Total No. of Questions—**12**] [Total No. of Printed Pages—**8+3**

Seat No.	

[4657]-1

S.E. (Civil) (First Semester) EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer from Section I Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**.

From Section II Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Solve the following (any *three*) : [12]

(*i*) $(D^2 + 3D + 2)\, y = e^{e^x}$

(*ii*) $(D^2 + 6D + 9)\, y = 5^x - \log 2$

(*iii*) $(D^2 + 1)\, y = \cot x$ (By variation of parameters)

(*iv*) $x^2 \dfrac{d^2y}{dx^2} - 3x\dfrac{dy}{dx} + 3y = x^2 \sin(\log x)$.

(*b*) Solve : [5]

$$\frac{dx}{y} = \frac{dy}{-x} = \frac{dz}{xe^{x^2+y^2}}.$$

Or

2. (*a*) Solve the following (any *three*) : [12]

(*i*) $(D^2 - 4D + 4)\, y = e^{2x} \sin 3x$

(*ii*) $(D^2 + 6D + 9)\, y = e^{-3x} (x^3 + \sin 3x)$

(*iii*) $(D^2 - 1)\, y = x \cos 3x$

(*iv*) $(2x + 3)^2 \dfrac{d^2y}{dx^2} + (2x + 3)\dfrac{dy}{dx} - 2y = 24x^2$

(*b*) Solve the simultaneous equations : [5]

$$\frac{dx}{dt} - wy = a \cos pt, \text{ and}$$

$$\frac{dy}{dt} + wx = a \sin pt.$$

3. (*a*) Solve : [8]

$$\frac{\partial u}{\partial t} = C^2 \frac{\partial^2 u}{\partial x^2},$$

if

(*i*) u is finite; $\forall t$

(*ii*) $u(0, t) = 0; \ \forall t$

(*iii*) $u(L, t) = 0; \ \forall t$

(*iv*) $u(x, 0) = u_0; \ 0 \le x \le t$

where, L being a length of a bar.

(*b*) The whirling speed of a shaft of length l is given by :

$$\frac{d^4 y}{dx^4} - m^4 y = 0,$$

where

$$m^4 = \frac{Ww^2}{EIg}$$

and y is the displacement at distance x from one end. If both the ends of the shaft are short bearing, show that shaft will whirl when $\sin ml = 0$. [8]

Or

4. (*a*) Weight of 1 N stretches a spring 5 cm, a weight of 3 N is attached to the spring and weight W is pulled to 10 cm below the equilibrium position and released. Determine the position and velocity. [8]

(*b*) A string is stretched and fastened to two points L aparts. Motion is started by displacing the string in the form :

$$u = a \sin\left(\frac{\pi x}{L}\right)$$

from which it is released at time $t = 0$. Find the displacement $u(x, t)$ from one end. [8]

5. (*a*) Solve the following system of equations by Gauss elimination method : [9]

$$2x_1 + x_2 + x_3 = 10$$

$$3x_1 + 2x_2 + 3x_3 = 18$$

$$x_1 + 4x_2 + 9x_3 = 16.$$

(*b*) Use Runge-Kutta method of fourth order to solve : [8]

$$\frac{dy}{dx} = \sqrt{x+y}, \ y(0) = 1,$$

to find y at $x = 0.1$, taking $h = 0.1$.

Or

6. (*a*) Solve the following system of equations by Gauss-Seidel iteration method : [9]

$$20x + y - 2z = 17$$

$$3x + 20y - z = -18$$

$$2x + 3y + 20z = 25.$$

(*b*) Solve the equation :

$$\frac{dy}{dx} = x^2 + y, \ y(0) = 1$$

to find y at $x = 0.1$, using Euler's modified method taking $h = 0.05$. [8]

SECTION II

7. (*a*) Find the first four moments about mean if the moments about working mean 44.5 of a distribution are –0.4, 2.99, –0.08 and 27.63. Also calculate β_1 and β_2. [6]

(*b*) Find the correlation co-efficient for the data : [6]

x_1	y_1
10	18
14	12
18	24
22	6
26	30
30	36

(*c*) In a male population of 1000, the mean height is 68.16 inches and standard deviation is 3.2 inches. How many men will be expected to be more than 6 feet (72 inches) ?

Given : A(z = 1.2) = 0.3849. [5]

Or

8. (*a*) The scores obtained by two batsmen A and B in 10 matches are given below. Determine who is more consistent and who is better run getter. [7]

Batsman A	Batsman B
30	34
44	46
66	70
62	38
60	55
34	48
80	60
46	34
20	45
38	30

(*b*) Assume that, the probability of an individual coal miner being killed in a mine accident during a year is $\frac{1}{2400}$. Calculate the probability that in mine employing 200 miners, there will be at least one will be killed by accident in a year. [5]

(*c*) A dice is thrown 6 times. If "getting an odd number" is a "success", what is the probability of ?

(*i*) 5 success

(*ii*) At least 5 success. [5]

9. (*a*) If

$$\bar{r} \cdot \frac{d\bar{r}}{dt} = 0$$

then show $\bar{r}$ have constant magnitude. [5]

(*b*) Find directional derivative of :

$$\phi = x^2y^2 + y^2z^2 + z^2x^2 \text{ at } (1, 1, -2)$$

in the direction of tangent to the curve

$$x = e^t;\ y = 2\sin t - 1;\ z = t - \cos t \text{ at } t = 0.$$ [6]

(*c*) Find the value of m if

$$\overline{F} = (x + 2y)\,\hat{i} + (my + 4z)\,\hat{j} + (5z + 6x)\,\hat{k}$$

is solenoidal. [5]

Or

10. (*a*) Prove the following identities (any *two*) : [8]

(*i*) $\nabla^4\left(r^2 \log r\right) = \dfrac{6}{r^2}$

(*ii*) $\nabla \cdot \left(\dfrac{\bar{a} \times \bar{r}}{r^n}\right) = 0$

(*iii*) $\nabla^2 f(r) = f''(r) + \dfrac{2}{r} f'(r).$

(*b*) Find constants a, b, c so that :

$$\overline{F} = (x + 2y + az)\,\hat{i} + (bx - 3y - z)\,\hat{j} + (4x + cy + 2z)\,\hat{k}$$

is irrotational. [4]

(*c*) Find the values of a, b, c so that the directional derivative of :

$$\phi = axy^2 + byz + cz^2x^2$$

at (2, 1, 1) has a maximum magnitude 12 in the direction parallel to x-axis. [4]

11. (*a*) If

$$\overline{F} = \left(3x^2 + 6y\right)\hat{i} - 14yz\,\hat{j} + 20xz^2\,\hat{k}$$

then find work done of $\overline{F}$ from (0, 0, 0) to (1, 1, 1) along the path C : [5]

$$x = t;\ y = t^2;\ z = t^3.$$

(*b*) By using Stokes' theorem, evaluate :

$$\iint_S \nabla \times \overline{F} \cdot d\overline{s}$$

where,

$$\overline{F} = (2y + x)\,\hat{i} + (x - y)\,\hat{j} + (z - x)\,\hat{k}$$

and S is the surface of the region bounded by

$$x = 0,\ y = 0 \text{ and } x + y + z = 1$$

which is not included in xoy plane. [6]

(c) Use Divergence theorem, evaluate :

$$\iint \overline{F} \cdot d\overline{s},$$

where

$$\overline{F} = x\hat{i} + y\hat{j} + z\hat{k} \quad \text{and}$$

$$d\overline{s} = dy\,dz\,\hat{i} + dz\,dx\,\hat{j} + dx\,dy\,\hat{k},$$

over the surface of sphere of radius a. [6]

Or

12. (a) Using Green's theorem, evaluate :

$$\int_C \left(xy - x^2\right) dx + x^2\, dy$$

along the curve C formed by : [6]

$$y = 0, \; x = 1, \; y = x.$$

(b) Evaluate :

$$\iint_S \left(\nabla \times \overline{F}\right) \cdot \hat{n}\, ds$$

where

$$\overline{F} = (x - y)\,\hat{i} + \left(x^2 + yz\right)\hat{j} - 3xy^2\,\hat{k}$$

and S is surface of cone

$$z = 4 - \sqrt{x^2 + y^2}$$

above xoy plane. [6]

(*c*) Show that :

$$u = 3x + 2y;$$

$$v = 2x - 3y;$$

$$w = 0$$

are the velocity components of possible fluid motion. Determine whether flow is irrotational. [5]

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S.E. (Civil) (Second Semester) EXAMINATION, 2014

Fluid Mechanics-I

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. 4, Q. No. **5** *or* Q. No. **6** from Section I. Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Define absolute viscosity and give classification of fluids based on Newton's law of viscosity and represent it graphically. [6]

(*b*) Write short notes on : [4]

(*i*) Capillarity

(*ii*) Surface tension.

(*c*) The pressure drop 'dp' in a pipeline of diameter 'D' and length 'L' depends upon density 'ρ' and viscosity 'μ' of flowing fluid, mean velocity 'V' and average height of roughness projection '*k*'. Obtain an expression for 'dp' in the form : [8]

$$dp = \rho V^2 \phi\left[\frac{L}{D}, \frac{\mu}{\rho VD}, \frac{k}{D}\right].$$

Or

2. (*a*) If the equation of a velocity profile over a plate is $u = 2y^{2/3}$ in which the velocity in m/s at a distance of '*y*' meters above the plate, determine the shear stress at $y = 0$, and $y = 0.075$ m. [6] Given $\mu = 0.835$ Ns/m^2.

(*b*) Calculate the capillary rise in a glass tube of 2 mm diameter when immersed in (*i*) water (*ii*) mercury. Both the liquids at 20ºC and the values of the surface tension for water and mercury at 20ºC in contact with air are respectively 0.0075 N/m and 0.052 N/m. [6]

(*c*) Explain any *one* of the methods of dimensional analysis. [6]

3. (*a*) A triangular gate which has a base of 1.5 m and an altitude of 2 m lies in a vertical plane. The vertex of the gate is 1 m below the surface of tank which contains oil of S.G. 0.8, find the force exerted by the oil on the gate and the position of the centre of pressure. [8]

(*b*) What are the conditions of equilibrium for floating and submerged bodies ? Explain them with neat sketches. [8]

Or

4. (*a*) A wooden cylinder of diameter '*d*' and length '2*d*' floats in water with its axis vertical. Is the equilibrium stable ? Locate the metacentre with reference to water surface. S.G. of wood is 0.6. [8]

(*b*) Explain the terms total pressure and centre of pressure. Also show that the centre of pressure of any lamina immersed under liquid is always below its centroid. [8]

5. (*a*) Define and distinguish between : [8]

(*i*) Steady and unsteady flow;

(*ii*) Uniform and non-uniform flow

(*iii*) Rotational and irrotational flow

(*iv*) Streamline and streakline

(*b*) For a two-dimensional flow : [8]

$$\phi = 3xy \quad \text{and} \quad \psi = \frac{3}{2}\left(y^2 - x^2\right).$$

Determine the velocity components at the points (1, 3) and (3, 3). Also find the discharge passing between the streamlines passing through the points given above.

Or

6. (*a*) What is flow net ? Give the uses and limitations of flow net. [8]

(*b*) The velocity component in a two-dimensional flow field for an incompressible fluid are expressed as :

$$u = \frac{y^3}{3} + 2x - x^2 y$$

and $$v = xy^2 - 2y - x^3/3$$

Obtain an expression for velocity potential ϕ and strem function ψ. [8]

SECTION II

7. (*a*) A venturimeter of throat diameter 6 cm is fitted into a 12 cm diameter pipeline. Determine the flow in the pipeline when the reading of differential U-tube manometer is 20 cm. If the energy loss in downstream part of divergent cone is 10 times the velocity head in pipe, calculate the total head loss. Take Cd = 0.96. [8]

(*b*) Define Hydraulic Gradient and Total Energy line. Draw H.G.L. and T.E.L. for flow of ideal fluid in a pipeline. [4]

(*c*) State Bernoulli's theorem and limitations of the same. [6]

Or

8. (*a*) A drainage pump has tapered suction pipe. The pipe is running full of water. The pipe diameters at the inlet and at the upper end are 1 m and 0.5 m respectively. The free water surface is 2 m above the centre of the inlet and centre of the upper end is 3 m above the top of free water surface. The pressure at the tip of the pipe is 25 cm of mercury and it is known that the loss of head by friction between top and bottom section is one tenth of the velocity head at the top section. Compute the discharge. Neglect the loss of head at the entrance of the tapered pipe. [8]

(*b*) Explain with a neat sketch working of pitot tube. Derive expression for measurement of velocity in a pipe by pitot tube. [6]

(*c*) Explain coefficient of velocity of orifice is determined experimentally. [4]

9. (*a*) Derive an equation for velocity distribution for viscous flow through a circular pipe. Also sketch the distribution of velocity and shear stress across a section of pipe. [8]

(*b*) A flat plate 450 mm × 150 mm has been placed longitudinally in a stream of crude oil (specific gravity 0.925 and kinematic viscosity of 0.9 stoke) which flows with a velocity of 6 m/s.

Calculate :

(*i*) The friction drag on the plate

(*ii*) Thickness of the boundary layer at the trailing edge and

(*iii*) Shear stress at the training edge. [8]

Or

10. (*a*) Crude oil of viscosity 0.9 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 120 mm and length 12 m. Calculate the pressure difference at the two ends of the pipe, if 785 N of oil is collected in a tank in 25 seconds. [8]

(*b*) Prove that the momentum thickness and energy thickness for boundary layer flow is given by : [8]

$$\theta = \int_0^\delta \frac{u}{U}\left(1 - \frac{u}{U}\right)dy \quad \text{and} \quad \delta_e = \int_0^\delta \frac{u}{U}\left(1 - \frac{u^2}{U^2}\right)dy.$$

11. (*a*) A horizontal pipe 150 mm in diameter is joined by sudden enlargement to a 225 mm diameter pipe. Water is flowing through it at the rate of 0.05 m^3/s.

Find :

(*i*) loss of head due to sudden abrupt expansion

(*ii*) Pressure difference in two pipes. [8]

(*b*) Explain 'Prandtl's mixing length theory' and show that the velocity distribution across a section of circular pipe is logarithmic for turbulent flow. [8]

Or

12. (*a*) Water is discharged from a reservoir into the atmosphere through a pipe 39 m long. There is a sharp entrance to the pipe and the diameter is 50 mm for 15 m from the entrance. The pipe then enlarges suddenly to 75 mm in diameter for the reminder of its length. Taking into account the loss of head at entry and at the enlargement calculate the difference of level between the surface of the reservoir and the pipe exit which will maintain a flow of 0.0028 m^3/s. Take f as 0.0048 for the 50 mm pipe and 0.0058 for the 75 mm pipe. [8]

(*b*) Briefly explain the following : [8]

(*i*) Temporal mean velocity

(*ii*) Shear velocity

(*iii*) Instantaneous velocity

(*iv*) Karman-Prandtl velocity distribution equation.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

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S.E. (Printing Engineering) (II Sem.) EXAMINATION, 2014

ELECTRICAL MACHINES AND UTILIZATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt any *three* questions from Section I and Section II on separate answer-sheet.

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

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of non-programmable calculator is permitted.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw and explain the characteristic curves of d.c. shunt motor and d.c. series motor. [8]

(*b*) A 25 kW, 250 V, d.c. shunt generator has armature and field resistances of 0.06 Ω and 100 Ω respectively. Determine the total armature power developed in the machine while working :

(*i*) as a generator delivering 25 kW output and

(*ii*) as a motor taking 25 kW input. [8]

Or

2. (*a*) Why is a starter required in the operation of d.c. motors ? Explain the working of three point starter with the help of schematic. [8]

(*b*) A 200 V, d.c. shunt motor running at 1000 rpm takes an armature current of 17.5 A. It is required to reduce the speed to 600 rpm. What must be the value of resistance to be inserted in the armature circuit if the original armature resistance is 0.4 Ω ? Take armature current to be constant during this process. [8]

3. (*a*) Discuss the relationship between the torque and slip of a three-phase induction motor with the help of characteristic curve. [8]

(*b*) The power input to the rotor of a 400 V, 50 Hz, 6 pole, 3-phase induction motor is 75 kW. The rotor electromotive force is observed to make 100 complete alterations per minute. Calculate :

(*i*) Slip

(*ii*) Rotor speed

(*iii*) Rotor copper loss

(*iv*) Mechanical power developed. [8]

Or

4. (*a*) Describe the construction and working of a shaded pole induction motor with the help of suitable diagrams. Mention its applications. [8]

(*b*) State different methods of controlling the speed of a three phase induction motor. Explain any *one* of the methods in detail. [8]

5. (*a*) Explain the process of selecting motors based on various load requirements in printing industries. [8]

(*b*) Write short notes on :

(*i*) Special features of synchronous motor

(*ii*) Servo motor. [10]

Or

6. (*a*) What is Universal Motor ? Explain its working and mention at least *two* specific applications. [8]

(*b*) What are drives ? State advantages of electrical drives. Distinguish between individual and group drives. [10]

SECTION II

7. (*a*) Two wattmeters are connected to measure the input power in balanced 3-phase load gives 1000 W and 400 W respectively. Find the power factor :

(*i*) when both readings are positive and

(*ii*) when W_2 reading is obtained after reversing the connection of current coil or pressure coil. [8]

(*b*) Derive the equation of active power with two wattmeter method for 3-phase balanced load. Also draw a neat circuit and phasor diagram. [10]

Or

8. (*a*) A wattmeter reads 7 kW when its current coil is connected to R and its pressure coil is connected between R and N of symmetrical 3-phase balanced inductive load of 30 A, 400 V, 50 Hz supply. What will be the reading of wattmeter if current coil remain unchanged and pressure connected between Y and B. Hence determine total reactive power. [8]

(*b*) Explain in detail Relay, Photo cells and Proximity switches. [10]

9. (*a*) State the advantages of electric heating. [8]

(*b*) A 20 kW, 1-phase, 240 V resistance oven is to employ Ni-Cr strip of 0.2 mm thickness for its heating element. If temperature of strip is not to exceed 1100°C and temperature of charge is to be 550°C. Calculate suitable width of the strip. Take $k = 0.5$, $e = 0.9$ and $\rho = 1.09$ $\mu\Omega$m. [10]

Or

10. (*a*) A piece of an insulating material is to be heated by dielectric heating. The size of piece is 12 cm × 12 cm × 3 cm. A frequency of 20 MHz is used and the power absorbed is 450 W. If the material has a $\varepsilon_r = 5$ and power factor 0.05, calculate the voltage necessary for heating and current that flows in the material. [8]

(*b*) Explain with a neat diagram direct resistance heating. [10]

11. (*a*) Explain in detail laws of Illumination. [8]

(*b*) Write a short note on safety and maintenance of printing industry. [8]

Or

12. (*a*) A drawing hall with an area of 20 m × 15 m is to be illuminated with an average illumination of 250 lux. The lamps are to be fitted at 6 m height. Find out the number and size of the lamps required for a η of 20 lumens/W. Take UF = 0.8 and MF = 0.7. [8]

(*b*) Explain different methods of energy conservation and its application in printing industry. [8]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**8+1**

Seat No.	

[4657]-101

S.E. (Biotechnology) (First Semester) EXAMINATION, 2014

APPLIED CHEMISTRY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer only *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic table *or* electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain carbenes with their generation methods and geometry. [6]

(*b*) Draw the resonance structures of : [6]

(*i*) Benzene

(*ii*) Aniline

(*iii*) Phenol.

(*c*) Justify the following (*two* marks each) : [6]

(*i*) Pyrrole is weaker base than Pyridine

(*ii*) 2, 4, 6-trinitro N, N-dimethyl aniline is 40,000 times stronger base than 2, 4, 6-trinitro aniline.

(*iii*) Phenol is more acidic than alcohol.

Or

2. (*a*) Explain in brief about Hyperconjugation and Tautomerism with suitable example. [6]

(*b*) Explain inductive effect and steric effect with suitable examples. [6]

(*c*) Classify the following compounds as Aromatic, Non-aromatic and Antiaromatic : [6]

(*i*) Naphthalene

(*ii*) Cyclopentadienyl cation

(*iii*) Anthracene

(*iv*) Thiophene

(*v*) Tropylium ion

(*vi*) Annulene.

3. (*a*) Explain the effect of the following factors on S_N2 reaction : [6]

(*i*) Nature of nucleophile and substrate

(*ii*) Nature of leaving group

(*iii*) Nature of solvent.

(*b*) Predict the product (*one* mark each) : [6]

(*i*) $CH_3 - CH = CH_2 + HBr \longrightarrow ?$

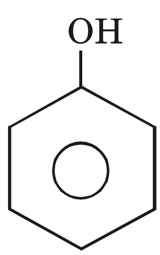
(*ii*) $CH_3 - CH = CH_2 + HBr \xrightarrow{H_2O_2} ?$

(*iii*) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH \xrightarrow[H_2SO_4]{20\%} ?$

(*iv*) $CH_3 - C \begin{matrix} \diagup H \\ \diagdown\!\!\diagdown O \end{matrix} + CH_3MgBr \longrightarrow CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{H}{|}}{C}} - OMgBr$

$\xrightarrow{\overset{+}{H}/H_2O} ?$

(*v*) $CH_3 - CH_2 - CH_2 - Cl \xrightarrow[KOH]{alcoholic} ?$

(*vi*)  $\xrightarrow[conc.H_2SO_4]{conc.HNO_3 +} ? + ?$

(*c*) Write Beckmann rearrangement with its mechanism. [4]

Or

4. (*a*) Explain E1-mechanism with suitable example. [6]

(*b*) What is the action of CH_3MgBr on formaldehyde, acetaldehyde and Acetone followed by hydrolysis ? [6]

(*c*) Write the mechanism of Claisen ester condensation reaction with suitable example. [4]

5. (*a*) Define optical isomerism and explain the optical activity of the compound containing two dissimilar asymmetric carbon atoms. [6]

(*b*) Define the following with suitable example : [6]

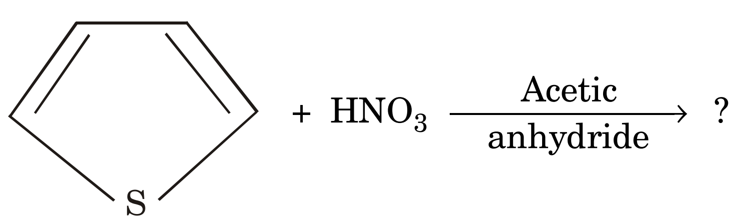
(*i*) Enantiomer

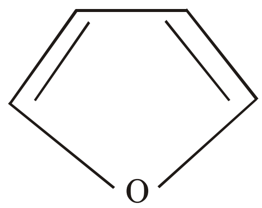
(*ii*) Racemic mixture

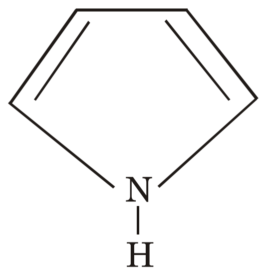
(*iii*) Functional isomerism.

(*c*) Predict the product (*one* mark each) : [4]

(*i*)



(*ii*)  $+ \ NH_3 \xrightarrow[\text{Steam}]{Al_2O_3} ?$

(*iii*)  $\xrightarrow[\Delta]{H_2/Ni} ?$

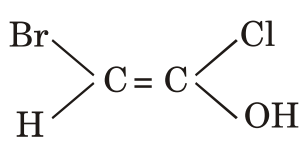
(*iv*) $2HC \equiv CH + HCN \longrightarrow ?$

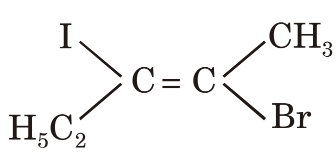
Or

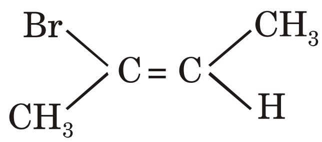
6. (*a*) Explain conformations of Butane with energy profile diagram. [6]

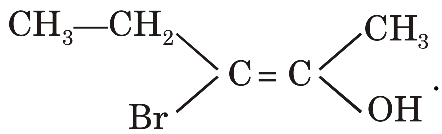
(*b*) Write Skraup synthesis of Quinoline. [6]

(*c*) Assign E or Z configuration of the following (**1** mark each) : [4]

(*i*) 

(*ii*) 

(*iii*) 

(*iv*) 

SECTION II

7. (*a*) Define viscosity. Derive Poiseuille equation to determine viscosity coefficient of a liquid flowing through a tube. [6]

(*b*) Derive Bragg's equation for studying internal structure of solid crystals. [6]

(*c*) (*i*) The time required to flow through Ostwald's viscometer is 1.52 minutes for water and for same volume of organic liquid having density 0.8 g/cc is 2.25 minutes. Find the viscosity of liquid relative to that of water. (Viscosity coefficient of water is 1.002 centipoise). [3]

(*ii*) Find the interplanar distance in a crystal in which a series of planes produce a first order reflection from a copper X-ray tube (λ = 1.539 Å) at an angle of 22.5°. [3]

Or

8. (*a*) Explain the concept of Parachor to calculate surface tension of liquid. [6]

(*b*) Define surface tension and explain drop number method by use of stalagmometer to measure surface tension of liquid. [6]

(*c*) (*i*) At 298 °K, surface tension of Ethanol in contact with its vapour is 2.189×10^{-2} Nm^{-1} and its density is 0.740 g/cc. How far up will the liquid rise in a tube of internal radius of 0.1 mm. (g : 980 gm/sec^2). [3]

(*ii*) Calculate the angles at third order reflection obtained from planes 500 pm apart, using X-rays of wave-lengths 100 pm. [3]

9. (*a*) Explain in brief RMS, average and most probable velocities and their inter-relation. [6]

(*b*) What is meant by free path ? Derive an expression for measurement of collision diameter. [6]

(*c*) Calculate collision diameter of CO_2, if at 20°C the coefficient of viscosity of CO_2 is 1.48×10^{-5} kg/m^{-1}s^{-1}. [4]

Or

10. (*a*) Derive kinetic gas equation. [6]

(*b*) Derive van der Walls' equation to explain the deviation of real gases from ideal gas behaviour. [6]

(*c*) Calculate RMS velocity of CO_2 at 27°C. (At.wt. of C = 12 and O = 16). [4]

11. (*a*) Show that elevation in boiling point is colligative property. How will you find out molecular weight of solute by using elevation in boiling point ? [6]

(*b*) Define Van't Hoff's factor. How are Van't Hoff's factor and degree of dissociation related with each other ? [6]

(*c*) A solution of 0.278 g of an organic substance in 55.6 g of acetone had its boiling point raised by 0.472°C. Find the molecular weight of that compound if K*b* for 1000 gm of solvent is 1.72. [4]

Or

12. (*a*) Define osmosis and osmotic pressure. Explain Berkeley and Hartley method to determine osmotic pressure of dilute solutions. [6]

(*b*) Define : [6]

(*i*) Molarity

(*ii*) Molality

(*iii*) Mole fraction

(*iv*) Normality

(*v*) Ideal solution

(*vi*) Colligative property.

(*c*) Calculate the osmotic pressure of 2.5% solution of sucrose at 27°C. Find the strength of urea solution which is isotonic with this solution. [4]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**8**

Seat No.	

[4657]-102

S.E. (Biotechnology) (First Semester) EXAMINATION, 2014

FLUID FLOW AND UNIT OPERATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) With respect to pressure measurement define : [4]

(*i*) Gauge pressure

(*ii*) Absolute pressure

(*iii*) Vacuum pressure.

P.T.O.

(*b*) In a quality control test, viscosity of a liquid is being measured with a viscometer. A shear stress of 4 dyne/cm^2 at a shear rate of 100/sec was recorded. Calculate the viscosity and express it as Pas, cP, P and mPas. [6]

(*c*) A 20% sucrose solution flows from a mixing tank at 50 kPa through a horizontal pipe 5 cm in diameter at 25 m^3/h. If the pipe diameter reduces to 3 cm, calculate the new pressure in the pipe. Take density of the sucrose solution as 1070 kg/m^3. [6]

Or

2. (*a*) Derive the Bernoulli's equation for flow of an incompressible fluid through a circular pipe. State the assumptions made. [8]

(*b*) Two fluids, milk and rapeseed oil, are flowing along pipes of the same diameter (5 cm) at 20ºC and the same flow velocity of 3 m/s. Determine the nature of flow in each case.

Given : Density and viscosity of milk are 1030 kg/m^3 and 2.1×10^{-3} Pas resp.

Density and viscosity of oil are 900 kg/m^3 and 118×10^{-3} Pas resp. [4]

(*c*) The space between two square flat parallel plates is filled with oil. Each side of the plate is 720 mm. The thickness of the oil film is 15 mm. The upper plate which moves at 3 m/s requires a force of 120 N to maintain the speed. Determine the dynamic viscosity of oil. [4]

3. (*a*) Define roughness. Classify the different types of surfaces based on roughness. [6]

(*b*) A 50% lye solution at 20°C is flowing in a pipe with 0.0475 m inside diameter and 10 m length at a rate of 3 m^3/h. The viscosity and the density of the solution at 20°C are 15.43 cp and 1232 kg/m^3 respectively. Find :

(*i*) the mean velocity

(*ii*) the maximum velocity

(*iii*) the pressure drop of the sucrose solution. [6]

(*c*) A horizontal pipe 150 mm in diameter is joined by sudden enlargement to a 225 mm diameter pipe. Water is flowing through it at rate of 0.05 m^3/s. Find :

(*i*) Loss of head due to sudden enlargement

(*ii*) Pressure difference in the two pipes. [6]

Or

4. (*a*) Write notes on :

(*i*) Moody's Diagram

(*ii*) Major energy losses in flow through pipe. [6]

(*b*) An oil of viscosity 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60 mm diameter. If the pressure drop in 100 m length of the pipe is 1800 kN/m^2, determine :

(*i*) Maximum velocity

(*ii*) Rate of flow of oil

(*iii*) If the shear stress at the wall is 270 N/m^2, find velocity and shear stress at 8 mm from the wall. [8]

(*c*) State the expressions for loss of head due to : [4]

(*i*) Skin friction

(*ii*) Sudden enlargement in flow area

(*iii*) Sudden contraction in flow area

(*iv*) Valves and fittings.

5. (*a*) With the help of a neat sketch explain what are radial flow impellers. [5]

(*b*) A concentrated fruit juice with a viscosity of 0.03 Pas and a density of 1100 kg/m^3 is being agitated in an agitation system containing a turbine impeller. The impeller has a disk with six blades. The tank diameter is 1.8 m. The height of the liquid in the tank is the same as the tank diameter. The impeller diameter is 0.5 m. The width of the blade is 0.1 m. The tank is equipped with four baffles, each with a width of 0.15 m. If the turbine is operated at 100 rpm, determine the required power. (Take $N_p = 5$) [6]

(*c*) How are the equipments used for mixing viscous material different from those used for mixing non-viscous ones ? Name few equipments employed for mixing of pastes. [5]

Or

6. (*a*) What are the standard design considerations for an agitated vessel system ? [4]

(*b*) Write notes on the following : [12]

(*i*) Necessity of mixing in Biotech industries

(*ii*) Prevention of swirling in agitated vessels

(*iii*) NPSH.

SECTION II

7. (*a*) For an object falling in a fluid of density ρ, the terminal settling velocity is given as :

$$\nu = \sqrt{\frac{2m(\rho_p - \rho)g}{C_D A_p \rho_p \rho}}$$

Derive the Stokes' law and Newton's for spherical particle of diameter *Dp*, starting from the above expression. [8]

(*b*) Determine the velocity of fall of rain drops of 0.3 mm diameter in atmospheric air having density 12 kg/m^3 and kinematic viscosity 0.15 stokes. Assume Stokes' law holds good. [5]

(*c*) State the Kynch's theory of sedimentation along with its assumptions. [5]

Or

8. (*a*) With the help of appropriate expressions, explain how the area of a batch sedimentation tank is calculated. [8]

(*b*) A steel ball of diameter 40 mm and of density 8500 kg/m^3 is dropped in a large mass of water. The coefficient of drag of the ball in water is given as 0.45. Find the terminal settling velocity of the ball in water. [5]

(*c*) Explain the principle, construction and working of a cyclone. [5]

9. Write notes on the following : [16]

(*i*) Particulate fluidization

(*ii*) Application of fluidization

(*iii*) Washing of filter cake

(*iv*) Factors affecting rate of filtration.

Or

10. (*a*) Derive the Kozeny Carmen equation for determination of pressure drop across a packed bed. [8]

(*b*) A bed consists of uniform spherical particles of diameter 3 mm and density 4200 kg/m^3. Calculate the minimum fluidization velocity in a liquid of viscosity 3 mPas and density 1100 kg/m^3. Take porosity of bed as 0.4. [8]

11. (*a*) Define work index and derive an expression for it. [6]

(*b*) Catalyst particles are milled from 6 mm to 0.0012 mm using a 10 hp motor. Would this motor be adequate to reduce the size of the particles to 0.0008 mm ? Assume Rittinger's equation and that 1 hp = 745.7 W. [6]

(*c*) What is the difference between screen capacity and screen effectiveness ? [4]

Or

12. (*a*) Write notes on the following : [6]

(*i*) Equivalent size of particles

(*ii*) Factors affecting screen capacity.

(*b*) What is the principle of operation of a Ball mill ? Derive an expression for calculating the critical speed of a ball mill. [6]

(*c*) A certain set of crushing rolls has rolls of 1.5 m diameter having the crushing surface set 15 mm apart. The angle of nip is 31°. What is the maximum possible size of particles which should be fed to the rolls ? [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-103

S.E. (Biotechnology) (First Semester) EXAMINATION, 2014

MICROBIOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer Q. No. **1** or Q. No. **2**. Answer Q. No. **3** or Q. No. **4**. Answer Q. No. **5** or Q. No. **6**. Answer Q. No. **7** or Q. No. **8**. Answer Q. No. **9** or Q. No. **10**. Answer Q. No. **11** or Q. No. **12**.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

SECTION I

1. Define bacterial growth. How is it measured ? Enumerate the growth requirement of bacteria. [18]

Or

2. Explain with the help of a diagram, different organelles found in an eukaryotic cell. [18]

3. Answer the following : (8 marks each) [16]

(*i*) Explain the five kingdom classification system.

(*ii*) Describe the construction and working of an autoclave.

Or

4. Answer the following : (8 marks each) [16]

(*i*) Describe the important contributions of Joseph Lister.

(*ii*) Explain the Fluid-Mosaic Model of the Cell Plasma Membrane.

5. Define each of these groups as to what kind of carbon and energy source they utilize. Give examples. [16]

(*i*) Phototrophs

(*ii*) Lithotrophs

(*iii*) Organotrophs

(*iv*) Heterotrophs.

Or

6. Answer the following : (8 marks each) [16]

(*i*) Write a note on Nutrition requirements in bacteria.

(*ii*) What is the difference between bactericidal and bacteriostatic ? Give examples.

SECTION II

7. What is the typical reproduction cycle of a DNA virus ? Give examples of DNA viruses. [18]

Or

8. Explain the different inoculation technique used in Virology. [18]

9. Answer the following : (8 marks each) [16]

(*i*) What are the different techniques used to preserve food ?

(*ii*) Write a note on Air microflora.

Or

10. Answer the following : (8 marks each) [16]

(*i*) Write the causative agent of typhoid and explain the morphology of the organism.

(*ii*) Classification of RNA viruses.

11. Write short notes on : (4 marks each) [16]

(*i*) Food infection

(*ii*) Lysogenic cycle in viruses

(*iii*) Septic tank

(*iv*) Antibiosis association.

Or

12. Write in brief : (8 marks each) [16]

(*i*) E.coli as an indicator of water pollution.

(*ii*) Isolation of air microflora.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-104

S.E. (Biotechnology) (First Semester) EXAMINATION, 2014

BIOCHEMISTRY–I

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data if necessary.

(*v*) Answer to the two Sections should be written in separate answer-books.

SECTION I

1. Write short notes on (9 each) : 18

(*a*) Fitness of aqueous environment for living organisms.

(*b*) First by-pass reaction in the synthesis of glucose.

Or

2. Derive Handerson-Hasselbalch equation. What will be the pH of a mixture of 5 ml of 0.1 M/lit sodium acetate and 4 ml of 0.1 mol/lit acetic acid ? How is the pH changed on adding 1 ml of 0.1 mol/lit HCl to the above mixture ? [18]

3. Draw a general scheme of the pentose phosphate pathway and a flow chart for oxidative reactions of the pentose phosphate pathway with all enzymes involved in it. Draw the structures of each intermediate product. [16]

Or

4. Draw a neat diagram for (8 each) : [16]

(*i*) Cori cycle

(*ii*) Pentose phosphate pathway.

5. Describe in detail about (8 each) : [16]

(*i*) Transamination and deamination

(*ii*) Urea cycle.

Or

6. Write short notes on (8 each) : [16]

(*i*) Peptide bond

(*ii*) Cysteine and cystine.

SECTION II

7. Answer the following (9 each) : [18]

(*i*) Role of acetyl—CoA in the formation of ketone bodies

(*ii*) Classification of lipids with suitable example of each.

Or

8. Answer the following (9 each) : [18]

(*i*) Write down in detail about β-oxidation of fatty acid. Draw the structures of intermediate product.

(*ii*) Describe in detail about acidosis and keosis.

9. Write short notes on (8 each) : [16]

(*i*) Write in short about nucleic acid protein supramolecular complex.

(*ii*) Nucleoside and nucleotide.

Or

10. Answer the following : [16]

(*i*) Describe and draw the structure of pyrimidines and purines.

(*ii*) Describe in short about Sanger's method for hydrolysis of nucleotides.

11. Answer the following (8 each) : [16]

(*i*) Describe in detail about functions and deficiencies of vitamin A and D.

(*ii*) Write in short about Osteomalacia and Osteoporosis.

Or

12. Give the detail account about sources, recommended dietary allowance and deficiencies of any *two* water soluble vitamins. [16]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-109

S.E. (Biotechnology) (Second Semester) EXAMINATION, 2014

GENETICS AND MOLECULAR BIOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** or Q. No. **2**. Answer Q. No. **3** or Q. No. **4**. Answer Q. No. **5** or Q. No. **6**. Answer Q. No. **7** or Q. No. **8**. Answer Q. No. **9** or Q. No. **10**. Answer Q. No. **11** or Q. No. **12**.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

SECTION I

1. Explain how Gregor Mendel's work on pea plants provided the foundation for genetics. [18]

Or

2. Explain the role of model organisms in Genetics and how Zebra fish is a model genetic organism. [18]

P.T.O.

3. Answer the following : (**8** Marks each) [16]

(*a*) Explain Pedigree Analysis and its applications.

(*b*) What are Genes and how do they work ?

Or

4. Answer the following : (**8** Marks each) [16]

(*a*) What is DNA supercoiling ? Explain its roles.

(*b*) Differentiate between the processes of mitosis and meiosis.

5. Write notes on : (**4** Marks each) [16]

(*a*) Chromatin and chromosome structure

(*b*) Griffith's experiments

(*c*) Wobble base-pairing in DNA

(*d*) The role of topoisomerases.

Or

6. Answer the following : (**8** Marks each) [16]

(*a*) Explain the principle underlying the Meselson-Stahl experiment.

(*b*) Write a note on the features of the DNA Double Helix.

SECTION II

7. Define mutations. Explain the steps in excision repair mechanisms. [18]

Or

8. Answer the following : (**9** Marks each) [18]

(*a*) Define the terms contour length and persistence length of a DNA molecule.

(*b*) Explain the Splicing of introns in pre-mRNAs.

9. Discuss on the following : (**4** Marks each) [16]

(*a*) Process of transcription in prokaryotic cells

(*b*) DNA organization in eukaryotic cells

(*c*) Persistence length of a DNA molecule

(*d*) Point mutation.

Or

10. Answer the following : (**8** Marks each) [16]

(*a*) Write in brief the components and the functions of an operon.

(*b*) What is Replication fork ? How does the process of replication on one side of a replication fork differ from that on the other ?

11. Write notes on : (**8** Marks each) [16]

(*a*) The process of DNA replication

(*b*) The two major forms of Diabetes mellitus.

Or

12. Write short notes on : (**8** Marks each) [16]

(*a*) On genetic recombination

(*b*) Oncogenes causing cancer.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-11

S.E. (Mech./Prod/Auto) (First Semester) EXAMINATION, 2014

ENGINEERING MATHEMATICS-III

(2008 Course)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. 4, Q. No. **5** *or* Q. No. **6** from Section I. Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat sketches must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Solve any *three* : [12]

(*i*) $$\frac{d^3y}{dx^3} + y = \sin(2x + 3) + e^{-x} + 2^x$$

(ii) $(D^2 + 1)y = \operatorname{cosec} x$ (By method of variation of parameter)

(iii) $\dfrac{d^2y}{dx^2} + 5\dfrac{dy}{dx} + 4y = x^2 + 7x + 9$

(iv) $(D^2 - 9D + 18)\, y = e^{e^{-3x}}$

(b) A body of weight 1 N is suspended from a spring stretches it 4 cm. If the weight is pulled down 8 cm below the equilibrium position and then released. Find the position and velocity as function of time. Also find amplitude and period. [5]

Or

2. (a) Solve any *three* : [12]

(i) $(D + 1)^2 y = 2\cos x + 3e^x$

(ii) $(D^2 + 4)y = \sec 2x$ (By method of variation of parameter)

(iii) $(D^2 + 2D + 1)y = e^{-x} \cos 2x$

(iv) $(3x + 2)^2 \dfrac{d^2y}{dx^2} + 3(3x + 2)\dfrac{dy}{dx} - 36y = 3x^2 + 4x + 1$.

(b) Solve : [5]

$$\frac{dx}{dt} - 3x - 6y = t^2$$

$$\frac{dy}{dt} + \frac{dx}{dt} - 3y = e^t.$$

3. (*a*) Find Laplace Transform of the following (any *two*) : [6]

(*i*) $\dfrac{1 - \cos t}{t}$

(*ii*) $\dfrac{\cos \sqrt{t}}{\sqrt{t}}$

(*iii*) $t \int_0^t e^{-3t} \sin 2t \, dt$

(*b*) $\dfrac{dy}{dt} + 2y(t) + \int_0^t y(t) = \sin t$, given that $y(0) = 1$. [5]

(*c*) Using Fourier integral representation, show that : [6]

$$\int_0^\infty \frac{\sin \pi\lambda \sin \lambda x}{1 - \lambda^2} \, d\lambda = \begin{cases} \dfrac{\pi}{2} \sin x & 0 \le x \le \pi \\ 0 & x \ge \pi \end{cases}$$

Or

4. (*a*) Find Inverse Laplace Transform of the following (any *two*): [6]

(*i*) $\log\left(\dfrac{s + b}{s + a}\right)$

(*ii*) $\dfrac{s}{s^2 + 4}$

(*iii*) $\dfrac{s + 7}{s^2 + 2s + 2}$.

(*b*) Solve the integral equation : [6]

$$\int_0^{\infty} f(x) \sin \lambda x \, dx = \begin{cases} 1 - \lambda & 0 \leq \lambda \leq 1 \\ 0 & \lambda \geq 1 \end{cases}$$

(*c*) Find Fourier sine transform of : [5]

$$f(x) = \frac{1}{x}.$$

5. (*a*) Solve the equation $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$, where $u(x, t)$ satisfies the following conditions : [8]

(*i*) $u(0, t) = 0$

(*ii*) $u(l, t) = 0$ for all t

(*iii*) $u(x, 0) = x$ in $0 < x < l$

(*iv*) $u(x, \infty)$ is finite

(*b*) A string is stretched and fastened to two points distance l apart is displaced into the form $y(x, 0) = \lambda \sin \frac{2\pi x}{l}$ from which it is released at $t = 0$, find the displacement of the string at a distance x from one end.

(Use wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$) [8]

Or

6. (*a*) Solve the equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ with conditions : [8]

(*i*) $u(x, \infty) = 0$

(*ii*) $u(0, y) = 0$

(*iii*) $u(10, y) = 0$

(*iv*) $u(x, 0) = 100 \sin\left(\frac{\pi x}{10}\right)$.

(*b*) Use Fourier Transform to solve : [8]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad 0 < x < \infty, \quad t > 0.$$

where $u(x, t)$ satisfies the conditions :

(*i*) $\left(\frac{\partial u}{\partial x}\right)_{x=0} = 0 \quad , t > 0$

(*ii*) $u(x, 0) = \begin{cases} x & 0 < x < 1 \\ 0 & x > 1 \end{cases}$

(*iii*) $u(x, t) < M$.

SECTION II

7. (*a*) Goals scored by two teams A and B in a football season are as follows : [6]

No. of Goals in a Match	**No. of Matches**	
	Team A	**Team B**
0	27	17
1	9	9
2	8	6
3	5	5
4	4	3

Find out which team is more consistent.

(*b*) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. Obtain the first four central moments, mean, standard deviation and coefficients of skewness and kurtosis. [5]

(*c*) If 10% of the rivets produced by the machine are defective, find the probability that out of 5 rivets chosen at random :

(*i*) None will be defective

(*ii*) One will be defective. [5]

Or

8. (*a*) Obtain the regression lines for the following data : [6]

x	y
6	9
2	11
10	5
4	8
8	7

(*b*) In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation is 2.5. Assuming the distribution to be normal, find how many students score between 12 and 15. [5]

Given :

$A_1 = 0.8, \; z_1 = 0.2881$

$A_2 = 0.4, \; z_2 = 0.1554$

(c) An average box containing 15 articles is likely to have 1 defective article. Out of 6 articles chosen what is the probability that not more than 3 are defective. [5]

9. (a) Show that tangent at any point on the curve $x = e^t \cos t$, $y = e^t \sin t$, $z = e^t$ makes constant angle with z-axis. [5]

(b) Show that the vector field $\overline{F} = f(r)\overline{r}$ is always irrotational and determine $f(r)$ such that the field is solenoidal also. [6]

(c) Find the directional derivative of $f = x^2y + xyz + z^3$ at $(1, 2, -1)$ along normal to the surface $x^2y^3 = 4xy + y^2z$ at the point $(1, 2, 0)$. [6]

Or

10. (a) With usual notations show the following results (any *two*) : [8]

(i) $\nabla \cdot \left[r \, \nabla \left(\frac{1}{r^n} \right) \right] = \frac{n(n-2)}{r^{n+1}}$

(*ii*) $\nabla^2 \; [r^2 \log r] = 5 + 6 \log r$

(*iii*) For a solenoidal vector field $\bar{E}$, show that curl curl curl curl $\bar{E} = \nabla^4 \bar{E}$.

