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SEAT No. :

P801

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[5315]-401

T.Y. B.Sc. (Semester - IV)

MATHEMATICS

MT - 341 : Complex Analysis

(2013 Pattern) (Semester - IV) (Paper - I)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

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

Q1) Attempt any five of the following :

[10]

- a) Find the principal argument  $\text{Arg } z$  when  $z = (\sqrt{3} - i)^6$ .
- b) Show that limit of the function  $f(z) = \left(\frac{z}{z}\right)^2$  as  $z$  tends to 0 does not exist.
- c) Find singular points for the function  $f(z) = \frac{z^2 + 1}{(z + 2)(z^2 + 2z + 2)}$ .
- d) Show that when  $n = 0, \pm 1, \pm 2, \dots$ ,  $(-1)^{\frac{1}{\pi}} = e^{(2n+1)i}$
- e) Evaluate  $\int_C f(z) dz$  where  $f(z) = \frac{z+2}{z}$  and  $C$  is the semicircle  $z = 2e^{i\theta} (0 \leq \theta \leq \pi)$ .
- f) Find  $\int_C f(z) dz$  where  $f(z) = \frac{z}{e^z}$  and  $C$  is the circle  $|z| = 1$  in the positive sense.
- g) Show that the singular point of the function  $f(z) = \frac{1 - \cosh z}{z^3}$  is a pole. Determine the order  $m$  of the pole and corresponding residue  $B$ .

P.T.O.

**Q2)** Attempt any two of the following :

[10]

- a) Suppose that  $f(z) = u(x, y) + iv(x, y)$  and that  $f'(z)$  exists at a point  $z_0 = x_0 + iy_0$ . Then, show that the first order partial derivatives of  $u$  and  $v$  must exist at  $(x_0, y_0)$  and they must satisfy the Cauchy Riemann equations  $u_x = v_y, u_y = -v_x$  there. Also, show that  $f'(z_0) = u_x + iv_x$  where the partial derivatives are calculated at  $(x_0, y_0)$ .
- b) Let  $f(z)$  be an analytic function in a domain  $D$  such that  $|f(z)|$  is constant throughout  $D$ . Prove that  $f(z)$  must be constant throughout  $D$ .
- c) Find the four roots of the equation  $z^4 + 4 = 0$  and use them to factor  $z^4 + 4$  into quadratic factors with real coefficients.

**Q3)** Attempt any two of the following :

[10]

- a) Show that  $u(x, y) = \sinh x \sin y$  is harmonic in some domain and find its harmonic conjugate  $v(x, y)$ .
- b) Show that for all  $z$     a)  $\overline{\sin z} = \sin \bar{z}$     b)  $\overline{\cos z} = \cos \bar{z}$ .
- c) Write the two Laurent series in powers of  $z$  that represent the function

$$f(z) = \frac{1}{z(1+z^2)} \text{ in certain domain and specify those domains.}$$

**Q4)** Attempt any one of the following :

[10]

- a) i) State and prove the Cauchy integral formula.
- ii) Show that if  $C$  is the boundary of the triangle with vertices at the points  $0, 3i$  and  $-4$  oriented in the counterclockwise direction then

$$\left| \int_C (e^z - \bar{z}) dz \right| \leq 60.$$

- b) i) Let  $f$  be continuous in a domain  $D$ . If  $\int_C f(z) dz = 0$  for every closed contour lying in  $D$ , then show that  $f$  is analytic throughout  $D$ .
- ii) Using the Cauchy's residue theorem evaluate the integral of  $f(z) = \frac{z+1}{z^2-2z}$  around the circle  $|z|=3$  in the positive sense.



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T.Y. B.Sc. (Semester - IV)

MATHEMATICS

MT - 342 : Real Analysis - II

(2013 Pattern)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

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

Q1) Attempt any five of the following : [10]

a) Let  $f(x) = x^2 (0 \leq x \leq 1)$ . for each  $n \in I$ , let  $\sigma_n$  be the subdivision

$\left\{0, \frac{1}{n}, \frac{2}{n}, \dots, \frac{n}{n}\right\}$  of  $[0, 1]$ . Compute  $\lim_{n \rightarrow \infty} \bigcup [f; \sigma_n]$ .

b) True or false? If  $f \in R[a, b]$  and if  $f(x) = g(x)$  except for a finite number of points  $x \in [a, b]$ , then  $g \in R[a, b]$ . Justify your answer.

c) Give an example of a sequence of real valued functions that converges pointwise but not uniformly justify.

d) Show that the series  $\sum_{n=1}^{\infty} e^{-nx} x^n (0 \leq x \leq 10)$  is uniformly convergent on  $[0, 10]$ .

e) If  $F$  is continuous on  $[a, b]$  such that  $f(x) > 0, a \leq x \leq b$  and if

$f(x) = \int_a^x f(t) dt, a \leq x \leq b$ , then prove that  $F$  is strictly increasing on  $[a, b]$ .

f) Show that  $\int_1^{\infty} \frac{1}{\sqrt{x}} dx$  is divergent.

g) Prove that  $\int_0^1 \frac{dx}{x^2 + x^{1/2}}$  is convergent.

P.T.O.

**Q2)** Attempt any two of the following :

**[10]**

- a) If  $a < b$ , prove that  $[a, b]$  can not be covered by a finite number of open intervals whose lengths add upto less than  $b-a$ . Hence deduce that  $[a, b]$  is not of measure zero.
- b) Let  $f$  be a bounded function on the closed bounded interval  $[a, b]$ . Then prove that  $f \in R[a, b]$  if and only if for each  $\epsilon > 0$ , there exists a subdivision  $\sigma$  of  $[a, b]$  such that  $U[f; \sigma] < L[f; \sigma] + \epsilon$ .
- c) Let  $\{f_n\}_{n=1}^{\infty}$  be a sequence of real-valued functions on a metric space  $M$  which converges uniformly to the function  $f$  on  $M$ . If each  $f_n$  is continuous at  $a \in M$ , then prove that  $f$  is also continuous at  $a$ .

**Q3)** Attempt any two of the following :

**[10]**

- a) Let  $f$  be a non-increasing function on  $[1, \infty]$  such that  $f(x) \geq 0$  for  $1 \leq x < \infty$ . Prove that  $\sum_{n=1}^{\infty} f(n)$  will converge if  $\int_1^{\infty} f(x) dx$  converges and  $\sum_{n=1}^{\infty} f(n)$  will diverge if  $\int_1^{\infty} f(x) dx$  diverges.
- b) Let  $\sum_{k=1}^{\infty} u_k$  be a series of functions in  $R[a, b]$  which converges uniformly to  $f$  on  $[a, b]$ . Then prove that  $f \in R[a, b]$  and  $\int_a^b f(x) dx = \sum_{k=1}^{\infty} \int_a^b u_k(x) dx$ .
- c) Prove that  $\frac{2\pi^2}{9} \leq \int_{\pi/6}^{\pi/2} \frac{2x}{\sin x} dx \leq \frac{4\pi^2}{9}$ .

**Q4)** Attempt any one of the following :

**[10]**

- a) i) State and prove the second fundamental theorem of calculus.
- ii) If  $f$  is continuous on  $[a, b]$ , prove that there exists  $c \in (a, b)$  such that  $\int_a^b f(x)dx = f(c).(b - a)$ .
- b) i) Let  $f$  be a uniformly continuous real-valued function on  $(-\infty, \infty)$  and for each  $n \in I$ , Let  $f_n(x) = f\left(x - \frac{1}{n}\right)$   $(-\infty < x < \infty)$ . Prove that  $\{f_n\}_{n=1}^{\infty}$  converges uniformly on  $(-\infty, \infty)$ .
- ii) Find the Cauchy principal value of  $I = \int_{-1}^4 \frac{dx}{(x-1)^3}$ .



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P803

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T.Y. B.Sc. (Semester - IV)

MATHEMATICS

MT - 343 : Problem Course Based on MT 341 and MT 342  
(2013 Pattern) (Paper - III)

Time : 2 Hour]

[Max. Marks : 40

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.
- 4) The answer books of both sections tie together.

**SECTION - I**

**(Complex Analysis)**

**Q1) a)** Attempt any three of the following : **[6]**

i) If  $f(z) = \bar{z}$  then show that  $f'(z)$  does not exist at any point  $z$ .

ii) Show that  $f(z) = (3x + y) + i(3y - x)$  is an entire function.

iii) Show that  $\int_{|z|=1} \frac{z^2}{z-3} dz = 0$ .

iv) Find the residue at  $z = 1$  of the function  $f(z) = \frac{z}{(z-1)(z+1)^2}$ .

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

i) Evaluate  $\int_C (z-1) dz$  where  $C$  is the arc from  $z = 0$  to  $z = 2$  consisting of

A) the semicircle  $z = 1 + e^{i\theta}$  ( $\pi \leq \theta \leq 2\pi$ ).

B) The segment  $z = x$  ( $0 \leq x \leq 2$ ) of the real axis.

**P.T.O.**

ii) Give two Laurent series expansions in powers of  $z$  for the function

$f(z) = \frac{1}{z^2(1-z)}$  and specify the regions in which those expansions are valid.

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

- a) Show that  $u(x, y) = 2x(1 - y)$  is harmonic in some domain and find its harmonic conjugate  $v(x, y)$ .
- b) Find all roots of  $\sin z = \cosh 4$ .
- c) Evaluate the integral.

$$\int_C \frac{(3z + 2)^2}{z(z-1)(2z+5)} dz$$

When  $C$  is the circle  $|z| = 3$ , described in the positive sense.

### **SECTION - II**

#### **(Real Analysis - II)**

**Q3)** a) Attempt any three of the following : **[6]**

i) Compute  $w[f; x]$  for all  $x \in [0, 1]$  for the characteristic function  $f$  of the set of rationals in  $[0, 1]$ .

ii) If  $0 \leq x \leq 1$ , show that  $\frac{x^2}{\sqrt{2}} \leq \frac{x^2}{\sqrt{1+x}} \leq x^2$ .

iii) Prove that  $\int_2^{\infty} \frac{dx}{\sqrt{x^2-1}}$  diverges.

iv) Let  $f_n(x) = \frac{x^n}{n}$  ( $0 \leq x \leq 1$ )

show that  $\{f_n\}_{n=1}^{\infty}$  converges uniformly to 0 on  $[0, 1]$ .



b) Attempt any one of the following : [4]

i) If  $f \in R[0,1], \sigma_n = \left\{0, \frac{1}{n}, \frac{2}{n}, \dots, \frac{n}{n}\right\}$  and

$\lim_{n \rightarrow \infty} U[f; \sigma_n] = \lim_{n \rightarrow \infty} L[f; \sigma_n] = A$ , then prove that  $\int_0^1 f(x) dx = A$ .

ii) Discuss the uniform convergence of

$$h_n(x) = \frac{nx}{1+n^2x^2} \quad (-\infty < x < \infty)$$

**Q4)** Attempt any two of the following : [10]

a) For  $f(x) = \sin x \quad \left(0 \leq x \leq \frac{\pi}{2}\right)$  and  $\sigma_n = \left\{0, \frac{\pi}{2n}, \frac{2\pi}{2n}, \dots, \frac{n\pi}{2n}\right\}$ ,

compute  $U[f; \sigma_n]$  Hence find  $\lim_{n \rightarrow \infty} U[f; \sigma_n]$ .

b) Let  $g_n(x) = \frac{1}{n} e^{-nx} \quad (0 \leq x < \infty)$

Prove that  $\{g_n\}_{n=1}^{\infty}$  converges uniformly to 0 on  $[0, \infty)$ .

c) Discuss the convergence of the series  $\sum_{n=2}^{\infty} \frac{1}{n(\log n)^\alpha}$  where  $\alpha > 0$ .



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SEAT No. :

P804

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[5315]-404

T.Y. B.Sc. (Semester - IV)

MATHEMATICS

MT - 344 : Ring Theory

(2013 Pattern) (Paper - IV)

Time : 2 Hour]

[Max. Marks : 40

Instructions to the candidates:

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

Q1) Attempt any five of the following :

[10]

- a) Find all zeros of  $x^3 + 2x + 2$  in  $Z_7$ .
- b) Give an example of finite non-commutative ring.
- c) Define unit of a ring. find all units in  $Z$ .
- d) In  $Z[i]$ , show that 5 is not irreducible.
- e) Determine whether the polynomial  $8x^3 + 6x^2 - 9x + 24$  is irreducible over  $Q$ . Justify.
- f) Give an example to show that a factor ring of an integral domain may have divisors of zero.
- g) Find all prime ideals of  $Z_{12}$ .

Q2) Attempt any two of the following :

[10]

- a) If  $R$  is a ring with additive identity  $0$ , then prove that for any  $a, b \in R$  we have
  - i)  $0.a = a.0 = 0$
  - ii)  $a.(-b) = (-a).b = -(a.b)$

P.T.O.

- b) Let  $f(x) \in F[x]$ , and let  $f(x)$  be of degree 2 or 3. Then prove that  $f(x)$  is reducible over  $F$  if and only if it has zero in  $F$ .
- c) Using Fermat's theorem, find the remainder of  $3^{245}$  when it is divided by 7.

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

- a) Prove that a non zero ideal  $\langle p(x) \rangle$  of  $F[x]$  is maximal if and only if  $p(x)$  is irreducible over  $F$ .
- b) Let  $P$  be an ideal of a commutative ring  $R$  with unity. Prove that  $R/P$  is an integral domain if and only if  $P$  is prime.
- c) Let  $R = \{a + b\sqrt{2} \mid a, b \in \mathbb{Z}\}$  and let  $R'$  consist of all  $2 \times 2$  matrices of the form  $\begin{bmatrix} a & 2b \\ b & a \end{bmatrix}$  for  $a, b \in \mathbb{Z}$ . Then show that  $\phi: R \rightarrow R'$  where  $\phi(a + b\sqrt{2}) = \begin{bmatrix} a & 2b \\ b & a \end{bmatrix}$  is an isomorphism.

**Q4)** Attempt any one of the following : **[10]**

- a) i) If  $D$  is a UFD, then prove that a product of two primitive polynomials in  $D[x]$  is primitive.
- ii) If  $P$  is a prime, then show that  $\mathbb{Z}_p$  has no divisors of zero.
- b) i) Prove that every PID is a UFD.
- ii) Let  $R = \{0, 2, 4, 6, 8\}$  under addition and multiplication modulo 10. Write addition and multiplication table for  $R$ . Is  $R$  a field? Explain.



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SEAT No. :

P805

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T.Y. B.Sc. (Semester - IV)

MATHEMATICS

MT - 345 : Partial Differential Equations

(2013 Pattern) (Paper - V)

Time : 2 Hour]

[Max. Marks : 40

Instructions to the candidates:

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

Q1) Attempt any Five of the following :

[10]

- a) Test the integrability of the following equation :  
 $(1 + yz)dx + x(z - x)dy - (1 + xy)dz = 0$ .
- b) Eliminate arbitrary function F from the equation  $z = F(xy / z)$  and find the corresponding partial differential equation.
- c) Define the term : 'The singular integral'.
- d) Find the integral curves of  $\frac{dx}{x} = \frac{dy}{y} = \frac{dz}{z}$ .
- e) Find the general integral of  $xp + yq = z$ .
- f) Find the complete integral of  $z = px + qy + pq$ .
- g) Define the term : 'Integrating factor'.

Q2) Attempt any two of the following :

[10]

- a) Define homogeneous pfaffian differential equation in three variables. Also explain method of solving it.
- b) Verify that the equation  $(y + z)dx + (z + x)dy + (x + y)dz = 0$  is integrable and solve it.
- c) Find the orthogonal trajectories on the conicoid  $(x + y)z = 1$  of the conies in which it is cut by the system of planes  $x - y + z = k$  where  $k$  is parameter.

P.T.O.

**Q3)** Attempt any two of the following :

[10]

- a) State and prove a necessary and sufficient condition that there exists between two functions  $u(x, y)$  and  $v(x, y)$  a relation  $F(u, v) = 0$ , not involving  $x$  or  $y$  explicitly is that  $\frac{\partial(u, v)}{\partial(x, y)} = 0$ .
- b) Find integral curves of the equation.

$$\frac{dx}{xz - y} = \frac{dy}{yz - x} = \frac{dz}{1 - z^2}.$$

- c) Find complete integral of  $z(p^2 + q^2) + px + qy = 0$ .

**Q4)** Attempt any one of the following :

[10]

- a) i) Show that there always exists an integrating factor for a pfaffian differential equation in two variables.
- ii) Explain Charpit's method of finding complete integral of first order partial differential equation.
- b) i) Solve  $x^2 u_x - u_y^2 - \alpha u_z^2 = 0$  by Jacobi's method.
- ii) Show that the equations.

$$f = p^2 + q^2 - 1 = 0$$

$$g = (p^2 + q^2)x - pz = 0$$

are compatible and find the one-parameter family of common solutions.



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SEAT No. :

P806

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T.Y. B.Sc.

MATHEMATICS

MT - 346 : Problem Course Based on MT - 344 and MT - 345  
(2013 Pattern) (Paper - VI) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Answer to the two sections should be written in separate answer books.
- 4) Tie answer books of both sections together.

**SECTION - I**

(Ring Theory)

**Q1) a)** Attempt any three of the following : **[6]**

- i) Find all solution of the congruence  $2x = 6 \pmod{4}$ .
- ii) State the characteristics of  $Z_5$  and  $5Z$ .
- iii) Does there exist an integral domain of characteristic 6? if so, give an example.
- iv) List all polynomials of degree 3 in  $Z_2[x]$

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

- i) Find the sum and product of the polynomials  
 $f(x) = 4x-5$ ,  $g(x) = 2x^2 - 4x + 2$  in  $Z_8[x]$ .
- ii) Prove that if  $p$  is a prime in an integral domain  $D$ , then  $p$  is an irreducible.

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

- a) Show that the boolean ring is commutative.
- b) Find the remainder of  $49!$  modulo 53
- c) Let  $D$  be a Euclidean domain and let  $v$  be a euclidean norm on  $D$ . Show that if  $a$  and  $b$  are associates in  $D$ , then  $v(a) = v(b)$ .

**P.T.O.**

**SECTION - II**  
(Partial Differential Equations)

**Q3) a)** Attempt any three of the following : **[6]**

i) Find the integral curves of the equations

$$\frac{dx}{z-y} = \frac{dy}{x-z} = \frac{dz}{y-x}$$

ii) Solve the differential equation

$$a^2 y^2 z^2 dx + b^2 x^2 z^2 dy + c^2 x^2 y^2 dz = 0$$

by variable separable method.

iii) Find the general integral of

$$yzp + xzq = xy$$

iv) Find a complete integral of Clairaut's partial differential equation.

$$z = px + qy + pq$$

v) Show that the differential equation

$$(2x + y^2 + 2xz) dx + 2xy dy + x^2 dz = 0$$

is integrable.

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

i) Show that the differential equation

$$z y dx - z x dy - y^2 dz = 0$$
 is integrable and find its primitive.

ii) Find the general solution of

$$y^2 p - xyq = x(z - 2y)$$

**Q4)** Attempt any two of the following: **[10]**

i) Find the complete integral by Jacobi's method

$$P_1 P_2 P_3 = z^3 x_1 x_2 x_3$$

ii) Find the complete integral of

$$p = (z + qy)^2$$

by using Charpit's method.

iii) Find the orthogonal trajectories of the family of parabola with vertices at origin and foci on y – axis.

$$x^2 = 4by, \text{ where } b \text{ is parameter.}$$



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SEAT No. :

P807

[Total No. of Pages : 3

[5315]-407

T.Y. B.Sc.

MATHEMATICS (Semester - IV)

MT - 347 (A) : Optimization Techniques

(2013 Pattern) (Paper - IV)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

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

Q1) Attempt any five of the following :

[10]

- a) Define the term Game.
- b) What are the type of failure in the replacement problem.
- c) In a game of matching coins, player A wins Rs.2 if there are two heads, nothing if there are two tails and losses Rs. 1 when there is one head and one tail. Determine the pay-offmatrix.
- d) Examine the following functions for extreme point.  
 $f(x) = x^4 + x^2$
- e) Draw the network for the following relationship.  
Event number : 0                      1    2,3    4    5    6  
Preceded by : start event      0    1    2,3    3    4,5
- f) Give any two characteristics of two person zero sum game.
- g) What do you mean by no passing rule in sequencing problem?

Q2) Attempt any two of the following :

[10]

- a) We have a nine jobs each of which has to go through the machines  $M_1$  and  $M_2$  in the order  $M_1 - M_2$ . Processing time (in hours) are given as:

Jobs :	$J_1$	$J_2$	$J_3$	$J_4$	$J_5$	$J_6$	$J_7$	$J_8$	$J_9$
Mahine $M_1$ :	2	5	4	9	6	8	7	5	4
Machine $M_2$ :	6	8	7	4	2	9	3	8	11

Determine a sequence of these jobs that will minimize the total elapsed time.

Also find the idle time for machine  $M_2$ .

P.T.O.



- b) A fleet owner finds from his past records that the cost per year of an auto whose purchase price is Rs. 10,000 are given below.

Year:	1	2	3	4	5	6	7	8
Running Cost(Rs.):	15,00	1900	2300	2900	3600	4500	5500	
Resale Value (Rs):	5000	2500	1250	600	400	400	400	

Determine the optimum period of replacement

- c) Solve the following non-linear programming problem by lagranges method.

$$f(x) = 2x_1^2 - 24x_1 + 2x_2^2 - 8x_2 + 2x_3^2 - 12x_3 + 200$$

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

Solve the following game using graphical method and find the value of the game.

		B			
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
A	A <sub>1</sub>	1	4	-2	-3
	A <sub>2</sub>	2	1	4	5

- b) Construct a network of project whose activities and their precedence relationship are as given below.

Activity	A	B	C	D	E	F
Predecessor	-	A	A	B	C	D,E

- c) Using dominance rule. Find the optimal strategies for player A and player B in the following game. Also determine the value of game.

		Player B			
		B <sub>1</sub>	B <sub>2</sub>	B <sub>3</sub>	B <sub>4</sub>
Player A	A <sub>1</sub>	19	6	7	5
	A <sub>2</sub>	7	3	14	6
	A <sub>3</sub>	12	8	18	4
	A <sub>4</sub>	8	7	13	-1

**Q4)** Attempt any one of the following : **[10]**

- a) A project consist of a series of tasks labeled A,B,C, --- H, I in the following relationships (constraints)  $A < D, E$ ;  $B, D < F$ ;  $C < G$ ;  $B < H$ ;  $F, G < I$ .

The time (in days) for each task is given below

Task	:	A	B	C	D	E	F	G	H	I
Time (in days):		23	8	20	16	24	18	19	4	10

- a) Draw a network diagram for the project  
 b) Find a critical path and project completion time.
- b) The data for a PERT network is given in the following table.

Predecessors	Successors	Time estimates		
<u>event i</u>	<u>event j</u>	<u>to</u>	<u>tm</u>	<u>tp</u>
10	- 20	6	9	12
10	- 50	4	7	8
20	- 30	14	17	20
20	- 40	7	10	13
20	- 50	3	5	9
30	- 70	13	18	25
40	- 60	10	14	16
40	- 70	12	15	18
50	- 60	9	11	12
60	- 70	17	20	25

- i) Draw a network for the project  
 ii) Compute the expected project completion time.



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P808

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T.Y. B.Sc. (Semester - IV)

MATHEMATICS (Paper - VII)

MT - 347 (B) : Differential Geometry

(New Course 2013 Pattern)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

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

Q1) Attempt any five of the following :

[10]

- a) Find a parametrisation of the level curve  $y^2 - x^2 = 1$ .
- b) Define curvature of a curve in  $\mathbb{R}^3$ .
- c) Show that the curve  $\bar{r}(t) = \left( \frac{1+t^2}{t}, t+1, \frac{1-t}{t} \right)$  is a plane curve.
- d) State frenet servet equation.
- e) Show that second fundamental form of a plane is zero.
- f) State isoperimetric inequality.
- g) Define geodesics.

Q2) Attempt any two of the following :

[10]

- a) Find the equation of the tangent plane of the following surface patch at  $(1,0,1)$   
 $\sigma(r,\theta) = (r \cosh\theta, r \sinh\theta, r^2)$
- b) Show that the quadric  $x^2 + 2y^2 + 6x - 4y + 3z = 7$  is a smooth surface with an atlas consisting of the single surface patch.
- c) Find the torsion of the circular helix  $r(\theta) = (a \cos\theta, a \sin\theta, b\theta)$ .

P.T.O.

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

- a) State and prove meusniers theorem
- b) Find the area of the interior of the ellipse  $\gamma(t) = (a\cos t, b\sin t)$ , where  $a$  and  $b$  are positive constants.
- c) Find the arc-length along the cycloid  $\gamma(t) = a(t - \sin t, 1 - \cos t)$ ,  $0 \leq t \leq 2\pi$ .

**Q4)** Attempt any one of the following : **[10]**

- a)
  - i) Show that every isometry is a conformal map. Give an example of a conformal map that is not an isometry.
  - ii) Define a reparametrization of a parametrized curve  $\gamma : (\alpha, \beta) \rightarrow \mathbb{R}^n$ . When you say that a point  $\gamma(t)$  of the curve  $\gamma$  is a regular point. Prove that any reparametrization of a regular curve is regular.
- b)
  - i) With usual notation, show that  $\|\sigma_u \times \sigma_v\| = (EG - F^2)^{1/2}$ .
  - ii) Prove that transition maps of a smooth surface are smooth.



Total No. of Questions : 4]

SEAT No. :

**P809**

[Total No. of Pages : 3

**[5315]-409**

**T.Y. B.Sc.**

**MATHEMATICS**

**MT - 347 (C) : C - Programming - II**

**(2013 Pattern) (Semester - IV) (Paper - VII)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

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

**Q1)** Attempt any five of the following.

**[10]**

- a) Name the four storage class specifications included in C.
- b) What kind of information is represented by a pointer variable?
- c) Explain the meaning of the following declaration  
  
`char *x[10];`
- d) Declare a one-dimensional floating-point array using pointer notation.
- e) Define a structure that contains an integer quantity called 'marks' and a floating point quantity called 'percentage'. Also include the user defined data type name within the definition.
- f) Associate the stream pointer 'fpt' with a new stream oriented data file called teacher.dat.' open the data file for writing only.
- g) What is the purpose of fclose() function?

**P.T.O.**

**Q2)** Attempt any two of the following.

**[10]**

- a) Write a short note on a structure.
- b) Explain automatic and external variables.
- c) The skeletal structure of a C-program is shown below.

```
void funct (int *p);  
  
main ( )  
{  
    Static int x[5] = {10, 20, 30, 40, 50};  
    -----  
    funct (x);  
    -----  
}  
  
void funct (int *p)  
{ int i, sum = 0;  
  for (i = 0; i<5; ++i)  
    sum += *(p+i);  
  printf ("sum = %d", sum);  
  return;  
}
```

- i) What kind of argument is passed to funct?
- ii) What kind of information is returned by funct?
- iii) What kind of formal argument is defined within funct?
- iv) What is the purpose of the for loop that appears within funct?
- v) What value is displayed by the printf statement within funct?

**Q3)** Attempt any two of the following :

**[10]**

- a) Write a short note on `fprintf( )` function
- b) Explain union with an example
- c) Write a C Program to generate successive fibonacci numbers.

**Q4)** Attempt any one of the following :

**[10]**

- a)
  - i) Describe the three bitwise operators. What is the purpose of each?
  - ii) Write a C program to read a line of lower case text and store in uppercase within a data file.
- b)
  - i) Explain passing structures to functions
  - ii) A C program contains the following declaration `static int x[5] = {20, 40, 60, 80, 100};`
    - a) What is the meaning of  $x$ ?
    - b) What is the meaning of  $(x + 2)$ ?
    - c) What is the value of  $*x$ ?
    - d) What is the value of  $(*x + 2)$ ?
    - e) What is the value of  $*(x+2)$ ?



Total No. of Questions : 4]

SEAT No. :

P810

[Total No. of Pages : 3

**[5315]-410**  
**T.Y. B.Sc.**  
**MATHEMATICS**  
**MT - 347 (D) : Graph Theory**  
**(2013 Pattern) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

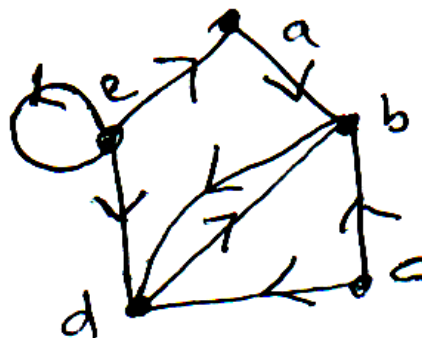
*Instructions to the candidates:*

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

**Q1)** Attempt any five of the following.

**[10]**

- a) Define bipartite graph and complete bipartite graph.
- b) Draw a self complementary graph with 5 vertices.
- c) Draw all trees with atmost 4 vertices.
- d) Prove that any tree with atleast two vertices is a bipartite graph.
- e) Give an example of a graph which is Eulerian but not Hamiltonian.
- f) Define randomly traceable Euler graph. Give one example of it.
- g) Find  $od(v)$  and  $id(v)$  for each of the vertex in the following graph.

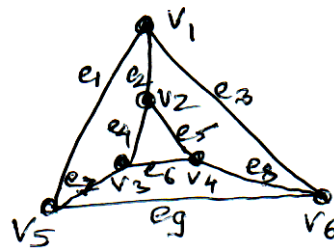


*P.T.O.*



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

- a) For any graph  $G$  with  $e$  edges and  $n$  vertices,  $v_1, v_2, \dots, v_n$ , prove that  $\sum_{i=1}^n d(v_i) = 2e$ . Also prove that in any graph  $G$ , there is an even number of odd vertices.
- b) Let  $G$  be a simple graph. Show that, if  $G$  is not connected then its complement  $\bar{G}$  is connected.
- c) Write down the adjacency matrix and incidence matrix for the following graph.

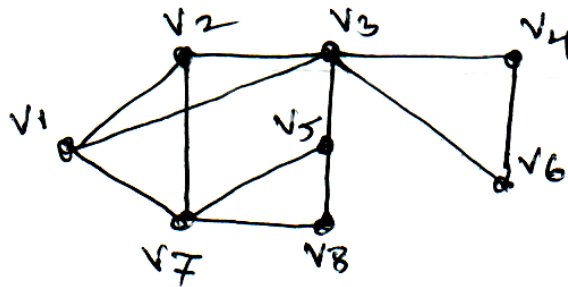


**Q3)** Attempt any two of the following : [10]

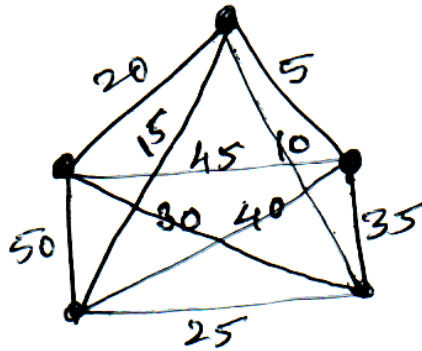
- a) Prove that, if  $T$  is a tree with  $n$  vertices then it has precisely  $n - 1$  edges.
- b) Prove that a graph is connected if and only if it has a spanning tree.
- c) Prove that a vertex  $v$  of a tree  $T$  is a cut vertex if and only if  $d(v) > 1$ .

