 4) *Neat diagrams must be drawn wherever necessary.*
- 5) *Figures to the right indicate full marks.*

SECTION-I

Q1) Answer Any Two of the following: [10]

- a) Discuss the fundamental requirements for environmental management.
- b) What is meant by life cycle analysis? Also discuss procedure for it.
- c) Discuss with suitable examples gate to gate and well to wheel approach.

Q2) Answer Any Two of the following: [10]

- a) Write an account on background and development of ISO 14000 standards.
- b) What are various tools used in life cycle analysis?
- c) Explain in detail PDCA model.

Q3) Answer Any Two of the following: [10]

- a) What are the different stages of environment management system?
- b) Write an account on environmental design requirements for green buildings.
- c) Discuss in detail benefits and limitations of conducting LCA.

P.T.O.

Q4) Write short notes on Any Two of the following: [10]

- a) Principles of environmental design.
- b) Benefits of environment management system.
- c) Cradle to grave approach in LCA.

SECTION-II

Q5) Answer Any Two of the following: [10]

- a) Discuss in detail various health impacts caused by solid waste generation.
- b) What are the reasons behind improper treatment of solid wastes generated in India?
- c) Write an account on engineering principles involved in solid waste management.

Q6) Answer Any Two of the following: [10]

- a) Write an account on recyclable and reusable components of MSW.
- b) Discuss in detail possible areas for improvement in proper management of solid wastes.
- c) What are the various steps involved in solid waste management?

Q7) Answer Any Two of the following: [10]

- a) What are the various types of solid wastes?
- b) Discuss in detail pyrolysis and incineration of solid wastes.
- c) What are sanitary landfills? Give an ideal design for it.

Q8) Write short notes on Any Two of the following: [10]

- a) Types and characteristics of hazardous wastes.
- b) Solid waste disposal techniques.
- c) properties of solid wastes.



Total No. of Questions : 8]

SEAT No. :

P2019

[Total No. of Pages : 3

[4634]-101

M.Sc. (Semester - I)
ELECTRONIC SCIENCE

ELIUT 01 : Mathematical Methods in Electronics and Network
Analysis.

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions :

- 1) Attempt any five questions.
- 2) All questions carry equal marks.
- 3) Uses of non-programmable calculator is allowed.

Q1) Answer the following :

- a) An electrical system can be modelled using differential equations. Elaborate the statement using appropriate example. [4]
- b) What is ordinary differential equation of order two. Define and give an example. [3]
- c) Explain the terms node, tree and branch in connection with electrical network. [3]

Q2) Answer the following :

- a) Draw a pole zero diagram for the given network function $I(s)$. Obtain $i(t)$.

$$I(s) = \frac{4s}{(s+1)(s+2)}. \quad [4]$$

- b) Explain the terms ordinary and partial differential equation. Give an example of each. [3]
- c) State Thevenin's theorem for DC resistive network using suitable example. [3]

Q3) Answer the following :

- a) The s-domain current through a certain branch of network is given by

$$I(s) = \frac{2s+9}{s^2+5s+6} \quad \text{Determine } i(t). \quad [4]$$

P.T.O.

- b) Define the terms homogenous and linear differential equations of order two Give examples of each. [3]
- c) State Norton's theorem for dc resistive network. Give a simple example. [3]

Q4) Answer the following :

- a) Determine the Laplace transforms of $u(t)$ and $\sinh(at)$. [4]
- b) The coordinates of a point in cartesian coordinate system are (3,4,12). Determine coordinates in cylindrical coordinate system. [3]
- c) State maximum power transfer theorem for dc network. Explain using example. [3]

Q5) Answer the following :

- a) A ramp voltage, $v(t) = 4t$ Volt is applied to series circuit of inductor (2H) and resistor (4 Ω). Determine Voltage $v(t)$ across inductor. [4]
- b) Draw a neat diagram to show coordinates of a point in cartesian and spherical coordinate systems. State the relations between these two systems. [3]
- c) With the help of any suitable electrical network, explain state variable approach to solve network problem. [3]

Q6) Answer the following :

- a) In case of two port network, define the various transforms and transfer functions. [4]
- b) State Bessel differential equation. Give examples of occurrence in physics, or electronics. [3]
- c) A π - network is characterized by resistances $R_a = 8\Omega$, $R_b = 2\Omega$ and $R_c = 10\Omega$. Obtain its T equivalent network. [3]

Q7) Answer the following :

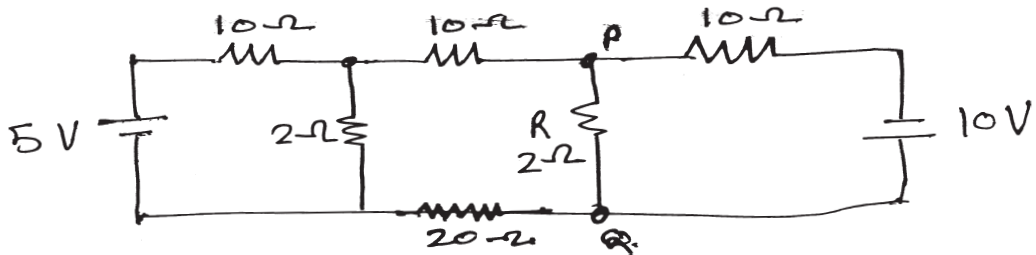
- a) With the help of suitable illustrations, explain the concept of analogous physical and electrical quantities. [5]
- b) Using method of separation of variables separate the variables of Laplace equation in spherical coordinate system. [5]

Q8) Answer the following :

- a) The Z-transform of a sequence $x(n)$ is given by

$$X(Z) = \frac{z^2 + 2}{z^2 - 2z + 5}. \text{ Find the first 3 terms of a sequence.} \quad [5]$$

- b) Determine the voltage across resistor R in the following circuit.



[5]



Total No. of Questions : 5]

SEAT No. :

P2011

[Total No. of Pages : 2

[4634] - 11
M.Sc. (Semester-I)
ELECTRONIC SCIENCE
EL1UT01 : Foundation of Semiconductor Devices
(2008 Pattern)

Time : 3 Hours]

[Maximum Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Use of non - programmable calculator is allowed.*

Q1) Attempt any two of the following : **[2 × 8 = 16]**

- a) Discuss qualitatively how and why bands of allowed and forbidden energies are formed in crystal. State their importance.
- b) What is Fermi - Dirac probability function? Explain it for Fermi energy and its dependence on temperature.
- c) Explain the construction of MOSFET. Discuss small dimension effects with respect to the threshold voltage and narrow width.

Q2) Attempt any two of the following **[2 × 8 = 16]**

- a) Discuss small signal model of the p - n junction. Obtain reverse bias generation current in p - n diode. Obtain relation for diffusion resistance.
- b) With neat diagram explain modern BJT structures like polysilicon emitter BJT and Heterojunction bipolar transistor (HBT).
- c) How are JFETs are different from MOSFETs? Draw the small signal equivalent circuit for JFET and explain ac response of it.

Q3) Attempt any four of the following : **[4 × 4 = 16]**

- a) What are Miller indices? What is the significance of labeling a crystal using reciprocal lattice?
- b) State and explain importance of Schrodinger's wave equation in solving bound state potential problems.
- c) What is effective mass? State its importance in semiconductors.
- d) Explain Hall voltage and Hall coefficient. What are the Hall voltage values for n - type and p - type semiconductors?

P.T.O.

- e) State Poissons equation in terms of charge density and number of charge carriers. What is the importance of this equation in depletion approximation.

Q4) Attempt any four of the following : **[4 × 4 = 16]**

- a) “The breakdown voltage of a p - n junction decrease as the doping concentration increase”, comment.
- b) Explain Eber moll model for BJT. How it is used to define equations for I_E and I_C with transistor circuit in SPICE program.
- c) Differentiate between BJT and HBT, with respect to construction, working, advantages and limitations.
- d) Explain the basic MOS capacitor structure. Compare its working with parallel plate capacitor.
- e) Define MOSFET transconductance. Explain its function.

Q5) Attempt any four of the following : **[4 × 4 = 16]**

- a) Explain epitaxial growth technique that is used in device and IC fabrication.
- b) Write formula for calculating energy levels of electron. Calculate first three energy levels of an electron in an infinite potential well of width 5 \AA .
- c) Determine the probability that an electron level 3 KT above the Fermi energy is occupied by an electron using Fermi Dirac distribution. Assume $T = 300 \text{ K}$.
- d) With neat cross sectional diagram explain working of a npn polysilicon emitter BJT.
- e) Discuss ideal CV characteristics of MOSFET.



Total No. of Questions : 8]

SEAT No. :

P2023

[Total No. of Pages : 3

[4634]-201

M.Sc. (Semester- II)

ELECTRONIC SCIENCE

EL2UT05 : Applied Electromagnetics, Microwaves & Antennas
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *All the questions carry equal marks.*
- 3) *Use of log -table / non - programmable calculator is allowed.*
- 4) *Figures to the right side indicate full marks.*

Q1) Answer the following questions:

- a) Explain the terms 'directive gain' and 'directivity' of an antenna. [4]
- b) A transmission line has the following parameters:
 $R=2\Omega/m$, $G = 0.5 \text{ mmho/m}$, $f=1\text{GHz}$,
 $L = 6 \text{ n H / m}$, $C = 0.27 \text{ p F}$. Calculate its characteristic impedance. [3]
- c) How do wave guides differ from parallel wire transmission lines? [3]

Q2) Answer the following questions:

- a) Write Maxwell's equations in frequency domain and obtain the electric wave equation and magnetic wave equation from these. [4]
- b) What is intrinsic propagation constant of a medium? From the expression for intrinsic propagation constant obtain the expression for skin depth, using suitable arguments. [3]
- c) What are cavity resonators? [3]

P.T.O.

Q3) Answer the following questions:

- a) State Poynting theorem in frequency domain and explain each term in it .
What is the use/application of poynting theorem? [4]
- b) Using suitable arguments obtain the boundary conditions at the surface
between two dielectrics. [3]
- c) A transmission line has characteristic impedance of $70+j50\Omega$ and has
a load impedance of $75 + j 0.01\Omega$. Find the reflection coefficient. [3]

Q4) Answer the following questions:

- a) A rectangular wave guide has $a = 1.5\text{cm}, b = 0.8\text{cm}, \sigma = 0, \mu = \mu_0$ and
 $\epsilon = 4\epsilon_0$. Determine its cut off frequency for TM_{13} mode. [4]
- b) For a uniform plane wave incident normally on a plane boundary between
two dielectric media, find the expression for reflection coefficient. [3]
- c) What is Q of a cavity? How is it determined? [3]

Q5) Answer the following questions:

- a) Show how different modes can be excited in rectangular wave guides.[4]
- b) What is an optical fibre? What are its advantages over copper wire? [3]
- c) What are the various modes of operation of a Gunn diode? [3]

Q6) Answer the following questions:

- a) A $\frac{\lambda}{2}$ wire dipole antenna has effective area of 13.05 Square meters. If
the incident plane wave has a strength of 2mV/m , how much power is
received by the antenna? [4]
- b) A transmission line has reflection coefficient $0.377\angle -37^\circ$. Find the standing
wave ratio. [3]
- c) What is a Smith chart? What are its characteristics? [3]

Q7) Answer the following questions:

- a) Obtain the expression for reflection coefficient for a transmission line terminated with load impedance Z_l and with voltage and current waves travelling along the line given by [5]

$$V = V_+ e^{-\gamma z} + V_- e^{+\gamma z}$$

$$I = I_+ e^{-\gamma z} + I_- e^{+\gamma z}$$

- b) A uniform plane wave propagating in a medium has $\vec{E} = 2e^{-\alpha z} \sin(10^8 t - \beta z) \hat{a}_y \text{ V/m}$. If the medium has $\epsilon_r = 1$, $\mu_r = 20$ and $\sigma = 3 \text{ S/m}$, find α and β . [5]

Q8) Answer the following questions:

- a) With the help of necessary diagram, obtain the final transmission line equations in voltage form. [5]
- b) Using a neat diagram, explain the principle of working of a magnetron. What are its applications? [5]



Total No. of Questions : 8]

SEAT No. :

P2024

[Total No. of Pages : 3

[4634]-202

M.Sc. (Semester- II)

ELECTRONIC SCIENCE

EL2 UT 06 : Instrumentation and Measurement Techniques
(2013 Pattern) (Credit System)

Time : 3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*
- 5) *Use of non programmable calculator is allowed.*

Q1) a) Derive the equation of time response of first order system when subjected to unit step input.

The temperature of furnace is increased at a rate of $0.1^{\circ}\text{C}/\text{sec}$. What is the maximum permissible time constant of first order system, the temperature is read with maximum error of 5°C . [4]

- b) Explain the following parameters of measurement system [3]
- i) Threshold
 - ii) Dead space and
 - iii) Span.
- c) List the primary sensing elements for the measurement of physical parameters. [3]

Q2) a) List the static and dynamic parameters of measurement system. Explain Accuracy and speed of response. [4]

- b) State different methods for displacement and motion measurement. Explain linear potentiometer method. [3]
- c) Give different transducers used for pressure measurement. State the principle of thermal conductivity method of pressure measurement. [3]

P.T.O.