(*b*) Show that $\bar{F} = (2xz^3 + 6y)\bar{i} + (6x - 2yz)\bar{j} + (3x^2z^2 - y^2)\bar{k}$ is irrotational. Find the scalar potential ϕ such that $\bar{F} = \nabla\phi$. [4]

(*c*) If the directional derivative of $f = ax^2y + by^2z + cz^2x$ at (1, 1, 1) has a maximum magnitude 15 in the direction parallel to the line $\dfrac{x-1}{2} = \dfrac{y-3}{-2} = \dfrac{z}{1}$. Find a, b, c. [5]

11. (*a*) Evaluate : [5]

$$\oint_C \bar{F} \cdot d\bar{r}$$

where

$$\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$$

and C is $x^2 + y^2 = a^2, \; z = 0$.

(*b*) Apply Stokes' theorem to evaluate $\int_C 4y\,dx + 2z\,dy + 6y\,dz$ where C is the curve of intersection of $x^2 + y^2 + z^2 = 6z$ and $z = x + 3$. [6]

(*c*) Evaluate : [6]

$$\iint (x^3\bar{i} + y^3\bar{j} + z^3\bar{k}).\, d\bar{s}$$

over the surface of sphere $x^2 + y^2 + z^2 = 9$.

Or

12. (*a*) Find the work done in moving a particle once round the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$ and $z = 0$ under the force field $\bar{F} = (2x - y + z)\bar{i} + (x + y - z^2)\bar{j} + (3x - 2y + 4z)\bar{k}$. [5]

(*b*) Using Green's theorem for $\bar{F} = xy\,\bar{i} + y^2\bar{j}$ over the region R enclosed by parabola $y = x^2$ and the line $y = x$ in the first quadrant, evaluate $\int xydx + y^2dy$. [6]

(*c*) Apply Stokes' theorem to evaluate :

$$\int_C 2y(1 - x)dx + (x - x^2 - y^2)dy + (x^2 + y^2 + z^2)dz$$

over the area of the triangle ABC cut-off from the coordinate planes by the plane $2x + 2y + z = 4$. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

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S.E. (Polymer/Petroleum/Petrochem)(First Semester)

EXAMINATION, 2014

ENGINEERING CHEMISTRY—I

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Answer any *three* questions from each Section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Define and explain the following terms : [6]

(*i*) Homolysis and Heterolysis

(*ii*) Electrophile and Nucleophile.

(*b*) Define and explain with *one* example : [6]

(*i*) Huckel Rule

(*ii*) Tautomerism.

(*c*) Draw resonance structure of : [4]

(*i*) Aniline

(*ii*) Benzaldehyde.

Or

2. (*a*) Write a short note on resonance effect. [6]

(*b*) Explain the following : [6]

(*i*) Chloroacetic acid is stronger than acetic acid.

(*ii*) Aniline is much weaker base than ammonia.

(*c*) Explain the structure of carbocation and carbanion. [4]

3. (*a*) Write a short note on Aldol condensation. [6]

(*b*) What is Grignard reagent ? Explain its use in synthesis of primary, secondary and tertiary alcohol. [6]

(*c*) Explain nitration of benzene. [4]

Or

4. (*a*) Discuss mechanism of the following reactions : [6]

(*i*) Addition of HI to propene

(*ii*) Hydrolysis of ethyl iodide with alcoholic KOH.

(*b*) Explain S_N1 and S_N2 mechanism with suitable example. [6]

(*c*) Give mechanism of Beckmann reaction with suitable example. [4]

5. (*a*) Explain geometrical isomerism with suitable example. [6]

(*b*) Draw conformations of *n*-butane. Explain their stability. [6]

(*c*) Give *one* method for preparation of : [6]

(*i*) Furan

(*ii*) Pyridine

(*iii*) Thiophene.

Or

6. (*a*) Define and explain : [6]

(*i*) Diastereoisomers

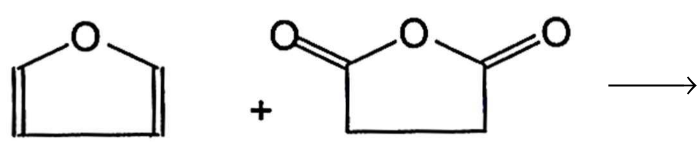
(*ii*) Enantiomers

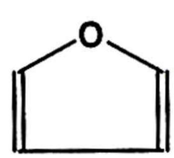
(*iii*) Meso isomers.

(*b*) Predict the product (any *three*) : [6]

(*i*) Quinoline $\xrightarrow[\text{KMnO}_4]{\text{Alkaline}}$

(*ii*) Pyridine $\xrightarrow[\text{Absolute alcohol}]{\text{Na}}$

(*iii*) 

(*iv*)  $+ \text{NH}_3 \xrightarrow[\text{Steam}]{\text{Al}_2\text{O}_3}$

(*c*) Write a note on Skraup synthesis of quinoline. [6]

SECTION II

7. (*a*) Derive PV = *n*RT using Boyle's law and Charles' law. [6]

(*b*) Give experimental method for determination of critical constant. [6]

(*c*) Define : [4]

(*i*) Boiling point of liquid

(*ii*) Melting point of solid

(*iii*) Coefficient of viscosity.

Or

8. (*a*) Derive the kinetic gas equation for ideal gases. [6]

(*b*) Explain Andrew's experiment for CO_2. [6]

(*c*) Using van der Waals equation of a state, find pressure exerted by of 10 g of O_2 at 25°C occupying volume of 1 litre ($R = 0.0821$ lit.atm K^{-1} mol^{-1}, $a = 1.360$ atm.lit^{-2}, $b = 0.0318$ lit/atm). [4]

9. (*a*) Define 'batteries'. Give their classification with *one* example each. [6]

(*b*) Write a note on Li-ion battery. [6]

(*c*) What are the advantages and disadvantages of H_2-O_2 fuel cell ? [5]

Or

10. (*a*) Write a short note on lead acid battery. [6]

(*b*) Write a short note on electro-chemical series. [6]

(*c*) What is need of storage of electrical energy ? [5]

11. (*a*) Show that depression in freezing point is a colligative property. [6]

(*b*) What is osmosis ? Derive $\pi = \frac{WRT}{M_2C}$ for dilute solutions. [6]

(*c*) If concentration of cane sugar (M = 342) is 3.525 g/100 ml, calculate osmotic pressure of the solution at 30°C. [5]

Or

12. (*a*) Discuss in brief characteristic properties of colloidal solutions such as : [6]

Tyndall effect, dialysis and electrophoresis.

(*b*) What is Vant Hoff's factor *i*, in case of electrolyte ? Derive relationship between Vant Hoff's factor *i* and degree of dissociation of an electrolyte. [6]

(*c*) A solution of 0.278 of an organic compound in 55.6 g of acetone had boiling point raised by 0.472°C. Find the molecular weight of compound, if molal elevation constant for solvent is 1.72. [5]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

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S.E. (Polymer/Petro./Petrochem.) (First Semester) EXAMINATION, 2014

CHEMICALS PROCESS CALCULATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Discuss various systems of units and enlist the basic quantities associated with them. [8]

(*b*) Find molecular weight of (*i*) H_2SO_4 and (*ii*) Na_2CO_3. [8]

Or

2. (*a*) Explain in detail Raoult's law and Henry's law along with mathematical expressions. [8]

(*b*) A cylinder contains 15 kg of liquid propane. What volume in m^3 will propane occupy if it is released and brought to NTP conditions ? [8]

3. The gaseous mixtures with the following composition expressed in mol % are to be blended : [18]

Gas	I	II	III
CH_4	25	35	55
C_2H_6	35	20	40
C_3H_8	40	45	5

The three gas mixtures are to be blended in such a proportion that the final mixture should have 40% CH_4, 35% C_2H_6 and 25% C_3H_8 (mole basis). Calculate the proportion in which they should be mixed.

Or

4. 5000 kg of mixture of benzene and toluene containing 50 mole % benzene is distilled to get an overhead product containing 95 mole % benzene and a residue containing 90 mole % toluene. Calculate the weights of benzene and toluene in feed, distillate and residue. [18]

5. In production of chlorine gas by oxidation of hydrochloric acid gas, air is used 30% in excess of that theoretically required. Based on 4 kmol HCl, calculate : [16]

(*i*) The weight ratio of air to hydrochloric acid gas in feed.

(*ii*) If oxidation is 80% complete, find the composition of product stream on mole basis.

Or

6. A coke is known to contain 90% carbon and 10% non-combustible ash (by weight) : [16]

(*i*) How many moles of oxygen are theoretically required to burn 100 kg of coke completely ?

(*ii*) If 50% excess air is supplied, calculate the analysis of gases at the end of combustion.

SECTION II

7. With a neat diagram and theoretical equations, explain single stage absorption process. [16]

Or

8. What is vaporization ? Note down flash calculations involved. [16]

9. Pure ethylene is heated from 303 K to 523 K at atmospheric pressure. Calculate the heat added per kmol ethylene using the heat capacity data given below : [16]

$$C_P^\circ = 4.1261 + 155.0213 \times 10^{-3}\ T - 81.5455 \times 10^{-6}\ T^2 + 16.9755 \times 10^{-9}\ T^3.$$

Or

10. Methane gas is heated from 303 K to 523 K at atmospheric pressure. Calculate the heat added per kmol methane using data given below : [16]

$$C_P^\circ = a + bT + cT^2 + dT^3,\ \text{kJ/(kmol.K)}$$

Constants	**Values**
a	19.2494
$b \times 10^3$	52.1135
$c \times 10^6$	11.973
$d \times 10^9$	–11.3173

11. Draw schematic representation and describe Hess's law of Constant Heat Summation. [18]

Or

12. Note and explain the three step process to obtain ΔH_R° analysing the effect of temperature on heat of reaction. [18]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

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S.E. (Polymer/Petroleum/Petrochemical) (First Semester)

EXAMINATION, 2014

MOMENTUM TRANSFER

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

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

(*iii*) Use of electronic calculators is allowed.

(*iv*) Draw neat sketch wherever necessary.

SECTION I

1. (*a*) Explain the role of Fluid Properties in Petrochemical, Polymer and Petroleum Field operations. [8]

(*b*) Explain the applications of Newton's law of Viscosity. [8]

Or

2. (*a*) With the help of a neat diagram define the terms : Absolute pressure, Gauge pressure and Vaccum pressure. [6]

(*b*) If density of a liquid is 900 kg/m^3, find its specific weight, specific gravity and specific volume. If Kinematic viscosity of this liquid is 2 cm^2/sec, find its dynamic viscosity. [5]

(*c*) The bulk modulus of elasticity of water is given as K = 3×10^9 Pa. What pressure is required to reduce its volume by 0.6% ? [5]

3. (*a*) A glass tube of internal diameter 3 mm is partially dipped in glycerin with its lower end 30 mm deep below surface. Air is blown in the tube so as to form an air bubble at its bottom end of the diameter of the tube. If specific weight and surface tension of glycerin are 13 kN/m^2 and 0.07 N/m, find the pressure inside the bubble. [8]

(*b*) In a three-dimensional fluid flow, two velocity components u and v are $u = 3x^3$ and $v = 3\ xyz$. Find the third component 'w' such that continuity equation is satisfied. [8]

Or

4. (*a*) A 'U' tube mercury manometer is used to measure pressure of oil (sp.gr. 0.8) in a pipeline. The difference shown by manometer is 500 mm, the mercury oil interface is 1.5 m above the centre line of the pipe. Find the pressure of oil in pipeline. [6]

(*b*) State whether the flow of liquid given by $u = 3x$ and $v = -3y$ is (*i*) Continuous (*ii*) Rotational. [4]

(*c*) Distinguish between 'U' Tube Manometer and Differential Manometer with the help of a neat diagram. [6]

5. (*a*) The water is flowing through a pipe having diameters 30 cm and 15 cm at section 1 and 2 respectively. The rate of flow through pipe is 40 lits/sec. The section 1 is 7 m above Datum and section 2 is 3 m above datum, if the pressure at section 1 is 40 N/cm^2, find intensity of pressure at section 2. [8]

(*b*) Define the principle, working and flow coefficient of an Orifice. [10]

Or

6. (*a*) Derive Bernoulli Equation for a pumping system. [12]

(*b*) A fluid of density 1000 kg/m^3 is flowing through a pipe of diameter 40 cm is suddenly contracted to a diameter of 20 cm.

the pressure in the larger pipe is 160 kN/m^2 and pressure in the smaller pipe is 150 kN/m^2 head lost due to sudden contraction of pipe cross-section is 0.34 m. Determine the coefficient of contraction if the velocity of fluid in the larger pipe is 0.98 m/s. [6]

SECTION II

7. (*a*) Draw Moody's diagram and explain variation of friction factor *f* in laminar, transition and turbulent flow regimes. Explain the use of Moody's chart in Flow through pipe calculations. [8]

(*b*) Explain the following :

(*i*) Hydraulic diameter

(*ii*) Equivalent length

(*iii*) No slip condition

(*iv*) Hydrodynamic rough boundary. [8]

Or

8. (*a*) Derive the expression for shear stress distribution in steady laminar flow through a circular pipe. [8]

(*b*) Oil having specific gravity 0.9 is pumped through a horizontal pipe 120 mm diameter and 2000 m long at the rate 30 lit/sec. the pump requires 8 kW at 60% efficiency. Taking friction factor = 64/Re, determine the viscosity of oil. [8]

9. (*a*) Explain with neat sketch :

(*i*) Momentum thickness

(*ii*) Energy Thickness

(*iii*) Displacement Thickness. [8]

(*b*) Discuss applications of multiphase flows in process industry. Give the expression for Ergun's equation and Darcy's law and give its application. [8]

Or

10. (*a*) What is boundary layer ? Give the importance of boundary layer theory in heat and mass transfer operations. [8]

(*b*) Explain with the help of neat sketch various multiphase flow regimes in vertical pipe. What is the flow regime map ? [8]

11. (*a*) Explain the following with significance : [8]

(*i*) Euler No.

(*ii*) Mach No.

(*iii*) Weber No.

(*iv*) Froude No.

(*b*) What is NPSH ? [2]

(*c*) Draw a neat labelled sketch of a centrifugal pump and explain the function of each part. Also show the basic pump heads on the sketch. [8]

Or

12. (*a*) Explain the detail procedure of dimensional analysis using Buckingham's π-method. [9]

(*b*) Explain the classification of Pumps. [9]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

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S.E. (Polymer/Petroleum/Petrochemical)

(First Semester) EXAMINATION, 2014

STRENGTH OF MATERIALS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right side indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data if necessary.

SECTION I

1. (*a*) A 2 m length of an aluminium pipe of 240 mm outer diameter and 10 mm wall thickness is used as a short column and

P.T.O.

carries an axial load of 640 kN. If E = 73 GPa and μ = 0.33, find :

(*i*) change in the length of the pipe

(*ii*) change in its outer diameter

(*iii*) change in its wall thickness. [10]

(*b*) Define volumetric stress and volumetric strain. Hence derive the expression for volumetric strain of a circular bar subjected to an axial force P. [8]

Or

2. (*a*) Explain w.r.t. axial loading :

(*i*) Strain energy

(*ii*) Resilience

(*iii*) Proof resilience

(*iv*) Modulus of resilience. [8]

(*b*) Derive the formula for maximum instantaneous stress induced in a body if an axial force is applied with an impact. [10]

3. (*a*) Derive an expression for the normal and tangential stress developed on an inclined plane of a stressed element when it is subjected to direct stress in two mutually perpendicular directions. [8]

(*b*) Find the maximum torque that can be applied to a shaft of 300 mm diameter if the permissible angle of twist is 1.5° in a length of 7.5 m and the shear stress is not to exceed 42 MPa. Take G = 84.4 GPa. [8]

Or

4. (*a*) Compare the weights of equal lengths of hollow and solid steel shafts to transmit the given torque for the same maximum stress if internal diameter of shaft is 0.6 times the external diameter for the hollow shaft. [8]

(*b*) At a point in a strained material in a 2D stress system the normal stress on two perpendicular planes are 80 MPa and 20 MPa, both tensile. Find the value of shear stress on these planes if one of the principal stress is zero. Find also the other principal stress and the maximum shear stress developed. [8]

5. (*a*) Using usual notations derive the expression for the change in volume of a thin cylindrical shell subjected to an internal pressure. [8]

(*b*) A thick cylindrical shell open at ends has an internal diameter of 150 mm and outer diameter of 300 mm. It is subjected to an internal pressure of 25 MPa and an external pressure of 5 MPa. Sketch the radial and hoop stress distribution across the section. [8]

Or

6. (*a*) Derive the expression for change in volume of a thin spherical shell subjected to an internal pressure. [8]

(*b*) A thick spherical shell of 400 mm inner diameter is subjected to an internal pressure of 1.5 N/mm^2. Find the necessary thickness of the shell, if the permissible stress in the shell material is 3N/mm^2. [8]

SECTION II

7. (*a*) A cantilever 1.5 m long is loaded with a udl of 3 kN/m over a length of 1 m from free end. It also carries a point load of 3 kN at 0.25 m from free end. Draw SFD and BMD for the beam. [8]

(*b*) Derive flexure formula for pure bending. [10]

Or

8. (*a*) A simply supported beam of 5 m span carries a uniformly increasing load of 800 N/m at one end to 1600 N/m at the other end. Draw SFD and BMD for the beam showing all important values. [10]

(*b*) A CI cantilever bracket having unequal I section has the following cross-section :

Top flange : 200 mm × 50 mm

Web : 50 mm × 200 mm

Bottom flange : 130 mm × 50 mm

Overall depth : 300 mm

If the maximum BM acting on the section is 40 Nm, draw the bending stress distribution diagram. [8]

9. (*a*) For a solid circular cross-section of a beam of radius *r*, obtain an expression for shear stress at any level in terms of usual notations. Hence obtain expression for average and maximum shear stress in the section. [8]

(*b*) What is effective length for a column ? Explain. What is the effective length for columns with different end conditions ? [8]

Or

10. (*a*) A T-section of a beam is subjected to a SF of 25 kN. Its flange is 100 mm × 12 mm and web is 12 mm × 88 mm with overall depth as 100 mm. Draw the shear stress distribution diagram for the section. [8]

(*b*) A hollow circular CI column has 4 m length and both ends fixed. Using a FS of 3.5, find the safe load for the column using Rankine formula, if inner diameter = 160 mm, thickness = 20 mm, f_c = 550 MPa, $\alpha = \frac{1}{1600}$. [8]

11. (*a*) A hollow shaft having inner diameter half the outer is subjected to a torque of 450 kNm and BM = 220 kNm. If the maximum shear stress is not to exceed 80 MPa, find a suitable diameter for the shaft. [8]

(*b*) A cantilever of length L of uniform cross-section is subjected to a udl w throughout its length. From first principles derive an expression for the slope and deflection at the free end in terms of w, L, E, I. [8]

Or

12. (*a*) A beam ABC of uniform cross-section is simply supported at A and B and has a overhang BC such that AB = 6 m, BC = 1.5 m. A vertical load of 50 kN acts at free end C. Find the deflection at the midspan of AB in terms of EI. [8]

(*b*) What is core of a section ? Explain. Derive the expression for the core of a solid circular section. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

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S.E. (Mechanical/Automobile) (First Semester) EXAMINATION, 2014

APPLIED THERMODYNAMICS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *three* questions from Section I and any *three* questions from Section II.

(*ii*) Answer to the two sections should be written in separate answer-books.

(*iii*) Neat sketches must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, Slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

Unit I

1. (*a*) Discuss the limitations of first law of thermodynamics. [6]

(*b*) Explain Kelvin Planck and Clausius statements of second law of thermodynamics. [10]

Or

2. (*a*) Prove equivalence of Kelvin-Planck and Clausius statements with neat diagrams. [10]

(*b*) Write a note on reversibility and give reasons. [6]

Unit II

3. (*a*) Explain the following : [6]

(*i*) Available and unavailable energy.

(*ii*) High grade and low grade energy.

(*iii*) Dead state.

(*b*) Explain availability of heat source at constant temperature and variable temperature. [10]

Or

4. (*a*) For an Ideal gas prove that heat is transferred in a polytropic process is given by : [10]

$$Q = \frac{\gamma - n}{\gamma - 1} \times \text{W.D. in a Polytropic Process}$$

(*b*) In a piston and cylinder arrangement the pressure varies inversely proportional to the square of volume during a process. The initial pressure in the cylinder is 20 bar and the initial volume is 0.1 m^3. The final pressure after expansion is 200 kPa. Estimate the work done. [6]

Unit III

5. (*a*) With a neat sketch explain Separating Calorimeter. [8]

(*b*) Explain the following terms : [10]

(*i*) Pure Substance

(*ii*) Steam formation and phase change

(*iii*) Satuaration temperature

(*iv*) Dyrness fraction

(*v*) Degree of superheat.

Or

6. (*a*) Prove that Rankine cycle efficiency is given by : [8]

$$\eta_R = \frac{h_2 - h_3}{h_2 - h_4} \text{ with usual notations.}$$

i.e. h_2 = specific enthalpy of steam formed

h_3 = specific enthalpy of steam entering condenser

h_4 = specific enthalpy after condensation

(*b*) Steam at 20 bar and 360ºC expands in a steam turbine to 0.08 bar. It is then condensed in a condenser to saturated water. The pump feeds back the water to the boiler. Assume ideal Rankine cycle and determine : [10]

(*i*) Net work done/kg of steam

(*ii*) η_R.

SECTION II

Unit IV

7. (*a*) Explain Bomb Calorimeter to determine the CV of solids fuels. [8]

(*b*) Give the classification of fuels and also explain HCV and LCV. [8]

Or

8. (*a*) Explain with neat sketch Boy's gas calorimeter. [8]

(*b*) Explain the following : [8]

(*i*) Stoichiometric mixture

(*ii*) Excess air

(*iii*) Actual and stoichiometric air fuel ratio

(*iv*) Rich mixture, Weak mixture and Mixture strength.

Unit V

9. (*a*) Prove that work input for the reciprocating air compressor, if compression follows $PV^n = c$, is given by :

Work input or IP $= \dfrac{n}{n-1} P_1V_1 \left\{ \left(\dfrac{p_2}{p_1} \right)^{\frac{n-1}{n}} - 1 \right\}$ with usual notations. [8]

(*b*) A single-stage, single-acting RAC delivers air at 6 bar. The suction temperature is 25°C, and suction pressure is 1 bar, volume of air entering the compressor is 3 m^3/min. Index of compressor is 1.2. Calculate :

(*i*) Isothermal efficiency

(*ii*) Power required to drive the compressor, neglecting clearance volume. [8]

Or

10. (*a*) Explain for reciprocating air compressor : [6]

(*i*) Clearance volume

(*ii*) Isothermal efficiency

(*iii*) FAD.

(*b*) Discuss the following : [4]

(*i*) Need of multistaging

(*ii*) Intercooling and aftercooling.

(*c*) Explain with a neat sketch Roots blower. [6]

Unit VI

11. (*a*) Give the classification of steam generator. [8]

(*b*) Explain with neat sketches the following mountings : [10]

(*i*) Fusible plug

(*ii*) Water level indicator.

Or

12. (*a*) Explain : [6]

(*i*) Boiler thermal efficiency;

(*ii*) Equivalent of evaporation from and at 100ºC.

(*b*) During a boiler trial the following data was obtained :

Duration of trials = 8 hrs

Pressure of steam = 14 bar

Dryness fraction = 0.973

Feed water evaporated = 26700 kg

Temperature of inlet water = 50ºC

Fuel used = 4260 kg

Calorific value of fuel = 28900 kJ/kg

Air used/kg of fuel = 17 kg

Temperature of flue gases = 344°C

Boiler room temperature = 21°C

Cp of flue gases = 1.1 kJ/kg-K

Determine :

(1) Boiler efficiency

(2) Equivalent of evaporation

(3) Heat lost to flue gases in kJ/kg of coal and in percentage. [12]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

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S.E. (Production/Production Sandwich) (First Semester)

EXAMINATION, 2014

HEAT AND FLUID ENGINEERING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data wherever necessary.

SECTION I

1. (*a*) Define the following terms : [8]

(*i*) Ideal fluid and real fluid

(*ii*) Compressibility and bulk modulus

(*iii*) Dynamic viscosity and kinematic viscosity

(*iv*) Surface tension and vapour pressure.

P.T.O.

(*b*) Derive an expression for total pressure and centre of pressure for an inclined plane immersed in liquid. [8]

Or

2. (*a*) State and prove Pascal's law. Write its application. [8]

(*b*) What are the different types of pressure measurement devices ? Explain U-tube manometer for positive and negative pressure. [8]

3. (*a*) Derive an expression for discharge through venturimeter. [8]

(*b*) An orifice meter with orifice diameter 15 cm is inserted in a pipe of 30 cm diameter. The pressure difference measured by a mercury differential manometer on the two sides of orifice gives the reading of 50 cm of mercury. Find the rate of flow of oil of specific gravity 0.9 when the coefficient of discharge of orifice meter is 0.64. [8]

Or

4. (*a*) Define the following terms : [8]

(*i*) Stream lines

(*ii*) Streak lines

(*iii*) Velocity potential

(*iv*) Flow net.

(*b*) Derive Bernoulli's equation and write its assumptions. [8]

5. (*a*) What are the different types of losses of energy in pipes ? Write the equation for each loss with neat sketch. [9]

(*b*) Explain with neat sketch constructional details and working of centrifugal pump. [9]

Or

6. (*a*) Explain the following terms : [10]

(*i*) Froude number

(*ii*) Euler number

(*iii*) Mach number

(*iv*) Dimensional homogeneity

(*v*) Reynolds number.

(*b*) Explain with neat sketch constructional details and working of Pelton turbine. [8]

SECTION II

7. (*a*) Describe with the neat sketch the working of Cochran boiler, show the position of different mountings and explain the function of each. [8]

(*b*) A petrol consists of 86% carbon, 14% hydrogen by mass. If fuel is burnt with 20% excess air and combustion is complete, estimate volumetric composition of products of combustion including water vapour formed. [8]

Or

8. (*a*) Write the combustion equation by mass of the following : [8]

(*i*) For complete combustion of carbon

(*ii*) For incomplete combustion of carbon

(*iii*) For combustion of hydrogen

(*iv*) For combustion of CH_4.

(*b*) Explain the working principle of Babcock and Wilcox Boiler with neat sketch. [8]

9. (*a*) Describe the working of vapor compression refrigeration system with neat sketch. Draw P-h and T-s diagram. [8]

(*b*) Describe and explain the following terms in relation to psychrometry : [8]

(*i*) Dry Bulb Temperature

(*ii*) Wet Bulb Temperature

(*iii*) Dew Point Temperature

(*iv*) Relative Humidity and Specific Humidity.

Or

10. (*a*) What are the different types of air conditioning system ? Explain the central air conditioning system. [8]

(*b*) An air refrigeration open system operating between 10 bar and 1 bar required to produce a cooling effect of 2000 kJ/min. Temperature of air leaving the cold chamber is (–5°C) and at leaving the cooler is 30°C. Neglect losses and clearance in the compressor and expander. Determine :

(*i*) Mass of air circulated per min

(*ii*) Compression work, Expansion work and Cycle work

(*iii*) COP and power required in kW. [8]

11. (*a*) Derive the relation for volumetric efficiency of Reciprocating Air Compresser with clearance and hence explain the effect of pressure ratio and clearance ratio on it. [9]

(*b*) Draw PV and TS diagram for 2 stage air compressor. Write advantages and disadvantages of multistage compressor. [9]

Or

12. (*a*) Using the T-s diagram, prove that, for the same quantity of heat added, increase of compression ratio increases the thermal efficiency of an Otto-cycle. [9]

(*b*) Four cylinder petrol engine with 7 cm bore and 10 cm stroke length works on 4 stroke principle. The clearance volume per cylinder is 0.065 liters. Torque developed at 4000 rpm is 140 Nm. Fuel consumption is 14 kg/h. Calculate : [9]

(*i*) BP

(*ii*) BMEP

(*iii*) Brake Thermal Efficiency

(*iv*) Air Standard Efficiency.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-122

S.E. (Production and Production Sandwich) (First Semester)

EXAMINATION, 2014

STRENGTH ANALYSIS OF MACHINE ELEMENTS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt any *one* question from each Unit of Section I and Section II respectively.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Use of non-programmable electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

Unit I

1. (*a*) Prove that : [6]

$$E = 3K(1 - 2\mu)$$

where,

E = Young's modulus,

K = Bulk modulus

μ = Poisson's ratio.

P.T.O.

(*b*) Link BG and DE are both made of steel (E = 200 GPa) and are 12 mm wide and 6 mm thick. Determine the force in each link when a force P = 2.5 kN is applied to the rigid member AF as shown in Fig. 1. Also find corresponding displacement of point A. [10]

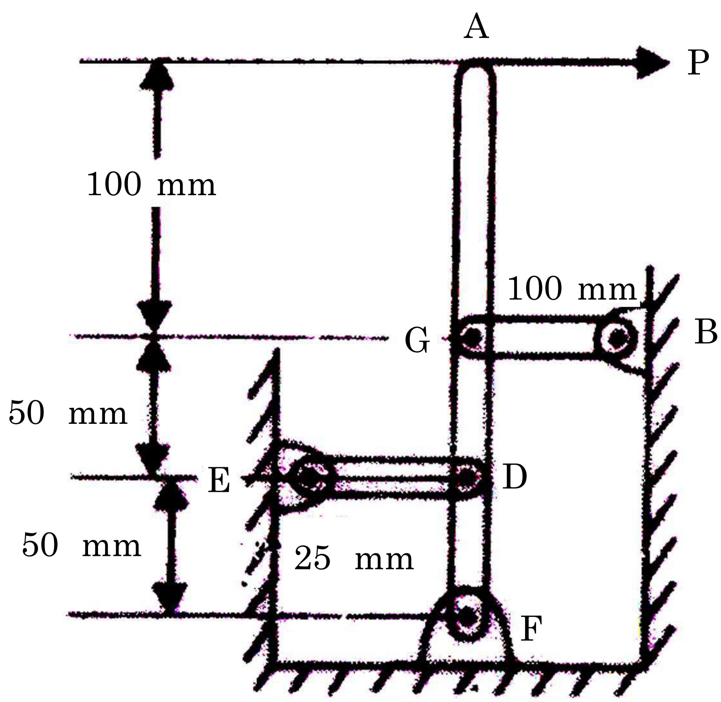


Fig. 1

Or

2. (*a*) In an experiment a bar of 30 mm is subjected to a pull of 60 kN. The measured extension length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli. [6]

(*b*) A steel flat plate AB of 1 cm thickness; tapers uniformly from 10 cm to 5 cm width, in a length of 40 cm as shown in Fig. 2. Determine the elongation of the plate, if an axial tensile force of 5000 kg acts on it.

Take E = 2.0×10^6 kg/cm^2. [10]

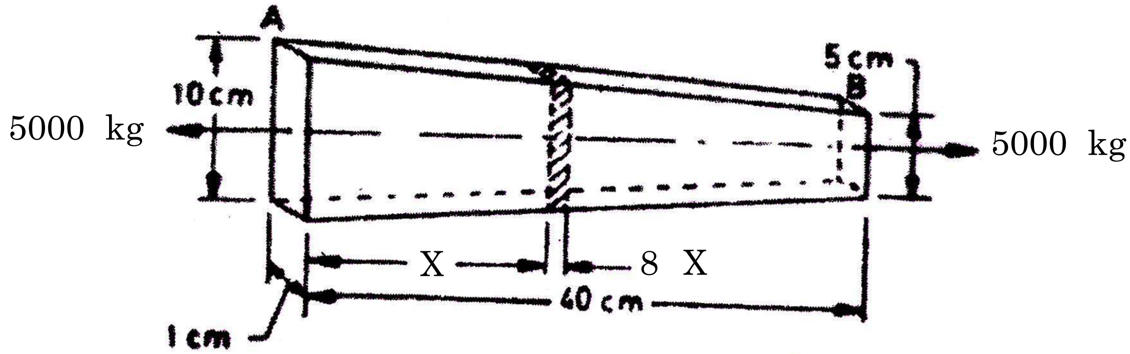


Fig. 2

Unit II

3. (*a*) The two supports of a simply supported beam are 5 m apart. The beam is 8 m long with two overhangs of 2 m and 1 m on the left hand and the right hand sides respectively. The beam carries concentrated loads of 40 kN at the left hand end, 40 kN at 4 m, 20 kN at 6 m both from the left end and 20 kN at the right end of the beam. Draw shear force and bending moment diagrams for the beam. [8]

(*b*) A simply supported beam with over-hanging ends carries transverse loads as shown in Fig. 3. If W = 10 w, what is the overhanging length on each side, such that the bending moment at the middle of the beam, is zero ? Sketch the shear force and bending moment diagrams. [10]

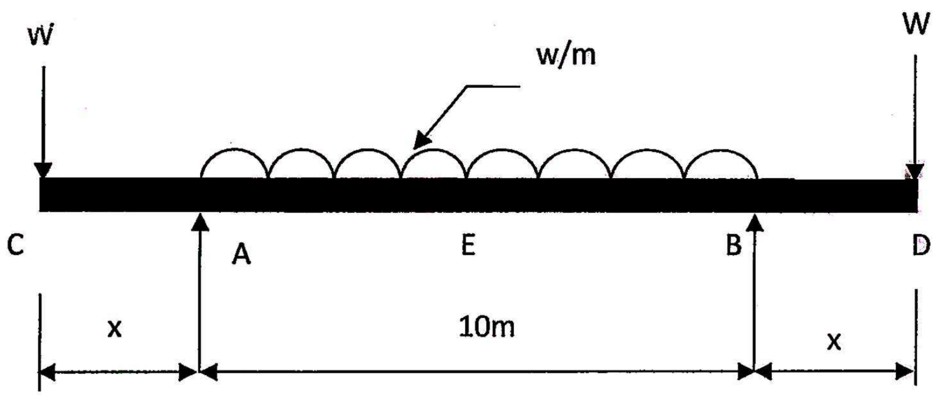


Fig. 3

Or

4. (*a*) A cantilever PQ of 1.5 m is fixed at point P and carrying a concentrated load of 2 kN at the free end Q. It also carries a uniform distributed load (u.d.l.) of 1 kN/m over a span of 1 m from the fixed end. Draw the S.F. and B.M. diagrams for this beam. [8]

(*b*) A beam ABCD is fixed at A and D, and hinges at B and C, as shown in Fig. 4. Draw the shear force and bending moment diagrams indicating all important values. [10]

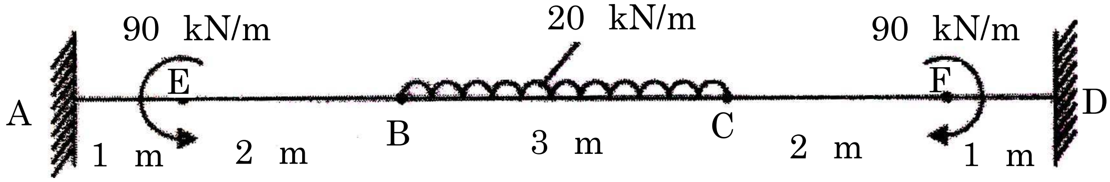


Fig. 4

Unit III

5. (*a*) Prove the relations :

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

where,

M = Total moment of resistance offered by the beam section in N-mm

I = Moment of Inertia of the section about the neutral axis in mm^4

σ = stress intensity in the fiber N/mm^2

y = distance of the fiber from the neutral axis in mm

E = Modulus of Elasticity in N/mm^2

R = Radius of Neutral surface in mm. [6]

(*b*) A cast iron bracket as shown in Fig. 5 is subjected to bending and has cross-section of I-form with unequal flanges. The total depth of the section is 280 mm and the metal is 40 mm thick throughout. The top flange is 200 mm wide. Find the position of neutral axis and the moment of inertia of the section about the neutral axis and determine the maximum bending moment that should be imposed on this section, if the tensile stress in the top flange is not to exceed 20 N/mm^2. What is then the value of the compressive stress in the bottom flange ? [10]

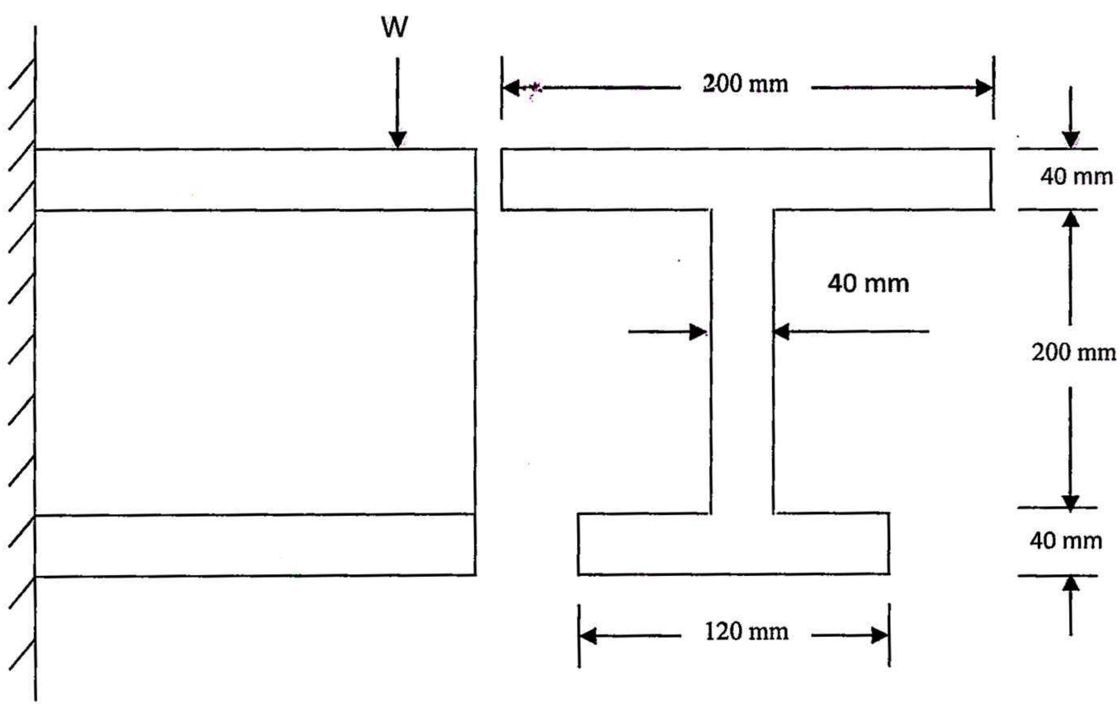


Fig. 5

Or

6. (*a*) Define the term 'bending stress' and explain clearly the theory of simply bending. [6]

(*b*) Draw shear stress distribution on a 'T' section with flange 150 mm × 15 mm deep and flange 200 mm × 20 mm wide. The section is symmetric about vertical axis. The shear force applied is 110 kN. [10]

SECTION II

Unit IV

7. (*a*) Deduce expressions for stresses on an inclined plane in a body subjected to pure shear stress condition. [8]

(*b*) The stresses on two perpendicular planes through a point are 120 MPa tensile and 80 MPa compression along with 60 MPa shear. Determine the normal and shear stress components on a plane at 60° to that of the 120 MPa stress and also the resultant and its inclination with the normal component on the plane. [8]

Or

8. (*a*) What is strain energy of a material ? Derive the expressions for the same in different forms. [8]

(*b*) A vertical composite tie bar rigidly fixed at the upper end consists of steel rod of 16 mm diameter enclosed in a brass tube of 16 mm internal diameter and 24 mm external diameter, each being 2 m long. Both are fixed together at the ends. The tie bar is suddenly loaded by a weight of 8 kN falling through a distance of 4 mm. Determine the maximum stresses in the steel rod and the brass tube.

E_s = 205 GPa and E_b = 100 GPa. [8]

Unit V

9. (*a*) Deduce the torsion equation stating the assumptions made. Deduce the expressions for maximum stresses in solid and hollow shafts. [8]

(*b*) Determine the diameter of a solid shaft which will transmit 90 kW at 160 rpm if the shear stress in the shaft is limited to 60 N/mm^2. Find also the length of the shaft, if the twist must not exceed 1° over the entire length.

Take $C = 8 \times 10^4$ N/mm^2. [10]

Or

10. (*a*) Compare the weight of a solid shaft with that of a hollow one to transmit a given power at a given speed with a given maximum shearing stress, the outside diameter of the hollow shaft being 1.5 times the internal diameter. [10]

(*b*) A hollow shaft with external and internal diameters of 120 mm and 80 mm respectively is to be replaced by a solid shaft of the same weight. Find the torques transmitted by the shafts if the permissible shear stress is 100 MPa. If the solid shaft is replaced by a hollow shaft of 160 mm external diameter, what is the torque transmitted for the same weight of the shafts ? [8]

Unit VI

11. (*a*) A simply supported beam of 8 m length carries two point loads of 64 kN and 48 kN at 1 m and 4 m respectively from the left hand end. Find the deflection under each load the maximum deflection.

$E = 210$ GPa and $I = 180 \times 10^6$ mm^4. [8]

(*b*) Establish the governing differential equation of beams. What are its limitations ? [8]

Or

12. (*a*) What is meant by equivalent length of columns ? What are its values for different end conditions of columns ? [6]

(*b*) A straight cylinder bar of 15 mm diameter and 1.2 m long is freely supported at its two ends in a horizontal position. It is loaded with a concentrated load of 100 N at the center when the center deflection is observed to be 5 mm. If placed in the vertical position and loaded vertically, what load would cause it to buckle ? Also find the ratio of the maximum stress in the two cases. [10]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-123

S.E. (Production/Industrial) (First Semester)

EXAMINATION, 2014

MACHINE TOOL OPERATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) With the help of neat sketch explain the working of all gear head stock of lathe stating its advantages and limitations. [10]

(*b*) Explain with neat sketch construction and working of backgeared headstock of a lathe. [8]

Or

2. (*a*) List the various taper tuning methods used on lathe. Explain with sketch taper turning using taper turning attachment. [10]

P.T.O.

(*b*) Explain the following lathe operations : [8]

(*i*) Chamfering

(*ii*) Knurling

(*iii*) Grooving

(*iv*) Parting off.

3. (*a*) Sketch a Twist drill and lable main parts of it. Describe the function of each part of twist drill. [8]

(*b*) Differentiate between gang drilling and multispindle drilling machine. [8]

Or

4. (*a*) Explain the construction and working of radial drilling machine. [8]

(*b*) Sketch and explain any *four* operations performed on drilling machine. [8]

5. (*a*) What is indexing ? List the types of indexing. Explain briefly direct indexing. [8]

(*b*) Calculate compound indexing for 87 divisions. The hole circles available are : [8]

Plate No. 1 — 15, 16, 17, 18, 19 and 20 holes

Plate No. 2 — 21, 23, 27, 29, 31 and 33 holes

Plate No. 3 — 37, 39, 41, 43, 47 and 49 holes.

Or

6. (*a*) Explain with sketch milling cutter geometry. List out milling various cutters. [8]

(*b*) Differentiate between up-milling and down-milling. [8]

SECTION II

7. (*a*) Explain with neat sketch the working of hydraulic shaper. List out its advantages over other shapers. [8]

(*b*) Sketch a broach and lable main parts of it. Describe the function of each part of broach. [10]

Or

8. (*a*) Explain crank and slotted link mechanism of shaper with sketch. [10]

(*b*) Difference between slotter machine and shaper machine. [8]

9. (*a*) Explain with suitable example standard marking system of grinding wheel. [8]

(*b*) Describe principle, construction and working of external centerless grinding. [8]

Or

10. (*a*) State the selection criteria of grinding wheel. [8]

(*b*) Sketch the various shapes of grinding wheels and write their field operations. [8]

11. (*a*) Explain the following with neat sketches : [8]

(*i*) Honing

(*ii*) Lapping

(*iii*) Buffing

(*iv*) Burnishing.

(*b*) Write a short note on metal spraying. [8]

Or

12. (*a*) Write short notes on the following : [8]

(*i*) Electroplating

(*ii*) Hot dipping.

(*b*) Differentiate between lapping and honing process. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-128

S.E. (Production Industrial) (Second Semester) EXAMINATION, 2014

INDUSTRIAL ORGANIZATION AND MANAGEMENT

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer any *three* questions from Section I and any *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Use of calculator is allowed.

(*iv*) Figures to the right indicate full marks

SECTION I

1. (*a*) Explain along with example the functions of Management. [8]

(*b*) Write short notes on the following : [8]

(1) Types of Organization.

(2) List out single line 14 Principles of H. Fayol.

P.T.O.

Or

2. (*a*) Define co-operative organization. State objectives, advantages and limitations of co-operative enterprises. [8]

(*b*) List various forms of business ownership and explain in detail Public Trusts. [8]

3. (*a*) List out the different theories of Motivation. Explain any *two* theories in detail. [10]

(*b*) Explain Vroom's expectancy theory of motivation. [8]

Or

4. (*a*) What is meant by leadership ? Explain the qualities of good leadership. Also explain the various styles of leaderships. [10]

(*b*) Explain, how leaders can help the development of the nation and society. [8]

5. (*a*) Define entrepreneur and entrepreneurship. Explain various qualities of an entrepreneur. [8]

(*b*) Explain along with example basic elements of Business plan. [8]

Or

6. (*a*) Explain the different sources of Finances. [8]

(*b*) Write a short note on Break-Even analysis and determine the break-even from the following data : [8]

(1) Fixed costs = Rs. 55,000

(2) Variable costs = Rs. 45 per piece

(3) Selling price = Rs. 100 per piece.