**Q4)** Attempt any one of the following : [10]

- a) i) Let  $G$  be a graph in which the degree of every vertex is at least two. Prove that  $G$  contains a cycle.
- ii) Using the Hopcroft and Tarjan algorithm, find strongly connected orientation for the following graph.



- b) i) Carry out the two optimal method for the Travelling salesman problem for the following complete weighted graph.



- ii) Prove that every tournament  $T$  has a directed Hamiltonian path.



Total No. of Questions : 4]

SEAT No. :

P811

[Total No. of Pages : 2

[5315]-411

T.Y. B.Sc.

MATHEMATICS

MT - 347 (E) : Lebesgue Integration (Paper - VII)  
(2013 Pattern) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:-

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

Q1) Attempt any five of the following: [10]

- a) Define length of an open set  $G$  of  $[a, b]$ .
- b) Is the following statement true or false :  
If  $F$  is a closed subset of  $[a, b]$ ; and  $|F| = 0$ , then  $F = \phi$ .
- c) If  $E_1$  and  $E_2$  are measurable subsets of  $[0, 1]$  and if  $mE_1 = 1$ , Prove that  $m(E_1 \cap E_2) = mE_2$ .
- d) Let  $f$  be a function on  $[a, b]$  and  $P$  is a measurable partition of  $[a, b]$  such that  $U(f, P) = L(f, P)$ . Prove that  $f$  is Lebesgue integrable on  $[a, b]$ .
- e) If  $f(x) = \frac{1}{2} + \sin x$  ( $0 \leq x < 2\pi$ ) find  $f^+$ .
- f) If  $f(x) = \text{Log} \frac{1}{x}$  ( $0 < x \leq 1$ ) find  $\int f$ .
- g) Show that if  $f$  is an even function on  $[-\pi, \pi]$  and  $g$  is an odd function on  $[-\pi, \pi]$  then  $fg$  is an odd function on  $[-\pi, \pi]$ .

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

- a) If  $G$  is an open subset of  $[a, b]$ , then prove that  $G$  is measurable and  $mG = |G|$ .

P.T.O.

- b) If  $E_1$  and  $E_2$  are measurable subsets of  $[a, b]$ , then prove that  $E_1 \cup E_2$  and  $E_1 \cap E_2$  are also measurable. Also prove

$$mE_1 + mE_2 = m(E_1 \cup E_2) + m(E_1 \cap E_2)$$

- c) Prove that the characteristic function of Cantor set is in  $R[0, 1]$ .

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

- a) If  $f$  and  $g$  are measurable functions on  $[a, b]$ , then prove that  $f + g$  is also measurable function on  $[a, b]$ .

- b) Let  $f$  be a bounded function on  $[a, b]$ . If  $f \in R[a, b]$  then prove that

$$f \in L[a, b] \text{ and } R \int_a^b f = L \int_a^b f$$

- c) If  $f \in L[a, b]$ , if  $E \subset [a, b]$  and  $mE=0$ , show that  $\int_E f = 0$ .

**Q4)** Attempt any one of the following: **[10]**

- a) i) Find the Fourier series for  $f(x) = |x| (-\pi \leq x \leq \pi)$ .

- ii) Let  $E$  be any measurable subset of  $[a, b]$ .

If  $f \in L[a, b]$ ,  $g \in L[a, b]$  and if  $f(x)=g(x)$  almost every where ( $x \in E$ ),

then prove that  $\int_E g = \int_E f$ .

- b) i) If  $E$  is a measurable subset of  $[a, b]$  than prove that  $\int_E 1 = mE$ .

- ii) If  $f$  is a non-negative valued measurable function on  $[a, b]$  and if  $f(x) \leq g(x)$  ( $a \leq x \leq b$ ) where  $g \in L[a, b]$ , prove that  $f \in L[a, b]$ .



Total No. of Questions : 4]

SEAT No. :

P812

[Total No. of Pages : 2

[5315]-412

T.Y. B.Sc.

MATHEMATICS

MT - 347 (F) : Computational Geometry  
(2013 Pattern) (Semester IV)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:-

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

Q1) Attempt any five of the following: [10]

- a) Write the transformation matrix for reflection through the origin.
- b) Find the combined transformation matrix to create top view of an object.
- c) Write the transformation matrix for scaling in x, y and z coordinates by factors  $\frac{1}{2}$ ,  $\frac{1}{3}$  and 1 respectively.
- d) Find the value of  $\delta\theta$  to generate 10 points on the parabola  $x = \theta^2$ ,  $y = 2\theta$  in the first quadrant for  $1 \leq x \leq 4$ .
- e) If a square with sides 2cm is reflected through y axis then what is the area of transformed figure?
- f) Determine fore shortening factor  $f_x$  and  $f_y$  for the matrix

$$[T] = \begin{bmatrix} \frac{\sqrt{3}}{2} & \frac{\sqrt{2}}{4} & 0 & 1 \\ \frac{\sqrt{2}}{2} & 0 & 0 & 1 \\ \frac{1}{2} & -\frac{\sqrt{6}}{4} & 0 & 1 \end{bmatrix}$$

- g) Write the parametric equation of Be'zier curve with two control points.

P.T.O.

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

- a) Prove that the mid point of the line AB transform into the mid point of the line  $A^*B^*$  under any  $2 \times 2$  transformation matrix [T].
- b) Find the concatenated transformation matrix for the following sequence of transformation
  - i) Translation in x, y and z direction by  $-1, 2, 1$  units respectively.
  - ii) Scaling x and z coordinate by factor  $\frac{1}{3}$  and 2 units respectively.
  - iii) Reflection through the yz plane.
- c) Obtain the dimetric projection if a fore - shortening factor along z-direction is  $\frac{1}{2}$ .

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

- a) Find the cavalier and cabinet projection for  $\alpha = 25^\circ$  of the object

$$X = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 2 & 1 \end{bmatrix}$$

- b) The plane  $x + 2y + 2z = 0$  is to be rotated so that it coincides with the  $z=0$  plane. Determine the required angles of rotation about the x-axis and y-axis.
- c) Write an algorithm to generate equispaced n points of ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$

**Q4)** Attempt any one of the following: **[10]**

- a)
  - i) Consider the Be'zier curve determined by the control points  $B_0[4 \ 3]$ ,  $B_1[0 \ 1]$  and  $B_2[2 \ -1]$ . Find the first and second derivative of the curve at  $t = 0.3$ .
  - ii) Generate uniformly spaced 5 points on the circumference of the circle  $(x-2)^2+(y+1)^2=9$ .
- b) Reflect the triangle ABC with position vector  $[2 \ 4 \ 1]$ ,  $[4 \ 6 \ 1]$  and  $[2 \ 6 \ 1]$  through the line  $y = \frac{1}{2}x + 2$



Total No. of Questions : 4]

SEAT No. :

P813

[Total No. of Pages : 2

[5315]-413

T.Y. B.Sc.

PHYSICS

**PH - 341 : Classical Electrodynamics  
(2013 Pattern) (Semester IV) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All the questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of calculator & Log-table is allowed.*

**Q1)** Attempt all of the following (ONE mark each)

**[10]**

- a) Define the term : current density. Give its S.I. unit.
- b) What is meant by electric potential at a point?
- c) Write the equation of continuity in magnetostatics.
- d) What is a dielectric material?
- e) Define : Volume charge density. Give its S.I. unit.
- f) What is a polar molecule?
- g) State Ampere's circuital law.
- h) Define the term - magnetic vector potential.
- i) State Faraday's law in electromagnetic induction.
- j) Give the physical interpretation of 'poynting vector ( $\vec{P}$ )'.

**Q2)** Attempt any two of the following (5 marks each)

**[10]**

- a) Using Biot-Savart's law, derive an expression for magnetic induction due to a straight conductor, carrying a current 'I'; at a point near the conductor.

**P.T.O.**

- b) Show that  $\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$
- c) State Ampere's force law. Show that force between two current loops due to their mutual interaction is equal in magnitude and opposite in direction.

**Q3)** Attempt any two of the following (5 marks each) **[10]**

- a) Find the Magnitudes of vectors  $\vec{D}$  and  $\vec{P}$  for a dielectric material placed in an electric field of  $4 \times 10^5$  V/m.

[Given :  $\chi_e = 8, \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$ ]

- b) An electric field is given by  $E = E_0 \sin B_z \cos \omega t \hat{a}_z$ ; spread over in free space. Determine the corresponding charge density.
- c) Two long, parallel wires, separated by 3.5 cm in air carry currents of 0.8 A and 2.5 A in the same direction. Find the force per unit length of the wire. Also comment on nature of the force.

**Q4) A)** Attempt any one of the following (8 marks) **[8]**

- a) A dielectric material is kept in external electric field of intensity  $\vec{E}$ . Deduce an expression for electric potential at a point located outside the material.
- b) Show that, for a charge free, non-conducting medium, Maxwell's

equations lead to  $\nabla^2 \vec{E} = \frac{1}{C^2} \cdot \frac{\partial^2 \vec{E}}{\partial t^2}$  and  $\nabla^2 \vec{H} = \frac{1}{C^2} \cdot \frac{\partial^2 \vec{B}}{\partial t^2}$

**B)** Attempt any one of the following (2 marks) **[2]**

- a) Two point charges interact with a force of  $4 \times 10^{-3}$  N in a medium of dielectric constant 2. What would be the force, if the medium is changed to air, keeping other conditions same?
- b) Two straight conductors carry the same current of 0.5 A, and are separated by 2 mm, in air. Determine the force per unit length experienced by them.





Total No. of Questions : 4]

SEAT No. :

P814

[Total No. of Pages : 2

[5315]-414

T.Y. B.Sc.

PHYSICS

**PH - 342 : Quantum Mechanics  
(2013 Pattern) (Semester - IV) (Paper - II)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All the questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of calculator & Log-table is allowed.*

**Q1)** Attempt all of the following (one mark each)

**[10]**

- a) Write the formula for expectation value of momentum.
- b) Define raising and lowering operator.
- c) What is wave group?
- d) What is a free particle?
- e) Define degeneracy.
- f) Write the time-energy uncertainty relation.
- g) Define Hamiltonian operator.
- h) Write the Schrodinger's steady state equation.
- i) Represent infinite one dimensional potential well graphically.
- j) What is rigid rotator?

**Q2)** Attempt any two of the following (5 marks each)

**[10]**

- a) A ruby laser emits light of wavelength 693.4 nm. If this light is due to transition from  $n=2$  to  $n=1$  state of an electron in a one-dimensional box, find the width of the box

[Given :  $h = 6.625 \times 10^{-34}$  J -sec;  $c = 3 \times 10^8$  m/sec,  $m = 9.1 \times 10^{-31}$  kg]

**P.T.O.**

- b) The moment of inertia of HCl molecule is  $2.7 \times 10^{-40}$  gm-cm<sup>2</sup>. What would be the separation between  $l = 0$  and  $l = 1$  energy levels.
- c) Normalise the wave function

$$\psi(x) = Ae^{\frac{-x^2}{2a^2} + ikx}$$

Where A is normalisation constant. The range of x is from  $-\infty$  to  $+\infty$ .

**Q3)** Attempt any two of the following (5 marks each) **[10]**

- a) Show that the momentum operator  $-i\hbar \frac{\partial}{\partial x}$  is hermitian operator.
- b) Discuss a thought experiment of  $\gamma$  ray microscope to illustrate uncertainty relation.
- c) Show that the ladder operator  $L_+$  increases the eigen value of operator  $L_z$  by  $\hbar$ .

**Q4)** a) Attempt any one of the following **[8]**

- i) Using Schrodinger's steady state equation, obtain the energy eigen values and eigen functions for a particle in one-dimensional infinitely deep potential well.
- ii) Obtain equation of continuity and give its physical significance.

b) Attempt any one of the following **[2]**

- i) What is tunneling effect? Give any two applications of tunneling effect.
- ii) Calculate the de Broglie wavelength of an electron having momentum  $2.73 \times 10^{-23}$  kg-m/sec.



Total No. of Questions : 4]

SEAT No. :

P815

[Total No. of Pages : 3

[5315]-415

T.Y.B.Sc.

PHYSICS (Paper - III)

PH - 343 : Thermodynamics and Statistical Physics

(2013 Pattern) (Semester IV)

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All the questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagram wherever necessary.*
- 4) *Use of logtables and calculator is allowed.*

**Q1)** Attempt All of the following (One mark each):

**[10]**

- a) What are transport phenomena in gases?
- b) What is Binomial distribution?
- c) Define temperature of Inversion.
- d) What do you mean by microstate of a system.
- e) Define the term canonical ensemble.
- f) What are Fermions?
- g) Define probability of an event.
- h) What is partition function?
- i) What are symmetric wave functions?
- j) What is meant by thermodynamic probability of macrostate?

**P.T.O.**

**Q2)** Attempt any two of the following (Five marks each) **[10]**

- a) Derive an expression for the coefficient of viscosity ( $\eta$ ) of a gas in terms of mean free path of its molecules and discuss the effect of temperature on coefficient of viscosity.
- b) What is Jonle Thomson effect? Prove that Jonle Thomson coefficient

$$\mu = \frac{1}{C_p} \left[ T \left( \frac{\partial V}{\partial T} \right)_p - V \right]$$

- c) Derive Ganssian probability distribution equation.

**Q3)** Attempt any two of the following (Five marks each): **[10]**

- a) Consider the case of  $N = 100$  steps, where  $p = q = \frac{1}{2}$ . Find mean value of  $n_1$ , mean displacement and Root mean square deviation.
- b) In a system in thermal equilibrium at Temperature  $T$ , two states with energy difference  $5.52 \times 10^{-14}$  erg occur with relative probability 'e<sup>2</sup>' erg deg<sup>-1</sup>. Calculate the temperature. Given  $K = 1.38 \times 10^{-16}$  erg/deg.
- c) Three particles are to be distributed in four energy levels a, b, c and d. Calculate all possible whys of this distribution when particles are
- i) Classical particles and
  - ii) Fermions.

**Q4)** a) Attempt any one [Eight marks]: **[8]**

- i) Prove that for a homogeneous fluid,  $C_p - C_v = T \left( \frac{\partial P}{\partial T} \right)_v \left( \frac{\partial V}{\partial T} \right)_T$  and hence prove that for a perfect gas  $C_p - C_v = R$ . Where symbols have their usual meanings.
- ii) Compare M.B., B.E. and F.D. statistics.

b) Attempt any one [Two marks]: [2]

i) A bag contains 7 red balls, 9 white balls and 12 black balls. If a ball is drawn from the bag, what is the probability that it is either white or black?

ii) Establish the Gibbs - Helmholtz equation  $U = F - T \left( \frac{\partial F}{\partial T} \right)_v$ .



Total No. of Questions : 4]

SEAT No. :

P 816

[Total No. of Pages : 2

[5315]- 416

T.Y. B.Sc. (Semester - IV)

PHYSICS

PH - 344 : Nuclear physics (Paper - IV)

(2013 Pattern)

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of log table and calculator is allowed.*

**Q1)** Attempt all of the following (1 mark each):

**[10]**

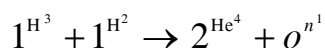
- a) State law of radioactive disintegration.
- b) What are hadrons?
- c) Define even parity.
- d) What is nuclear reaction?
- e) What is threshold voltage?
- f) List different types of particle accelerators.
- g) What are elementary Particles?
- h) What is nuclear reactor?
- i) Give the structure of neutron using Quark model.
- j) Radon has half life 3.8 days. Calculate its decay constant.

**Q2)** Attempt any two of the following :

- a) Determine the time required for 20% of uranium sample to disintegrate.  
Half life of uranium is  $4.51 \times 10^9$  years. **[5]**

**P.T.O**

- b) Calculate the energy released in the nuclear reaction.



Give : mass of  $1^{\text{H}^3} = 3.016049$  a.m.u.

Mass of  $1^{\text{H}^2} = 2.014102$  a.m.u.

Mass of  $2^{\text{He}^4} = 4.002603$  a.m.u.

Mass of  $0^{\text{n}^1} = 1.008665$  a.m.u. [5]

- c) The mass of deuteron ( $1^{\text{H}^2}$ ) nucleus is 2.013553 a.m.u. calculate the mass defect, packing fraction, binding energy and binding energy per nucleon.

Given : Mass of proton = 1.007825 a.m.u.

and mass of neutron = 1.008665 a.m.u. [5]

**Q3)** Attempt any two of the following :

- a) Explain in brief meson theory of nuclear forces. [5]
- b) What is linear accelerator? Describe with neat diagram principle and working of linear accelerator [5]
- c) Draw binding energy curve per nucleon against the mass number and write the conclusions that can be drawn from the curve. [5]

**Q4)** a) Attempt any one of the following :

- i) Draw a sketch of G.M. Counter. Explain its construction and working in detail. [8]
- ii) What is nuclear reactor? State the essential components of the reactor. With neat diagram describe power reactor. [8]
- b) Attempt any one of the following.
- i) Define specific activity and give its unit. [2]
- ii) Compute the mass of 1 curie of  $\text{C}^{14}$ . The half life of  $\text{C}^{14}$  is 5,700 years. [2]



Total No. of Questions : 4]

SEAT No. :

P 817

[Total No. of Pages : 4

[5315] - 417

T.Y. B.Sc.

PHYSICS

PH : 345 (A) : Electronics

(2013 Pattern) (Paper - V) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 40

*Instructions to the candidates:*

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

**Q1)** Attempt all (One mark each)

**[10]**

- a) State any two features of Ic 78xx.
- b) What do you mean by karnaugh map.
- c) Draw symbol of R-S flipflop.
- d) State any four parameters of an Ideal OPAMP.
- e) Define trip point.
- f) Draw symbol of P-channel JFET.
- g) State materials used for LED.
- h) Define duty cycle and conduction angle.
- i) What is mean by virtual ground?
- j) State schockly's equation.

**Q2)** Attempt any two

**[10]**

- a) Explain Ic 555 as an astable multivibrator. Derive necessary formula for frequency obtained at it's out put.
- b) What is multiplexure and de-multiplexure? Draw circuit diagram for 4 : 1 multiplexure
- c) Explain working of a 4-bit ripple / Asynchronous counter with suitable diagram.

**P.T.O.**



- Q3)** Attempt any two **[10]**
- a) Explain basic low voltage regulator using Ic 723. Draw suitable circuit diagram. Explain designing of low voltage regulator.
  - b) Explain construction of N-channel MOSFET. Draw it's transfer characteristics curves.
  - c) Explain OPAMP as differentiator. Derive necessary formula for it's output.

- Q4)** A) Attempt any one **[8]**
- a) What is register? State four possible modes of operation. Explain parallel in serial out mode (PISO) in detail with necessary diagram.
  - b) What is cross over distortion in Push Pull amplifier. draw the circuit diagram for class B push pull amplifier. How cross over distortion can be eliminated?

- B) Attempt any one **[2]**
- a) Define optocoupler and draw it's symbol
  - b) Draw block diagram of Ic555.



Total No. of Questions : 4]

P 817

[5315] - 417

T.Y. B.Sc. (PHYSICS)

**PH-345 (B) : Advanced Electronics  
(2013 Pattern) (Paper - V) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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 logtables and calculators is allowed.*

**Q1)** Attempt all of the following (1 Mark each)

**[10]**

- a) State the principle of liquid expansion thermo meters.
- b) What do you mean by linearization of a signal?
- c) State the seebeck effect in thermocouple.
- d) List the applications of laser
- e) What are the disadvantages of photovoltaic cell?
- f) How population inversion is achieved in laser?
- g) State any two features of instrumentation amplifier
- h) What do you mean by demultiplexer?
- i) Define the term resolution in DAC.
- j) What is discrete state control system?

**Q2)** Attempt any two of the following

- a) Explain the construction and working of narrow band pyrometer. **[5]**
- b) Describe principle, construction and working of photoemissive detector. **[5]**
- c) Explain opamp as a differentiator with the help of a neat diagram. **[5]**

**Q3)** Answer any two of the following .

- a) An Accelerometer has a seismic mass of 0.05 kg and a spring constant of  $3 \times 10^3$  N/m. Calculate the maximum measurable acceleration in 'g' and the natural frequency if maximum mass displacement is  $\neq 0.02$ m. **[5]**
- b) Explain various performance parameters of DAC. **[5]**
- c) Estimate the binary, octal and hex equivalents of  $0.3125_{10}$ . **[5]**

**Q4)** a) Attempt any one of the following

- i) What are filter circuits? Discuss the RC filters with reference to their frequency response. **[8]**
  - ii) Draw the block diagram of process control system. Explain each block in brief. **[8]**
- b) Attempt any one of the following
- i) Germanium has band gap of 0.67 ev. estimate the maximum wavelength for resistance change by photon absorption. **[2]**
  - ii) State the objectives of control system. **[2]**



Total No. of Questions : 4]

SEAT No. :

P 818

[Total No. of Pages : 12

[5315]-418

T.Y. B.Sc. (Semester - IV)

PHYSICS

PH - 346 (G) : Medical Electronics

(2013 Pattern) (Paper - VI)

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

**Q1)** Attempt all of the following :

**[10]**

- a) What do you mean by EMG?
- b) Define the term 'Diastole'.
- c) State the principle of spectrophotometry.
- d) Define CMRR.
- e) Give any two characteristics of medical instruments.
- f) What do you mean by EEG?
- g) State the two requirements of bioamplifiers.
- h) Define sensors.
- i) State disadvantages of flame photometer.
- j) State the principle of radiation sensor.

**Q2)** Attempt any two of the following :

**[10]**

- a) Explain the electrode- electrolyte interface with suitable examples.
- b) Explain the principle, construction and working of resistive sensors.
- c) Describe in detail isolation amplifier with circuit diagram.

**P.T.O.**

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

- a) Describe the basic medical instrumentation system with suitable examples.
- b) Describe in detail heart sound with suitable examples.
- c) Describe in detail the electrodes of ECG in brief.

**Q4)** a) Attempt any one of the following. **[8]**

- i) Describe in detail the direct method of B.P. measurement.
- ii) Describe in detail construction and working of calorimeter with suitable examples.

b) Attempt any one of the following : **[2]**

- i) Find the heart rate of patient if the distance between two consecutive peak is 10mm and chart speed of machine is 25 mm/s.
- ii) What do you mean by inductive sensor.



Total No. of Questions : 4]

**P 818**

**[5315]-418**

**T.Y. B.Sc. (Semester - IV)**

**PHYSICS**

**PH - 346 (H) : Physics of Nanomaterials**

**(2013 Pattern) (Elective - II) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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 log table and calculator is allowed.*

**Q1)** Attempt all of the following (One mark each) : **[10]**

- a) Name of the scientist who delivered the historical talk there is plenty of room at the bottom.
- b) State the classification of nanostructured materials.
- c) What is bottom-up approach?
- d) What are colloids?
- e) State any two types of sputter deposition.
- f) What is use of transmission electron microscope?
- g) What is mean by exciton?
- h) Define carbon nanotube.
- i) Define 'Quantum - dots'.
- j) State any two nanomaterial prominently used in cosmetics.

**Q2)** Attempt any two (Five marks each) : **[10]**

- a) Explain bottom up and top down approaches in nanomaterial synthesis.
- b) Describe construction and working of UV-Vis-NIR spectrometer.
- c) What are carbon nanotubes? How they are synthesized by electric arc discharge.

**Q3) Attempt any two (Five marks each) : [10]**

- a) Explain sol-gel methods of synthesis of nanomaterials.
- b) Explain Mechanical and Electrical properties of nanomaterials.
- c) Explain the applications of nanomaterials on cosmetic, space and defense.

**Q4) a) Attempt any one (Eight marks): [8]**

- i) Describe the brief history of nanomaterials and challenges in nanotechnology. Give its significance.
- ii) Explain in details :
  - 1) Scanning Electron Microscope
  - 2) Transmission Electron Microscope

**b) Attempt any one (Two marks) : [2]**

- i) Name of any two milestones in the development of nanotechnology.
- ii) State different types of colloids with its shape.



Total No. of Questions : 4]

**P 818**

**[5315]-418**

**T.Y. B.Sc. (Semester - IV)**

**PHYSICS**

**PH - 346 (I) : Microcontrollers  
(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Use of log table and calculator is allowed.*

**Q1)** Attempt all of the following. (One mark each) :

**[10]**

- a) How (-56) is represented in 8051 microcontroller?
- b) What is meant by half duplex data transfer?
- c) What is the function of stack pointer register?
- d) State the function of ALE pin of 8051 microcontroller.
- e) Define 'baud rate'.
- f) Compare the instruction LJMP with SJMP.
- g) What is meant by an assembly language?
- h) What is the length of memory address used in 8051?
- i) Explain the meaning of instruction CLRA of 8051.
- j) State the function of assembler directive ORG.

**Q2)** Attempt any two of the following:

**[10]**

- a) Explain with suitable example the different addressing modes of 8051 microcontroller.
- b) What is stack? Explain the operation of stack in 8051 microcontroller.
- c) Explain the interfacing of (2 line × 16) LCD to 8051 microcontroller with neat diagram.



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

- a) Write an 8051 assembly language program to multiply two numbers (8 bit) without using MUL instruction, such that these two numbers are in memory at 40H and 41H and store the result of lower byte in R2 register and higher byte in R3 register.
- b) Explain the various flags of 8051 microcontroller and their function.
- c) Write an 8051 assembly language program to subtract 67H from 89H using 2's complement of 67H. Store the result in R3 register.

**Q4)** a) Attempt any one of the following : **[8]**

- i) Draw the architecture of 8051 microcontroller. Explain the on-chip memory of 8051 microcontroller.
- ii)
  - 1) Explain the interrupts of 8051 microcontroller in brief.
  - 2) Explain the different logical instructions of 8051 microcontroller.

b) Attempt any one of the following : **[2]**

- i) Explain the instruction DA of 8051 microcontroller.
- ii) State the function of register data pointer (DPTR).



Total No. of Questions : 4]

P 818

[5315]-418

T.Y. B.Sc. (Semester - IV)

PHYSICS

PH - 346 (J) : Electro - Acoustics and Entertainment Electronics  
(2013 Pattern) (Paper - VI) (Elective - II)

Time : 2 Hours]

[Max. Marks : 40

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of log table and calculator is allowed.*

**Q1)** Attempt all of the following (One mark each) : **[10]**

- a) Sketch intensity level versus frequency curves representing threshold of audibility and threshold of feeling.
- b) Give the frequency theory of hearing.
- c) What is the significance of cut - off frequency in case of an exponential horn?
- d) What is meant by Hi-Fi?
- e) What is volume compressor?
- f) What is meant by directivity index of a microphone?
- g) What is a folded horn?
- h) Give typical frequency response of a carbon microphone.
- i) What is reverberation?
- j) What is coefficient of reflection?

**Q2)** Attempt any two (Five marks each) : **[10]**

- a) Write a short note on bass reflex cabinet.
- b) Distinguish between monophonic and stereophonic sound reproducing systems.
- c) Write a note on Digital Audio Tape.

**Q3)** Attempt any two (Five marks each) : **[10]**

- a) Draw a diagram showing construction of a moving coil microphone. Discuss the role of tubular vent at the lower chamber of a moving coil microphone.
- b) The frequency of mechanical response of a cone speaker is 60Hz. The stiffness of the cone system is  $1.85 \times 10^3$  N/m. Determine radiation reactance if total mass of the diaphragm and voice - coil is 11 gm.
- c) Find the reverberation time of an office which has a volume of 1600 m<sup>3</sup> and a total sound absorption of 100 metric sabines. What sound absorption will be required for an optimum reverberation time of 1.2 sec?

**Q4)** a) Attempt any one : **[8]**

- i) Explain the effect of voice - coil parameters on the acoustic output of direct radiator loudspeakers.
- ii) Discuss the digital audio CD parameters.

b) Attempt any one : **[2]**

- i) Distinguish between voiced and unvoiced sounds.
- ii) Write a note on equalizer.



Total No. of Questions : 4]

**P 818**

**[5315]-418**

**T.Y. B.Sc. (Semester - IV)**

**PHYSICS**

**PH - 346 (K) : Lasers**

**(2013 Pattern) (Elective - II) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of log table and calculator is allowed.*

**Q1)** Attempt all of the following (One mark each) : **[10]**

- a) Define metastable state.
- b) What is difference between laser light and normal light?
- c) State any two types of lasers.
- d) What is population of inversion?
- e) Give two types of liquid lasers.
- f) What is holography?
- g) Define spontaneous emission.
- h) Define active medium in laser.
- i) What is pumping?
- j) Give applications of lasers in defence.

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

- a) Write a short note on optical feedback.
- b) Explain the characteristics / properties of a laser beam.
- c) Give two techniques of pumping and explain three - level pumping scheme.

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

- a) Light from a sodium lamp, which is the traditional monochromatic source, has coherence length of about 0.3mm and bandwidth of about  $6\text{\AA}$ . Calculate wavelength of sodium light.
- b) What will be the reflectivity of other cavity mirror if the reflectance of first mirror is 100%? The length of the cavity is 15cm and gain factor of laser material is 0.0005 per cm.
- c) Find the ratio of population of the two states in a He - Ne lasers that produces light of wavelength  $6328\text{\AA}$  at  $27^\circ\text{C}$ .

**Q4)** a) Attempt any one of the following : **[8]**

- i) Explain the applications of lasers in mechanical industry.
- ii) Explain with neat diagram construction and working of  $\text{CO}_2$  laser . Also give its applications.

b) Attempt any one of the following : **[2]**

- i) Draw diagram of He-Ne laser.
- ii) What is stimulated emission.



Total No. of Questions : 4]

**P 818**

**[5315]-418**

**T.Y. B.Sc. (Semester - IV)**

**PHYSICS**

**PH - 346 (L) : Radiation Physics**

**(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

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

**Q1)** Attempt all of the following :

**[10]**

- a) What are X - rays?
- b) What is meant by Radioactive Isotopes?
- c) What are Radio waves?
- d) Define I - rad dose.
- e) State the materials used for radiation shielding.
- f) What are cosmic radiation?
- g) Define one mega electron voltage energy.
- h) Define attenuation coefficient.
- i) What is Fricke Dosimeter?
- j) Define lifetime of radioactive sources.

**Q2)** Attempt any two of the following :

**[10]**

- a) Explain the use of gamma rays in sterilization of medical instruments.
- b) Explain Interaction of UV & microwave radiation with matter.
- c) Explain various applications of X-rays in medical fields.

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

- a) Write a note on radioactive pharmaceuticals & labeled compounds.
- b) What do you mean by microwave & radio waves? Explain any one method for detection for microwave & radio waves.
- c) Explain the production of radioactive nuclides in nuclear reactors.

**Q4)** a) Attempt any one of the following : **[8]**

- i) Explain various laboratory sources of Infrared & UV- Visible radiation with details of energy spectrum.
- ii) What are different types of neutron sources based on radioactive sources? Explain any-one in detail.

b) Attempt any one of the following : **[2]**

- i) How gamma - rays are used for preservation of food.
- ii) Give any two applications of microwave in medical field.