- Q3)** a) Derive the equation of gage factor of a resistive wire strain gage in terms of poisson's ratio. State applications of strain gage. [4]
- b) Explain RTD as temperature transducer. State different materials used in RTD. [3]
- c) A multimeter having sensitivity of $50\text{K}\Omega/\text{V}$ is used for measurement of voltage across a circuit having an output resistance of $10\text{K}\Omega$. The open circuit voltage is 12V. Find the reading of multimeter when it is set to its 20V range. Find percentage error in the reading. [3]
- Q4)** a) With neat circuit diagram explain LVDT as displacement measurement. State its advantages and disadvantages. [4]
- b) Explain the following with suitable examples. [3]
- i) Deflection and null type instruments.
 - ii) Direct and indirect instruments, and
 - iii) Intelligent and dumb type instruments.
- c) State different methods of flow measurement. Explain working principle of electromagnetic flowmeter. [3]
- Q5)** a) An amplifier whose bandwidth is 500KHz has noise power spectrum density input of $7 \times 10^{-21}\text{J}$, If the input resistance is $50\text{K}\Omega$ and amplifier gain is 100. What is the noise output voltage. [4]
- b) A set of independent resistance measurement were recorded as 100.25, 100.20, 99.90, 100.10 and 100.05Ω . Calculate the average value of resistance and the range of error. [3]
- c) The voltage output of a metallic strain gage is quite small. So amplification is generally needed. Consider the measurement of stress level of 7Mpa in steel with single active gauge of 120Ω and a gage factor of 2.0. if bridge circuit of all equal arms is used. Find the maximum allowable bridge voltage for 30mA gage current. [3]
- Q6)** a) What is loading effect of measurement system? What is the effect of input and output impedance on the measurement? Explain with suitable example. [4]
- b) List the advantages of electronic instrument over mechanical and electrical instruments. [3]

- c) State different methods used for velocity measurement. Explain transnational moving coil velocity pickup transducer. [3]

Q7) a) Give classification of transducers in detail. Write steps to be Considered while selecting a transducer for measurement of physical parameter say temperature. [5]

- b) A temperature probe is transferred from air at 25°C to air at 35°C, then to water at 70°C and back to air at 35°C. Assume that in each case the transfer is instantaneous. The effective time constant and the time sequence as [5]

In air (dry probe) $\tau = 30$ sec,

In water $\tau = 5$ sec,

In air (wet probe) $\tau = 20$ sec.

For $t < 0$, $T = 25^\circ\text{C}$ (initial temperature)

$0 < t < 7$, $T = 35^\circ\text{C}$ (dry probe in air)

$7 < t < 15$, $T = 70^\circ\text{C}$ (probe in water)

$15 < t < 30$, $T = 35^\circ\text{C}$ (wet probe in air)

Calculate the indicated temperature at the end of each time interval and sketch the approximate indicated temperature between $t = 0$ and $t = 30$ sec.

Q8) a) A pressure gauge is to be used in an LVDT - diaphragm combination. The sensitivity of LVDT is 1v/mm and a steel diaphragm $E = 200$ GPa and $\nu = 0.3$ and density is 7800 kg/m³ with diameter of 20cm. Calculate the diaphragm thickness in accordance with the restriction that the maximum deflection does not exceed one-fourth of the thickness. The maximum pressure is 2MPa. If a millivoltmeter capable of measuring a minimum of 1mV and in steps of 1 mV is used for measurement. What is the lowest pressure in KPa which may be sensed, the resolution and natural frequency of diaphragm. [5]

- b) What is sound pressure level? Draw the block diagram of sound pressure level meter and explain working of sound pressure level meter. [5]



Total No. of Questions : 8]

SEAT No. :

P2025

[Total No. of Pages : 3

[4634]- 203

M.Sc. (Semester - II)

ELECTRONIC SCIENCE

EL 2 UT 07 - Embedded System Design

(2013 Pattern) (Credit System)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Attempt any five questions.*
- 2) *All questions carry equal marks.*
- 3) *Use of log table/non-programmable calculator is allowed.*
- 4) *Figures to the right indicates full marks.*

Q1) Attempt the following:

- a) Draw the block diagram of typical Embedded system and explain all the components used in it. [4]
- b) Explain WREG register in PIC. [3]
- c) Write different ALU instructions using two GPRs in AVR. [3]

Q2) Attempt the following:

- a) Explain basic concept of CAN bus and state its features. [4]
- b) Draw and explain format of TOCON register of PIC. [3]
- c) Write a AVR assembly program to subtract two 16-bit numbers. [3]

P.T.O.

Q3) Attempt the following:

- a) Explain the organization of AVR data memory. [4]
- b) Draw basic block diagram of Harvard architecture and explain in brief. [3]
- c) Write C Program to turn bit 5 of port B of PIC ON and OFF 50,000 times. [3]

Q4) Attempt the following:

- a) Explain different addressing modes of PIC with suitable example. [4]
- b) Write AVR C Program to get a byte of data from port B and then send it to port C. [3]
- c) What is Zigbee protocol? State its specifications. [3]

Q5) Attempt the following:

- a) State the different ports available with PIC 18F 458. Explain dual role of port A and B. [4]
- b) State different methods to program the AVR microcontroller and explain best of them for the development of AVR target board. [3]
- c) Show the bus signals and format of bits during transfer of byte at I²C bus. [3]

Q6) Attempt the following:

- a) Draw the format of AVR status register and explain. [4]
- b) State the different software tools required for the design of general embedded system and explain any one in brief. [3]
- c) Write PIC assembly program to find the greater of two values. [3]

Q7) Attempt the following:

- a) Compare RISC and CISC architecture. **[5]**
- b) Interface DAC to AVR. Write C Program to generate stair- step RAMP waveform. **[5]**

Q8) Attempt the following:

- a) State any four specifications of SPI and explain its master slave configuration. **[5]**
- b) Interface stepper motor to PIC 18F458. Write Program to rotate it in clockwise direction. **[5]**



Total No. of Questions : 6]

SEAT No. :

P2026

[Total No. of Pages : 1

[4634]-204

M.Sc. (Semester- II)

ELECTRONIC SCIENCE

EL2 UT 08 : Foundations of Semiconducting Devices
(2013 Pattern) (Credit System)

Time : 2 Hours 30 Minutes]

[Maximum Marks : 40

Instructions to the candidates:

- 1) Answer any four questions.
- 2) All questions carry equal marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right side indicate full marks.

- Q1)** a) Describe I-V characteristic of a p-n junction diode with zero bias, forward bias and reverse bias [4]
- b) What is meant by complete ionization of donor state and acceptor states. [3]
- c) What is difference between primitive cell and a unit cell? [3]
- Q2)** a) Explain Hybrid - pi - equivalent circuit BJT. [4]
- b) Obtain expression for decay of electrons in p-type semiconductor recombination process. [3]
- c) Discuss qualitatively channel width of JFET variation along the channel with $V_G = 0$ and small I_D . [3]
- Q3)** a) Hall measurements are made on a semiconductor bar of length 5mm, 500 μm wide and 20 μm thick. The current pass through the sample is 3mA for voltage applied 100 mV. The voltage appeared $V_{AB} = -3.2\text{mV}$, When magnetic field $B_z = 10^{-4}\text{wb/cm}^2$ given $n_0 = 3.125 \times 10^{17}\text{cm}^{-3}$. Find the concentration and mobility of majority carriers. State the type of sample used. [4]
- b) Explain the behaviour of Fermi - Dirac distribution function at absolute zero temperature and higher temperature T, define fermi level. [3]

P.T.O.

- c) Define the following performance parameter of transistor (BJT) amplifier. [3]
- i) Base transport factor
 - ii) Current transfer ratio
 - iii) Current amplification factor

Q4) a) Define the terms. [4]

- i) Lattice
 - ii) Basis
 - iii) Primitive vector
 - iv) Unit cell
- b) Describe the lattice structure of simple cubic, body centered cubic and face centered cubic. [3]
- c) Classify the solids based on periodic structure. What are their features. [3]

Q5) a) Draw band diagram and show variation of fermi-Distribution function and carrier concentration for

- i) Intrinsic
 - ii) n-type and
 - iii) p-type semiconductor at thermal equilibrium. Show that the product of electron and hole concentration is given by $n_0 p_0 = n_i^2$ [5]
- b) Explain drift current density, Write the equation for the total drift current density [5]

Q6) a) Discuss qualitatively the I_D - V_D curve for variation of a negative gate bias for JFET. Explain pinch off variation for different negative gate bias voltage. [5]

- b) For a bcc lattice of identical atoms with a lattice constant 6 \AA . Calculate the maximum packing fraction and radius of atoms treated them as hard spheres with the neighbour touching. [5]



Total No. of Questions : 5]

SEAT No. :

P2014

[Total No. of Pages : 2

[4634] - 21

M.Sc. (Semester - II)

ELECTRONIC SCIENCE

EL2UT04 : Applied Electromagnetics, RF and Microwave

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicates full marks.*
- 3) *Draw neat diagrams wherever necessary.*
- 4) *Log-table / Non programmable calculator is allowed.*

Q1) Attempt any two of the following :

[2 × 8 = 16]

- a) Starting from maxwell equations for a plane wave in non conducting media, obtain an expression for intrinsic impedance in free space medium.
- b) Describe salient features of Horn antenna, Why it is called as supergain antenna? Explain its construction and working in brief.
- c) Discuss electromagnetic effects in high speed digital systems with suitable examples.

Q2) Attempt any two of the following :

[2 × 8 = 16]

- a) With the help of energy diagram, explain principle of operation of tunnel diode.
- b) Draw a schematic diagram of elementary section of transmission line with parameters R, C, L and G. Obtain the transmission line equations in voltage and current form.
- c) Explain the concept of antenna temperature and its application in passive remote sensing and signal to noise ratio.

P.T.O.

Q3) Attempt any four of the following : [4 × 4 = 16]

a) Show that the skin depth in case of good conductor is represented

$$\text{by } \delta = \sqrt{\frac{2}{\omega \mu \sigma}}$$

- b) Sketch and explain structure of MESFET.
c) What is meant by retarded potential? Explain in brief.
d) How optical fibre can be used as a rod wave guide?
e) What are the losses in microstripline? Discuss in short.

Q4) Attempt any four of the following : [4 × 4 = 16]

- a) State and prove poynting vector theorem.
b) Write a short note on Reflex Klystron.
c) What are the sources of EMI? How EMI is reduced?
d) With the help of schmitt chart diagram discuss any one application.
e) Discuss how CD player on airplane interferes with navigation system.

Q5) Attempt any four of the following : [4 × 4 = 16]

- a) State Amper's law. How Maxwell modified this law?
b) With the help of neat diagram, discuss double stub matching.
c) What is RF heating? Why it is called as clean heating.
d) What is cavity resonator? Explain Q factor.
e) Explain Gunn diode as a microwave device.



Total No. of Questions : 5]

SEAT No. :

P2015

[Total No. of Pages : 2

[4634] - 22

M.Sc. (Semester - II)

ELECTRONIC SCIENCE

EL2UT05 : Communication Electronics

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

Q1) Answer any four of the following :

[4 × 4 = 16]

- a) Explain the terms
 - i) Thermal noise
 - ii) Noise figure
- b) Draw the block diagram of FM transmitter and explain its working in short.
- c) Explain the working of multistage tuned amplifier.
- d) With the help of block diagram, explain the working of amplitude shift keying (ASK) in short.
- e) Explain any two line codes in short.
- f) With reference to satellite communication, explain the terms
 - i) Crosstalk
 - ii) Propagation delay.

Q2) Attempt any two of the following :

[2 × 8 = 16]

- a)
 - i) Describe the equipment and atmospheric noise in short.
 - ii) Explain Infrared data association (IrDA) module in short.
- b) Draw the block diagram of super heterodyne receiver and explain each block of it in short.
- c) Write short note on :
 - i) RF amplifier.
 - ii) Synchronous stagger tuning.

P.T.O.

Q3) Write any four of the following : [4 × 4 = 16]

- a) In AM modulation, show that the power contained in the sidebands is one third of the total power.
- b) What is neutralisation? Explain any one method of it.
- c) Explain any one algorithm for code error detection and correction.
- d) Draw the basic format of HDLC and explain each field of it in short.
- e) With the help of neat diagram, explain VSAT in short.

Q4) Answer any two of the following : [2 × 8 = 16]

- a) With the help of block diagram, explain the working of pulse code modulation (pcm) in detail.
- b) What is QAM? With the help of diagram, explain the working of 16 QAM.
- c) What is ISDN? List the applications of ISDN. Explain any two of them in detail.

Q5) Answer any four of the following : [4 × 4 = 16]

- a) Draw the circuit diagram of balanced modulator to suppress the carrier and explain its working.
- b) With the help of diagram, explain the working of delta modulation.
- c) Explain the working of time division multiplexing in short.
- d) Explain XMODEM protocol in short.
- e) Write short note on DSL.



Total No. of Questions : 5]

SEAT No. :

P2016

[Total No. of Pages : 2

[4634] - 23

M.Sc. (Semester - II)

ELECTRONIC SCIENCE

EL2UT06 : Digital System Design Using VHDL

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicates full marks.

Q1) Attempt any two : [2 × 8 = 16]

- a) What is entity in VHDL program? Explain process statement in VHDL. Write VHDL code for 1 to 4 demultiplexer.
- b) List different sequential statements used in VHDL. Explain any two in detail. Write VHDL code for 4-bit gray counter.
- c) Explain in detail different steps of digital system design using VHDL.

Q2) a) Attempt any two : [2 × 8 = 16]

- i) Design 4 line to 2 line priority encoder.
 - ii) Design a logic circuit for segment b, c, using k map for BCD to seven segment decoder, to drive common anode display.
 - iii) Design BCD adder to add two one digit BCD numbers using 4-bit parallel adders.
- b) Write a procedure in VHDL to add two 4-bit numbers and returns 4-bit sum and carry.

Q3) Attempt any two : [2 × 8 = 16]

- a) Design synchronous modulo 10 up-counter using T flip-flops.
- b) What is FSM? Write VHDL code for stepper motor controller using FSM, which rotate in clockwise direction, if dir input is “11”, anticlock wise direction if dir input is “00” and does not rotate if dir input is “10” or “01”.
- c) Design a digital parking controller.

P.T.O.