SECTION II

7. (*a*) Define Marketing. Discuss the steps involved in Marketing Management Process along with suitable example. [8]

(*b*) Discuss the major factors that influence the buyer behaviour. [8]

Or

8. (*a*) Explain the major decision involved in developing the advertising programme along with Split A.C. taken as example. [10]

(*b*) Write a short note on Product Life Cycle. [6]

9. (*a*) Define selection. Explain the steps involved in selection procedure. [8]

(*b*) What are the different types of interview technique ? Explain all the techniques in detail. [8]

Or

10. (*a*) Explain the principles of Human Resources Management in detail along with example. [8]

(*b*) Explain in detail various types of Training Method. Why is it needed ? [8]

11. (*a*) Define the Job Evaluation and explain Point method for Job Evaluation. [6]

(*b*) Explain the concept of Wages in detail. [6]

(*c*) Define merit rating. State objective of merit rating. [6]

Or

12. (*a*) Explain Trade Unionism in India. [6]

(*b*) Explain Halsey Plan for payment of wages. [6]

(*c*) List out various Labour Acts. Explain any *one* in detail. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-13

S.E. (Mechanical & Mechanical (S/W)) (First Semester)

EXAMINATION, 2014

(METALLURGY-I)

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Figures to the right indicate full marks.

(*ii*) Assume suitable data, if necessary.

SECTION I

1. (A) Show the following planes and directions in a cubic cell : [4]

(*a*) (1 0 1)

(*b*) $(1\ \bar{1}\ 0)$

(*c*) [1 1 2]

(*d*) [1 2 1].

(B) Derive an expression for critical resolved shear stress in single crystal. How is plastic deformation in a polycrystalline material different from deformation in a single crystal ? [6]

P.T.O.

(C) Give the reasons for the following : [6]

(*a*) Copper is more ductile than iron. Do you agree ? Justify your choice.

(*b*) Substitutional and interstitial crystal defects improve the strength and hardness. Comment.

Or

2. (A) What are dislocations ? What are the types of dislocations ? Explain Screw and Edge dislocation. Define Burger vector. [6]

(B) Calculate resolved shear stress of a single crystal if applied tensile stress is 30 kg/mm^2 and slip plane is oriented at 45° to the tensile axis ? [4]

(C) Why is annealing done after cold working ? Explain the changes in mechanical properties that take place during annealing with proper graphs. [6]

3. (A) What is creep ? How is creep test conducted ? [6]

(B) Why are impact test specimens notched ? What is the effect of temperature on impact strength ? [6]

(C) Explain the principle of ultrasonic flow inspection. State its advantages, limitations and applications. [4]

Or

4. (A) The steel specimen tested in standard tension test to evaluate mechanical properties. The data is given below : [8]

Diameter of the specimen = 12.5 mm

Original gauge length = 50 mm

Load at lower yield point = 45 kN

Load at upper yield point = 46 kN

Maximum load = 75 kN

Gauge length after fracture = 62.5 mm

Diameter at fracture = 80 mm

Stain at 20 kN = 7×10^{-4}

Calculate the following :

(*a*) UTS

(*b*) % Elongation and Modulus of Elasticity

(*c*) Modulus of resilience

(*d*) Modulus of toughness.

(B) Compare Brinel and Vickers Hardness Test. [4]

(C) Explain the principle of radiography with neat sketch. State its applications. [4]

5. (A) Draw the microstructures of AISI 1080 steel which is cooled to room temperature under equilibrium cooling condition. Find amounts of phases in it. [6]

(B) Explain the reasons for Widmanstatten structure. Is it desirable ? Justify your answer. [6]

(C) Compare and contrast between Ferritic, Austenitic and Martensitic stainless steels. [6]

Or

6. (A) Draw neat, labeled Fe-Fe3C equilibrium diagram. Explain slow cooling 0.4% C steel with neat sketches. [6]

(B) A slowly cooled steel contains 60% Ferrite and 40% Pearlite at room temperature. Determine the amount of total Ferrite and Cementite present in the alloy. [6]

(C) White cast iron finds limitations in engineering industry. True or False ? Justify your choice. State typical composition of white cast iron. [6]

SECTION II

7. (A) Draw T.T.T. curve for eutectoid steel. Explain the procedure for plotting T.T.T. curve for 0.8% C steel. [6]

(B) Distinguish between annealing and normalizing. [6]

(C) Explain the mechanism of austenite to martensite transformation and state characteristics of this transformation. What is retained austenite ? Is it desirable ? Justify. [6]

Or

8. (A) What is tempering ? Is it mandatory ? With a suitable graph, explain the variations in properties with tempering temperatures. [6]

(B) State True/False and justify (any *three*) : [6]

(*a*) Heat treatment is not required after carburizing.

(*b*) Plain carbon steels cannot be successfully Nitrided.

(*c*) Lathe beds are flame hardened.

(*d*) 0.1% carbon steel can be induction hardened.

(C) Distinguish between the following : [6]

(*i*) Cyaniding and liquid carburizing;

(*ii*) Flame and induction hardening.

9. (A) Enlist the powder production processes. Explain any *one* technique in brief. [6]

(B) Explain step-by-step manufacturing process for cemented carbide tools. [6]

(C) In sintering mandatory in P/M technique ? Justify in brief. [4]

Or

10. (A) Distinguish between Brass and Bronzes. [4]

(B) Enlist the properties required for the material to be bearing material. Write a brief note on Babbitts. [6]

(C) Suggest suitable non-ferrous material for the following applications, also mention compositions (any *three*) : [6]

(*a*) Cylinder head of diesel engine

(*b*) Bearings to be used in sea water

(*c*) Thermocouple wire

(*d*) Non-sparkling tools

(*e*) Aircraft components

(*f*) Measuring tape.

11. (A) Explain the characteristics of the following fibers used in composites (any *three*) : [6]

(*a*) Boron

(*b*) Silicon carbide

(*c*) Glass

(*d*) Aramid.

(B) Explain the property requirement for Biomedical materials. Justify Alumina and Zirconia as biomedical material. [6]

(C) Distinguish between Particle Reinforced and Fiber Reinforced composites. [4]

Or

12. Write short notes on (any *four*) : [16]

(*i*) Self-lubricated bearings

(*ii*) Powder conditioning;

(*iii*) Carbon-nanotubes;

(*iv*) General properties of ceramics;

(*v*) Powder Rolling;

(*vi*) Isostatic Pressing.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-131

S.E. (Production S/W) (First Semester) EXAMINATION, 2014

MANUFACTURING PROCESSES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two sections should be written in separate answer-books.

(*ii*) Answer any *three* questions from each section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data if necessary.

SECTION I

1. (*a*) Explain the following with neat sketches : [6]

(*i*) Sand Slinger

(*ii*) Split Pattern.

(*b*) Explain the following characteristics of moulding sand in short : [6]

(*i*) Refractoriness

(*ii*) Permeability.

(*c*) Compare permanent mould casting method to sand casting. [6]

Or

2. (*a*) What is continuous casting ? Describe in detail with figure the continuous casting process. [6]

(*b*) List the defect you would expect from the following stating the precautions necessary to prevent them : [6]

(1) Improper pouring temperature.

(2) Use of defective getting system.

(3) High moisture content in sand.

(*c*) What are the various non-destructive testing methods used for inspection of casting ? State advantages and limitations of any *three* methods. [6]

3. (*a*) Neatly draw the process to 'draw wire' and explain. [6]

(*b*) With a neat figure explain 2-High and 3-High rolling mill. [6]

(*c*) Explain with sketches the following forging operations : [4]

(*i*) Drawing out

(*ii*) Upsetting.

Or

4. (*a*) With a neat sketch, explain Indirect Extrusion stating advantages, limitations and area of applications. [9]

(*b*) Explain with the help of a neat sketch, the working of 'Board Drop Hammer'. [7]

5. (*a*) Explain different types of joints and welding positions used in welding with neat sketch. [6]

(*b*) Explain with neat sketch 'Laser Beam Welding' and give its applications, advantages and limitations. [8]

(*c*) Differentiate between forehand and backhand gas welding techniques. [2]

Or

6. (*a*) Explain with suitable diagram the following processes : [8]

(*i*) Friction welding

(*ii*) Seam welding.

(*b*) Explain the following electric arc welding process with the help of neat sketches : [8]

(*i*) Flux cored arc welding (FCAW)

(*ii*) Gas metal arc welding (GMAW).

SECTION II

7. (*a*) Explain the following operations performed on lathe with suitable sketch : [8]

(*i*) Eccentric Turning

(*ii*) Facing

(*iii*) Parting off

(*iv*) Knurling.

(*b*) What are desirable properties of cutting tool ? Describe any *four* cutting tool material in short. [10]

Or

8. (*a*) Describe different types of mandrels with their specific use. [6]

(*b*) What do you understand by thread catching ? Why is it necessary ? [4]

(*c*) Why are back gears used ? Describe in detail with sketch the method of using them. [8]

9. (*a*) Index 69 division by compound indexing method. The hole circle available are : [6]

Plate I : 15, 16, 17, 18, 19, 20

Plate II : 21, 23, 27, 29, 31, 33

Plate III : 37, 39, 41, 43, 47, 49

(*b*) Describe with the help of neat sketch the 'Universal Milling Machine' indicating the various controls and constructional features. [10]

Or

10. (*a*) With the help of a neat sketch explain the construction and working of Radial Drilling Machine. [8]

(*b*) What is twist drill ? Draw neat sketch of twist drill showing various parts and name it properly. [8]

11. (*a*) Compare the Honning and Lapping Processes with respect to : [4]

(*i*) Principle of working

(*ii*) Types of abrasive

(*iii*) Area of applications

(*iv*) Surface finish.

(*b*) With the aid of neat sketch, explain construction and working of tool and cutter grinder. State its applications. [6]

(*c*) Name the different types of bonds used in the manufacture of abrasive wheel. Describe any *one* in detail starting its advantages and disadvantages. [6]

Or

12. (*a*) How do you classify cylindrical grinders ? What is the difference between Plain and Universal Grinders ? [8]

(*b*) What essential factors will you consider while choosing a grinding wheel ? [4]

(*c*) Describe the 'Indian Standards' method of specifying a grinding wheel by taking a concrete example. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-133

S.E. (Production) S/W (Second Semester) EXAMINATION, 2014

PRODUCTION AND INDUSTRIAL MANAGEMENT–I

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the types of Management along with examples. [8]

(*b*) Explain the contribution of F.W. Taylor in the field of management. [8]

Or

2. (*a*) Explain the principle of Scientific Management. [8]

(*b*) Explain the role of Public Private Partnership Indian Society. [8]

3. (*a*) Explain the modern technique used in Industrial in Industrial Engineering. [8]

(*b*) Define productivity. What is meant by factor productivity and tool productivity ? Explain. [8]

Or

4. (*a*) What do you mean by Plant Layout ? Explain in detail Work Space Design. [8]

(*b*) Explain different types of diagnostics technique used in repairing. [8]

5. (*a*) What are work element explain along with example. [8]

(*b*) Explain micro-motion study how its carried out ? What are the different symbols used in micro-motion study ? [10]

Or

6. (*a*) Importance of Bi-mechanical Cycle in Ergonomics. [9]

(*b*) Explain one-handed and Simo-Process Chart in detail. [9]

SECTION II

7. (*a*) Explain objective of time study. [8]

(*b*) Explain the different methods of Time study in detail along with example. [10]

Or

8. (*a*) Explain the following : [8]

(1) Observed Time

(2) Qualified Worker

(3) Interface Allowance

(4) Contingency Allowance.

(*b*) List out the different theories of Motivation. Explain any *two* theories in detail. [10]

9. (*a*) Explain the Trait Theory of leader in ship. [8]

(*b*) Explain the qualities of Good entrepreneur. [8]

Or

10. (*a*) Write short notes on the following : [12]

(1) Job Evaluation

(2) Incentive schemes.

(*b*) Function of HR Department. [4]

11. (*a*) Explain the Break-even analysis in detail along with an example. [8]

(*b*) Explain the role of Financial Institute in Indian industry. [8]

Or

12. (*a*) Explain along with the examples different types of overhead costs. [8]

(*b*) Compare and contrast Costing and Cost Control. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4657]-14

S.E. (Mechanical/Auto./S/W) (First Semester) EXAMINATION, 2014

FLUID MECHANICS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

Unit I

1. (*a*) What is viscosity of fluid ? Explain why viscosity of liquids decreases while that of gases increases with rise in temperature. [6]

(*b*) What is capillarity ? Derive an expression for capillary rise of a liquid having surface tension 'σ' inside a glass tube of small diameter '*d*'. [6]

(*c*) Two horizontal plates are placed 1.25 cm apart, the space between them being filled with oil of viscosity 14 poise. Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s. [6]

Or

2. (*a*) Derive a general equation for continuity for a three-dimensional flow in Cartesian coordinates for a steady incompressible flow. [10]

(*b*) A fluid flow field is given by :

$$V = x^2yi + y^2zj - (2xyz + yz^2)k.$$

Prove that it is a case of possible steady incompressible fluid flow. Calculate the velocity at the point (2, 1, 3). [8]

Unit II

3. (*a*) Derive expression for total pressure and center of pressure on inclined plane surface completely submerged in static mass of liquid. [8]

(*b*) A rectangular plane surface 3 m wide and length 4 m deep lies in water in such a way that its plane makes an angle of 30° with the free surface of water (length inclined to free surface). Determine the total pressure force and position of center of pressure, when the upper edge is 2 m below the free surface. [8]

Or

4. (*a*) State and prove hydrostatic law. [4]

(*b*) Explain with neat sketches, the condition of equilibrium for floating bodies. [4]

(*c*) A solid cylinder of diameter 4 m has a height of 3 m. Find the metacentric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder is 0.6. [8]

Unit III

5. (*a*) Derive an expression for Bernoulli's equation along a streamline. State the assumption made. What are limitations of the Bernoulli's equation ? [10]

(*b*) Describe an orificemeter and find an expression for measuring discharge of fluid through a pipe with this device. [6]

Or

6. (*a*) Draw a neat sketch of Venturimeter, indicate different parts of it, state its governing principle and derive the expression for the discharge through it. [8]

(*b*) Explain the terms :

(*i*) End contractions, and

(*ii*) Velocity of approach.

How the discharge over a rectangular notch is affected by these ? [8]

SECTION II

Unit IV

7. (*a*) Derive Hagen-Poiseuille equation and hence show that the value of coefficient of friction for viscous flow through a circular pipe is $F = 16/R_e$, where R_e is Reynolds number. [12]

(*b*) Explain in brief physical significance of the following dimensionless numbers : [6]

(*i*) Reynolds number

(*ii*) Mach number

(*iii*) Froude number.

Or

8. (*a*) The resistance R, to the motion of a supersonic aircraft of length L, moving with a velocity V, in air of density ρ depends on the viscosity μ and bulk modulus of elasticity K of air. Obtain an expression for the resistance R, using Buckingham's π theorem. [8]

(*b*) Two parallel plates kept 0.1 m apart have laminar flow of oil between them with a maximum velocity of 1.5 m/s. Calculate :

(*i*) the discharge per meter width,

(*ii*) the shear stress at the plates,

(*iii*) the difference in pressure in pascals between two points 20 m apart,

(*iv*) the velocity gradient at the plates, and

(*v*) velocity at 0.02 m from the plate.

Take viscosity of oil to be 2.453 N.s/m^2. [10]

Unit V

9. (*a*) Derive Darcy-Weisbach equation. What is the concept of equivalent pipe ? [10]

(*b*) A 0.3 m diameter pipe 2340 m long is connected with a reservoir whose surface is 72 m above the discharging end of the pipe. If for the last 1170 m, a second pipe of same diameter be laid beside the first and connected to it, what percentage would be the change in discharge ?

Take $f = 0.02$ in the equation $h_f = f\text{LV}^2/2\text{gD}$. [6]

Or

10. (*a*) The difference in the water surface levels of two reservoirs which are connected by a Siphon is 8 m. The length of the siphon is 600 m and its diameter 0.3 m. Assuming $f = 0.02$ in the equation $h_f = f\text{LV}^2/2\text{gD}$, determine the discharge when the siphon is running full. If the summit of the pipeline is 5 m above the surface level of the upper reservoir, determine the maximum length of the inlet leg for the pipe to run full. Allow for all the losses and assume the permissible pressure at the summit of the siphon to be absolute zero. [8]

(*b*) Power to be transmitted hydraulically to an accumulator at a distance of 8 km by means of a number of 100 mm pipes laid horizontally, for which the coefficient of friction may be taken as $f = 0.03$ (in the equation $h_f = f\mathrm{LV}^2/2\mathrm{gD}$). The pressure at the accumulator is maintained constant at 6524 $\mathrm{kN/m^2}$. Determine the minimum number of pipes required to ensure an efficiency of at least 92 percent when the power delivered is 162 kW. [8]

Unit VI

11. (*a*) Explain what is meant by "Separation of boundary layers". Describe with sketches the methods to control separation. [8]

(*b*) The velocity distribution in the boundary layer is given by :

$$u/\mathrm{U} = 2(y/\delta) - (y/\delta)^2,$$

where δ being boundary layer thickness.

Calculate the following :

(*i*) Displacement thickness,

(*ii*) Momentum thickness, and

(*iii*) Energy thickness. [8]

Or

12. (*a*) Describe coefficient of drag and lift. State the factors on which these coefficient depends. [4]

(*b*) Differentiate between streamline body and bluff body. [4]

(*c*) On a flat plate of 2 m length and 1 m width, experiments were conducted in wind tunnel with a wind speed of 50 km/h. The plate is kept at such angle that the coefficients of drag and lift are 0.18 and 0.9 respectively. Determine :

(*i*) Drag force,

(*ii*) Lift force,

(*iii*) Resultant force, and

(*iv*) Power exerted by the air stream on the plate.

Take density of air = 1.15 kg/m^3. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-15

S.E. (Mech., Mech. Sand., Prod., Prod. Sand., Auto) (II Sem.) EXAMINATION, 2014

ELECTRICAL TECHNOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of electronic pocket calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) With the help of neat circuit diagram explain how two wattmeters can be used to measure active power of three-phase star connected load. Also draw the necessary phasor diagram for lagging power factor. [7]

(*b*) Explain any *one* method of improvement of power factor of the circuit with a neat circuit diagram. [7]

(*c*) State and explain any *four* requirements of good lighting scheme. [4]

Or

2. (*a*) Explain with neat circuit diagram use of CT and PT for measurement of power in single-phase circuit operating at high voltage and drawing high current by the load. [7]

(*b*) State and explain various factors considered while designing good lighting scheme. [7]

(*c*) With a neat circuit diagram explain use of single wattmeter for measurement of reactive power of the three-phase balance load. [4]

3. (*a*) Draw approximate equivalent circuit of single-phase transformer and explain each component used in it. [6]

(*b*) Three-phase 4 pole induction motor operating from 3 ϕ, 50 Hz, A.C. supply is giving 5 kWatt output at 1470 rpm. If motor has 900 watt rotor copper loss, 250 watt frictional and windage loss and 600 watt stator losses, determine : [6]

(*i*) Slip

(*ii*) Input power

(*iii*) Efficiency.

(*c*) State various types of connections of the three-phase transformer. Explain any *one* of them with diagram. [4]

Or

4. (*a*) With neat diagram explain various power stages of induction motor operation. [6]

(*b*) With the help of neat diagram explain a typical distribution transformer substation. [6]

(*c*) In connection with transformer theory, define the following terms : [4]

(*i*) Voltage Regulation

(*ii*) Efficiency.

5. (*a*) Explain construction, working and features of the single-phase induction motor—shaded pole type. Also state any *two* applications of it. [8]

(*b*) With neat diagram explain construction of salient type rotor of three-phase alternator. State advantages and disadvantages of such construction. [8]

Or

6. (*a*) State various types of single-phase motor split phase technique. Explain any *one* of them with the help of a neat diagram. [8]

(*b*) Explain step by step how regulation of three-phase alternator is determined by synchronous impedance method. [8]

SECTION II

7. (*a*) Draw and briefly explain characteristics of DC shunt and series motors. [6]

(*b*) What is universal motor ? Explain working of universal motor with the help of a neat sketch. [6]

(*c*) A 250 V DC shunt motor has armature resistance of 0.25 Ω. It takes an armature current of 50 A while running at 750 rpm. Find the speed of the motor if the flux is reduced by 10% without changing the load torque. [6]

Or

8. (*a*) Describe the mechanism of three point starter with the help of a neat sketch. [6]

(*b*) Write a short note on AC Servomotor. [6]

(*c*) A 220 V DC series motor runs at 800 rpm while taking a current of 15 A. The motor has an armature resistance of 0.3 Ω and series field resistance of 0.2 Ω. Find the resistance to be connected in series with the armature if it has to take same current at the same voltage while running at 600 rpm. [6]

9. (*a*) Explain the following with regards to *n*-channel enhancement type MOSFET : [8]

(*i*) Construction

(*ii*) Transfer Characteristics

(*iii*) Output Characteristics.

(*b*) Explain with a neat diagram constructional details and V-I characteristics of DIAC. [8]

Or

10. (*a*) Draw V-I characteristics of SCR. State and explain Turn ON methods for SCR. [8]

(*b*) Explain construction and V-I characteristics of TRIAC with the help of the neat sketches. [8]

11. (*a*) State advantages of electrical drives. Distinguish between individual and group drives. [8]

(*b*) What are chopper drives ? Explain operation of two quadrant chopper circuit with the help of suitable diagram. [8]

Or

12. (*a*) Explain v/f control of three-phase induction motor. [8]

(*b*) Discuss the selection of electrical drives based on load characteristics, quoting suitable examples. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-2

S.E. (Civil) (First Semester) EXAMINATION, 2014

BUILDING MATERIALS AND CONSTRUCTION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Use separate answer-sheet for Section I and Section II.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain clearly the importance of plinth filling. [5]

(*b*) Differentiate between End Bearing and Under-reamed pile foundation. [6]

(*c*) Explain the essence of providing bonds in the brickwork. [5]

Or

2. (*a*) What is DPC ? Explain the general principles followed for DPC. [5]

(*b*) Describe the following with sketches : [6]

(*i*) Header

(*ii*) Course

(*iii*) Perpend

(*iv*) Coping.

(*c*) State the precautions to be taken for the brickwork. [5]

3. (*a*) State the advantages of Reinforced Brickwork and its applications. [5]

(*b*) Explain in detail "Column Forms". [6]

(*c*) State different curing methods and explain any *one* of them. [5]

Or

4. (*a*) Write a note on "Cavity wall construction". [5]

(*b*) Explain in detail "Expansion and Contraction joints". [6]

(*c*) State different causes of failure of the formwork and the necessary action. [5]

5. (*a*) Write short notes on : [6]

(*i*) Hollow Block and Rib Floor

(*ii*) Cork Floor.

(*b*) Write a short note on "Construction details of concrete floor". [6]

(*c*) Compare between "A.C. and G.I. sheets". [6]

Or

6. (*a*) State the functional requirements of flooring and mention the tests to be conducted on tiles. [6]

(*b*) Explain the following terms : [6]

(*i*) Eaves

(*ii*) Valley

(*iii*) Ridge Piece

(*iv*) Cleats.

(*c*) Write a short note on "Space Frames". [6]

SECTION II

7. (*a*) Explain the following with sketches : [6]

(*i*) Arch

(*ii*) Lintel

(*iii*) Nar-madi.

(*b*) Explain the necessity of fixtures and fastenings in doors and windows. [6]

(*c*) Define painting. Explain defects in painting. [6]

Or

8. (*a*) Define the following : [6]

(*i*) Spandrill

(*ii*) Hold-fast

(*iii*) Horn.

(*b*) State the different types of locks. Explain Bay windows in detail. [6]

(*c*) Explain the detailed procedure of plastering. Give explanatory sketch. [6]

9. (*a*) Describe the following terms with labelled sketches : [6]

(*i*) Pitch

(*ii*) Nosing

(*iii*) Scotia

(*iv*) Rise.

(*b*) Comment the safety precautions in the construction of Apartment Building. [6]

(*c*) Write a short note on flying shores. [4]

Or

10. (*a*) Give the plan of dog-legged stair and explain step by step design procedure of dog-legged star. [6]

(*b*) Write short notes on : [6]

(*i*) Demolition of high rise building in crowded area

(*ii*) Escalators.

(*c*) What is shoring and strutting ? Explain cantilever needle beam method. [4]

11. (*a*) Write short notes on : [6]

(*i*) Plaster of Paris

(*ii*) Artificial stone

(*iii*) Veneers.

(*b*) Explain engineering properties of the following building materials : [6]

(*i*) Gypsum

(*ii*) Aluminium

(*iii*) Glass.

(*c*) Define seasoning. Explain radial shakes with sketch. [4]

Or

12. (*a*) Draw neat and labelled sketch (section) of Indian type w.c. pan. [6]

(*b*) State defects in timber. Explain air seasoning. [4]

(*c*) Explain the following : [6]

(*i*) Slaking of lime

(*ii*) Glass cladding.

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-20

S.E. (Mechanical/Automobile) (II Sem.) EXAMINATION, 2014

PRODUCTION TECHNOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

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

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of non-programmable electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

(*vi*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

SECTION I

1. (*a*) An orthogonal cut 2 mm wide is made at a speed of 0.6 m/s and feed of 0.27 mm with a H.S.S. tool having a 20° rake angle. The chip thickness ratio is found to be

0.6, the cutting force is 1500 N and the feed thrust force is 500 N, find : [10]

(*i*) Chip thickness

(*ii*) Shear plane angle

(*iii*) Resultant force

(*iv*) Coefficient of friction on the face of the tool

(*v*) Shearing force and normal force on the shear plane.

(*b*) Explain various factors affecting tool life. [6]

Or

2. (*a*) A seamless tube of 60 mm outside diameter is turned on lathe with cutting speed of 10 m/min. The tool rake angle is 15° and feed rate is 0.18 m/rev. The length of chip in one revolution measures 80 mm. Calculate : [10]

(*i*) Chip thickness ratio

(*ii*) Shear plane angle

(*iii*) Shear flow speed

(*iv*) Shear strain.

(*b*) Explain with sketch types of chips produced during machining. [6]

3. (*a*) Explain types of Broaching Machines. [5]

(*b*) Explain the concept of gear shaping process with neat sketch. [5]

(*c*) Explain with sketch Thread Rolling process. [6]

Or

4. (*a*) Explain the process of thread milling with neat sketch. [5]

   (*b*) Draw the neat sketch of broach geometry details. [6]

   (*c*) Explain the process of gear hobbing with neat sketch. [5]

5. (*a*) Explain classification of NC system. [8]

   (*b*) Explain with a neat sketch Automatic Tool Changer and Automatic Pallet Changer. [10]

Or

6. (*a*) Explain the meaning of every code written in the following line : [4]

   G02 X37 Z20 M04 T02.

   (*b*) Compare CNC and DNC Machines. [4]

   (*c*) Write notes on (any *two*) : [10]

   (*i*) Machining Centre

   (*ii*) G codes

   (*iii*) Functions of DNC.

SECTION II

7. (*a*) Explain methods of reducing cutting forces in sheet metal works. [8]

(*b*) Describe the following terms : [10]

(*i*) Centre of Pressure

(*ii*) Strip layout.

Or

8. (*a*) Explain with sketch Combination die and Compound die. [8]

(*b*) A cup without flanges and height 25 cm and diameter 10 cm is to be made from sheet metal 1 mm thickness with ultimate tensile strength 425 N/mm^2. Find : [10]

(*i*) Blank size

(*ii*) No. of draws

(*iii*) Dimensions of die and punch for first draw

(*iv*) Force for first draw (40% reduction in first draw stage).

9. (*a*) Explain USM in detail with neat sketch. State advantages, limitations and applications. [8]

(*b*) Explain Abrasive Jet Machining. State parameters in AJM and why reuse of abrasives is not recommended in AJM ? [8]

Or

10. (*a*) Explain the EBM in detail with neat sketch. [6]

(*b*) What is LASER ? What are the gases commonly used in LASER ? [4]

(*c*) Explain Electrochemical Grinding with sketch. [6]

11. (*a*) Explain 3-2-1 principle of location. [8]

(*b*) State various types of clamping devices used in jig and fixtures and explain any *one* in detail with neat sketch. [8]

Or

12. (*a*) Define jig and fixture. Differentiate between them with suitable example. [8]

(*b*) State various types of fixtures and explain any *one* in detail with neat sketch. [8]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-21

S.E. (Mechanical S/W) (II Sem.) EXAMINATION, 2014

COMPUTER APPLICATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Answer *three* questions from each Section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Find the real root of the equation $3x + \sin x - e^x = 0$ by the False Position Method correct to 3 decimal places. [8]

(*b*) Draw flow chart for Simpson's 1/3 rule. [8]

Or

2. (*a*) Draw flow chart for Modified Newton-Raphson Method. [8]

(*b*) Compute the value of

$$\int_{0.2}^{1.4} \left(\sin x - \log x + e^x\right) dx$$

using Simpson's 3/8 rule. Take $n = 6$. [8]

3. (*a*) Using Newton's Divided Difference Formula, find the value of $f(8)$: [8]

x	F(x)
4	48
5	100
7	294
10	900
11	1210
13	2028

(*b*) Draw flow chart for forward differentiation. [8]

Or

4. (*a*) Draw flow chart for Newton's Backward Difference Interpolation. [8]

(*b*) Find dy/dx and d^2y/dx^2 for $x = 2.2$ using the following table : [8]

x	y
1	2.7183
1.2	3.3201
1.4	4.0552
1.6	4.9530
1.8	6.0496
2.0	7.3891
2.2	9.0250

5. (*a*) Explain partial pivoting of simultaneous equations using suitable example. [8]

(*b*) Solve the following equations using Gauss-Jordan Method : [10]

$$10x_1 + x_2 + x_3 = 12$$
$$x_1 + 10x_2 - x_3 = 10$$
$$x_1 - 2x_2 + 10x_3 = 9.$$

Or

6. (*a*) Explain the procedure for solution of simultaneous equations using LU decomposition method. [8]

(*b*) Solve the following equations using Gauss-Siedel Method : [10]

$$20x_1 + x_2 - 2x_3 = 17$$
$$3x_1 + 20x_2 - x_3 = -18$$
$$2x_1 - 3x_2 + 20x_3 = 25.$$

SECTION II

7. (*a*) Fit the second degree polynomial of type $(ax^2 + bx + c)$ to the following data : [7]

x	*y*
–3	12
–2	4
–1	1
0	2
1	7
2	15
3	30

(*b*) Distinguish between truncation error and round off error. With suitable example explain how they occur. [6]

(*c*) Explain the concept of significant digits. [3]

Or

8. (*a*) Fit the exponential curve $y = a.e^{bx}$ to the following data : [8]

x	y
2	25
4	38
6	56
6	84

(*b*) The load lifted (kN) and corresponding force (kN) applied in a pulley system is given in table. If (effort = a* load lifted + b), evaluate the value of a and b. Find load lifted, if the effort required is 1.05 kN : [8]

Load lifted, kN	**Effort applied in kN**
10	0.75
15	0.93
20	1.10
25	1.20
30	1.30

9. (*a*) Temperature at one surface of slab of thickness $x = 0.2$ m is T = 200°C. Find the temperature of other surface of slab by taking step size in thickness 40 mm. Assume heat flux 1000 W/m^2. The governing equation of heat flow is : [8]

$$\frac{dT}{dx} = -\frac{q}{A}\left[\frac{1}{0.5(0.01T + 1)}\right].$$

(*b*) Solve the following equation using Milne method :

$$\frac{dy}{dx} = x - y + 1.$$

Given $y(1) = 0$, $y(1.1) = 0.1951$, $y(1.2) = 0.3812$, $y(1.3) = 0.5591$. Find y at $x = 1.5$ with step size of 0.1. [8]

Or

10. (*a*) Solve the following equation for $y(0.2)$ using fourth order Runge-Kutta method : [9]

$$10\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^2 + 6x = 0, \quad y(0) = 1, \quad y'(0) = 0.$$

(*b*) What is meant by r-order Runge-Kutta method ? What is the order of the following methods ?

(*i*) Euler's method

(*ii*) Modified Euler's method. [7]

11. (*a*) Solve the following equation using Crank-Nicolson method : [10]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

Initial and boundary conditions are : at $x = 0$ and $x = 3$, $u = 0$ for all t. At $t = 0$, $u = x^2$ for $0 < x < 3$. Take increment in x and t as 1 and 0.1 respectively. Find all values of u for $t = 0$ to 0.3.

(*b*) Draw the flow chart to solve Laplace equation. [8]

Or

12. Solve $100u_{xx} = u_{tt}$ given $u(0, t) = 0$, $u(0.6, t) = 0$, $u(x, 0) = (5x - 1)$ and $u_t(x, 0) = 0$ by taking $h = 0.2$ upto 4 time steps.

Draw the flow chart to solve above equation. [18]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-25

S.E. (Mechanical/Mechanical Sandwich) (First Semester)

EXAMINATION, 2014

THERMAL ENGINEERING

(Thermodynamics)

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Solve any *three* questions from Section I and Section II each.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Draw neat and labelled diagrams wherever necessary.

(*iv*) Use of steam table, Mollier charts, scientific calculator is allowed.

(*v*) Assume suitable data, if necessary.

(*vi*) Figures to the right indicate full marks.

Section I

Unit I

1. (*a*) Derive steady flow energy equation (SFEE). Obtain the expressions using SFEE for any *four* of the following applications/devices : [8]

(*i*) Closed system

(*ii*) Isolated system

(*iii*) Heat added in boiler

(*iv*) Turbine work

(*v*) Throttling

(*vi*) Condenser.

(*b*) A 30 kg of copper block C_p = 0.386 kJ/kg K at 95 deg. C is dropped in 30 liters of water at 24 deg. C. Find the final equilibrium temperature and entropy generation. [8]

Or

2. (*a*) Derive the equation for heat transfer, work done change in entropy, change in internal energy and change in enthalpy for polytropic process undergone by an Ideal gas. Show the process on P-v and T-s diagram. [8]

(*b*) A mass of 0.25 kg of an ideal gas has a pressure of 300 kPa, temperature of 80 deg. C and volume of 0.07 m^3. It undergoes an irreversible adiabatic process to a final pressure of 300 kPa and final volume of 0.1 m^3 during which work done on the gas is 25 kJ. Evaluate C_p and C_v of the gases. [8]

Unit II

3. (*a*) State classification of boilers and desirable characteristics of boiler. [4]

(*b*) Draw a neat labelled diagram of fusible plug and state its function. [4]

(*c*) The following results were obtained from boiler trial : [8]

(*i*) Feed water per hour = 700 kg at 27 deg. C.

(*ii*) Steam pressure = 8 bar of dryness 0.97.

(*iii*) Coal consumption = 100 kg/hr.

(*iv*) C.V. of coal = 25000 kJ/kg.

(*v*) Unburnt coal collected = 0.6 kg/hr.

(*vi*) Flue gas/per kg of fuel = 17.3 kg at 327 deg. C, C_p of flue gas = 1.025 kJ/kg-K.

(*vii*) Room temperature = 16 deg. C.

Determine :

(1) Equivalent evaporation

(2) Boiler efficiency

(3) Draw the heat balance sheet on kJ/min basis.

Or

4. (*a*) Define : [8]

(*i*) Equivalent evaporation,

(*ii*) Boiler efficiency.

Discuss the heat balance sheet used in boilers in tabular form.

(*b*) Determine the A : F ratio for an oil fired steam with the following data :

(*i*) Chimney height = 40 m

(*ii*) Draught = 25 mm of water column

(*iii*) Mean chimney gas temperature = 367 deg.C.

(*iv*) Ambient outside temperature = 20 deg.C.

Also calculate draught in terms of hot gas column and velocity of the flue gases. [8]

Unit III

5. (*a*) Define Dryness fraction. Describe Barrel Calorimeter with neat sketch. [9]

(*b*) In a test on combined separating and Throttling calorimeter the following data was obtained : [9]

Pressure of the steam sample = 15 bar

Pressure of steam at exit = 1 bar

Temperature of steam at exit = 150 deg.C

Discharge of water from separating calorimeter = 0.2 kg/min

Discharge collected at exit = 10 kg/min

Calculate dryness fraction of the steam collected in the main.

Or

6. (*a*) Discuss phase transformation of water into steam on T-s and P-h diagram. Show clearly : [9]

(*i*) Saturated liquid line and its dryness fraction,

(*ii*) Saturated vapor line and its dryness fraction,

(*iii*) Compressed liquid region,

(*iv*) Two phase region,

(*v*) Superheated region,

(*vi*) Critical point.

For the above 6 points also write down the equations used to estimate enthalpy, entropy and specific volume.

(*b*) A steam power plant operates on Rankine cycle. The condition of steam at the entry to turbine is 40 bar and 400 deg. C and condenser pressure is 0.06 bar absolute. If the turbine and pump work with 80% mechanical efficiency each, calculate :

(*i*) Cycle efficiency

(*ii*) Work ratio

(*iii*) Specific steam consumption (S.R.). [9]

Section II

Unit IV

7. (*a*) Define :

(*i*) Mass fraction,

(*ii*) Mole fraction,

(*iii*) Theoretical air,

(*iv*) Excess air.

Derive the equation for theoretical amount of air required to completely burn 1 kg of fuel, when the fuel contains C, H, S, O constituents. [8]

(*b*) The ultimate analysis of solid fuels is as follows : [8]

C = 78%, O_2 = 3%, H_2 = 3%, S = 1%, Moisture = 5%, ash = 10%.

Calculate the mass of actual air supplied also individual and total mass of products of combustion per kg of fuel if 30% of excess is supplied of combustion.

Or

8. (*a*) Describe working of Bomb Calorimeter with neat sketch. [8]

(*b*) The following results are obtained when sample of gas is tested by a gas calorimeter : [8]

Gas burnt in calorimeter = 0.08 m^3

Pressure of gas supply = 5.2 cm of water

Barometer = 75.5 cm of Hg

Temperature of gas = 13°C

Weight of water heated by the gas = 28 kg

Temperature of water at inlet = 10°C

Temperature of water at outlet = 23.5°C

Steam condensed = 0.06 kg.

Find HCV per m^3 of gas at 15°C and barometric pressure of 76 cm of Hg.

Unit V

9. (*a*) Draw P-v and T-s diagram for :

(*i*) Otto cycle

(*ii*) Diesel cycle

(*iii*) Dual cycle.

List down various processes undergone during this cycle. State air-standard efficiency for above cycles with symbols used. Discuss various losses in actual engine if possible show them on P-v or T-s diagram. [10]

(*b*) An engine working on Otto cycle has a cylinder of diameter 20 cm and stroke of 25 cm. The clearance volume is 1570 cc. Determine the air standard efficiency of the Otto Cycle. Also find pressure and temperature after compression stroke if suction conditions are 1 bar and 20°C. [6]

Or

10. (*a*) Show Otto cycle on P-v and T-s diagram and derive the equation of air-standard efficiency for Otto cycle. [8]

(*b*) State the difference in air-standard cycle and fuel air cycle. Compare P-v diagram for air-standard cycle and fuel air cycle. Discuss the losses in actual cycle. [8]

Unit VI

11. (*a*) Define volumetric efficiency of a compressor. Explain how clearance volume affects the performance of compressor. [8]

(*b*) A reciprocating compressor of single stage, double acting type delivers 20 m^3/min when measured at free air condition of 1 bar, 27°C. The compressor has pressure ratio of 7 and the conditions at the end of suction are 0.97 bar, 35°C. Compressor runs at 240 rpm with clearance volume of 5% of swept volume. The L/D ratio is 1.2. Determine the volumetric efficiency and dimensions of cylinder and isothermal efficiency taking the index of compression and expansion as 1.25. Also show the cycle on P-V diagram. [10]

Or

12. (*a*) Explain the methods of improving isothermal efficiency of reciprocating compressors with P-V diagram. [12]

(*b*) Define volumetric efficiency and discuss the effect of clearance volume on efficiency of the compressor.

(*c*) In a single stage air compressor initial pressure is 1 bar and final pressure is 16 bar.

The compression is according to the law $PV^{1.3}$ = constant.

Piston speed is 200 m/min, shaft rpm = 350.

Indicated power = 30 kW.

Volumetric efficiency = 0.85.

Calculate the cylinder stroke and Bore. [6]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**12**

Seat No.	

[4657]-3

S.E. (Civil) (First Semester) EXAMINATION, 2014

STRENGTH OF MATERIALS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** and Q. No. **5** *or* Q. No. **6** in Section I.

(*ii*) Answer Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10** and Q. No. **11** *or* Q. No. **12** in Section II.

(*iii*) Answers to the two Sections should be written in separate answer-books.

(*iv*) Neat sketches must be drawn wherever necessary.

(*v*) Figures to the right indicate full marks.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw and explain stress-strain diagram for mild steel. [4]

(*b*) A rigid beam AB, 3.6 m long is hinged at B and supported by two wires CD and EF as shown in Fig. 1.1. If a load of 4.3 kN is applied at A, find stresses developed in each wire. The wires are 2.9 m in diameter. Take E for wire = 198 GPa. [7]

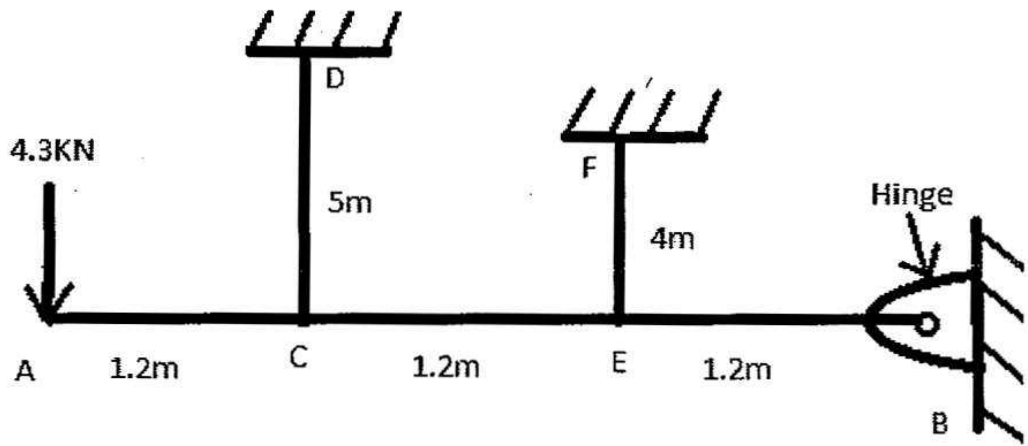


Fig. 1.1

(*c*) Determine the Poisson's ratio and bulk modulus of a material, for which Young's modulus is 120 kN/mm^2 and modulus of rigidity is 4.8×10^4 N/mm^2. [6]

Or

2. (*a*) The composite bar as shown in Fig. 2.1 is rigidly fixed at the ends. An axial pull of P = 18 kN is applied at B at

+ 14°C. Find the stresses in each material at 68°C. Take $\alpha_{Al} = 23 \times 10^{-6}$ per °C, $\alpha_{Cu} = 16 \times 10^{-6}$ per °C, and $E_{Al} = 72$ kN/mm^2, $E_{Cu} = 115$ kN/mm^2. [9]

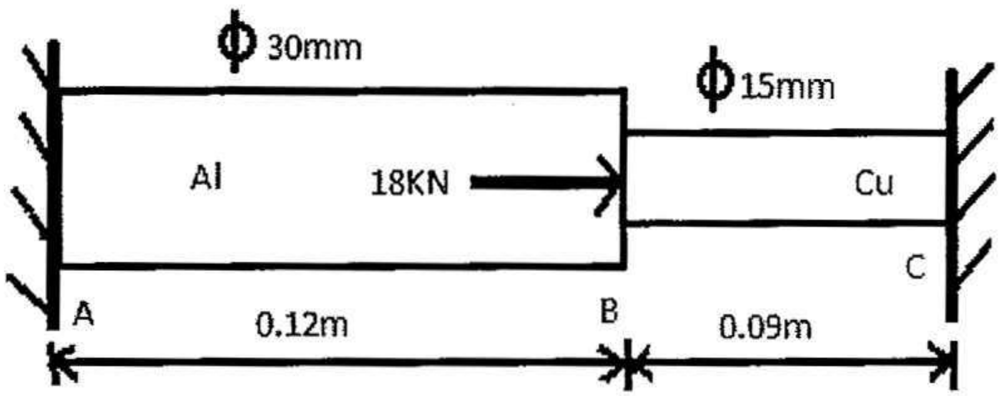


Fig. 2.1

(*b*) The following observations were made during a tension test on a mild steel specimen of 35 cm diameter and 0.295 m long. [8]

(*i*) Load at limit of proportionality = 38 kN

(*ii*) Corresponding extension = 0.043 mm

(*iii*) Yield point load = 86 kN

(*iv*) Ultimate load = 132 kN

(*v*) Length of specimen at fracture = 325 mm

Determine :

(1) Young's Modulus of Elasticity

(2) Yield stresses

(3) Ultimate stress

(4) % Elongation.