Total No. of Questions : 4]

SEAT No. :

P819

[Total No. of Pages : 2

[5315]-419

T.Y. B.Sc

CHEMISTRY

CH-341: Physical Chemistry

(2013 Pattern) (Paper - I) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicates full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Use of calculator and logarithmic table is allowed.
- 5) Actual calculation must be shown while solving the problems.

Q1) Answer the following:

[10]

- a) Define plane of symmetry.
- b) State Heisenberg's uncertainty Principle.
- c) What is packing Fraction?
- d) What is anisotropic solid?
- e) What do you mean by temperature coefficient of emf?
- f)  ${}_{15}^{30}\text{P} \rightarrow {}_{14}^{30}\text{Si} + \dots\dots\dots$
- g) State the thermodynamics relationship of emf of a cell and  $\Delta G$ .
- h) The intercept by a crystal plane on the three crystallographic axes are 1,1,  $\infty$  What are the Miller indices of the plane?
- i) Write the Nernst equation for the following electrode reaction  $\text{Fe}^{2+} \rightleftharpoons \text{Fe}^{3+} + e^{-}$ .
- j) What is plateau voltage of G-M counter?

Q2) a) Answer any two of the following

[6]

- i) What is mean by wave function? State the condition for well behaved wave function.

P.T.O



- ii) Distinguish between reversible cell and irreversible cell.
- iii) Sketch 100, 110 and 111 planes in body centered cubic lattice.

b) Solve any one of the following. [4]

i) The emf of the cell



is 0.6753 volt at 25°C and 0.6915 at 0°C. Calculate  $\Delta G$ ,  $\Delta H$ , and  $\Delta S$  of the cell at 25°C. (F=96500 coulombs)

ii) Half life period of  $^{24}\text{Na}$  is 15 hours. In what time of period will a sample containing  $^{24}\text{Na}$  lose 75% of its radioactivity?

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

- a) What is crystallography? Explain law of constancy of interfacial angles and the law of elements of symmetry.
- b) Describe construction and working of standard hydrogen electrode.
- c) Derive the expression for the decay of radio element. Explain the term half life period.

**Q4)** a) What is tracers? Describe the use of tracers in structure determination and studying reaction mechanism. [6]

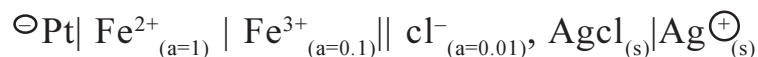
OR

Deduce the time independent Schrodinger wave equation.

b) Solve any one of the following. [4]

i) The element chromium exist as body-centered cubic lattice. The unit cell edge is 2.88Å. The density of chromium is 7.2 gcm<sup>-3</sup>. How many atoms does 52g of chromium contain.

ii) Calculate emf of the following cell at 25°C,



Given  $E^{\circ}_{\text{Fe}^{2+}|\text{Fe}^{3+}(\text{oxi})} = -0.7710\text{v}$

$E^{\circ}_{\text{Ag}|\text{Agcl}(\text{oxi.})} = -0.2330\text{v}$ .



Total No. of Questions : 4]

SEAT No. :

P820

[Total No. of Pages : 2

[5315]-420

T.Y. B.Sc

CHEMISTRY

CH-342: Inorganic Chemistry (Semester - IV)

(2013 Pattern) (Paper - II)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Actual calculations must be shown while solving the problems.
- 5) Use of log table and calculator is allowed.

Q1) Answer the following:

[10]

- a) Which catalyst is used in synthesis of acetic acid by monsanto process?
- b) Define 'unit cell'.
- c) Give any two applications of superconductors.
- d) Give general electronic configuration of actinides.
- e) Complete the reaction:  ${}_{92}^{238}\text{U} + {}_1^2\text{D} \rightarrow ? + {}_0^1\text{n}$ .
- f) Define radius ratio effect.
- g) What are metalloenzymes?
- h) Draw N(E) v/s E curve for univalent metal.
- i) Which catalyst is used in synthesis of TPA from xylene?
- j) What is the function of myoglobin?

Q2) a) Answer any two of the following

[6]

- i) Explain why FeO shows p-type semiconductivity when heated.
- ii) Write short note on; iron-sulphur protein.
- iii) What are transuranic elements? Explain neutron bombardment method for synthesis of transuranic elements.

P.T.O

- b) Answer any two of the following. [4]
- Explain biological role of sodium and potassium.
  - What is the effect of increase in temperature on conductivity of metal?
  - Write short note on, 'oxidation states of lanthanides.

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

- What is misch metal? How it is prepared? Give its properties and uses.
- Define radius ratio. Calculate limiting radius ratio for coordination number three and six.
- Explain the mechanism of polymerisation of ethylene by Zeigler-Natta catalyst.

**Q4)** a) What are extrinsic semiconductors? Explain n-type and p-type semiconductor with suitable example. [6]

OR

- Answer the following: [6]
  - Write mechanism of hydrogenation of alkene to alkane using Raney nickel catalyst.
  - Explain the structure of haem b.
- Calculate crystal radii of  $Mg^{2+}$  ion having univalent radius  $0.82A^\circ$  (Given Born exponent  $n = 7$ ) [4]

OR

- Answer the following: [4]
  - What are the properties of heterogeneous catalysis?
  - What is the IUPAC name and symbol of element having atomic number 134 and 967.



Total No. of Questions : 4]

SEAT No. :

P821

[Total No. of Pages : 5

[5315]-421

T.Y. B.Sc.

CHEMISTRY (Paper - III)

CH-343: Organic Chemistry (New) (Semester - IV)

(2013 Pattern)

Time : 2 Hours]

[Max. Marks : 40

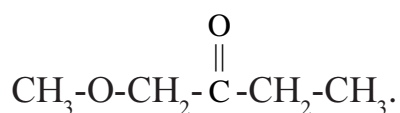
Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw structures and neat diagrams if necessary.
- 4) IR, NMR and UV spectroscopic data is given in Tables - 1, 2 and 3 respectively.

Q1) Answer the following:

[10]

- a) Calculate the fundamental modes of vibrations for H<sub>2</sub>O.
- b) How will you prove presence of  $\alpha$ ,  $\beta$ -unsaturated aldehyde group in citral.
- c) Express  $\lambda = 725 \text{ nm}$  in  $\text{cm}^{-1}$ .
- d) Write the stability order of carbanion.  
 $\overset{\ominus}{\text{C}}\text{H}_3$ ,  $\text{R}-\overset{\ominus}{\text{C}}\text{H}_2$ ,  $\text{R}-\overset{\ominus}{\text{C}}\text{H}-\text{Cl}$   $\text{R}-\overset{\ominus}{\text{C}}\text{H}-\text{NO}_2$
- e) Define the term synthon.
- f) How many sets of protons are present in



- g) In which rearrangement reaction ketone and peroxyacids are used.
- h) Give evidence for nature of nitrogen in ephedrine.
- i) Define bathochromic shift.
- j) Define chemical shift.

Q2) A) Attempt any two of the following:

[6]

- i) How will you prepare cyclopentane carboxylic acid from diethyl malonate.
- ii) Write retrosynthesis and synthesis of cyclohexenone.
- iii) Write a note on favorskii rearrangement.

P.T.O

B) Calculate  $\lambda_{\max}$  for the following. [4]



OR

- B) i) Explain the formation of 1, 1-diphenylethane from benzophenone.  
ii) Aniline shows blue shift in acidic medium, Explain.

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

- A) i) Write Nagai synthesis of ephedrine. [3]  
ii) How will you distinguish following pair by IR spectroscopy. [2]



- B) i) Explain Curtius rearrangement with suitable example. [3]  
ii) How IR spectroscopy is useful in detection of impurity in a sample. [2]
- C) i) Define spin-spin coupling and write the rules of spin-spin coupling. [3]  
ii) How will you prove presence of carbon skeleton in citral. [2]

**Q4)** A) Propose structures for the compounds from the following spectroscopic data. Justify your answer (any two) [6]

- i) Molecular Formula:  $C_4H_5O_2N$   
IR: 2250, 1750  $cm^{-1}$   
NMR: i) singlet, 3.50  $\delta$  (2H)  
ii) singlet, 3.80  $\delta$  (3H)
- ii) Molecular Formula:  $C_4H_8Br_2$   
NMR: i) singlet, 1.90  $\delta$  (6H)  
ii) singlet, 3.87  $\delta$  (2H)

iii) Molecular Formula:  $C_9H_{10}O$

IR:  $1700\text{ cm}^{-1}$

NMR: i) triplet,  $1.20\ \delta$  (3H)

ii) quartet,  $2.50\ \delta$  (2H)

iii) singlet,  $6.70\ \delta$  (5H)

B) Write notes on any two of the following.

[4]

i) Claisen ester condensation

ii) Structure, source and uses of ephedrine

iii) Chemical shift

iv) Synthon and functional group interconversion



TABLE - 1  
Characteristic Infrared Absorptions of Functional Groups

GROUP	FREQUENCY RANGE $\text{cm}^{-1}$	INTENSITY
A. Alkyl		
C-H (stretching)	2853-2962	(m - s)
Isopropyl - $\text{CH}(\text{CH}_3)_2$	1380 - 1385	(s)
	and 1365 - 1370	(s)
tert - Butyl - $\text{C}(\text{CH}_3)_3$	1385 - 1395	(m)
	and 1365	(s)
B. Alkenyl		
C-H (stretching)	3010 - 3095	(m)
C = C (stretching)	1620 - 1680	(v)
R-CH = CH <sub>2</sub>	985 - 1000	(s)
	and 905 - 920	(s)
R <sub>2</sub> C = CH <sub>2</sub>	880 - 900	(s)
cis - RCH = CHR	675 - 730	(s)
trans - RCH = CHR	960 - 975	(s)
	(out of plane C-H bendings)	
C. Alkynyl		
$\equiv$ C-H (stretching)	3300	(s)
C $\equiv$ C (stretching)	2100 - 2260	(v)
D. Aromatic		
Ar - H (stretching)	- 3030	(v)
Aromatic substitution type (C-H out-of-plane bendings)		
Monosubstituted	690 - 710	(very s)
	and 730 - 770	(very s)
o - Disubstituted	735 - 770	(s)
m - Disubstituted	680 - 725	(s)
	and 750 - 810	(very s)
p - Disubstituted	800 - 840	(very s)
E. Alcohols, Phenols, Carboxylic Acids		
OH (alcohols, phenols, dilute solutions)		
OH (alcohols, phenols, hydrogen bonded)	3200 - 3550	(broad)
OH (carboxylic acids, hydrogen bonded)	2500 - 3000	(very broad)
F. Aldehydes, Ketones, Esters and Carboxylic Acids		
C = O stretch	1630 - 1780	(s)
aldehydes	1690 - 1740	(s)
ketones	1680 - 1750	(s)
esters	1735 - 1750	(s)
carboxylic acids	1710 - 1780	(s)
amides	1630 - 1690	(s)
G. Amines		
N - H	3300 - 3500	(m)
H. Nitriles		
C = N	2220 - 2260	(m)
I. $\begin{array}{c}   \\ -\text{C}-\text{O} \text{ stretch (alcohol, ether, phenol)} \\   \end{array}$	1000 - 1300	(s)
J. Nitro N = O	1550 - 1350	(s)
k. Halides		
	F	(s)
	Cl	(s)
	Br	< 667 (s)

TABLE - 2  
Approximate Proton Chemical Shifts in NMR

TYPE OF PROTON	CHEMICAL SHIFT, DELTA, PPM ( $\delta$ )		
1° Alkyl, RCH <sub>3</sub>	0.8 - 1.0		
2° Alkyl, RCH <sub>2</sub> R	1.2 - 1.4		
3° Alkyl R <sub>3</sub> CH	1.4 - 1.7		
Allylic, R <sub>2</sub> C=C-CH <sub>2</sub>   R	1.6 - 1.9	Ester R-C(=O)-O-CH <sub>2</sub> -R	4 to 4.5
Benzylic, ArCH <sub>2</sub>	2.2 - 2.5		
Alkyl chloride RCH <sub>2</sub> Cl	3.6 - 3.8		
Alkyl bromide, RCH <sub>2</sub> Br	3.4 - 3.6		
Alkyl iodide, RCH <sub>2</sub> I	3.1 - 3.3		
Ether, ROCH <sub>2</sub> R	3.3 - 3.9		
Alcohol, HOCH <sub>2</sub> R	3.3 - 4.0		
Ketone, RC(=O)CH <sub>2</sub> -	2.1 - 2.6	R-C(=O)-CH <sub>2</sub> -	2.4 $\delta$
		R-C(=O)-CH-	2.5 $\delta$
Aldehyde, RCH=O	9.5 - 9.0		
Vinyl, R <sub>2</sub> C=CH <sub>2</sub>	4.6 - 5.0		
Vinyl, R <sub>2</sub> C=CH-R	5.2 - 5.7		
Aromatic, ArH	6.0 - 9.5		
Acetylenic, RC $\equiv$ CH	2.5 - 3.1		
Alcohol hydroxyl, ROH	0.5 - 6.0*		
Carboxylic, RCOOH	10 - 13*		
Phenolic, ArOH	4.5 - 7.7*		
Amino R-NH <sub>2</sub>	1.0 - 5.0		

\*The chemical shifts of these groups vary in different solvents and with temperature and concentration.

TABLE - 3  
U.V. Absorption rules for diene chromophores

1) Parent	215 nm	6) - halogen	5 nm
2) Each extra conjugation	30 nm	7) - SR	30 nm
3) Homoannular	39 nm	8) - NR <sub>2</sub>	60 nm
4) Exocyclic double bond	05 nm	9) - OH, - OR	5 nm
5) Each alkyl (R) substituent directly attached to double bonded carbon	05 nm		

U.V. Absorption rules for Enone System

1) Parent	215 nm (207 nm for aldehyde) (202 nm for five member ring)		
2) Each extra conjugation	30 nm	6) - Cl	$\alpha$ 15 nm
3) Homoannular	39 nm	7) - OH, -OR	$\beta$ 12 nm
4) Substituents		8) - SR	$\alpha$ 35 nm
a) Alkyl group at $\alpha$	10 nm	9) - NR <sub>2</sub>	$\beta$ 30 nm
b) Alkyl group at $\beta$	12 nm		$\beta$ 85 nm
c) Alkyl group at $\gamma$ , $\delta$ & higher	18 nm		$\beta$ 95 nm
5) Exocyclic double bond	05 nm		



Total No. of Questions : 4]

SEAT No. :

**P822**

[Total No. of Pages : 2

**[5315]-422**

**T.Y. B.Sc**

**CHEMISTRY**

**CH- 344: Analytical Chemistry (Paper - IV)**

**(2013 Pattern) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicates full marks.*
- 3) Use of log table and calculator is allowed.*

**Q1)** Answer the following:

**[10]**

- a) Define Nernst Distribution Law.
- b) What do you mean by isoelectric point?
- c) What is demineralized water?
- d) What is HPLC?
- e) Name the Detector used in Gas chromatography.
- f) Which mobile phase is used in SFC?
- g) Give the principle of electrophoresis.
- h) What is eluent?
- i) Define the turbidance.
- j) Give any one application of electrophoresis.

**P.T.O**

- Q2) a)** Answer any two of the following: [6]
- Explain the principle of paper chromatography.
  - What are advantages of TLC.
  - Explain any one application of ion-exchange chromatography.
- b)** Answer any two of the following: [4]
- Draw a labeled diagram of electron capture detector used in GC.
  - Calculate the distribution ratio when concentration of solute in organic phase is 0.028 M. and in aqueous phase is 0.04M.
  - Calculate turbidance, if the transmittance is 0.7568.

- Q3)** Answer any two of the following: [10]
- Define the term Distribution coefficient. Derive relationship between distribution coefficient and distribution ratio.
  - Explain the principle and technique of column chromatography.
  - Explain principle and working of gas chromatography.

- Q4) a)** Draw a block diagram of HPLC. Explain the role of components involved in it. [6]

OR

- Explain in brief zone electrophoresis.
  - Explain the construction and working of Nephelometry.
- A metal chelate was extracted to the extent of 40% when equal volumes of aqueous and organic phases shaken together. What will be the percent extracted if volume of organic phase is doubled. [4]

OR

- In a paper chromatographic separation of 'A', 'B' and 'C', the solvent front was 30 cm, white front due to above components were 20, 18 and 10 cm. respectively. Calculate  $R_f$  values of A, B & C.



Total No. of Questions : 4]

SEAT No. :

**P823**

[Total No. of Pages : 2

**[5315]-423**

**T.Y. B.Sc**

**CHEMISTRY**

**CH-345: Industrial Chemistry (Semester - IV)**

**(2013 Pattern) (Paper - V)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Draw neat diagrams and flowsheet wherever necessary.*

**Q1)** Answer the following.

**[10]**

- a) What is monomer?
- b) Explain the term biodegradable waste.
- c) Draw the structure of Alizarin dye.
- d) What is detergent?
- e) What are analgesics?
- f) What do you mean by molasses?
- g) Define the term fermentation.
- h) What is sunscreen?
- i) What are accelerators?
- j) What is pigment?

**Q2)** a) Attempt any two of the following.

**[6]**

- i) Write a note on anesthetics.
- ii) Write a note on surfactants.
- iii) What are basic requirements of fermentation process.

**P.T.O**

- b) Answer any two of the following. [4]
- Explain the term pharmacodynamic agent with suitable example.
  - Give the preparation of nylon-6,6.
  - What do you mean by organic process waste?

**Q3)** Answer any two of the following. [10]

- What are silicones? Explain the properties and applications of silicones.
- Draw the structures of fluorescein and naphthol yellow, state their applications.
- Give the synthesis and uses of paracetamol and aspirin.

**Q4)** a) Describe the manufacture of raw sugar from sugarcane with flowsheet and special reference to multiple effect evaporator. [6]

OR

What are conditioners? Explain different types of conditioners.

- b) Explain the characteristics and uses of [4]
- white lead
  - Zinc oxide

OR

Write a note on

- Buna -N.
- Treatment of waste containing inorganic impurities.



Total No. of Questions : 4]

SEAT No. :

**P824**

[Total No. of Pages : 2

**[5315]-424**

**T.Y. B.Sc**

**CHEMISTRY**

**CH-346 A: Nuclear Chemistry (Semester - IV)**

**(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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) *Use of log tables and calculator is allowed.*

**Q1)** Answer the following.

**[10]**

- a) What are prompt and delayed neutrons?
- b) Which coolant is used in nuclear reactors?
- c) State the names of electrostatic accelerators.
- d) What are charge carriers in a semiconductor.
- e) Mention the radioisotope of carbon and Hydrogen.
- f) State one example of cow and milk system.
- g) Give one application of radiometric titrations.
- h) Mention one biological effect of radiations.
- i) State one reaction of nuclear fission process.
- j) State an expression for design parameter F of nuclear reactors.

**Q2)** a) Attempt any two of the following.

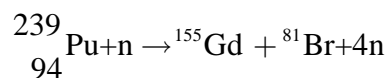
**[6]**

- i) Write a note on cockcroft-walton Accelerator.
- ii) Describe Indias nuclear energy programme.
- iii) Describe the properties required for the selection of ideal scintillators.

**P.T.O**

b) Attempt any two of the following. [4]

i) Compute the energy released in the following fission



Given: Atomic masses of:

$${}_{94}^{239}\text{Pu} = 239.0522 \text{amu}; {}^{155}\text{Gd} = 154.9220 \text{amu}$$

$${}^{81}\text{Br} = 80.9163 \text{amu}, m_n = 1.00897 \text{amu}$$

ii) Describe the fuel and moderator used in nuclear reactors.

iii) Why is semiconductor used as detectors?

**Q3)** Answer any two of the following. [10]

- Describe in detail the natural uranium reactor.
- Discuss the principle and working of isotope dilution analysis.
- Describe the discovery of nuclear fission with different experiments.

**Q4)** a) What are Breeder Reactors? Explain the principle of Breeding. [6]

OR

Explain photochemical processes in:

- Typical inorganic Scintillator.
  - General organic scintillator.
- b) Describe safety standards and safe working methods required in the study of radiation chemistry. [4]

OR

Explain Szilard - chalmers reaction.



Total No. of Questions : 4]

SEAT No. :

**P825**

[Total No. of Pages : 2

**[5315]-425**

**T.Y. B.Sc**

**CHEMISTRY**

**CH-346 B: Polymer Chemistry (Semester - IV)**

**(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicates full marks.*
- 3) *Draw diagrams wherever necessary.*

**Q1)** Answer the following.

**[10]**

- a) Define homochain polymer.
- b) 'A synthetic garment yellowing after long use'. Explain.
- c) Give the important IR peaks of polystyrene.
- d) What is meant by biopolymers?
- e) Define the term: Compounding.
- f) Draw the correct structure of polytetrafluoro ethylene.
- g) Give two important uses of polyvinyl chloride (PVC).
- h) Explain the term: Calendering.
- i) What is meant by scouring.
- j) The acronym-GTT stands for \_\_\_\_\_ .

**Q2)** a) Attempt any two of the following.

**[6]**

- i) 'Molecular weight of polymer affects on glass transition temperature'. Explain.
- ii) Write a brief note on thermal degradation.
- iii) Comment on degree of crystallinity.

**P.T.O**

- b) Answer the following. (any two) [4]
- i) How will you distinguish polyacrylonitrile and polyvinyl acetate by using IR spectroscopy.
  - ii) 'T<sub>g</sub> of polyvinyl chloride is 81°C while T<sub>g</sub> of polyvinyl carbazole is 150°C'. Explain.
  - iii) Draw the correct structure of linear and branched polymers.

**Q3)** Attempt any two of the following. [10]

- a) Write a detailed note on polymer blends.
- b) Give method of preparation, properties and important uses of,
  - i) Polyester.
  - ii) Phenol-formaldehyde resin.
- c) Give detailed account of spectroscopic methods in structure determination of polymers.

**Q4)** a) Attempt any two of the following. [6]

- i) Explain the die casting process in polymer technology.
  - ii) Write a short note on sulphur-vulcanisation.
  - iii) Describe the lamination technique in brief.
- b) What is meant by fibre? Give a detailed account of wet spinning process in fibre technology. [4]





Total No. of Questions : 4]

SEAT No. :

P826

[Total No. of Pages : 2

[5315] - 426

T.Y. B.Sc.

CHEMISTRY (Semester - IV)

CH - 346 (C) : Introduction To Biochemistry & Molecular  
Biology  
(2013 Pattern) (Paper - VI)

Time :2 Hours]

[Max. Marks :40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.

Q1) Answer the following:

[10]

- i) Give two significances of ATP.
- ii) Name the enzyme that converts pyruvate to lactate
- iii) List out three ketone bodies.
- iv) Which type of DNA polymerase in bacteria helps to remove RNA primer
- v) Give the significance of Initiation codon.
- vi) Name two inhibitors of Transcription
- vii) What is the role of Helicase?
- viii) Define Chimeric Vectors.
- ix) What are transamination reactions?
- x) Name two electron, carriers of ETC. in mitochondria.

Q2) a) Attempt Any Two of the following :

[4]

- i) Define Nucleosides and Nucleotides. Give examples.
- ii) Give the complementary sequence of this DNA fragment 5'AGTTGCACG3'
- iii) Why is TCA cycle referred as an amphibolic pathway.

P.T.O.

- b) Answer any two of the following : [6]
- i) List out the components of pyruvate dehydrogenase complex.
  - ii) Differentiate between DNA and RNA.
  - iii) Write note on uncouplers with suitable example.

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

- i) Elaborate on experiments that proved DNA as genetic material.
- ii) Describe steps involved in  $\beta$  - Oxidation of fatty acids.
- iii) Explain the steps involved in gene cloning.

**Q4)** Answer the following : [6]

- i) Discuss the steps involved in DNA replication

OR

Describe the reactions of Urea cycle.

- ii) Write note on anaerobic glycolysis. [4]

OR

Give the features of genetic code.



Total No. of Questions : 4]

SEAT No. :

P 827

[Total No. of Pages : 2

[5315] - 427

**T.Y. B.Sc. CHEMISTRY (Semester - IV)**  
**CH - 346 (D) : Environmental And Green Chemistry**  
**(2013 Pattern) (Elective - II) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Answer the following:

**[10]**

- i) What is mean by 'Sludge Gas'.
- ii) What is mean by 'Soil Horizon'.
- iii) What is role of carrier gas in gaschromatography (GC)
- iv) Which is most commonly used detector in HPLC.
- v) Why carbon dioxide is I.R. active.
- vi) What is mean by 'Heat of Vaporisation'.
- vii) How much energy stored by C = O bond.
- viii) Define 'Screening'
- ix) Define 'Incineration'.
- x) Explain 'Green house effect'.

**Q2)** a) Explain any two of the following :

**[6]**

- i) Explain 'Green house gases'.
- ii) Explain in detal "Electrodialysis'.
- iii) Explain 'Mackereth oxygen cell'.

**P.T.O.**

- (b) Write short notes on (any two) [4]
- i) Wind energy
  - ii) Fizzy Water
  - iii) Sanitary Land fills

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

- i) Explain in detail Secondary or biological waste water treatment.
- ii) Explain in detail principle and working of gas chromatography (GC)
- iii) Give an account on various chemical processes in water.

**Q4)** a) Explain Acid - base and Ionic reactions in soil and PH of soil. [6]

OR

What is Nuclear energy. Explain typical Nuclear fission power plant.

- b) Write note on any one of the following : [4]
- i) Global Warming and climate changes.
  - ii) Metals in water



Total No. of Questions : 4]

SEAT No. :

P828

[Total No. of Pages : 2

[5315]-428

T.Y. B.Sc. (Semester - IV)

CHEMISTRY (Paper - VI)

CH - 346 (E) : Dairy Chemistry

(2013 Pattern) (Elective - II)

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicates full marks.*

**Q1)** Answer the following :

**[10]**

- a) What is meant by developed / real acidity in milk?
- b) Which pigments are present in the milk?
- c) How is vacuum pasteurization of milk carried out?
- d) Define homogenization of milk.
- e) Define flavacired milk.
- f) Give advantages of sterilized milk.
- g) Draw the structure of Riboflavin.
- h) How is starch detected in the milk sample?
- i) Define ripening of cream.
- j) Give important uses of butter milk powder.

**Q2)** a) Answer any two of the following :

**[6]**

- i) Comment on density and specific gravity of milk.
- ii) Draw flow sheet of manufacture of sterilized milk.
- iii) Draw structure of Pyridoxal. Give uses of vitamin B<sub>6</sub>.

**P.T.O.**

- b) Answer any two of the following : [4]
- i) Define preservation. What are most commonly used chemicals for preserving milk?
  - ii) Define cheese. Give its food and nutritive value.
  - iii) What are the difficulties observed in the drying and storage of butter milk powder.

**Q3) a)** Define whey powder. Give flow sheet diagram for the manufacture of whey powder and give its keeping quality. [5]

OR

State the factors which influence the growth of micro-organisms in milk.

- b) What are carbohydrates? How are they classified? Give uses of lactose. [5]

OR

Define Ice-cream. Give flow sheet diagram of manufacture of ice-cream. Give its food and nutritive value.

**Q4) a)** Attempt any Two : [6]

- i) Milk is almost an ideal food. Explain.
- ii) Give composition and flow sheet diagram for manufacture of cheese powder.
- iii) Define adulterant. Give different methods of detection of adulterants.

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

- i) Give properties and uses of globulin.
- ii) How will you test the presence of
  - A)  $\beta$ -naphthol
  - B) Salicylic acid in milk sample
- iii) Define fermented milk. Give its advantages.



Total No. of Questions : 4]

SEAT No. :

**P829**

[Total No. of Pages : 2

**[5315] - 429**

**T.Y. B.Sc. (BOTANY) (Semester - IV)**  
**BO - 341 : Plant Physiology And Biochemistry**  
**(2013 Pattern) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Draw Neat labelled diagrams wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Answer the following:

**[10]**

- a) Define photosynthetic unit.
- b) Write any two examples of respiratory substrates?
- c) What is loading of solutes?
- d) What is Xenobiotic stress?
- e) Define polysaccharides.
- f) What is  $\beta$  - oxidation?
- g) Give first stable product of  $C_4$  Pathway.
- h) Enlist any two pathways of secondary Metabolites.
  - i) What are enzyme inhibitors?
  - ii) Write the name of any two plant physiologist.

**Q2)** Attempt Any Two of the following:

**[10]**

- a) Write the mechanism of non - cyclic photophosphorylation.
- b) Give properties and functions of carbohydrates.

**P.T.O.**

c) Describe the effect of stress on plant growth.

**Q3)** Write short notes on Any Two of the following. **[10]**

- a) Factors affecting the enzymes activity
- b) Classification and functions of Lipids
- c) CAM Pathway for CO<sub>2</sub> fixation.

**Q4)** What is Glycolysis ? Explain steps in details with energy output. **[10]**

OR

What are proteins ? Give properties and functions of proteins.





Total No. of Questions : 4]

SEAT No. :

**P830**

[Total No. of Pages : 2

**[5315] - 430**

**T.Y. B.Sc. (BOTANY) (Semester - IV)  
BO - 342 : Plant Ecology & Biodiversity  
(2013 Pattern) (Paper - II)**

*Time :2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Draw neat labelled diagrams wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Attempt the following:

**[10]**

- a) Give long form of MAB.
- b) Define Biodiversity.
- c) What is mean by Genetic Diversity?
- d) Define Alpha Diversity.
- e) What is 'Sthalvrikshas'?
- f) Give any two steps involved in personnel Environmental Audit.
- g) What is Eutrophication?
- h) Write principle of Remote sensing.
- i) Enlist any two Botanical Gardens in India.
- j) What is ecological succession?

**Q2)** Answer any two of the following:

**[10]**

- a) Explain the process of Environmental Audit.
- b) Give applications of Remote sensing in ecology.

**P.T.O.**

c) Write factors causing loss of species & Genetic Diversity.

**Q3)** Write short notes on any two of the following: **[10]**

a) Ozone depletion.

b) Process of EIA

c) Necessity of Inventoring & Monitoring of Biodiversity.

**Q4)** Explain the impact of human activities on Environment with respect to water. Give its causes, prevention measures & control. **[10]**

OR

What is **In-situ** conservation? Explain the concept of Biosphere Reserves & National Parks.



Total No. of Questions : 4]

SEAT No. :

**P831**

[Total No. of Pages : 2

**[5315]-431**

**T.Y. B.Sc. (Semester - IV)**

**BOTANY**

**BO-343: Plant Pathology  
(2013 Pattern) (Paper - III)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Answer the following :

**[10]**

- a) Define host.
- b) What is penetration.
- c) Define resistance.
- d) What is active dissemination?
- e) What is IPM?
- f) Define cultural control of disease.
- g) Give the names of any two fungal diseases.
- h) Give any two cause of Tip burn of paddy.
- i) Define antibodies.
- j) What is crop rotation?

**P.T.O.**

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

- a) Describe structural defence.
- b) Explain economic importance of plant diseases.
- c) Describe virus as plant pathogen.

**Q3)** Write notes on any two of the following : **[10]**

- a) Chemical control of plant disease.
- b) Serial dilution.
- c) Mineral deficiency.

**Q4)** Give an account of downy mildew of grapes and citrus canker with reference to causal organism, symptoms and control measures. **[10]**

OR

What is disease cycle? Describe in detail stages involved in the development of a disease.