Q4) Attempt any two :

[2 × 8 = 16]

- a) What is GAL? Implement $\overline{A}BC + B\overline{C} + AC$ using GAL16V8 in simple mode.
- b) Define scratch pad memory. How it is distinguished from main memory? Explain processor unit employing a scratch pad memory.
- c) Write VHDL code for 4-bit ALU.

Q5) Attempt any two :

[2 × 8 = 16]

- a) Explain with neat diagram architecture of FPGA. Compare CPLD and FPGA.
- b) Explain with neat diagram basic SRAM memory cell. Explain write operation.
- c) Explain how data is stored in EPROM. What is flash memory? Write applications of ROM.



Total No. of Questions : 8]

SEAT No. :

P2027

[Total No. of Pages : 3

[4634]-301

M.Sc. (Semester- III)

ELECTRONIC SCIENCE

EL3UT - 09 : Communication Electronics

(2013 Pattern) (Credit System)

Time :3 Hours]

[Maximum Marks : 50

Instructions to the candidates:

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

Q1) a) Draw the block diagram of FM transmitter and explain its working in short. [4]

b) Describe XMODEM protocol. Write the importance of it [3]

c) With reference to propagation of waves, explain the terms in short. [3]

i) Ionospheric scatter

ii) Tropospheric scatter

Q2) a) With the help of block diagram, explain the working of satellite transponder. [4]

b) Describe the internal and external noise in short [3]

c) Explain the working principle of 8 QAM in short. [3]

P.T.O.

- Q3)** a) With the help of diagram, explain the construction and working of any one type of micro wave antenna in short. [4]
- b) What is ISDN? Write the features of ISDN services. [3]
- c) Write the advantages and disadvantages of FM over AM. [3]
-
- Q4)** a) With the help of neat diagram, explain the working of adaptive delta modulation in short. [4]
- b) Explain in short switch beam and adaptive array smart antenna system in short [3]
- c) With the help of block diagram, explain fiber optic communication system.[3]
-
- Q5)** a) With the help of block diagram, explain the working of SSB transmitter using filter method. [4]
- b) Explain the working of frequency shift keying modulator in short. [3]
- c) Explain the ground effect of horizontal electric dipole antenna. [3]
-
- Q6)** a) Which are the 3G standards. Write the advantages and applications of 3G.[4]
- b) Write the working of AM superheterodyne receiver in short. [3]
- c) Explain any two digital signal codes in short. [3]

- Q7)** a) Draw the geometrical arrangement of small dipole antenna and explain the current distribution of it. [4]
- b) Explain the working of CDMA technique. [3]
- c) With the help of circuit diagram, explain the working of diode or transistor amplitude modulator. [3]
-
- Q8)** a) With reference to PCM, explain the terms in short [4]
- i) Quantization
 - ii) Quantization noise
 - iii) Componding
 - iv) Encoding
- b) With reference to antenna, explain the terms in short [3]
- i) Radiation power density
 - ii) Beam width
 - iii) Gain
- c) Describe the detectors used for optical receivers. [3]



Total No. of Questions : 5]

SEAT No. :

P2017

[Total No. of Pages : 2

[4634] - 31

M.Sc. (Semester - III)

ELECTRONIC SCIENCE

EL3UT-05 : Embedded Systems

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicates full marks.

Q1) Attempt any FOUR :

[4 × 4 = 16]

- a) List any three characteristics of embedded system that distinguishes it from general purpose computer system. List two examples of embedded system application
- b) Compare Harvard and van-Neuman architecture. Give two examples of RISC processors.
- c) Write C program for 8051 to display string on LCD, by passing string to LCD using pointer.
- d) Explain serial communication feature of 8051.
- e) List hardware development tools used in development of embedded system. Explain any one in detail.

Q2) Attempt any two :

[2 × 8 = 16]

- a) Draw schematic diagram of 8051 target board. Show crystal connection, power on reset and serial port interface to computer serial port. Explain watchdog timer with reference to embedded system design.
- b) Explain with neat diagram timer control logic of 8051. Write assembly / C program using timer to generate 10kHz square wave with 50% duty cycle on P0.0 Justify the mode of timer selected. Assume XTAL of 11.0592 MHz.
- c) A key is connected to $\overline{\text{INT0}}$ of 8051, Which makes high to low transition to change direction of rotation of stepper motor interface to po. Write assembly / C program to rotate stepper motor such that it should change its direction every time when key is pressed.

P.T.O.

Q3) Attempt any FOUR of the following : [4 × 4 = 16]

- a) What is development cycle with reference to embedded system design? Draw a diagram of development cycle.
- b) Draw and explain port pin circuitary of port 1.
- c) A Door sensor is connected to P0.0 and LED is connected to P1.0. Write assembly / C program in 8051 to monitor the door sensor and when it opens, blink the LED.
- d) Draw the interfacing of 3 devices connected to 8051 using SPI topology. Draw waveform during SPI data transfer from master to slave.
- e) List different data types used in embedded C with their sizes in bits. Explain with example how you will set and clear a bit in bit addressable and byte addressable SFR.

Q4) Attempt any two : [2 × 8 = 16]

- a) List and explain with example, instructions of AVR used with Data memory. Explain different flags in status register of AVR.
- b) List features of on chip ADC of AVR. Write C program for AVR to read ACD and display most significant 8-bits of data read on port D.
- c) Draw interface of 8-bit DAC to port 0 of 8051. Write assembly/ C program to generate stair case waveform using DAC.

Q5) Attempt any two : [2 × 8 = 16]

- a) Draw and explain architecture of PIC.
- b) Draw interfacing diagram of 4 × 4 keyboard to 8051. Write C program to read a key and display it on P0.
- c) With block diagram, explain PWM operation of CCP module of PIC. List SFRS involved in PWM generation. Write C program for PIC to generate PWM signal of 10 KHZ with 50% duty cycle. Use oscillator frequency = 8 MHZ.



Total No. of Questions : 5]

SEAT No. :

P2018

[Total No. of Pages : 2

[4634]-41

M.Sc. (Semester - IV)
ELECTRONIC SCIENCE

EL4UT - 06 : Control Systems : Theory and Application
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions :

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of log table calculator is allowed.

Q1) Solve any two :

[2 × 8 = 16]

- a) What is the need for process control? Give a block diagram of feedback control system and explain its working. How would you evaluate performance of such a system?
- b)
 - i) Discuss role of computers in process control.
 - ii) Differentiate between open-loop and closed-loop control, taking the example of an oven.
- c)
 - i) Give at least eight symbols of elements used in PLC programming.
 - ii) Presence of derivative control mode introduces strong stabilising effect on closed loop performance comment.

Q2) Solve any two :

[2 × 8 = 16]

- a) What is block diagram? How can it be used in control system analysis? Discuss rules for block diagram reduction.
- b)
 - i) Explain Routh-Hurwitz method. What are its advantages and limitations?
 - ii) Determine if the following characteristic equation has any roots with positive real parts.
$$S^4 + S^3 - S - 1 = 0.$$
- c) Discuss closed loop transient response of control systems on the basis of location of its closed-loop poles.

P.T.O.

Q3) Solve any two :

[2 × 8 = 16]

- a) Explain proportional control mode. What is offset error? How can this be compensated for? Give a circuit diagram and explain the working of a proportional controller.
- b) What is process-loop tuning? Explain open-loop transient response method for process-loop tuning. What is the limitation of this method?
- c)
 - i) Define root locus. What is its use? Explain angle and magnitude conditions for a point to be on the root locus.
 - ii) For $G(s)H(s) = \frac{k}{s(s+4)}$ obtain the nature of root locus.

Q4) Solve any two :

[2 × 8 = 16]

- a) Give block diagram of a PLC system and explain its working. Explain the difference between a PLC and a computer.
- b) Discuss processor scan cycle for a typical PLC. What is the function of a watchdog timer in a PLC?
- c) Give a block diagram of PLC memory. How is application memory organised? Discuss memory map for Allen Bradley SLC 500 PLC.

Q5) Solve any four :

[4 × 4 = 16]

- a) Explain the counter instruction (HSC).
- b) List the major differences between a modular PLC and a fixed PLC.
- c) Explain any two comparison instructions.
- d)
 - i) Draw a ladder diagram to realise two input EXOR gate.
 - ii) Draw a ladder that will allow three switches in a room to control a single light source. Switching ON any one switch must turn the light ON but all three must be OFF for light to go OFF.
- e) Explain integral windup in a PID controller. Give a circuit scheme to solve this problem.
- f) Write a short note on PLC networking.



Total No. of Questions :3]

SEAT No. :

P1583

[4636]-101

[Total No. of Pages :1

M.Sc.

BIOTECHNOLOGY

**BT-101: Advanced Biological Chemistry
(2013 Pattern) (Credit System) (Semester - I)**

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

Q1) Attempt any four of the following: **[20]**

- a) What are Nutritional Disorders? Differentiate between Marasmus and Kwashiorkor.
- b) Give importance non covalent interactions in stabilization of protein structure.
- c) Explain the role of lipid as an hormone with suitable example.
- d) Describe any one method for analysis of secondary metabolite.
- e) Explain how chaperons help in protein folding.
- f) What is homotropic allosterism? Explain binding of oxygen with Hemoglobin as an example of homotropic allosterism.

Q2) Write short notes on any four of the following: **[20]**

- a) Peptidoglycan.
- b) Terpenes and its classification.
- c) Phenylketouria and Alkaptonuria.
- d) Fate of pyruvate.
- e) Polyketide synthesis.
- f) Post translational modification: phosphorylation.

Q3) Attempt any one of the following: **[10]**

- a) Derive Michaeli's Menten equation for single substrate enzyme catalysed reaction.
- b) Define the term Metabolome and explain any one method of metabolic flux analysis.

EEE

Total No. of Questions :8]

SEAT No. :

P1567

[4636]-11

[Total No. of Pages :2

M.Sc. (Biotechnology)

BT -11: ADVANCED BIOLOGICAL CHEMISTRY

(2008 Pattern) (Semester -I)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *Attempt not more than 5 questions of which atleast 2 questions must be from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION -I

- Q1)** a) What is chemical shift? Explain use of NMR in determination of bimolecular structures. [8]
- b) State principle and biological applications of spectrofluometry. [8]
- Q2)** a) Give principle, working and application of Ion exchange chromatography. [8]
- b) Explain hormonal regulation of glycolysis and gluconeogenesis. [8]
- Q3)** Write explanatory notes on:
- a) Metabolic flux analysis. [8]
- b) Use of secondary metabolites in Agriculture. [8]
- Q4)** a) Describe the chemiosmotic hypothesis for oxidative phosphorylation. [8]
- b) Discuss supersecondary structure of proteins [8]

SECTION -II

- Q5)** a) Give different methods for phytochemical investigations and explain any one in detail. [8]
- b) Explain how chaperons help in protein folding. [8]

P.T.O.

- Q6)** a) Explain physical and chemical properties of soluble proteins. [8]
b) Giving a suitable example explain the term metabolic engineering. [8]
- Q7)** Explanatory notes:
- a) Alkaloids and their therapeutic uses. [8]
b) Allosteric enzymes. [8]
- Q8)** a) Give principle, and applications of 2-D-Gel electrophoresis. [8]
b) What are phenolics? Mention types of phenolics and give their pharmacological action. [8]

EEE

Total No. of Questions :3]

SEAT No. :

P1587

[4636]-201

[Total No. of Pages :1

M.Sc. (Biotechnology)
BT-201: GENETIC ENGINEERING
(2013 Pattern) (Credit System) (Semester - II)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

Q1) Write self explanatory notes on (any four): **[20]**

- a) YACs.
- b) Transfection.
- c) Hot start PCR.
- d) Ex vivo Gene therapy.
- e) Genetically engineered biotherapeutics.
- f) Baculovirus expression system.

Q2) Attempt the following in 10-15 lines (Any four): **[20]**

- a) Sangers method of DNA sequencing can be easily automated, justify.
- b) Explain with a suitable example DNA fingerprinting.
- c) Compare and contrast cDNA and genomic DNA library.
- d) Describe any three methods employed in detection and diagnosis of genetic diseases.
- e) Write the salient features used for designing PCR primers.
- f) Distinguish between traditional and modern vaccines.

Q3) Eukaryotic proteins when produced in E.coli form inclusion bodies due to lack of sufficient chaperones. You as a master in genetic engineer write a procedure to solve the above problem of expressing eukaryotic proteins in E.coli. **[10]**

OR

Explain with a suitable examples any five DNA modifying enzymes.

EEE

Total No. of Questions : 2]

SEAT No. :

[Total No. of Pages : 1

P1588

[4636]-202

M.Sc.-II

BIOTECHNOLOGY

BT - 202 : Immunology

(2013 Pattern) (Semester-II) (Credit System)

Time : 1 $\frac{1}{2}$ Hours]

[Max. Marks : 25

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat and labelled diagram wherever necessary.*

Q1) Answer Any Three:

[3 x 5 = 15]

- a) Give a brief account of structure and function of Thymus.
- b) Write the steps of Inflammation and its significance.
- c) Give a flow chart of different types of complement pathways.
- d) Write the principle of complement fixation test and its significance.
- e) What do you mean by molecular mimicry? Give an example.

Q2) Answer Any One:

[1 x 10 = 10]

- a) Write any two transgenic animal models of immunological importance.
- b) Write a note on the applications of stemcell technology.

OR

Explain in details the phage display technology and its importance.



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

P1589

[4636]-203

M.Sc.

BIOTECHNOLOGY

BT - 203 : Principles of Bacteriology and Virology

(2013 Pattern) (Credit System) (Semester-II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Neat labelled diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Answers to the two sections must be written in separate books.*

SECTION-I

Q1) Answer the following (Any Three):

[3 x 5 = 15]

- a) Explain molecular adaptations of halophiles.
- b) Describe the proteins involved in binary fission.
- c) Explain the process of endospore formation.
- d) 'Mac Conkey medium is selective & differential'. Justify.
- e) Write a note on metabolic diversity of iron bacteria.