3. (*a*) For the beam loaded as shown in Fig. 3.1. Draw SFD and BMD showing all salient points. [8]

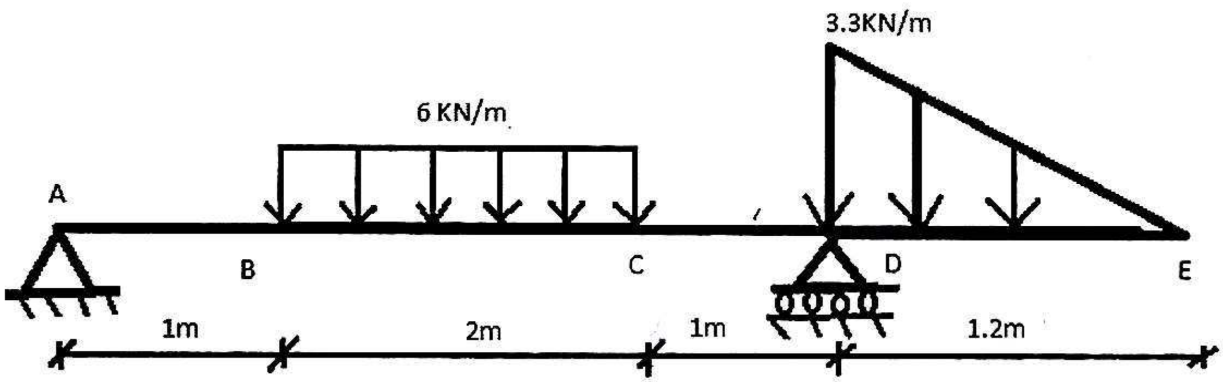
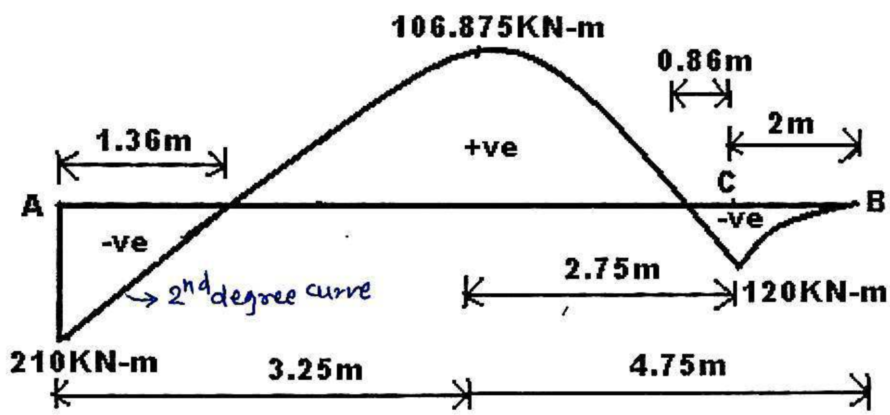


Fig. 3.1

(*b*) Construct the corresponding loading diagram and SFD for the beam his BM diagram is as shown in Fig. 3.2. [9]



BMD

Fig. 3.2

Or

4. (*a*) Draw SFD and BMD for the loaded beam shown in Fig. 4.1 with all salient points. [9]

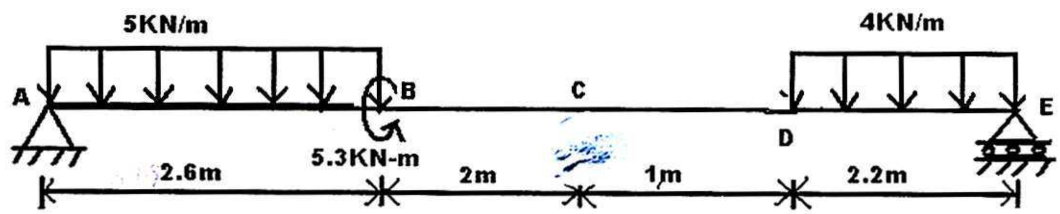
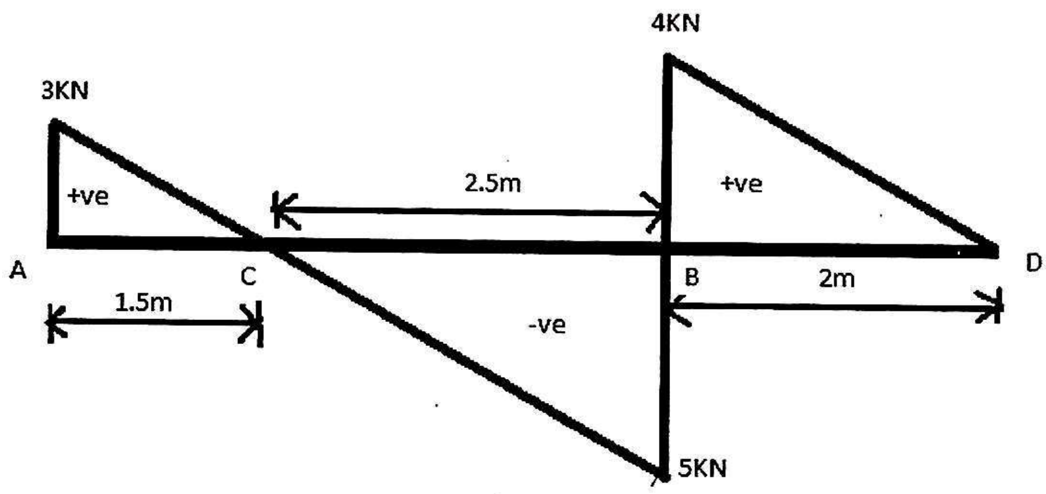


Fig. 4.1

(*b*) Draw loading diagram and BM diagram from given SF diagram as shown in Fig. 4.2. [8]



SFD

Fig. 4.2

5. (*a*) A cast iron beam is of T-section as shown in Fig. 5.1. The beam is simply supported on a span of 8 m. The beam carries a uniformly distributed load of 1.5 kN/m length an entire span. Determine the maximum tensile and maximum compressive stress. [8]

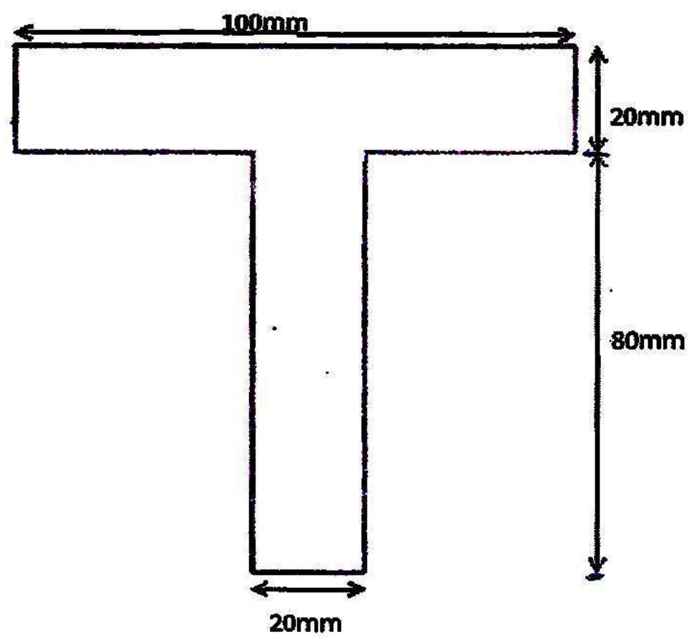


Fig. 5.1

(*b*) Determine shear stress at important points and show shear stress distribution diagram for a given beam as shown in Fig. 5.2.

The maximum shear force on beam is 150 kN. [8]

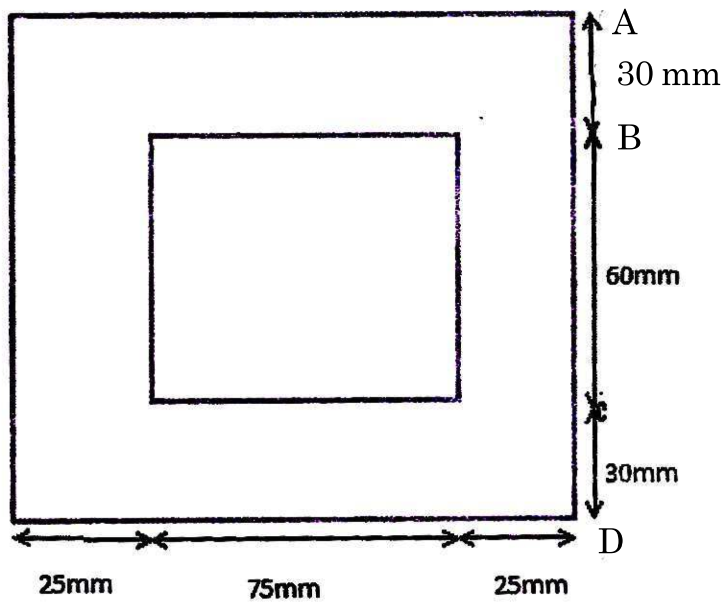


Fig. 5.2

Or

6. (*a*) A wooden rectangular section 230 × 400 mm deep is strengthened by fixing two steel plates as top and bottom of the section 230 mm wide and 12 mm thick Es/Ew = 20 and allowable stress in steel and timber are 200 MPa and 20 MPa respectively Find the MR of section. [8]

(*b*) A simply supported beam as shown in Fig. 6.2 is subjected to loading. Calculate the shear stress distribution at point 1 m from left support. A beam of rectangular in c/s of size 230 mm × 450 mm. [8]

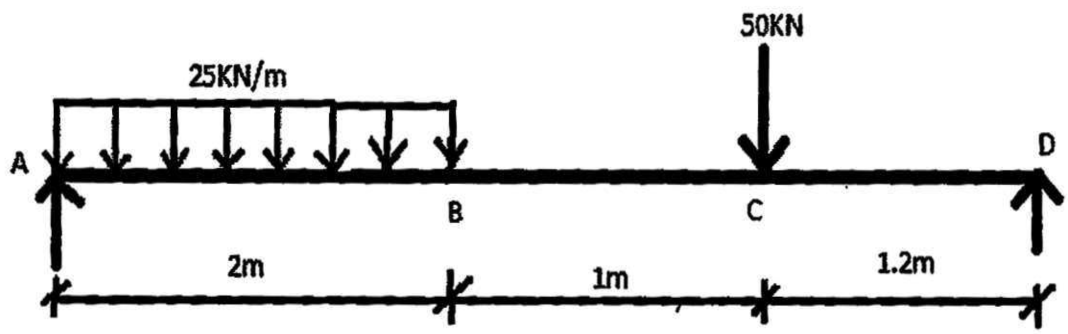


Fig. 6.2

SECTION II

7. (*a*) A hollow shaft is to transmit 300 kN power at 80 rpm. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter is 0.6 of the external. Find the external and internal diameter assuming that the maximum torque is 1.4 times the mean. [9]

(*b*) The maximum stress produced by a pull in a bar of length 1 m is 180 N/mm^2. The area of c/s and length is as shown in Fig. 7.2. Calculate strain energy stored in the bar if E = 200 kN/mm^2. [9]

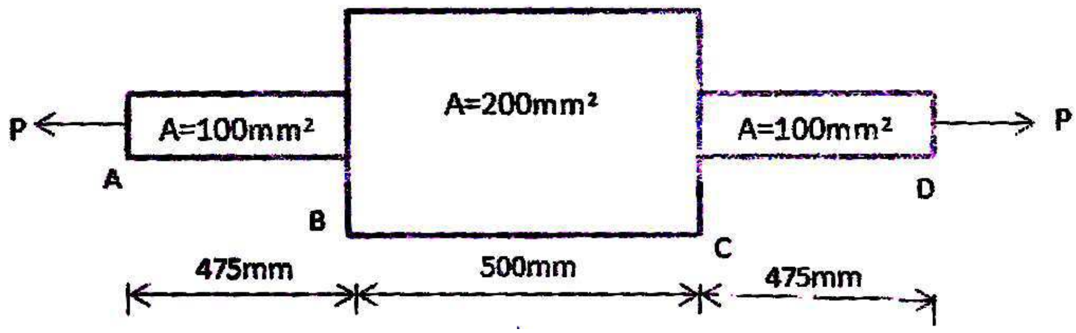


Fig. 7.2

Or

8. (*a*) A shaft of different materials is fixed at the ends and subjected to twisting couples T_1 = 180 kN-mm and T_2 = 280 kN-mm as shown in Fig. 8.1. Find shear stress and angle of twist in each member. [9]

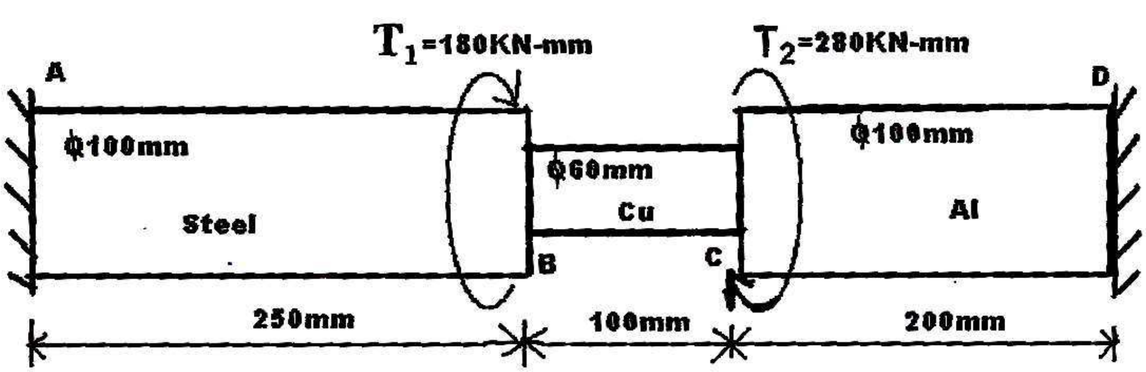


Fig. 8.1

(*b*) The maximum instantaneous extension produced by an unknown falling weight through a height of 4 cm in a vertical bar of length 3 m and of c/s area 5 cm^2 is 2.1 mm. [9]

Determine :

(1) The instantaneous stress induced in the vertical bar, and

(2) The value of unknown wt. Take $E = 2 \times 10^5$ N/mm^2.

9. (*a*) The stresses at a point in a bar are 200 N/mm^2 tensile and 100 N/mm^2 compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of major stress. Also determine the maximum intensity of shear stress in the material at the point. [8]

(*b*) A solid shaft of 85 mm diameter has to resist a bending moment of 450 kN-m accompanied by torque 330 kN-m. Calculate maximum principal stress induced in the shaft. Also calculate the maximum shear stress reduced. [8]

Or

10. (*a*) A point in strained material is subjected to stress showing in Fig. 10.1. Using Mohr's circle method, determine the normal and tangential stress across oblique plane. [8]

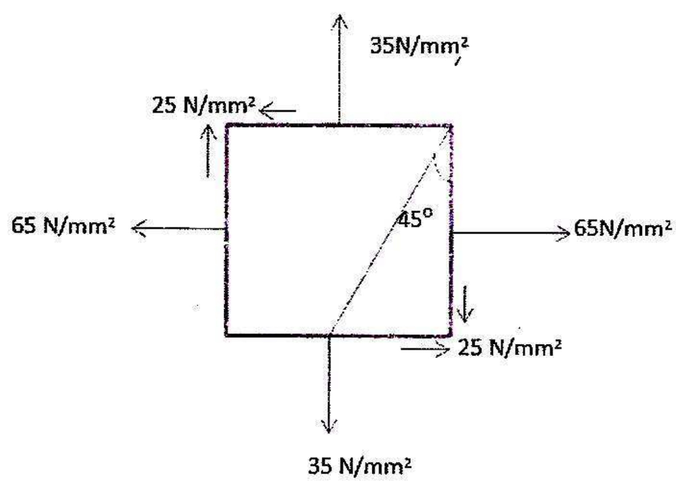


Fig. 10.1

(*b*) Derive the expression for equivalent torque T and equivalent bending moment M_e when a shaft is under combined action of bending moment M and torsion T. [8]

11. (*a*) Compare the critical loads given by the Euler and Rankine's formula for a circular column of 35 mm diameter and 2.5 mm long. Take yield stress as 320 MPa. Rankine's constant a = 1/7500 and E = 200 GPa. [8]

(*b*) A short column (230 × 150) mm is subjected to an eccentric load of 30 kN at an eccentricity of 50 mm in the plane bisecting the 150 mm side. Find maximum and minimum intensities of stress at the face and draw stress distribution diagram. [8]

Or

12. (*a*) Derive an expression for Euler's critical load for a column having both ends hinged. [8]

(*b*) A short column of rectangular c/s 80 mm by 60 mm carries a load of 40 kN at a point E. Determine the maximum compressive and tensile stresses in section. Refer Fig. 12.1 [8]

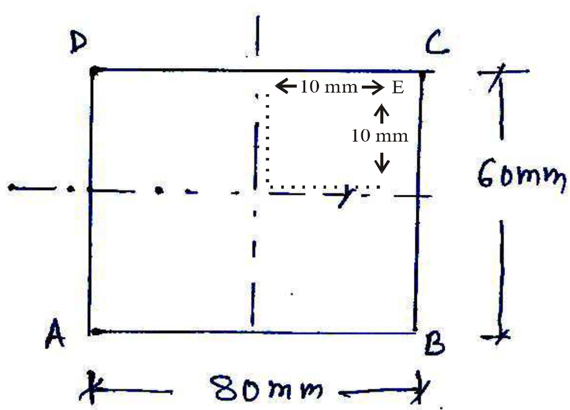


Fig. 12.1

Total No. of Questions—**12**]　　　　[Total No. of Printed Pages—**8+3**

Seat No.	

[4657]-31

S.E. (Electrical/Inst./Comp./I.T.) (First Semester)

EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

Time : Three Hours　　　　**Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, electronic pocket calculator is allowed.

(*v*) Neat diagrams must be drawn wherever necessary.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Solve any *three* : [12]

(*i*) $(D^2 + 4)\, y = x \sin x$

P.T.O.

(*ii*) $\dfrac{d^2y}{dx^2} - y = x \sin x + \left(1 + x^2\right)e^x$

(*iii*) $(1 + x)^2 \dfrac{d^2y}{dx^2} + (1 + x)\dfrac{dy}{dx} + y = 2\sin\left[\log(1 + x)\right]$

(*iv*) $\dfrac{dx}{y^2} = \dfrac{dy}{-xy} = \dfrac{dz}{x(z-2y)}$.

(*b*) A circuit consists of an inductance L and condenser of capacity C in series. An alternating e.m.f. E sin nt is applied to it at time $t = 0$; the initial current and charge on the condenser being zero. Find the charge at any time for $w \neq n$; $w^2 = \dfrac{1}{\text{LC}}$. [5]

Or

2. (*a*) Solve any *three* : [12]

(*i*) $(D^2 + 2D + 1)\ y = xe^{-x} \cos x$

(*ii*) $\dfrac{d^3y}{dx^3} - y = \left(1 + e^x\right)^2$

(*iii*) $(D^2 + 1)\ y = \operatorname{cosec} x$ [Use method of variation of parameter]

(*iv*) $x^2 \dfrac{d^2y}{dx^2} - 3x\dfrac{dy}{dx} + 5y = x^2 \sin(\log x)$.

(*b*) Solve : [5]

$$\frac{dx}{dt} + 2x - 3y = t$$

$$\frac{dy}{dt} + 2y - 3x = e^{2t}.$$

3. (*a*) If

$$u = \frac{1}{2}\log\left(x^2 + y^2\right) \text{ and}$$

$$f(z) = u + iv$$

is analytic then find $f(z)$ in terms of z and hence find v. [5]

(*b*) Find bilinear transformation which maps the points $z = 1, i, -1$ to the points $0, 1, \infty$ respectively. [6]

(*c*) By using Cauchy's formula evaluate : [5]

$$\oint \frac{e^z}{z^2 + 1}\, dz$$

over $|z - 1| = 1$.

Or

4. (*a*) Apply residue theorem to evaluate :

$$\oint_C \frac{z + 2}{z^2 + 1}\, dz$$

where C is $|z - i| = \frac{1}{2}$. [6]

(*b*) If both $f(z)$ and $\overline{f(z)}$ are analytic functions of z then prove that $f(z)$ is constant function. [5]

(*c*) Find the map of straight line $y = x$ under the transformation : [5]

$$w = \frac{z - 1}{z + 1}.$$

5. (*a*) Find Fourier cosine transform of [5]

$$f(x) = \begin{cases} \cos x, & 0 < x < a \\ 0, & x \geq a \end{cases}.$$

(*b*) Solve the integral equation : [6]

$$\int_0^\infty f(x) \sin \lambda x \, dx = e^{-\lambda}, \qquad \lambda > 0.$$

(*c*) Find the z-transform of (any *two*) : [6]

(*i*) $f(k) = k5^k, \ (k \geq 0)$

(*ii*) $f(k) = e^{-3k} \sin 4k, \ (k \geq 0)$

(*iii*) $f(k) = \dfrac{e^{-k} - e^{-2k}}{k}.$

Or

6. (*a*) Use z-transform to solve : [5]

$$f(k+1) - f(k) = 1;$$

$$f(0) = 0;\ k \geq 0.$$

(*b*) Find inverse z-transform of (any *two*) : [6]

(*i*) $\dfrac{z}{(z-1)(z-2)};\ |z| > 2$

(*ii*) $\dfrac{z(z+1)}{(z-1)^2};\ |z| > 1$

(*iii*) $\dfrac{z}{(z-2)(z+4)^2}$

(Use inversion integral method.)

(*c*) Solve the integral equation : [6]

$$\int_0^\infty f(x) \cos \lambda x \, dx = \begin{cases} 1 \ ; \ 0 < \lambda < 1 \\ 2 \ ; \ 1 < \lambda < 2 \\ 0 \ ; \quad \lambda > 2 \end{cases}.$$

SECTION II

7. (*a*) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. From the given information obtain the first four central moments, mean, standard deviation and coefficient of skewness and kurtosis. [9]

(*b*) The following are the values of import of raw material and export of finished product in suitable units :

Export	**Import**
10	12
11	14
14	15
14	16
20	21
22	26
16	21
12	15
15	16
13	14

Calculate the coefficient of correlation between the import values and export values. [8]

Or

8. (*a*) A can hit the target 1 out of 4 times, B can hit the target 2 out of 3 times, C can hit the target 3 out of 4 times. Find the probability of at least two hit the target. [6]

(*b*) Probability of a man aged 60 years will live for 70 years is $\frac{1}{10}$. Find the probability of 5 men selected at random 2 will live for 70 years. [5]

(*c*) Assuming that the diameter of 1000 brass plugs taken consecutively from machine form a normal distribution with mean 0.7515 cm and standard deviation 0.0020 cm. How many of the plugs are likely to be approved if the acceptable diameter is 0.752 ± 0.004.

[Area corresponding to 2.25 is 0.4878 and Area corresponding to 1.75 is 0.4599]. [6]

9. (*a*) The position vector of a particle at time t is :

$$\bar{r} = \cos(t-1)\,\bar{i} + \sinh(t-1)\,\bar{j} + mt^3\,\bar{k}.$$

Find the condition imposed on m by requiring that at time $t = 1$, the acceleration is normal to the position vector. [5]

(*b*) Find the directional derivative of the function :

$$\phi = e^{2x-y-z}$$

at (1, 1, 1) in the direction of the tangent to the curve

$$x = e^{-t},\ y = 2 \sin t + 1,\ z = t - \cos t$$

at $t = 0$. [5]

(*c*) Solve any *two* : [6]

(*i*) Show that the vector field $f(r)\bar{r}$ is always irrotational.

(*ii*) Show that :

$$\bar{a} \cdot \nabla\left[\bar{b} \cdot \nabla\left(\frac{1}{r}\right)\right] = \frac{3(\bar{a} \cdot \bar{r})(\bar{b} \cdot \bar{r})}{r^5} - \frac{(\bar{a} \cdot \bar{b})}{r^3}.$$

(*iii*) If $\bar{u}$ and $\bar{v}$ are irrotational vectors then prove that $\bar{u} \times \bar{v}$ is solenoidal vector.

Or

10. (*a*) Show that : [5]

$$\bar{F} = (6xy + z^3)\bar{i} + (3x^2 - z)\bar{j} + (3xz^2 - y)\bar{k}$$

is irrotational. Find scalar ϕ such that :

$$\bar{F} = \nabla\phi.$$

(*b*) If the directional derivative of

$$\phi = axy + byz + cxz$$

at (1, 1, 1) has maximum magnitude 4 in a direction parallel to x-axis. Find the values of a, b, c. [5]

(*c*) Solve any *two* : [6]

(*i*) Show that :

$$\nabla^4 \left(r^2 \log r\right) = \frac{6}{r^2}.$$

(*ii*) Show that :

$$\bar{F} = \frac{\bar{a} \times \bar{r}}{r^n}$$

is solenoidal field.

(*iii*) For constant vector $\bar{a}$, show that :

$$\nabla \times \left(\bar{a} \times \bar{r}\right) = 2\bar{a}.$$

11. (*a*) Evaluate : [5]

$$\oint_C x^2 \, dx + xy \, dy$$

over the curve 'C' bounded by $y = x^2$ and the line $y = x$ by using Green's theorem.

(*b*) Evaluate : [6]

$$\iint_S \overline{F} \cdot \overline{ds},$$

where 'S' is the surface of sphere

$$x^2 + y^2 + z^2 = 1$$

which lies in positive octant and

$$\overline{F} = yz\overline{i} + xz\overline{j} + xy\overline{k}.$$

(*c*) Evaluate : [6]

$$\iint_S \left(\nabla \times \overline{F}\right) \cdot \overline{ds}$$

where

$$\overline{F} = \left(x^3 - y^3\right)\overline{i} - xyz\overline{j} + y^3\overline{k}$$

and 'S' is the surface

$$x^2 + 4y^2 + z^2 - 2x = 4$$

above the plane $x = 0$.

Or

12. (*a*) Find the work done in moving a particle once round the ellipse

$$\frac{x^2}{25} + \frac{y^2}{16} = 1, \ z = 0$$

under the field of force given by : [5]

$$\overline{F} = (2x - y + z)\overline{i} + \left(x + y - z^2\right)\overline{j} + (3x - 2y + 4z)\overline{k}.$$

(*b*) Evaluate : [6]

$$\iint_S \left(x^3\bar{i} + y^3\bar{j} + z^3\bar{k}\right) \cdot \overline{ds}$$

where 'S' is the surface of the sphere :

$$x^2 + y^2 + z^2 = 16.$$

(*c*) Apply Stokes' theorem to calculate : [6]

$$\int_C 4ydx + 2zdy + 6ydz$$

where C is the curve of intersection of

$$x^2 + y^2 + z^2 = 6z \text{ and } z = x + 3.$$

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-32

S.E. (Electrical) (First Semester) EXAMINATION, 2014

POWER PLANT ENGINEERING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *three* questions from Section I and any *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

(*v*) Use of scientific calculator, steam tables, Mollier chart is allowed.

Section I

Unit I

1. (*a*) Compare Carnot cycle with Rankine cycle with T-S diagram and state the advantages of Reheat cycle. [8]

(*b*) What is meant by flue gas analysis ? Explain with neat sketch instrument utilized for it. [8]

P.T.O.

Or

2. (*a*) Explain with neat sketch Pulverized bed combustion system. [8]

   (*b*) Which calorimeter is utilized for determination of C.V. of gaseous fuel ? Explain in detail with neat sketch. [8]

Unit II

3. (*a*) Explain with a neat sketch the working of modern thermal power plant. [8]

   (*b*) Compare Impulse and Reaction Turbine. [5]

   (*c*) Write a short note on surface condenser with neat sketch. [5]

Or

4. (*a*) What is Boiler Draught ? Explain natural and artificial draught with sketches. [6]

   (*b*) Explain coal handling system in coal thermal power plant with neat flow chart. [6]

   (*c*) Explain with neat sketch Pneumatic Ash Handling System. [6]

Unit III

5. (*a*) Draw the schematic layout of hydroelectric power plant and discuss the functions of each component and operation of plant. [8]

(*b*) Explain the working of surge tank and give its classification with neat sketches. [8]

Or

6. (*a*) Explain the following terms with sketches : [6]

(*i*) Hydrograph

(*ii*) Flow duration curve

(*iii*) Mass curve.

(*b*) Explain with neat sketch the working of : [10]

(*i*) Pelton Wheel

(*ii*) Francis Turbine.

Section II

Unit IV

7. (*a*) What are the factors considered for site selection of Nuclear Power Plant ? [6]

(*b*) Explain with neat sketch the working of a Gas Cooled Reactor. [10]

Or

8. (*a*) State advantages, disadvantages and applications of Diesel Power Plant. [8]

(*b*) Explain with neat sketch the working of a BOSCH fuel pump. [8]

Unit V

9. (*a*) State the advantages and disadvantages of gas turbine power plants over diesel and thermal power plants. [8]

(*b*) Explain with neat sketch the working of an Open Cycle Gas Turbine Plant. [8]

Or

10. (*a*) Write a short note on "Prospectus and Development of Non-conventional Power Plants" in India. [8]

(*b*) Explain with neat sketch the working of a "Geothermal Power Plant". [8]

Unit VI

11. (*a*) Explain the different factors affecting cost of power generation. [6]

(*b*) The maximum load on a thermal power plant of 70 MW capacity is 55 MW at an annual load factor of 60%. The coal consumption is 0.96 kg/unit of energy generated and the cost of coal is Rs. 2 per kg. Find the annual revenue earned, if the electrical energy is sold at Rs. 2.5 per kW/hr. [12]

Or

12. (*a*) Write a short note on "Load Duration Curve". [6]

(*b*) Calculate the Annual energy generated and the cost of power generation per kWh for a power station having the following data :

(*i*) Installed capacity of the plant 200 MW

(*ii*) Capital cost = Rs. 400 crores

(*iii*) Rate of interest and depreciation = 12%

(*iv*) Annual cost of fuel, salaries and taxation = Rs. 5 crores and load factor is 50%. [12]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-33

S.E. (Electrical) (First Semester) EXAMINATION, 2014

MATERIAL SCIENCE

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt any *three* questions from Section I and Section II each.

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

(*iii*) Assume suitable data, if necessary.

(*iv*) Draw diagrams wherever necessary.

***Physical Constants* :—**

(*i*) Angstrom Unit (AU) = 1×10^{-10} metres

(*ii*) Boltzmann's Constant (k) = 1.380×10^{-23} joule.degree-1

(*iii*) Charge on Electron (e) = 1.601×10^{-19} coulomb

(*iv*) Mass of Electron (m) = 9.107×10^{-31} kg.

(*v*) Electron volt (eV) = 1.602×10^{-19} joules

(*vi*) Mass of Proton (m_p) = 1.627×10^{-27} kg

(*vii*) Velocity of light (c) = 2.998×10^{8} m/sec

(*viii*) Dielectric Constant of free space (ε_0) = 8.854×10^{-12} F/m

(*ix*) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$ H/m

(*x*) Debye Unit = 3.33×10^{-30} coulomb.metre.

SECTION I

1. (*a*) Derive Clausius-Mossotti relation as applied to dielectric materials in static field. State clearly the assumptions made. [8]

(*b*) State different types of photoelectric cells. Describe with neat diagram, construction and working of photoconductive cell. [8]

Or

2. Write short notes on : [16]

(*i*) Piezoelectric materials

(*ii*) Polar and non-polar dielectric materials

(*iii*) Dielectric loss tangent

(*iv*) Photoemissive cell.

3. (*a*) Write down properties and applications of paper and pressboard. [9]

(*b*) Define the following with the units : [8]

(*i*) Primary Ionization

(*ii*) Secondary Ionization of Gases

(*iii*) Breakdown Voltage

(*iv*) Breakdown Strength.

Or

4. (*a*) Write down properties and applications : [8]

(*i*) Ceramics

(*ii*) Transformer Oil

(*iii*) Varnish

(*iv*) Mica.

(*b*) Write insulating materials used in Capacitors and Switchgears. [9]

5. (*a*) Derive Curie and Weiss law for Ferro-magnetic materials. Hence explain spontaneous magnetisation. [9]

(*b*) A magnetic field strength of a material is 1.0×10^6 A/m. If the susceptibility of the material is 0.0014, calculate its permeability, flux density and magnetization. [8]

Or

6. (*a*) Write a short note on magnetic tape recorders. [8]

(*b*) Differentiate between Permeability and Magnetic Susceptibility. Hence derive relationship between two. [9]

SECTION II

7. Write down properties and applications of the following : [16]

(*i*) Material used for solders

(*ii*) Tungsten

(*iii*) Brass and Bronze

(*iv*) Constantan.

Or

8. (*a*) Write a short note on Thermal Bimetal and Thermocouple. [8]

(*b*) Explain superconductivity and its applications. [8]

9. (*a*) Explain in brief energy bands in insulators, semiconductors and conductors. [9]

(*b*) Write a short note on Carbon Nano-structures and Carbon Clusters. [9]

Or

10. (*a*) Write a short note on BN Nanotubes and Nano wires. [9]

(*b*) What are carbon nano-tubes ? Write down applications of carbon nano-tubes. [9]

11. (*a*) Explain various tests conducted on high voltage bushing. [8]

(*b*) Describe method of measurement of tan delta and resistivity of liquid insulating material. [8]

Or

12. (*a*) Describe measurement of flux density with Gauss meter. What is the principle of operation of Gauss meter ? [8]

(*b*) With a neat sketch describe the method of measurement of Dielectric strength of solid insulating material as per IS 2584. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-34

S.E. (Electrical) (First Semester) EXAMINATION, 2014

ANALOG AND DIGITAL ELECTRONICS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Draw and explain the working of RC-coupled transistorized amplifier. Give the advantages, disadvantages and applications also. [9]

(*b*) Explain with neat circuit diagram working of Push Pull amplifier. [9]

Or

2. (*a*) Explain transfer and drain characteristics of FET. [9]

(*b*) Explain input-output characteristics of CE configuration with neat connection diagram and characteristic curve. [9]

3. (*a*) Define the following terms related with operational amplifier and give their values for practical OPAMP : [8]

(*i*) Open loop gain

(*ii*) Input offset voltage

(*iii*) Input bias current

(*iv*) Input offset current.

(*b*) Explain with the help of circuit diagram the operation of an OPAMP comparator. Also draw the transfer characteristics of the comparator. [8]

Or

4. (*a*) Explain the circuit of voltage to current converter (V to I) converter with floating load. Mention the field of application. [8]

(*b*) Explain OPAMP as an integrator. [8]

5. (*a*) Explain OPAMP as triangular wave generator. [8]

(*b*) Explain the following parameters related to voltage generator : [8]

(*i*) Line regulation

(*ii*) Load regulation

(*iii*) Output resistance

(*iv*) Voltage stability factor.

Or

6. (*a*) Explain the operation of IC555 as an Astable Multivibrator. [8]

(*b*) Explain the typical connection diagram of IC LM 317. State the advantages of variable voltage IC regulator over fixed voltage IC regulator. [8]

SECTION II

7. (*a*) Solve : [12]

(*i*) What is the octal equivalent of decimal 294.6875_{10} ?

(*ii*) Convert the following number to hexadecimal equivalent 62395_{10}.

(*iii*) Convert the following binary number to Gray code 10011011_{binary}

(*iv*) Excess-3 code $(295)_{10}$.

(*b*) Perform the following operation : [6]

(*i*) Solve using Boolean Algebra

$$\bar{A}\bar{B}\bar{C}\bar{D} + \bar{A}\bar{B}\bar{C}D + A\bar{B}\bar{C}\bar{D} + A\bar{B}\bar{C}D$$

(*ii*) Subtract using 2's complement $17_{10} - 22_{10}$.

Or

8. (*a*) What is a comparator ? Design and draw a 1 bit comparator circuit using K-map. [9]

(*b*) Draw Multiplexer circuit 8 : 1 using NAND gate and Strobe. [9]

9. (*a*) Draw and discuss logic diagram of SR flip-flop and how to build JK flip-flop using SR flip-flop. Write the truth table for both. [8]

(*b*) Explain 4-bit SIS0 shift register and hence explain twisted ring counter. Draw Timing diagram. [8]

Or

10. (*a*) What is the Modulus of counter ? Design a MOD-10 counter. Draw circuit diagram and truth table of 4 bit ripple counters. [8]

(*b*) Explain the following terms with reference to flip-flops : [8]

(*i*) Level triggering

(*ii*) Edge triggering.

11. (*a*) Differentiate between Multiplexer and Demultiplexer with its applications. [8]

(*b*) Differentiate between Synchronous and Asynchronous counter. Draw and explain the circuit diagram of synchronous counter using JK flip-flops. [8]

Or

12. (*a*) Give the complete classification of memories. [8]

(*b*) Explain R-2R ladder Digital to Analog converter. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-35

S.E. (Electrical) (First Semester) EXAMINATION, 2014

ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I.

(*ii*) Answer Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*iii*) Answers to the two Sections should be written in separate answer-books.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Figures to the right indicate full marks.

(*vi*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vii*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Which three forces are required for satisfactory operation of an analog indicating instrument ? State the function of each force. [6]

P.T.O.

(*b*) What are shunts and multipliers ? What are the disadvantages of shunt ? [6]

(*c*) With a neat sketch, explain construction and working of moving iron instrument. What are the advantages of this instrument ? [6]

Or

2. (*a*) Explain advantages and disadvantages of MI and PMMC instrument. [9]

(*b*) Design a multi-range D.C. milli-ammeter using a basic movement with an internal resistance Rm = 50 Ω and a full scale deflection current Im = 1 mA. The ranges required are 0—10 mA, 0—50 mA, 0—100 mA and 0—500 mA. [9]

3. (*a*) Draw a circuit diagram of Anderson's bridge. Derive the expression for unknown inductance and draw the phasor diagram. [8]

(*b*) Draw circuit diagram of Kelvin's double bridge. Derive an expression for unknown resistance with usual notations. [8]

Or

4. (*a*) Write a short note on megger. [8]

(*b*) A 4 terminal resistor of approximately 50 μΩ resistance was measured by means of a Kelvin bridge having the following component resistance :

Standard resistance = 100.03 μΩ

Inner ratio arms = 100.31 Ω and 200 Ω

Outer ratio arms = 100.24 Ω and 200 Ω

Resistance of link connecting the standard and unknown resistance = 700 μΩ

Calculate the unknown resistance and draw circuit diagram. [8]

5. (*a*) Draw and explain working principle of dynamometer type wattmeter and derive its torque equation. [8]

(*b*) Draw and explain the three wattmeter method for measurement of power in three-phase system for balanced and unbalanced load. [8]

Or

6. (*a*) A wattmeter reads 5 kW when its current coil is connected in red phase and its voltage coil is connected between neutral and red phase of symmetrical 3-phase system supplying a balanced three-phase inductive load of 25 A at 440 V. What will be the reading of the wattmeter if the connections of current coil remain unchanged and voltage coil be connected between blue and yellow phases ? Hence determine the total reactive power in the circuit. Draw the diagram in both the cases. [8]

(*b*) Write a short note on LPF type wattmeter. [4]

(*c*) What are the errors in dynamometer type wattmeter ? How are these errors compensated ? [4]

SECTION II

7. (*a*) What are the disadvantages of shunt and multiplier when it is used for measurement of a.c. high current and voltage ? [8]

(*b*) Describe construction and working of single-phase induction type energy-meter with a neat diagram. Also draw the phasor diagram of energy-meter showing respective quantities. [10]

Or

8. (*a*) Define the following terms associated with instrument transformer : [8]

(*i*) Transformation ratio

(*ii*) Turns ratio

(*iii*) Nominal ratio

(*iv*) Phase angle error.

(*b*) What is meant by creeping in an energy-meter and how is it prevented ? [6]

(*c*) Draw the experimental set-up used in laboratory to calibrate the single-phase energy-meter. [4]

9. (*a*) What are Lissajous figures ? How can these be used to measure frequency and phase angle ? [8]

(*b*) Explain measurement of pressure using McLeod gauge. [8]

Or

10. (*a*) Give a detailed classification of transducers. [8]

(*b*) With a suitable sketch explain working of dual trace CRO. [8]

11. (*a*) With a neat sketch explain the construction and working of LVDT. State its advantages and disadvantages. [8]

(*b*) Explain hydraulic method for measurement of level. [8]

Or

12. (*a*) What is a strain gauge ? How is it classified ? Explain any *one* type of strain gauge in detail. [8]

(*b*) Explain ultrasonic flow-meter with a neat diagram. [8]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-4

S.E. (Civil) (First Semester) EXAMINATION, 2014

ENGINEERING GEOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answers to the two sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Assume suitable data, if necessary.

SECTION I

1. 'Igneous rocks show wide variety of textures due to their different mode of origin'. Explain with suitable examples. [16]

Or

(*a*) Describe textures formed by 'Dynamothermal' metamorphism. [8]

(*b*) What is weathering ? Describe in detail 'Disintegration' and 'decomposition' processes. [8]

2. (*a*) What is 'Rejuvenation' ? Describe any *two* features resulting from rejuvenation with neat sketches. [8]

(*b*) Describe in detail 'Physiographic divisions of India'. Write a note on importance of 'Dharwar' rocks. [8]

Or

(*a*) State and explain general principles of 'Stratigraphy'. [8]

(*b*) Explain with neat sketches 'Erosional' and 'Depositional' work of rivers. [8]

3. (*a*) How are rocks folded ? Describe different types of 'Folds'. Explain, how fold passes into the 'Fault'. [10]

(*b*) Write a note on 'Discordant' igneous intrusions. [8]

Or

(*a*) What structural features are developed due to 'Concordant' igneous intrusions ? [9]

(*b*) Write a note on 'Mountain Building' activities. [9]

SECTION II

4. (*a*) Discuss in detail drilling as a method of Subsurface Geological Exploration giving its limitations. [10]

(*b*) Write a note on applications of remote sensing in Civil Engineering. [6]

Or

(*a*) Describe Geography, Geology and History of the map attached herewith (Fig. No. 1) [10]

(*b*) Write a note on quality and quantity of returning drill water. [6]

5. (*a*) What are the earthquakes ? How are they caused ? Explain seismic waves. [10]

(*b*) Discuss influence of texture and structure of rocks on groundwater storage. [6]

Or

Write notes on the following :

(*a*) Causes of landslides and their preventive measures. [10]

(*b*) Factors governing bearing capacity of rocks. [6]

6. (*a*) What are common defects occurring at dam sites ? Explain treatment to be given to these defects. [8]

(*b*) What problems are to be faced while tunneling through folded and faulted strata ? [6]

(*c*) State importance of Pilot-Cut along dam alignment. [4]

Or

(*a*) Discuss in detail about difficulties may have to be faced while tunneling through Deccan Trap basalts. [13]

(*b*) Write a note on geological conditions suitable for Reservoir site. [5]

4. (*a*)

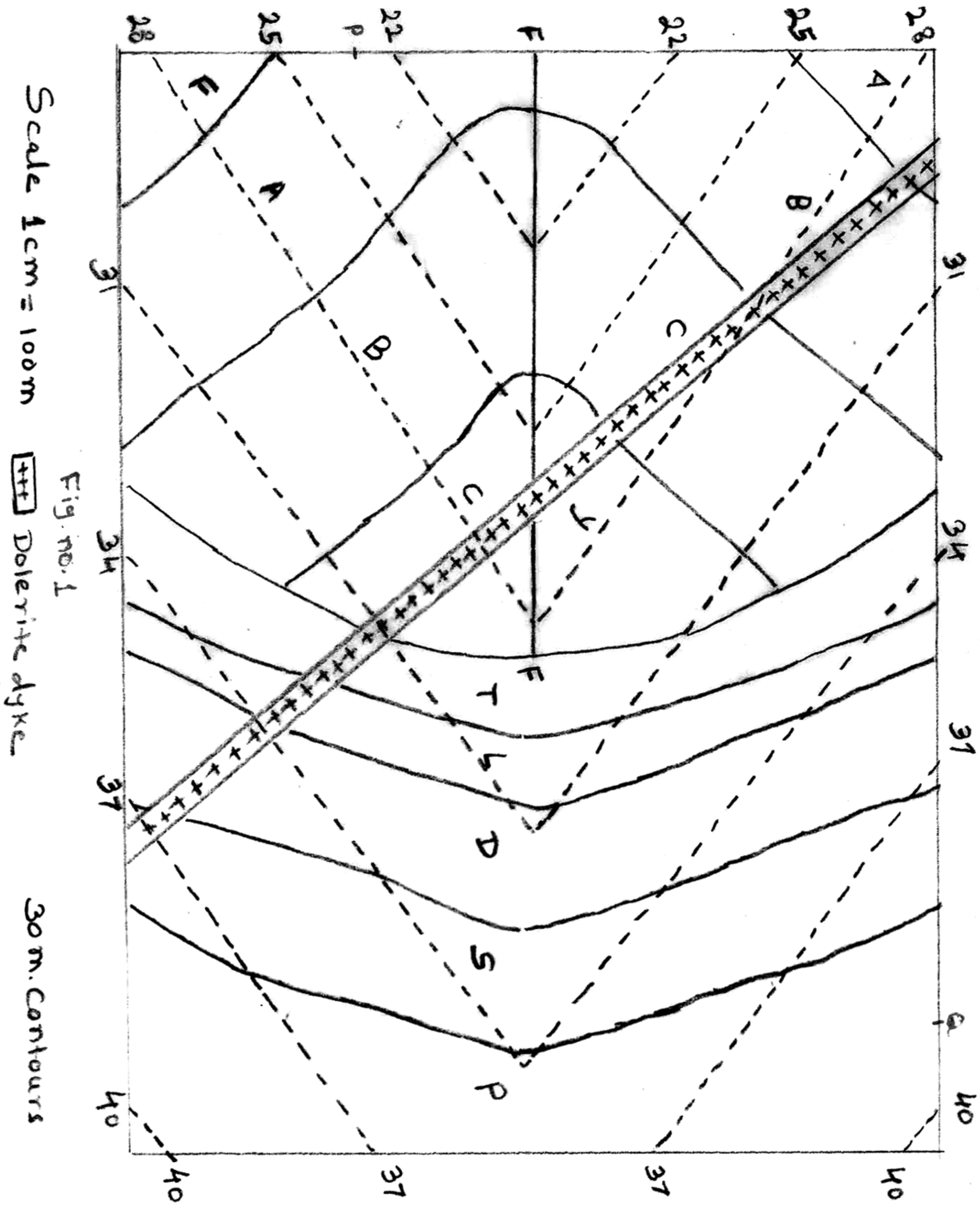


Fig. 1

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-40

S.E. (Electrical) (Second Semester) EXAMINATION, 2014

DIGITAL COMPUTATIONAL TECHNIQUES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain what is error and explain relative and absolute error with examples. [6]

(*b*) State Descartes' rule of sign and determine the no. of possible roots for the equation :

$$f(x) = x^4 - 5x^3 - x^2 + 15x - 5 = 0.$$ [6]

P.T.O.