Total No. of Questions : 4]

SEAT No. :

P832

[Total No. of Pages : 2

[5315]-432

T.Y. B.Sc. (Semester - IV)

BOTANY

**BO-344: Medicinal and Economic Botany**

**(2013 Pattern) (Paper - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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 :

**[10]**

- a) Define Pharmacognosy.
- b) Give any two methods of classification of drugs.
- c) What is Kapha?
- d) Define garbling.
- e) Mention any two uses of Amala.
- f) What is pharmacokinetics?
- g) Define ethanobotany.
- h) What are economic plants?
- i) Give any two uses of Dioscorea.
- j) Define ethanoagriculture.

**P.T.O.**

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

- a) Give methods of preparation of Asawa and Churna.
- b) Describe hot continuous extraction of drugs by Soxhlet methods.
- c) Explain methods of cultivation and uses of Adhatoda.

**Q3)** Write notes on any Two of the following : **[10]**

- a) Storage of crude drugs.
- b) Macroscopic and microscopic characters of Strychnos nux-vomica.
- c) Botanical resources of paper.

**Q4)** Give distribution, cultivation, microscopic characters and uses of clove. **[10]**

OR

Give evolution origin, sources and uses of sugarcane.



Total No. of Questions : 4]

SEAT No. :

**P833**

[Total No. of Pages : 2

**[5315]-433**

**T.Y. B.Sc. (Semester - IV)**

**BOTANY**

**BO-345: Plant Biotechnology (Theory)**

**(2013 Pattern) (Paper - V)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Draw neat and labelled diagram wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Answer the following :

**[10]**

- a) What is Bioinformatics?
- b) What is plant protection?
- c) Enlist two examples of therapeutic drugs by r-DNA technology.
- d) Enlist two GMO plants.
- e) What are biofertilizers?
- f) Enlist any two cases of patenting in India.
- g) What is NCBI?
- h) What is genomics?
- i) What are Nif genes?
- j) What is somatic hybridization?

**P.T.O.**

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

- a) Explain methods of haploid production.
- b) Explain the types of Proteomics.
- c) Describe the use of Biotechnology in human health care.

**Q3)** Write short notes on any two of the following : **[10]**

- a) Steps of Patenting.
- b) Bioplastic.
- c) Data Retrieval tools.

**Q4)** What is plant tissue culture? Describe the concept, technique and applications of cell suspension culture. **[10]**

OR

What is Nitrogen fixation? Explain in detail mechanism of symbiotic Nitrogen fixation.





Total No. of Questions : 4]

SEAT No. :

**P834**

[Total No. of Pages : 2

**[5315]-434**

**T.Y. B.Sc. (Semester - IV)**

**BOTANY**

**BO-346: Plant Breeding and Seed Technology  
(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Draw neat labelled diagrams wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Answer the following :

**[10]**

- a) What is Plant breeding?
- b) Write any two applications of Heterosis.
- c) What is Back cross?
- d) Define plant introduction.
- e) What are induced mutations?
- f) Mention any two seed purity components.
- g) What is seed?
- h) Give any two duties of seed inspector.
- i) What is Seed processing?
- j) What is Seed Marketing?

**P.T.O.**

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

- a) What is Mass selection? Explain its procedure.
- b) Define germination testing? Give its objectives.
- c) What are polyploids? Describe any two methods of obtaining polyploids.

**Q3)** Write notes on any Two of the following : **[10]**

- a) Gamma garden.
- b) Seed Markets in India.
- c) Moisture Meter.

**Q4)** What is hybridization? Explain general procedure of hybridization. **[10]**

OR

Define seed sampling. Explain various factors affecting seed storage. Add a note on need of seed storage.



Total No. of Questions : 4]

SEAT No. :

**P835**

[Total No. of Pages : 2

**[5315]-435**

**T.Y. B.Sc. (Semester - IV)**

**ZOOLOGY**

**ZY-341: Biological Techniques**

**(2013 Pattern) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) What is electrophoresis?
- b) Define Osmolarity.
- c) What is fixation of tissue?
- d) State any four names of WBCS.
- e) Enlist the types of microtomes.
- f) Define vital stain.
- g) What is Feulgen reaction?
- h) What is camera lucida?
- i) What is ocular micrometer?
- j) Define ultra centrifugation.

**P.T.O.**

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

- a) Explain the principle and working of compound microscope.
- b) What is colorimetry? Explain principle and working of colorimeter.
- c) What is microtome? Describe any two types of microtome knives.

**Q3)** Write notes on any Two of the following : **[10]**

- a) PAS techniques.
- b) Total count of RBCs.
- c) Mounting media.

**Q4)** What is chromatography? Describe in detail principle and applications of Ion exchange chromatography. **[10]**

OR

What is embedding? Describe in detail methods of embedding.



Total No. of Questions : 4]

SEAT No. :

**P836**

[Total No. of Pages : 2

**[5315]-436**

**T.Y. B.Sc. (Semester - IV)**

**ZOOLOGY**

**ZY - 342 : Mammalian Physiology and Endocrinology**

**(2013 Pattern) (Paper - II)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) Define cardiac cycle.
- b) State clinical significance of dialysis.
- c) Define striated muscle.
- d) What is saltatory conduction?
- e) Define pregnancy.
- f) State any two characters of crinism.
- g) What is electro cardiogram?
- h) What is oxyhaemoglobin?
- i) State the role of liver in physiology of digestion.
- j) What is angina pectoris.

**Q2)** Attempt any two of the following :

**[10]**

- a) Describe the role of pancreas in physiology of digestion.
- b) Describe the process of tubular secretion during urine formation.
- c) Describe sliding filament theory of muscle contraction.

**P.T.O.**

**Q3)** Write notes on any two of the following :

**[10]**

- a) Cardiac output
- b) Endocrinology
- c) Hormonal control of male reproduction.

**Q4)** What is respiration? Describe mechanism of transport of carbon dioxide during respiration.

**[10]**

OR

Define impulse. Describe origin and conduction of impulse in a non-myelinated nerve fibre.



Total No. of Questions : 4]

SEAT No. :

P837

[Total No. of Pages : 2

[5315]-437

T.Y. B.Sc. (Semester - IV)

ZOOLOGY

ZY - 343 : GENETICS AND MOLECULAR BIOLOGY

(2013 Pattern) (Paper - III)

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) What is Chiasma?
- b) Define gene frequency.
- c) Elaborate TMV
- d) What are histones?
- e) Define the term 'replication'.
- f) What are Okazaki fragments?
- g) What is triplet?
- h) Give role of helicase enzyme.
- i) What is nucleotide?
- j) Define reverse transcription.

**Q2)** Attempt any two of the following :

**[10]**

- a) Give an account of heterochromatin.
- b) Explain the process of recombination in Genetics.
- c) Give an account of cloning vectors.

**P.T.O.**

**Q3)** Write short notes on any two of the following :

**[10]**

- a) Regulation of gene action
- b) PCR
- c) Hardy - Weinberg equilibrium.

**Q4)** What is 'Central Dogma of Molecular Biology'?

Describe process of translation in eukaryotes.

**[10]**

OR

Define mutation. Describe various types of mutation.





Total No. of Questions : 4]

SEAT No. :

**P838**

[Total No. of Pages : 2

**[5315]-438**

**T.Y. B.Sc. (Semester - IV)**

**ZOOLOGY**

**ZY - 344 : Organic Evolution**

**(2013 Pattern) (Paper - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) Who was Lamark?
- b) State any one factor influencing speciation.
- c) What are plastids?
- d) What is mesozoic era?
- e) Define protenoid microsphere.
- f) Define mutation.
- g) Write any one palaeontological evidence of organic evolution.
- h) What is Zoogeography?
- i) State two characters of Kenyapithecus.
- j) Define postzygotic isolating mechanisms.

**Q2)** Attempt any two of the following :

**[10]**

- a) Describe allopatric and Sympatric speciation.
- b) Describe patterns of animal distribution.
- c) Explain modern synthetic theory of organic evolution.

**P.T.O.**

**Q3)** Write short notes on any two of the following : **[10]**

- a) Geographic range and fauna of Oriental and Nearctic realms.
- b) Prezygotic isolating mechanisms
- c) Darwinism

**Q4)** What is organic evolution? Explain embryological and biochemical evidences supporting it. **[10]**

OR

What is antiquity of man? Describe characters of Homo Sapiens and Homo erectus.



Total No. of Questions : 4]

SEAT No. :

**P839**

[Total No. of Pages : 2

**[5315]-439**

**T.Y. B.Sc. (Semester - IV)**

**ZOOLOGY**

**ZY - 345 : GENERAL EMBRYOLOGY**

**(2013 Pattern) (Paper - V)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) Define microlecithal egg.
- b) What is amnion?
- c) Define morula.
- d) What is chalaza?
- e) What is tertiary egg membrane?
- f) What is primary organiser?
- g) Define spermatogenesis.
- h) What is isogamy?
- i) Define amphimixis?
- j) What is epiboly?

**Q2)** Attempt any two of the following :

**[10]**

- a) Describe the structure of isolecithal egg.
- b) Describe stereoblastula.
- c) Describe Ultra structure of sperm.

**P.T.O.**

**Q3)** Write short notes on any two of the following : **[10]**

- a) Vitellogenesis
- b) Gastrula
- c) Planes of cleavages

**Q4)** What is fertilization? Describe in detail sperm penetration. **[10]**

OR

Describe the development of chick embryo up to 24 hours.



Total No. of Questions : 4]

SEAT No. :

**P840**

[Total No. of Pages : 4

**[5315]-440**

**T.Y. B.Sc. (Semester - IV)**

**ZOOLOGY**

**ZY - 346 (A) : Public Health and Hygiene**

**(2013 Pattern) (Paper - VI) (Elective - II)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) Define personal health.
- b) Define condiments.
- c) What is coronary heart disease?
- d) State any two radiation risks.
- e) State any two emergencies in industry.
- f) Define epidemiology.
- g) State any two symptoms of tuber culosis.
- h) Define food.
- i) What is biosafety for disabled persons?
- j) State any two components of soil.

**Q2)** Attempt any two of the following :

**[10]**

- a) Explain the purpose of data sampling.
- b) Give an account of properties of soil.
- c) Describe artificial ventilation system.

**P.T.O.**

**Q3)** Write short notes on any two of the following :

**[10]**

- a) Methods of epidemiology
- b) Necessity of food
- c) Mechanical filtration of water

**Q4)** Explain the signs, symptoms, mode of transmission and control measures of chicken pox.

**[10]**

OR

Explain the concept of sanitation with reference to disposal of refuse.



Total No. of Questions : 4]

**P840**

**[5315]-440**

**T.Y. B.Sc. (Semester - IV)**

**ZOOLOGY**

**ZY - 346 (B) : Medical Entomology**

**(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Attempt the following :

**[10]**

- a) Define medical entomology.
- b) Define interspecific relationship.
- c) Mention any two methods of Ant control.
- d) Mention any two diseases spread by tick.
- e) State the names of any two forest pests.
- f) State the order of mosquito.
- g) Write any two control methods of bed bug.
- h) Apterygotan insect.
- i) Mention any two adaptations in head louse.
- j) Write any two names of abdominal appendages.

**Q2)** Attempt any two of the following :

**[10]**

- a) Describe the effects of flea on man.
- b) Explain veterinary entomology.
- c) Describe social organisation in termites.

**Q3)** Write notes on any two of the following :

**[10]**

- a) Forest entomology.
- b) Digestive system of insects.
- c) Intraspecific relationship.

**Q4)** Describe the life cycle of Housefly. Add a note on diseases spread by it and its control.

**[10]**

OR

Describe the life cycle of silverfish in brief and add a note on its distribution, damage and control measures.





Total No. of Questions : 4]

SEAT No. :

**P841**

[Total No. of Pages : 2

**[5315]-441**

**T.Y. B. Sc.**

**GEOLOGY**

**GL - 341 : Metamorphic Petrology**

**(2013 Pattern) (Paper - I) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Neat diagrams must be drawn wherever necessary.*

**Q1)** Answer the following questions in 2/3 lines.

**[10]**

- a) What is AFM diagram?
- b) What is metasomatism?
- c) Define cataclastic metamorphism.
- d) What is tourmalinisation?
- e) What is contact metamorphism?
- f) What are eclogites?
- g) What are phase diagrams?
- h) What is lineation?
- i) What is augen structure?
- j) What are antistress minerals?

**Q2)** Write notes on (any 2) :

**[10]**

- a) Growth of minerals under stress.
- b) Textures and structures of regional metamorphism.
- c) Significance of inclusions in metamorphic crystals.

**P.T.O.**

- Q3)** Write notes on (any 2) : **[10]**
- a) Aureoles of thermal metamorphism.
  - b) Effects of thermal metamorphism on igneous rocks.
  - c) Gneissosity.

**Q4)** Describe the effect of regional metamorphism on argillaceous rocks. **[10]**

OR

Describe the concept of metamorphic facies. Give diagrammatic representation of pressure temperature conditions of metamorphic facies.



Total No. of Questions : 4]

SEAT No. :

P842

[Total No. of Pages : 2

[5315]-442

T.Y. B.Sc.

GEOLOGY

**GL - 342 : Environmental Geology  
(2013 Pattern) (Paper - II) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Define/Answer the following in 2/3 lines.

**[10]**

- a) Erosion
- b) Mining restoration
- c) Tsunami
- d) Environmental Geology
- e) Soil Pollution.
- f) Alkalinity of Soil
- g) Impact assesment.
- h) Avalanches
- i) Floods
- j) Conventional source of energy.

**Q2)** Write notes on (any two)

**[10]**

- a) Types of natural resources.
- b) Flood hazards in India.
- c) Causes of Dessertification.

**P.T.O.**

**Q3)** Answer the following (any two)

**[10]**

- a) Causes of subsidence of land
- b) Explain Nitrogen cycle.
- c) Effects of volcano

**Q4)** Define Earthquake. Describe the terms associated with earthquake Explain instrumental and natural precursors to predict earthquake. **[10]**

OR

What is water pollution? Explain in detail sources of water pollution. Add a note on flourosis.



Total No. of Questions : 4]

SEAT No. :

**P843**

[Total No. of Pages : 2

**[5315]-443**

**T.Y. B.Sc.**

**GEOLOGY**

**GL - 343 : Economic Geology**

**(2013 Pattern) (Paper - III) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Neat diagrams must be drawn wherever necessary.*

**Q1)** Answer the following questions in 2/3 lines.

**[10]**

- a) What are epigenetic deposits?
- b) What is tenor of ore?
- c) What is shale gas?
- d) What are mesothermal deposits?
- e) What is true gossan?
- f) What is metasomatic replacement?
- g) Give two ore minerals of silver.
- h) Give the different variation of coal.
- i) Give the types of oil traps
- j) What is saddle reef?

**Q2)** Answer the following questions (any two)

**[10]**

- a) Types of placer deposits.
- b) Mineralogy and uses of radioactive elements.
- c) Gossans as guides to the hidden deposits.

**P.T.O.**

**Q3)** Write notes on (any two)

**[10]**

- a) Residual concentration
- b) Origin of coal
- c) Assam shelf oil field

**Q4)** Explain early and late magmatic deposits with suitable examples.

**[10]**

OR

Give, mineralogy, geological and geographical distribution and uses of Iron deposits.



Total No. of Questions : 4]

SEAT No. :

**P844**

[Total No. of Pages : 2

**[5315]-444**

**T.Y. B.Sc.**

**GEOLOGY**

**GL - 344 : Geotectonics**

**(2013 Pattern) (Paper - IV) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Answer in 2/3 lines.

**[10]**

- a) What are S waves?
- b) What is lithosphere?
- c) What is CRM?
- d) What is Wilson's cycle?
- e) What is divergent plate boundary?
- f) Give 2 examples of hot spots.
- g) What is platform?
- h) Name any 2 fold mountains.
- i) What is magnetic inclination?
- j) What is conrad discontinuity?

**Q2)** Write notes on (any two)

**[10]**

- a) Core
- b) P & S waves shadow zone
- c) Back arc basins

**P.T.O.**

**Q3)** Write notes on (any two)

**[10]**

- a) Neotectonics
- b) Triple junctions.
- c) Low velocity zone

**Q4)** Write a note on different types of plate boundaries.

**[10]**

OR

Write a note on meteorites.





Total No. of Questions : 4]

SEAT No. :

**P845**

[Total No. of Pages : 2

**[5315]-445**

**T.Y. B.Sc.**

**GEOLOGY**

**GL - 345 : Phanerozoic Stratigraphy of India and Palaeontology  
(2013 Pattern) (Paper - V) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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.*

**Q1)** Answer the following in 2/3 lines.

**[10]**

- a) Give fossils of Narmada valley
- b) Give morphological characters of Graptolites.
- c) Give fauna and flora of siwaliks.
- d) Give systematic classification of ptillophyllum.
- e) Give economic importance of Deccan traps.
- f) Give fossil content of Jurassic of Kachchh.
- g) Give systematic classification of Brachyphyllum.
- h) Give origin of laterites.
- i) Give economic importance of Gondwana super group.
- j) Give the duration of volcanic eruption during Deccan volcanism.

**Q2)** Answer the following (any two)

**[10]**

- a) Classification of Gondwana supergroup
- b) Age of Deccan trap.
- c) P-C boundary

**P.T.O.**

- Q3)** Write notes on (any two) **[10]**
- a) Cretaceous of Cauvery basin
  - b) Tertiary of Assam
  - c) Lithology and fossil content of Devonian.

- Q4)** Give the systematic classification, generic definition and distribution of Glossopteris. **[10]**

OR

- a) Origin and types of Laterites **[5]**
- b) Give the classification, lithology and fossil content of Tertiary system. **[5]**



Total No. of Questions : 4]

SEAT No. :

P 846

[Total No. of Pages : 2

[5315]- 446

T.Y. B.Sc. (Semester - IV)

GEOLOGY (Paper - VI)

GL- 346 : Applied Geology - II

(Engineering Geology, Geohydrology and Prospecting)

(2013 Pattern)

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Figures to the right indicate full marks.*
- 4) *Neat diagrams must be drawn wherever necessary.*

**Q1)** Answer in 2/3 lines

**[10]**

- a) What is Peached Aquifer?
- b) What are Geophones?
- c) What is meant by Rainwater Harvesting?
- d) Define Tunnel.
- e) Define Railroad Ballast.
- f) Define Arch Dam.
- g) Give uses of rock aggregate.
- h) What is Connate and Juvenile water?
- i) Name two types of dams.
- j) What is Torsion Balance?

**P.T.O**

**Q2)** Answer in short (any two)

**[10]**

- a) Explain Tunnelling in Deccan traps
- b) Describe Mineralogic Guides
- c) Describe recharge through Pits and Shafts.

**Q3)** Write short notes (any two)

**[10]**

- a) Opencast mining
- b) Porosity and Secondary porosity
- c) Any two engineering properties of rocks.

**Q4)** Define the terms Hydrology, Geohydrology and hydrogeology. Explain the vertical distribution of Groundwater. **[10]**

OR

Explain in detail Lithological and Structural criteria for prospecting.



Total No. of Questions : 4]

SEAT No. :

P 847

[Total No. of Pages : 3

[5315] - 447

T.Y.B.Sc.

STATISTICS (Principal)

ST - 341 : Actuarial Statistics

(2013 Pattern) (Paper - I) (Semester - IV) (Theory)

Time : 2 Hour]

[Max. Marks :40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of Calculator and statistical table is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following :

[1 each]

A) Choose the correct alternative in each of the following :

i) If  $S(x)$  is survival function of  $X$  then  $S(0)$  is

- |             |                  |
|-------------|------------------|
| a) 0        | b) 1             |
| c) $\infty$ | d) $\frac{1}{2}$ |

ii) the present value of annuity certain immediate at the rate of 1 unit per annum for  $n$  years is

- |                      |                           |
|----------------------|---------------------------|
| a) $\frac{1+v^n}{d}$ | b) $\frac{1-v^n}{\delta}$ |
| c) $\frac{1-v^n}{i}$ | d) $\frac{1-v^n}{d}$      |

iii) Discount function  $V$  and instantaneous rate of interest  $\delta$  is related as :

- |                       |                      |
|-----------------------|----------------------|
| a) $V = -\log \delta$ | b) $V = \log \delta$ |
| c) $V = e^{-\delta}$  | d) $V = e^{\delta}$  |

P.T.O

- iv) Which of the following statement or expression is not true for  ${}^t p_x$
- ${}^t p_x$  is survival function of  $T(x)$
  - $P(T(x) > t)$
  - ${}^t p_x = 1 - {}^t q_x$
  - ${}^t p_x$  is the probability that a person aged  $(x)$  dies in  $(x, x + t)$
- B) State whether the following statements are True or False : **[1each]**
- Premiums are determined by actuary.
  - If  $T(x) = 7.5$  then  $K(x) = 8$
- C) Define the following terms : **[1each]**
- Loss function
  - Policy
- D) Explain each of the following terms : **[1each]**
- $\ddot{a}_{x:n}$
  - $A^1_{x:n}$

**Q2)** Attempt any two of the following : **[5 each]**

- a) The survival model of a species of birds is as :

X	0	1	2	3	4	5
$P_x$	0.8	0.65	0.5	0.35	0.2	0

For a radix of  $l_0 = 1000$ , obtain the columns of  $l_x$  and  $d_x$ . Obtain the limiting age.

- Explain the concept of utility function  $U(w)$ . If  $G$  is one time premium and  $X$  is loss random variable with  $E(X) = \mu$ , then prove that  $G \geq \mu$ .
- Define curtate future lifetime random variable  $K(x)$  and find it's probability mass function.

Q3) Attempt any Two of the following :

[5 each]

- a) Explain the term 'Annuity' with an illustration. Explain
  - i) Annuity certain due
  - ii) Annuity certain immediate
- b) A loan of Rs. 80,000 is taken and it has to be repaid in 10 equal installments payable yearly at the beginning of the year. Based on 6% annual effective rate of interest. Determine the amount of installments.
- c) State any two properties of survival function  $S(x)$ . Derive the expression for  $S(x)$  in terms of force of mortality.

Q4) Attempt any one of the following :

- A) a) Explain, with an illustration, each of the following : [5]
- i)  $n$  year term insurance
  - ii) Whole life insurance

State and explain the expression for net single premium in terms of  $V$  for each of the above insurance schemes.

- b) On 5<sup>th</sup> June 2002, (65) bought a Rs. 1,00,000 whole life insurance policy with death benefit payable at the end of year of death. The policy is purchased by means of annual premiums, payable at the start of each year policy remains in force. The policy holder died on 10<sup>th</sup> August 2009 and the loss to the insurer was 35,000. If  $i = 0.06$ , what was the annual premium paid? [5]
- B) a) Given that  $P_{60} = 0.985$ ,  $P_{61} = 0.98$ ,  $A_{62} = 0.6$ ,  $i = 0.05$  Calculate  $A_{61}$ ,  $A_{60}$  [5]
- b) If effective rate of interest is 7% per annum, then obtain [5]
- i) Accumulated value of Rs. 40,000 at the end of 5<sup>th</sup> year,
  - ii) Present value of Rs. 35,000 due at the end of third year.



Total No. of Questions : 4]

SEAT No. :

P 848

[Total No. of Pages : 3

[5315] - 448

T.Y.B.Sc.

STATISTICS (Principal)

ST - 342 : Testing of Hypotheses

(2013 Pattern) (Paper - II) (Semester - IV) (Theory)

Time : 2 Hour]

[Max. Marks :40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of Calculator and statistical table is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following :

- A) Choose the correct alternative in each of the following : **[1each]**
- i) For exponential distribution with mean  $\theta$ , to test null hypothesis  $H_0 : \theta = \theta_0$  against  $H_1 : \theta > \theta_0$ , the critical region will be
    - a)  $\sum X_i < C$
    - b)  $\sum X_i > C$
    - c)  $|\bar{X}| < C$
    - d)  $|\bar{X}| > C$
  - ii) Which of the following is used for testing goodness of fit?
    - a) Sign test
    - b) Mann - Whitney U test
    - c) Kolmogorov- Smirnov test
    - d) Run Test
  - iii) For carrying out SPRT which of the following should be fixed in advance?
    - a) Both  $\alpha$  and  $\beta$
    - b) Only  $\alpha$
    - c) Only  $\beta$
    - d) Neither  $\alpha$  nor  $\beta$

P.T.O





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

- A) Describe Kolmogorov - Smirnov test for one sample problem
- B) Construct a likelihood ratio test of level  $\alpha$  for testing the hypothesis  $H_0 : \sigma^2 = \sigma_0^2$  against  $H_1 : \sigma^2 < \sigma_0^2$  for a random sample of size  $n$  taken from the  $N(4, \sigma^2)$  distribution.
- C) State Neyman - Pearson theorem. Use it to find the most powerful test of level  $\alpha$  for testing the hypothesis  $H_0 : \theta = 1$  against  $H_1 : \theta = 2$  where  $\theta$  is the parameter of the distribution of a random variable  $X$  with p.d.f. given by

$$f(x) = \frac{\theta}{1-\theta} x^{\left(\frac{2\theta-1}{1-\theta}\right)} \quad 0 < x < 1, \theta > 0$$

$= 0 \quad \text{o.w.}$

**Q4) Attempt any one of the following :**

- A) i) Construct a SPRT of strength  $(\alpha, \beta)$  for testing the hypothesis  $H_0 : \theta = \theta_0$  against the hypothesis  $H_1 : \theta = \theta_1 (\theta_1 > \theta_0)$  for Bernoulli distribution with parameter  $\theta$ . **[5]**  
ii) Following is a random sample drawn from the continuous population in the order in which the observations are made :  
75, 56, 44, 89, 95, 23, 32, 84, 77, 71, 88, 41.  
Test the hypothesis of randomness of the sample. Use 5% level of significance. **[5]**
- B) i) Let  $X_1, X_2, \dots, X_n$  denote the random sample of size  $n$  from the normal distribution with mean  $\mu$  and standard deviation 16. Find the sample size  $n$  and a uniformly most powerful test of level 0.1 for testing  $H_0 : \theta = 25$  against  $H_1 : \theta < 25$  with power function  $K(\theta)$  such that  $k(24) = 0.5$  **[5]**  
ii) Steel rods produced by a certain company have a median length 10 meters when the process is operating properly. A sample of 10 rods, randomly selected from production line, yields the following observed length.  
9.87, 10.18, 10.22, 9.84, 10.05, 9.81, 10.03, 10.09, 9.95, 9.80  
Assuming that the lengths are symmetrically distributed about their median, test whether the process is operating properly using Wilcoxon's signed ranked test. (Use 5% . l.o.s.) **[5]**



Total No. of Questions : 4]

SEAT No. :

P 849

ss[Total No. of Pages : 3

[5315]-449

T.Y.B.Sc. (Semester - IV)

STATISTICS (Principal)

ST - 343 : STATISTICAL QUALITY CONTROL

(2013 Pattern)

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of Scientific and statistical Calculator tables is allowed.*
- 4) *Symbols and abbreviations have their usual meaning.*

**Q1)** Attempt each of the following :

- a) Choose the correct alternative in each of the following : **[1each]**
  - i) The UCL and CL on  $\bar{X}$  Chart are respectively a and b. Hence the LCL on the  $\bar{X}$  chart is
    - a)  $2a + b$
    - b)  $2a-b$
    - c)  $2b-a$
    - d)  $2b+a$
  - ii) Which of the following process tool is used to evaluate inter - relationship between two quality characteristic?
    - a) Pareto diagram
    - b) Histogram
    - c) Cause and effect diagram
    - d) Scatter plot
  - iii) Producer's risk is probability of rejecting a lot of quality
    - a) AQL
    - b) AOQ
    - c) LTFD
    - d) AOQL

**P.T.O**





Total No. of Questions : 4]

SEAT No. :

P 850

ss[Total No. of Pages : 4

[5315]-450

T.Y. B.Sc.

STATISTICS (Principal)

ST - 344 : Operations Research

(2013 Pattern) (Paper - IV) (Semester - IV)

Time : 2 Hours]

[Max. Marks :40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) a) Choose the correct alternative in each of the following : [1each]

- i) If the primal linear programming problem (LPP) has infeasible solution, the solution of its dual is
  - 1) infeasible
  - 2) unbounded
  - 3) unique optimal
  - 4) not optimal
- ii) The method used for obtaining optimal solution of a Transportation Problem (TP) is
  - 1) Vogel's approximation method
  - 2) Least cost method
  - 3) Hungarian method
  - 4) Modified distribution (MODI) method
- iii) The solution to a TP with m sources and n destinations is non degenerate if the number of positive allocations is
  - 1)  $m + n$
  - 2)  $m + n - 1$
  - 3)  $m \times n$
  - 4)  $m + n + 1$

P.T.O

- iv) In PERT, variance of the project is based on
- 1) critical activities
  - 2) non - critical activities
  - 3) all activities
  - 4) dummy activities
- b) State whether each of the following is true or false. **[1each]**
- i) The dual of a dual is primal.
  - ii) Assignment problem can be treated as a particular case of transportation problem.
- c) Define each of the following. **[1each]**
- i) Artificial variable
  - ii) Surplus variable
- d) What is an unbalanced TP? How to convert it into a balanced TP? **[2]**

**Q2)** Attempt any two of the following : **[5 each]**

- a) A firm engaged in producing two models A and B performs three operations; assembly, painting and testing. The relevant data are as follows.

Total number of hours available each week are :

Assembly - 150 Painting - 80 Testing - 24

Model	Unit sale	Hours		
	Price (in Rs.)	Assembly	Painting	Testing
A	50	1	0.5	0.2
B	80	1.25	0.5	0.1

The firm wishes to determine its weekly product - mix 50 as to maximize revenue. Formulate it as a LPP.

- b) Explain the following terms with regards to LPP.
- i) feasible solution
  - ii) optimal solution
  - iii) infeasible solution
  - iv) unbounded solution
  - v) alternate solution

c) Write dual of the following LPP

$$\begin{aligned} \text{Minimize } z &= 2x_1 + 3x_2 + x_3 \\ \text{Subject to } x_1 - x_2 + x_3 &\leq 5 \\ 2x_1 + x_2 &= 7 \\ x_1 + x_2 - x_3 &\geq 8 \\ x_1, x_2, x_3 &\geq 0 \end{aligned}$$

Q3) Attempt any two of the following :

[5 each]

- a) Explain the term "simulation". Write its merits and demerits.
- b) A car hire company has one car in each of four depots  $D_1, D_2, D_3$  and  $D_4$ . A Customer in each of four regions  $R_1, R_2, R_3$  and  $R_4$  requires a car. The distance in km between depots and regions is as follows.

Depo \ Region	$R_1$	$R_2$	$R_3$	$R_4$
$D_1$	160	120	50	55
$D_2$	130	120	50	35
$D_3$	190	160	80	80
$D_4$	200	175	110	105

How should cars be assigned to the customers so as to minimise the total distance travelled?

- c) Explain the following terms as regards to CPM :
- i) earliest start time
  - ii) earliest finish time
  - iii) latest start time
  - iv) latest finish time
  - v) critical path



**Q4)** Attempt any one of the following :

- a) i) Explain how simulation can be used to obtain probabilities of events related to gamma distribution. [3]
- ii) Following table gives per unit cost of transportation (in Rs.) from sources to destinations along with availability and requirement.