Q2) Answer Any One question:

[10]

- a) Describe in detail nutritional classification of bacteria.
- b) Discuss the causative agent, pathogenesis and treatment of protozoal disease.

SECTION-II

Q3) Answer Any Three:

[3 x 5 = 15]

- a) Characterize Arboviruses with examples.
- b) Write the functions of capsid, envelope and peplomers.

P.T.O.

- c) Explain the replication of RNA (+ve) virus.
- d) Differentiate live attenuated & killed vaccines.
- e) Give a brief account of viral diseases of plant.

Q4) Answer Any One:

[1 x 10 = 10]

- a) Write in detail about Emerging and Re-emerging viral diseases.
- b) Describe in detail any one type of the following infection.
 - i) Latent infection.
 - ii) Acute infection.
 - iii) Persistent infection.



Total No. of Questions : 3]

SEAT No. :

[Total No. of Pages :2

P1590

[4636] - 204

M.Sc.

BIOTECHNOLOGY

BT - 204 : Plant Biotechnology

(2013 Pattern) (Semester - II) (Credit System)

Time :3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

Q1) Answer any four questions

[4 × 5 = 20]

- a) Discuss any one method of vector based gene transfer.
- b) Enlist various applications of somatic hybrids.
- c) Write a note on plantibodies.
- d) Discuss various stages of micropropagation.
- e) Explain the role of transgenic technology for enhanced production of secondary metabolites.
- f) Differentiate between vertical and horizontal gene transfer.

Q2) Answer any four questions

[4 × 5 = 20]

- a) Write a short note on biofuels.
- b) Comment on the promoters used for Agrobacterium mediated transformation of plants.

P.T.O.

- c) Briefly describe the methodologies for androgenic haploid production.
- d) Explain with diagram the method for production of artificial seeds.
- e) Comment on production of single cell protein from algae.
- f) Discuss various advantages of biopesticides.

Q3) Answer any one question

[1 × 10 = 10]

- a) Discuss in detail the role of biotechnology in fungal strain improvement and cultivation of mushrooms.
- b) Discuss in detail the methodologies involved in production of drought tolerant transgenic plants.



Total No. of Questions :8]

SEAT No. :

P1570

[4636]-21

[Total No. of Pages :2

M.Sc. (Biotechnology)
BT -21: GENETIC ENGINEERING
(2008 Pattern) (Semester -II)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *Attempt not more than 5 questions of which atleast 2 questions must be from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION -I

Q1) Write short notes on:

[16]

- a) Transformation
- b) BAC
- c) Restriction modification system
- d) Shuttle vector

Q2) a) Give the salient features of a YAC vector with suitable example. **[8]**

- b) Discuss the criteria used to decide if a particular protein should be expressed in bacteria, mammalian & Baculovirus system. **[8]**

Q3) a) Comment on colony hybridization method for selection of recombinant in gene library construction. **[8]**

- b) Explain the mechanism & applications of yeast expression system for industrially important products. **[8]**

Q4) a) Give the comparative account on plasmid & phage cloning vectors. **[8]**

- b) Write a note on various DNA modifying enzymes used in genetic Engineering. **[8]**

P.T.O.

SECTION -II

- Q5)** a) Explain Automated method of DNA sequencing. [8]
b) Describe genetically engineered biotherapeutics. [8]
- Q6)** a) Explain the criteria for designing of primer for PCR. [8]
b) Write a brief about applications of RFLP & RAPD markers. [8]
- Q7)** a) Distinguish between genetic mapping & physical mapping with respect to their strength & weaknesses. [8]
b) With a suitable example explain how viral & non viral gene delivery system used in gene therapy. [8]
- Q8)** Write short notes on: [16]
- a) Electroporation method of gene transfer.
 - b) Recombinant vaccines.
 - c) Gene annotation.
 - d) DNA finger printing.

EEE

Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages : 2

P1571

[4636]-22
M.Sc. (Part-II)
BIOTECHNOLOGY
BT - 22 : Bioinformatics
(2008 Pattern) (Semester-II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt a total of any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

Q1) Write notes on Any Two of the following: **[16]**

- a) CATH.
- b) BLAST.
- c) OMIM.

Q2) Explain Ramachandran plot. Comment on importance of phi, psi angles & torsion angles in secondary structure prediction. Explain with appropriate examples. **[16]**

Q3) a) Define databases. Give types and classification criteria for databases with appropriate examples. **[8]**

b) Enlist energy optimization techniques in molecular modeling and explain golden section method in details. **[8]**

Q4) a) Explain the term immunoinformatics. Discuss the main steps in epitope prediction. **[8]**

b) What is gene annotation? Explain major steps in gene finding. **[8]**

P.T.O.

Q5) Write short note on Any Two of the following: **[16]**

- a) SCOP.
- b) SMILES.
- c) Bioinformatics business models.

Q6) a) Explain concepts of Global and local alignments with appropriate examples. **[8]**

b) Explain Homology modeling and write important steps in it. **[8]**

Q7) What is chemoinformatics? Explain main steps in molecular docking. Give its importance and applications. **[16]**

Q8) a) Write a note on BLOSUM and PAM scoring matrix & give its applications. **[8]**

b) Give importance & applications of multiple sequence alignment & write a brief note on phylogenetic analysis. **[8]**



Total No. of Questions : 8]

SEAT No. :

P1572

[Total No. of Pages : 2

[4636]-23

M.Sc. (Biotechnology)

BT - 23 : PLANT BIOTECHNOLOGY

(2008 Pattern) (Semester-II)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *Attempt a total of five questions selecting at least two from each section.*
- 2) *Answer for the two sections should be written in separate answer books.*
- 3) *Neat diagram must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION-I

- Q1)** a) Explain the process of protoplast isolation, fusion and regeneration & give application of it. [8]
b) Discuss in detail strategies for establishment of drought tolerance in transgenic plants. [8]
- Q2)** a) Explain the concept of plant biotechnology. Mention the land mark in the development of plant biotechnology as of today. [8]
b) Describe the methods used for seed improvement, testing and certification. [8]
- Q3)** a) Give different routes of multiplication during Micropropagation. Describe any two of them. [8]
b) Explain with example the use of qualitative improvement in protein & lipids. [8]
- Q4)** Write explanatory note on Any Two of the following: [16]
a) Importance of haploids in plant breeding.
b) Somatic embryogenesis.
c) Application of plant tissue culture in agriculture.

P.T.O.

SECTION-II

- Q5)** a) What is molecular farming? Illustrate how plants can be used for production of pharmaceutical & cosmaceutical products. [8]
b) Define somatic hybridization & cybridization. Explain its relationship with recent crop improvement programme. [8]
- Q6)** a) Enlist economically important fungi. Explain the technology used to improve it. [8]
b) Describe the culture conditions & factors influencing the regeneration potential of in vitro produced triploids. [8]
- Q7)** a) Illustrate the applications of somaclonal variation. [8]
b) Explain biotransformation as strategy for enhancing secondary metabolites. [8]
- Q8)** Write short notes on: [16]
a) Single cell protein.
b) Plant derived vaccines.
c) Biodiesel.
d) Biofertilizers.



Total No. of Questions :3]

SEAT No. :

P1591

[4636]-301

[Total No. of Pages :1

M.Sc. (Biotechnology)

BT-301: ANIMAL BIOTECHNOLOGY

(2013 Pattern) (Credit System) (Semester - III)

Time : 3 Hours]

[Max. Marks :50

Instructions to the candidates:

- 1) All questions are compulsory.*
- 2) Neat diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

Q1) Answer the following (Any four): [20]

- a) Write a note on carbonate - bicarbonate buffering system in tissue culture medium.
- b) Explain the concept of tissue engineering.
- c) Write a note on application of cell culture in mass production of viruses.
- d) Markers used in selection of hybridoma heterokaryon over, homo karyon.
- e) Characterization of animal genome is an important tool in animal husbandary: Explain.
- f) Explain different non-enzymatic cell dissociation methods.

Q2) Answer the following (Any four): [20]

- a) Write a note on biosafety measures to be taken while handling animals and cell cultures in laboratory.
- b) Explain any two methods of cell sorting.
- c) Write the advantages of monolayer culture over organ culture.
- d) Write a note on embryo transfer technology.
- e) Write a note on cytotoxicity testing.
- f) Explain the reason why mycoplasma contamination is difficult to detect. Add a note on irrudication of mycoplasma contamination.

Q3) Explain in detail any one transgenic mouse model to study human neurological disorder. [10]

OR

Explain the concept of cell lineage with example. Add a note on markers denoting lineage specificity and position in the lineage. [10]

EEE

Total No. of Questions :6]

SEAT No. :

P1573

[4636]-31

[Total No. of Pages :2

M.Sc. (Biotechnology)

BT -31: ANIMAL BIOTECHNOLOGY

(2008 Pattern) (Semester -III)

Time : 3 Hours]

[Max. Marks :80

Instructions to the candidates:

- 1) *All questions are compulsory.*
- 2) *Attempt both the sections on separate answer sheets.*
- 3) *Draw neat and labelled diagrams wherever necessary.*

SECTION -I

Q1) Write short notes (Any 3):

[15]

- a) Cryopreservation of animal cells.
- b) Organ culture.
- c) Embryo sexing.
- d) Any one method for semen collection.

Q2) Explain the method used for establishment of primary cell cultures. Also comment on advantages and disadvantages of primary cell cultures over histotypic cultures. **[10]**

OR

Write a note on characterization of cell lines.

Q3) Explain the concept of artificial breeding. Add a note on embryo transfer technology. Also comment on its advantages and limitations. **[15]**

OR

What are embryonic stem cells? Explain the methods for maintenance of embryonic stem cells in laboratory. Give a comparative account of ES & adult stem cells.

P.T.O.

SECTION -II

Q4) Write short notes (Any 3): **[15]**

- a) Bioethics for use of transgenic animals.
- b) Serum free media.
- c) Gene banking.
- d) Neoplastic transformation.

Q5) What is cell lineage? Comment on differentiation of stem cells with one suitable example. **[10]**

OR

Describe the conditions in which in vitro fertilization is implemented. Add a note on procedure for the same.

Q6) Explain in detail any two methods to generate transgenic animals. **[15]**

OR

What is a chimeric animal? Explain methods used to generate chimeric animals. Give a comparative account of concept of chimeric & transgenic animals.

EEE

Total No. of Questions :8]

SEAT No. :

P1577

[4636]-41

[Total No. of Pages :2

M.Sc. Biotechnology
BT -41: GENOMICS & PROTEOMICS
(2008 Pattern) (Semester- IV)

Time : 3 Hours]

[Max. Marks :60

Instructions to the candidates:

- 1) Attempt any five questions selecting at least two questions from each section.*
- 2) Answers to the question must be written on a separate answer books.*
- 3) Draw neat and labelled diagrams wherever necessary.*
- 4) Figures to the right indicate full marks.*

SECTION -I

Q1) Write note on any two of the following: **[12]**

- a) Human genome project.
- b) Functional genomics.
- c) Transcriptomics.

Q2) What is comparative genomics? How is it useful in genome annotation? **[12]**

Q3) Describe sequencing strategies for the analysis of whole genome sequencing. Explain with appropriate example. **[12]**

Q4) Explain in brief: **[12]**

- a) Structural genomics & its scope.
- b) Pharmacogenomics.

SECTION -II

Q5) What is proteomics? Give applications of proteomics with examples. **[12]**

Q6) Explain the principle of 2D gel electrophoresis & its applications in proteomics analysis. **[12]**

P.T.O.

Q7) Explain. How microarrays are useful in functional proteomics? **[12]**

Q8) Write notes on any two of the following: **[12]**

- a) Principle of MALDI- TOF.
- b) Structural proteomics.
- c) Yeast two - hybrid systems.

EEE

Total No. of Questions : 8]

SEAT No. :

P1578

[Total No. of Pages : 2

[4636]-42

M.Sc.-II

BIOTECHNOLOGY

BT - 42 : Legal and Ethical Aspects in Biotechnology and IPR

(2008 Pattern) (Semester-IV)

Time : 3 Hours]

[Max. Marks : 60

Instructions to the candidates:

- 1) *Attempt a total of five questions selecting atleast two questions from each section.*
- 2) *Answers to the two sections must be written on seperate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION-I

Q1) What are the basic requirements for patenting and invention? Explain the process of patenting and invention in detail. **[12]**

Q2) Write the salient features of protection of plant variety and farmers right Act 2001. **[12]**

Q3) Write short notes on:

- a) Role of WTO safeguarding IPR. **[6]**
- b) Infringement of patent & remedies. **[6]**

Q4) Explain salient features of TRIPS with specific reference to protection of various IPR. **[12]**

SECTION-II

Q5) Explain in brief:

- a) Patent Co-operation Treaty. **[6]**
- b) Patenting of Microorganisms. **[6]**

P.T.O.

Q6) Explain the specification required for filing a patent in biotechnology. [12]

Q7) Write short notes on:

a) Protection of software programmes. [6]

b) Trademarks and rights arising from TM registration. [6]

Q8) Explain the main objectives of convention on Biological Diversity. [12]



Total No. of Questions : 6]

SEAT No. :

P1579

[Total No. of Pages : 2

[4636]-43

M.Sc.-II

BIOTECHNOLOGY

BT - 43 : Clinical Research and Data Base Management

(2008 Pattern) (Semester-IV)

Time : 1 $\frac{1}{2}$ Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) *Attempt a total of four questions selecting atleast two questions from each section.*
- 2) *Answers to the two sections must be written on separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION-I

Q1) Give detailed accounts of the roles, responsibilities and significance of FDA. **[10]**

Q2) How medical devices are classified? Explain in detail the development and marketing of medical devices. **[10]**

Q3) Write short notes on Any Two of the following: **[10]**

- a) Development and licencing of Biologic.
- b) IND.
- c) GMP's role in pharmaceutical industry.