(*c*) Perform 2 iterations of Birge Vieta method to find the smallest positive root of the following equation. Take initial approximation $p_0 = 0.5$:

$$f(x) = x^4 - 3x^3 + 3x^2 - 3x + 2 = 0.$$ [6]

Or

2. (*a*) Explain the term significant digits. What is its importance ? [6]

(*b*) Using synthetic division, obtain $f(2)$, $f'(2)$, $f''(2)$ $f'''(2)$ for

$$f(x) = 2x^3 - 6x + 13 = 0.$$ [6]

(*c*) Explain floating point representation of numbers. What is the importance of normalized floating point representation ? [6]

3. (*a*) Using NR method, find the root of the function $f(x) = e^x - 3x^2$ to an accuracy of 5 digits. Take $x_0 = 1$. [8]

(*b*) With neat diagram, explain secant method for solution of transcendental equation and derive the formula. [8]

Or

4. (*a*) Explain bisection method to find root of an equation. [8]

(*b*) Using Regula-Falsi method, find a real root of the equation $x^4 - 11x + 8 = 0$ take $x_0 = 1$ and $x_1 = 2$. Show 4 iterations. [8]

5. (*a*) Explain Jacobi iterative method to solve linear simultaneous equations. [8]

(*b*) Using Gauss-Seidel method, solve the following system of linear simultaneous equations. Show 4 iterations : [8]

$$8x + 2y - 2z = 8$$
$$x - 8y + 3z = -4$$
$$2x + y + 9z = 12.$$

Or

6. (*a*) Explain Gauss Elimination method to solve linear simultaneous equations. [8]

(*b*) Find inverse of matrix A using Gauss-Jordan method : [8]

$$A = \begin{bmatrix} 2 & 2 & 0 \\ -2 & 1 & 1 \\ 3 & 0 & 1 \end{bmatrix}.$$

SECTION II

7. (*a*) Derive the formula for Newton's forward interpolation. [8]

(*b*) Given that :

x	f
5	380
6	–2
9	196
11	508

Compute $f(10)$ using Lagrange's Interpolation formula. [8]

Or

8. (*a*) Explain least square method to fit the data into a straight line. Fit a straight line to the following data considering y as a dependent variable : [8]

x	y
1	5
2	7
3	9
4	10
5	11

(*b*) Apply Bessel's interpolation formula to obtain $f(25)$ given that : [8]

x	y
20	2860
24	3167
28	3555
32	4112

9. (*a*) Solve the equation $\frac{dy}{dx} = \sqrt{x + y}$, with $x_0 = 0$, $y_0 = 1$ to find y at $x = 0.2$ and $h = 0.1$. [8]

(*b*) Explain Taylor series method for solution of ordinary differential equation. [8]

Or

10. (*a*) Given with $y(0) = 0$, $y(0.2) = 0.2027$, $y(0.4) = 0.4228$ and $y(0.6) = 0.6841$. Compute $y(0.8)$ using Milne Simpson method. [8]

(*b*) Use Euler's method to solve ordinary differential equation :

$$\frac{dy}{dx} = \frac{1}{2}y, \; y(0) = 1 \quad \text{and} \quad h = 0.1.$$

Find $y(0.5)$. [8]

11. (*a*) Derive Newton Cote's Quadrature formula for numerical integration. From the same derive Simpson's 1/3rd rule for numerical integration. [9]

(*b*) Evaluate the integral

$$\int_0^{1.0} e^x dx,$$

by Simpson's 3/8 rule and trapezoidal rule taking 7 ordinates. [9]

Or

12. (*a*) Derive an expression for finding 1st and 2nd order differentiation using Newton's backward difference interpolation formula for equal interval data points. Write down the formula for at 1st and 2nd order differentiation at $x = xn$. [10]

(*b*) From the following table find the value of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at the points $x = 1.0$: [8]

x	y
1	5.4680
1.1	5.6665
1.2	5.9264
1.3	6.2551
1.4	6.6601
1.5	7.1488

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-41

S.E. (E & TC, Electronics)

(Second Semester) Examination, 2014

ENGINEERING MATHEMATICS–III

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data if necessary.

SECTION I

1. (A) Solve any *three* : [12]

(1) $(D^2 + 3D + 2)y = e^{e^x} + \cos e^x$

(2) $(D^2 - 1)y = x \sin x$

P.T.O.

(3) $(D^2 + 1)y = \cot x$ (by method of variation of parameters)

(4) $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = \sin(\log x^2)$.

(B) Solve : [5]

$$\frac{dx}{dt} + y = \sin t; \quad \frac{dy}{dt} + x = \cos t.$$

Or

2. (A) Solve any *three* : [12]

(1) $(D^2 - 2D + 5)y = 25x^2$

(2) $(D^4 - 4D^3 + 6D^2 - 4D + 1)y = e^x + 2^x + \frac{1}{3}$

(3) $(2x + 3)^2 \frac{d^2y}{dx^2} + (2x + 3)\frac{dy}{dx} - 2y = 24x^2$

(4) $(D^2 - 2D + 2)y = e^x \tan x$ (by method of variation of parameters)

(B) An e.m.f. E sin pt is applied at $t = 0$ to a circuit containing a condenser C and inductance L in series. The current x satisfies the equation $L\frac{dx}{dt} + \frac{1}{C}\int x\, dt = E \sin pt$ where $x = -\frac{dq}{dt}$. If $p^2 = \frac{1}{LC}$ and initially the current x and charge q are zero, show that the current in the circuit at time t is given by $\frac{E}{2L} t \sin pt$. [5]

3. (A) Evaluate :

$$\oint_C \frac{z^2 + 1}{z - 2}\, dz$$

where

(*i*) C is the circle $|z - 2| = 1$

(*ii*) C is the circle $|z| = 1$. [5]

(B) Find the bilinear transformation which maps the points 1, 0, i of z-plane onto the points ∞, -2, $-\frac{1}{2}(1 + i)$ of the w-plane. [5]

(C) If the function $f(z) = u + iv$ is analytic, then find $f(z)$ if

$$u + v = e^{-x}(\cos y - \sin y).$$ [6]

Or

4. (A) Find the map of the straight line $y = x$ under the transformation

$$w = \frac{z - 1}{z + 1}.$$ [5]

(B) If $f(z)$ is analytic function then show that :

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4\,|f'(z)|^2.$$ [5]

(C) Evaluate by using residue theorem

$$\oint_C \frac{\sin \pi z^2 + 2z}{(z-1)^2 (z-2)} dz$$

where C is the circle $|z| = 4$. [6]

5. (A) Find z-transform of the following (any *two*) : [6]

(1) $f(k) = k5^k, \ k \geq 0$

(2) $f(k) = \cos \left(\frac{k\pi}{2} + \frac{\pi}{4}\right), \ k \geq 0$

(3) $f(k) = \frac{a^k}{k!}, \ k \geq 0$.

(B) Solve the difference equation :

$$f(k+2) + 3f(k+1) + 2f(k) = 0,$$

$$f(0) = 0, \ f(1) = 1.$$ [5]

(C) Using Fourier integral representation show that :

$$\int_0^\infty \frac{1 - \cos 2\lambda}{\lambda} \sin \lambda x \, d\lambda = \begin{cases} 1, & \text{for } 0 < x < 2 \\ -1, & \text{for } -2 < x < 0 \\ 0, & \text{for } x > 2 \text{ and } x < -2. \end{cases}$$ [6]

Or

6. (A) Find Fourier cosine transform of $f(x) = 2e^{-5x} + 5e^{-2x}, \ x \geq 0$. [5]

(B) Solve the integral equation : [6]

$$\int_0^{\infty} f(x) \sin \lambda x \, d\lambda = \begin{cases} 1-\lambda, & 0 \le \lambda \le 1 \\ 0, & \lambda \ge 1 \end{cases}.$$

(C) Find inverse z-transform of the following (any *two*) : [6]

(1) $\dfrac{1}{(z-2)(z-3)}, |z| > 3$

(2) $\dfrac{z}{\left(z-\frac{1}{4}\right)\left(z-\frac{1}{5}\right)}, \dfrac{1}{5} < |z| < \dfrac{1}{4}$

(3) $\dfrac{10z}{(z-1)(z-2)}$. (by inversion integral method)

SECTION II

7. (A) The velocity distribution of a fluid near a flat surface is given below :

***x*(mm)**	**V(mm/sec)**
0.1	0.72
0.3	1.81
0.6	2.73
0.8	3.47

where 'x' is the distance from the surface and 'V' is the velocity (mm/sec). Using Lagrange's interpolating polynomial, obtain velocity at $x = 0.4$. [5]

(B) Evaluate the integral

$$\int_0^{\pi} \frac{\sin^2 \theta \, d\theta}{5 + 4 \cos \theta}$$

by Simpson's $\frac{3}{8}$th rule. (take $h = \frac{\pi}{6}$). [5]

(C) Using modified Euler's method, solve the following differential equation :

$$\frac{dy}{dx} = x - y^2, \quad y(0) = 1,$$

calculate $y(0.4)$ using $h = 0.2$. [6]

Or

8. (A) The distance travelled by a point 'p' in the $x - y$ plane in a mechanism is as shown in the table below. Estimate the distance travelled, velocity and acceleration of the point 'p'

when $x = 4.5$ mm (Use Newton's Backward difference interpolation formula). [6]

x **(mm)**	y **(mm)**
1	14
2	30
3	62
4	116
5	198

(B) The table below represents the temperature $f(t)$ as a function of time 't' :

Time 't'	**Temperature $f(t)$**
1	81
2	75
3	80
4	83
5	78
6	70
7	60

Estimate $\int_{1}^{7} f(t)\, dt$, using :

(*i*) Simpson's 1/3rd rule

(*ii*) Trapezoidal rule. [4]

(C) Using Runge-Kutta fourth order method, obtain numerical solution of $\frac{dy}{dx} = x^2 + y^2$, $y(1) = 1.5$ in the interval (1, 1.2) with $h = 0.1$ [6]

9. (A) The position vector of a particle at any time 't' is $\vec{r} = \cos(t-1)\hat{i} + \sin h(t-1)\hat{j} + mt^3\hat{k}$, find the value of '$m$' so that acceleration is normal to position vector at $t = 1$. [5]

(B) Find the directional derivative of the function $\phi = e^{2x - y - z}$ at (1, 1, 1) in the direction of tangent to the curve $x = e^{-t}$, $y = 2 \sin t + 1$, $z = t - \cos t$ at $t = 0$. [6]

(C) For scalar functions 'ϕ' and 'ψ' show that :

(*i*) $\nabla \cdot (\phi\nabla\psi - \psi\nabla\phi) = \phi\nabla^2\psi - \psi\nabla^2\phi$

(*ii*) $\nabla^2(\phi\psi) = \phi\nabla^2\psi + \psi\nabla^2\phi$. [6]

Or

10. (A) If the directional derivative of $\phi = axy + byz + czx$ at (1, 1, 1) has maximum magnitude '4' in a direction parallel to x-axis. Find values of a, b, and 'c'. [5]

(B) Prove the following (any *two*) : [6]

(*i*) $\nabla \cdot \left(\dfrac{\vec{a} \times \vec{r}}{r^n} \right) = 0$

(*ii*) $\vec{b} \times \nabla (\vec{a} \cdot \nabla \log r) = \dfrac{\vec{b} \times \vec{a}}{r^2} - \dfrac{2(\vec{a} \cdot \vec{r})}{r^4} (\vec{b} \times \vec{r})$

(*iii*) $\nabla^4 (e^r) = e^r (1 + 4/r)$.

(C) Verify whether the following vector field

$\vec{F} = (y \sin z - \sin x)\,\hat{i} + (x \sin z + 2yz)\,\hat{j} + (xy \cos z + y^2)\,\hat{k}$

is irrotational, if so find corresponding scalar potential 'ϕ'. [6]

11. (A) Verify Green's theorem for $\vec{F} = x\hat{i} + y^2\hat{j}$ over the first quadrant of the circle $x^2 + y^2 = a^2$. [6]

(B) Evaluate $\iint_S (y^2 z^2 \hat{i} + z^2 x^2 \hat{j} + x^2 y^2 \hat{k}) \cdot d\vec{S}$ where 'S' is the upper part of the sphere $x^2 + y^2 + z^2 = 9$, above xoy plane using Gauss divergence theorem. [6]

(C) Using Stokes' theorem, evaluate :

$$\int_C (4y\,\hat{i} + 2z\hat{j} + 6y\,\hat{k}) \,.\, \vec{dr},$$

where 'C' is the curve of intersection of $x^2 + y^2 + z^2 = 2z$ and $x = z - 1$. [5]

Or

12. (A) Find the work done in moving a particle along $x = a \cos \theta$, $y = a \sin \theta$, $z = b\theta$ from $\theta = \frac{\pi}{4}$ to $\theta = \frac{\pi}{2}$ under a field of force given by

$\vec{F} = -3a \sin^2 \theta \cos \theta\, \hat{i} + a(2 \sin \theta - 3 \sin^3 \theta)\, \hat{i} + b \sin^2 \theta \hat{k}\cdot$ [5]

(B) Verify Stokes' theorem for $\vec{F} = x^2\hat{i} + xy\,\hat{j}$ for the surface of a square lamina bounded by $x = -1$, $x = 1$, $y = -1$ and $y = 1$. [7]

(C) Two of Maxwell's electromagentic equations are

$\nabla \,.\, \vec{B} = 0$, $\nabla \times \vec{E} = \frac{-\partial \vec{B}}{\partial t}$. Given $\vec{B} = \text{curl}\ \vec{A}$ Deduce that

$\vec{E} + \frac{\partial \vec{A}}{\partial t} = -$ grad 'v', where 'v' is a scalar point function.

[5]

Total No. of Questions—**12**]   [Total No. of Printed Pages—**8**

Seat No.	

[4657]-42

S.E. (E & TC) (First Semester) EXAMINATION, 2014

SOLID STATE DEVICES AND CIRCUITS

(2008 PATTERN)

Time : Three Hours   **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two sections should be written in separate answer-books.

(*ii*) Answer any *three* questions from each Section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain with characteristics small signal and large signal diode models for forward and reversed biased conditions. [8]

(*b*) For the circuit shown in Fig. 1 let $V_{cc} = 4$ V, R = 40 kΩ. Determine V_D and I_D using ideal diode equation and graphical method. [8]

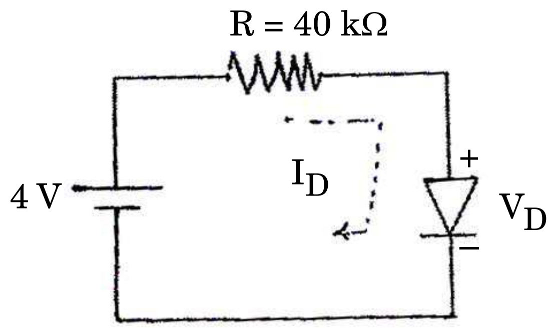


Fig. 1

Or

2. (*a*) With the help of a necessary diagram explain the operation of an *n*-channel enhancement type MOSFET. [8]

(*b*) What is body effect ? What are its drawbacks ? [4]

(*c*) Explain the subthreshold conduction and its disadvantages. [4]

3. (*a*) Explain with a neat diagram and equation how to draw d.c. load line and decide various point and region on it for MOSFET. [8]

(*b*) For the circuit shown in Fig. 2 Determine I_{DQ}, V_{GSQ} and V_{DSQ}

and state the region of operation with $V_{GS(TH)} = 2$ V, $Kn = 0.5$ mA/V^2. [10]

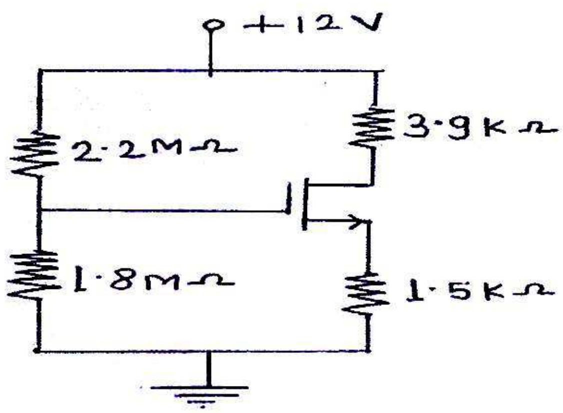


Fig. 2

Or

4. (*a*) For Common Source Amplifier circuit shown in Fig. 3. Determine g_m, r_o, A_v, R_i, R_o. Given $V_T = 1.2$ V, $K = 0.48$ mA/V^2, $\lambda = 0.012$/V. [10]

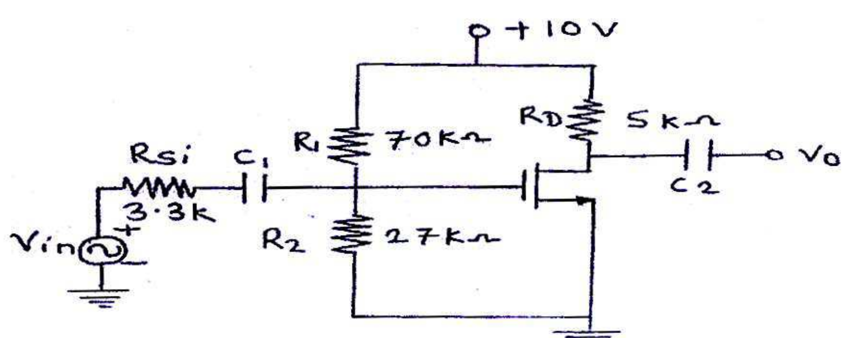


Fig. 3

(*b*) Describe the internal capacitance and high frequency model of MOSFET. [8]

5. (*a*) Explain different scaling model of MOSFET, also explain various scaling factors and limitation of scaling. Explain small geometry effect. [10]

(*b*) What is meant by d.c. biasing of a transistor ? Explain the need of bias stabilization in BJT amplifier circuit. [6]

Or

6. (*a*) For the circuit shown in Fig. 5, calculate the A_I, A_{IS} A_v, A_{VS}, R_i and R_o'. The h parameters are h_{ie} = 1.1 kΩ, h_{fe} = 50, h_{re} = 2.5×10^{-4} and h_{oe} = 25 μA/V. [12]

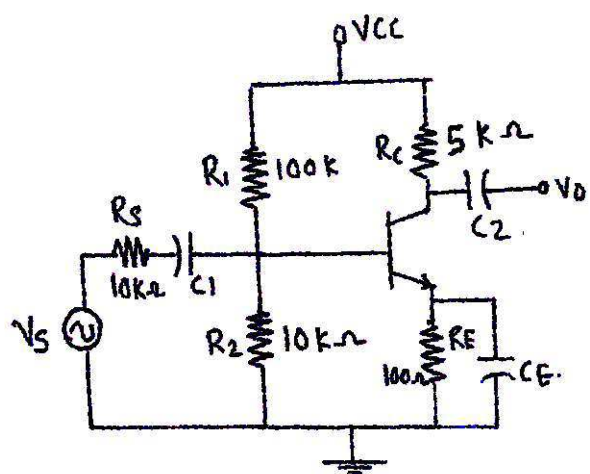


Fig. 5

(*b*) Compare CE, CC, CB configuration of transistor. [4]

SECTION II

7. (*a*) Draw the hybrid π equivalent circuit of transistor and derive the expression for : [8]

(*i*) Base Spreading Resistance $r_{b'b}$.

(*ii*) Output conductance g_{ce}.

(*b*) The high frequency amplifier shown in Fig. 6 uses a transistor with the following parameter :

g_m = 50 mA/V, $r_{b'b}$ = 1 kΩ, $r_{b'e}$ = 1 kΩ, C_e = 50 pf, C_c = 2 pf, r_{ce} = 80 kΩ.

Assume coupling and bypass capacitors to be very large. Calculate : [8]

(*i*) F_β

(*ii*) F_T

(*iii*) A_{vs}

(*iv*) Draw complete hybrid Π equivalent circuit amplifier.

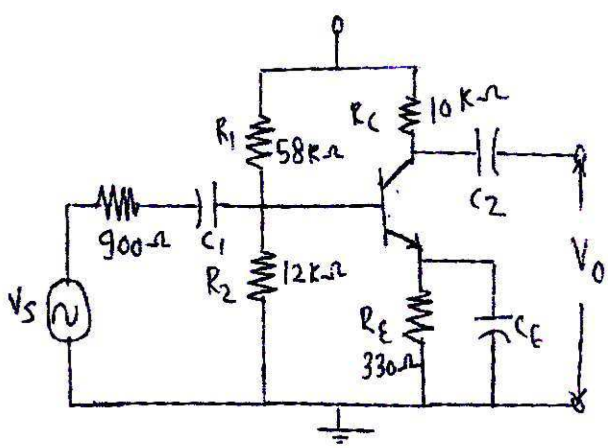


Fig. 6

Or

8. (*a*) Sketch the frequency response of an amplifier. Discuss the effect of C_C and C_E on frequency response. Why does the gain fall at high frequency ? Explain in detail. [8]

(*b*) Find out an expression for current gain with resistive load for CE amplifier. [8]

9. (*a*) Calculate β, A_v, A_{vf}, R_{if}, R_{of}, R_{of}' for the amplifier shown in Fig. 7 if both transistors are identical and have the following *h*-parameter : h_{ie} = 1100 Ω, h_{fe} = 50, h_{oe} = h_{re} = 0. [12]

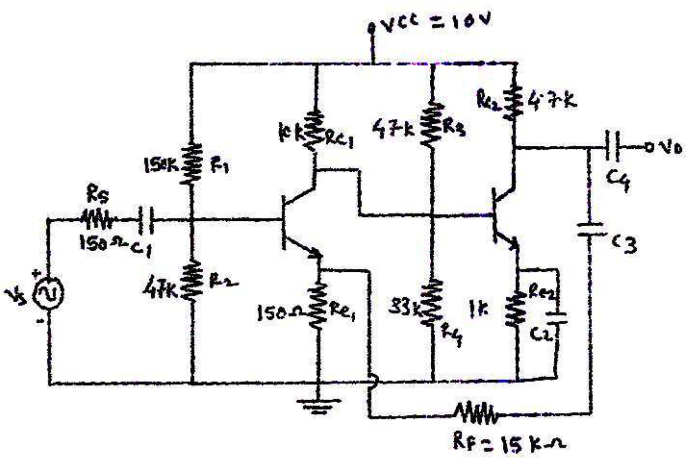


Fig. 7

(*b*) Explain crystal oscillator and write down advantages and disadvantages of crystal oscillator. [6]

Or

10. (*a*) The circuit shown in Fig. 7 has the following parameters : $h_{ie} = 1.1$ k, $h_{fe} = 50$, $h_{re} = h_{oe} = 0$. [12]

Find :

(*i*) β

(*ii*) A_I

(*iii*) A_{If}

(*iv*) R_i

(*v*) A_{if}

(*vi*) A_{of}.

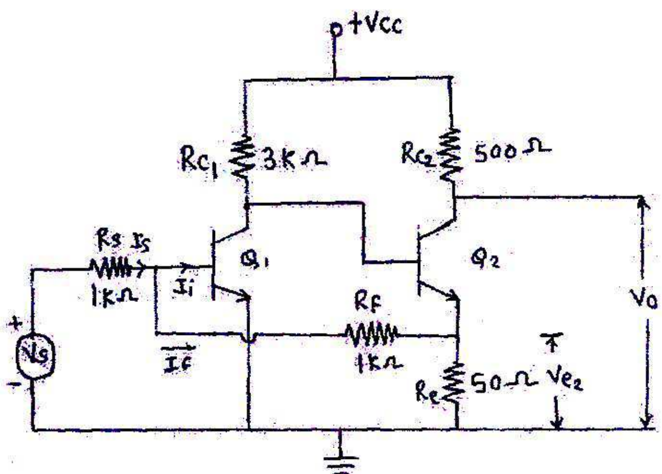


Fig. 8

(*b*) Write short notes on : [6]

(*i*) Wien bridge oscillator;

(*ii*) Hartley oscillator.

11. (*a*) Compare power BJT and simple BJT. [4]

(*b*) Discuss the safe operating area of transistor. [4]

(*c*) Describe the construction of power MOSFET for : [8]

(*i*) DMOSFET

(*ii*) VMOSFET.

Or

12. (*a*) In a class A amplifier V_{CE} max = 25 V, V_{CE} min = 5V, find the overall efficiency for : [8]

(*i*) series fed load

(*ii*) Transformer coupled load.

(*b*) Draw the circuit diagram class B push pull power amplifier and discuss in brief : [8]

(*i*) its operation

(*ii*) its merits.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-43

S.E. (Electronics/E&TC) (First Semester) Examination, 2014

NETWORK ANALYSIS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Answer *three* questions from Section I and Section II each.

(*v*) Assume suitable data if necessary.

SECTION I

1. (*a*) State and explain Maximum power transfer theorem. [4]

(*b*) Using source transformation, find V_1 and V_2 in the circuit shown in Fig. 1. [8]

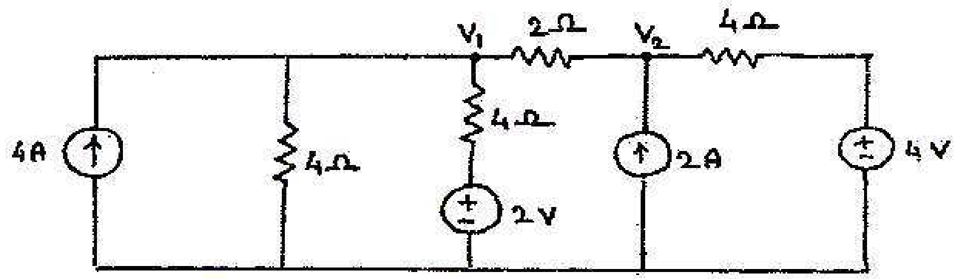


Fig. 1

P.T.O.

(*c*) Find the Thevenin's and Norton's equivalent of the circuit shown in the Fig. 2. [6]

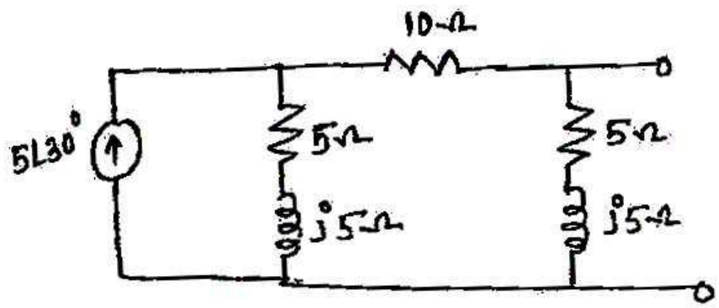


Fig. 2

Or

2. (*a*) Explain voltage source shifting and current source shifting. [4]

(*b*) Using superposition theorem to find voltage V in the network shown in Fig. 3. [6]

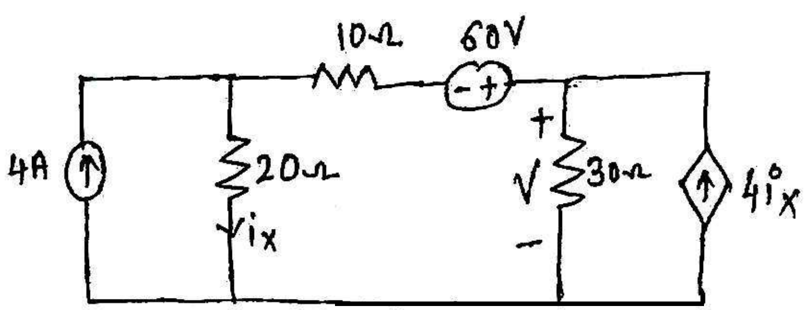


Fig. 3

(*c*) Find the current through branch a-b using Mesh analysis as shown in Fig. 4. [8]

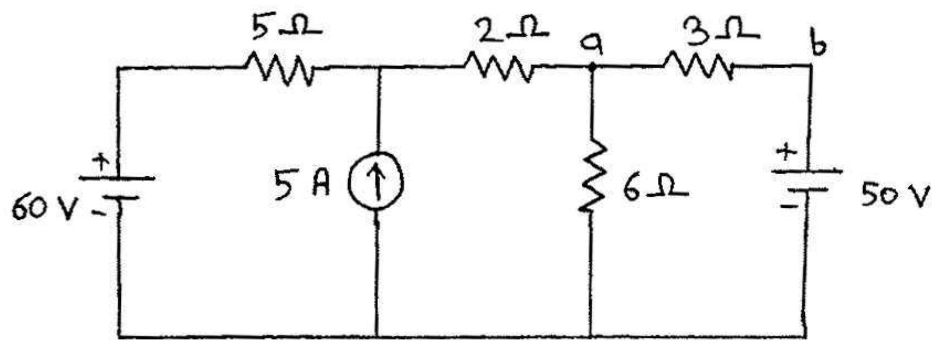


Fig. 4

3. (*a*) Derive the expression for resonant frequency for series resonating circuit. [4]

(*b*) A parallel resonant circuit is "current amplifier" justify. [4]

(*c*) A series circuit is in resonance at 8 MHz and has a coil of 35 μH and 10 Ω resistor [8]

(*i*) Find current at resonance

(*ii*) What capacitance will be required for resonance ?

(*iii*) Find impedance at 8.1 MHz

(*iv*) Find current 8.1 MHz frequency.

Applied voltage is sinusoidal 100 V.

Or

4. (*a*) State properties of parallel resonant circuit. [4]

(*b*) Explain with neat sketch variation of impedance and admittance of series resonant circuit. [4]

(*c*) Find R_L for resonance in the circuit shown in Fig. 5 below. Comment on R_L obtained. [8]

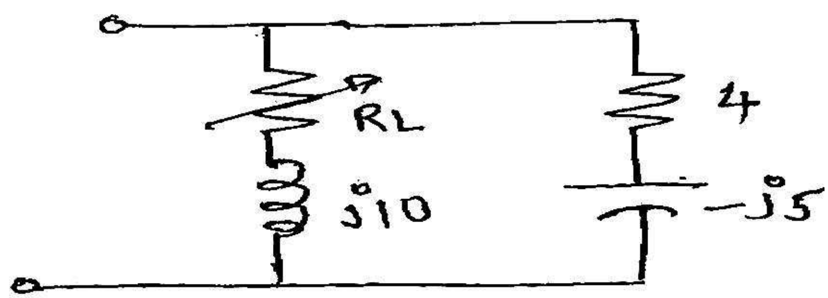


Fig. 5

5. (*a*) Design m-derived LPF having cut-off frequency of 5 kHz and impedance of 600 Ω the frequency of infinite attenuation is 1.25 times the cut-off frequency. [8]

(*b*) Design π type attenuator with the following specification : Attenuation = 20 db, characteristic resistance = 500 Ω. [4]

(*c*) Define characteristic Impedance and Propagation constant of symmetrical network. [4]

Or

6. (*a*) Design constant K π section LPF to be terminated into 600 Ω and having a cut-off frequency of 3 kHz. Determine the frequency at which filter offer an attenuation of 17.37 db. [6]

(*b*) Derive the relation between neper and decibel. [4]

(*c*) Design a T and π type attenuator with the following specification :[6]

Attenuation = 10 db, Characteristic Impedance = 600 Ω.

SECTION II

7. (*a*) State initial condition for resistor, inductor and capacitor. [4]

(*b*) In the circuit shown in Fig. 6 the switch is kept in position 1 for long period to establish the steady state condition. The switch is then moved to position 2 at t = 0. Find out the expression for current after switching the switch to position 2. [8]

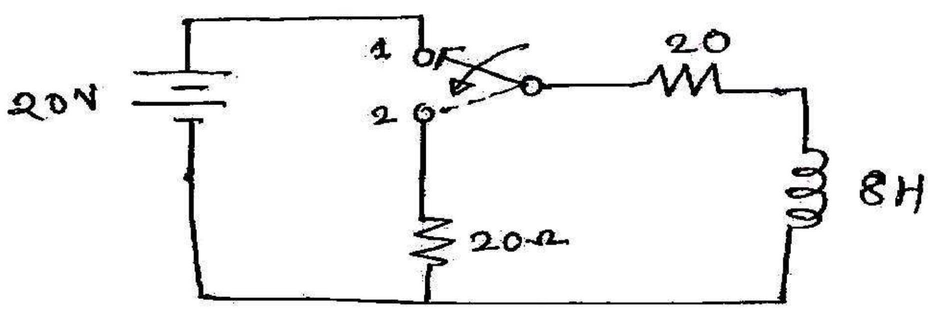


Fig. 6

(*c*) The network shown in Fig. 7 below is under steady state condition with switch K is at position 1. Find expression for $i(t)$ if switch K is moved to position 2. Draw variation of $i(t)$. [6]

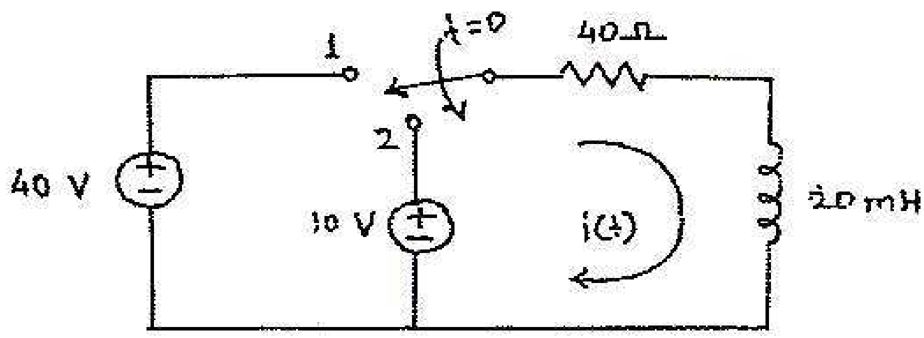


Fig. 7

Or

8. (*a*) Explain the following properties of Laplace transform : [8]

(*i*) Linearity

(*ii*) Time shifting

(*iii*) Time scaling

(*iv*) Convolution.

(*b*) The switch in the network shown in Fig. 8 is closed at $t = 0$, determine voltage across capacitor. [6]

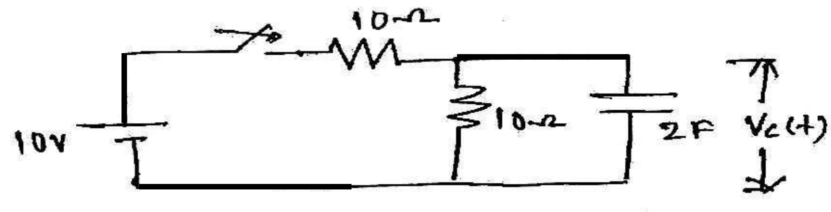


Fig. 8

(*c*) Explain the following : [4]

(*i*) Initial Value Theorem

(*ii*) Final Value Theorem.

9. (*a*) Obtain Z parameter of the following two port network as shown in Fig. 9. [6]

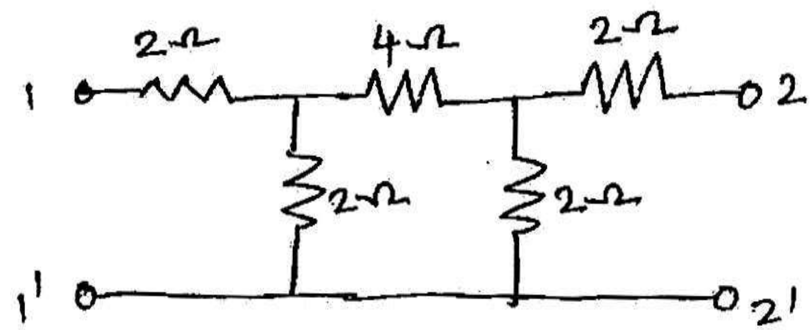


Fig. 9

(*b*) Derive condition of Reciprocity and Symmetry for Y parameter. [4]

(*c*) Obtain *h* parameter of the network shown in the Fig. 10. [6]

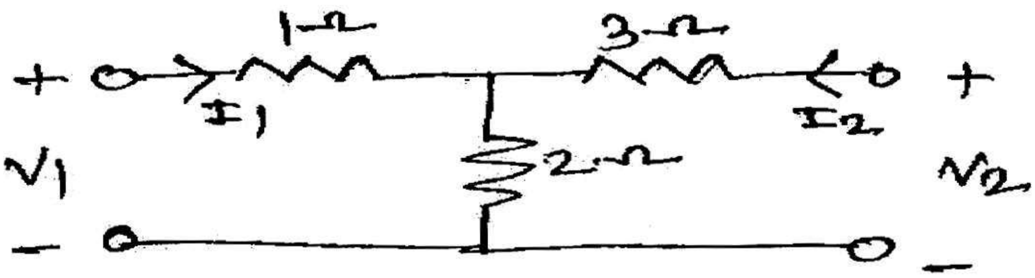


Fig. 10

Or

10. (*a*) What is network function ? Explain various types of network functions for a one port network and two port networks. [4]

(*b*) Explain the significance of poles and zeros in network analysis. [6]

(*c*) Find input impedance $Z_{in}(s)$ and plot its poles zero for the circuit shown in Fig. 11. [6]

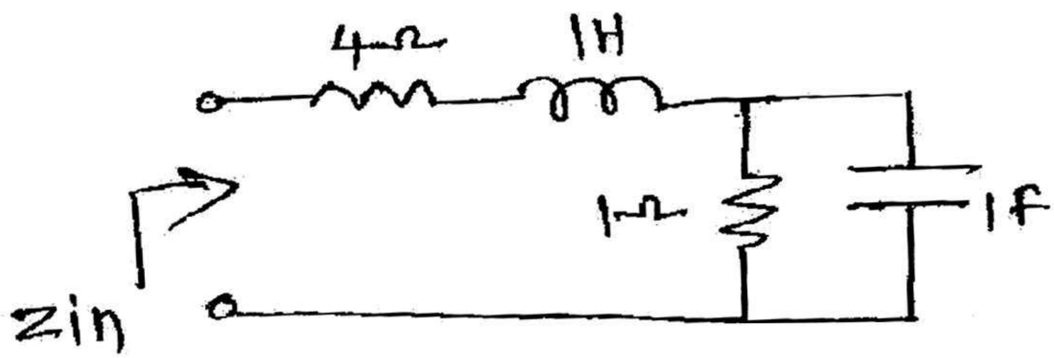


Fig. 11

11. (*a*) Derive equation for voltage and current at any point on the transmission line. [8]

(*b*) An unloaded underground cable has the following constants :

$R = 40 \ \Omega/\text{km}$,

$G = 0.5 \ \mu\text{mho/km}$,

$L = 1 \ \mu\text{H/km}$,

$C = 0.08 \ \mu\text{f/km}$.

Find the approximate values of Zo, α, β at 400 Hz and 1600 Hz. [8]

Or

12. (*a*) Explain in brief : [8]

(*i*) Standing wave ratio

(*ii*) Reflection coefficient

(*iii*) Transmission coefficient

(*iv*) Propagation constant.

(*b*) A transmission line cable has the following primary constant per kilometer :

$R = 78\ \Omega$, $L = 1.75$ mH, $C = 0.0945\ \mu f$, $G = 62\ \mu$mho.

At frequency 1.6 kHz. Calculate.

(*i*) Characteristic impedance

(*ii*) Propagation constant

(*iii*) Wavelength in Km

(*iv*) Velocity of signal travelling. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-44

S.E. (Electronics/E & TC) (First Semester) EXAMINATION, 2014

DIGITAL LOGIC DESIGN

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) In Section I : Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**.

(*vi*) In Section II : Attempt Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

SECTION I

1. (*a*) Simplifying the following function using Quine McClusky method : [10]

$$F(P, Q, R, S) = \Sigma m(0, 1, 2, 3, 5, 7, 8, 9, 11, 14) + d(10, 13).$$

(*b*) Explain Hazards in combinational circuits. [4]

P.T.O.

(*c*) Implement the following Boolean function using 8 : 1 multiplexer

$F(W, X, Y, Z) = \Sigma m(1, 5, 7, 9, 11, 12, 14, 15)$. [4]

Or

2. (*a*) Design and implement a circuit to convert gray code to binary code. [10]

(*b*) A combinational circuit has four inputs and one output. The output is equal to 1 when :

(*i*) All inputs are equal to 1.

(*ii*) None of the inputs are equal to 1.

(*iii*) An odd number of inputs are equal to 1.

(A) Obtain the truth table.

(B) Obtain the simplified output in Sum of Products.

(C) Implement it using Logic Gates. [8]

3. (*a*) Draw neat circuit diagram of clocked JK Flip-Flop using NAND gates. Explain with its truth table and explain race around condition. [8]

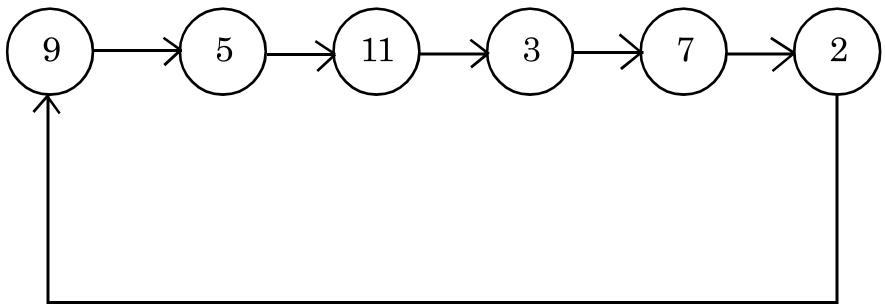
(*b*) Explain how JK Flip-Flop is converted into :

(*i*) SR FF

(*ii*) D FF. [8]

Or

4. (*a*) Design the following sequence using T Flip-Flop. [8]



(*b*) Design pulse train generator using shift register to generate the following pulse

....10101... [8]

5. (*a*) Write VHDL code for 4-bit ALU with minimum 4 arithmetic and 4 logical operations using behavioural modeling. [8]

(*b*) Explain the following statements used in VHDL with suitable examples : [8]

(*i*) IF

(*ii*) Case

(*iii*) when-else

(*iv*) Process.

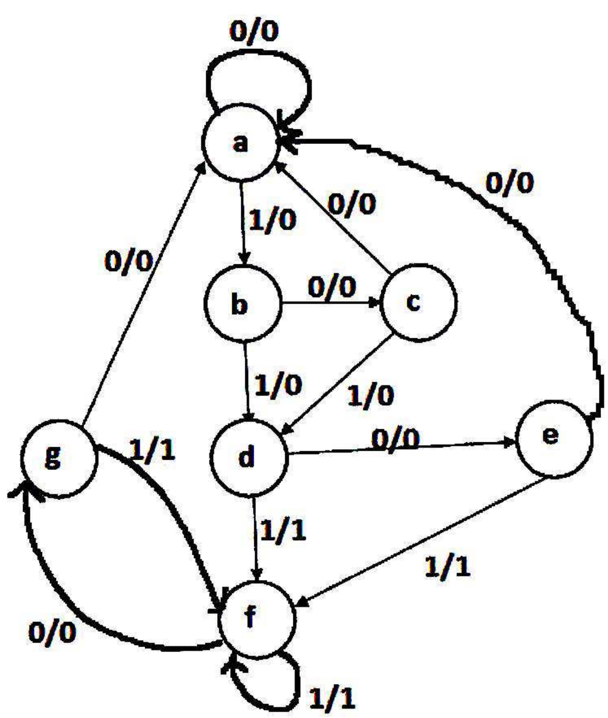
Or

6. (*a*) Write the VHDL code for JK Flip-Flop using synchronous and asynchronous preset and clear input. [8]

(*b*) Describe modeling styles of VHDL with suitable examples. [8]

SECTION II

7. (*a*) For given state diagram, prepare state table and reduce the same using "State table reduction" technique and implement it using D Flip-Flop. [10]



(*b*) Explain Mealy circuit with example. Also compare Moore and Mealy circuit. [8]

Or

8. (*a*) Explain : [8]

(*i*) State Table

(*ii*) State Diagram

(*iii*) State Assignment

(*iv*) ASM Chart.

(*b*) Design a sequential circuit using Mealy machine for detecting the sequence ....1010.... Use T Flip-Flop. [10]

9. (*a*) Draw and explain TTL to CMOS and CMOS to TTL interfacing. [8]

(*b*) Describe the characteristics of CMOS family and explain the operation of CMOS inverter. [8]

Or

10. (*a*) Draw and explain briefly working of 2 input CMOS NAND gate. [8]

(*b*) Define and explain : [8]

(*i*) Fan out

(*ii*) Noise Margin

(*iii*) Propagation Delay

(*iv*) Figure of Merit.

11. (*a*) Implement the following function using PLA :

$$F1\ (p,\ q,\ r) = \Sigma m(1,\ 2,\ 5,\ 7)$$

$$F2\ (p,\ q,\ r) = \Sigma m(2,\ 3,\ 4,\ 5).$$ [8]

(*b*) Discuss in detail characteristics of the following memories :

(*i*) RAM

(*ii*) ROM

(*iii*) EPROM

(*iv*) EEPROM

(*v*) NVRAM

(*vi*) DRAM. [8]

Or

12. (*a*) Differentiate between SRAM and DRAM. [8]

(*b*) How to obtain 64 × 4 memory using 16 × 4 memory chip. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-45

S.E. (Electronics/E & TC) (First Semester) EXAMINATION, 2014

POWER DEVICES AND MACHINES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data if necessary.

SECTION I

1. (*a*) Draw the construction diagram of power BJT and explain its switching characteristics. [7]

(*b*) Explain reverse recovery characteristics of a power diode. Derive expression for t_{rr} and I_{RR}. [7]

(*c*) Compare power diode with ordinary diode. [4]

P.T.O.