Sources \ destination	destination				Availability
	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	D <sub>4</sub>	
S <sub>1</sub>	15	10	17	18	20
S <sub>2</sub>	16	13	12	13	60
S <sub>3</sub>	12	17	20	11	70
Requirement	30	30	40	50	

Obtain IBFS using VAM. Further, find optimal solution. [7]

- b) i) Explain the following terms in PERT analysis [4]
- 1) Pessimistic time estimate
  - 2) Optimistic time estimate
  - 3) Most likely time estimate
  - 4) Variance of the project length
- ii) Draw a network diagram from following activities. Find critical path.

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Predecessor	-	-	-	B	B	A, E	C, D	G	H	I	C, D	C, D	C, D	J	M
Time (days)	2	2	4	6	1	1	3	45	10	7	6	2	2	1	2

[6]



Total No. of Questions : 4]

SEAT No. :

P851

[Total No. of Pages : 8

[5315]-451

T.Y. B.Sc. (Semester - IV)

STATISTICS (Principal) (Paper - V)

ST - 345 (A) : Reliability and Survival Analysis

(2013 Pattern)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator and statistical tables is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following:

a) Choose the correct alternative in each of the following : [1 each]

i) For a k-out-of-n : G system, the number of cut vectors is

A)  $2^n - \sum_{r=k}^n {}^n C_r$

B)  $2^n - \sum_{r=0}^{k-1} {}^n C_r$

C)  $\sum_{r=k}^n {}^n C_r$

D)  $\sum_{r=0}^{k-1} {}^n C_r$

ii) The number of irrelevant components in a series system is

A) n

B) 0

C) 1

D) n - 1

P.T.O.

- iii) Let  $r(t)$  be a failure rate function of a lifetime random variable (r.v.) then

$$A) \quad r(t) = \lim_{0 < h \rightarrow \infty} \left( \frac{\bar{F}(t) - \bar{F}(t+h)}{h \bar{F}(t)} \right)$$

$$B) \quad r(t) = \lim_{0 < h \rightarrow 0} \left( \frac{\bar{F}(t+h) - \bar{F}(t)}{h \bar{F}(t)} \right)$$

$$C) \quad r(t) = \lim_{0 < h \rightarrow 0} \left( \frac{\bar{F}(t) - \bar{F}(t+h)}{h \bar{F}(t)} \right)$$

$$D) \quad r(t) = \lim_{0 < h \rightarrow \infty} \left( \frac{\bar{F}(t+h) - \bar{F}(t)}{h \bar{F}(t)} \right)$$

- iv) If  $T$  is a lifetime r.v. having exponential distribution with mean 5 then mean residual life of unit aged  $t$  is

A) 5    B)  $\frac{1}{5}$

C)  $\frac{1}{5+t}$     D)  $5+t$

- b) State whether each of the following statement is true or false : **[1 each]**

i) Let  $h(\underline{P})$  be the system reliability of a coherent system then  $0 < h(\underline{P}) < 1$ .

ii) Exponential distribution is a member of positive ageing class of lifetime distributions.

- c) Define the following terms: **[1 each]**

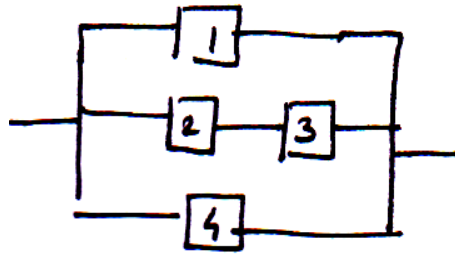
i) Harmonically New Better than used in Expectation class of lifetime distribution.

ii) Decreasing Failure Rate in Average (DFRA) class of lifetime distribution.

- d) Attempt each of the following : [1 each]
- i) Give an application of a k - out - of - n : G system.
  - ii) Give an example of right random censoring scheme.

**Q2)** Attempt any two of the following: [5 each]

- a) Consider the system with reliability block diagram as given below :



- i) Find minimal path sets
  - ii) Find minimal cut sets
  - iii) Represent the above system as a series arrangement of minimal cut parallel structure.
  - iv) Draw reliability block diagram of a dual of a given system.
- b) Let  $h(\cdot)$  be the reliability function of a coherent system then show that
- $$h(\underline{P} \parallel \underline{P}') \geq h(\underline{P}) \parallel h(\underline{P}') \text{ for all } 0 \leq P_i \leq 1, 0 \leq P_i' \leq 1 \text{ and equality holds for all } P_i, P_i' \text{ iff the system is parallel.}$$
- c) Show that if F belongs to Increasing Failure Rate (IFR) class of lifetime distributions then it belongs to Increasing Failure Rate in Average (IFRA) class of lifetime distributions.

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

- a) Discuss in detail structural importance of a component in a coherent system with the help of an illustration. Also state its use.

- b) Let a lifetime r.v.T with cumulative hazard rate function as

$$R(t) = \begin{cases} kt & ; 0 \leq t \leq 1 \\ \frac{t^2}{2} & ; t > 1 \end{cases}$$

Where k is a positive constant

Find

- i) the value of k such that T is strictly continuous.
  - ii) Survival function of T.
  - iii) Probability density function of T.
- c) Obtain an expression for an actuarial estimator of survival function of a lifetime r.v.T.

**Q4)** Attempt any one of the following:

- a)
  - i) Show that k-out-of-n : G system is a coherent system hence show that series system is also a coherent system. [6]
  - ii) Let a lifetime r.v.T follows Weibull ( $\lambda$ :scale. parameter,  $\gamma$ :shape parameter)  
Compute failure rate function. Discuss its different nature for various values of shape parameter  $\gamma$ . [4]
- b)
  - i) Define Decreasing Mean Residual Life property (DMRL) of a lifetime r.v.T and New Better than used in Expectation (NBUE) class of lifetime distributions. [6]  
Show that
    - 1) If  $F \in \text{IFR} \Rightarrow F \in \text{DMRL}$
    - 2) If  $F \in \text{DMRL} \Rightarrow F \in \text{NBUE}$
  - ii) What is the component reliability of each of n identical components in a series system if the system reliability is 0.9? [2]
  - iii) Consider the following data of remission time (in weeks) of leukemia patients receiving control treatment.  
1, 1, 2, 2, 5, 5, 5, 5, 6, 6, 8, 8, 8, 8, 9, 9, 10, 10  
Calculate an estimate of an unbiased estimator of  $\bar{F}(9)$  where  $\bar{F}(\cdot)$  is a survival function. [2]



Total No. of Questions : 4]

P851

[5315]-451

T.Y. B.Sc. (Semester - IV)

STATISTICS (Principal) (Paper - V)

ST - 345 (B) : Introduction to Stochastic Processes  
(2013 Pattern)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Use of scientific calculator and statistical tables is allowed.
- 4) Symbols and abbreviations have their usual meaning.

Q1) Attempt each of the following:

- a) Choose the correct alternative in each of the following: [1 each]
- i) In a Markov chain if all states communicate with each other then it is called
- A) irreducible                      B) reducible  
C) discrete                          D) finite
- ii) Let  $\{N(t), t \geq 0\}$  be a Poisson process with parameter  $\lambda$ . Mean number of occurrences in an interval of length  $t$  is
- A)  $\frac{1}{\lambda}$                                   B)  $\lambda t$   
C)  $\lambda^2 t$                                 D)  $\frac{1}{\lambda t}$
- iii) A persistent state is null persistent if the mean recurrence time is
- A) finite                                B) infinite  
C) 0                                        D) 1

- iv) A Markov chain is aperiodic, if its every state is
- A) periodic                                  B) irreducible  
 C) persistent                                D) aperiodic
- b) State whether each of the following statements is true or false :**[1 each]**
- i) Absorbing state of a Markov chain is always ergodic.  
 ii) The difference between two independent Poisson processes is also a Poisson process.
- c) Define : **[1 each]**
- i) Stochastic matrix  
 ii) Markov chain (M.C.)
- d) i) Define stationary distribution of a Markov Chain. **[1]**  
 ii) Explain One step transition probability matrix of a Markov Chain.**[1]**

**Q2)** Attempt any two of the following: **[5 each]**

- a) State & prove Chapman - Kolmogorov equations for Markov Chain.  
 b) Describe Ehrenfest Chain model.  
 c) Let  $\{X_n, n \geq 0\}$  be a Markov Chain having state space  $s = \{1, 2, 3, 4\}$  and transition probability matrix P as follows :

$$P = \begin{bmatrix} \frac{1}{3} & \frac{2}{3} & 0 & 0 \\ 1 & 0 & 0 & 0 \\ \frac{1}{2} & 0 & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} \end{bmatrix}$$

Show that state 1 and 2 are ergodic.

**Q3)** Attempt any two of the following:

**[5 each]**

- a) Explain the periodicity of a state of a Markov Chain with the help of a suitable example.

Check whether state 1 is aperiodic for the following transition probability matrix (P) of a Markov Chain with state space  $s = \{1, 2, 3\}$

$$P = \begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$$

- b) Let  $\{X_n, n \geq 0\}$  be a Markov Chain with state space  $s = \{0, 1, 2, 3, 4\}$  and transition probability matrix is

$$P = \begin{bmatrix} \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ \frac{1}{2} & \frac{1}{2} & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 0 & \frac{1}{2} & \frac{1}{2} & 0 \\ \frac{1}{4} & \frac{1}{4} & 0 & 0 & \frac{1}{2} \end{bmatrix}$$

Show that state 4 is transient.

- c) Explain Gambler's ruin problem.

**Q4)** Attempt any one of the following:

- a) i) A Particle performs a random walk with absorbing barriers 0 & 4. Whenever it is at any position  $r$  ( $0 < r < 4$ ), it moves to  $r + 1$  with probability  $p$  or to  $(r - 1)$  with probability  $q$ , s. t  $p + q = 1$ . But as soon as it reaches 0 or 4 it remains there itself. **[5]**



Let  $X_n$  be position of the particle after  $n$  moves.

Obtain a transition probability matrix of the Markov Chain  $\{X_n\}$ .

Also compute  $P[X_2 = 3 / X_1 = 2]$

- ii) If  $\{N_1(t), t \geq 0\}$  and  $\{N_2(t), t \geq 0\}$  are two independent Poisson processes with parameters  $\lambda_1$  &  $\lambda_2$  respectively, then show that [5]

$$P[N_1(t) = k | N_1(t) + N_2(t) = n] = \binom{n}{k} p^k q^{n-k}$$

$$\text{where } p = \frac{\lambda_1}{\lambda_1 + \lambda_2} \text{ and } q = \frac{\lambda_2}{\lambda_1 + \lambda_2}$$

- b) i) State & Explain postulates of Poisson process. [3]  
ii) Explain closed set of states in M.C. [2]  
iii) Let  $\{X_n, n \geq 0\}$  be a Markov Chain with state space  $s = \{0, 1, 2\}$  with one step transition probability matrix [5]

$$P = \begin{bmatrix} 0.2 & 0.1 & 0.7 \\ 0.5 & 0.3 & 0.2 \\ 0.4 & 0.2 & 0.4 \end{bmatrix}$$

and initial probability distribution  $P[X_0 = i] = \frac{1}{3}$  for  $i = 0, 1, 2$ .

Obtain two step transition probability matrix

compute

- 1)  $P[X_2 = 1 | X_0 = 0]$   
2)  $P[X_2 = 2, X_0 = 0]$



Total No. of Questions : 4]

SEAT No. :

P852

[Total No. of Pages : 4

[5315]-452

T.Y. B.Sc. (Semester IV)

STATISTICS : (Principal) (Paper - VI)

ST - 346 : Statistical Computing Using R Software

(2013 Pattern) (Batch - I)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:-

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Each question is to be solved using R Software installed on your computer.
- 4) Attach computer printout of your work to the answer book supplied to you.

Q1) Attempt each of the following:

[1 each]

- a) Create a data frame of following data consists names of students and their marks in the exam:

Richard	Jack	Anthony	Wang	Statham
58	52	68	75	42

- b) Represent the p.m.f of Binomial distribution with parameters  $n = 6$  and  $p = 0.65$  through a rod plot.
- c) Using for loop obtain sum of first 10 natural numbers.
- d) The following are the measurements of the breaking strength ( $X$ ) (in pounds) of a certain kind of 2-inch cotton ribbon:

163, 165, 160, 189, 161, 171, 158, 151, 169, 162, 163, 139, 172, 165, 148, 166, 172, 163, 187, 173

Test the hypothesis that population median of  $X$  is 160 against it is greater than 160 at 5% level of significance using Wilcoxon signed rank test.

- e) The following data relates to the heights (in cm) of 20 flowers. Create a vector " $h$ " of the heights using scan function. Hence extract the values which are greater than 24.

9, 26, 28, 21, 20, 44, 40, 33, 31, 22, 20, 28, 39, 8, 12, 11, 9, 31, 25, 24

P.T.O.

- f) Calculate quartile deviation for the following set of observations:  
2, 6, 4, 1, 3, 5, 10, 5, 4, 3, 6, 2, 3, 4, 7
- g) Let  $X \sim P(\lambda = 4.5)$ . Find  $P(X = 3)$  and  $P(X \leq 4E(x))$ .
- h) Draw boxplot for the following data on weight (in kg) of 20 school boys:  
41, 50, 47, 38, 45, 47, 31, 35, 41, 52, 57, 62, 49, 48, 45, 35, 37, 49, 39, 41.
- i) Find harmonic mean of following observations:  
63, 79, 70, 55, 42, 37, 67, 29, 36, 74, 36, 68, 58, 30, 60
- j) Draw a random sample of size 8 from hypergeometric distribution with parameters  $N = 28$ ,  $M = 10$  and  $n = 6$ .

**Q2)** Attempt **any two** of the following:

**[5 each]**

- a) Suppose  $X_1, X_2, \dots, X_n$  is a random sample from  $N(\mu = 5, \sigma^2 = 2.5)$  distribution. Verify whether sample mean is consistent for  $\mu$ . Write R program script.
- b) The time in minutes taken to complete a job by machine I and machine II is given below:

Machine I	20	16	26	27	23	22	25		
Machine II	27	33	42	35	32	34	38	29	40

Using Mann-Whitney test can we conclude that the time taken to complete a job by machine I is less than that in machine II?

- c) Frequency distribution of height (in cms) of number of students is given below:

Height	140-145	145-150	150-155	155-160	160-165	165-170
No. of students	4	13	22	45	16	9

Draw histogram and frequency polygon for the above data.

**Q3)** Attempt **any two** of the following:

**[5 each]**

a) Represent the following data by a subdivided bar diagram:

Cost per vehicle (Rs.)	2002	2003	2004
Raw materials	21600	26000	27000
Labour	5400	7000	8100
Direct expenses	3600	3000	3500
Office expenses	1800	2000	2700
Factory expenses	3600	2000	3600

b) The following data represent the distribution of number of students according to their monthly pocket money (in Rs.)

Pocket money	100-150	150-200	200-250	250-300	300-350	350-400
No. of students	13	31	47	27	18	5

Compute coefficient of skewness based on moments.

c) Fit a Poisson distribution to the following data related to faulty units produced in a single shift in a factory:

No. of faults	0	1	2	3	4	5	6 and more
No. of shifts	4	14	23	23	18	9	9

Find the expected frequencies. Plot observed and expected frequencies and comment on adequacy of model.

**Q4)** Attempt **any one** of the following:

a) i) A coffee company appoints four salesmen P, Q, R and S and observed their sales (in lakh Rs.) in three districts A, B and C as given below:

District / Salesman	P	Q	R	S
A	36	36	21	35
B	28	29	31	32
C	26	28	29	29

Perform two way analysis of variance by verifying the assumptions. **[6]**

- ii) Two batsmen A and B scored the following runs in ten innings:

A	101	27	5	36	82	45	7	13	65	14
B	97	12	40	96	13	8	85	8	56	15

Who is the more consistent batsman? [4]

- b) i) Following are the data on the time (in mts.) required to fill the bottles by two machines A and B.

A	5	9	7	8	5.7	7.5	8.1
B	7.5	3.5	8	7.5	3.9	4.5	8.1

Can we conclude that average time required by two machines is same. Take  $\alpha = 0.05$ . Write R program script. [5]

- ii) A group of 50 girls and 40 boys was asked to give their preference between two brands of mobile hand sets. The results obtained are as follows:

	Brand I	Brand II
Boys	23	17
Girls	20	30

Test at 5% level of significance whether preference of a particular brand is independent of sex. [5]



Total No. of Questions : 4]

SEAT No. :

P853

[Total No. of Pages : 4

**[5315]-452A**  
**T.Y. B.Sc. (Semester IV)**  
**STATISTICS : (Principal) (Paper - VI)**  
**ST - 346 : Statistical Computing Using R Software**  
**(Batch - II) (2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Each question is to be solved using R Software installed on your computer.*
- 4) *Attach computer printout of your work to the answer book supplied to you.*

**Q1)** Attempt each of the following:

**[1 each]**

- a) Create a data frame using edit command of item name and its price for 5 items.
- b) Find geometric mean of following observations:  
63, 79, 70, 55, 42, 37, 67, 29, 36, 74, 36, 68, 58, 30, 60
- c) An experiment of tossing a die 50 times gave following results:

Number appeared	1	2	3	4	5	6
Frequency	4	8	13	17	6	2

Draw spike plot.

- d) Use Kolmogorov-Smirnov test to test whether the following observations comes from  $U(0, 1)$  distribution:  
0.25, 0.1, 0.3, 0.75, 0.85, 0.9, 0.39, 0.56.
- e) Create a vector Y of following numbers using scan function:  
37, 73, 55, 33, 40, 57, 50, 77, 61, 77  
Using vector Y create vector T containing numbers of Y which are smaller than 55.
- f) Using for loop obtain product of first 10 natural numbers.

**P.T.O.**

- g) A car hire firm has 2 cars. The number of demands for a car on a day has Poisson distribution with mean 1.5. Find the probability that on a day
- neither car is used
  - some demand is not fulfilled.
- h) From the following data find mean deviation about mean :
- 74, 55, 55, 46, 57, 75, 66, 37
- i) Let  $X \sim N(\mu = 3, \sigma^2 = 5)$ . Find  $P(-3 \leq x \leq 5)$ .
- j) Draw stem and leaf plot for the following data on weight (in kg) of 20 school boys:
- 41, 50, 47, 38, 45, 47, 31, 35, 41, 52, 57, 62, 49, 48, 45, 35, 37, 49, 39, 41.

**Q2) Attempt any two of the following:**

**[5 each]**

- a) Suppose  $X_1, X_2, \dots, X_n$  is a random sample from a Poisson distribution with mean 3.2. Verify whether sample mean is consistent for  $m$ . Write R. program script.
- b) Calculate quartile deviation for the following data :

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	10	25	62	26	19	8

- c) Frequency distribution of height (in cms) of number of students is given below:

Height	140-144	145-149	150-154	155-159	160-164	165-169
No. of students	4	13	22	45	16	9

Draw less than and more than cumulative frequency curves for the above data.

**Q3)** Attempt **any two** of the following:

**[5 each]**

- a) Fit a normal distribution to the following data:

Class	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80
Frequency	3	18	45	62	51	34	9	2

- b) Following table gives the mode of transport used by employees of a certain company

Mode of transport	Walk	Bicycle	Train	Bus	Two-wheeler	Four wheeler
No. of employees	45	60	105	200	380	70

Represent the above data by pie diagram.

- c) The manufacturer of a certain make of electric tubes claims that the tubes have a minimum mean life of 50 months with a standard deviation of 8 months. A random sample of 8 such tubes gave the following life times (in months):

52, 59, 78, 41, 38, 67, 54, 50

Can we regard the producers claim to be valid at 1% level of significance? Write R program script.

**Q4)** Attempt **any one** of the following:

- a) i) Find AM, GM and HM of the observations given below:

47, 51, 35, 66, 35, 45, 55, 41, 60, 34.

Verify the relation between them.

**[5]**

- ii) Measurements of the fat content of brands of icecream A and B gave the following data:

A	13.5	14	13.6	12.9	13
B	12.1	15.5	12.4	13	16.9

Test whether the variation of fat contents in both brands is same by verifying the assumptions. Write R program script.

**[5]**



- b) i) The following data represent the number of hours that two different types of scientific pocket calculators operate before a recharge is required:

Calculator A	5.5	5.6	6.3	4.6	5.3	5	6.2	5.8	5.1
Calculator B	3.8	4.8	4.3	4.2	4	4.9	4.5	5.2	4.5

Use Mann-Whitney test with 1% level of significance to determine if calculator A operates longer than calculator B on a full battery charge. **[4]**

- ii) A farmer applies three types of fertilizers on four separate plots. The figures of yield per acre are given below:

Fertilizer / Plots	A	B	C	D
Nitrogen	6	4	8	6
Potash	7	6	6	9
Phosphates	8	5	10	9

Carry out two way analysis of variance using above data. **[6]**



Total No. of Questions : 4]

SEAT No. :

P854

[Total No. of Pages : 4

**[5315]-452B**  
**T.Y. B.Sc. (Semester - IV)**  
**STATISTICS (Principal) (Paper - VI)**  
**ST - 346 : Statistical Computing Using R Software**  
**(2013 Pattern) (Batch - III)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Each question is to be solved using R Software installed on your computer.*
- 4) *Attach computer printout of your work to the answer book supplied to you.*

**Q1)** Attempt each of the following:

**[1 each]**

- a) Use Kolmogorov-Smirnov test to test whether the following observations comes from exponential distribution with parameter 5:  
0.132, 0.343, 0.055, 0.086, 0.273, 0.513, 0.016, 0.205, 0.784, 0.071  
Use 5% level of significance.
- b) Let  $X \sim \text{Poisson}(m)$  such that  $P(X = 0) = P(X = 1)$ . Find  $P(X > 2)$ .
- c) Using following data compute quartile deviation:  
70, 43, 56, 36, 53, 71, 74, 35, 75, 49
- d) Create a data frame of seven days in a week showing maximum temperature ( $^{\circ}\text{C}$ ) on that day.
- e) Create a vector Z of following numbers using scan function  
34, 93, 46, 69, 220, 113, 297, 1196, 200, 364, 123, 12, 139, 21,98  
Using vector Z create vector T containing numbers of Z which are less than 100.
- f) Find mode of following observations:  
63, 79, 70, 55, 42, 37, 67, 29, 36, 74, 36, 55, 55, 30, 60
- g) Using for loop find factorial 10.

**P.T.O.**

- h) Draw box plot of following observations:  
2.50, 15.98, -34.93, -20.93, 20.68, -0.69, 35.61, 45.67, -31.13, -49.60
- i) Draw a random sample of size 8 from  $N(\mu = 4, \sigma^2 = 5.8)$  distribution.
- j) Represent the p.m.f of Poisson distribution with parameters  $m = 4$  through a rod plot.

**Q2) Attempt any two of the following: [5 each]**

- a) Frequency distribution of height (in cms) of number of students is given below:

Height	140-144	145-149	150-154	155-159	160-164	165-169
No. of students	4	13	22	45	16	9

Calculate mean deviation about mean for the above data.

- b) Find AM, GM and HM of the observations given below:

23 ,11 ,11 ,24 ,21 ,21 ,22, 20, 10, 20.

Verify the relation between them.

- c) Suppose  $X_1, X_2, \dots, X_n$  is a random sample from a  $N(\mu = 2.5, \sigma^2 = 4)$  distribution. Verify whether sample mean is consistent for  $\mu$ . Write R program script.

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

- a) Fit a Poisson distribution to the following data:

x	0	1	2	3	4	5	6
Frequency	93	67	50	30	16	5	2

Also, plot observed and expected frequencies and comment on adequacy of model.

- b) Frequency distribution of marks in Marathi obtained by the students is given below:

Marks	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of students	1	14	22	40	31	9	3

Calculate Bowleys coefficient of skewness.

- c) Following are the data on the time (in mts.) required to fill the bottles by two machines A and B.

A	5	9	7	8	5.7	7.5	8.1
B	7.5	3.5	8	7.5	3.9	4.5	8.1

Can we conclude that average time required by two machines is same. Take  $\alpha = 0.05$ . Write R program script.

**Q4)** Attempt **any one** of the following:

- a) i) The following data represent the number of hours that two different types of scientific pocket calculators operate before a recharge is required: [5]

Calculator A	5.5	5.6	6.3	4.6	5.3	5	6.2	5.8	5.1
Calculator B	3.8	4.8	4.3	4.2	4	4.9	4.5	5.2	4.5

Use Mann-Whitney test with 1% level of significance to determine if calculator A operates longer than calculator B on a full battery charge.

- ii) Represent the following data by a multiple bar diagram: [5]

Cost per vehicle (Rs.)	2002	2003	2004
Raw materials	21600	26000	27000
Labour	5400	7000	8100
Direct expenses	3600	3000	3500
Office expenses	1800	2000	2700
Factory expenses	3600	2000	3600

- b) i) For the following data draw histogram and frequency polygon: [4]

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	10	25	62	26	19	8

- ii) Three processors A, B and C are tested to see whether their outputs are equivalent. The following observations of output are obtained:

A	12	8	17	14	13	10	11
B	13	16	15	12	9		
C	9	10	18	17	16	12	

Carry out the analysis of variance using above data by verifying the assumptions. [6]



Total No. of Questions : 4]

SEAT No. :

P855

[Total No. of Pages : 4

**[5315]-452(C)**  
**T.Y. B.Sc. (Semester - IV)**  
**STATISTICS : (Principal) (Paper - VI)**  
**ST - 346 : Statistical Computing Using R Software**  
**(2013 Pattern) (Batch - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

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

**Q1)** Attempt each of the following:

**[1 each]**

- a) Let  $X \rightarrow C(3,2)$  find  $P(3 \leq X < 4)$ .
- b) Draw a rodplot for the following data  
68, 44, 25, 68, 75, 72, 83, 88, 40, 25, 68, 44.
- c) Create a vector X of the following observations by using scan function  
28, 50, 30, 48, 39, 25, 28.
- d) Find mean & median of the following observations.  
23, 15, 20, 18, 32, 30, 35, 20, 18, 50, 19, 20.
- e) Let  $X \rightarrow N(\mu = 5, \sigma^2 = 9)$ .  
Find K such that  $P(7 < X < K) = 0.3$ .
- f) Draw a box plot of the following data  
5, 10, 23, 28, 50, 27, 18, 98, 10, 18, 25, 28.
- g) Create a data frame of name of 6 students & their favourite colour using edit command.
- h) Draw a random sample of size 10 from Poisson distribution with  $m = 8$ .

**P.T.O.**

- i) Write R - program script for computing value of factorial 10 using a for loop.
- j) Create a file in MS-Excel containing number of students from Arts, Commerce & Science faculty in the year 2010, 2012 respectively & save it as text file. Import this text file in R.

**Q2)** Attempt any two of the following:

**[5 each]**

- a) Draw Histogram & frequency polygon for the following data :

Length (in cms)	Number of rods
0 - 5	2
5 - 10	7
10 - 15	18
15 - 20	30
20 - 25	41
25 - 30	6

- b) The following are the lengths of time (in minutes) spent in the operating room by 20 patients undergoing the same operative procedure.

Hospital A : 25 20 23 29 31 19 20 26 35 37 30

Hospital B : 35 48 32 40 50 30 31 46 51

From above data, can we conclude that, for the same operative procedure, patients in Hospital B tend to be in the operating room longer than patients in hospital A?

Use Mann - Whitney test, Use  $\alpha = 0.01$ .

- c) Measurements of the fat content of brands of ice-cream A & B gave the following sample data :

A: 12.8 13 13.8 12.9 14

B: 12.1 15.4 15 12.8 16.9

Test whether the variation of fat contents in both brands are same. Write R-program in script to check normality of samples A & sample B. & then carry out the F-test for equality of variances.

**Q3)** Attempt any two of the following:

**[5 each]**

- a) Fit a Poisson distribution to the following data & find expected frequencies. Plot observed & expected frequencies & comment on adequacy of the model :

Number of misprints	0	1	2	3	4	5
No. of pages	139	76	28	4	2	1

- b) Calculate Bowley's coefficient of skewness for the following data :

Age group	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50
Number of persons	15	20	35	15	8

- c) A Tea Company appoints four salesmen P, Q, R & S and observes their sales in three seasons Summer, Winter & Monsoon.

The figures (in lakhs) of sales are given in the following table :

Season	Salesmen			
	P	Q	R	S
Summer	36	35	20	34
Winter	27	30	30	33
Monsoon	28	30	27	29

- i) Do the salesmen significantly differ in performance?  
ii) Is there significant difference between the seasons?  
(Use Two way ANOVA)

**Q4)** Attempt any one of the following:

- a) i) Draw a probability curve of Weibull distribution with shape parameter 1.5 & scale parameter 2. **[3]**  
ii) Following data represents information regarding favourite colour of 400 school boys & girls. **[5]**

Gender \ Colour	Blue	Yellow	Pink
	Boy	80	70
Girl	50	40	120



Test whether the attributes Gender & Favourite colour are independent using Chi - Square test for independence.

(Use  $\alpha = 0.05$ )

- iii) The times to failure (in hours) of 10 randomly selected 9-volt transistor batteries of a certain brand were recorded as follows :[2]

25, 28.7, 48.6, 45, 44.8, 50, 51.5, 54.5, 45.8, 44.8

Test the hypothesis that the failure times are exponentially distributed with mean 42 hours at 5% l.o.s. (Use Kolmogorov - Smirnov test)

- b) i) The following are the measurements of the breaking strength (X) in pounds of a certain kind of 2 - inch cotton ribbon : [5]

163, 165, 160, 189, 161, 171, 158, 151, 169, 153, 139, 170, 166, 152, 183, 163, 150, 152, 150, 149.

Test the null hypothesis that population median of X is 150 against the alternative that it is greater than 150 at  $\alpha = 0.05$  using Wilcoxon signed rank test.

- ii) Suppose  $X_1, X_2, \dots, X_n$  is a random sample from a  $N(\mu = 3, \sigma^2 = 16)$  distribution.

Verify whether sample mean is consistent for  $\mu$ . Write R program script. [5]



Total No. of Questions : 4]

SEAT No. :

**P856**

[Total No. of Pages : 2

**[5315]-453**

**T.Y. B.Sc**

**GEOGRAPHY**

**Gg. 341: FUNDAMENTALS OF HUMAN GEOGRAPHY**

**(2013 Pattern) (Semester - IV) (Paper - II) (Part - II)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams and sketches wherever necessary.*
- 4) *Use of map stencils is allowed.*

**Q1)** Answer the following questions in one or two sentences (any ten): **[10]**

- a) Define urbanisation.
- b) Give any two examples of conurbation.
- c) Define Gini coefficient.
- d) Names the types of age-sex pyramids.
- e) Define balance of payments.
- f) Name the continent with maximum proportion of urban population.
- g) List various criteria used to define a town.
- h) State any two demographic factors affecting urbanization.
- i) Name the largest megacity in China.
- j) Name the major crop grown under extensive agriculture in North America.
- k) Name the areas of intensive agriculture in India.
- l) Name the areas of plantation agriculture in the world.
- m) Who developed the 'Demographic Transition Model.

**Q2)** Write short notes (any two): **[10]**

- a) Lorenz curve
- b) Plantation Agriculture.

**P.T.O**

- c) Measurement of active population.
- d) International trade.