SECTION-II

Q4) Define database. Explain in detail how clinical trial data is managed in a database. **[10]**

P.T.O.

- Q5)** a) What is Serious Adverse Event? Describe the essential requirements of SAE reporting.
- b) What do you mean by protocol? State and explain in brief various components of a protocol.

[10]

Q6) Write short notes on Any Two of the following:

[10]

- a) Case report form.
- b) Comparative account of phases of clinical trial.
- c) Query Resolution Process.



Total No. of Questions : 6]

SEAT No. :

[Total No. of Pages :2

P1580

[4636] -44

M.Sc.

BIOTECHNOLOGY

BT - 44 a : Nano Biotechnology

(2008 Pattern) (Semester - IV)

Time : 1½ Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) Attempt not more than 4 questions of which at least 2 questions must be from each section.*
- 2) Answers to the two sections should be written in separate books.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*

SECTION - I

Q1) Answer the following:

[2 × 5 = 10]

- a) Explain the trends of Nanobiotechnology research in life sciences.
- b) Discuss the chemical method of sol-gel process in synthesis of nanoparticles.

Q2) Answer the following:

[2 × 5 = 10]

- a) Explain how nanoparticles can be used in gene therapy studies.
- b) Enlist the methods used for characterization of nanoparticles with appropriate examples.

Q3) Write short notes on:

[2 × 5 = 10]

- a) Band gap.
- b) Nano thin films.

P.T.O.

SECTION - II

Q4) Answer the following: **[2 × 5 = 10]**

- a) Discuss the application of biomolecules for synthesis of nanoparticles with a representative example.
- b) Why functionalization of nanoparticles is essential for biological applications.

Q5) Explain how nanoparticles has been useful to chemical & material sciences.[10]

Q6) Write short notes on: **[2 × 5 = 10]**

- a) Scanning electron microscope.
- b) Chemical Vapor deposition.



Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages :2

P1581

[4636] - 45

M.Sc. - II

BIOTECHNOLOGY

BT - 44-b : Stem Cell Techniques & Reproduction

(2008 Pattern) (Semester - IV)

Time :3 Hours]

[Max. Marks : 60

Instructions to the candidates:

- 1) *Attempt both the sections on separate answer sheets.*
- 2) *All questions are compulsory.*
- 3) *Draw neat & labelled diagrams wherever necessary.*

SECTION - I

Q1) Write short notes on (Any three)

[3 × 5 = 15]

- a) Slow block to polyspermy.
- b) Acrosomal reaction in mammals.
- c) Role of maternal genes in zygote development.
- d) Neural Induction.

Q2) a) Explain in detail sperm formation and differentiation.

[7]

- b) Explain the concept of cell lineage. Add a note on targeted stem cell differentiation.

[8]

OR

Explain in detail process of egg maturation.

[8]

P.T.O.

SECTION - II

Q3) Write short notes (Any three)

[3 × 5 = 15]

- a) Knock - in Mice.
- b) Gene therapy.
- c) Bioethics while handling stem cells.
- d) Formation of founder animal in transgenic technology.

Q4) Explain in detail method to generate a transgenic animal using Cre-Lox P system. **[15]**

OR

Give properties of stem cells. Write the differences between embryonic, adult & induced pluripotent stem cells. **[15]**



Total No. of Questions : 8]

SEAT No. :

[Total No. of Pages :2

P1582

[4636] - 46

M.Sc. BIOTECHNOLOGY

BT - 44 - c : Agricultural Biotechnology

(2008 Pattern) (Semester - IV)

Time :3 Hours]

[Max. Marks : 60

Instructions to the candidates:

- 1) *Attempt total five questions selecting at least two questions from each section.*
- 2) *Answers to the sections must be written on separate answer books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right indicate full marks.*

SECTION - I

Q1) Explain the method of homozygous plant production by ovule culture & their application in crop improvement. **[12]**

Q2) Describe embryo rescue and embryo culture for production of hybrid embryos. Add note on its applications. **[12]**

Q3) Comment on “Micropropagation can be used effectively for mass production of elite varieties of pulses”. **[12]**

Q4) Write notes on (any two): **[12]**

- a) Endosperm culture.
- b) Application of gametoclonal variation in crop improvement.
- c) Role of Biopesticide in agriculture.

P.T.O.

SECTION - II

Q5) Describe metabolic engineering approaches for enhancement of plant secondary metabolites. **[12]**

Q6) Discuss the role of molecular markers for crop improvement against abiotic stresses with suitable examples. **[12]**

Q7) Explain: **[12]**

- a) Polyembryony.
- b) Pest resistant transgenic crops.

Q8) Write explanatory notes on any two of the following: **[12]**

- a) Use of biofertilizers for crop improvement.
- b) Role of apomixis in agriculture.
- c) Applications of transgenic plants as source of edible vaccines.



Total No. of Questions : 8]

SEAT No. :

P1718

[4637] - 2001

[Total No. of Pages : 2

M.Sc.

COMPUTER SCIENCE

**CS - 201: Digital Image Processing
(2013 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any Five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

- Q1)** a) State and explain any two properties of DFT. [4]
b) Write a short note on 'chain codes'. [4]
c) Find the first order derivative of following 1-D image– {5, 5, 5, 1, 2, 3, 4, 00}. [2]

- Q2)** a) Give a mask to detect vertical lines in an image. Explain its working. [4]
b) What are the fundamental steps in edge detection? [4]
c) Mention two ranges of EM spectrum used for imaging. Give one application each. [2]

- Q3)** a) Define 8-adjacency and m-adjacency. What is the advantage of m-adjacency? [4]
b) What is 'Gamma correction'? How is it implemented using power law transformation? [4]
c) State convolution theorem. [2]

- Q4)** a) Explain image acquisition using a sensor strip. Give one application. [4]
b) Illustrate the working of 'High pass filter', for an image in frequency domain. [4]
c) Find the convolution of following 1-D images {-1, 4, 2, 3} and {0, 1, 2, 3}. [2]

P.T.O.

- Q5)** a) Explain the concept of unsharp masking with help of appropriate diagrams. [4]
 b) Write iterative algorithm for global thresholding. [4]
 c) Why is it easy to remove periodic noise using frequency domain processing? [2]

- Q6)** a) Explain the working of Homomorphic filter. [4]
 b) Write equations for 'Harmonic' and contraharmonic filters. [4]
 c) Mention two ways of estimating degradation function. [2]

- Q7)** a) Use the following table to find the transformation function that is obtained with histogram equalization technique. The image is a 3-bit 64×64 image. [5]

r_k	n_k
$r_0 = 0$	700
$r_1 = 1$	1113
$r_2 = 2$	800
$r_3 = 3$	706
$r_4 = 4$	300
$r_5 = 5$	274
$r_6 = 6$	192
$r_7 = 7$	11

- b) Explain the working of a general purpose DIP system with a neat block diagram. [5]

- Q8)** a) Give three edge models. When and how do we use zero detection? [5]
 b) Define 'opening' and 'closing' operations. In what way do they differ from each other? [5]



Total No. of Questions : 8]

SEAT No. :

P1719

[4637] - 2002

[Total No. of Pages : 2

M.Sc.

COMPUTER SCIENCE

**CS- 202: Advanced Operating System
(2013 Pattern) (Semester - II)**

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) *Answer any Five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

- Q1)** a) Write a 'C' program to create a named pipe file and store the alphabets A to Z in it and verify this contents by reading this pipe file. [4]
b) Write a short note on page stealer process. [4]
c) Explain with example absolute & relative path. [2]
- Q2)** a) Explain how signals were un-reliable in earlier versions of UNIX & how it is reliable in newer versions. [4]
b) Explain any 4 functions from exec () family with proper syntax & example. [4]
c) What is page ageing? [2]
- Q3)** a) Write a short note on super block. [4]
b) Explain the signals SIGABRT & SIGALRM. [4]
c) What are the types of links. [2]
- Q4)** a) Explain the system calls link (), unlink (), remove () and rename () with syntax and example. [4]
b) Discuss the idle thread concept of windows O.S. [4]
c) What is copy-on-write? [2]

P.T.O.

- Q5)** a) Explain the memory layout of 'C' program. [4]
 b) Consider that there are 5 processes in the system, all created at time 0. Assume context switch occurs at 1- second intervals. The swapper swaps the processes from primary memory to swap device at 2 seconds interval. Show with the help of neat diagram the sequence of swapping operations. [4]
 c) Explain the types of priorities of processes w.r.t. UNIX O.S. [2]
- Q6)** a) Find the physical byte offset for logical byte offset 24,00,000. Also find the respective block number. [4]
 b) What are the types of interrupts w.r.t. UNIX O.S.? Explain in detail. [4]
 c) Differentiate user mode & kernel mode level of execution. [2]
- Q7)** a) Explain in brief any 10 contents of u-area. [5]
 b) Explain the behaviour of foll program [5]
- ```

int main ()
{
fork ();
fork ();
fork ();
if (wait (o) == -1)
 Printf ("Leaf child \n");
}.

```
- Q8)** a) What is context switch? What are the cases when a process context switch? [5]  
 b) Write a short note on thread scheduling under windows O.S. [5]



Total No. of Questions : 8]

SEAT No. :

P1720

[4637] - 2003

[Total No. of Pages : 2

M.Sc.

COMPUTER SCIENCE

CS - 203: Data Mining and Data Warehousing  
(2013 Pattern) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume Suitable data if necessary.

- Q1)** a) Explain K-means method of clustering. [4]  
b) What is the difference between OLTP and OLAP? [4]  
c) What do you mean by CART? [2]

- Q2)** a) Explain the need of data cleaning. What are the different tasks involved in data Cleaning? [4]  
b) What are the major challenges of mining a huge amount of data (such as billions of tuples) in comparison with mining a small amount of data (such as a few hundred tuple data set)? [4]  
c) “Classification is called Supervised Learning” Comment. [2]

- Q3)** a) Construct FP tree for the following set of transactions with support count = 2. [4]

| TID | ITEMS        |
|-----|--------------|
| 1   | {A, B}       |
| 2   | {B, C, D}    |
| 3   | {A, C, D, E} |
| 4   | {A, D, E}    |
| 5   | {A, B, C}    |
| 6   | {A, B, C, D} |
| 7   | {B, C}       |
| 8   | {A, B, C}    |
| 9   | {A, B, D}    |
| 10  | {B, C, E}    |

P.T.O.



- b) What is Page rank? Explain how web structure mining is used to increase the effectiveness of search engines. [4]
- c) Write any two challenges of text mining. [2]
- Q4)** a) Explain in brief architecture of Data Warehouse. [4]
- b) Discuss the use of crawlers in Web Content mining. [4]
- c) How a database design is represented in OLAP systems? [2]
- Q5)** a) Write any four applications of data mining. [4]
- b) Explain algorithm for decision tree induction. [4]
- c) What is Apriori property? [2]
- Q6)** a) Explain in brief non-linear regression. [4]
- b) Specify the advantages of using concept hierarchies in data mining applications. [4]
- c) Mention methods to handle the missing values. [2]
- Q7)** a) The following table consists of training data. Construct a decision tree based on this data, using the basic algorithm of decision tree induction. Classify the records by “Play Golf” attribute. [5]

| Oulook   | Temp | Humidity | Windy | Play Golf |
|----------|------|----------|-------|-----------|
| Rainy    | Hot  | High     | False | No        |
| Rainy    | Hot  | High     | True  | No        |
| Overcast | Hot  | High     | False | Yes       |
| Sunny    | Mild | High     | False | Yes       |
| Sunny    | Cool | Normal   | False | Yes       |
| Sunny    | Cool | Normal   | True  | No        |
| Overcast | Cool | Normal   | True  | Yes       |
| Rainy    | Mild | High     | False | No        |
| Rainy    | Cool | Normal   | False | Yes       |
| Sunny    | Mild | Normal   | False | Yes       |
| Rainy    | Mild | Normal   | True  | Yes       |

- b) Write a short note on Graph Mining. [5]
- Q8)** a) Explain accuracy and error measures for classifiers. [5]
- b) Describe Text Mining with example. [5]



Total No. of Questions : 8]

SEAT No. :

**P1721**

**[4637]-2004**

[Total No. of Pages :2

**M.Sc. (Computer Science)**

**CS-205: PROGRAMMING WITH DOT NET**

**(2013 Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks :50*

*Instructions to the candidates:*

- 1) *Attempt any five out of EIGHT.*
- 2) *All questions carry equal marks.*

**Q1)** Attempt the following:

- a) List the development models supported by ASP. NET. Explain any one in detail. **[4]**
- b) What is an interface? Why they are used in c# programming? Explain with an example. **[4]**
- c) Explain the concept of Generics. **[2]**

**Q2)** Attempt the following:

- a) Name the different types of arrays available in C#, explain with an example. **[4]**
- b) Consider the table student (rollno, name , marks). Write down the steps with syntax to connect to the database (MSACCESS/SQL) using disconnected architecture. **[4]**
- c) What is brush? Explain different types of brush available in GDI+. **[2]**

**Q3)** Attempt the following:

- a) Explain ASP.NET page life cycle. **[4]**
- b) Write a note on SOAP. **[4]**
- c) What is TCP Listener class? **[2]**

**Q4)** Attempt the following:

- a) What is metadata? Mention it uses in NET. **[4]**
- b) What do you understand by events and delegates in C# , give examples. **[4]**
- c) Explain anchor and Dock properties under system. Windows. Forms. **[2]**

**P.T.O**

**Q5)** Attempt the following:

- a) What are the fundamental operations of streams available in file I/O? Explain the types of streams: [4]
- b) What is server side programming? Explain its advantages. [4]
- c) State true or false. [2]
  - i) C# is case sensitive.
  - ii) In C#, like Java, file name should be same as that of class name.