Or

2. (*a*) Draw construction diagram and explain steady state characteristics of power MOSFET (*n*-channel enhancement type). [7]

(*b*) The bipolar transistor is specified to have β_F in the range of 8 to 40. The load resistance is $R_C = 11\ \Omega$. The d.c. supply voltage is $V_{CC} = 200$ V and the input voltage to the base circuit is $V_B = 10$ V. If V_{CE} (sat) = 1 V and V_{BE}(sat) = 1.5 V, find :

(*i*) the value of R_B that results in saturation with an ODF of 5

(*ii*) the β_{forced} and

(*iii*) the power loss P_T in the transistor. [6]

(*c*) Draw and explain Gate Drive Circuit for IGBT. [5]

3. (*a*) Why is UJT triggering preferred ? Draw and explain synchronized UJT triggering circuit for SCR. [7]

(*b*) Compare SCR with TRIAC. [4]

(*c*) Draw two transistor analogy of SCR. Derive an expression for I_A. [5]

Or

4. (*a*) The gate triggering circuit of a SCR has a source voltage of 15 V and the load line has a slope of –120 V/A. The minimum gate current to turn on the SCR is 40 mA. If average gate power dissipation is 0.4 W, calculate :

(*i*) Triggering voltage

(*ii*) Triggering current

(*iii*) Gate series resistance. [6]

(*b*) Explain AC phase control circuit using TRIAC and DIAC with o/p waveforms. [6]

(*c*) Draw construction diagram and steady state characteristics of TRIAC. [4]

5. (*a*) Draw and explain single-phase fully controlled bridge converter for R-L load with all modes and waveforms. Also derive expressions for average output voltage and rms output voltage. [10]

(*b*) A single-phase fully controlled bridge rectifier is given 230 V, 50 Hz supply. The firing angle is 60° and load is highly inductive. If load current is continuous of 10 A, determine :

(*i*) Average output voltage

(*ii*) Reactive power

(*iii*) Average output voltage if a freewheeling diode is connected across the load. [6]

Or

6. (*a*) A single-phase full wave a.c. voltage controller has a resistive load of R = 10 Ω and the input voltage is V_S = 230 V(rms), 50 Hz. The delay angles of thyristors T1 and T2 are equal : $\alpha 1 = \alpha 2 = \pi/2$. Determine :

(*i*) the rms output voltage and current

(*ii*) the input PF

(*iii*) rms current of each SCR. [6]

(*b*) Draw and explain single-phase full wave AC voltage controller for R load. Also draw the waveforms of : gate pulses, output voltage and current, voltage across SCR1 and SCR2. Derive an expression for its output voltage. [10]

SECTION II

7. (*a*) Explain different control techniques in d.c. chopper. [6]

(*b*) A chopper circuit is operating on TRC principle at a frequency of 2 kHz on 220 V d.c. supply. If the load voltage is 170 V, calculate :

(*i*) Conduction period of chopper

(*ii*) Blocking period of chopper

(*iii*) rms o/p voltage. [6]

(*c*) Explain with block schematic working of Online UPS. [6]

Or

8. (*a*) Explain 1-Φ bridge inverter for R-L load with circuit and waveforms. Derive expression o/p rms voltage. [8]

(*b*) Single-phase full bridge inverter is operated from 100 V d.c. supply and is supplying power to pure resistive load of R = 20 Ω, calculate :

(*i*) rms o/p voltage and current

(*ii*) First four harmonics

(*iii*) Output rms power. [6]

(*c*) Compare SMPS with linear power supply. [4]

9. (*a*) A 4-pole, lap wound D.C. motor has 540 conductors. Its speed is 1000 rpm. The flux per pole is 25 mWb. It is connected to 230 V d.c. supply, armature resistance is 0.8 Ω. Find :

(*i*) Back e.m.f.

(*ii*) Armature current

(*iii*) Torque developed. [6]

(*b*) Explain construction of a d.c. motor with a neat diagram. [6]

(*c*) Explain torque-speed and torque-current characteristics for d.c. shunt motor. [4]

Or

10. (*a*) Explain construction, working and characteristics of universal motor. [8]

(*b*) Explain with neat schematic construction of a.c. motor. [8]

11. (*a*) Explain construction, characteristics of a.c. servomotor. [5]

(*b*) Draw and explain various types of 3-phase transformer connection along with phasor diagrams. [8]

(*c*) Compare voltage (potential) transformer with current transformer. [3]

Or

12. (*a*) Compare stepper motor with d.c. motor. [3]

(*b*) Explain construction, working of BLDC motor, also draw its characteristics. [6]

(*c*) State various protection methods for motors. Explain in detail. [7]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4657]-5

S.E. (Civil) (First Semester) EXAMINATION, 2014

GEOTECHNICAL ENGINEERING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of logarithmic tables, slide rule, electronic calculator is allowed.

(*v*) Assume suitable data, if required.

SECTION I

1. (*a*) Define water content of soil. List out the methods to determine water content. Explain in brief how to decide the minimum quantity of specimen to be taken for the test. [6]

(*b*) Draw three-phase diagram in terms of void ratio and derive the following expression : [6]

$$\gamma' = \{[G - 1]\gamma_w\}/(1 + e)$$

Where, γ' = Submerged weight of soil,

γ_w = Unit weight of water,

G = Specific gravity,

e = Void ratio,

S_r = Degree of saturation.

(*c*) Define liquid limit and plastic limit of soil. If for a given soil, natural water content = 20%, W_L = 25%, I_f = 12.5% and W_p = 15% determine Plasticity index, Toughness index, Liquidity index and Relative consistency. [6]

Or

2. (*a*) Explain the different types of structures in soil mass with sketches. [6]

(*b*) Sketch the following with neat labels : [6]

(*i*) Casagrande Plasticity chart

(*ii*) Gradation Curves (Particle distribution curves).

(*c*) The following are the observations by Pycnometer method : [6]

(1) Mass of pycnometer = 803 gm

(2) Mass of pycnometer + soil = 1165 gm

(3) Mass of pycnometer + soil + water = 2008 gm

(4) Mass of pycnometer + water = 1802 gm

Calculate water content if G = 2.65.

3. (*a*) Write any *two* applications of flow net. [4]

(*b*) Explain graphical method for obtaining phreatic line in case of homogeneous earth dam with horizontal filter. [6]

(*c*) Derive Laplace equation : [6]

$$(\partial^2 h / \partial x^2) + (\partial^2 h / \partial y^2) = 0 .$$

Or

4. (*a*) State Darcy's law and derive $k_p = k/n$. [6]

Where, k_p = Coefficient of percolation,

k = coefficient of permeability and

n = Porosity of soil.

(*b*) Explain in brief *six* factors affecting permeability of soils. [6]

(*c*) A flow net is constructed under sheet pile and following are the details :

Coefficient of permeability = 5×10^{-4} cm/sec. Total head = 6 m, No. of flow channels for the complete flow net = Nf = 4 and No. of potential drops in the entire flow net = Nd = 12.

Calculate the discharge through flow net. [4]

5. (*a*) Explain in brief effect of compactive efforts on compaction characteristics with sketch. [4]

(*b*) Write any *four* assumptions made by Boussinesq to evaluate the stress at a point inside the soil mass due to a point load. Also explain in brief stress Isobar. [6]

(*c*) The following data have been obtained in a laboratory Proctor compaction test on a soil sample :

Water content (%)	**Weight of compacted soil** (kg)
12	1.68
14	1.85
16	1.91

18	1.87
20	1.85
22	1.84

The volume of the mould was 950 cm^3. Plot compaction curve. Obtain MDD and OMC. [6]

Or

6. (*a*) A concentrated load of 2000 kN is applied at the ground surface. Determine the vertical stress at a point P which is 6 m directly below the load. Also calculate the vertical stress at a point R which is at a depth of 6 m but a horizontal distance of 5 m from the axis of the load. [4]

(*b*) Write a note on equivalent point load method to determine stress in soils. [4]

(*c*) Differentiate between Light weight compaction and Heavy weight compaction. [4]

(*d*) Explain the effect of compaction on permeability, compressibility, pore pressure and swelling of soil. [4]

SECTION II

7. (*a*) What is Coulomb's equation for shear strength of soil ? Discuss the factors which affect the shear strength parameters of soil. [6]

(*b*) What are the advantages and disadvantages of triaxial compression test in comparison with the direct shear test ? [6]

(*c*) In a consolidated drained triaxial test, a specimen of a clay fails at a cell pressure of 60 kN/m^2. The effective shear strength parameters are $c = 15\ kN/m^2$ and $\varphi = 2^o$. Determine the additional stress required for the failure. [6]

Or

8. (*a*) Draw a typical Mohr circle for unconfined compression test and explain how you would determine the shear strength parameters from the Mohr circle. [6]

(*b*) What is liquefaction of sands ? How can it be prevented ? [6]

(*c*) Two samples of a soil were tested in a triaxial machine. The all round pressure maintained for the first sample was 200 kN/m^2 and a failure occurred at an additional axial stress of 770 kN/m^2. For second sample, these values were 500 kN/m^2 and 1370 kN/m^2, respectively. Find c and φ for the soil. [6]

9. (*a*) What is Infinite and Finite slopes ? Give examples. [5]

(*b*) Define the terms active earth pressure and passive earth pressure. [5]

(*c*) A wall with a smooth vertical back, 10 m high, supports a purely cohesive soil with $c = 9.81$ kN/m^2, and $\gamma = 17.66$ kN/m^3. [6]

Determine :

(*i*) total Rankine's active pressure against the wall;

(*ii*) position of zero pressure.

Or

10. (*a*) What is 'earth pressure at rest' ? Derive an equation for determining the magnitude of earth pressure for at rest condition. [5]

(*b*) What is stability number ? What is its utility in the analysis of stability of slopes ? [5]

(*c*) What are the different modes of slope failure ? Give examples. [6]

11. Write short notes on (any *four*) : [16]

(*a*) Slake durability Index

(*b*) Sonic velocity

(*c*) Beam bending test

(*d*) Triaxial compression test

(*e*) Hardness of rock.

Or

12. Write short notes on (any *four*) : [16]

(*a*) Shear strength of rocks

(*b*) In situ stresses in rocks

(*c*) Hardness of rocks

(*d*) Rock permeability

(*e*) Ring shear test.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4657]-50

S.E. (E&TC/Elec.) (First Semester) EXAMINATION, 2014

SIGNALS AND SYSTEMS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Express Signum function in terms of unit step function. State and explain properties of unit impulse function. [8]

(*b*) Find whether the following signals are energy or power and find the corresponding value : [8]

(*i*) $x(t) = tu(t)$

(*ii*) $x(t) = e^{-at}\ u(t)\ a > 0.$

(*c*) Find whether the given system is static, and/or causal having impulse response as : [2]

$$h(t) = e^{-2t}\ u(-t).$$

Or

2. (*a*) Determine whether or not each of the following signal is periodic. If periodic, find the period of the signal : [6]

(*i*) $x(t) = \cos(t) + \sin\left(\sqrt{2}\,t\right)$

(*ii*) $x[n] = \cos(5\pi n).$

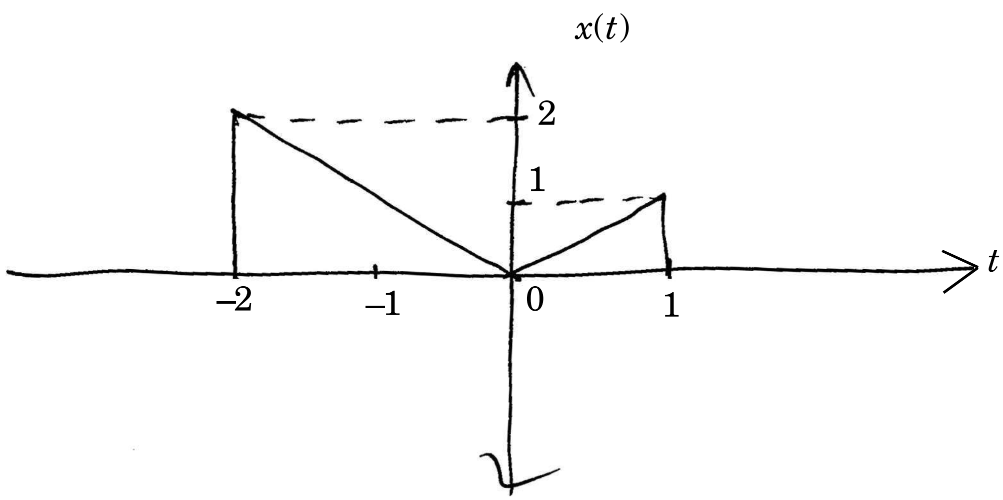
(*b*) For the given signal $x(t)$, find : [8]

(*i*) $x(t - 4)$

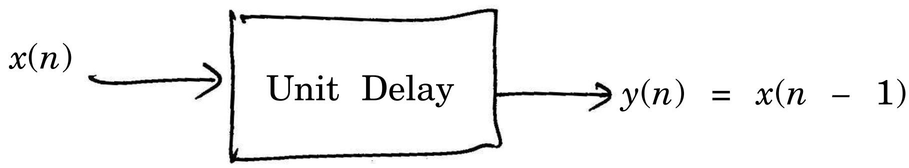
(*ii*) $x(2t - 4)$

(*iii*) $x(-t)$

(*iv*) $2x(t)$.



(*c*) Check whether the following DT system is memoryless, causal, linear, time variant. [4]



3. (*a*) The unit impulse response of DTS is : [10]

$$h[n] = \left\{1,\ 2,\ \underset{\uparrow}{4},\ -1,\ 2\right\}.$$

Find the system response for the following inputs :

(*i*) $x_1[n] = \left\{\underset{\uparrow}{1},\ 1,\ 3\right\}$ using Tabular method

(*ii*) $x_2[n] = \left\{2,\ \underset{\uparrow}{1},\ 4\right\}$ using Mathematical method.

(*b*) If two LTI systems with impulse responses :

$$h_1(t) = e^{-at}\ u(t) \text{ and}$$

$$h_2(t) = e^{-bt}\ u(t)$$

are connected in cascade. What is the overall impulse response of cascaded system ? [6]

Or

4. (*a*) Find CTS convolution if [8]

$$h_1(t) = 2u(t)$$

$$x_1(t) = 3u(t).$$

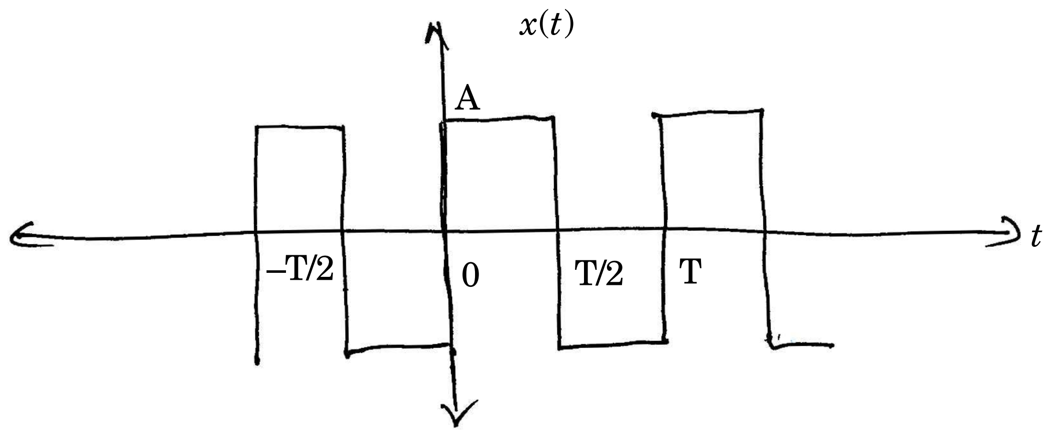
(*b*) State and explain properties of convolution. Find DTS convolution : [8]

$$x[n] = \left\{1, \underset{\uparrow}{2}, 3\right\}$$

$$h[n] = \left\{\underset{\uparrow}{1}, 1\right\}$$

using graphical method.

5. (*a*) Determine Trigonometric F.S. for the given signal. [8]



(b) Find Fourier transform of the following signals : [8]

(i) $x(t) = \delta(t)$

(ii) $x(t) = u(t)$

(iii) $x(t) = e^{-at} u(t) \quad a > 0.$

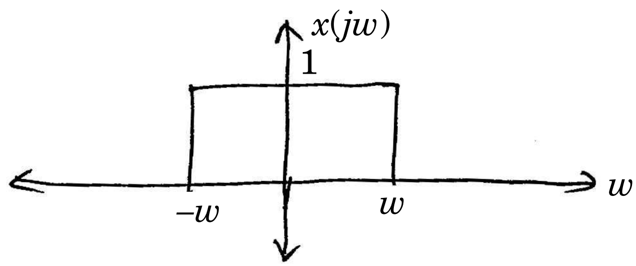
Or

6. (a) Using time scaling and shifting property, solve the following F.T.: [8]

(i) $x(t) = e^{-a|t|}$

(ii) $x(t) = e^{-a|t-t_0|}.$

(b) Find Inverse F.T. of a Rectangular Pulse in figure below : [8]



SECTION II

7. (a) Find Laplace transform of the following signals. Plot ROC : [8]

$$x(t) = e^{-3t} u(-t).$$

(*b*) Prove the following properties for Unilateral Laplace transform : [10]

(*i*) Linearity

(*ii*) Scaling

(*iii*) Time shifting

(*iv*) Convolution.

Or

8. (*a*) If [10]

$$x(t) \xleftrightarrow{\text{L.T.}} \frac{2s}{s^2 + 2},$$

where $x(t) = 0$ for $t < 0$.

Find L.T. of the following time signals :

(*i*) $x(3t)$

(*ii*) $x(t - 2)$

(*iii*) $e^{-t} x(t)$.

(*b*) Find Unilateral L.T. for : [8]

(*i*) $x(t) = u(t - 2)$

(*ii*) $x(t) = e^{-2t} u(t + 1)$

(*iii*) $x(t) = u(t) - u(t - 2)$.

9. (*a*) State and explain properties of Autocorrelation. [8]

(*b*) Find the following for the given power signal : [8]

$$x(t) = \text{A} \sin \omega t$$

(*i*) Autocorrelation

(*ii*) Power from Autocorrelation

(*iii*) PSD.

Or

10. (*a*) What is ESD and PSD ? Explain with their properties. [8]

(*b*) Find Autocorrelation of : [8]

$$x(t) = e^{-4t} u(t).$$

Find energy of the given signal.

11. (*a*) A fair coin is tossed thrice. Find its sample space. Find all the probabilities and plot its CDF and PDF. [8]

(*b*) A Gaussian RV has [8]

$$\text{E[X]} = 10 \text{ and } \text{E[X}^2\text{]} = 500.$$

Find :

$$\text{P(X} > 20), \text{P(10} < \text{X} < 20),$$

$$\text{P(0} < \text{X} <= 20) \text{ and } \text{P(X} > 0).$$

Or

12. (*a*) The outcome of an experiment is an integer I whose value is equally likely to be any integer in the range [10]

$$1 <= I <= 4.$$

The experiment is performed twice, producing two outcomes I_1 and I_2.

Let

A be the event $I_1 = I_2$

B be the event $I_1 > I_2$

C be the event $I_1 + I_2 >= 6$

Draw Venn diagram. Find probabilities of events A, B, C, AB, AC, BC and A‘B.

(*b*) Explain PDF and CDF. Explain probability distribution models. [6]

Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-501

S.E. (Civil) (First Semester)

EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Answer all the questions.

(*iii*) Figures to the right indicate full marks.

(*iv*) Electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Solve any *two* : [8]

(*i*) $(D^2 + 2D + 1)y = xe^{-x} \cos x$

(*ii*) $(2x + 1)^2 \dfrac{d^2y}{dx^2} - 2(2x + 1) \dfrac{dy}{dx} - 12y = 6x$

(*iii*) Use method of variation of parameters to solve :

$$(D^2 - 2D + 2)y = e^x \tan x.$$

(*b*) Solve the following system of equations using Gauss-Seidel iteration method : [4]

$$28x_1 + 4x_2 - x_3 = 32$$

$$x_1 + 3x_2 + 10x_3 = 24$$

$$2x_1 + 17x_2 + 4x_3 = 35$$

Or

2. (*a*) Solve the following system of symmetrical simultaneous equations : [4]

$$\frac{dx}{3z - 4y} = \frac{dy}{4x - 2z} = \frac{dz}{3y - 2x}.$$

(*b*) Use Euler's modified method to find the value of y satisfying the equation : [4]

$$\frac{dy}{dx} = \log(x + y), \; y(1) = 2$$

for $x = 1.2$ and $x = 1.4$ correct to three decimal places by taking $h = 0.2$.

(*c*) Solve the following system of equations by Cholesky's method : [4]

$$2x_1 - x_2 = 1$$

$$-x_1 + 3x_2 + x_3 = 0$$

$$x_1 + 2x_3 = 0.$$

3. (*a*) The first four moments of a distribution about $x = 2$ are 1, 2.5, 5.5 and 1.6. Calculate first four moments about mean. Also find β_1 and β_2. [4]

(*b*) Assuming that the probability of an individual coal miner being killed in a mine accidents during a year is $\frac{1}{2400}$. Use Poisson's distribution to calculate the probability that in a mine employing 200 miners there will be at least one fatal accident in a year. [4]

(*c*) Find the directional derivative of $\phi = xy + yz^2$ at $(1, -1, 1)$ towards the point $(2, 1, 2)$. [4]

Or

4. (*a*) Prove the following (any *one*) : [4]

(*i*) $\nabla^2 \left(\frac{\bar{a} \cdot \bar{b}}{r}\right) = 0$

(*ii*) $\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r^3}\right) = \frac{-\bar{a}}{r^3} + \frac{3(\bar{a} \cdot \bar{r})}{r^5} \bar{r}$.

(*b*) Show that : [4]

$$\overline{\mathrm{F}} = (2xz^3 + 6y)\,\bar{i} + (6x - 2yz)\,\bar{j} + (3x^2z^2 - y^2)\,\bar{k}$$

is irrotational. Find the scalar potential ϕ such that $\overline{\mathrm{F}} = \nabla\phi$.

(c) If two lines of regression are :

$$9x + y - \lambda = 0 \text{ and } 4x + y = \mu$$

and the means of x and y are 2 and –3 respectively, find the values of λ and μ, also find coefficient of correlation between x and y. [4]

5. (a) Find the work done in moving a particle once round the circle $x^2 + y^2 = 9$ in the xy plane if the force field $\overline{\mathrm{F}}$ is given by : [4]

$$\overline{\mathrm{F}} = (2x - y - z)\, i + (x + y - z^2)\, j + (3x - 2y + 4z)\, \hat{k}.$$

(b) Evaluate :

$$\iint_{\mathrm{S}} \overline{\mathrm{F}} \,.\, \hat{n}\, d\mathrm{S},$$

where :

$$\overline{\mathrm{F}} = (2x + 3z)\,\hat{i} - (xz + y)\,\hat{j} + (y^2 + 2z)\,\hat{k}$$

and S is the surface of the sphere having centre at (3, –1, 2) and radius 3. [4]

(c) Evaluate :

$$\iint_{\mathrm{S}} (\nabla \times \overline{\mathrm{F}}) \,.\, \hat{n}\, d\mathrm{S},$$

where 'S' is the curved surface of the paraboloid :

$$x^2 + y^2 = 2z$$

bounded by the plane $z = 2$, where : [5]

$$\overline{\mathrm{F}} = 3(x - y)\,\hat{i} + 2xz\,\hat{j} + xy\,\hat{k}.$$

Or

6. (*a*) If :

$$\overline{\mathrm{F}} = (2xz^3 + 6y)\,\hat{i} + (6x - 2yz)\,\hat{j} + (3x^2 z^2 - y^2)\,\hat{k}$$

evaluate :

$$\int_{\mathrm{C}} \overline{\mathrm{F}} \,.\, d\overline{r}$$

where C is the join of (0, 0, 0) and (1, 1, 1). Is the force $\overline{\mathrm{F}}$ conservative ? [4]

(*b*) Prove that :

$$\iiint_{\mathrm{V}} \frac{1}{r^2}\, dv = \iint \frac{1}{r^2}\, \overline{r} \,.\, d\overline{\mathrm{S}}$$

where S is the closed surface enclosing volume V. Hence evaluate :

$$\iint \frac{x\,\hat{i} + y\hat{j} + z\hat{k}}{r^2} \,.\, d\overline{\mathrm{S}}$$

where S is the surface of the sphere : [5]

$$x^2 + y^2 + z^2 = a^2.$$

(*c*) Show that the velocity potential :

$$\phi = (x^2 - 2y^2 + z^2)$$

satisfies the Laplace's equation. Also determine the stream-lines. [4]

7. (*a*) A string of length l is stretched and fastened to two ends. Motion is started by displacing the string in the form : [7]

$$u(x) = a \sin\left(\frac{\pi x}{l}\right)$$

from which it is released at $t = 0$.

Find the displacement u at any time 't', if it satisfies the equation : [6]

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}.$$

(*b*) Solve :

$$\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$$

if :

(*i*) $u(x, \infty)$ is finite

(*ii*) $u(0, t) = 0$

(*iii*) $u(l, t) = 0$

(*iv*) $u(x, 0) = \frac{u_0 x}{l}, \quad 0 < x < l$

Or

8. (*a*) An infinitely long plane uniform plate is bounded by two parallel edges in the y direction and an end at right angles to them. The breadth of the plate is π. The end is maintained at temperature u_0 at all points and other edges at zero temperature. Find steady state temperature $u(x, y)$, if it satisfies : [7]

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0.$$

(*b*) Use Fourier transform to solve : [6]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2};\ 0 < x < \infty,\quad t > 0$$

where $u(x, t)$ satisfies the conditions :

(*i*) $|u(x, t)| < \mathrm{M}$

(*ii*) $\left(\frac{\partial u}{\partial x}\right)_{x = 0} = 0$, at $t > 0$

(*iii*) $u(x, 0) \begin{array}{l} = x,\ 0 < x < 1 \\ = 0,\ x > 1 \end{array}$

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-502

S.E. (Civil) (First Semester) EXAMINATION, 2014

BUILDING TECHNOLOGY AND MATERIALS

(2012 PTTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data if necessary.

1. (*a*) It is proposed to construct a residential building on black cotton soil. As a civil engineer; you have two choices, Isolated column footing and Pile foundation. Comment with reason, which you would select. [6]

(*b*) Write short notes on :

(*i*) Laying of block

(*ii*) Form-work for beam. [6]

Or

2. (*a*) Write short notes on : [6]

(*i*) Strap footing

(*ii*) English bond.

(*b*) Discuss slip form-work. State advantages of block masonry. [6]

3. (*a*) State functional requirements of flooring. Draw sketch of King post truss. [6]

(*b*) Define the following with line sketches : [6]

(*i*) Door

(*ii*) Window

(*iii*) Arch

(*iv*) Lintel.

Or

4. (*a*) State *four* market names of flooring tiles. Draw sketch of Queen-post truss. [6]

(*b*) Explain the following with sketches : [6]

(*i*) Corner window

(*ii*) Corbel Arch

(*iii*) Barrel bolt.

5. (*a*) Explain the following with sketches : [6]

(*i*) Newel post

(*ii*) Dots in plastering

(*iii*) Winder.

(*b*) State ideal requirements of good stair. Explain defects in plastering. [7]

Or

6. (*a*) Write short notes on : [7]

(*i*) Wall papering

(*ii*) Quarter turn stair.

(*b*) Explain the following with sketches : [6]

(*i*) Scotia

(*ii*) Beaded pointing

(*iii*) Dots in plastering

(*iv*) Blistering.

7. (*a*) Define seasoning of timber. Explain defects in timber. [6]

(*b*) Write short notes on : [7]

(*i*) Ceramic products

(*ii*) Gypsum

(*iii*) Repairs and Maintenance.

Or

8. (*a*) Write down engineering properties of : [7]

(*i*) Glass

(*ii*) Ceramic products

(*iii*) Timber.

(*b*) Write short notes on : [6]

(*i*) Prevention of accidents on site

(*ii*) Storage of materials at site.

Total No. of Questions—8] [Total No. of Printed Pages—4+2

Seat No.	

[4657]-503

S.E. (Civil) (First Semester) EXAMINATION, 2014

STRENGTH OF MATERIALS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

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

(*iii*) Use of electronic pocket calculator is allowed.

(*iv*) Assume suitable data, if necessary.

(*v*) Answer Q. No. **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6**, Q. No. **7** *or* **8**.

1. (*a*) A steel bar 120 mm long, 40 mm × 40 mm in cross-section is subjected to tensile load 200 kN along longitudinal axis and tensile loads of 500 kN and 400 kN on lateral faces as shown in Fig. 1. Change in volume was observed to be 125 mm^3. Find the value of Poisson's ratio and Bulk Modulus. Take E = 200 GPa. [6]

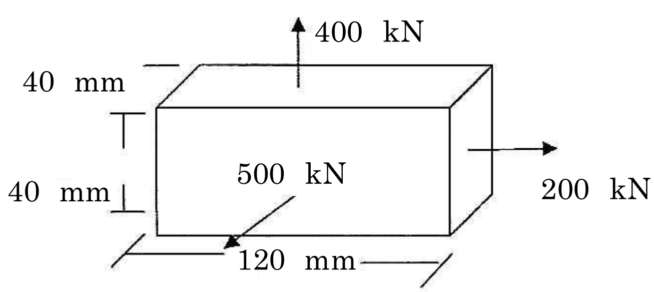


Fig. 1

P.T.O.

(*b*) Two Wooden Planks 150 mm × 50 mm each are connected to form a T section of a beam. A moment of 6.4 kN-m is applied around the horizontal neutral axis. Find the bending stresses at both the extreme fibers of cross-section (Fig. 2) : [6]

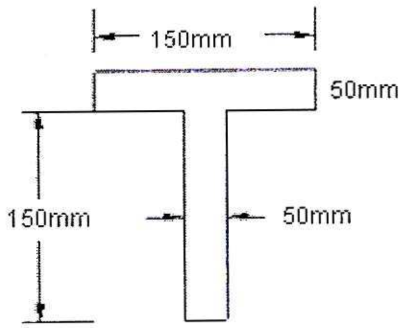


Fig. 2

Or

2. (*a*) A composite member made of steel bar (60 mm dia. and 600 mm length) and aluminum bar (30 mm dia. and 300 mm length) is held between two supports as shown in Fig. 3. The composite member is stress free at a temperature 38°C. What will be the stress in the two materials, when temperature is 21°C. Assume supports are unyielding. Take E_S = 210 GPa, E_A = 74 GPa and $\alpha_s = 11.7 \times 10^{-6}/°C$, $\alpha_A = 23.4 \times 10^{-6}/°C$. [6]

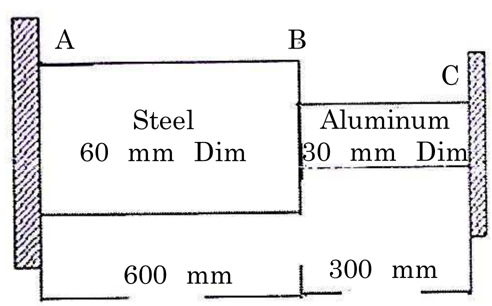


Fig. 3

(*b*) A beam of symmetrical I section is 200 mm × 400 mm in size. The thickness of flange is 20 mm and web is 15 mm. The beam is carrying maximum shear force 80 kN. Draw stress distribution diagram over the depth of section. [6]

3. (*a*) A bronze tube of 80 mm outside diameter is fitted over and firmly attached to a steel shaft of 50 mm dia. The working shearing stresses are 65 MPa and 40 MPa for steel and bronze respectively. Calculate the power which can be transmitted by the compound shaft at 5 rpm. Take G = 85 GPa for steel and 45 GPa for bronze. [6]

(*b*) A shaft of 100 mm diameter transmits 200 kW power at 200 rpm. If at a section bending moment is 5 kNm, then find the principal stress and maximum shear stress. [6]

Or

4. (*a*) A steel rod 80 mm in diameter is 5 m long. Find the maximum instantaneous stress induced when a pull of 160 kN is applied (*i*) Gradually (*ii*) Suddenly. Also find instantaneous elongation. Comment on result. Take E = 210 GPa. [6]

(*b*) Prove : [6]

$$\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$$

in case of torsion of circular shaft.

5. (*a*) A beam AB 10 m long and hinged at its ends is subjected to couples as shown in Fig. 4. Draw shear force diagram and bending moment diagram. Also determine the position of a point of contraflexure if any. [7]

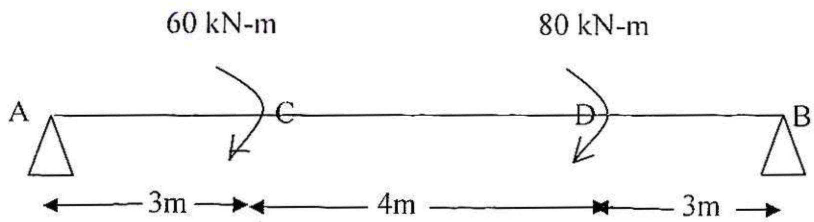


Fig. 4

(*b*) For the beam ABCD the shear force diagram as shown in Fig. 5. Construct the bending moment diagram and load diagram from given shear force diagram. No couple is acting on the beam. [6]

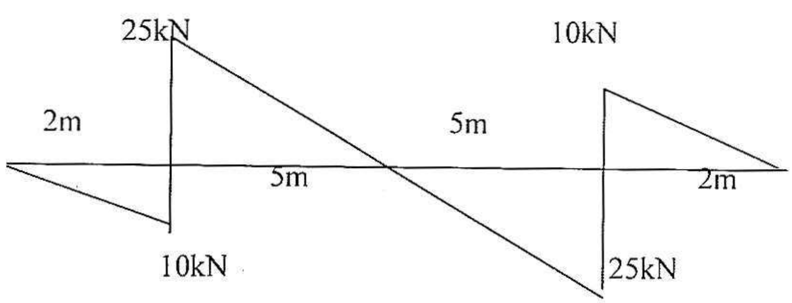


Fig. 5

Or

6. (*a*) Draw shear force diagram and bending moment diagram for the beam as shown in Fig. 6. Indicate the numerical values at all important section. Find the position of contraflexure if any : [7]

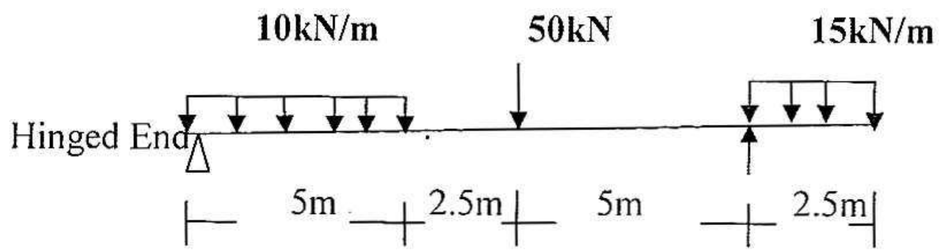


Fig. 6

(*b*) The diagram as shown in Fig. 7 is the shear force diagram for a beam which rests on two supports, one being at the left hand end. [6]

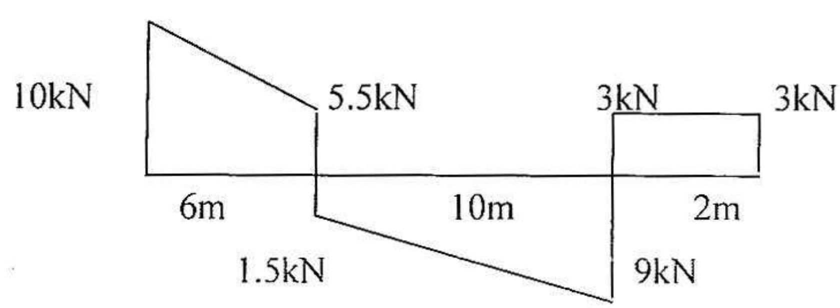


Fig. 7

7. (*a*) Determine the crippling load when strut is used with both ends pinned or hinged. [6]

(*b*) A short length of tube of 40 mm internal diameter and 50 mm external diameter failed in compression at a load of 240 kN. When 2 m length of the same tube was tested as a strut with fixed ends the load at failure was 158 kN. Assuming that 'σ_C' in Rankine's formula is given by the first test, find the value of the constant 'α' in same formula. What will be crippling load of this tube, if it is used as a strut 3 m long with one end fixed and the other end hinged ? [7]

Or

8. (*a*) A steel rod 5 m long and of 40 mm diameter is used as a column with one end fixed and other is free. Determine the crippling load by Euler's formula. Take E = 200 GPa. [6]

(*b*) A rectangular column section of size 400 mm × 200 mm is subjected to compressive eccentric load of 210 kN acting as shown in Fig. 8 at an eccentricity of 80 mm from longitudinal axis. Determine the maximum and minimum stresses set up in the section : [7]

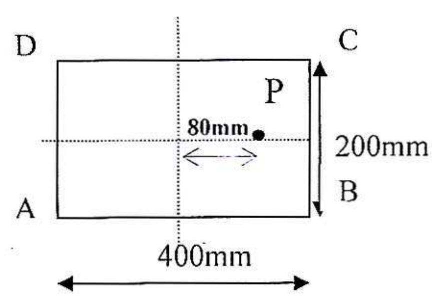


Fig. 8

Total No. of Questions—8] [Total No. of Printed Pages—4+1

Seat No.	

[4657]-504

S.E. (Civil) (First Semester) EXAMINATION, 2014

SURVEYING

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Neat diagrams must be drawn wherever necessary.

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

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data if necessary.

1. (*a*) Explain the following technical terms with sketches : [6]

(*i*) Oblique offset

(*ii*) Swivel joint

(*iii*) True meridian

(*iv*) Base line.

(*b*) The following notes refer to reciprocal levels. Find R.L. of B. [6]

Instrument at	**Staff reading on**		**Remarks**
	A	**B**	
A	1.755	3.155	Distance AB = 500.00 m
B	1.155	2.915	RL of A = 1000.00 m

Or

2. (*a*) Explain the following with sketches :

(*i*) Lifting lever

(*ii*) U-fork with plumb-bob

(*iii*) WCB

(*iv*) Eye ranging. [6]

(*b*) While carrying out the permanent adjustment of a dumpy level by two peg method, the following observations were made :

Inst. At	**Reading on C**	**Reading on D**	**Remark**
E midpoint of CD	2.000	3.000	CD = 100 m; CF = 120 m;
F	1.500	2.75	DF = 20 m;

Check whether the instrument needs adjustment or not and whether the line of collimation is inclined upwards or downwards. What should be the correct reading at C if the instrument is to be adjusted at F ? [6]

3. (*a*) Write short notes on : [6]

(*i*) Direction angle method

(*ii*) Error of closure in Theodolite traversing.

(*b*) A simple circular curve is to be set out by offsets from chord produced. The curve has the following details :

(*i*) Radius of the curve 600 m

(*ii*) Deflection angle of the curve 29°

(*iii*) Chainage of intersection point 2900 m

(*iv*) Peg interval 30 m.

Tabulate the data necessary to set out the curve. [6]

Or

4. (*a*) Write short notes on : [6]

(*i*) Balancing the traverse

(*ii*) Prolonging a line.

(*b*) Draw neat sketch and write equations for the following in terms of radius of curve (R) and deflection angle (ϕ) : [6]

(*i*) Long chord

(*ii*) Versed sine

(*iii*) Apex distance.

5. (*a*) Describe the methods of determination of tacheometric constants. [7]

(*b*) Explain permanent adjustment of the horizontal axis. [6]

Or

6. (*a*) The following observations are made on a vertically held staff with a tacheometer fitted with a anallactic lens. The multiplying constant of the instrument was 100. Compute the length of AB and RL of B : [7]

Inst. at	**H.I**	**Bearing**	**Staff station**	**Vertical angle**	**Hair readings (m)**	**Remarks**
BM	1.50	30°	A	–5° 30'	1,000, 1.110, 1.250	R.L.of BM 200.00 m
		120°	B	+10° 00'	0.950, 1.150, 1.260	

(*b*) State permanent adjustments of Theodolite. Explain any *one* in detail. [6]

7. (*a*) Explain step by step procedure of setting out building with total station. [7]

(*b*) Describe setting out tunnel centre line on surface. [6]

Or

8. (*a*) Write the working principle of total station. Explain the features of total station. [7]

(*b*) Write a short note on Route Survey. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-505

S.E. (Civil) (First Semester) EXAMINATION, 2014

GEOTECHNICAL ENGINEERING

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data if necessary.

1. (*a*) State details of all natural transportation agents for formation of soils and give *one* example of each category. [6]

(*b*) A sand deposit with specific gravity of 2.65, has bulk density of 19.20 kN/m^3 on the field. Its natural moisture content is 9%. Determine the critical hydraulic gradient of the sand deposit. Take γ_W = 9.81 kN/m^3. [6]

Or

2. (*a*) Define consistency of soils and show the four states of consistency graphically with appropriate consistency limits. [6]

(*b*) With neat sketch explain the procedure of construction of flownet for seepage through earthen dam. [6]

3. (*a*) Explain the procedure for unconfined compression test with neat sketches. [6]

(*b*) Explain the process of field compaction and its control using Proctor needle. [6]

Or

4. (*a*) State and explain the terms involved in Boussinesq's point load and circular load equation for vertical stress determination. [6]

(*b*) Define sensitivity :

A clayey sample when tested in unconfined compression, gave compressive strength of 100 kN/m^2. Specimen of same clay, with same initial condition is subjected to undrained, unconsolidated triaxial test under a cell pressure of 100 kN/m^2. Determine the axial stress in kN/m^2 of failure. [6]

5. (*a*) Determine the relation for lateral earth pressure in active state for submerged cohesionless backfill. [7]

(*b*) Explain step by step procedure for determination of lateral earth pressure graphically by Rehbann's method with neat sketch. [6]

Or

6. (*a*) Define the term lateral earth pressure in passive state.

A wall 8 m high with a smooth vertical back retains dry cohesionless sand with $\gamma = 18$ kN/m^3 and $\phi = 30°$. Determine the total lateral pressure per metre length of the wall in passive state. [7]

(*b*) Determine the relation for lateral earth pressure in active state for dry and cohesive backfill. [6]

7. (*a*) Explain Taylor's stability number.

Determine the factor of safety for a cohesive soil ($\phi = 0$) 7 m high, if its stability number is known to be 0.156. The slope material has cohesion = 25 kN/m^2 and unit weight 18.5 kN/m^3. [7]

(*b*) State and describe the zones in the contaminated soil strata below the waste dump and how is their extent determined ? [6]

Or

8. (*a*) Discuss the slope stability measures that can be adopted to avoid the occurrence of landslides. [6]

(*b*) What is subsurface contamination ? Discuss the solidification and stabilization method for control of subsurface contamination. [7]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-50A

S.E. (Electronics/E & TC) (Second Semester) EXAMINATION, 2014

SIGNALS AND SYSTEMS

(2008 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) (*i*) Draw the following signals : [3]

$$x(t) = u(t + 1) - 2u(t) - 2u(t - 1).$$

(*ii*) For the following system represented in input-output relationship determine whether the corresponding system is memoryless, causal, stable, time invariant, linear, invertible : [6]

$$y(t) = \sin x(t).$$

P.T.O.

(*b*) Perform the convolution integral for the following signals : [9]

$$x(t) = \text{rect}(t) \text{ and}$$

$$h(t) = \text{rect}(t).$$

Or

2. (*a*) (I) Find whether the following signals are periodic or aperiodic and if periodic, find the value of the fundamental period : [4]

(*i*) $x(t) = \sin tu(t)$

(*ii*) $x[n] = \cos 5\pi n.$

(II) Find whether the following signals are energy or power signals and find the value of the same : [5]

(*i*) $x(t) = u(t)$

(*ii*) $x[n] = \text{Asgn}[n].$

(*b*) (I) State and prove the condition of stability for an LTI system. [5]

(II) Find the step response if the impulse response is given by : [4]

$$h(t) = tx(t + 1)\ u(t).$$

3. (*a*) (I) Determine the complex exponential Fourier series for the periodic rectangular pulse train having amplitude A, width τ, Period T_0. [5]

(II) What is significance of Fourier series ? What are the advantages of exponential Fourier series over other types of Fourier series ? [3]

(*b*) State and prove the following properties with respect to Laplace Transform : [8]

(*i*) Shifting in time domain

(*ii*) Convolution in time domain.

Or

4. (*a*) Find the Fourier transform of the following signals : [8]

(*i*) $e^{j\omega_0 t}$

(*ii*) $\cos\omega_0 t u(t)$

(*iii*) $\delta(t)$

(*iv*) $u(t)$.

(*b*) (I) Find the initial and final value for the given Laplace transform : [4]

$$X(s) = \frac{7s + 10}{s(s + 2)}.$$

(II) Find the Laplace transform and ROC for the given signal : [4]

$$x(t) = e^{-at}u(-t) \quad t \leq 0.$$

5. (*a*) Find autocorrelation, PSD and power of the following signals : [8]

$$x(t) = A \sin\omega_0 t.$$

(*b*) Explain Binomial distribution and Gaussian distribution probability models. [8]

Or

6. (*a*) A coin is tossed three times. Write the sample space. A random variable X represents number of tails obtained on any triple toss. Draw the mapping of S on to real line. Also find the probabilities of X. Also find and plot CDF. [8]

(*b*) If

$$x(t) = e^{-at}u(t),$$

show that autocorrelation and ESD forms Fourier transform pair for the given signal. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-51

S.E. (Instrumentation & Control) (I Sem.) EXAMINATION, 2014

FUNDAMENTALS OF INSTRUMENTATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Explain in brief — Resolution, Dynamic error, Precision and Hysteresis. [8]

(*b*) The input resistance of voltmeter should be very high as compared to load resistance. Explain this statement. [8]

Or

2. (*a*) Derive the equation for the loading effect of a series connected instrument. [8]

(*b*) What is calibration ? Explain the process of calibration with neat example. [8]

3. (*a*) Explain the working of electrodynamometer type of wattmeter with neat diagram. [8]

(*b*) Explain how d.c. potentiometer is used for measurement of unknown voltage. Also explain the working of duo range potentiometer. [10]

Or

4. (*a*) Derive an expression for the measurement of unknown resistance R_x using shunt type ohmmeter. Why is switch used in the construction of shunt type of ohmmeter ? [10]

(*b*) Extend the range of basic PMMC movement whose internal resistance is 1000 ohm and full scale deflection current of 1 mA into voltmeters having ranges of 5 V, 15 V and 50 V. [8]

5. (*a*) Derive the balancing condition of a.c. bridges with the help of neat diagram. [8]

(*b*) Explain, how Wheatstone bridge is used for measurement of unknown resistance. [8]

Or

6. (*a*) Explain the working of current sensitive and voltage sensitive bridge. [8]

(*b*) How can a Schering bridge be used to measure unknown capacitance and its dissipation factor ? [8]

SECTION II

7. (*a*) Explain, how temperature is measured using digital thermometer with help of neat block diagram. [8]

(*b*) What are the advantages of digital instruments over analog instruments ? [8]

Or

8. (*a*) The digital multimeter is basically a digital voltmeter. State whether this statement is true or false. Justify your answer. [8]

(*b*) Explain, how speed can be measured with help of Digital Tachometer. [8]

9. (*a*) Explain, how frequency can be measured using Y-*t*, X-Y and Z modulation. [12]

(*b*) Explain the principle of waveform display in CRO. [6]

Or

10. (*a*) Explain the function of the following front panel control knobs of dual trace CRO. Also state how these are achieved : Intensity, Focus, Volts/div., Time/div., TR, Level. [12]

(*b*) What is the Lissajous pattern in CRO ? How is it used for phase measurement ? [6]

11. (*a*) What is role of Virtual Instrumentation in modern world instrumentation ? [8]

(*b*) With the help of op-amp circuit, explain how triangular and square waves are generated. [8]

Or

12. (*a*) Explain galvanometric recorder with neat diagram. [8]

(*b*) Explain the different marking mechanism in recorders. [8]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-510

S.E. (Civil) (II Sem.) EXAMINATION, 2014

FLUID MECHANICS—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain the role of Fluid Mechanics and its practical applications for obtaining solution to practical flow problems. [3]

(*b*) Explain with suitable examples application of viscosity in every day activity and design of engineering systems. [3]

(*c*) Differentiate between surface tension and capillarity. Give practical example of each. Derive the relation showing the capillary rise or fall depends on surface tension. [6]

Or

2. (*a*) A 10 mm glass tube is inserted into trough containing mercury. Find the capillary effect when the contact angle is :

(*i*) 180° and

(*ii*) 110°.