**Q3)** Answer the following questions in 100 words (any two): **[10]**

- a) Explain Weber's theory of industrial location.
- b) Describe the Demographic Transition Model.
- c) Explain Von Thunen's theory of agricultural landuse.
- d) Discuss the factors affecting trade.

**Q4)** Answer the following questions in 200 words (any one): **[10]**

Explain Malthus' theory of population growth.

OR

Explain the network indices for transport network analysis.



Total No. of Questions : 4]

SEAT No. :

**P857**

[Total No. of Pages : 2

**[5315]-454**

**T.Y. B.Sc**

**Gg. 342: GEOGRAPHY OF TRAVEL & TOURISM (Part - II)  
(2013 Pattern) (Semester - IV) (Paper - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicates full marks.*
- 3) Draw neat diagrams and sketches wherever necessary.*
- 4) Use of map stencils is allowed.*

**Q1)** Answer the following questions in one or two sentences (any ten): **[10]**

- a) Define cultural tourism.
- b) What is eco tourism?
- c) Name any two UNESCO world Heritage sites in Tamil Nadu.
- d) In which State is the Great Himalayan National park located.
- e) What is meant by multiplier effect of tourism?
- f) Name any two hill stations in Uttarakhand.
- g) Name any two luxury trains in India exclusively for the purpose of tourism
- h) Name any two beaches in Kerala.
- i) Name any two mountain railways of India in the rugged hill regions of Himalayas.
- j) State any two impacts of tourism on language.
- k) In which State is Manas wildlife sanctuary located?
- l) In which city is Sri Harmandir Sahib located.
- m) Name any two hill forts of Rajasthan which are under UNESCO world heritage sites.

***P.T.O***

**Q2) Write short notes (any two):** **[10]**

- a) Caravan tourism
- b) Houseboats in India
- c) Sustainable Tourism development
- d) IRTC web portal

**Q3) Answer the following questions in 100 words (any two):** **[10]**

- a) Describe the impacts of tourism on health giving suitable examples.
- b) Explain the importance of road transport in development of tourism in India.
- c) Explain the different types of expenditures giving suitable examples.
- d) Explain the impact of tourism on balance of payment of the country.

**Q4) Answer the following questions in 200 words (any one):** **[10]**

- a) Explain the social and cultural impacts of tourism by giving suitable examples.

OR

- b) Describe the importance of National parks in tourism with reference to Jim corbett and Kaxiranga National park.



Total No. of Questions : 4]

SEAT No. :

**P858**

[Total No. of Pages : 2

**[5315]-455**

**T.Y. B.Sc**

**GEOGRAPHY**

**Gg. 343: Fundamentals of Geo-informatics (Part -II)  
(2013 Pattern) (Semester - IV) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Diagrams and maps must be drawn wherever necessary.*
- 4) Use of map stencils is allowed.*

**Q1)** Answer the following questions in two or three sentences (any ten): **[10]**

- a) Define GIS.
- b) Mention any two types of data input in GIS.
- c) Define the term 'Topology'.
- d) What is a TIN?
- e) Define spatial analysis in GIS.
- f) Define contiguity.
- g) What is a DTM?
- h) What is a non-spatial query?
- i) What is a GPS?
- j) Give any two uses of GPS.
- k) When is merge analysis used?
- l) What is edge-matching?
- m) What is a space segment of GPS?

**P.T.O**

- Q2)** Write short notes (any two): **[10]**
- a) Locational errors
  - b) Buffer analysis
  - c) Scan map as an input in GIS
  - d) Accuracy factors of GPS

- Q3)** Answer the following questions in 100 words (any two): **[10]**
- a) Explain overlay analysis.
  - b) Describe topological errors.
  - c) Explain the types of spatial queries in GIS.
  - d) Discuss recent trends in GIS.

- Q4)** Answer the following questions in 200 words (any one): **[10]**
- a) Explain in detail various types of data input in GIS.
  - b) Give an account of topographic analysis in GIS.



Total No. of Questions : 4]

SEAT No. :

**P859**

[Total No. of Pages : 2

**[5315]-456**  
**T.Y. B.Sc**  
**GEOGRAPHY (Part - II)**  
**Gg. 344 : Geography of India**  
**(Semester - IV) (Paper - VIII)**  
**(2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Diagrams and maps must be drawn wherever necessary.*
- 4) Use of map stencils is allowed.*

**Q1)** Answer the following questions in two or three sentences (any ten): **[10]**

- a) What do you mean by non-conventional resources?
- b) State any two states with highest bauxite production in India.
- c) Mention any two disadvantages of atomic energy.
- d) What do you mean by white revolution?
- e) Define horticulture.
- f) What do you understand by population composition?
- g) Name any two states with lowest sex ratio.
- h) Define overpopulation.
- i) What do you mean by regional planning?
- j) State any two needs of regional planning.
- k) Define natural hazards.
- l) State any two effects of floods.
- m) Name any two areas affected by cloud burst in India.

**P.T.O**



**Q2) Write short notes (any two):** **[10]**

- a) Non-conventional energy resources.
- b) Remedies on overpopulation.
- c) Blue revolution.
- d) Objectives of regional planning.

**Q3) Answer the following questions in 100 words (any two):** **[10]**

- a) Explain the distribution of coal reserves in India.
- b) Discuss the significance of horticulture in India.
- c) Explain the suicides of farmers in Maharashtra.
- d) Explain the advantages of wind energy.

**Q4) Answer the following questions in 200 words (any one):** **[10]**

- a) Describe the merits and demerits of hydroelectricity in India.

OR

- b) Discuss the causes and effects of droughts in India.



Total No. of Questions : 4]

SEAT No. :

**P860**

[Total No. of Pages : 2

**[5315]-457**

**T.Y. B.Sc.**

**GEOGRAPHY**

**Gg. 345: Geography of Soils (Part - II) (Semester - IV)  
(2013 Pattern) (Paper - X)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Diagrams and maps must be drawn wherever necessary.*
- 4) Use of map stencils is allowed.*

**Q1)** Answer the following questions in two or three sentences. (any 10) **[10]**

- a) Define 'Soil Colloids'.
- b) Define 'Soil taxonomy'.
- c) Name any two soil survey methods.
- d) Define gully erosion.
- e) Write two characteristics of acidic soils.
- f) Name any two secondary minerals.
- g) Mention any two soil nutrients.
- h) What is neutral soil?
- i) Define soil pH.
- j) What is C:N ratio?
- k) What is transformation processes?
- l) Write two sources of organic material.
- m) Define organic carbon.

**P.T.O**

- Q2)** Write short note (any two) **[10]**
- a) Chemical weathering
  - b) Bench mark soil
  - c) Types of organic colloids
  - d) Irrigation techniques

- Q3)** Answer the following questions in 100 words (any two) **[10]**
- a) Write different agents of soil erosion.
  - b) Write the importance of soil Humus.
  - c) Discuss the 'P' factor in the USLE.
  - d) Write soil erosion types and suggest measurement techniques.

- Q4)** Answer the following questions in 200 words (any one) **[10]**
- a) Write soil classification of Maharashtra.
  - b) Explain land capability classification with suitable examples.



Total No. of Questions : 4]

SEAT No. :

**P862**

[Total No. of Pages : 2

**[5315]-459**

**T.Y. B.Sc. (Semester - IV)**

**MICROBIOLOGY**

**MB - 341 : Medical Microbiology - II**

**(2013 Pattern) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Draw neat labelled diagrams wherever necessary.*

**Q1)** Attempt the following :

A) Match the following : **[5]**

- | I               | II                |
|-----------------|-------------------|
| i) Rifamycin    | a) Lentivirus     |
| ii) Zidovudin   | b) Reoviridae     |
| iii) HIV        | c) Bird faeces    |
| iv) Rotavirus   | d) AZT            |
| v) Cryptococcus | e) RNA polymerase |

B) State True or False : **[2]**

- i) MIC is always greater than MBC.
- ii) FMD is zoonotic disease.

C) Fill in the blanks : **[3]**

- i) Diploid cell lines used for virus cultivation are prepared from tissues of \_\_\_\_\_ origin.
- ii) Two hosts for plasmodium are \_\_\_\_\_ & \_\_\_\_\_
- iii) \_\_\_\_\_ is amount of chemotherapeutic agent killing half of the population of experimental animals.

**P.T.O.**

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

- a) Diagrammatically explain life cycle of Giardia lamblia.
- b) Write a note on antibiotic misuse.
- c) Describe pathogenesis & lab diagnosis of Rinderpest.

**Q3)** Write short notes on any two of the following : **[10]**

- a) Structure of Rabies virus.
- b) Dermatomycosis.
- c) Mode of action of Trimethoprim.

**Q4)** Attempt any one of the following : **[10]**

- a) Enlist various mechanisms of drug resistance & describe any two mechanisms in detail.
- b) Describe pathogenesis and clinical features of poliomyelitis.



Total No. of Questions : 4]

SEAT No. :

**P863**

[Total No. of Pages : 3

**[5315]-460**

**T.Y. B.Sc. (Semester - IV)**

**MICROBIOLOGY**

**MB - 342 : Genetics and Molecular Biology - II**

**(2013 Pattern) (Semester - IV) (Paper - II)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Figures to the right indicate full marks.*
- 4) Draw neat labelled diagrams wherever necessary.*

**Q1) A)** Select the correct answer from the given options.

**[10]**

- a) Interrupted mating experiment was carried out by \_\_\_\_\_
  - i) Lederberg & Tatum
  - ii) Smith & Nathans
  - iii) Jacob & Wallman
  - iv) Kornberg
- b)  $\lambda$ dg is formed in \_\_\_\_\_
  - i) Conjugation
  - ii) Generalized transduction
  - iii) Specialized transduction
  - iv) Transformation
- c) Base excision repair is mediated by \_\_\_\_\_
  - i) Oxidase
  - ii) Glycosylase
  - iii) Catalase
  - iv) Amylase

**P.T.O.**

- d) Certain sites in genome of  $T_4$  phage, highly prone to mutation observed in rII mutants are called \_\_\_\_\_
- i) Hot Spots
  - ii) Transitions
  - iii) Deletions
  - iv) Transversions.
- e) E. Coli DNA ligase requires \_\_\_\_\_ as co factor.
- i) ATP
  - ii)  $NAD^+$
  - iii) CTP
  - iv) GTP
- B) State true or false.
- a) Genetic recombination is one of the mechanisms leading to evolution.
  - b) Amber mutant of  $T_4$  phage is formed due to missense type of mutation.
  - c) Name the artificially constructed plasmid, widely used in r-DNA technology developed in Bolivar's laboratory.
  - d) What is c - DNA? Name the key enzyme used for c-DNA preparation.
  - e) Define the term 'Clone'.

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

- a) Diagrammatically represent generalized transduction in bacteria.
- b) Explain with suitable examples, damage of DNA by hydrolysis and deamination.
- c) With suitable diagram, explain the process of conjugation in Hfr and  $F^-$  strains of E. Coli.

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

- a) With suitable diagram, explain transformation in Gram Positive Bacteria.
- b) Explain the mechanism of translesion DNA synthesis.
- c) With suitable example, explain the use of plasmids as vectors in r-DNA technology.

**Q4)** Attempt any one of the following : **[10]**

- a) Explain the method of construction of c-DNA library. What are the advantages of it?
- b) Explain the following mutants of bacteriophages.
  - i) Plaque morphology mutants.
  - ii) Conditional lethal mutants.





Total No. of Questions : 4]

SEAT No. :

**P864**

[Total No. of Pages : 2

**[5315]-461**

**T.Y. B.Sc. (Semester - IV)**

**MICROBIOLOGY**

**MB - 343 : Metabolism**

**(2013 Pattern) (Paper - III)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) All questions carry equal marks.*
- 3) Draw neat labelled diagrams wherever necessary.*

**Q1) A) Attempt the following : [5]**

a) Define :

- i) Antiport
- ii) Free energy

b) List any two enzymes of cellulose degradation.

c) State True or False

Hypotonicity is due to high solute concentration outside the cell.

d) What is Group translocation?

**B) Match the following : [5]**

- |                      |                              |
|----------------------|------------------------------|
| a) NADH              | i) Green bacteria            |
| b) NAG               | ii) Complex I                |
| c) FADH <sub>2</sub> | iii) Purple bacteria         |
| d) <u>Chromatium</u> | iv) Monomer of peptidoglycas |
| e) <u>Chlorobium</u> | v) Complex II                |

***P.T.O.***

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

- a) Describe urea cycle.
- b) Diagrammatically represent Noncyclic photophosphorylation.
- c) Define passive transport and comment on facilitated transport.

**Q3)** Write short note on any two : **[10]**

- a) Pathway of phospholipid synthesis
- b) Structure of ATP synthase
- c) Carboxylation phase of calvin cycle

**Q4)** Attempt any one **[10]**

- a) Explain steps in glycogen synthesis.
- b) What are high energy compounds? Explain with suitable example how Acyl phosphates are high energy compounds.



Total No. of Questions : 4]

SEAT No. :

**P865**

[Total No. of Pages : 2

**[5315]-462**

**T.Y. B.Sc. (Semester - IV)**

**MICROBIOLOGY**

**MB - 344 : Immunology - II (Paper - IV)**

**(2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat labelled diagrams wherever necessary.*

**Q1) A) Match the following :**

**[5]**

- |                                |                         |
|--------------------------------|-------------------------|
| a) Salk vaccine                | i) Rabies               |
| b) Sabin vaccine               | ii) Tuber culosis       |
| c) BCG                         | iii) Live polio vaccine |
| d) Human immuno gamma globulin | iv) Snake bite          |
| e) Horse antivenom serum       | v) Killed polio vaccine |

**B) Fill in the blanks by using correct option.**

**[2]**

- a) When Anti A, Anti B and Anti H antibodies are present in the serum of the person's blood, the blood group is \_\_\_\_\_.
- |             |       |
|-------------|-------|
| i) AB       | ii) A |
| iii) Bombay | iv) O |
- b) Organization of MHC in humans is called \_\_\_\_\_.
- |                  |                 |
|------------------|-----------------|
| i) H-2 complex   | ii) HLA complex |
| iii) MLA complex | iv) D-2 complex |

**P.T.O.**

- C) Attempt the following : [3]
- a) State true or false :
- i) Type II hypersensitivity can be induced by penicillin.
  - ii) 'B' Rh negative person can donate the blood to 'B' Rh positive person.
- b) Define : Antibody avidity.

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

- a) Illustrate diagrammatically : Solid phase RIA
- b) Describe the structure and functions of MHC II.
- c) Elaborate on : Inheritance of ABH antigens.

**Q3)** Write short note (any two) : [10]

- a) Biochemistry of ABH substances
- b) Interferons
- c) Application of monoclonal antibodies.

**Q4)** Attempt any one. [10]

- a) Write comparative account of type I, II, III and IV hypersensitivity reactions.
- b) What are precipitation reactions? Explain ouchterlony and immunoelectrophoresis in brief.



Total No. of Questions : 4]

SEAT No. :

P 866

[Total No. of Pages : 2

[5315] - 463

**T.Y. B.Sc. MICROBIOLOGY (Semester - IV)**

**MB - 345 : Fermentation Technology -II**

**(2013 Pattern) (Paper - V)**

*Time :2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat, labelled diagrams wherever necessary.*

**Q1)** Attempt the following:

a) Define: [04]

- i) SSF
- ii) Fermentation
- iii) Spawn
- iv) Immune Sera

b) Fill in the blanks. [03]

- i) Cortisolone biotrans formation to hydrocortisone is carried out by \_\_\_\_\_.
- ii) Botanical name of button mushroom is \_\_\_\_\_.
- iii) Immune sera is \_\_\_\_\_ and \_\_\_\_\_ type.

**P.T.O.**

- c) State True or False: [03]
- i) Production of steroids by microorganisms is not a fermentation process.
  - ii) Mushrooms are the fruiting bodies of basidiomycetes fungi.
  - iii) Antibiotic serum combat toxic metabolites of microbes.

- Q2)** Attempt any two : [10]
- a) Enlist the commercial applications of amylases. Describe briefly the production process of bacterial amylase.
  - b) Briefly describe the production process of white wine.
  - c) Enlist the commercial uses of citric acid. Explain the recovery of citric acid from the fermented broth.

- Q3)** Write short notes (any two) : [10]
- a) Production of oral polio vaccine
  - b) Bakers yeast production
  - c) Production of 'cheddar' cheese

- Q4)** Attempt any one: [10]
- a) Describe production of vinegar by 'Quick Vinegar Process.'
  - b) Describe the chemical changes occurring in a typical penicillin fermentation. Add a note on semisynthetic penicillins.



Total No. of Questions : 4]

SEAT No. :

P 867

[Total No. of Pages : 2

[5315] - 464

**T.Y. B.Sc. (MICROBIOLOGY) (Semester - IV)**  
**MB - 346 : Agricultural And Environmental Microbiology**  
**(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat labelled diagrams wherever necessary.*

**Q1)** Attempt the following:

- a) Define : Biosorption [1]
- b) What is Bioterrorism? [1]
- c) Write two applications of bioaugmentation [1]
- d) State true or false: [2]
  - i) Nitrogenase enzyme reduces other substrater besides nitrogen.
  - ii) Hillside leaching method is used for copper leaching.
- e) What is Heap leaching? [1]
- f) Write an example of iron chelates. [1]
- g) Enlist any two applications of nanoparticles produced by microorganisms. [1]
- h) Write two applications of biochips. [1]
- i) Write an advantage of bioleaching [1]

**P.T.O.**

**Q2)** Write short notes on any two : **[10]**

- a) Phosphate solubilization with respect to biofertilizers.
- b) Eradication as a method of plant disease control.
- c) Biofuel cells and biodegradable plastics.

**Q3)** Attempt any two : **[10]**

- a) Diagrammatically illustrate the mechanism of electron flow during nitrogen reduction.
- b) Bioleaching of gold and silver.
- c) Describe applications of Biosensors.

**Q4)** Attempt any one : **[10]**

- a) Describe the biological control of plant diseases with examples.
- b) Explain the role of plants and microbes in bioremediation of heavy metals.





Total No. of Questions : 4]

SEAT No. :

**P868**

[Total No. of Pages : 2

**[5315] - 465**

**T.Y. B.Sc. (ELECTRONIC SCIENCE) (Semester - IV)**

**EL - 341 : Advanced Communication Systems**

**(2013 Pattern) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagram must be drawn whenever necessary.*

**Q1)** Attempt all of the following:

- a) State one application of vocoder. [1]
- b) Define Directive gain of an antenna. [1]
- c) Give the types of A.M. transmitters. [1]
- d) Write two features of low noise amplifier. [1]
- e) Write different types of filters used in filter method of suppression of side band. [2]
- f) List applications of Doppler Radar. [2]
- g) Write different blocks of Deltamodulator. [2]
- h) Calculate critical frequency of E-layer of Ionosphere, if  $muf = 3\text{MHz}$  and angle of incidence is  $0^\circ$ . [2]

**Q2)** Attempt any two of the following:

- a) Discuss tropospheric scatter propagation. [4]
- b) Explain phase modulation using phase locked loop. [4]
- c) Draw the block diagram of PCM transmitter and explain its working. [4]

**P.T.O.**

**Q3)** Attempt any two of the following:

- a) Explain construction of rhombic antenna. Draw its radiation pattern. **[4]**
- b) Draw block diagram of Delta modulator and explain it. **[4]**
- c) Explain working of frequency stabilized reactance FM transmitter with suitable block diagram. **[4]**

**Q4)** Attempt any two of the following:

- a) With the help of block diagram, Explain working of Armstrong method of FM generation. **[6]**
- b) With the help of block diagram, Explain working of simple Doppler Radar. Write its advantages. **[6]**
- c) Describe working of balanced modulator using FETs. **[6]**



Total No. of Questions : 4]

SEAT No. :

**P869**

[Total No. of Pages : 2

**[5315] - 466**

**T.Y. B.Sc. (Electronic Science) (Semester - IV)**

**EL - 342 : Microcontroller And Its Applications**

**(2013 Pattern) (Paper - II)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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 all of the following:

- a) State which data type would you use to represent a temperature. [1]
- b) What is the function of TMOD register in 8051  $\mu$ C? [1]
- c) Which timer of 8051  $\mu$ C is used to set the band rate? [1]
- d) Which register of 8051 is used to enable / disable the interrupts? [1]
- e) With XTAL = 11.0592 MHz, find the TH1 value needed to have 9600 band rate . [2]
- f) What is RTC ? Where it is used? [2]
- g) Give the ROM and RAM size in PIC 18F4580 microcontroller. [2]
- h) Write the instruction to load 85H into WREG register of PIC microcontroller. [2]

**Q2)** Attempt Any Two of the following:

- a) State the major reasons for writing programs in embedded C instead of assembly. [4]
- b) Write the steps through which 8051 $\mu$ C goes upon activation of an interrupt. [4]
- c) Explain PIC 18 status register format. [4]

**P.T.O.**

**Q3)** Attempt any two of the following:

- a) Explain the factors that affect the accuracy of time delay using a for loop. [4]
- b) Draw and explain an interface diagram of LCD to 8051. [4]
- c) Draw a simplified view of a PIC microcontroller. [4]

**Q4)** Attempt any two of the following:

- a) Write a note on interrupt priority in 8051 $\mu$ C. [6]
- b) Interface DAC0808 to 8051 $\mu$ C & write a C program to generate square waveform. [6]
- c) Interface a stepper motor to 8051 $\mu$ C and write a C program to rotate the motor in clockwise direction. [6]

OR

Attempt all of the following:

- a) Write an 8051 C program to send values of -4 to +4 to port P1. [4]
- b) Write an 8051 C program to convert 11111101 (FDhex) to decimal and display the digits on P0,P1, and P2. [4]
- c) Write an 8051 C program to transfer the letter "A" serially at 4800 baud continuously. Use 8-bit data and 1 stop bit. [4]



Total No. of Questions : 4]

SEAT No. :

P870

[Total No. of Pages : 2

[5315] - 467

T.Y. B.Sc.

**ELECTRONIC SCIENCE (Semester - IV)**

**EL - 343 : Power Electronics**

**(2013 Pattern) (Paper - III)**

*Time :2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Use of calculator is allowed.*

**Q1)** Attempt all of the following:

- a) State the names of any two power electronic circuits. [1]
- b) Sketch the out put characteristics of triac. [1]
- c) Draw the out put wave form of full wave controlled rectifier for firing angle of SCR at  $90^\circ$ . [1]
- d) State the type of UPS used for critical load. [1]
- e) "SCR requires dv/dt protection". Comment. [2]
- f) "The output of full bridge Inverter with resistive load is square wave" comment. [2]
- g) "Diode connected in antiparallel to Inducter coil is called as free whelling diode". Comment. [2]
- h) "Class-B chopper works in regnerative breaking mode". Comment. [2]

**Q2)** Attempt any two of the following:

- a) With the help of RLE load, explain the working of class - A chopper. [4]
- b) Explain the working of Half Bridge Inverter with Resistive load and sketch the output wave form accross the load resistance. [4]

**P.T.O.**

- c) With the help of neat diagram explain the working of Fly Back type SMPS. [4]

**Q3)** Attempt any two of the following:

- a) Draw the circuit diagram of switching Buck regulator and explain the working. Write the equation for output voltage and duty cycle. [4]
- b) Sketch the output characteristics of all choppers indicating motoring mode and regenerative mode. [4]
- c) State the names of different methods used to turn on SCR. Which method is widely used. [4]

**Q4)** Attempt any two of the following:

- a) Draw the block diagram of ONLINE UPS and explain the working of each block. state any two parameters of UPS. [6]
- b) Explain the working of PVT as relaxation oscillator. Write the equation for charging time of capacitor. [6]
- c) Explain the working at single phase Half Wave controlled rectifier. sketch the wave form across load resistance and SCR with reference to Input signal for  $45^\circ$  firing angle of SCR. [6]

**OR**

- a) In a step down DC converter the resistive load is  $R = 200\Omega$  and Input source voltage is 200 Volt. Calculate the average output Voltage across load and input power feed to load of converter. Consider chopping frequency as  $2\text{ KH}_2$  and Duty cycle 50%
- b) If source voltage  $V_s = 100\text{v}$ ,  $R_s = 10\Omega$  and  $dv/dt = \text{V}/\mu\text{s}$ . Calculate the value of capacitor  $C_s$  in snubber circuit.
- c) If the secondary voltage of transformer is  $400 \sin \omega t$  and it is feed to single phase Half wave rectifier having firing angle of SCR at  $30^\circ$ . Calculate average load voltage and RMS load voltage.



Total No. of Questions : 4]

SEAT No. :

P871

[Total No. of Pages : 3

[5315] -468

T.Y.B.Sc.

ELECTRONIC SCIENCE

EL - 344 : Foundation of Nano Electronics

(2013 Pattern) (Paper - IV) (Semester - IV)

Time : 2 Hours]

[Max. Marks :40

Instructions to the candidates:

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Neat diagram must be drawn wherever necessary.
- 4) Use of calculator is allowed.

Given : i) Mass of electron,  $m_e = 9.1 \times 10^{-31}$  kg  
ii) Planck's constant,  $h = 6.625 \times 10^{-34}$  J.S.  
iii) Charge on electron  $e = 1.6 \times 10^{-19}$  C.

Q1) Attempt all of the following :

- a) Write an expression for equation of continuity. [1]
- b) What is tunneling effect? [1]
- c) What is Gaussian Distribution? [1]
- d) Define Lithography. [1]
- e) Write Schrodinger's time independent equation. [2]
- f) Define cyclotron frequency and write its expression. [2]
- g) What is density of states of electrons? [2]
- h) What is bottom up approach in nanoelectronics? [2]

P.T.O.

**Q2)** Attempt any two of the following :

- a) Write a note on electron transport in quantum wire. [4]
- b) Explain maxwell - boltzmann statistics. [4]
- c) Obtain an expression for wave equation for E in conducting medium? [4]

**Q3)** Attempt any two of the following :

- a) Describe the construction of resonant tunneling diode with proper diagram. [4]
- b) Obtain schrodinger time dependent wave equation. [4]
- c) Obtain an expression for density of states of electron in 2 D nanostructure. [4]

**Q4)** Attempt any two of the following.

- a) State poynting vector theorem and obtain expression for it. [6]
- b) i) State and explain Pauli's exclusion principle. [3]  
ii) Write the comparision between energy of electron in an atom and energy of electron in infinite potential well. [3]
- c) i) Explain Bose - Einstein statistics. [3]  
ii) Write any three applications of quantum dot. [3]

OR



Attempt all of the following

- a) Calculate the de - Broglie wave length of an electron moving with the velocity of  $10^6$  m/s. [4]
- b) Calculate the skin - depth for conducting medium for a wave of frequency 60 Hz, conductivity of  $3 \times 10^4$  mho/m and permeability of  $4 \pi \times 10^{-7}$  H/m. [4]
- c) Calculate the ground state energy of an electron in infinite potential well of width  $2A^\circ$  [4]



Total No. of Questions : 4]

SEAT No. :

P872

[Total No. of Pages : 3

[5315] - 469

T.Y. B.Sc. (Semester - IV)

ELECTRONIC SCIENCE

EL - 345 : Mathematical Methods and Circuit Analysis Using MATLAB  
(2013 Pattern) (Paper - V)

*Time : 2 Hours]*

*[Max. Marks :40*

*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.*
- 4) *Use of calculator is allowed.*

**Q1)** Answer all of the following :

- a) Write the MATLAB command to clear figure window. [1]
- b) Write the MATLAB command to generate column vector  $x$  with three elements 10,20, & 30. [1]
- c) What is meant by periodic function? [1]
- d) State the use of Laplace Transform. [1]
- e) Write the Fourier series expansion for odd function. [2]
- f) Define Laplace Transform of a function. [2]
- g) Write a MATLAB program to plot  $y = e^x$ , for  $0 \leq x \leq 4$ . [2]
- h) Write the MATLAB commands to set equal scale on both axis & to set the axis limit. [2]

**P.T.O.**

**Q2)** Answer any two of the following :

- a) Write the MATLAB code to draw a straight line  $y = mx + c$ , where  $m$  &  $c$  are constants. Compute the  $y$  coordinates of a line with slope  $m = 0.3$  & the intercept  $e = -5$  at the following  $x$  - coordinates  $x = 0, 1.2, 1.5, 4, 5, 8, 9$  and  $10$ . [4]
- b) Find the Laplace transform of  $(e^{-2t} + e^{3t})^2$ . [4]
- c) Find the Laplace transform of  $\sin^2 3t$  [4]

**Q3)** Answer any two of the following :

- a) Explain the FOR - End loop in MATLAB. [4]
- b) Obtain the Laplace transform of unit step function. [4]
- c) For a square wave voltage.

$$v(t) = \begin{cases} -v & 0 < t < T/4 \\ v & T/4 < t < 3T/4 \\ -v & 3T/4 < t < T \end{cases}$$

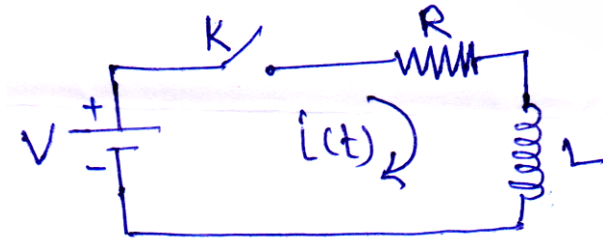
Find the fourier series coefficient  $a_4$ . [4]

**Q4)** Answer any two of the following :

- a) Describe polyfit command in MATLAB. Write a script file in MATLAB to fit a straight line to the following data & plot the polynomial. [6]

$x$	0.9	1.5	3	4	6	8	9.5
$y$	0.8	1.6	3	4	5	6	7.3

- b) Consider RL circuit as shown in figure. [6]



Find current  $i(t)$  using Laplace transform.