**Q6)** Attempt the following:

- a) Enumerate the concept of properties in C#, explain with of an example. [4]
- b) What are namespaces? List the properties of namespaces. [4]
- c) What do you mean by boxing and unboxing. [2]

**Q7)** Attempt the following:

- a) Create a structure book which contains following members: book ID, title, price, book type. Type of book should an enumerated data type with values as: magazine, novel, Reference book write a console based application to do the following : [5]
  - i) Accept the details of the book.
  - ii) Display the details of the book.Use methods for accepting and displaying details.
- b) Write a note on DOTNET frame work. [5]

**Q8)** Attempt the following:

- a) What is a webservice? List the features of webservice. [5]
- b) List the reasons which make C# a widely used professional language. Also mention important features of C#. [5]

□□□

Total No. of Questions : 8]

SEAT No. :

**P1722**

**[4637]-2005**

[Total No. of Pages :4

**M.Sc. – I**

**COMPUTER SCIENCE**

**CS-206: Artificial Intelligence**

**(2013 Pattern) (Semester-II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Answer any five questions.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*

- Q1)** a) Differentiate between simulated annealing simple hill climbing algorithms. **[4]**
- b) What is Conceptual Dependency? With the help of examples, describe any two conceptual tenses. **[4]**
- c) What is Artificial Intelligence? **[2]**

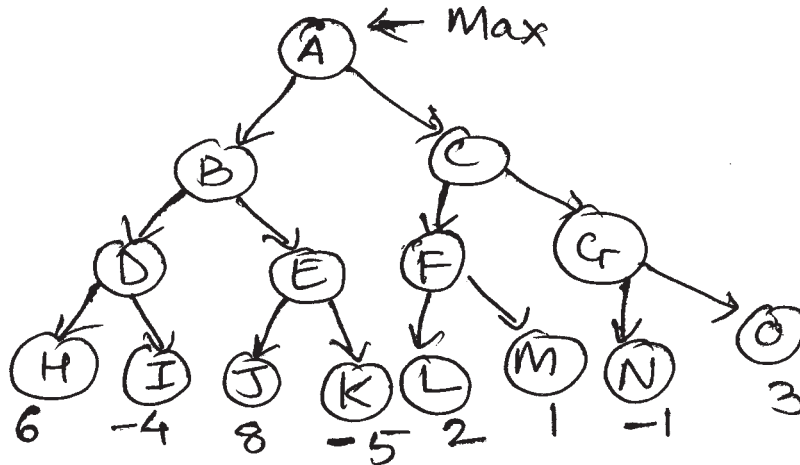
- Q2)** a) Describe learning by parameter adjustment. When should the Value of a coefficient be increased / decreased? **[4]**
- b) The following is a problem, which can be solved using state-space search techniques: “A farmer with his dog, rabbit and lettuce come to the East side of a river they wish to cross. There is a boat at the river’s edge; but only the farmer can row. The boat can hold atmost 2things (including the rower) at any one time. If the dog is ever left alone with the rabbit, the dog will eat it. Similarly, if the rabbit is ever left alone with the lettuce, the rabbit will eat the lettuce. How can the farmer get accross the river so that all 4 characters arrive safety on the other side?”
- Formalize the above problem in terms of state- space search. You should:
- i) Suggest a suitable representation for the problem.
  - ii) State what the initial and final states are in this representation.
  - iii) State the available operators / rules for getting from one state to the next, giving any conditions on when they may be applied. **[4]**
- c) What is means-ends analysis search strategy? **[2]**

**P.T.O**

**Q3) a)** Represent the following using Conceptual Dependency. **[4]**

- i) John sold his car to bill
- ii) John threw a ball to Mary

b) Given the following search -tree, apply the alpha -beta pruning algorithm to it and show the search tree that would be built by this algorithm. Make sure that you show where the alpha & beta cuts are applied & which parts of the search tree are pruned as a result. **[4]**



c) In A\* algorithm, the function 'g' is a measure of the cost of getting from the initial state to the current node. Comment on the role of the 'g' function in this algorithm. **[2]**

**Q4) a)** Consider the following 3FOPL statements. Using resolution prove. FIDO WILL DIE **[4]**

- i)  $\forall x: \text{dog}(x) \rightarrow \text{animal}(x)$
- ii) Dog (FIDO)
- iii)  $\forall y: \text{animal}(y) \rightarrow \text{die}(y)$

b) Represent the following sentence into the appropriate semantic network diagram: "I own a tan leather chair". **[4]**

c) What are the advantages of breadth first search? **[2]**

**Q5) a)** Consider the following statements: [4]

- i) All philosophers are Indian.
- ii) All Indians are happy
- iii) Either Aryabhata or C.V. Raman is a philosopher.
- iv) C.V. Raman is not a philosopher.

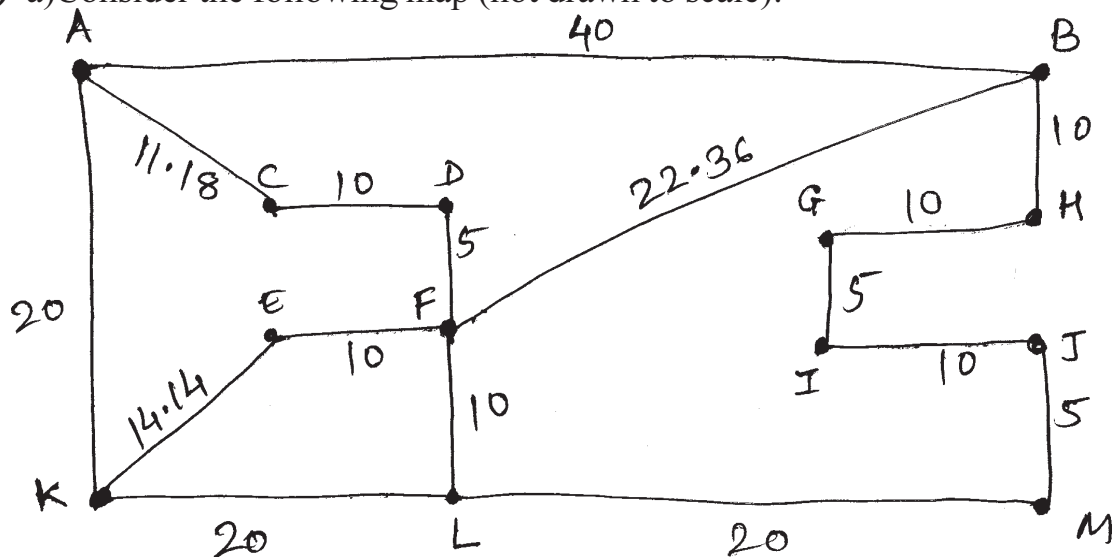
Represent the above information in WFFs and prove that “Aryabhata is happy.”

- b) What is learning? Write a short note on “learning from examples” method of learning. [4]
- c) Represent the following statement using predicate logic and partitioned semantic nets. “Every batter hit a ball”. [2]

**Q6) a)** Explain the unification algorithm. [4]

- b) In game playing, state the use of static evaluation function. How is it similar to the ‘h’ function in A\* algorithm? Describe the two knowledge-based components of a good game playing program. [4]
- c) Comment. The minmax search procedure is a depth-first, depth -limited search procedure. [2]

**Q7) a)** Consider the following map (not drawn to scale): [5]



Using the A\* algorithm work out a route from town A to town M. Use the following cost functions.

-G(n) = the cost of each move as the distance between each town (shown on the map)

-H (n) = the straight line distance between any town and town M. These distances are given in the table below.

Straight line distance to M:-

|   |       |   |       |   |       |
|---|-------|---|-------|---|-------|
| A | 44.72 | F | 22.36 | K | 40.00 |
| B | 20.00 | G | 14.14 | L | 20.00 |
| C | 33.54 | H | 10.00 | M | 0.00  |
| D | 25.00 | I | 11.18 |   |       |
| E | 31.62 | J | 5.00  |   |       |

b) Describe the advantages & disadvantages of an expert system. [5]

**Q8)** a) Consider the following statements: [5]

- i) Ravi likes all kinds of food.
- ii) Apples and chicken are food.
- iii) Anything anyone eats and is not killed is food.
- iv) Ajay eats peanuts and is still alive.
- v) Rita eats everything that Ajay eats.

Convert the above statements to well - formed formulas in first- order predicate calculus.

b) Translate the following English statements to FOPL: [5]

- i) There is a mushroom that is purple and poisonous.
- ii) There is a bunny who is cute.

□□□

Total No. of Questions : 8]

SEAT No. :

**P1707**

**[4637] - 201**

[Total No. of Pages : 3

**M.Sc. (Computer Science)**  
**CS 201: DIGITAL IMAGE PROCESSING**  
**(2011 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Question 1 is compulsory.*
- 2) *Attempt any four from the remaining.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Attempt all.

**[8×2 = 16]**

- a) State the 4 diagonal neighbours of a pixel p.
- b) List any two methods of edge detection.
- c) Calculate the memory required to store a gray image that has a resolution of  $1024 \times 1024$  and has 256 different levels of intensity.
- d) Define city block distance between two pixels 'p' & 'q' of an image.
- e) Write the equation of hole filling.
- f) Define unsharp masking.
- g) List any two segmentation approaches.
- h) Why does impulse noise arise in image.

**Q2)** a) With the help of neat diagram, explain the 2D convolution theorem. Comment on wraparound error & the importance of Zero padding. **[8]**

b) What is inverse filtering? State the use of inverse filtering. **[4]**

c) Explain the steps in processing an image in frequency domain. **[4]**

**Q3)** a) Describe the fundamental steps in digital image processing with the help of diagram. **[8]**

**P.T.O.**



- b) What are chain codes? What do you mean by normalizing a chain code. [4]
- c) Explain linear spatial filters. [4]

**Q4)** a) Following is a 1-D intensity profile of an image. Calculate and plot first & second order derivatives of it. Explain the nature & use of each derivative. [8]

|    |    |    |    |   |   |   |   |   |   |   |   |   |    |   |   |   |   |   |   |   |
|----|----|----|----|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|
| 10 | 10 | 10 | 10 | 9 | 8 | 7 | 6 | 5 | 5 | 5 | 5 | 5 | 12 | 5 | 5 | 5 | 8 | 8 | 8 | 8 |
|----|----|----|----|---|---|---|---|---|---|---|---|---|----|---|---|---|---|---|---|---|

- b) Give the expressions for thinning and thickening a set A by a structuring element B. [4]
- c) Illustrate the working of ideal 'Low pass filter' for a digital image in frequency domain. [4]

**Q5)** a) What is the use of 'Hit-or-Miss' transformation? Explain the morphological operations involve in this transformation. [8]

- b) Write the equations for forward and inverse 2-D Discrete Fourier Transform (DFT) . Give the significance of each variable in the equation. [4]
- c) Write a short note on shape numbers. [4]

**Q6)** a) Give three different ways of acquiring image. Explain any one. [8]

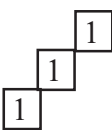
- b) Explain the working of 'Homomorphic filter'. [4]
- c) What is degradation of image. Mention two ways of estimating degradation function. [4]

**Q7)** a) What do you mean by signature? Show how to find signatures for a circular and a square boundary. [8]

- b) Explain m-adjacency with an example. [4]
- c) Explain how bit plane slicing is used to analyze relative importance of each bit used to store a pixel in a digital image. [4]

**Q8)** a) What is thresholding? Write the iterative algorithm for global thresholding. [8]

- b) Explain the sampling and quantization process involved in making a digital image. **[4]**
- c) Define Erosion and dilation. Apply dilation on the following binary image with structuring element shown. **[4]**

SE = 

image

|   |   |   |   |   |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 |
| 0 | 1 | 1 | 1 | 0 |
| 0 | 1 | 1 | 1 | 0 |
| 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 0 | 0 |



Total No. of Questions : 5]

SEAT No. :

**P1708**

**[4637] - 202**

[Total No. of Pages : 6

**M.Sc. - I**

**COMPUTER SCIENCE**

**CS-202: Advanced Operating System  
(2011 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*

**Q1)** Attempt all of the following.

**[8×2 = 16]**

- a) What do you mean by kernel level execution of a process?
- b) If we execute `lseek (fd, 0, 2)`, what will be the new file byte offset?
- c) Give syntax of `mmap`.
- d) Which user-ids are associated with a process? What is their significance?
- e) What do you mean by processor affinity?
- f) How Linux uses opportunistic allocation?
- g) Write an equivalent of `kill (getpid( ), SIGINT)`.
- h) Give any two design goals of windows.

**Q2)** State whether following statements are true or false. Justify your answer (any eight). **[8×2 = 16]**

- a) The kernel must sometimes prevent the occurrence of interrupts during critical activities.
- b) Random access I/O is not possible for pipe files.
- c) `dup ( )` system call duplicates the contents of the file.
- d) u-area of a process is accessible only in kernel mode.

**P.T.O.**

- e) Update process is a daemon process.
- f) memfrob ( ) function is used to encrypt/decrypt.
- g) A reentrant procedure is one which never accesses/modifies global data structures.
- h) The default action of a process is exit + dump whenever it receives SIGCHLD signal.
- i) In windows, worker factories refer to the internal mechanism used to implement user-mode thread pools.
- j) Windows implements a priority-driven, preemptive scheduling system.

**Q3)** Attempt the following (any four). **[4×4 = 16]**

- a) A process executes a system call and while it is not in critical region, receives a terminal interrupt, followed by disk interrupt and then clock interrupt. How many context layers (at most) it needs to save on dynamic portion of system level context? Draw an appropriate diagram for the same.
- b) Which operations are performed by kernel during execution of fork ( )?
- c) How “Anticipatory I/O” scheduler works?
- d) Explain different types of file links. How do they differ from each other?
- e) Give seven stages for creation of a process in Windows.