Take surface tension of mercury in contact with air as 0.51 N/m. [3]

(*b*) What is total pressure and centre of pressure ? Derive the condition for total pressure on vertically immersed surface. [3]

(*c*) Conduct a dimensional analysis by Buckingham Π theorem and prove that the pressure drop in a venturimeter can be expressed by :

$$P = \rho V^2 f\left(\frac{d}{D}\right).$$

Where, P = pressure drop, V = velocity at inlet, ρ = fluid density, D and *d* diameter at inlet and throat. [6]

3. (*a*) Explain :

(*i*) Velocity potential function ϕ and

(*ii*) Stream function ψ

and what are their properties. Show that equipotential and streamline meet orthogonally. [6]

(*b*) Describe the flow given by the expression below : [6]

(*i*) $\psi = 12y^2 + 10$,

(*ii*) $\psi = 3x + 12$,

(*iii*) $\psi = 5x - 4y^2$.

Or

4. (*a*) A venturimeter is to be fitted to a pipe of area 0.01767 m^2. A maximum discharge of 5 m^3/min under a pressure of 4.5 m flows through the pipe. Find the diameter at the throat for no negative pressure at the throat. [6]

(*b*) What is the difference between orifice and mouthpiece ? Show that the discharge through an external mouthpiece is given by $Q = 0.855\ a\ \sqrt{2}\,gH$, where a = area of mouthpiece and H = Height of liquid above mouthpiece. [6]

5. (*a*) Write brief notes on : [6]

(*i*) Rotameter,

(*ii*) Nozzlemeter.

(*b*) Explain with sketch the development of boundary layer of flat plate. Explain the phenomenon of boundary layer separation and any *one* method to control it. [7]

Or

6. (*a*) Derive the expression for velocity distribution for generalized couette flow (one plate stationary and other moving) and from it develop equation for discharge and shear stress. [7]

(*b*) Derive expression for boundary layer thickness, boundary shear stress and friction drag in a turbulent boundary layer. [6]

7. (*a*) What is turbulent flow and its characteristics ? Explain Isotropic turbulence, wall turbulence and free turbulence. [7]

(*b*) What is roughening of pipe with age ? How is roughness of old pipe determined ? Explain Nikuradse's experiment with artificially roughened pipe and what are their significance ? [6]

Or

8. (*a*) Derive the Darcy-Weishbach equation for friction loss in pipe. [6]

(*b*) Three pipes of diameter 10 cm each, and having length 25 m, 50 m and 25 m are joined together in series. Water flows through this pipe at 2.15 m/s. The central pipe of length 50 m is replaced by 20 cm diameter pipe. The change in section due to replacement at both ends are sudden. Assuming friction factor f = 0.032 and Cc is 0.62, find the net saving in head. [7]

Total No. of Questions—8] [Total No. of Printed Pages—8

Seat No.	

[4657]-511

S.E. (Mech./Mech. Sand/Prod. etc.) (First Semester)

EXAMINATION, 2014

ENGINEERING MATHEMATICS–III

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of electronic pocket calculator is allowed.

(*v*) Assume suitable data if necessary.

1. (*a*) Solve any *one* of the following : [8]

(*i*) $(D^2 - 4D + 4)y = e^x . \cos^2 x$

P.T.O.

(*ii*) $(D^2 + 5D + 6)y = e^{-2x} \cdot \sec^2 x\,(1 + 2\tan x)$

(*iii*) $\dfrac{d^2y}{dx^2} + y = \operatorname{cosec} x$, by variation of parameters.

(*b*) Find the Fourier transform of : [4]

$$f(x) = 1, \quad |x| \le a$$
$$= 0, \quad |x| > a$$

Or

2. (*a*) Weight of 1 N, stretches a spring 5 cms. A weight of 3 N is attached to the spring and weight W is pulled 10 cm below the equilibrium position and released. Determine the position and the velocity as a function of time. [4]

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

(*i*) Find Laplace transform of the function :

$$f(t) = \frac{(e^{-at} - e^{-bt})}{t}$$

(*ii*) Find inverse Laplace transform of the function :

$$F(s) = \frac{3s + 1}{(s - 1)(s^2 + 1)}.$$

(*c*) Solve the following equation using Laplace transform method : [4]

$$y''(t) - 3y'(t) + 2.y(t) = 12.\,e^{-2t};\ y(0) = 2,\ y'(0) = 6.$$

3. (*a*) If the directional derivative of :

$$\phi = axy + byz + cxz \text{ at } (1, 1, 1)$$

has maximum magnitude 4 in a direction parallel to x axis, find the values of a, b, c. [4]

(*b*) Show that the vector field :

$$\overline{F} = (2xz^3 + 6y)\,i + (6x - 2yz)\,j + (3x^2z^2 - y^2)k$$

is irrotational and find scalar function ϕ such that $\overline{F} = \nabla\phi$. [4]

(*c*) Find the coefficient of correlation for the following data : [4]

x	y
10	18
14	12
18	24
22	6
26	30
30	36

Or

4. (*a*) Prove the following (any *one*) : [4]

(*i*) $\nabla^4 e^r = e^r + \frac{4}{r} e^r$

(*ii*) $\nabla . \left[r \nabla \left(\frac{1}{r^n} \right) \right] = \frac{n(n-2)}{r^{n+1}}$.

(*b*) Between 2 p.m. and 3 p.m. the average number of phone calls per minute coming into company are 2. Find the probability that during one particular minute there will be 2 or less calls. [4]

(*c*) Calculate the first four moments about the mean of the given distribution. Also find β_1 and β_2. [4]

x	***f***
2	5
2.5	38
3	65
3.5	92
4	70
4.5	40
5	10

5. (*a*) Evaluate $\int_C \overline{F} \cdot d\overline{r}$ for : [4]

$$\overline{F} = 3x^2\,\bar{i} + (2xz - y)\,\bar{j} + z\bar{k}$$

along the straight line joining (1, 2, 1) and (2, 1, 3).

(*b*) Evaluate :

$$\iint_S \overline{F} \cdot d\overline{S} \quad \text{where} \quad \overline{F} = (x + y^2)\,\bar{i} - 2x\bar{j} + 2yz\,\bar{k}$$

and S is the surface of the tetrahedron bounded by the coordinate planes and the plane : [5]

$$2x + y + 2z = 6.$$

(*c*) Evaluate :

$$\int_c (xy\,dx + xy^2\,dy)$$

by Stokes' theorem, where C is the square in x-y plane with vertices (0, 0), (1, 0), (1, 1), (0, 1). [4]

Or

6. (*a*) Using Green's theorem, show that the area bounded by a simple closed curve C is given by :

$$\frac{1}{2}\int xdy - ydx.$$

Hence find the area of circle $x = a\cos\theta$, $y = a\sin\theta$. [4]

(*b*) Evaluate :

$$\iint_S (x^3 \, \bar{i} + y^3 \, \bar{j} + z^3 \, \bar{k}) \cdot d\bar{S}$$

where S is the surface of the sphere : [5]

$$x^2 + y^2 + z^2 = a^2.$$

(*c*) Evaluate :

$$\iint_S (\nabla \times \bar{F}) \cdot \hat{n} \, dS \quad \text{where} \quad \bar{F} = (x - y)\,\bar{i} + (x^2 + yz)\,\bar{j} - 3xy^2\,\bar{k}$$

and S is the surface of the cone :

$$z = 4 - \sqrt{x^2 + y^2}$$

above xoy plane. [4]

7. (*a*) If

$$\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$$

represents the vibrations of a string of length l fixed at both ends, find solution with conditions : [7]

(*i*) $y(0, t) = 0$

(*ii*) $y(l, t) = 0$

(*iii*) $\left(\dfrac{\partial y}{\partial t}\right)_{t=0} = 0$

(*iv*) $y(x, 0) = k(lx - x^2),\ 0 \le x \le l.$

(*b*) A homogeneous rod of conducting material of length 100 cm has ends kept at zero temperature and the temperature initially is :

$$u(x, 0) = x, \quad 0 \le x \le 50,$$

$$= 100 - x, \quad 50 \le x \le 100.$$

Find the temperature $u(x, t)$ at any time t. [6]

Or

8. (*a*) An infinitely long uniform metal plate is enclosed between lines $y = 0$ and $y = l$ for $x > 0$. The temperature is zero along the edges :

$$y = 0,\ y = l$$

and at infinity. If the edge $x = 0$ is kept at a constant temperature u_0, find the temperature distribution $u(x, y)$. [7]

(*b*) Use Fourier transform to solve : [6]

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

subject to the following conditions :

(*i*) $u(0, t) = 0, t > 0$

(*ii*) $u(x, 0) = 1, 0 < x < 1$

$= 0, x > 1,$

(*iii*) $u(x, t)$ is bounded.

Total No. of Questions—8] [Total No. of Printed Pages—4+2

Seat No.	

[4657]-512

S.E. (Mechanical/Automobile/Mechanical Sandwich)

(First Semester) EXAMINATION, 2014

THERMODYNAMICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Solve any *four* questions (Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**).

(*ii*) All the four questions should be solved in one answer-book and attach extra supplements if required.

(*iii*) Draw neat and labelled diagrams wherever necessary.

(*iv*) Use of steam tables, Mollier charts, scientific calculator is allowed.

(*v*) Assume suitable data wherever necessary.

(*vi*) Figures to the right side indicate full marks.

1. (*a*) State limitations of first law of thermodynamics. Explain how Clausius and Kelvin Planck statements overcome these limitations using the heat engine, heat pump and refrigerator concept. Define thermal efficiency of heat engine and COP for refrigerator and heat pump. [6]

(*b*) 1 kg of ice at –5 deg. C is exposed to atmosphere at 20 deg. C. The ice melts and attains thermal equilibrium with surrounding. Determine : [6]

(*i*) Change in entropy of the universe

(*ii*) Total heat transfer during the process.

$C_{p\ ice}$ = 2.093 kJ/kg K, Latent heat of fusion = 333.3 kJ/kg. $C_{p\ water}$ = 4.187 kJ/kg K.

Or

2. (*a*) Derive expression for the following quantities for an ideal gas undergoing a constant pressure process : [6]

(*i*) Heat transfer

(*ii*) Non-flow work transfer

(*iii*) Steady flow work transfer

(*iv*) Change in entropy

(*v*) Change in internal energy and change in enthalpy during the process.

(*b*) A reversible heat engine working as a refrigerator absorbs heat from low temperature reservoir of 650 kJ, when work input is 250 kJ : [6]

(*i*) Find its COP and heat transferred to the surrounding.

(*ii*) If the same device works as a heat engine, find out its thermal efficiency.

(*iii*) If the same device works as a heat pump, estimate the COP.

3. (*a*) Draw P-v and T-s diagram for Otto cycle and derive the efficiency equation for Otto cycle. [6]

(*b*) Steam initially at 1.5 MPa, 300 deg. C expands isentropically in a steam turbine to 40 deg. C. Determine the ideal work output of the steam per kg of steam. [6]

Or

4. (*a*) Define dryness fraction. Explain throttling calorimeter with neat diagram for estimating the dryness fraction. [6]

(*b*) 1000 kJ of heat leaves the hot gases at 1400 deg. C from a fire box and goes to a steam at 250 deg. C. Atmospheric temperature is 20 deg. C. Divide the energy into available and unavailable part as it : [6]

(*i*) Leaves the hot gases

(*ii*) Enters the system.

5. (*a*) Show block diagram of a boiler plant showing location of air-preheater, superheater, economizer clearly indicating the air and water circuit flow. [6]

(*b*) The following particulars refer to a steam power plant consisting of a boiler, superheater and economizer :

Steam pressure = 20 bar, Mass of steam generated = 10000 kg/hr, Mass of coal used = 1300 kg/hr, CV for coal = 29000 kJ/kg. Temperature of feed water entering the economizer

= 35 deg. C, temperature of feed water leaving the economizer = 105 deg. C. Dryness fraction of the steam leaving the boiler = 0.98. Temperature of steam leaving the superheater = 350 deg. C.

Determine :

(1) Overall efficiency of the boiler plant.

(2) Equivalent evaporation of the given boiler from and at 100 deg. C in kg of steam generated/kg of coal burnt and

(3) Percentage of heat utilised in economizer, boiler and superheater. [7]

Or

6. (*a*) Define equivalent evaporation and boiler efficiency. Explain heat balance sheet for boiler. [7]

(*b*) How must air per kg of coal is burnt in a boiler having chimney height of 32.3 m to create a draught of 19 mm of water column when the temperature of the flue gases leaving chimney is 370 deg. C and temperature of boiler house is 29.5 deg. C. Also calculate the draught produced in terms of hot gas column. [6]

7. (*a*) Define :

(*i*) Mass fraction

(*ii*) Mole fraction

(*iii*) Stoichiometric air

(*iv*) Actual and excess air

(*v*) Air-fuel ratio and mixture strength. [6]

(*b*) The ultimate analysis of solid fuel is as follows :

C = 78%, O_2 = 3%, H_2 = 3%, S = 1%, moisture = 5% and ash = 10%. Calculate the mass of air supplied also individual and total mass of products of combustion per kg of fuel if 30% of excess air is supplied for combustion. [7]

Or

8. (*a*) Explain working of a bomb calorimeter with neat sketch for estimating the CV of solid for liquid fuels. [6]

(*b*) In a bomb calorimeter the following observations were recorded :

Mass of coal burnt = 3 gm

Mass of water in calorimeter = 1.4 kg

Water equivalent of the calorimeter = 0.9 kg/K

Rise in temperature of water jacket = 9 deg. C

The coal contains 3% moisture by weight and R.T. = 25 deg. C. Calculate the HCV and LCV. Consider latent heat of condensation of steam 2470 kJ/kg. [7]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-513

S.E. (Mechanical and Automobile) (I Sem.) EXAMINATION, 2014

MANUFACTURING PROCESSES—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) The questions should be solved in one answer-book and attach extra supplements if required.

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

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of non-programmable electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

(*vi*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** Q. No. **5** *or* Q. No. **6** Q. No. **7** *or* Q. No. **8**.

1. (*a*) Explain Investment casting along with advantages and limitations. [6]

(*b*) A cylindrical riser must be designed for a sand casting mould. The size of steel casting is 60 mm × 120 mm × 20 mm. The previous observations have indicated that the total solidification time for casting is 90 sec. The cylindrical riser have (d/h) = 1. Find the size of riser so that its total solidification time is 130 sec. [6]

Or

2. (*a*) Explain with sketch Extrusion type. [6]

(*b*) Using open-die forging operation, a solid cylindrical piece of 304 stainless steel having 100 mm diameter × 72 mm height is reduced in the height to 60 mm at room temperature. Assuming the coefficient of friction as 0.22 and the flow stress for this material at the required true strain as 1000 MPa, calculate the forging force at the end of stroke. [6]

3. (*a*) Explain Resistance welding. State the advantages and limitations of the process. [6]

(*b*) Explain with sketch Extruder type. [6]

Or

4. (*a*) Explain with sketch GTAW. State the advantages and limitations of the process. [6]

(*b*) Explain with sketch Injection molding. [6]

5. (*a*) Explain methods of reducing cutting forces in sheet metal works. [7]

(*b*) Determine force required for blanking a square plate having its side 60 mm and have a central hole of diameter 15 mm. The sheet metal thickness is 3 mm and shear strength of material is 380 N/mm^2. Show die and punch dimensions. Consider clearance of 10% of stock thickness. [6]

Or

6. (*a*) Explain with sketch the type of strippers used in sheet metal working. [7]

(*b*) A cup without flanges and height 25 cm and diameter 10 cm is to be made from sheet metal 1 mm thickness with ultimate tensile strength.

Find :

(*i*) Blank size

(*ii*) No. of draws

(*iii*) Dimensions of die and punch for first draw

(40% reduction in first draw) [6]

7. (*a*) State various taper turning methods on lathe and explain *one* with sketch. [7]

(*b*) Calculate the machining time required for 3 passes while reducing 65 mm diameter shaft to 55 mm diameter for a length of 1200 mm with depth of cut of 2 mm for rough cut and 1 mm for finish cut. [6]

Given :

(*i*) Cutting speed = 25 m/min

(*ii*) Feed = 0.5 mm/rev

(*iii*) Approach length = 5 mm

(*iv*) Overrun length = 5 mm

(*v*) Number of passes = 3 (2 rough cut + 1 finish cut)

Or

8. (*a*) State various lathe accessories and explain *one* with sketch. [7]

(*b*) Calculate the gears and sketch the gear train for cutting a 26 TPI in a lathe with leadscrew having 4 TPI. Available gears are 20 to 120 in step for five teeth. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4+1

Seat No.	

[4657]-514

S.E. (Mechanical/Automobile) (First Semester)

EXAMINATION, 2014

FLUID MECHANICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer *four* questions out of **8**.

(*ii*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*iii*) All the four questions should be solved in one answer-book and attach extra supplements if required.

(*iv*) Draw diagrams wherever necessary.

(*v*) Use of scientific calculator is allowed.

(*vi*) Assume suitable data wherever necessary.

1. (*a*) State and prove Pascal's law. [6]

(*b*) Stream function is defined as :

$$\psi = x^3 - 3xy^2.$$

Determine whether the flow is rotational or not. Also deduce the expression of velocity potential. [6]

Or

2. (*a*) A Newtonian liquid of kinematic viscosity 3 stokes flows over a flat horizontal plate of surface area 0.8 m^2. Velocity at y meters from plate is given as $u = 2y - 2y^3$ in m/s. If shear force on plate is 0.352 N, find the density of liquid. [6]

(*b*) Prove that streamlines and equipotential lines are orthogonal to each other. [6]

3. (*a*) Derive an expression for Bernoulli's equation along stream-line. [6]

(*b*) A liquid of viscosity of 34.5 poise is flowing between two horizontal plates 50 mm apart with a maximum velocity of 2.5 m/s. Calculate :

(*i*) The discharge per meter width

(*ii*) Shear stress at the plates

(*iii*) The difference in pressure between two plates. [6]

Or

4. (*a*) Two orifices are placed in a vertical wall in such a way that lower one is 30 cm above the ground while upper one is 6 m above the first one. Horizontal distance travelled by the jet from top orifice is 3 times than the one travelled by lower jet. Both distances are measured at ground level. Assume C_v = 0.96 for both orifices, find the head of water behind the wall. [6]

(*b*) Derive expression for velocity distribution for flow in fixed parallel plates. [6]

5. (*a*) Derive an expression for Dupuit's equation. [6]

(*b*) Discharge Q of a centrifugal pump can be assumed to be dependent on density of liquid ρ, viscosity of liquid μ, pressure *p*, impeller diameter D, and speed N in RPM. Using Buckingham π-theorem, show that : [7]

$$Q = ND^3 \, \phi\left[\frac{gH}{N^2D^2}, \quad \frac{v}{ND^2}\right].$$

Or

6. (*a*) Explain :

(*i*) Reynolds number

(*ii*) Weber number

(*iii*) Euler number. [6]

(*b*) Power is to be transmitted through 300 mm dia., 500 m long pipe fitted with a nozzle at the end. The inlet is from a reservoir where water level is 90 m above the nozzle. Calculate the maximum power which can be transmitted and diameter of nozzle required. Take $f = 0.03$. [7]

7. (*a*) Derive an expression for displacement, momentum and energy thicknesses. [9]

(*b*) A truck having a projected area of 6.5 m^2, travelling 70 km/hr, has a total resistance of 2000 N. Of this 40% is due to rolling friction and 20% due to skin friction. The rest is due to pressure drag. Find the coefficient of pressure drag. Take $\rho = 1.22$ kg/m^3 for air. [4]

Or

8. (*a*) A metallic ball of diameter 0.04 m drops in a fluid of specific gravity 0.7 and viscosity is 20 poise. Density of ball = 12000 kg/m^3. Determine : [6]

(*i*) Drag force exerted on ball

(*ii*) Pressure drag and friction drag

(*iii*) Terminal velocity of the ball.

(*b*) Write a short note on "Separation of Boundary Layer its Control". [7]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-515

S.E. (Mechanical/Automobile) (First Semester)

EXAMINATION, 2014

MATERIAL SCIENCE

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer *four* questions out of 8.

(*ii*) Solve Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

(*iii*) All the *four* questions should be solved in one answer-book and attach extra supplements if required.

(*iv*) Draw diagrams wherever necessary.

(*v*) Assume suitable data wherever necessary.

1. (*a*) Sketch within a cubic unit cell the following planes :

(100), (110), (111) and (011). [4]

(*b*) Differentiate between slip and twinning. [4]

(*c*) Explain the classification of composites. [4]

Or

2. (*a*) The planes in a crystalline solid intersect the crystal axes at $(2a, 2b, c)$, $(2a, b, 2c)$ and (a, b, c). Calculate the Miller Indices of this plane. [4]

(*b*) Explain any *two* Imperfection in Crystal (or Lattices) from the list given below : [4]

(*i*) Edge Dislocation

(*ii*) Stacking fault

(*iii*) Low angle boundary.

(*c*) A glass fibre reinforced epoxy matrix composite contains 60 volume percent of continuous glass fibre. Determine Young's modulus of the composite assuming longitudinal loading condition. Modulus of elasticity for glass fibre is 72 GPa and that of epoxy is 2.4 GPa. [4]

3. (*a*) The following observations are made during tension test carried out on a 15 mm diameter plain carbon steel rod :

Yield load = 68 kN

Ultimate tensile load = 105 kN.

Find the yield strength and ultimate tensile strength of the steel rod. [4]

(*b*) Which non-destructive test is suitable for the following situations ? [4]

(*i*) For detection of surface cracks on brass components.

(*ii*) For detection of slag inclusion of welded joint.

(*c*) What are the non-destructive applications of eddy current testing ? [4]

Or

4. (*a*) Explain fatigue test. [4]

(*b*) Explain piling up and sinking effects on surface of test piece found when conducting Brinell Hardness test. [4]

(*c*) Explain the principle advantages and limitations of Radiographic test. [4]

5. (*a*) Briefly explain Bio-material and its classification ? [6]

(*b*) What are Nano-materials ? Explain any *three* properties of Nano materials. [7]

Or

6. (*a*) Briefly explain Biosensors and its application. [6]

(*b*) Write advantages of Cryogenic materials. [3]

(*c*) Explain Shape Memory Alloys (SMA). [4]

7. (*a*) What are the major steps in manufacturing of component by Powder Metallurgy ? [6]

(*b*) What are the advantages and limitations of Powder Metallurgy ? [7]

Or

8. (*a*) Draw the flow chart for manufacturing of cemented carbides ? [6]

(*b*) List down the steps involved in production of sintered structural components ? [3]

(*c*) What is conditioning of metal powders ? [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-52

S.E. (Instrumentation and Control Engineering) (First Semester)

EXAMINATION, 2014

LINEAR INTEGRATED CIRCUITS—I

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) State the assumptions made in the ideal op-amp. Also, explain the implications of these ideal assumptions. [6]

(*b*) A square wave of 1 MHz frequency and 8 V peak to peak amplitude is applied as an input to op-amp voltage follower

P.T.O.

circuit. The output of voltage follower is as shown in figure. What is the slew rate of op-amp ? Can 741 C op-amp be used in this application ? [8]

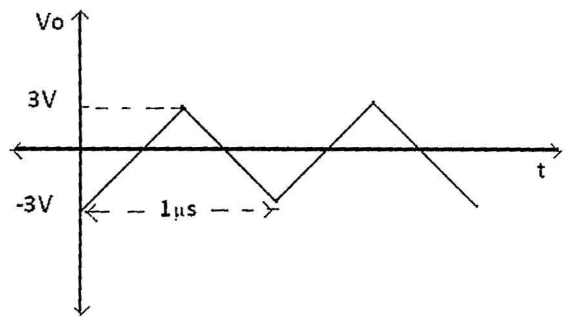


Fig. 1

(*c*) Explain, why gain of op-amp roll off after certain frequency is reached. [4]

Or

2. (*a*) Define any *five* characteristics of op-amp 741. Write the practical values of the characteristics mentioned in the same. [10]

(*b*) Using a 741 op-amp, what is the break frequency for a non-inverting amplifier with gain of 20 dB ? [6]

(*c*) Draw the high frequency equivalent circuit model of op-amp 741. [2]

3. (*a*) Derive the equation for voltage gain for voltage shunt feedback amplifier. [8]

(*b*) Why open loop op-amp configurations are not used in linear applications ? List out the advantages of negative feedback in amplifier circuits. [6]

(*c*) For the same closed loop gain, the closed loop bandwidth of inverting amplifier is lower than for non-inverting amplifier. State true *or* false. [2]

Or

4. (*a*) Derive the equation for voltage gain for op-amp non-inverting configuration. [8]

(*b*) For a differential amplifier with one op-amp, input resistance is of 1 kΩ and feedback resistance is of 10 kΩ. Calculate output voltage of the circuit where 8.5 V is applied at non-inverting input terminal & 7.0 V is applied inverting input terminal. The supply voltage for circuit is 20 V. Draw the circuit diagram. [8]

5. (*a*) Implement the following equation using op-amp :

$$V_0 = 0.1 \; V_1 + V_2 + 10V_3$$

where V_1, V_2 and V_3 are inputs and V_0 is output of op-amp. Draw the circuit diagram. [10]

(*b*) What are the requirements of good instrumentation op-amp ? List out any *two* instrumentation op-amp ICs. [6]

Or

6. (*a*) Explain working of Average Circuit using op-amp for input voltages V_1, V_2 and V_3. [8]

(*b*) State the limitations of basic differentiator. Explain with a neat diagram how limitations can be overcome in practical differentiator. [8]

SECTION II

7. (*a*) Design a Wien bridge oscillator for an output frequency of 1 kHz. Draw the circuit diagram. [6]

(*b*) Explain the working of precision full wave rectifier circuit with neat diagram. [10]

(*c*) State the importance of positive feedback in Schmitt trigger circuit. [2]

Or

8. (*a*) Explain the working of precision half-wave rectifier circuit with neat diagram. [8]

(*b*) An open loop circuit using op-amp 741 has 6 V peak to peak sine wave input at pin number 3 and 1 V dc signal at pin number 2. The output voltage swing is of ± 14 V. Draw the input and output waveforms and also the circuit diagram. [4]

(*c*) Design a Schmitt trigger for the given data :

$$VUT = VLT = 3.5 \text{ V.}$$

Let saturation voltage = ± 12 V. [6]

9. (*a*) Explain the working of astable multivibrator using IC 555. [8]

(*b*) Define the following terms of voltage regulator ICs with their units : [8]

(*i*) Line regulation

(*ii*) Load regulation

(*iii*) Ripple rejection

(*iv*) Dropout voltage.

Or

10. (*a*) Explain the working of monostable multivibrator using IC 555. [8]

(*b*) Explain how square wave can generate using astable multivibrator. [4]

(*c*) Write a short note on switching regulator. [4]

11. (*a*) Design an active first order low pass butterworth filter of cut off frequency 10 kHz. Assume passband gain of 2 and capacitor value as 0.01 μF. Show the calculations and draw the circuit diagram. [10]

(*b*) Compare active and passive filter. [6]

Or

12. (*a*) Draw frequency responses of ideal Low Pass, High Pass, Band Pass and Band Reject filters. [8]

(*b*) Draw practical frequency responses of above filters. [8]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-520

S.E. (Mechanical/Automobile) (II Sem.) EXAMINATION, 2014

ENGINEERING METALLURGY

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

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

(*iii*) Draw the neat sketch wherever necessary.

1. (*a*) With a neat diagram show the cooling curve of eutectic diagram and show the application of Gibb's phase rule in each region. [4]

(*b*) What is nucleation ? What are its types ? [2]

(*c*) Draw the steel region of Iron-Carbon equilibrium diagram and explain Austenite and Pearlite phase in detail. [6]

Or

2. (*a*) Explain classification of tool steel in detail. [4]

(*b*) What do you mean by weld decay ? [2]

(*c*) What is coring ? Which alloys shows coring ? [4]

(*d*) Explain the following : [2]

(*i*) Phase

(*ii*) Variable.

3. (*a*) Draw and show the following heat treatments on TTT curve and state the transformed product : [6]

(*i*) Martempering

(*ii*) Austempering

(*iii*) Ausforming.

(*b*) Explain in detail stress corrosion and pitting corrosion with the remedies to avoid it. [7]

Or

4. (*a*) What are the various transformation products of austenite ? Explain any *one* in detail with respect to transformation mechanism, temp., characteristics and structure. [7]

(*b*) Write short notes on : [6]

(*i*) Intergranular corrosion

(*ii*) Electroplating.

5. (*a*) Compare gray cast iron and white cast iron with respect to composition, microstructure, application. [6]

(*b*) What are the advantages of cast iron over steel ? Explain the role of Si and Phosphorous in cast iron. [7]

Or

6. (*a*) Suggest the suitable cast iron for the following applications and justify : [6]

(*i*) Jaw crusher

(*ii*) Automobile shaft

(*iii*) Bearing.

(*b*) Explain in detail production of nodular and malleable cast iron. [7]

7. (*a*) Suggest suitable non-ferrous material for the following applications and write its composition : [6]

(*i*) Imitation Jewellery

(*ii*) Bell

(*iii*) Coins.

(*b*) Explain the role of Sn in brass. [2]

(*c*) Describe the classification of Brasses. [4]

Or

8. (*a*) Enlist types of non-ferrous bearings. Why are they used in bearing ? Explain any *one* in detail. [6]

(*b*) Explain with a neat diagram how the strength of Al-Cu alloy can be increased. [6]

Total No. of Questions—8] [Total No. of Printed Pages—3

Seat No.	

[4657]-521

S.E. (Mechanical Sandwich) (Second Semester)

EXAMINATION, 2014

METROLOGY AND QUALITY CONTROL

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answers to the questions should be written in one answer-book.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain sigma comparator with neat sketch. [6]

(*b*) Describe use of four balls and height gauge for finding diameter of bore. [6]

Or

2. (*a*) Explain Taylor's principle. [2]

   (*b*) Which allowances are given on 'Go' gauge ? Explain. [4]

   (*c*) Justify why sin bar is recommended for smaller values of angles and not for larger values. [6]

3. (*a*) Explain gear rolling tester with sketch. [6]

   (*b*) Explain the economics of quality of design. [6]

Or

4. (*a*) Explain CMM in detail. [6]

   (*b*) Explain Juran's and Deming's approach of quality. [6]

5. (*a*) What is TPM ? Explain pillers of TPM. [7]

   (*b*) Write a note on UMM. [6]

Or

6. (*a*) Write a note on QFD. [6]

   (*b*) Explain what is ISO : TS16949. [7]

7. (*a*) Explain OC curve. [6]

   (*b*) Explain control charts for variable and attribute. [7]

Or

8. (*a*) For certain measurement, subgroup size is 6 $\sum \overline{X} = 649.6$ and $R = 129$ over 25 observations. Compute control limits for the $\overline{X}$ and R charts and control limit for the process. Use $D_4 = 2.004$, $D_3 = 0$, $A_2 = 0.483$, $d_2 = 2.534$. [7]

(*b*) Explain DMAIC in six sigma. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4+2

Seat No.	

[4657]-522

S.E. (Mechanical Sandwich) (First Sem.) EXAMINATION, 2014

FLUID MECHANICS AND MACHINERY

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) *All* questions are compulsory.

(*ii*) Answers should be written in same answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Your answers will be valued as a whole.

(*vi*) Use of logarithmic tables, slide, rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vii*) Assume suitable data, if necessary.

1. (*a*) Prove that Equipotential line and Streamline are perpendicular to each other. [4]

(*b*) A 150 mm diameter shaft rotates at 1500 rpm in a 200 mm long journal bearing with 150.5 mm internal diameter. The uniform annular space between the shaft and the bearing is filled with oil of viscosity 0.008 cP. Calculate the power dissipated as heat. [8]

Or

2. (*a*) The velocity component in a two-dimensional incompressible flow are as follows :

$$u = \frac{y^3}{3} + 2x - x^2 y \quad \text{and} \quad v = y^2 x - 2y - \frac{x^3}{3}$$

Find :

(1) Whether flow is possible.

(2) Obtain an expression for a stream function for ψ.

(3) Obtain an expression for a potential function for ϕ. [9]

(*b*) Explain Laminar and Turbulent flow in detail. [3]

3. (*a*) Explain Venturimeter with neat sketch. [3]

(*b*) The water from reservoir is supplied to Pelton wheel having gross head of 450 m through penstock of diameter 1.1 m and length 4 km. The friction factor is 0.03. Water from penstock is discharged through two nozzles of 10 cm diameter each and strikes the bucket having an exit angle of 15°. Relative velocity reduction is 13%. Assuming speed ratio of 0.47 and $\eta_{mech} = 85\%$.

Find :

(1) Hydraulic power

(2) Shaft power

(3) Hydraulic efficiency

(4) Overall efficiency [10]

Or

4. (*a*) Explain major losses and minor losses for water flowing through pipe. [4]

(*b*) A jet of water having velocity of 45 m/s imparts on a series of vanes moving at 15 m/s. The direction of motion of vanes is inclined at 20° to that of the jet. Assume friction factor = 0.9 and absolute velocity of water at exit is normal to the motion of vane.

Find :

(1) Vane angles at inlet and outlet.

(2) Work done per unit weight of water.

(3) Hydraulic efficiency. [9]

5. (*a*) Explain physical significance of Reynolds's Number and Mach Number. [2]

(*b*) An inward flow reaction turbine develops 1200 kW power having the vane velocity at inlet as 30 m/s and corresponding whirl velocity of 24 m/s. The ratio of outer to inner diameter is 2. The velocity of flow remains constant at 6 m/s and discharge at exit is radial. The head available on wheel is 75 m.

Find :

(1) Vane angles

(2) Power developed per unit weight of water

(3) Discharge

(4) Hydraulic efficiency [11]

Or

6. (*a*) Write the dimensions of dynamic viscosity and surface tension. [2]

(*b*) A Kaplan Turbine develops 2500 kW under a net head of 8 m with an overall efficiency of 85%. It is fitted with draft tube having inlet diameter 1.75 m and efficiency of 80%. Determine how much above or below the tail race level should the draft tube inlet be set, so that vacuum pressure over there does not exceed 500 mm of Hg. Assume velocity of water at the outlet of draft tube = 1 m/s. [11]

7. A centrifugal pump delivers 1565 LPS against a manometer head of 6.1 m, when impeller rotates at 200 rpm. The impeller diameter is 1.22 m and area at outer periphery is 6450 cm^2. If the vanes are set back at an angle of 26° at the outlet.

Determine :

(1) η_{mano}

(2) Power required to drive the pump

(3) Minimum starting speed,

if ratio of external to internal diameter is 2. [12]

Or

8. A 3-stage centrifugal pump in series has impeller of diameter 400 mm and 20 mm wide. The vane angle at outlet is 45° and area occupied by the thickness of vanes may be assumed 8% of total area. If pump delivers 3.6 m^3 of water per minute when running at 920 rpm.

Find :

(1) Power

(2) Manometric Head

(3) Specific Speed

Assume :

$\eta_{mech} = 88\%$ and $\eta_{mano} = 77\%$ [12]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-523

S.E. (Mechanical Sandwich) (First Semester) EXAMINATION, 2014

MATERIAL SCIENCE AND METALLURGY

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer *four* questions : Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams should be drawn wherever necessary.

(*iii*) Use of electronic pocket calculator is allowed.

(*iv*) Figures to the right indicate full marks.

1. (*a*) Discuss the differences between edge and screw dislocations. [4]

(*b*) How engineering stress differs from a true stress. [4]

(*c*) Illustrate with a diagram the relationship between critical resolved stress (CRSS) and normal shear stress in a single crystal. [5]

Or

2. (*a*) What is "wear" ? How can a resistance to wear be increased in a material ? [4]

   (*b*) Explain Vicker's hardness test. Why VPN is load independent ? [4]

   (*c*) What is strain-hardening ? Why crystalline material gets "strain hardened" when it is plastically deformed at normal temperatures ? [5]

3. (*a*) Explain the variations the properties of the steel with change in carbon % in plain carbon steels. [4]

   (*b*) What is "normalizing" of steels ? Why normalized steel shows good tensile strength ? [4]

   (*c*) Give the chemical composition of the following steels (any *two*) :

   (*i*) AISI/SAE-1040

   (*ii*) En8

   (*iii*) ISI 25C5. [4]

Or

4. (*a*) What is the role of chromium and nickel in stainless steels. [4]

(*b*) Explain hardening and tempering cycle of 18% W, 4% Cr and 1% V alloy tool steel. [4]

(*c*) Draw a microstructure of nodular cast iron; explain its properties and applications. [4]

5. (*a*) Why "Blending" of powder is carried before the compaction ? [4]

(*b*) What is "Sintering" process ? What are the common applications of sintered products ? [4]

(*c*) How "Lead base babitts" differ from Tin base babitts ? What are the applications of babitts. [4]

Or

6. (*a*) What is 'Y' (or LM14) alloys ? What are the properties and applications of this alloys ? [4]

(*b*) What are self-lubricated bearings ? What are their properties and applications ? [4]

(*c*) What are different methods of powder production ? Explain any *one* in brief. [4]

7. (*a*) What are thermosetting polymers ? What are their properties and applications ? [4]

(*b*) Explain mechanical properties of ceramic materials. [4]

(*c*) What are particle reinforced composites ? Explain properties and applications of any *one* particle reinforced composites. [5]

Or

8. (*a*) Draw the "mer" structures of any *two* from the following : [4]

   (*i*) Poly chloroprene

   (*ii*) Poly styrene

   (*iii*) Poly tetra fluoro ethylene.

   (*b*) What is polymerization ? Explain the types of polymerization with *one* example of each. [4]

   (*c*) Give any *five* areas of applications of ceramics in Industry. [5]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-525

S.E. (Mechanical Sandwich) (Second Semester)

EXAMINATION, 2014

THERMAL ENGINEERING

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Solve any 4 questions (Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**) .

(*ii*) All the four questions should be solved in one answer-book and attached extra supplements if required.

(*iii*) Draw neat and labelled diagrams wherever necessary.

(*iv*) Use of steam tables, Mollier charts, scientific calculator is allowed.

(*v*) Answer suitable data wherever necessary.

(*vi*) Figures to the right indicate full marks.

1. (*a*) Prove that work input for the reciprocating air compressor, if compression follows $PV^n = c$, is given by :

$$\text{Work input or IP} = \frac{n}{n-1} P_1 V_1 \left\{ \left(\frac{P_2}{P_1} \right)^{\frac{n-1}{n}} - 1 \right\}$$

with usual notations. [6]

(*b*) Explain with neat sketch vapor absorption refrigeration system. [6]

Or

2. (*a*) A single stage, single acting RAC delivers air at 6 bar. The suction temperature is 25°C, and suction pressure is 1 bar, volume of air entering the compressor is 3 m^3/min. Index of compressor is 1.2. Calculate :

(*i*) Isothermal efficiency

(*ii*) Power required to drive the compressor, neglecting clearance volume. [6]

(*b*) Explain with a neat schematic diagram vapor compression refrigeration cycle. [6]

3. (*a*) Discuss the factors affecting human comfort as regards with air conditioning. [6]

(*b*) Explain magneto-ignition system with a neat sketch. [6]

Or

4. (*a*) With a neat sketch explain window air conditioner. [6]

(*b*) Explain with neat sketches different types of super-chargers. [6]

5. (*a*) Discuss stages of combustion in case of SI engine. [6]

(*b*) Discuss : [7]

(*i*) Pre-ignition

(*ii*) Detonation

(*iii*) Octane number.

Or

6. (*a*) Compare diesel knock and detonation. [6]

(*b*) Discuss emission from SI and CI engines. [7]

7. (*a*) What are the advantages of closed cycle gas turbines and open cycle gas turbines ? [6]

(*b*) What are the advantages and disadvantages of gas turbine over IC engines ? [7]

Or

8. (*a*) Explain the theory of jet propulsion. Give the classification of jet engines. [6]

(*b*) Explain the following with neat sketches : [7]

(*i*) Turbojet engine

(*ii*) Turbo-prop

(*iii*) Ramjet.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-53

S.E. (Instrumentation & Control) (First Semester)

EXAMINATION, 2014

PRINCIPLES OF SENSORS AND TRANSDUCERS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer any 3 questions from each Section.

(*ii*) Neat diagrams must be drawn wherever necessary.

SECTION I

1. (*a*) Define instrument and instrumentation. Draw and explain basic stages of measurement system and state function of instrument. [8]

(*b*) Define calibration and explain different standards available for calibration. [8]

Or

2. (*a*) Define error. List different types of errors in measurement. Give their causes and remedies. [8]

(*b*) Explain the following terms : [8]

(*i*) Threshold

(*ii*) Accuracy

(*iii*) Resolution

(*iv*) Precision.

3. (*a*) Define thermodynamic temperature scale. Give principle of bimetallic element. Explain with neat sketch fluid expansion system for temperature measurement. [8]

(*b*) Define absolute pressure and atmospheric pressure. Explain with neat sketch Bourdon element and bellows for pressure measurement. [8]

Or

4. (*a*) Give principle of operation of spring and cantilever beam for force measurement. Explain proving ring type load cell for force measurement with neat diagram. [8]

(*b*) Define torque. Draw and explain flat spiral spring for torque measurement. State principle of operation of gyroscope. [8]

5. (*a*) A liquid of density 900 kg/m^3 enclosed in a horizontal pipe of radius 5 cm the section of tube of restriction radius 3 cm. The liquid pressure is 15 kN/m^2 less than the main pipe calculate the apparent velocity of liquid in main pipe. (Cd = 0.9) [8]

(*b*) Define viscosity and explain with neat diagram viscosity to torque converter. [6]

(*c*) Write a short note on static vane element for flow measurement. [4]

Or

6. (*a*) State principle of flow obstruction elements. Compare orifice, venturi, flow nozzle and dall tube based on discharge coefficient, accuracy, permanent pressure loss, ß value and Reynolds number. [6]

(*b*) Write a short note on hydrometer for density measurement. [4]

(*c*) Discharge of water through an orifice meter was 0.070 m^3/s which was fitted in 250 mm diameter pipe with orifice diameter 125 mm differential mercury manometer reads 31.75 cm deflection. Calculate coefficient of discharge for the meter (g_m = 13600 kg/m^3) [8]

SECTION II

7. (*a*) Explain with neat diagram measurement of moisture using capacitive transducer. [6]

(*b*) State transduction principle used in RTD and strain gauge. Differentiate between RTD and thermister. [4]

(*c*) A thermister has resistance of 3980 Ω at the ice point and 794 Ω. At 50ºC the resistance temperature relationship is given by R_T = Ro.a.exp (b/T). Calculate constants *a* and *b*. Calculate the constant range of resistance to be measured in case the temperature varies from 40ºC to 100ºC. [8]

Or

8. (*a*) It is required to design a resistance thermometer using a nickel wire of 0.002 mm diameter. The thermometer resistance at 0ºC is to be 100 Ω. How long the wire should be ? For nickel value of resistively is $8.7 * 10^{-6}$ Ω-cm at 0ºC and temperature coefficient of resistance is 0.0068/ºC. Determine value of resistance at steam point. [8]

(*b*) Explain with neat diagram thickness measurement using inductive transducers. [6]

(*c*) Write a short note on displacement measurement using capacitive transducer. [4]

9. (*a*) State thermoelectric phenomena. Explain with neat diagram thermocouple system and necessity of cold junction compensation. [8]

(*b*) Write short notes on : [8]

(*i*) Magnetostriction phenomena and its application

(*ii*) Hall effect and its applications.

Or

10. (*a*) Explain with neat diagram digital tachometer in detail. [8]

(*b*) State piezoelectric phenomena. Explain radioactive gauges for thickness and vacuum measurement. [8]

11. (*a*) Draw and explain magnetic type recorder. [8]

(*b*) Draw and explain self-balancing system. [8]

Or

12. (*a*) Enlist different digital input-output devices. Draw and explain a servo-operated manometer. [8]

(*b*) Write short notes on : [8]

(*i*) Data logger

(*ii*) Alphanumeric devices.

Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

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[4657]-531

S.E. (Electrical/Instrumentation) (I Sem.) EXAMINATION, 2014

ENGINEERING MATHEMATICS–III

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

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

(*iii*) Assume suitable data, if necessary.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Use of electronic non-programmable calculator is allowed.

1. (*a*) Solve any *two* of the following : [8]

(1) $$\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = \frac{e^{-3x}}{x^3}$$

(2) $$\frac{d^2y}{dx^2} - y = x\sin x$$

(3) $$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$$ (by method of variation of parameters).

P.T.O.

(*b*) Find Laplace transform of : [4]

$$f(t) = e^{-t} \sin t \, U(t - \pi).$$

Or

2. (*a*) Solve simultaneously the following equations : [4]

$$\frac{du}{dx} + v = \sin x, \quad \frac{dv}{dx} + u = \cos x.$$

(*b*) Find (any *one*) : [4]

(1) $L[(t^2 - 1) \sin 2t]$

(2) $L^{-1}\left[\frac{2(s+1)}{s^2 + 2s + 10}\right].$

(*c*) Using Laplace transform method, solve the differential equation : [4]

$$\frac{d^2y}{dx^2} - 3\frac{dy}{dx} = 9$$

when $x = 0$, $y = 0$ and $\frac{dy}{dx} = 0$.