- c) Find inverse Laplace transform of [6]

$$\frac{11s^2 - 2s + 5}{(s-2)(2s-1)(s+1)}$$

OR

Answer the following :

- a) Write the MATLAB code to calculate  $f(3)$  and to plot the polynomial

$$f(x) = x^5 - 12.1x^4 + 40.59x^3 - 17.015x^2 - 71.95x + 35.88$$

for  $-1.5 \leq x \leq 6.7$  [4]

- b) Find the Laplace transform of  $\sin at$ . [4]

- c) For fourier series, obtain the expression of fourier coefficient  $a_n$ . [4]



Total No. of Questions : 4]

SEAT No. :

**P873**

[Total No. of Pages : 5

**[5315] - 470**

**T.Y.B.Sc.**

**ELECTRONIC SCIENCE**

**EL : 346(A) Industrial Automation**

**(Semester - IV) (2013 Pattern) (Paper - VI) (Optional)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

**Q1)** Attempt all of the following :

- a) What is peltier effect? [1]
- b) What is trans - impedance amplifier? [1]
- c) State any two advantages of position control. [1]
- d) What is dead time element? [1]
- e) State advantages of thermistor. [2]
- f) Draw symbols of push buttons and pressure switches used in ladder diagram. [2]
- g) Explain the concept of sample and hold circuit. [2]
- h) Identify two parameters of ON - OFF controller. [2]

***P.T.O.***

**Q2)** Attempt any two of the following :

- a) Explain the terms : **[4]**
  - i) Variable range and
  - ii) control lag.
- b) Explain the action of three position controller mode. **[4]**
- c) Explain zero order system with neat diagram. **[4]**

**Q3)** Attempt any two of the following :

- a) Draw and explain multichannel data acquisition system using single ADC. **[4]**
- b) Explain discrete control system with neat diagram. **[4]**
- c) Draw block diagram of generalized measurement system. Explain each block in brief. **[4]**

**Q4)** Attempt any two of the following :

- a) What is second order system? Draw and explain step response of second order system. **[6]**
- b)
  - i) Write a note on “Electrostatic shielding” **[3]**
  - ii) The temperature control system has a range of 330 to 450 k and a set point of 390 k. Find the percent of span error, when the temperature is 379 k **[3]**
- c) Describe proportional - Integral - Derivative (PID) controller mode. **[6]**

Total No. of Questions : 4]

**[5315] - 470**  
**T.Y.B.Sc.**  
**ELECTRONIC SCIENCE**  
**EL : 346 (B) Consumer Electronics**  
**(2013 Pattern) (Semester - IV) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks :40*

*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 all of the following :

- a) Write down any two advantages of Impact Printer. [1]
- b) State the name of high wattage loud speaker [1]
- c) State the range of frequency used for microwave applications. [1]
- d) List any two parameters of digital camera. [1]
- e) “Local oscillator is used in out door unit of dish TV” Comment. [2]
- f) “LNA is noise amplifier”. Comment. [2]
- g) “OPC drum is a part of Xerox machine” comment. [2]
- h) State the names of blocks used in basic telephone set. [2]

**Q2)** Attempt any two of the following :

- a) With the help of block diagram explain the working of Hand set of cordless phone. **[4]**
- b) Draw the setup diagram of crystal microphone and explain the working. **[4]**
- c) With the help of block diagram explain the method used to read the data from the surface of compact Disc. **[4]**

**Q3)** Attempt any two of the following :

- a) Compare the LCD, Plasma TV and LED TV with reference to power used and picture quality. **[4]**
- b) With the help of Block diagram explain the working of remote control. **[4]**
- c) Draw the block diagram of Electronic weighing machine and explain each block in detail. **[4]**

**Q4)** Attempt any two of the following :

- a) Draw the block diagram of Dot matrix printer and explain each block. **[6]**
- b) With the help of block diagram explain the working of monochrome TV receiver. **[6]**
- c) With the help of Indoor unit and outdoor unit explain working of Dish TV. **[6]**

OR



- a) Draw the Setup diagram of Micro wave oven and explain its working of micro wave oven. **[4]**
- b) Draw the block diagram of public address system and explain each block. **[4]**
- c) With the help of block diagram explain the working of flat bed scanner. **[4]**



Total No. of Questions : 4]

SEAT No. :

**P874**

[Total No. of Pages : 2

[5315] - 471

**T.Y.B.Sc. (Semester - IV)**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 401 : Internal Security of India**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 to 4 sentences each.

**[16]**

- a) What are the characteristics of a state?
- b) Define Human security
- c) Define internal security
- d) What do you mean by SEZ?
- e) Define Guerrilla warfare
- f) Define ethnicity
- g) Define sustainable development
- h) Define cultural identity

**P.T.O.**

**Q2)** Answer in 8 to 10 sentences each (any two)

**[8]**

- a) Explain political dimensions of India's internal security
- b) Discuss roles of Governance in human security
- c) Discuss Link between development and internal security.

**Q3)** Write short notes on (any two)

**[8]**

- a) Kashmir Dispute
- b) Ethnicity Conflict
- c) Naxalite

**Q4)** Answer in 18 to 20 sentences (Any one)

**[8]**

- a) What are the challenges to India's North - west border security? Discuss.
- b) Explain current security challenges to Northeast region of India.



Total No. of Questions : 4]

SEAT No. :

**P875**

[Total No. of Pages : 2

**[5315] - 472**

**T.Y.B.Sc.**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 402 : Trend's In India's Defence expenditure**

**(Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 to 4 sentences each.

**[16]**

- a) Define financial management
- b) What do you mean by strategic control?
- c) Write any two merits of war time economy.
- d) Write the meaning of Zero budget.
- e) Define performance budget
- f) Write the meaning of dual economy
- g) Define national power
- h) Write any two characteristics of peace time economy.

**P.T.O.**

**Q2)** Answer in 8 to 10 sentences each (any two)

**[8]**

- a) Explain the concept of public good
- b) Discuss role of private sector in India's defence production
- c) Describe organization of Ministry of defence

**Q3)** Write short notes on (any two)

**[8]**

- a) Link between Parliament and India's Defence expenditure
- b) Structure of India's defence budget
- c) DPSU

**Q4)** Answer in 18 to 20 sentences (Any one)

**[8]**

- a) Explain trends of India's defence expenditure from 1971.
- b) Discuss salient features of India's economy.



Total No. of Questions : 4]

SEAT No. :

**P876**

[Total No. of Pages : 2

**[5315] - 473**

**T.Y.B.Sc. (Semester - IV)**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 404 : Information Warfare and Cyber Security**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 to 4 Sentences each.

**[16]**

- a) Write any two threats to cyber security.
- b) Write any two needs for Information Security.
- c) Define Battlefield information system.
- d) Define War gaming
- e) Define operational planning.
- f) What do you mean by Internet Security?
- g) Define Cyber Laws
- h) Define E - Commerce.

**P.T.O.**

**Q2)** Answer in 8 to 10 sentences each (any two) **[8]**

- a) Discuss application of IT in Land warfare.
- b) Explain application of IT in War gaming.
- c) Explain application of IT in Sea warfare.

**Q3)** Write short notes on (any two) **[8]**

- a) 'Battle field information system'.
- b) Cyber Security
- c) Airborne Early warning system

**Q4)** Answer in 18 to 20 sentences (Any one) **[8]**

- a) Explain prospects of information warfare for military operations.
- b) Discuss role of information in the management of national security.



Total No. of Questions : 4]

SEAT No. :

**P877**

[Total No. of Pages : 2

**[5315] - 474**

**T.Y.B.Sc.**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 405 : Defence Production & Logistics in India**

**(Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 or 4 sentences each

**[16]**

- a) What do you understand by O.F?
- b) Define "Foreign Collaboration".
- c) What do you mean by Logistics?
- d) What do you mean by supply chain management?
- e) Define national Development.
- f) Under when the DRDC works?
- g) State the meaning of G.S.L
- h) Why the Mobilization of logistics resources is essential?

**P.T.O.**



**Q2)** Answer in 8 to 10 sentences. (Any Two)

**[8]**

- a) Explain in brief “Structure of Defence Production”.
- b) Write a few lines on “Just in Time Concept”.
- c) Discuss in brief the role of department of defence production.

**Q3)** Write short notes on (any Two)

**[8]**

- a) Concept of Foreign Collaboration.
- b) Aim & objectives of H.A.L.
- c) M.D.L. - Mumbai

**Q4)** Answer in 16 to 20 sentences. (Any one)

**[8]**

- a) Make in India programme will procure the defence requirements of our Armed forces “Do you agree? Justify your answer.
- b) Discuss the role of DPSU in modernisation of Indian Armed Forces.



Total No. of Questions : 4]

SEAT No. :

**P878**

[Total No. of Pages : 4

**[5315] - 475**

**T.Y.B.Sc. (Semester - IV)**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 406 (A) Defence Journalism and National Security**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 to 4 Sentences each

**[16]**

- a) State the meaning of Features Writing
- b) Define Media Ethics
- c) Define Conflict Management
- d) Define Investigative Journalism
- e) Define Mass Communication
- f) Write any two Challenges to Defence Journalism.
- g) Define Conflict Studies.
- h) Define International Security.

**P.T.O.**

**Q2)** Answer in 8 to 10 Sentences each (any two) **[8]**

- a) Explain Evolution of Defence Journalism
- b) Discuss essential of knowledge of Defence Journalism
- c) Discuss relationship between Media and Armed forces.

**Q3)** Write short notes on (any two) **[8]**

- a) Link between Media and security studies.
- b) Current trends in Defence journalism
- c) Media Responsibilities

**Q4)** Answer in 18 to 20 sentences (Any one) **[8]**

- a) Explain problems and prospects of Defence Journalism
- b) Discuss role of Defence Journalism in International Security Studies.



Total No. of Questions : 4]

**[5315] - 475**  
**T.Y.B.Sc. (Semester - IV)**  
**DEFENCE AND STRATEGIC STUDIES**  
**DS : 406 (B) Gender Based Conflicts and Human Rights**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 to 4 Sentences each

**[16]**

- a) Define Gender Equality
- b) Define 'positive peace'.
- c) Define Gender Based Conflicts
- d) State the meaning of Geopolitical Region
- e) Define structural violence
- f) Define gender violence
- g) State the meaning of sustainable education.
- h) Write the meaning of feminist perspectives.

**Q2)** Answer in 8 to 10 Sentences each (any two) **[8]**

- a) Explain Gender based violence in Africa.
- b) Write a note on the culture of peace
- c) Discuss Gender Issues in India.

**Q3)** Write short notes on (any two) **[8]**

- a) Challenges to world peace.
- b) Gender based violence in Middle East.
- c) Feminism and philosophy for peace.

**Q4)** Answer in 18 to 20 sentences (Any one) **[8]**

- a) Explain sustainable peace building and Human rights in India.
- b) Discuss causes of gender discrimination in India.



Total No. of Questions : 4]

SEAT No. :

**P879**

[Total No. of Pages : 4

**[5315] - 476**

**T.Y.B.Sc. (Semester - IV)**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 407(A) Role of Armed forces in Disaster Management**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 to 4 Sentences each.

**[16]**

- a) Define Environmental Disaster.
- b) Write the meaning of Guideline to Disaster Management.
- c) Write two roles of civilian in Disaster Relief.
- d) Define Nuclear War
- e) Define Natural Disaster
- f) Define Strategic planning.
- g) Define global warming.
- h) Write any two importances of pre - disaster plan

**P.T.O.**

**Q2)** Answer in 8 to 10 Sentences each (any two) **[8]**

- a) Explain role of Army in Disaster Response.
- b) Discuss structure of NDRF in Disaster Relief.
- c) Describe Roles of Navy in disaster management.

**Q3)** Write short notes on (any two) **[8]**

- a) Role of NGO in Disaster Relief.
- b) Role of Local Civil Administration in Disaster management.
- c) Importance of training for Disaster Relief.

**Q4)** Answer in 18 to 20 sentences (Any one) **[8]**

- a) Describe role of Central Government in Disaster Response.
- b) Write a note on the relationship between Disaster and national security.

Total No. of Questions : 4]

**[5315] - 476**  
**T.Y.B.Sc.**  
**DEFENCE AND STRATEGIC STUDIES**  
**DS : 407 (B) Global Security - II**  
**(Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 or 4 sentences each.

**[16]**

- a) What do you mean by Nuclear proliferation?
- b) State any two principal organs of U.N.
- c) State the name of the countries who have maritime dispute with China.
- d) What do you understand by Veto?
- e) State the meaning of Regional Conflicts.
- f) What do you mean by Global Security?
- g) What do you know about N.P.T.?
- h) State the meaning of American Monopoly?



**Q2)** Answer in 8 to 10 sentences. [Any Two] **[8]**

- a) Explain in brief peaceful progressive uses of Nuclear Energy.
- b) Write in brief “Nuclear Arsenal as a threat to global security.
- c) Discuss in short catchment policy of china.

**Q3)** Write short notes on [Any Two] **[8]**

- a) U.S.A. as a responsible member of world community.
- b) Chinese policy of Containment.
- c) Causes of conflict between USA & North Korea.

**Q4)** Answer in 16 to 20 sentences. [Any One] **[8]**

- a) Highlight on present scenario in South China Sea & its relevance to global security.
- b) Evaluate the Chinese Policy of Power Projection with special reference to the power race in Indian Ocean.



Total No. of Questions : 4]

SEAT No. :

**P880**

[Total No. of Pages : 4

[5315] - 477

**T.Y. B.Sc. (Semester - IV)**

**DEFENCE & STRATEGIC STUDIES**

**DS : 408 (A) Indian Military Strategy (1947 - 2014)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 or 4 sentences each

**[16]**

- a) When the first indo - Pak War took place?
- b) What do you mean by ceasefire?
- c) When the first India - China war took place?
- d) Why India sent her forces in Kashmir in 1947 - 48?
- e) During 1962 war who declared the unilateral ceasefire?
- f) Which treaty it was signed between India & Pakistan at the end of 1965 war.
- g) What do you know about Raje Harisingh?
- h) What do you know about chou - En - Lai?

***P.T.O.***

**Q2)** Answer in 8 or 10 sentences (Any two) : **[8]**

- a) Explain in brief ceasefire process of Indo - Pak war of 1947 - 48
- b) What were the causes of India - China war of 1962.
- c) Write in brief background of Indo - Pak war of 1965.

**Q3)** Write short notes on (Any Two) : **[8]**

- a) Role of U.S.S.R during Indo - Pak War of 1965.
- b) Affected sectors during Indo - Pak War of 1947 - 48.
- c) Nature of India - China border dispute.

**Q4)** Answer in 16 to 20 sentences (Any One) : **[8]**

- a) What were the implications of 1962 war on domestic front of India?
- b) “During 1965 India Won the war on the battleground but lost it at the negotiation table” Do you agree? Justify your answer.



Total No. of Questions : 4]

**P880**

**[5315] - 477**

**T.Y. B.Sc. (Semester - IV)**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 408 (B) Indian Military Strategy (1680 - 1818)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2or 4 sentences each :

**[16]**

- a) What do you mean Guerrilla Tactics?
- b) Why Nilzam fought a battle with Bajirao at Bhopal?
- c) Why Mughal released Sahu?
- d) Write any two causes of downfall of Maratha.
- e) Between whom the third battle of Panipat it was fought?
- f) State any two achievements of Sambhaji.
- g) Why Shivaji adopted Guerrilla Tactics?
- h) What do you know about Santaji?

**Q2)** Answer in 8 or 10 sentences (Any Two) : **[8]**

- a) Explain in brief impact of third battle of panipat.
- b) Write in brief causes for Anglo - Maratha conflict.
- c) Explain in brief Battle of Bhopal.

**Q3)** Write short notes on (Any Two) **[8]**

- a) Dhanaji.
- b) Tarabai.
- c) Background of first Anglo - Maratha war.

**Q4)** Answer in 16 to 20 sentences (Any One) : **[8]**

- a) Analyse the causes of Maratha defeat at III<sup>rd</sup> Battle of Panipat.
- b) Highlight on Sambhaji as a Military Leader.



Total No. of Questions : 4]

SEAT No. :

**P881**

[Total No. of Pages : 4

**[5315] - 478**

**T.Y. B.Sc. (Semester - IV)**

**DEFENCE & STRATEGIC STUDIES**

**DS : 409 (A) - United Nations Organisation**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 or 4 sentences each.

**[16]**

- a) State the date & Year of establishment of U.N.O.
- b) Define "Globalization".
- c) State the meaning of PM - 5 of S.C.
- d) Who is mainly responsible for Administration of UN?
- e) Define "Armscontrol"?
- f) What do you understand by UN - Charter
- g) What do you mean by diplomatic procedure?
- h) State the meaning of U.N. Peace keeping operation.

***P.T.O.***

**Q2)** Answer in 8 to 10 sentences (Any Two)

**[8]**

- a) Explain in brief the significance of UN security council.
- b) Highlight on the significance of “General Assembly”.
- c) Write few lines on “Veto”.

**Q3)** Write short notes on (Any Two)

**[8]**

- a) Structure of U.N.O.
- b) UN & Human rights
- c) Power & functions of secretary general.

**Q4)** Answer in 16 to 20 sentences. (Any One)

**[8]**

- a) “While restructuring U.N. Which changes you would like to introduce? Discuss.
- b) “U.N. Till today only postponed the third world war” Do you agree? Justify your answer.



Total No. of Questions : 4]

**P881**

**[5315] - 478**

**T.Y. B.Sc. (Semester - IV)**

**DEFENCE AND STRATEGIC STUDIES**

**DS : 409 (B) Indias Maritime Security**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

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

**Q1)** Answer in 2 or 4 sentences each

**[16]**

- a) What do you understand by continental shelf?
- b) Define “Exclusive Economic Zone”.
- c) What do you mean by Maritime trade?
- d) State the meaning of littoral countries.
- e) Write any two characteristics of Indian Navy
- f) State the limits of Exclusive Economic Zone.
- g) What do you understand by “Human Trafficking”.
- h) State the meaning of “Maritime Trade”.



**Q2)** Answer in 8 to 10 sentences. (Any Two) **[8]**

- a) Explain the concept of Fixed Assets.
- b) Write a few lines on “L.T.T.E”.
- c) Discuss in brief the limitations of coast guard.

**Q3)** Write short notes on (Any Two) **[8]**

- a) Limitations of Indian Navy
- b) Maritime Threats
- c) Territorial water

**Q4)** Answer in 16 to 20 sentences (Any One) : **[8]**

- a) Explain the role of Indian Navy for Maritime security.
- b) Highlight on 26/11 Mumbai attack & its linkages with Maritime Security.



Total No. of Questions : 4]

SEAT No. :

**P882**

[Total No. of Pages : 2

**[5315] - 479**

**T.Y.B.Sc. (Semester - IV)**

**ENVIRONMENTAL SCIENCE (Theory) (Paper - I)**

**Aquatic Ecosystems and Management**

**(2008 & 2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory and carry equal marks.*
- 2) *Neat and labelled diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Attempt the following in 1 - 2 lines each.

**[10]**

- a) What is edge effect.
- b) Define Spatial niche
- c) Give to example mutalism association.
- d) Define Liminetic zone in freshwater aquatic system.
- e) Give two names of Biotic communities from abyssal benthic zone.
- f) Mention two characteristics of symbiosis.
- g) In which state chilka lake is located.
- h) What is ecotype.
- i) What is continental drift
- j) Define hypolimnion

**P.T.O.**

**Q2)** Write a short note on ANY TWO of the following : **[10]**

- a) Types of interspecific interaction in ecosystem.
- b) Eco - development programme.
- c) Zonation of marine ecosystem C.

**Q3)** Answer ANY TWO questions from the following : **[10]**

- a) Write a note on restoration of Chilka lake
- b) Explain the role of local public in Wetland Conservation.
- c) Briefly write the note on parasitic adaptation behaviour in ecosystem.

**Q4)** Attempt any ONE of the following : **[10]**

- a) Briefly explain the sampling methods and data analysis of ecosystem.
- b) Narrate the importance of mangrove ecosystem in coastal marine environment.



Total No. of Questions : 4]

SEAT No. :

**P883**

[Total No. of Pages : 2

**[5315] - 480**  
**T.Y.B.Sc. (Semester - IV)**  
**ENVIRONMENTAL SCIENCE (Paper - II)**  
**Nature Conservation**  
**(2008 and 2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory and carry equal marks.*
- 2) *Neat and labelled diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*

**Q1)** Attempt the following in 1 - 2 lines each.

**[10]**

- a) What are merits of In - Situ conservation?
- b) What are the natural heritage sites?
- c) How ecosystem approach is important in species conservation?
- d) Write any two examples of extreme activism in nature conservation?
- e) What is meant by captive breeding?
- f) Write name of any two personalities associated with nature conservation.
- g) What are seed banks?
- h) Mention any two functional areas of BNHS.
- i) Write any two objectives of convention on biological diversity.
- j) What is the name of our national tree?

**P.T.O.**

**Q2)** Write a short note on ANY TWO of the following **[10]**

- a) Protected Area Network in India.
- b) Role of NGO's in Nature conservation.
- c) Habitat Conservation.

**Q3)** Answer Any Two questions of the following : **[10]**

- a) Which are the challenges associated with nature conservation in India?
- b) Discuss salient features of wildlife protection act
- c) What are various protected areas categories of IUCN?

**Q4)** Attempt ANY ONE of the following : **[10]**

- a) Explain traditional conservation practices with suitable examples. Also add a note on challenges associated with it.
- b) What are the basic objectives of ecotourism? Also add a note on merits and demerits of it.



Total No. of Questions : 4]

SEAT No. :

**P884**

[Total No. of Pages : 2

**[5315] - 481**

**T.Y.B.Sc.**

**ENVIRONMENTAL SCIENCE**

**Air and Soil Quality**

**(Semester - IV) (Paper - III) (2008 and 2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory and carry equal marks.*
- 2) Neat and labelled diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Attempt the following in 1 - 2 lines each.

**[10]**

- a) Write name of methods used for estimation of phosphorous and total nitrogen.
- b) What are organic contaminants of the soil?
- c) What is meant by soil texture?
- d) What are soil toxins?
- e) What is meant by acid rain?
- f) Mention any two factors which influence soil structure?
- g) What was the reason behind chernobyl disaster?
- h) Write any two effects of particulate matter.
- i) What are macronutrients?
- j) What is meant by smog?

**P.T.O.**

**Q2)** Write a short note on ANY TWO of the following :

**[10]**

- a) El Nino Phenomenon
- b) Chemical Reactions in soil
- c) Soil Remediation

**Q3)** Answer ANY TWO questions of the following :

**[10]**

- a) What are effects of carbon monoxide and sulphur dioxide on human health?
- b) Discuss in detail on status of vehicular pollution in India.
- c) What are the applications of GIS in management of soil resources?

**Q4)** Attempt ANY ONE of the following :

**[10]**

- a) Discuss in detail sampling and analysis methods used for nitrogen dioxide and sulphur dioxide.
- b) What is the concept of soil fertility? Explain the methods used in estimation of manganese and sulphur.



Total No. of Questions : 4]

SEAT No. :

**P885**

[Total No. of Pages : 2

**[5315] - 482**

**T.Y.B.Sc.**

**ENVIRONMENTAL SCIENCE (Theory)**

**Issues in Environmental Science - II**

**(Semester - IV) (Paper - IV) (2008 and 2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory and carry equal marks.*
- 2) Neat and labelled diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Attempt the following in 1 - 2 lines each.

**[10]**

- a) Enlist effects of desertification.
- b) Write full form of SEZ.
- c) Define Eutrophication
- d) What is GIS?
- e) Who initiated chipko movement?
- f) Enlist causes of Global warming.
- g) Mention any two effects of major dam projects in India.
- h) What is Rain water Harvesting?
- i) Write any two examples of Natural disasters.
- j) Enlist Environmental problems of urbanization.

**P.T.O.**



**Q2)** Write a short note on ANY TWO of the following : **[10]**

- a) Occupational health and safety.
- b) Importance of sustainable development.
- c) Ganga Action Plan

**Q3)** Answer any Two questions of the following : **[10]**

- a) Discuss effects of Bhopal gas Tragedy on Environment.
- b) Discuss significance of Environmental Health Modelling.
- c) Explain impact of vehicular pollution on Urban air quality.

**Q4)** Attempt ANY ONE of the following : **[10]**

- a) Discuss principles of Agenda - 21. Explain its importance in Biodiversity Conservation.
- b) What is Alkaline & Saline Soil. Explain various measures used for its reclamation.



Total No. of Questions : 4]

SEAT No. :

**P886**

[Total No. of Pages : 2

**[5315] - 483**

**T.Y.B.Sc. (Semester - IV)**

**ENVIRONMENTAL SCIENCE (Theory)**

**Environmental Governance & Equity : EMS and ISO 14000**

**(2008 and 2013 Pattern) (Paper - V)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory and carry equal marks.*
- 2) Neat and labelled diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Attempt the following in 1 - 2 lines each.

**[10]**

- a) Write full form of BIS.
- b) What is PDCA cycle?
- c) Define 'Impact'?
- d) Enlist stages of Environmental Audit.
- e) What is EIA?
- f) Mention any two ambient air quality standards in India?
- g) What is ESR?
- h) Define EMS.
- i) Write any two functions of 'WHO'.
- j) Write standard limit of BOD for inland discharge of effluent.

**P.T.O.**

**Q2)** Write a short note on ANY TWO of the following : **[10]**

- a) National Environmental Policy.
- b) Constitutional provisions of India for Environment protection.
- c) Environmental Economics.

**Q3)** Answer ANY TWO questions of the following : **[10]**

- a) Discuss objectives of Environmental Audit.
- b) Explain benefits of ISO 14001 certification.
- c) Discuss role of society in effective implementation of Environmental regulations.

**Q4)** Attempt ANY ONE of the following : **[10]**

- a) What is Generic standard? Explain role of Technical committee. Discuss guidelines of ISO 14001.
- b) Discuss stages of EIA in detail. Explain importance of EIA in resource management.



Total No. of Questions : 4]

SEAT No. :

**P887**

[Total No. of Pages : 2

**[5315] - 484**  
**T.Y.B.Sc. (Semester - IV)**  
**ENVIRONMENTAL SCIENCE (Theory)**  
**Environmental Biotechnology - II**  
**(2008 & 2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory and carry equal marks.*
- 2) Neat and labelled diagrams must be drawn wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Attempt the following in 1 - 2 lines each.

**[10]**

- a) Define Rhizofiltration.
- b) Enlist the advantages of bioleaching.
- c) Write full form of FBR and ABR.
- d) What is biomass gasification?
- e) What is electrolysis process in hydrogen production.
- f) Enlist any two demerits of biomethanation of MSN.
- g) Define in Situ bioremediation.
- h) Define fermentation.
- i) Enlist any two aquatic biomass used for biogas.
- j) Define hog fuel.

***P.T.O.***

**Q2)** Write a short note on ANY TWO of the following : **[10]**

- a) Biotechnology for air pollution control.
- b) Rotating biological contractor.
- c) In - Situ Leaching

**Q3)** Answer ANY TWO questions from the following : **[10]**

- a) What are the advantages of using immobilized enzymes.
- b) Explain the factors affecting methane formation.
- c) What are the advantages of anaerobic waste water treatment.

**Q4)** Attempt ANY ONE of the following : **[10]**

- a) What is bioremediation? In what ways it is good tool for environmental clean up.
- b) Explain the techniques used for removal of heavy metals from waste water.



Total No. of Questions : 4]

SEAT No. :

**P888**

[Total No. of Pages : 2

**[5315] - 486**  
**T.Y.B.Sc. (Vocational)**  
**BIOTECHNOLOGY**  
**Environmental Biotechnology and Bioinformatics**  
**(2015 Pattern) (Semester - IV) (Paper - I)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Draw neat labelled diagrams wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Answer the following questions in short.

**[10]**

- a) What are Nitrogen fixers? Give 1 example.
- b) What is Entrez?
- c) What is gasohol?
- d) What is scoring matrix?
- e) What is bioleaching? Name a microbe involved in bioleaching.
- f) Define homologues.
- g) Name the microbes used in waste water treatment.
- h) What is FASTA?
- i) Name the microbes involved in pesticide degradation.
- j) What is TrEMBL?

**P.T.O.**

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

- a) Explain the processes involved in phytoremediation.
- b) What is SWISS - PROT? Give its important features.
- c) Describe the process of bioaugmentation and biostimulation.

**Q3)** Write short notes on any two : **[10]**

- a) NDB
- b) Biogas production
- c) CATH

**Q4)** Answer any one in detail. **[10]**

- a) Describe the nucleic acid databases.
- b) What are hazardous wastes? Describe the role of biotechnology in hazardous waste management.



Total No. of Questions : 5]

SEAT No. :

**P889**

[Total No. of Pages : 2

**[5315] - 487**

**T.Y.B.Sc.**

**PHOTOGRAPHY AND AUDIO - VISUAL PRODUCTION**

**(Vocational) (Semester - IV) (Paper - V)**

**Entrepreneurship Development**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) Question number five is compulsory.*
- 2) Answer any three questions from the remaining questions.*
- 3) Provide suitable examples wherever necessary.*
- 4) Figures to the right indicate full marks.*

**Q1)** How is an “Entrepreneur” different from a “Businessman”? Support your answer with a relevant example and suitable logic. **[10]**

**Q2)** What is the difference between a “Client”, “Customer” and “Consumer”? Who according to you matters the most? **[10]**

**Q3)** How is “Marketing” different from “Sales”? Discuss the 4 Ps of Marketing in detail with suitable examples. **[10]**

**Q4)** Write short notes on any two of the following. **[10]**

- a) Utility
- b) Goods vs Services
- c) Demand

**P.T.O.**



**Q5)** Answer the following :

**[10]**

Mr. Ashirwad is a big dealer based in Dubai with an entire Gulf presence. However, Mr. Ganesh is a very well known supplier of electric wires and ICs and owns a workshop in Khopoli. Mr. Amit has a huge road transport business. His road transport network spans across all the Gulf nations. Miss. Neeraja and Miss. Sanjana have a similar network of transportation in India. However, they are not into International Cargo Transportation. Mr. Jonty is into Air Cargo and Mr. Shivang is into Water Cargo. Air Cargo is costlier and takes less time, while Water Cargo is cheaper but takes a lot of time to reach the destinations. Mr. Chetan has a huge farm of tomatoes near Bhigwan. Miss. Harshada and Miss Siddhi recently migrated to Abu Dhabi from Bhigwan in order to start some retail business outlets in the gulf. Mr. Shreyas owns a huge warehouse near JNPT Mumbai, but does not have cold storage facility. This facility is available in the warehouse of Mr. Gaurang, but it is a bit far from Mumbai JNPT and is a relatively costlier warehouse. Mr. Ketan and Mr. Kaushik are similar warehouse competitors in Dubai. Mr. Ketan has cold storage facility and has a cheaper storage rate. But there is no access to market from his warehouse. Where as Mr. Kaushik does not have storage facility, but is costlier as he has a great proximity to the Gulf markets. Mr. Oshan has a supreme command over any kind of production processes and is looking forward to joining a company in India as a Production Incharge. In all this, Mr. Pushkar is a confused entrepreneur at the moment. He is working out two options of starting an Export Business. Option 1 is to manufacture & export electric components in Gulf nations, while Option 2 is to manufacture tomato ketchups and export in Gulf nations. He plans to start a workshop in Pune. He comes to you for help, and asks you to design a Supply Chain for both the options. What are the 2 designs that you would prepare for him?



Total No. of Questions : 4]

SEAT No. :

**P890**

[Total No. of Pages : 2

**[5315] - 488**

**T.Y.B.Sc. (Vocational) (Semester - IV) (2013 Pattern)**  
**ELECTRONIC EQUIPMENT AND MAINTENANCE**  
**Entrepreneurship Development (Paper - V)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Use of log tables calculators is allowed.*

**Q1)** Answer the following :

**[4 × 1 = 4]**

a) Answer the following :

- i) What is 'cash flow'?
- ii) State two disadvantages of sole proprietorship.
- iii) Define the term 'entrepreneurship'.
- iv) What is 'Value Added Tax'?

b) Answer the following :

**[2 × 2 = 4]**

- i) State the importance of 'Soft Skill' in marketing.
- ii) What is 'PAN'?

c) Comment on the following :

**[2 × 2 = 4]**

- i) Identification of opportunities are necessary for the growth of business.
- ii) Modern concept of marketing is consumer centric.

**P.T.O.**

**Q2)** Answer any two of the following : **[2 × 4 = 8]**

- a) Explain the term working capital. State its importance.
- b) Explain typical characteristics of entrepreneur.
- c) Discuss the duties of District Industry Centre (DIC)

**Q3)** Answer any two of the following : **[2 × 4 = 8]**

- a) Discuss the various difficulties encountered by entrepreneur.
- b) Explain the role of consultancy organization in entrepreneurship development.
- c) Explain the essential attributes of entrepreneur for running successful business.