**Q4)** Solve the following (any four). **[4×4 = 16]**

- a) 

```
include <fcntl.h>

main ()
{
 int f;
 char s[1024];
 f = creat (“sample.dat”, 0666);
 lseek (f, 2000L, 2);
```

```

write (f, "hello world", 11);
close (f);
f = open ("sample.dat", 0-RDONLY);
read (f, s, 1024);
read (f, s, 1024);
read (f, s, 1024);
}

```

Explain how the program will work when executed.

b) #include < signal.h>

```

main ()
{
 int retval, status;
 signal (SIGCLD, SIG_IGN);
 if (fork () == 0)
 {
 /* child process does some processing*/
 exit (0);
 }
 retval = wait (& status);
}

```

Explain the execution of the program.

c) #include < signal.h>

```

main ()
{
 int i, *ip;
 extern f(), sigcatcher ();
 ip = (int *) f;
}

```

```

for (i = 1; i < 20; i++)
 signal (i, sigcatcher);
*ip = 1;
printf (“value at ip is changed \n”);
f ();
}
f ()
{
 printf (“Inside the function \n”);
}
sigcatcher ()
{
 printf (“caught signal \n”);
 exit (0);
}

```

Explain the execution of the program.

- d) What will happen when the following program is executed?

```

main ()
{
 char *endpt;
 char *sbrk ();
 int brk ();
 endpt = sbrk (0);
 printf (“endpt = %u after sbrk\n”, (int) endpt);
 while (endpt --)
 {
 if (brk (endpt) == -1)

```

```

 {
 printf ("brk of %u failed \n", endpt);
 exit ();
 }
 }
}

```

e) What will happen if the following program is executed?

```

#include <sys/types.h>
#include <sys/stat.h>
#include <fcntl.h>
main (int argc, char * argv [])
{
 int f;
 struct stat statbuf;
 if (argc != 2)
 exit ();
 f = open (argv[1], O_RDONLY);
 if (f == -1)
 exit ();
 if (unlink (argv [1]) == -1)
 exit ();
 if (stat (argv[1], &statbuf) == -1)
 printf ("stat failed \n");
 else
 printf ("stat succeeded \n");
 if (fstat (f, &statbuf) == -1)

```

```
printf ("fstat failed \n");
else
printf ("fstat succeeded \n");
close (f);
}
```

**Q5)** Attempt the following. (any four)

**[4×4 = 16]**

- a) Write a C program which takes multiple files as command -line argument and print their inode numbers.
- b) Write a C program to create daemon.
- c) Write a C program to demonstrate race condition in catching signals.
- d) Write a C program in which parent and child share a file access.
- e) Write a C program to handle two-way communication between parent and child using pipe.





Total No. of Questions :5]

SEAT No. :

**P1709**

**[4637]-203**

[Total No. of Pages :4

**M.Sc.-I (Computer Science)**  
**CS-203: DATA MINING AND DATA WAREHOUSING**  
**(Semester-II) (2011 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions carry equal marks.*
- 2) *All questions are compulsory.*

**Q1)** Attempt the following (any eight)

**[8×2=16]**

- a) Explain drill-up and drill-down operations of OLAP.
- b) Define
  - i) Support
  - ii) Confidence
- c) In supervised learning class-labels of training tuples are known. Comment.
- d) What do you mean by true +ve and false –ve tuples?
- e) Define
  - i) Precision
  - ii) Recall
- f) Which are commonly used attribute selection measure?
- g) Define “Data rich information poor” situation.
- h) Define
  - i) Closed itemset
  - ii) Maximal frequent itemset.
- i) In numerosity reduction we try to reduce the number of attributes in the data. Comment.
- j) Divisive clustering approach is also called as bottom-up approach. Comment.

**P.T.O**

**Q2)** Attempt the following (any four)

**[4×4=16]**

- a) What are the measures of quality of data? Explain any one of them in detail.
- b) The following data is present in the database which is noisy. How these values will be replaced to remove the noise by using,
  - i) Smoothing by bin boundaries.
  - ii) Smoothing by bin mean.Data is :    112, 34, 49, 57, 28, 47, 35, 38  
                  119, 120, 23, 16, 118, 37, 59, 55  
Assume that bin frequency is 4
- c) Write note on-Crawlers.
- d) What are the advantages of building data warehouse?
- e) How the missing values in the incomplete data can be handled?

**Q3)** Solve the following (any two)

**[8×2=16]**

- a) Consider the following class labeled tuples in training data set.

| TID | Age    | Income | Credit-rating | Class: buys computer |
|-----|--------|--------|---------------|----------------------|
| 1   | youth  | high   | fair          | no                   |
| 2   | youth  | high   | excellent     | no                   |
| 3   | middle | high   | fair          | yes                  |
| 4   | senior | medium | fair          | yes                  |
| 5   | senior | low    | fair          | yes                  |
| 6   | middle | low    | excellent     | yes                  |
| 7   | youth  | medium | excellent     | yes                  |
| 8   | senior | medium | fair          | yes                  |
| 9   | middle | high   | excellent     | yes                  |
| 10  | senior | medium | excellent     | no                   |

Find out the first split criteria (root node) of decision tree induction and its possible outcomes using information gain method of attribute selection.

b) Consider the following set of transactions.

| <u>TID</u>     | <u>List of Items</u>     |
|----------------|--------------------------|
| T <sub>1</sub> | Pen, Pencil, Book        |
| T <sub>2</sub> | Pencil, Eraser, Notebook |
| T <sub>3</sub> | Pencil, Eraser           |
| T <sub>4</sub> | Book, Notebook, Pen      |
| T <sub>5</sub> | Pencil, Pen, Eraser      |
| T <sub>6</sub> | Notebook, Pen            |
| T <sub>7</sub> | Pencil, Eraser           |
| T <sub>8</sub> | Pen, Pencil, Notebook    |

Draw a FP tree with this set of transaction. The minimum support count is 2

c) Following is the salary data of 10 persons . Based on this predict Using linear regression, what will be the salary of person after 13 years of experience.

Data is: (3, 15000), (9, 45000) (6, 30000), (4, 20000),  
(8, 40000) (15, 80000), (12, 55000) (10, 52000),  
(7, 33000), (16, 90000)

The data is in the form (x,y) where x is number of years of service and y is salary.

**Q4)** Attempt the following (any four): **[4×4=16]**

- Explain the strategies used for conflict resolution when more than one rules get fired, in rule based classification.
- Building data warehouse is a complex process.Comment.
- Which are the predictive data mining tasks? Explain any one of them in detail with example.
- Explain in detail any one technique of improving the efficiency of Apriori algorithm.
- Write note on Document Ranking method of text mining.

**Q5)** Attempt the following ( any four):

**[4×4=16]**

- a) Explain the process of 'data reduction' which is performed during preprocessing of data.
- b) What is pattern discovery in web-mining? What are different types of patterns that can be discovered?
- c) Explain with example the "class imbalance" problem encountered during measuring of accuracy of classification algorithms
- d) Write note on-  
Hierarchical clustering method .
- e) What are the difference between the traditional DBMS and Data warehouse?

□□□

Total No. of Questions : 5]

SEAT No. :

**P1697**

**[4637] - 21**

[Total No. of Pages : 2

**M.Sc. (Computer Science)**

**CS 201: ADVANCED NETWORKING CONCEPTS**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Black Figures to the right indicate full marks.*

**Q1)** Attempt all of the following.

**[8×2 = 16]**

- a) What is autonegotiation?
- b) State any four error reporting messages of ICMP.
- c) Explain the renewing state of DHCP transition state.
- d) What is a role of periodic timer in RIP?
- e) List the functions of Client side in Connectionless iterative server.
- f) Give the two steps of FTP-Control Connection.
- g) What is the role of urgent pointer in TCP Segments?
- h) Explain the nesting of TPDUS.

**Q2)** Attempt any four of the following:

**[4×4 = 16]**

- a) Explain the architecture of IEEE 802.11.
- b) Write a note on ICANN ranges.
- c) Write a note on ICMP query messages.
- d) Explain various fields of socket structure.
- e) Explain the two types of RIP messages.

**P.T.O.**

**Q3)** Attempt any four of the following: **[4×4 = 16]**

- a) Explain time-to-live field of IPV4 datagram.
- b) What is socket? Explain the different types of sockets.
- c) Explain the concept of dynamic address in DHCP.
- d) Write a note on flat name space and hierarchical name space of DNS name space.
- e) Explain the following fields of TCP segments.
  - i) Sequence number.
  - ii) Acknowledgment number.
  - iii) Window size.
  - iv) Checksum.

**Q4)** Attempt any four of the following: **[4×4 = 16]**

- a) Explain the implementation of DHCP client and server on the same network.
- b) With suitable diagram explain the basic model of FTP.
- c) Write a note on OSPF transient link and stub link.
- d) Explain source quench and redirection error reporting messages of ICMP.
- e) Write a note on unicasting.

**Q5)** Attempt any four of the following: **[4×4 = 16]**

- a) Explain the following terms of OSPF:
  - i) Area
  - ii) Area border router.
  - iii) backbone router.
  - iv) Virtual link.
- b) Write a note on cookies.
- c) Explain the mechanisms of open-loop congestion control.
- d) Discuss the designing goals of ATM.
- e) Write a note on POP3 and IMAP4.



Total No. of Questions : 5]

SEAT No. :

**P1698**

[4637] - 22

[Total No. of Pages : 3

**M.Sc. (Computer Science)  
CS-202: UNIX INTERNALS  
(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Figure to the right indicates full marks.*
- 3) *All questions carry equal marks.*
- 4) *Assume suitable data, if necessary.*
- 5) *All questions are compulsory.*

**Q1)** Attempt all of the following.

**[16]**

- a) In getblk, if kernel removes a buffer from the free list, it must raise the processor priority to block out interrupts before checking free list. Why?
- b) What are major and minor numbers of device file?
- c) Give any two services provided by the kernel.
- d) Which are the different I/O parameters saved in U-area?
- e) List the elements which are part of semaphore under Unix V.
- f) Explain any four fields of disk inode.
- g) Give the formula to calculate logical disk block number & byte offset of disk block.
- h) Under which circumstances, callout table entry can be negative.

**Q2)** State whether following statements are true or false. Justify your answer. **[16]**

- a) When a process accesses a page that is not part of its working set, it incurs a protection page fault.
- b) No process can preempt executing in kernel mode.
- c) The kernel unlocks the inode at the each system call that it uses.

**P.T.O.**

- d) “An inode is on the free list if and only if it is unlocked”.
- e) The process can access its u area when it executes in kernel mode but not when it executes in user mode.

**Q3)** Attempt any 4 of the following. **[16]**

- a) Explain different types of memory regions found in every process.
- b) What happens when process executes unlink (“.”)? What is the current directory of the process? Assume super user permissions.
- c) Explore the race condition for lock buffer.
- d) When we open a file, which are the different data structures that are updated?
- e) Describe the operations performed by kernel during exit system call.

**Q4)** Attempt any 4 of the following. **[16]**

- a) Explain the behavior of the following

```
main ()
{
char *endpt;
char *sbrk ();
int brk ();
endpt =sbrk (0);
printf (“endpt = %ud after sbrk\n”, (int) endpt);
while (endpt--)
{
 if (brk(endpt)= = -1)
 {
 print f (“brk of %ud failed\n”, enpt);
 }
}
}
```



- b) List any four functions of clock interrupt handler.
- c) Draw a block diagram of the system kernel and explain it.
- d) Explain wakeup algorithm in detail.
- e) Explain the behavior of the following program

```
#include <fcntl.h>
main ()
{
 int fd;
 char litbuf[20], bigbuf[1024];
 fd = open (“ /etc /passwd”, O_ RDONLY);
 read (fd, litbuff, 20);
 read(fd, bigbuff, 1024);
 read (fd, litbuff, 20);
}
```

**Q5)** Attempt any 4 of the following.

**[16]**

- a) Explain working of page stealer process.
- b) Which are the different fields in process table and u-area?
- c) What is the need of mount? What are the entries of mount table?
- d) What are the system calls associated with message?
- e) What is context switch?



Total No. of Questions : 5]

SEAT No. :

**P1699**

[4637]-23

[Total No. of Pages :2

**M.Sc.**

**COMPUTER SCIENCE**

**CS-203: Software Architecture**

**(Semester-II) (2008 Pattern)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Draw neat diagram wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Answer the following:

**[8×2=16]**

- a) Give the elements of describing design pattern.
- b) Name the phases of unified process.
- c) What are the characteristics of frame work?
- d) Give the name of two design patterns which are known as wrapper.
- e) What do you mean by software architecture?
- f) What are the two types of responsibilities?
- g) Define the term Architectural style.
- h) What are the advantages of struts.

**Q2)** Attempt the following (any four):

**[4×4=16]**

- a) Explain expert GRASP with suitable example.
- b) Explain MVC model.
- c) Give structure & participants of Factory method design pattern.
- d) What are the categories of 'pattern'.
- e) What is coupling? "Low coupling is desirable". Comment.

**P.T.O**

**Q3)** Attempt the following any four):

**[4×4=16]**

- a) Consider a class TCP connection that represents a network connection. A TCP connection object can be established listening closed. When TCP connection object receives requests from other objects it responds differently depending on whether it is established listening closed. For example the effect of open Request is depending upon whether connection is closed or established.

Select the most appropriate design pattern to address the about problem. Give structure & participants for this applicable pattern.

- b) Explain Iterative development.
- c) Explain pipes & filter architectural style.
- d) Give structure & participants of observer design pattern.
- e) Discuss Layered system architectural style “Layered system supports for enhancement and reuse”. Comment.

**Q4)** Attempt the following (any four):

**[4×4=16]**

- a) Explain Heterogeneous architecture.
- b) Draw structure and write participants of command design pattern.
- c) Give Intent and applicability of abstract factory Method design pattern.
- d) Explain interpreters in brief.
- e) Explain module based architectural structure.

**Q5)** Attempt the following any four:

**[4×4=16]**

- a) Why architecture is important.
- b) Write note on Espresso framework and cocoon framework.
- c) Discuss architectural structures & views.
- d) Give structure & participants of Adapter design pattern.
- e) Give applicability & collaborations of singleton design pattern

□□□

Total No. of Questions : 8]

SEAT No. :

**P1259**

**[4638]-204**

[Total No. of Pages : 2

**M.C.A. - I (Under Science Faculty)**

**COMPUTER SCIENCE**

**CA - 204 : Computer Network  
(2013 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) *Attempt any 5 of the following.*
- 2) *Neat diagram must be drawn whenever necessary.*
- 3) *Figure to the right indicates full marks.*

**Q1)** Attempt all of the following:

**[4 + 4 + 2 = 10]**

- a) What is router? Explain the different types of routing algorithm.
- b) Explain the serial transmission mode.
- c) What is hamming distance?

**Q2)** Attempt all of the following:

**[4 + 4 + 2 = 10]**

- a) Describe the various applications of computer network.
- b) Differentiate between pure and slotted ALOHA.
- c) What is pipelining?

**Q3)** Attempt all of the following:

**[4 + 4 + 2 = 10]**

- a) Distinguish between circuit switching and packet switching.
- b) An analog voice signal is digitized by sampling it 8000 times per second. The digital signal contains 256 levels. Calculate the bit rate.
- c) Define the following terms:
  - i) Polling.
  - ii) Token Passing.

**P.T.O.**

**Q4)** Attempt all of the following: **[4 + 4 + 2 = 10]**

- a) Explain the following addresses.
  - i) Physical
  - ii) Logical
  - iii) Port
  - iv) Specific
- b) Write a Short note on CSMA/CD protocol.
- c) Define the following:
  - i) Attenuation
  - ii) Jitter

**Q5)** Attempt all of the following: **[4 + 4 + 2 = 10]**

- a) Write a short note on Code division multiple access.
- b) Compare wireless LAN and Bluetooth.
- c) What is minimum and maximum Ethernet frame length?

**Q6)** Attempt all of the following: **[4 + 4 + 2 = 10]**

- a) Explain in detail the IPV4 header structure.
- b) Write a short note on Go-back N protocol.
- c) Give any two applications of UDP.

**Q7)** Attempt all of the following: **[5 + 5 = 10]**

- a) Explain in brief about the layers present in the OSI model.
- b) Explain the line coding process used for converting digital data to digital signal.

**Q8)** Attempt all of the following: **[5 + 5 = 10]**

- a) Explain the salient features of SMTP protocol.
- b) Explain in detail the role of DNS.



Total No. of Questions : 5]

SEAT No. :

**P1238**

**[4638]-24**

[Total No. of Pages : 3

**M.C.A. - I (Science Faculty)**

**COMPUTER SCIENCE**

**CS - 205 : Database Management System**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 80*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Assume appropriate data, if necessary.*

**Q1)** Attempt all of the following:

**[8 × 2 = 16]**

- a) What is functional dependency?
- b) State the purpose and syntax of IN clause in SQL.
- c) What is Query Language? State any two categories.
- d) Explain how to test conflict serializability.
- e) Define:
  - i) Super Key
  - ii) Candidate Key
- f) State wait-die scheme for deadlock prevention.
- g) Define trivial dependencies.
- h) What is a lock?

**Q2)** Attempt any four of the following:

**[4 × 4 = 16]**

- a) Consider the following database:  
Employee (empno, empname, salary, desg)  
Department(deptno, deptname, location)  
Create RDB and solve the query where employee and department are related with many to one relation.
  - i) find employee who are working at Pune location.
  - ii) find the maximum and average salary for ever designation.

**P.T.O.**

- b) Define a view. State its purpose. Discuss with syntax how to create and delete a view.
- c) Explain Strong entity set and weak entity set in detail.
- d) Find 3NF decomposition of given relation schema and FD's Banker-info = (branch-name, cust-name, banker-name, off-no)  
 FD's are: {banker-name  $\rightarrow$  branch-name, off-no, cust-name, branch-name  $\rightarrow$  banker-name}.
- e) What are the disadvantages of file processing?

**Q3)** Attempt any four of the following:

**[4 × 4 = 16]**

a)

| $T_1$                                                                        | $T_2$                                |
|------------------------------------------------------------------------------|--------------------------------------|
| Read (X)<br>$X = X - m$<br>Write (X)<br>Read (Y)<br>$Y = Y + m$<br>Write (Y) | Read (X)<br>$X = X + n$<br>Write (X) |

Consider given serial schedule. Give two non-serials schedules which are serializable to given schedule ( $T_1, T_2$ )

- b) Explain Aggregation with an example.
- c) What is transaction? Explain states of transactions with diagram.
- d) Explain Armstrong's axioms required to compute F+.
- e) What is Data model? State different data model.

**Q4)** Attempt any four of the following:

**[4 × 4 = 16]**

- a) Following is the list of the events in an interleaved execution of set of transaction  $T_1, T_2, T_3, T_4$  with 2PL

Is there deadlock in the system? If yes which transaction are involved in deadlock.

| Time  | Transaction | Code        |
|-------|-------------|-------------|
| $t_1$ | $T_1$       | Lock (A, X) |
| $t_2$ | $T_2$       | Lock (B, S) |
| $t_3$ | $T_3$       | Lock (A, S) |
| $t_4$ | $T_4$       | Lock (B, S) |
| $t_5$ | $T_1$       | Lock (B, X) |
| $t_6$ | $T_2$       | Lock (C, X) |
| $t_7$ | $T_3$       | Lock (D, S) |
| $t_8$ | $T_4$       | Lock (D, X) |

- b) What are different types of integrity constraints that can be specified on database?
- c) What do you mean by serial and concurrent schedule? Give advantages of concurrent schedule.
- d) What are different types of database user?
- e) Explain encryption. What is public - key encryption?

**Q5)** Attempt any four of the following:

**[4 × 4 = 16]**

- a) Explain in detail lossless join decomposition.
- b) Explain 3 levels of abstraction of DBMS with diagram.
- c) Consider the relation  $R = \{A, B, C, G, H, I\}$  and set of FD's defined on  $F = \{A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H\}$  compute the closer of the  $F^+$ .
- d) What are different data types in SQL?
- e) Explain Time Stamp Based Protocol in detail.





Total No. of Questions : 8]

SEAT No. :

**P2059**

[Total No. of Pages : 3

[4639] - 204

**M.Tech.**

**INDUSTRIAL MATHEMATICS WITH COMPUTER APPLICATIONS**

**MIM - 204 : Object Oriented Programming With C++**

**(2013 Pattern) (Credit System) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks : 50*

*Instructions to the candidates:*

- 1) Answer any five questions out of eight questions.
- 2) Figures to the right indicate full marks.
- 3) Assume suitable data if necessary.

**Q1)** Attempt all of the following questions:

- a) What are different benefits of object-oriented programming? [4]
- b) Write a C++ program to illustrate the concept of pointers to objects.[4]
- c) i) Define constructor. [1]  
ii) Which header file provides a set of functions called manipulators?[1]

**Q2)** Attempt all of the following questions:

- a) Write a note on member dereferencing operators in C++. [4]
- b) A template in C++ can be considered as a kind of macro. Then what are the differences between them?  
Write general format of the class template. [4]
- c) Why do we need the preprocessor directive,  
# include <iostream>? Explain its use in brief? [2]

**P.T.O.**

**Q3)** Attempt all of the following questions:

- a) What is the application of the scope resolution operator :: in C++?  
Write a code as an example. [4]
- b) List out different characteristics of a friend function. [4]
- c) i) Find error, if any, in the following. [1]  

```
char * cp = vp; //vp is a void pointer
```

  
ii) Define Reference variable. [1]

**Q4)** Attempt all of the following questions:

- a) Define a copy constructor. Illustrate the use with an example. [4]
- b) Write a list of operators that cannot be overloaded as well as a list of operators where a friend function cannot be used. [4]
- c) i) How do the following two statements differ in operation? [1]  

```
cin >> c;
```

```
cin.get(c);
```

  
ii) State whether following statement is true/false. [1]  
  
“In multiple inheritance, the constructors are executed in the order of inheritance”.

**Q5)** Attempt all of the following questions:

- a) Write a note on error handling functions for file operations. [4]
- b) What are different manipulators for formatting the O/P in C++?  
Explain in brief. [4]
- c) Define Pure Virtual function. Give a syntax. [2]

**Q6)** Attempt all of the following questions:

- a) Explain - C++ exception handling mechanism. **[4]**
- b) Write a C++ program to read a text from the keyboard and displays the following information on screen in two columns. **[4]**
  - i) no. of lines
  - ii) no. of words
  - iii) no. of characters

Strings should be left-justified and numbers should be right -justified in a suitable field width.
- c) What is the advantage of using new operator as compared to the function malloc ( ) ? **[2]**

**Q7)** Attempt all of the following questions:

- a) Write a C++ program that declares a swap ( ) function template which will swap two values of a integer type of data. **[5]**
- b) Write a C++ program to define a class string. Use overloaded == operator to compare two strings. **[5]**

**Q8)** Attempt all of the following questions:

- a) Write a C++ program to create a matrix m[3] [3]. A read( ) function accepts matrix elements from user. Write a friend function trans which will accept matrix object as a parameter and calculate transpose of the matrix, stores the transpose in a new matrix object. The display ( ) member function displays the matrix elements. **[5]**
- b) Two files named 'source 1' and 'source 2' contain sorted list of integers. Write a C++ program that reads the contents of both the files and stores the merged list in sorted form in a new file named 'Target'. **[5]**



Total No. of Questions :5]

SEAT No. :

**P2036**

**[4639]-24**

[Total No. of Pages :4

**M.Tech.**

**MIM - 204: DATABASE FUNDAMENTALS (DBMS)**

**Industrial Mathematics with Computer Applications**

**(2008 Pattern) (Semester - II)**

*Time : 3 Hours]*

*[Max. Marks :80*

*Instructions to the candidates:*

- 1) Figures to the right indicates full marks.*
- 2) All questions are compulsory.*

**Q1)** Attempt any eight of the following:

**[16]**

- a) State four aggregate functions in SQL.
- b) State any two functions of DBA.
- c) Explain the following:
  - i) Super key
  - ii) Foreign key
- d) Explain order by clause in SQL with example.
- e) What is left outer join and right outer join?
- f) Explain the terms:
  - i) Multivalued Attributes
  - ii) Composite Attributes.
- g) How Derived Attribute is represented in SQL?
- h) State Third Normal form (3NF)
- i) Define: DBMS.
- j) What is DDL and DML?

**P.T.O.**

**Q2)** Attempt any four of the following: **[16]**

- a) State any four advantages of DBMS over file processing system.
- b) Explain union operation and set - difference operation from relational algebra with example.
- c) Write note on different database system uses.
- d) Explain the concepts of generalization and specialization in E-R model with examples.
- e) Explain: Functional Dependency.

**Q3)** Attempt any four of the following: **[16]**

- a) Construct a E-R diagram for a car insurance company whose customers own one-or-more car each. Each car associated with it zero or any number of associated accidents. Also information related to cars and customers is also recorded.
- b) Construct E-R diagram for bank enterprise with minimum four entity sets.
- c) Write a note on with clause from SQL.
- d) Consider the following database  
Person (driver-id, name, address)  
Car (license, model, year)  
Accident (report-no, date, location)  
Owns (driver-id, license)  
Participated (driver-id, license, report-no, damage-amount)  
Write SQL expressions for the following queries.
  - i) Find the total number of people who owned cars that were involved in accidents in 1989.
  - ii) Update the damage amount for the car with license number "AABB2000" in the accident with report number "AR2197" to Rs. 3000/-
- e) Explain the concepts project operation and generalized projection from relational algebra.

**Q4)** Attempt any Two of the following:

**[16]**

a) Consider the following database.

Employee (emp-no, empname, salary, commision, designation)

Department (Dept-no, deptname, location)

Employee and Department are related with many-one relation. Write SQL expressions for the following.

- i) Find the maximum and minimum salary for every department.
- ii) Find out employee details who are working at “Pune” location.
- iii) Print all employee details whose designation is “Accountant” and location is Nasik.
- iv) List Department wise list of employees.

b) Consider the following database.

Movie (mvno, mvname, releaseyear)

Actor (actno, actname)

The relationship is many-to-many from movie to Actor. Write SQL expressions for the following:

- i) Count the number of movies in which “salman” has acted.
- ii) Display movie details having more than 5 actors.
- iii) Find all movies of “Amitabh” that are released between the years 1975 and 1985 and starting with letter’s.
- iv) List actorwise list of movies along with release year and movie name.

c) consider the database

student (RollNo, name, marks)

Teacher (tno, tname)

Stud - Teacher (RollNo, tno)

Write Relational algebra expressions for the following queries.

- i) List the student to whom Mr. Pawar is teaching more than two subjects.
- ii) List all T.Y. students who have scored distinction in a subject thought by Mr. Patil.
- iii) List all teachers teaching C++.
- iv) Count classwise number of students.

**Q5)** Attempt any four of the following:

**[16]**

- a) Explain lossless Decomposition with example.
- b) What is closure of a attribute?

Let  $R = (A,B,C,G,H,I)$  and set of FD'S  $F = \{A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H\}$ .

Calculate  $(CG)^+$

Check whether AG is a super key or not?

- c) Explain: Aggregation.
- d) Consider the following database.

employee (empno, name, office, age)

books (isbn, title, authors, publisher)

borrowed (empno, isbn, data)

Write the following queries in relational algebra.

- i) Find the list of employees who have borrowed a book published by McGraw -Hill.
  - ii) Find the list of employees who have borrowed more than 5 books published by Mc-Graw - Hill.
- e) Explain Two-Tier and Three-Tier architecture of database.

*EEE*