**Q4)** Answer any two of the following : **[2 × 6 = 12]**

- a) Explain the role of human resource management.
- b) Explain the entrepreneurship as career option.
- c) Discuss sources of finance to start a new business.

OR

Write short notes on the following : **[3 × 4 = 12]**

- a) SWOT analysis
- b) Marketing strategy
- c) Market segmentation



Total No. of Questions : 4]

SEAT No. :

**P891**

[Total No. of Pages : 2

**[5315] - 489**

**T.Y.B.Sc. (Vocational)**

**INDUSTRIAL MICROBIOLOGY**

**VOC - IND - MIC - 345 (Theory Course)**

**Molecular Biology and Recombinant DNA Technology**

**(Semester - IV) (2013 Pattern)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*
- 3) *Draw neat labeled diagrams wherever necessary.*

**Q1)** Answer the following

**[10]**

- a) What is Human Genome Project?
- b) Maximum Size of DNA that can be inserted in YAC vector is \_\_\_\_\_.
- c) Which enzyme is used to cut DNA molecule in Recombinant DNA Technology?
- d) DNA fingerprinting was developed by \_\_\_\_\_
- e) Name any two examples of monoclonal antibodies produced by RDT.
- f) What is Recombinant DNA Technology?
- g) According to HGP genetic similarity between all humans is \_\_\_\_\_ percent.
- h) What do you understand by colony PCR?
- i) What is a minisatellite DNA?
- j) Draw the structure of ddNTP.

**P.T.O.**

**Q2)** Attempt any two of the following :

**[10]**

- a) Diagrammatically explain Real time PCR.
- b) Comment on the role of nucleic acid hybridization in screening of desired clone. Give types of nucleic acid probes used in RDT.
- c) What is Sangers method of sequencing? Write the principle and methodology.

**Q3)** Comment on : (Any two of the following)

**[10]**

- a) YAC as a vector
- b) Blue - White screening.
- c) Transgenic animals.

**Q4)** Attempt any one of the following :

**[10]**

- a) What is site - directed mutagenesis? Discuss any two methods of inducing point mutations and its applications.
- b) Explain in detail the steps involved in cloning a desired gene. Draw diagrams wherever necessary.



Total No. of Questions : 4]

SEAT No. :

**P892**

[Total No. of Pages : 2

**[5315] - 491**  
**T.Y.B.Sc. (Vocational)**  
**VOC - ST - 321 : SEED TECHNOLOGY**  
**Entrepreneurship Development**  
**(2013 Pattern) (Paper - III) (Semester - IV)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat labelled diagrams wherever necessary.*

**Q1)** Answer in one sentence.

**[10 × 1 = 10]**

- a) Give one merit and demerit in partnership business.
- b) Mention any one skill the entrepreneurs need to possess.
- c) What is service tax?
- d) What is working capital?
- e) Give any two important aspects of marketing.
- f) What is pricing?
- g) What is wages act?
- h) Give the importance of soft skill in business organisation.
- i) Write any two roles/services of funding agency.
- j) Give the concept of entrepreneurship.

***P.T.O.***

**Q2)** Answer any two of the following : **[2 × 5 = 10]**

- a) Write an account on entrepreneurial process.
- b) Explain the role of Government Bank in entrepreneurship development.
- c) Comment on marketing mix.

**Q3)** Write notes on any two of the following : **[2 × 5 = 10]**

- a) District Industry Bank
- b) MIDC
- c) Training of personnel.

**Q4)** Explain in detail about the management of human resource in business organisation. **[10]**

OR

Write about various criteria used for selection of new product or service.



Total No. of Questions : 4]

SEAT No. :

**P893**

[Total No. of Pages : 2

**[5315] - 493**  
**T.Y.B.Sc. (Vocational)**  
**BIOTECHNOLOGY**  
**Entrepreneurship Development**  
**(2013 Pattern) (Semester - IV) (Paper - II)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Draw neat labelled diagrams wherever necessary.*
- 3) Figures to the right indicate full marks.*

**Q1)** Answer the following questions in short.

**[10]**

- a) What is SIDBI?
- b) What are the components of marketing mix?
- c) Define Entrepreneurship.
- d) What is SWOT?
- e) What is working capital?
- f) What is CGTMSE?
- g) What is Angel Finance?
- h) What is SICOM?
- i) Mention 2 types of entrepreneurs.
- j) What is digital marketing?

**P.T.O.**



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

- a) Who is an entrepreneur? Explain his keys elements and characteristics.
- b) Explain any 2 forms of business organization.
- c) What is a consultancy organization? Explain its role in development.

**Q3)** Write short notes on any two : **[10]**

- a) Exit policy
- b) SSI Registration
- c) Marketing channels.

**Q4)** Answer any one of the following : **[10]**

- a) What is the concept and scope of human resource management? Explain different modes of employment.

OR

- b) What are the sources of finance? Give the role of various government and commercial funding agencies.



Total No. of Questions : 8]

SEAT No. :

**P894**

[Total No. of Pages : 2

**[5315] - 494**

**T.Y.B.Sc.**

**PHOTOGRAPHY AND AUDIO - VISUAL PRODUCTION**

**Entrepreneurship Development**

**(Semester - IV) (Paper - VI) (Vocational)**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) Question number ONE is compulsory.*
- 2) Answer any four questions from the remaining questions.*
- 3) Provide suitable examples wherever necessary.*
- 4) Figures to the right indicate full marks.*

*Q1)* Radio is a medium of “Intimacy”. Explain. **[8]**

*Q2)* How Radio writing differs from print writing? **[8]**

*Q3)* In an interview programme, why interviewer should listen to others? **[8]**

*Q4)* Write a script for 3 minute talk on any one of the following. **[8]**

- a) IPL Cricket matches.
- b) Demonetization.

*Q5)* What is OB. programme? What care should be taken to cover any OB programme? **[8]**

**P.T.O.**

*Q6)* Explain any Broadcasting code in detail. [8]

*Q7)* It is a challenge to broadcast for visually challenged listeners. [8]

*Q8)* Appreciate any movie you like the most. [8]



Total No. of Questions : 4]

SEAT No. :

**P895**

[Total No. of Pages : 2

**[5315] - 495**  
**T.Y.B.Sc. (Semester - IV)**  
**Electronic Equipment Maintenance**  
**Medical Instrumentation**  
**Vocational EEM Paper - VI**

*Time : 2 Hours]*

*[Max. Marks :40*

*Instructions to the candidates:*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Draw neat diagrams wherever necessary.*

**Q1) a)** Answer the following :

**[4 × 1 = 4]**

- i) Which ion selective electrode is used as reference electrode?
- ii) What is CNS?
- iii) What is bioelectric potential?
- iv) State full forms of
  - 1) ENG,
  - 2) EEG

**b)** Answer the following :

**[2 × 2 = 4]**

- i) What are
  - 1) SA node
  - 2) AV node
- ii) State two considerations for bioelectric recorder amplifier.

**P.T.O.**

- c) Answer the following : [2 × 2 = 4]
- i) State 2 general senses and 2 special senses.
  - ii) What is reflex arc?

**Q2)** Attempt any two [2 × 4 = 8]

- a) Explain electrical activity of excitable cells.
- b) Write a note on ENG.
- c) Discuss electrodes for electrical stimulation of tissues.

**Q3)** Attempt any two [2 × 4 = 8]

- a) Give key features of EEG waves
- b) Discuss direct writing system.
- c) What are physiological effects of electric current on human body.

**Q4)** Attempt any two [2 × 6 = 12]

- a) Explain filter photometer.
- b) Discuss external noise sources in medical instrumentation.
- c) Explain spectrophotometer.

OR

**Q4)** Answer the following :- [3 × 4 = 12]

- a) Explain protection aspect with respect to equipment design in medical instrumentation.
- b) Write a note on ECG.
- c) Explain any one type of amplifier used with bioelectric recorders.



Total No. of Questions : 4]

SEAT No. :

**P896**

[Total No. of Pages : 2

**[5315]-496**

**T.Y. B.Sc. (Semester - IV)**

**INDUSTRIAL MICROBIOLOGY(Vocational)**

**VOC-IND-MIC-346: Entrepreneurship Development  
(2013 Pattern) (Paper - VI)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

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

**Q1)** Answer the following :

**[10]**

- a) Answer the following questions in 1-2 lines.
  - i) Define the term 'entrepreneur'.
  - ii) What is Sales Tax?
  - iii) Write full form of DIC.
  - iv) Write the Act of Partnership Firm.
  - v) State any two qualities possessed by an entrepreneur.

b) Match the pairs

**Group "A"**

Co-operative Societies Act

Maharashtra Value Added Tax Act

Indian Partnership Act

Sole Proprietorship

The Patents Act

**Group "B"**

1932

Maximum Secrecy

1904

Intellectual Property

2002

**P.T.O.**

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

- a) Distinguish between a Private Limited Company and a Public Limited Company.
- b) Explain the Bases for Market Segmentation.
- c) Write a note on four P's of Marketing Mix.

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

- a) Write a note on Factories Act.
- b) How to determine residential status in case of an individual under Income Tax Act.
- c) Write merits of Joint Stock Company.

**Q4)** Attempt *any one* of the following : **[10]**

- a) Explain the characteristics of a Company.
- b) Describe the characteristics which the investors seek in an entrepreneur.



Total No. of Questions : 4]

SEAT No. :

**P897**

[Total No. of Pages : 2

**[5315]-498**

**T.Y. B.Sc. (Vocational) (Semester - IV)**

**SEED TECHNOLOGY**

**VOC-ST-322: Biotechnology and Intellectual Property Rights  
(2013 Pattern) (Paper - IV)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:*

- 1) All questions are compulsory.*
- 2) Figures to the right indicate full marks.*
- 3) Draw neat and labeled diagrams wherever necessary.*

**Q1)** Answer in one sentence each :

**[10 × 1 = 10]**

- a) Define Biotechnology
- b) What is ICAR?
- c) Define Southern Blotting.
- d) Write full form of PCR.
- e) What is Gene cloning?
- f) Give any one name of Transgenic plant.
- g) What is Micropropagation?
- h) Define anther culture.
- i) What is meant by Trade Secret.
- j) Enlist aids to variety identification.

***P.T.O.***



**Q2)** Answer the following (Any two) : **[2 × 5 = 10]**

- a) Explain SDS-PAGE analysis.
- b) Describe in detail Northern Blotting.
- c) Explain in detail transgenics with suitable example.

**Q3)** Write Notes on any two of the following : **[2 × 5 = 10]**

- a) Plasmid vectors.
- b) Embryo culture.
- c) Intellectual Property Rights.

**Q4)** What is Tissue culture? Explain in detail tissue culture technique in Banana. **[10]**

OR

Give an account of DNA finger printing.



Total No. of Questions : 4]

SEAT No. :

P904

[Total No. of Pages : 2

**[5315]-601**  
**T.Y. B.Sc. (Semester IV)**  
**PHYSICS (Paper - V)**  
**PH - 345 (B) : Advanced Electronics**  
**(2008 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*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 log tables and calculator is allowed.*

**Q1)** Attempt all of the following (one mark each):

- a) Which material is used to construct NTC thermistors?
- b) Define the term : linearization of signals.
- c) Draw the circuit symbol for a photo diode.
- d) How the dosage of alum is decided in water purification process?
- e) Define the term : scan time for a PLC.
- f) State the principle of photo diode detector.
- g) What are the types of signal conditioning used in process control?
- h) State the working principle of narrow band pyrometer.
- i) What is discrete state process control?
- j) What is turbidity?

**Q2)** Attempt any two (five marks each)

- a) Explain the construction and working of photovoltaic detector with suitable diagram.

**P.T.O.**

- b) A metal wire shows following variation of resistance with temperature. Find the linear approximation for the resistance.

T(°C)	50	55	60	65	70	75	80
R(Ω)	150.0	162.5	170.1	175.0	180.2	184.2	190.0

- c) Draw a neat, labelled diagram for process control system.

**Q3)** Attempt any two (five marks each):

- Describe how analog control system can be used for continuous variation of temperature in an oven.
- State the main objectives of a control system. Discuss the terms - steady state regulation and transient regulation.
- What is chemical dosage in a water treatment plant? Discuss it with suitable diagram.

**Q4)** a) Attempt any one (Eight marks):

- Discuss the principle, construction and working of a broad band pyrometer using a neat diagram.
  - State the different types of motion; discuss the principle, construction and working of accelerometers.
- b) Attempt any one (Two marks):
- Discuss the principle of a bimetal strip temperature sensor in brief.
  - A RTD dissipates 20 mW/°C. If the temperature rise due to self heating is 0.55°C, determine the power dissipated in the RTD.



Total No. of Questions : 4]

SEAT No. :

P905

[Total No. of Pages : 4

**[5315]-602**  
**T.Y. B.Sc. (Semester IV)**  
**PHYSICS (Paper - VI) (Elective - II)**  
**PH - 346 (H) : Microcontrollers**  
**(2008 Pattern)**

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of log table and calculator is allowed.*

**Q1)** Attempt all of the following (one mark each):

**[10]**

- a) What is the on-chip RAM space in 8051?
- b) What is PSW register in 8051?
- c) Convert 03FFH hex number in to decimal.
- d) Give the ASCII codes for '0' (zero) and 'A'.
- e) State function of instruction CLR A.
- f) Give format of TCON register.
- g) Write the instruction to set external interrupt O.
- h) Give the function of E (enable) of the LCD.
- i) State the use of TXD pin in 8051.
- j) Define the full duplex data transfer.

**Q2)** Attempt any two (five marks each)

**[10]**

- a) What are different groups (functional) of 8051 instructions? Give one example of each.
- b) With memory map explain internal memory organisation of 8051.
- c) How 8051 is interfaced to PC using RS 232 standard?

**P.T.O.**

**Q3) Attempt any two (five marks each):** **[10]**

- a) Write an assembly language program for finding the smallest number from the given set (an array) of numbers.
- b) Write an assembly language program for adding two 16-bit numbers 3377H and 6622H, store the result in R0 and R1 registers.
- c) Draw block diagram of 8051 microcontroller.

**Q4) A) Attempt any one** **[8]**

- i) List the timers of 8051 and their associated registers. Explain different modes of 8051 timers.
- ii) Explain 8051 logic instructions AND, OR, XOR complement and compare with one example of each.

**B) Attempt any one** **[2]**

- i) What is the stack? How it is used in calling the subroutines?
- ii) What are assembler directives? Explain DB, ORG.



Total No. of Questions : 4]

P905

[5315]-602

T.Y. B.Sc. (Semester IV)

PHYSICS (Paper - VI) (Elective - II)

PH - 346 (G) : Physics of Nanomaterials  
(2008 Pattern)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:-

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat diagrams wherever necessary.

**Q1)** Attempt all of the following (1 mark each): **[10]**

- a) What is the meaning of word 'nano'?
- b) Name the scientist who delivered the historical talk "there's plenty of room at the bottom".
- c) Give an example of property of gold nano particles which is differ from bulk gold.
- d) State scherrer formula for diffraction from in nanomaterials.
- e) Enlist the four applications of nanomaterials.
- f) State two approches in the synthesis of nanomaterials.
- g) What are different types of carban nano tubes.
- h) Which detectors are typically used in a UV-vis-NIR spectrometer?
- i) Name any two nanomaterials prominently used in cosmetics.
- j) State hazardous effect of nanomaterials.

**Q2)** Attempt any two

- a) State and prove Bragg's law. **[5]**
- b) Explain : **[5]**
  - i) Atomic scattering factor
  - ii) Crystal structure factor.
- c) Explain working of transmission electron microscope (TEM) with suitable diagraph. **[5]**

**Q3)** Attempt any two:

- a) Write about the applications of nanomaterials in the field of medicine, electronics, sports, health and biology. [5]
- b) Explain with diagram, how the porous silicon is formed.
- c) What happens to the melting point, electrical conductivity and optical properties of nanoparticles compared to their bulk? [5]

**Q4)** a) Attempt any one : [8]

- i) Describe in detail UV- visible-NIR spectroscopy.
  - ii) Write a note on synthesis of nanoparticles by
    - 1) Sol-gel-method
    - 2) High energy ball milling
- b) Attempt any one :
- i) Name any two milestones in the development of nanotechnology. [2]
  - ii) State the magnitudes of resolution of SEM and TEM. [2]







b) In each of the following, state whether the given statement is true or false. **[1 each]**

i) Parallel system is a coherent system.

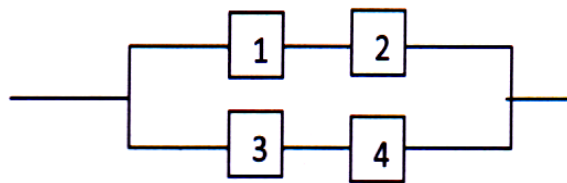
ii) In case of single sampling plan Average Total Inspection (ATI) always lies between  $n$  and  $N$ .

c) Define the following terms: **[1 each]**

i) Minimal cut vector

ii) Decreasing Failure Rate (DFR)

d) i) Draw the fault tree diagram for the following reliability **[1]**



ii) Explain the procedure of single sampling plan. **[1]**

**Q2)** Attempt **any two** of the following **[5 each]**

a) For a single sampling plan  $n = 100$ ,  $c = 3$  the lot is large as compared to sample size. Find the value of average outgoing quality AOQ if submitting lot has  $P = 0.03$

b) Explain: normal, reduced and tightened inspection.

c) Define reliability of a coherent system. Obtain reliability of parallel system with three components if all the components have same reliability.

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

a) Derive the expression of ATI in double sampling plan.

b) For the structure function  $1 - (1 - X_1 X_2)(1 - X_3 X_4)$  draw a reliability block diagram. Also find path vectors and path sets.

c) Write a short note on ISO.

**Q4)** Attempt **any one** of the following:

- a) i) Define hazard rate  $r(t)$ . Show that  $r(t) = \frac{f(t)}{\bar{F}(t)}$  ( $\bar{F}(t)$  is survival function)
- ii) Distinguish between 100% inspection and sampling inspection. **[5 + 5]**
- b) i) For a double sampling plan with  $N=2000$ ,  $n_1 = 60$ ,  $C_1 = 1$ ,  $n_2 = 100$ ,  $C_2=3$ , find ATI if lots of quality  $p = 0.04$  are submitted for inspection.
- ii) Write note on acceptance sampling plan with rectification. **[5 + 5]**



Total No. of Questions : 4]

SEAT No. :

P907

[Total No. of Pages : 4

[5315]-604

T.Y.B.Sc.

STATISTICS (Principal) (Paper - V)

ST - 345 : Operations Research

(2008 Pattern) (Semester - IV)

*Time : 2 Hours]*

*[Max. Marks : 40*

*Instructions to the candidates:-*

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*
- 3) *Use of scientific calculator and statistical tables is allowed.*
- 4) *Symbols and abbreviations have their usual meaning.*

**Q1)** Attempt each of the following:

- A) Choose the correct alternative in each of the following: **[1 each]**
- i) The role of artificial variable in simplex method is
    - a) to obtain optimal solution
    - b) to get alternate solution
    - c) to facilitate initial basic feasible solution
    - d) to get standard form of LPP
  - ii) The solution of a transportation problem of dimension  $m \times n$  is said to be degenerate if it has
    - a) exactly  $m + n - 2$  allocations
    - b) less than  $m$  allocations
    - c) exactly  $m + n - 1$  allocations
    - d) less than  $m + n - 1$  allocations
  - iii) If the primal linear programming problem has un bounded solution then its dual has
    - a) infeasible solution
    - b) unique optimal solution
    - c) alternate solution
    - d) unbounded solution

**P.T.O.**

- iv) An assignment problem is balanced if
  - a) the cost matrix is rectangular
  - b) the cost matrix is square
  - c) the cost values are negative
  - d) the cost values are 1 or 0.
  
- B) State whether each of the following statements is true or false: **[1 each]**
  - i) Simulation is used to reduce the chances of failure to meet specifications.
  - ii) While sequencing  $m$  jobs on machines, the time required to transfer jobs between machines is negligible.
  
- C) Define each of the following: **[1 each]**
  - i) Standard form of LPP
  - ii) General sequencing problem
  
- D) i) Explain how to convert an unbalanced transportation problem to balanced one. **[1]**
- ii) State linear congruential generator that will generate pseudo random numbers. **[1]**

**Q2) Attempt any two of the following: [5 each]**

- a) What is a transportation problem? Give its mathematical formulation. Explain degeneracy with respect to transportation problem.
- b) A manufacturing company is engaged in producing three types of products A, B and C.

The production department produces components sufficient to make 50 units of A, 25 units of B and 30 units of C.

In the assembly department 100 man - hours are available daily to assemble the products. Assembly time required for a unit of A is 0.8 hrs and that for a unit of B and is 1.7 hrs and 2.5 hrs respectively.

Profit contribution per unit of A is Rs 12 and that of B and C is Rs 20 and Rs 45 each. The company has daily order commitment of at least 20 units of A and 15 units each of B and C.

Formulate above problem as linear programming problem.

c) Solve the following LPP using graphical method

$$\text{Maximize } Z = 2x_1 + 4x_2$$

Subject to

$$3x_1 + 2x_2 \leq 48$$

$$x_1 + 3x_2 \leq 42$$

$$x_1 + x_2 \leq 21$$

$$x_1, x_2 \geq 0.$$

**Q3)** Attempt any two of the following:

**[5 each]**

- Describe Monte Carlo method of simulation.
- Describe the Least Cost method to obtain initial basic feasible solution in case of transportation problem.
- Following table indicates processing time (in hrs) taken by two machines  $M_1$  and  $M_2$  to complete 8 jobs in the order  $M_1 M_2$ .

Machines \ Jobs	A	B	C	D	E	F	G	H
$M_1$	20	8	10	4	5	12	15	7
$M_2$	8	5	13	11	12	8	13	6

Obtain the sequence of the jobs that will minimize total elapsed time.

**Q4)** Attempt any one of the following:

- Goods are transported from factories  $F_1, F_2, F_3$  to warehouses  $W_1, W_2, W_3$  and  $W_4$ .

Following matrix indicates per unit cost (in Rs) of transportation from factories to warehouses.

Factory \ Warehouse	$W_1$	$W_2$	$W_3$	$W_4$	Availability
$F_1$	48	60	56	54	140
$F_2$	45	55	53	60	260
$F_3$	50	63	60	62	360
Requirement	100	300	150	210	

Obtain optimal allocation to minimize total cost of transportation. [7]

ii) While solving LPP by simplex method, explain how to detect [3]

- 1) infeasible solution
- 2) unbounded solution

b) i) There are five jobs to be assigned to five machines. Following matrix shows the return in (100) rupees on assigning  $i^{\text{th}}$  job to  $j^{\text{th}}$  machine.  $i = 1, 2, \dots, 5, j = 1, 2, \dots, 5$

Machines \ Jobs	A	B	C	D	E
$M_1$	5	11	10	12	4
$M_2$	2	4	10	7	14
$M_3$	6	7	12	8	15
$M_4$	7	8	13	5	10
$M_5$	3	12	5	3	12

Obtain optimum assignment that will maximize the returns. [6]

ii) Write dual LPP for given primal LPP

$$\text{Maximize } Z = 3x_1 + 4x_2 - 7x_3$$

Subject to

$$x_1 + x_2 + x_3 \geq 5$$

$$2x_1 - 3x_2 \leq 15$$

$$4x_2 - 9x_3 = 12$$

$$x_1, x_2 \geq 0, x_3 \text{ unrestricted in sign.}$$

[4]





- iv) In epidemiology, logit function of probability  $\pi$  is given by
- A)  $\ln[(1 - \pi) / \pi]$                       B)  $\ln[\pi / (1 - \pi)]$   
 C)  $\ln[\pi(1 - \pi)]$                       D)  $\ln[\pi / (1 + \pi)]$
- b) In each of the following cases, state whether the given statement is true or false : **[1 each]**
- i) Correlation does not imply causation.  
 ii) Humans are used in preclinical trials.
- c) Define the following terms: **[1 each]**
- i)  $\pm 20\%$  role for assessment of bioequivalence  
 ii) blinding
- d) i) State the role of FDA. **[1]**  
 ii) Explain the term efficacy of drug. **[1]**

**Q2)** Attempt any *two* of the following: **[5 each]**

- a) Explain Mc Nemar's test for testing the hypothesis for symmetry of  $2 \times 2$  contingency table with help of an illustration.
- b) Explain in brief the discoveries in epidemiology made by the following:
- i) William Harvey  
 ii) Florence Nightingale
- c) Derive the equation for sigmoidal growth

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

- a) Suppose  $\mu_c$  and  $\mu_T$  denote the mean responses of two formulations control (C) and test (T) with unknown variance. Explain how you test  $H_0: \mu_T = \mu_c$  against  $H_1: \mu_T > \mu_c$ . Assuming equal sample sizes for both the test groups, find the expression of sample size of each group to get power  $1 - \beta$ .
- b) Write a short note on 'Parallel design' used in clinical trails.
- c) A survival model is defined by the following values of  $P_x$  for a radix of 1,00,000:

Time Units (x)	0	1	2	3	4	5	6
Survival Probability ( $P_x$ )	0.95	0.90	0.80	0.50	0.30	0.10	0

Prepare life-table containing columns  $d_x, q_x, L_x, T_x, e_x$ .



**Q4)** Attempt any *one* of the following:

- a) i) Explain in brief Phase IV study in clinical trails. [5]  
 ii) Consider the following data on time and concentration for a hypothetical drug. Estimate  $C_{max}$ ,  $T_{max}$ . Also calculate  $AUC_{(0,12)}$  [5]

Time	0.25	0.50	0.75	1	2	3	4	6	9	12
Concentration (microgram/ml)	15	12.5	10.5	9	5.9	4.5	3.6	2.4	1.3	0.7

- b) i) Consider the following data on vision grades of two eyes of 7477 women factory workers. Grade 1 represent normal vision and Grade 4 is the weakest vision. Using Bowker test, test whether there is any relation between the grade of left eye and right eye. Use 5% level of significance.

Vision grades of eyes of women workers

Right eye	1	2	3	4
Left eye				
1	1520	266	124	66
2	234	1512	432	78
3	117	362	1772	205
4	36	82	179	492

- ii) Define survival function and write down interpretation of  $S(x)$ . Also, state the properties of  $S(x)$ . [5]





b) In each of the following, state whether the given statement is true or false: **[1 each]**

i) Number of species in a community is called species richness.

ii) In case of a single recapture, Peterson's estimator is also m.l.e. of the population size (N).

c) Define each of the following: **[1 each]**

i) Gompertz curve

ii) Stable population

d) i) Explain the role of a Placebo in clinical trials.

ii) What is the role of FDA?

**[1 each]**

**Q2)** Attempt any two of the following: **[5 each]**

a) Explain Mc Nemar's test for testing the hypothesis for symmetry of  $2 \times 2$  contingency table with the help of an illustration.

b) Write a note on parallel designs used in clinical trials.

c) For a Gompertz model determine the maximum growth rate.

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

a) In Leslie matrix model state assumptions made, two kinds of parameters, model and its matrix representation.

b) Explain the concept of point to individual nearest neighbour distance in Poisson forest.

c) Explain the method of quadrant sampling to estimate the population density in a forest. Also discuss the scope and limitations of this method.

**Q4)** Attempt any one of the following:

- a) i) For a Gompertz model determine the maximum growth rate.
- ii) Discuss the states of equilibria in Gompertz growth model.

**[5+5]**

OR

- b) i) Describe the line transect method for estimating animal population in forest. What is rational behind using exponential detection function?
- ii) Describe capture - recapture method. Derive Peterson's estimator of population size (N) for single recapture in case of closed population.

**[5+5]**



Total No. of Questions : 4]

SEAT No. :

P909

[Total No. of Pages : 3

[5315]-606

T.Y.B.Sc.

STATISTICS (Principal) (Paper - VI)

ST - 346 (C) : Statistical Computing Using "R" Software  
(2008 Pattern) (Semester - IV)

Time : 2 Hours]

[Max. Marks : 40

Instructions to the candidates:-

- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Each question is to be solved using R software installed on your computer.
- 4) Attach computer printout of your work to the answer book supplied to you.

Q1) Attempt each of the following:

[1 each]

- a) Draw a random sample of size 8 from a  $P(m=2.5)$ .
- b) Create a data frame of student name and marks obtained in one subject for 4 students.
- c) Find mode of the following observations:  
12, 16, 28, 23, 25, 27, 25, 19, 24, 25.
- d) Draw spike plot of the following data:  
x : 1 3 6 8 9  
f : 8 10 12 7 5
- e) Simulate an experiment of tossing a die 70 times and prepare its frequency distribution.
- f) Let  $X \sim B(n = 9, p = 0.6)$ , find  $P(X < 5)$  and  $P(X \geq 4)$ .
- g) Create a vector x of observations 12, 34, 25, 36, 48, 56, 28, 47. From x vector, create vector y containing elements of x greater than 40.
- h) Draw a SRSWR of size 2 from a population of 5 units.
- i) Access data CO2 and obtain its summary statistics.
- j) Let  $\sim N(7, 4^2)$ , compute  $P(-5 < X < 12)$ .

P.T.O.

**Q2)** Attempt any two of the following:

**[5 each]**

- a) Following are the data on the time in minutes required to fill the bottles by two machines A and B:

A : 8.1, 4.8, 3.9, 7.6, 8.2, 8.4, 6.9, 7.1

B : 3.9, 4.9, 7.5, 8.1, 8.3, 7.2, 5.8, 6.3

Can we conclude that average time required by two machines is same, test at 5% l.o.s.?

- b) Represent the following data by a simple bar diagram:

Year	1995	1996	1997	1998	1999
Profits (lakh Rs.)	7.5	6.8	8.2	6.4	8.5

- c) A die is tossed 60 times with the following results:

Number On the upper face	1	2	3	4	5	6
Frequency	8	13	11	12	7	9

Compute mean deviation about mean.

**Q3)** Attempt any two of the following:

**[5 each]**

- a) Compute geometric mean and harmonic mean for the following data:

x: 0-5    5-10    10-15    15-20    20-25

f: 8    12    15    10    5

- b) Draw ogive curves for the following data:

Wage (in Rs.)	200-300	300-400	400-500	500-600	600-700
No. of workers	12	40	36	18	14

- c) Fit a Poisson distribution to the following data and find the expected frequencies:

X	0	1	2	3	4	5	6	7
f	301	170	102	67	52	25	8	1

**Q4)** Attempt any one of the following:

- a) i) Calculate coefficient of variation for the following data:

Marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of students	12	18	21	16	8	5

- ii) Draw a pie chart for the following data:

Commodity	Food	Clothing	Housing	Education	Misc.
Expenses (%)	30	15	15	20	20

**[6+4]**

- b) i) Carry out two way ANOVA for the following data of yield (in kgs):

	Manures		
Fertility	I	II	III
F1	13.5	15.2	14.7
F2	14.6	15.8	13.9
F3	15.8	14.4	13.2
F4	12.2	12.6	14.4

- ii) Compute Karl Pearson's coefficient of correlation and comment.

x	2	5	7	8	9
y	8	13	18	20	21

**[7+3]**