3. (*a*) Find the Fourier sine transform of the function $f(x) = e^{-x}$ and hence show that : [4]

$$\int_0^\infty \frac{x \sin mx}{1 + x^2} \, dx = \frac{\pi}{2} e^{-m}.$$

(*b*) Find z-transform of $f(k)$ where : [4]

$$\begin{aligned} f(k) &= 3^k \quad , \quad k < 0 \\ &= 2^k \quad , \quad k \geq 0 \end{aligned}$$

(*c*) Find the directional derivative of : [4]

$$\phi = xy^2 + yz^3 \quad \text{at} \quad P(1, -1, 1)$$

towards the point $Q(2, 1, -1)$.

Or

4. (*a*) Prove the following (any *one*) : [4]

(*i*) $\nabla \cdot (\phi \nabla \Psi - \Psi \nabla \phi) = \phi \nabla^2 \Psi - \Psi \nabla^2 \phi$

(*ii*) $\nabla \times \left(\dfrac{\bar{a} \times \bar{r}}{r^3} \right) = -\dfrac{\bar{a}}{r^3} + \dfrac{3(\bar{a} \cdot \bar{r})}{r^5} \bar{r}$.

(*b*) Find inverse z-transform of $F(z)$ where : [4]

$$F(z) = \frac{1}{(z-5)^3}, \quad |z| > 5.$$

(*c*) Find $f(k)$ given that : [4]

$$f(k+1) + \frac{1}{2} f(k) = \left(\frac{1}{2} \right)^k, \quad k \geq 0, \quad f(0) = 0.$$

5. (*a*) Evaluate : [4]

$$\int_c \bar{F} \cdot d\bar{r}$$

along the straight line joining points (0, 0, 0) and (1, 2, 3) where $\bar{F} = 3x^2 i + (2xz - y)\, j + zk$.

(*b*) Use Stokes' theorem to evaluate : [5]

$$\int_c (4y\, i + 2z\, j + 6y\, k) \cdot d\bar{r},$$

where curve '*c*' is the intersection of sphere $x^2 + y^2 + z^2 = 2z$ and $x = z - 1$.

(*c*) Prove that : [4]

$$\iint_s (\phi\nabla\psi - \psi\nabla\phi) \cdot d\bar{s} = \iiint_v (\phi\nabla^2\psi - \psi\nabla^2\phi) \cdot dv.$$

Or

6. (*a*) Find the work done in moving a particle once round the circle $x^2 + y^2 = a^2$; $z = 0$ under the force field : [4]

$$\bar{F} = (\sin y) i + x(1 + \cos y) j.$$

(*b*) Prove that : [4]

$$\int_c (\bar{a} \times \bar{r}) \cdot d\bar{r} = 2\bar{a} \cdot \iint_s d\bar{s}.$$

(c) Evaluate : [5]

$$\iint_s \bar{F} \cdot d\bar{s}$$

over the surface of cylinder $x^2 + y^2 = 4$, $z = 0$, $z = 3$ using divergence theorem, where $\bar{F} = 4xi - 2y^2 j + x^2 k$.

7. (a) If [4]

$$V = \frac{-y}{x^2 + y^2},$$

find u such that $f(z) = u + iv$ is analytic function. Write $f(z)$ in terms of z.

(b) Evaluate : [5]

$$\oint_c \frac{z+4}{(z^2 + 2z + 5)} dz,$$

where c is a circle $|z - 2i| = 3/2$.

(c) Find the bilinear transformation, which maps points 0, –1, ∞ of z-plane onto points –1, $-(2 + i)$, $+ i$ of w-plane. [4]

Or

8. (a) Find the condition under which : [4]

$$u = ax^3 + bx^2y + cxy^2 + dy^3$$

is Harmonic function.

(*b*) Evaluate : [5]

$$\int_0^{2\pi} \frac{d\theta}{5 - 3\cos\theta}$$

using Cauchy's theorem.

(*c*) Find the image of st. line $y = x$ under the transformation $w = \frac{z-1}{z+1}$. [4]

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

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[4657]-532

S.E. (Electrical) (First Sem.) EXAMINATION, 2014

POWER GENERATION TECHNOLOGIES

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Neat diagrams must be drawn wherever necessary.

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

(*iii*) Your answers will be valued as a whole.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Explain the operation of steam power plant with the help of schematic diagram. [7]

(*b*) Discuss the merits and demerits of a gas turbine power plant. [6]

Or

2. (*a*) What are the advantages of reheat cycle ? Explain with the help of schematic and (T-S) diagram. [7]

(*b*) Discuss the advantages and disadvantages of a nuclear plant as compared to other conventional power plants. [6]

3. (*a*) Explain the working of Pelton turbine with neat diagram in hydro power plant. [6]

(*b*) What methods are used to control the speed of wind turbine generator to achieve maximum power ? [6]

Or

4. (*a*) Compare impulse turbine with reaction turbine in hydro power plant. [6]

(*b*) Describe how the height of wind tower influences the wind power plant working. [4]

(*c*) Explain how wind power plant affects environment. [2]

5. (*a*) Discuss the working of a flat plate collector using air as working fluid with the help of a neat sketch. [6]

(*b*) What is PV system ? What are its advantages and disadvantages ? [7]

Or

6. (*a*) What is paraboloidal dish collector ? Discuss its working with a neat sketch. [6]

(*b*) Explain performance curve of PV cell with the help of I-V curves. Also draw equivalent and simplified circuits for PV cell. [7]

7. (*a*) Write a short note on Ocean Thermal Energy Conversion. [6]

(*b*) Explain Municipal Solid Waste to energy conversion. [6]

Or

8. (*a*) What are the requirements of storage and selection criteria of fuel cell ? [6]

(*b*) Write a short note on Biomass energy conversion to electricity. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-533

S.E. (Electrical) (First Semester) EXAMINATION, 2014

MATERIAL SCIENCE

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

Physical Constants :

(1) Angstrom Unit (AU) = 1×10^{-10} metres

(2) Boltzmann's Constant (k) = 1.380×10^{-23} joule.degree $^{-1}$

(3) Charge on Electron (e) = 1.601×10^{-19} coulomb

(4) Mass of Electron (m) = 9.107×10^{-31} kg

(5) Electron volt (eV) = 1.602×10^{-19} joules

(6) Mass of Proton (m_p) = 1.627×10^{-27} kg

(7) Velocity of light (c) = 2.998×10^{8} m/sec

(8) Dielectric Constant of free space (ε_0) = 8.854×10^{-12} F/m

(9) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$ H/m

(10) Debye Unit = 3.33×10^{-30} coulomb.metre

1. (a) Explain the following terms with their units :

(1) electric dipole

(2) electric polarisation

(3) polarizability. [6]

(*b*) State the electrical applications of the following materials. Explain why are these materials suitable for the given applications :

(1) mica

(2) ceramics. [6]

Or

2. (*a*) Write a note on piezoelectric materials stating their applications. [6]

(*b*) Explain the factors that cause the breakdown of solid insulating materials under normal industrial conditions. [6]

3. (*a*) Explain the behaviour of ferromagnetic material below and above the ferromagnetic Curie temperature. State Curie temperature for iron material. [6]

(*b*) The filament of a 230 volt incandescent lamp is to be drawn from a wire of 0.026 mm diameter and resistivity at 20°C of 4.3×10^{-6} ohm-cm. If temperature coefficient of resistance at 20°C is 0.005 per degree celsius, calculate the length of filament. [6]

Or

4. (*a*) In a material an application of magnetic field of 1.75×10^{5} ampere per meter causes a magnetic flux density of 218.2 mili weber/meter^2. Calculate its permeability and susceptibility. Also find magnetization. [6]

(*b*) Give with reasons the material used for making the :

(1) filament of a lamp

(2) precision resistors.

State the pair of materials used making the thermocouple. [6]

5. (*a*) Write a note on molecular machines. [7]

(*b*) What is meant by nano tube ? Compare carbon and BN nano tubes. [6]

Or

6. (*a*) Explain carbon clusters and nano wires. [8]

(*b*) Write a note on energy band gaps for conducting, insulating and semiconductor materials. [5]

7. (*a*) Explain the IR testing and power frequency voltage withstand tests conducted on power cables. Explain what is meant by withstand voltage. [7]

(*b*) Explain the method of finding the dielectric strength of solid insulating materials according to relevant standard. Draw the neat sketch of electrodes used. State the precautions to be taken for safety and accuracy. [6]

Or

8. (*a*) With a neat diagram explain the method of finding the tan δ value of insulating materials. State its significance. [7]

(*b*) With neat sketch explain the method of finding the dielectric strength of transformer oil according to relevant standard. [6]

Total No. of Questions—8] [Total No. of Printed Pages—3

Seat No.	

[4657]-534

S.E. (Electrical) (First Semester) EXAMINATION, 2014

ANALOG AND DIGITAL ELECTRONICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Your answers will be valued as a whole.

(*v*) Assume suitable data, if necessary.

1. (*a*) Perform the following addition in BCD : [6]

(*i*) $(36)_{10}$ with $(95)_{10}$

(*ii*) $(68)_{10}$ with $(74)_{10}$.

(*b*) Design Mod-6 asynchronous counter using JK flip-flop. [6]

Or

2. (*a*) Draw and explain clocked SR flip-flop. Also draw its timing diagram. [6]

(*b*) Use K-map to minimize the following expression in SOP form : [6]

$$Y = (A + \overline{B} + C + \overline{D})\,(\overline{A} + B + \overline{C} + D)\,(\overline{A} + \overline{B} + \overline{C} + \overline{D})\,(\overline{A} + \overline{B} + \overline{C} + D)\,.$$

3. (*a*) Explain the working of OPAMP as a comparator along with circuit diagram and input and output waveforms. [7]

(*b*) Explain the operation of low pass filter with a neat circuit diagram. [6]

Or

4. (*a*) Explain the operation of IC555 as astable multivibrator along with waveforms. [7]

(*b*) Explain grounded type voltage to current converter using OPAMP. [6]

5. (*a*) Draw and explain construction of FET with its characteristics. [6]

(*b*) Draw and explain RC coupled BJT amplifier. [6]

Or

6. (*a*) Explain AC-DC load line analysis using CE configuration of BJT. [6]

(*b*) Explain push-pull amplifier with a neat circuit diagram. [6]

7. (*a*) Explain the working of single-phase full wave centre tapped rectifier with pure resistive load. Also draw the input and output waveforms. [7]

(*b*) Compare single-phase full wave bridge rectifier with three-phase full wave bridge rectifier. [6]

Or

8. (*a*) Draw and explain three-phase bridge rectifier with R-load. Also draw input voltage and output voltage waveforms. [7]

(*b*) A single-phase full wave bridge rectifier is supplied from 230 V, 50 Hz source. The load consists of R = 10 Ω and a large inductance so as to render the load current constant. Determine :

(*i*) Average value of output voltage and output current

(*ii*) Average and r.m.s. values of diode currents

(*iii*) r.m.s. values of output and input currents. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4

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[4657]-535

S.E. (Electrical) (First Semester) EXAMINATION, 2014

ELECTRICAL MEASUREMENT AND INSTRUMENTATION

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Your answers will be valued as a whole.

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain in detail the function of deflecting, controlling and damping system of an analog indicating instrument. [6]

(*b*) A Maxwell's capacitance bridge shown in Fig. 1 is used to measure an unknown inductance in comparison with capacitance. The various values are $R_2 = 400\ \Omega$, $R_3 = 600\ \Omega$, $R_4 = 1000\ \Omega$,

$C_4 = 0.5\ \mu F$. Calculate the values of R_1 and L_1. Also find Q-factor of coil if frequency is 1 kHz. [6]

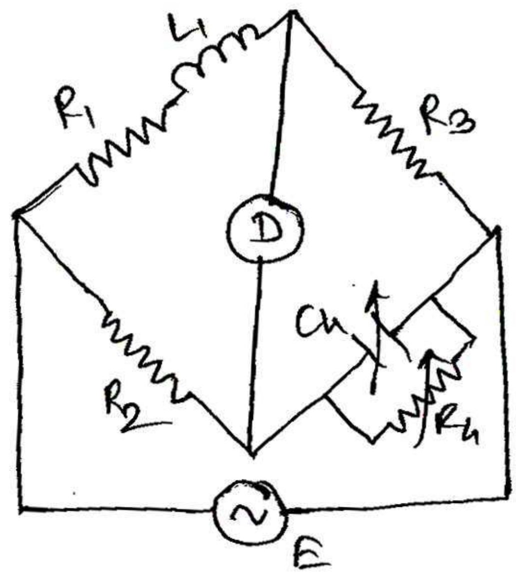


Fig. 1

Or

2. (*a*) A d.c. ammeter is having resistance of 50 Ω and full scale deflection of 1 mA. If this meter has to be used to measure current 50 mA, 100 mA, 500 mA, find the external resistance required for each range. [6]

(*b*) Explain earth tester for measurement of earth resistance. [6]

3. (*a*) Explain two wattmeter method with circuit diagram and vector diagram. Also state the effect of power factor on wattmeter reading. [6]

(*b*) The meter constant of 230 V, 10 A watthour meter is 1800 revolution per kWh. The meter is tested at rated voltage, half load and unity power factor. The meter is found to make 80 revolutions in 138 sec. Determine the % error. [6]

Or

4. (*a*) Two wattmeters are connected to measure the input to a balanced three-phase circuit indicate 2000 W and 500 W respectively. Find the power factor of the circuit :

(*i*) when both the readings are positive

(*ii*) when the later reading is obtained after reversing the connections to the current coil of instrument. [6]

(*b*) State and explain errors with their compensation for an induction energy-meter. [6]

5. (*a*) Explain the following terms associated with CRO : [6]

(*i*) volts/division

(*ii*) *xy* mode

(*iii*) invert.

(*b*) Define transducer. Give a detailed classification of transducer. [7]

Or

6. (*a*) Explain voltage, current and frequency measurement with the help of CRO. [6]

(*b*) Explain pressure measurement using McLeod gauge. [7]

7. (*a*) Explain Foil strain gauge with a neat diagram. Also state its advantages and disadvantages. [6]

(*b*) Explain level measurement using ultrasonic method. [7]

Or

8. (*a*) Explain level measurement using mechanical method. [6]

(*b*) Explain construction and working of LVDT. [7]

Total No. of Questions—**12**]   [Total No. of Printed Pages—**8**

Seat No.	

[4657]-54

S.E. (Instrumentation & Control) (First Semester)

EXAMINATION, 2014

AUTOMATIC CONTROL SYSTEM

(2008 PATTERN)

Time : Three Hours   **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** questions from Section II.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Your answers will be valued as a whole.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) With an example explain the difference between : [6]

(*i*) Feedback and Feed-forward

(*ii*) LTI and LTV

(*iii*) Linear and Non-linear.

P.T.O.

(*b*) Find the transfer function for the following system using $f \rightarrow v$ analogy and draw the circuit diagram for the same. [10]

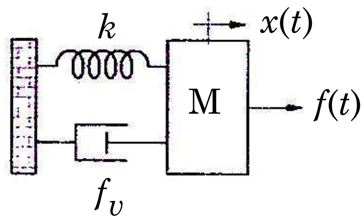


Fig. 1 : Mechanical System

Or

2. (*a*) With an example explain the difference between : [6]

(*i*) Open-loop and Closed-loop

(*ii*) LTI and LTV

(*iii*) Stable and Unstable.

(*b*) Figure 2 shows a liquid level system, where q_i, q_o, h, A, ρ and R are inflow, outflow, liquid level, cross-sectional area of tank, fluid density and restriction to outflow respectively. Find the transfer for same. [10]

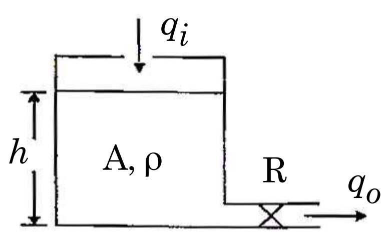


Fig. 2 : Liquid level system

3. (*a*) Reduce a block diagram shown in figure 3 using block reduction technique and find the transfer function C(*s*)/R(*s*). [10]

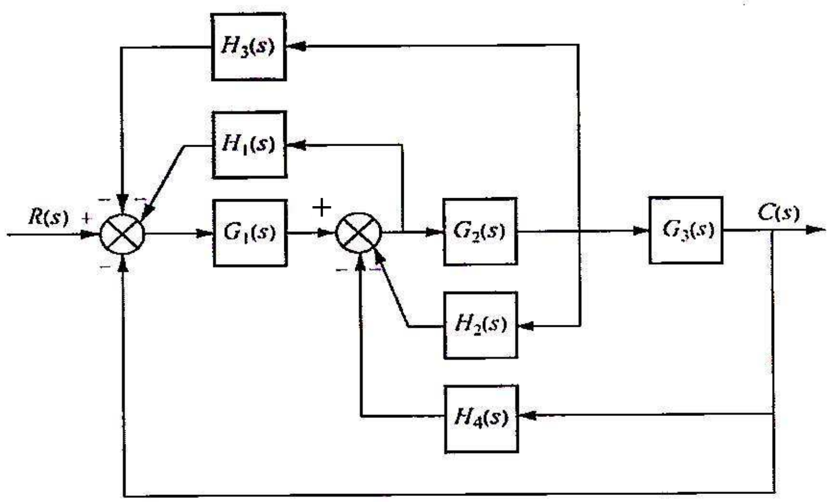


Fig. 3 : Block Diagram

(*b*) For a negative feedback canonical form of control system prove that :

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1+G(s)H(s)}.$$ [6]

Or

4. (*a*) Find a transfer function C(*s*)/R(*s*) of a block diagram shown in Figure 3 using Mason's gain formula. [10]

(*b*) For a positive feedback canonical form of control system prove that :

$$\frac{C(s)}{R(s)} = \frac{G(s)}{1-G(s)H(s)}.$$ [6]

5. (*a*) A unity feedback system is characterized by an open-loop transfer function :

$$G(s) = \frac{K}{s(s+10)}$$

Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine the settling time (for 5% tolerance criteria), rise time, peak overshoot, time to first peak overshoot and time to first undershoot for a unit step input. [12]

(*b*) A system is characterized by the differential equation :

$$\frac{d^2c(t)}{dt^2} + 6.4\frac{dc(t)}{dt} + 160\,[0.4c(t) - r(t)] = 0\,.$$

Find the value of natural frequency of oscillation and damping ratio. [6]

Or

6. (*a*) A unity feedback system is characterized by an open-loop transfer function :

$$G(s) = \frac{K}{s(s+12)}$$

Determine the gain K so that the system will have a damping ratio of 0.5. For this value of K determine the settling time (for 5% tolerance criteria), rise time, peak overshoot, time to first peak overshoot and time to first undershoot for a unit step input. [12]

(*b*) For a unity feedback system given by :

$$G(s) = \frac{20(s+2)}{s(s+3)(s+4)}$$

Find the static error constants. [6]

SECTION II

7. (*a*) Check the stability of the system with characteristic equation :

$$s^5 + 2s^4 + 24s^3 + 48s^2 - 25s - 50 = 0 .$$ [6]

(*b*) Sketch the root locus of the unity feedback system with open-loop transfer function :

$$G(s) = \frac{K}{s(s+2)(s^2+2s+2)}$$

and comment on the stability of the system. [12]

Or

8. (*a*) The characteristic equation of a feedback control system is :

$$s^4 + 25s^3 + 15s^2 + 20s + k = 0$$

Determine the value of k so the system is marginally stable and the frequency of sustained oscillations. [6]

(*b*) Sketch the root locus of the unity feedback system with open-loop transfer function :

$$G(s) = \frac{K(s+3)}{(s+1)(s+2)}$$

and comment on the stability of the system. [12]

9. (*a*) The forward path transfer function of a unity feedback system is :

$$G(s) = \frac{100}{s(s+6)}$$

Find the resonant peak M_r, resonant frequency ω_r and bandwidth of the closed loop system. [6]

(*b*) Consider the open-loop transfer function of a closed loop system :

$$G(s) = \frac{K\, e^{-\tau_d s}}{s(s+2)(s+4)}$$

Draw the bode plot for K = 1 and τ_d = 1. Determine gain margin and phase margin. Comment on the system stability. [10]

Or

10. (*a*) The specifications on a second-order unity feedback control system with closed loop transfer function :

$$T(s) = \frac{\omega_n^2}{s^2 + 2\xi\omega_n + \omega_n^2}$$

are that the maximum overshoot must not exceed 30% and rise time must be less than 0.2 sec. Find the limiting values of M_r and Bandwidth. [6]

(*b*) Draw the Bode plot of the open-loop transfer function :

$$G(s) = \frac{200(s+10)}{s(s+5)(s+20)}$$

Determine gain margin and phase margin. Comment on the system stability. [10]

11. (*a*) Sketch polar plot for the unity feedback system with open-loop transfer function :

$$G(s) = \frac{1}{s(s+2)}.$$ [8]

(*b*) For the given transfer function :

$$T(s) = \frac{s+3}{s^2 + 2s + 1}$$

Obtain the state model in controllable canonical form. [8]

Or

12. (*a*) Sketch polar plot for the unity feedback system with open-loop transfer function :

$$G(s) = \frac{1}{(s+4)}.$$ [8]

(*b*) State model of control system is given below :

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -7 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$$

$$y = \begin{bmatrix} 3 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$

Find a transfer function of a system. [8]

Total No. of Questions—8]　　　　[Total No. of Printed Pages—4

Seat No.	

[4657]-540

S.E. (Electrical) (II Sem.) EXAMINATION, 2014

FUNDAMENTALS OF MICROPROCESSOR AND MICROCONTROLLER

(2012 PATTERN)

Time : Two Hours　　　　**Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Write a program to add two numbers stored in locations D000H and D001H. Store the result in location D002H location and status of carry flag in a location D003H. [5]

(*b*) Explain Direct and Register Indirect addressing mode in 8085. [4]

(*c*) Explain the functions of program counter and instruction register. [4]

Or

2. (*a*) Explain the following instructions in detail : [5]

(*i*) MOV A, M

(*ii*) LXI H, D000H

(*b*) Explain the following interrupts of 8085 : [4]

TRAP

RST1

(*c*) Explain the function of stack pointer and give an instruction to initialize stack pointer. [4]

3. (*a*) DAC 0808 is interfaced with microprocessor 8085 through port A of 8255. Assuming the address of port A as 80H, write a program for generation of sawtooth wave form at the output of DAC. [4]

(*b*) Draw the control word register of 8254. [4]

(*c*) Draw a neat diagram of the internal RAM structure of 8051. [4]

Or

4. (*a*) Explain the functions of the following pins of ADC 0809 : [4]

(*i*) SOC

(*ii*) EOC.

(*b*) Draw the TCON. Explain the functions of each bit in the register. [4]

(*c*) Draw the control word register of 8255. [4]

5. (*a*) On Reset the following instructions were executed : [5]

MOV A, # 98H

ANL A, # 0FH

ADD A, # 08H

Draw the program status word and give the status of flag register after execution of the above instructions.

(*b*) Explain the following instructions : [4]

(*i*) MOV DPTR, # 1200H

(*ii*) MOV A, @Ri

(*c*) Explain the steps taken by 8051 in response to an interrupt. [4]

Or

6. (*a*) Explain the following instructions : [4]

MOVX @ DPTR, A

ANL A, # data

(*b*) Write an assembly language program to copy the contents of memory location D000H from external program memory to a location D001 in external data memory and to register R0 of bank 0. [5]

(*c*) Explain steps to be followed to receive data serially in 8051. [4]

7. (*a*) Write the assembly program to rotate the stepper motor in anticlockwise direction through an angle of 180 degrees. The stepper motor is controlled through the least significant 4 pins of Port 1 of 8051 microcontroller. [8]

Assume :

(*i*) The step angle to be 1.8 degrees.

(*ii*) Delay to be already written at suitable location.

(*iii*) The step sequence is as given below :

Step	**A**	**B**	**C**	**D**	
1	0	1	0	1	
2	1	0	0	1	↓ Anticlockwise direction
3	1	0	1	0	
4	0	1	1	0	

(*b*) Explain with a block diagram of measurement of power factor using 8085. [4]

Or

8. (*a*) Draw the interfacing diagram. Explain the measurement of temperature using 8051. [8]

(*b*) Explain with a block diagram of measurement of energy using 8085. [4]

Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

Seat No.	

[4657]-541

S.E. (Electronics/E&TC) (Second Sem.) EXAMINATION, 2014

ENGINEERING MATHEMATICS–III

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of non-programmable electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Solve any *two* : [8]

(*i*) $(D^2 - 2D)\,y = e^x \sin x$ by method of variation of parameters.

(*ii*) $x^2 \dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} + 4y = \cos(\log x) + x\sin(\log x)$

(*iii*) $(D^2 - 2D + D)y = x\, e^x \sin x$.

P.T.O.

(*b*) Find Fourier sine transform of : [4]

$$f(x) = x^2 \quad , \quad 0 \le x \le 1$$
$$= 0 \quad , \quad x > 1 .$$

Or

2. (*a*) An electric current consists of an inductance 0.1 henry, a resistance R of 20 ohms and a condenser of capacitance C of 25 microfarads. If the differential equation of electric circuit is :

$$\mathrm{L}\frac{d^2q}{dt^2} + \mathrm{R}\frac{dq}{dt} + \frac{q}{\mathrm{C}} = 0$$

then find the at time t, given that at $t = 0$, $q = 0.05$ coulombs $\frac{dq}{dt} = 0$. [4]

(*b*) Solve (any *one*) : [4]

(*i*) Find z transform of :

$$f(k) = \frac{2^k}{k}, \quad k \ge 1 .$$

(*ii*) Find inverse z transform :

$$\mathrm{F}(z) = \frac{1}{(z-3)(z-2)}, \quad |z| < 2 .$$

(c) Solve : [4]

$$12f(k+2) - 7f(k+1) + f(k) = 0, \quad k \geq 0,$$

$$F(0) = 0, \quad F(1) = 3.$$

3. (a) Solve the following differential equation to get $y(0.2)$: [4]

$$\frac{dy}{dx} = \frac{1}{x+y}, \quad y(0) = 1, \ h = 0.2$$

by using Runge-Kutta fourth order method.

(b) Find Lagrange's interpolating polynomial passing through set of points : [4]

x	y
0	4
1	3
2	6

Use it to find y at $x = 2$, $\frac{dy}{dx}$ at $x = 0.5$ and $\int_0^3 y \, dx$.

(c) Find the directional derivative of : [4]

$$\phi = 5x^2y - 5y^2z + 2z^2x$$

at the point (1, 1, 1) in the direction of the line :

$$\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1}.$$

Or

4. (*a*) Show that (any *one*) : [4]

(*i*) $\nabla\left(\dfrac{\bar{a}\,.\,\bar{r}}{r^n}\right) = \dfrac{\bar{a}}{r^n} - \dfrac{n(\bar{a}\,.\,\bar{r})}{r^{n+2}}\,\bar{r}$

(*ii*) $\nabla^2 f(r) = \dfrac{d^2 f}{dr^2} + \dfrac{2}{r}\,\dfrac{df}{dr}.$

(*b*) Find the function $f(r)$ so that $f(r)\,\bar{r}$ is solenoidal. [4]

(*c*) Evaluate : [4]

$$\int_0^1 \frac{dx}{1+x^2}$$

using Simpson's $\dfrac{3}{8}$ rule taking $h = \dfrac{1}{6}$.

5. (*a*) Find the work done by the force : [4]

$$(2xy + 3z^2)\,\bar{i} + (x^2 + 4yz)\,\bar{j} + (2y^2 + 6xz)\,\bar{k}$$

in taking a particle from (0, 0, 0) to (1, 1, 1).

(*b*) Apply Stokes' theorem to calculate : [5]

$$\int_c (4y\,dx + 2z\,dy + 6y\,dz)$$

where c is the curve of intersection of $x^2 + y^2 + z^2 = 6z$, $z = x + 3$.

(*c*) Evaluate : [4]

$$\iint_s \left(xz^2\, dydz + (x^2y - z^2)\, dzdx + (2xy + y^2z)\, dxdy\right)$$

where s is the surface enclosing a region bounded by hemisphere $x^2 + y^2 + z^2 = 4$ above xoy plane.

Or

6. (*a*) If [4]

$$\overline{F} = \frac{1}{x^2 + y^2}(-y\,\overline{i} + x\,\overline{j})$$

then show that :

$$\oint_c \overline{F} \,.\, d\overline{r} = 2\pi,$$

where c is circle $x^2 + y^2 = 1$.

(*b*) Evaluate : [5]

$$\iint_s (4xz\,\overline{i} - y^2\,\overline{j} + yz\,\overline{k}) \,.\, d\overline{s}$$

over the cube bounded by the planes :

$$x = 0,\ x = 2,\ y = 0,\ y = 2,\ z = 0,\ z = 2.$$

(*c*) Maxwell's electromagnetic equations are : [4]

$$\nabla \,.\, \overline{B} = 0, \quad \nabla \times \overline{E} = -\frac{\partial \overline{B}}{\partial t}.$$

Given $\bar{B} = \text{curl } \bar{A}$ then deduce that :

$$\bar{E} + \frac{\partial \bar{A}}{\partial t} = -\text{grad V}$$

where V is the scalar point function.

7. (*a*) Show that : [5]

$$u = e^{-x} (x \sin y - y \cos y)$$

is harmonic and determine an analytic function $f(z) = u + iv$.

(*b*) Evaluate : [4]

$$\int_c (z - z^2)\, dz$$

where c is the upper half of the unit circle $|z| = 1$.

(*c*) Find the Bilinear transformation which maps the points $z = 0, -1, \infty$ in the z-plane onto the points $w = -1, -(2 + i), i$ in the w-plane. [4]

Or

8. (*a*) Find the analytic function $f(z) = u + iv$ if : [4]

$$v = (r - 1/r) \sin \theta, \ r \neq 0.$$

(*b*) Using Cauchy's integral formula, evaluate the integral : [5]

$$\int_c \frac{(z+4)}{(z^2+2z+5)}\, dz$$

where c is the curve $|z+1-i|=2$.

(*c*) Find the image in the w-plane of the circle $|z-3|=2$ in the z-plane under the inverse mapping $w=\frac{1}{z}$. [4]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-542

S.E. (E&TC/Electronics) (First Semester) EXAMINATION, 2014

SIGNALS AND SYSTEMS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt four questions as Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Answer any *three* questions from each Section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Perform the following operations on the given signal $x(t)$ which is defined as : [4]

$$x(t) = u(t) - u(t - 4)$$

(*i*) Sketch $z(t) = x(-t - 1)$

(*ii*) Sketch $y(t) = x(t) + z(t)$.

(*b*) Determine whether the following signals are Energy or Power, and find energy or time averaged power of the signal : [4]

(*i*) $x(t) = 5\cos(\pi t) + \sin(5\pi t)\ ;\ -\infty \le t \le \infty$

(*ii*)
$$x[n] = \begin{cases} n, & 0 \le n < 5 \\ 10 - n, & 5 \le n \le 10 \\ 0, & \text{otherwise} \end{cases}$$

(*c*) Determine whether the following system is Static/Dynamic, Causal/Non-causal and Stable/Unstable and justify : [4]

$$h(t) = e^{-5t}u(t).$$

Or

2. (*a*) Compute the convolution integral by graphical method and sketch the output for the following signals : [6]

$$x(t) = u(t) - u(t - 2)$$

$$h(t) = e^{-2t}\ u(t)$$

(*b*) Evaluate the following integrals : [4]

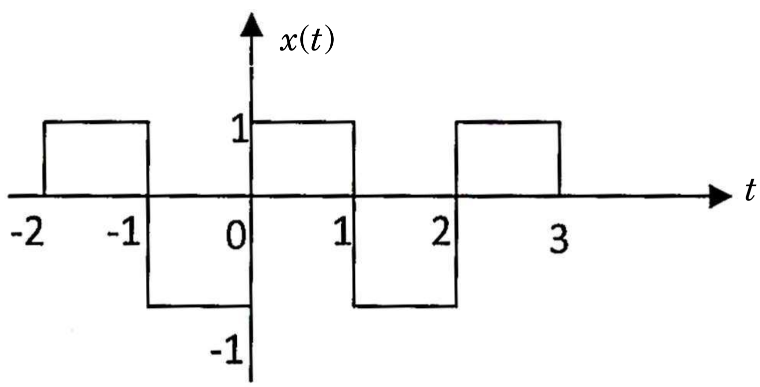
(*i*) $\displaystyle\int_0^{\infty} t^2\ \delta(t - 10)\,dt$

(*ii*) $\displaystyle\int_0^{10} \delta(t)\sin(2\pi t)\,dt$.

(*c*) Determine whether the following signal is periodic or not, if periodic, find the fundamental period of the signal : [2]

$$x(t) = \cos^2(2\pi t).$$

3. (*a*) Find the trigonometric Fourier series for the periodic signal $x(t)$ shown in the following figure and sketch the amplitude and phase spectra : [6]



(*b*) Find the inverse Laplace transform of : [6]

$$X(s) = \frac{2}{(s+4)(s-1)}.$$

If the Region of convergence is :

(*i*) $-4 \le \text{Re}(s) < 1$

(*ii*) $\text{Re}(s) > 1$

(*iii*) $\text{Re}(s) < -4$.

Or

4. (*a*) Find the Fourier transform of the following signals : [6]

(*i*) $x(t) = \text{sng}(t)$

(*ii*) $x(t) = u(t)$

(*iii*) $x(t) = e^{-at} \sin(\omega_0 t) u(t)$.

(*b*) Find the initial and final value of the following signal : [4]

$$X(s) = \frac{2s + 3}{s^2 + 5s - 7}.$$

(*c*) State the relationship between Fourier transform and Laplace transform. [2]

SECTION II

5. (*a*) Find the following for the given signal $x(t)$: [6]

(*i*) Autocorrelation

(*ii*) Energy from Autocorrelation

(*iii*) Energy Spectral Density.

$$x(t) = e^{-10t}u(t).$$

(*b*) Determine the cross-correlation between two sequences which are given below : [4]

$$x_1(n) = \{1 \ \ 2 \ \ 3 \ \ 4\}$$

$$x_2(n) = \{3 \ \ 2 \ \ 1 \ \ 0\}.$$

(*c*) State and describe any *three* properties of Power Spectral Density (PSD). [3]

Or

6. (*a*) Prove that autocorrelation function and energy spectral density form Fourier transform pair of each other and verify the same for : [9]

$$x(t) = e^{-10t}u(t).$$

(*b*) State and describe any *four* properties of Energy Spectral Density (ESD). [4]

7. (*a*) Explain Exponential probability model with respect to its density and distribution function. [4]

(*b*) Two cards are drawn from a 52 card deck successively without replacing the first : [4]

(*i*) Given the first one is heart, what is the probability that second is also a heart ?

(*ii*) What is the probability that both cards will be hearts ?

(*c*) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X, which represents the number of heads obtained on any double toss. Draw the mapping of S on to real line. Also find the probabilities of X and plot the C.D.F. [5]

Or

8. (*a*) PDF of a random variable X is : [6]

$$f_x(x) = ke^{-10x}, \qquad x > 0 \text{ and}$$

$$f_x(x) = 0, \qquad x \leq 0.$$

Find :

(*i*) value of k

(*ii*) $P(1 \leq X \leq 2)$

(*iii*) $P(X \geq 3)$.

(*b*) State the properties of Cumulative probability distribution function. [3]

(*c*) Find the mean standard deviation and variance of the uniform random variable. [4]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-543

S.E. (E & TC/Electronics) (First Semester) EXAMINATION, 2014

ELECTRONICS DEVICES AND CIRCUITS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6**, Q. No. **7** *or* **8**.

(*ii*) Neat diagrams drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data if necessary.

1. (*a*) Draw *h*-parameter models for C_E, C_B and C_C transistor configurations. [6]

(*b*) For the circuit shown in Fig. 1. Silicon transistor with β = 100 is used. Calculate I_B, I_C and V_{CE}. [6]

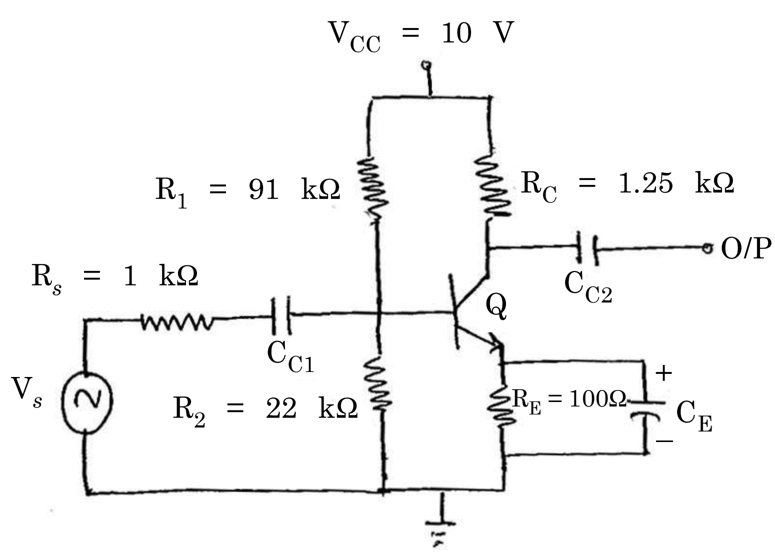


Fig. 1

Or

2. (*a*) For the circuit shown in Fig. 1, silicon transistor with h_{ie} = 1.1 kΩ, h_{fe} = 50, h_{re} = 2.5×10^{-4}, h_{oe} = 25 μA/V is used. Calculate A_i, A_v, R_i, R_i', R_0 and R_0'. [6]

(*b*) Derive the expression for stability factor S for the voltage divider bias circuit. [6]

3. (*a*) Draw and explain Hartley oscillator using BJT. Calculate frequency of oscillation, when C = 0.001 μF, L_1 = L_2 = 100 μH and mutual inductance between L_1 and L_2 is 20 μH. [6]

(*b*) Derive the expression for lower cut-off frequency and higher cut-off frequency in terms of percentage tilt and rise time respectively. [6]

Or

4. (*a*) Determine the input resistance of a series input connection and the output resistance of a shunt output connection for an ideal feedback voltage amplifier in which A_v = 10^5 and A_{vf} = 50. Assume that input and output resistances of the basic amplifier are R_i = 10 kΩ and R_0 = 20 kΩ respectively. [6]

(*b*) Explain the effect of internal capacitances of transistor used in amplifier circuit on bandwidth of amplifier with frequency response curve. Define F_{α} and F_{β} separately. [6]

5. (*a*) Draw class B push pull power amplifier and show that maximum efficiency is 78.5%. [6]

(*b*) A transformer coupled class A power amplifier draws a current of 200 mA from a collector supply of 10 V when no signal is applied to it. Determine : [7]

(*i*) Maximum output power

(*ii*) Maximum collector efficiency

(*iii*) Power rating of the transistors.

If the load connected across transformer. Secondary is of 2Ω and transformer turns ratio is 5 : 1.

Or

6. (*a*) Explain with circuit diagram, how even harmonics are eliminated in class B push-pull power amplifier. [6]

(*b*) A sinusoidal signal $V_S = 1.75 \sin (600\ t)$ is fed to a power amplifier. The resulting output current is $I_0 = 15 \sin 600\ t + 1.5 \sin 1200\ t + 1.2 \sin 1800\ t + 0.5 \sin 2400\ t$.

Calculate the percentage increase in the power due to distortion. [7]

7. (*a*) Explain various non-ideal current voltage characteristics of EMOSFET. [6]

(*b*) For the circuit shown in Fig. 2, the MOSFET parameters are $V_T = 3V$, $k = 0.4\ mA/V^2$. Determine V_{GS}, V_{DS} and I_D and show that MOSFET is biased in the saturation region : [7]

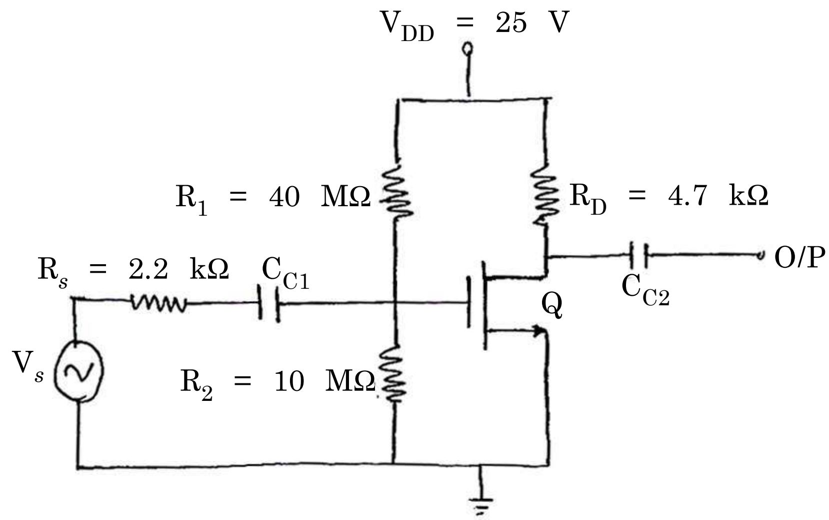


Fig. 2

Or

8. (*a*) For the circuit shown in the Fig. 2, determine g_m, A_v, R_i, R_i', R_0 and R_0'. Given $V_T = 3V$, $k = 0.4\ mA/V^2$ and $r_0 = 40\ k\Omega$. [7]

(*b*) Describe Bi-CMOS technology of MOSFET with circuit diagram. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4+2

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[4657]-544

S.E. (Electronics/E&TC) (First Semester) EXAMINATION, 2014

NETWORK THEORY

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Neat diagrams must be drawn wherever necessary.

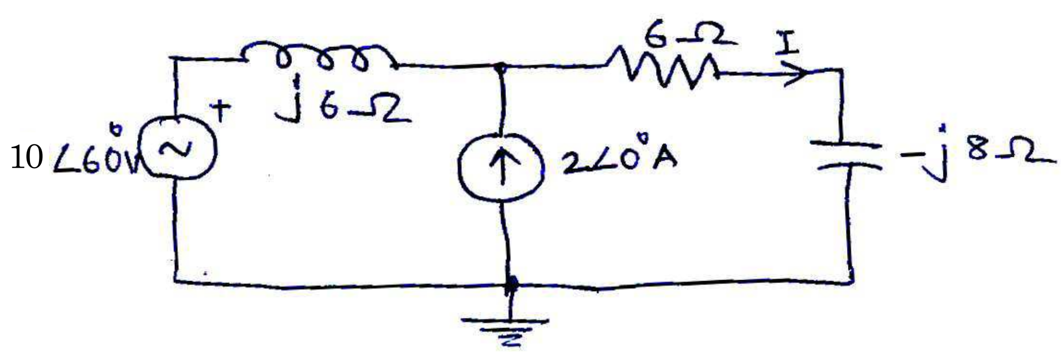
(*ii*) Figures to the right indicate full marks.

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*iv*) Assume suitable data, if necessary.

(*v*) All questions are compulsory.

1. (*a*) Calculate the current I through 6 Ω resistor by applying principle of superposition. [6]



P.T.O.

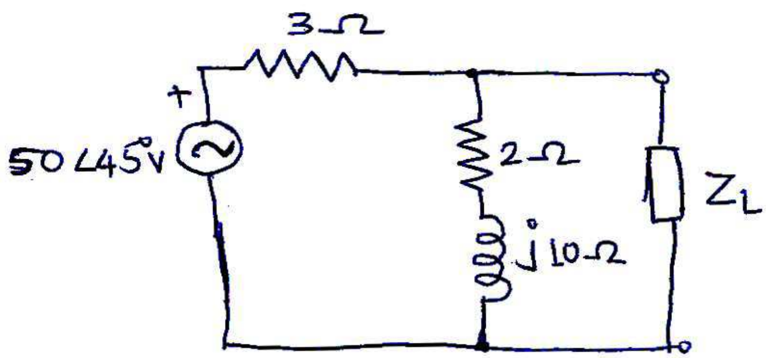
(*b*) The reduced incidence matrix of an oriented graph is :

$$A = \begin{bmatrix} 0 & -1 & 1 & 0 & 0 \\ 0 & 0 & -1 & -1 & -1 \\ -1 & 0 & 0 & 0 & 1 \end{bmatrix}.$$

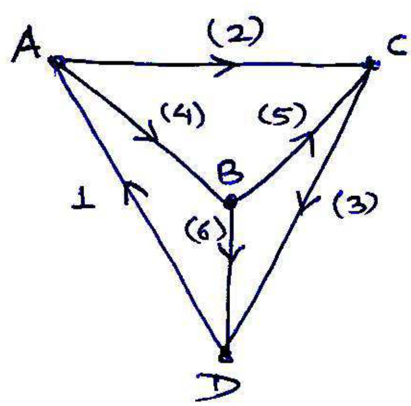
Draw the oriented graph. Also calculate the number of trees possible for this graph. [6]

Or

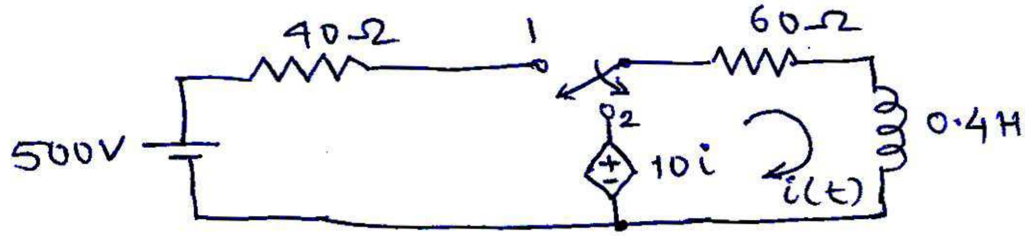
2. (*a*) Find the value of load impedance Z_L, so that maximum power can be transferred to it in the circuit shown below. Draw Thevenin's equivalent circuit. [6]



(*b*) Write the incidence matrix, tieset matrix and *f*-cutset matrix for the graph of a network given below. Select tree {4, 5, 6}. [6]

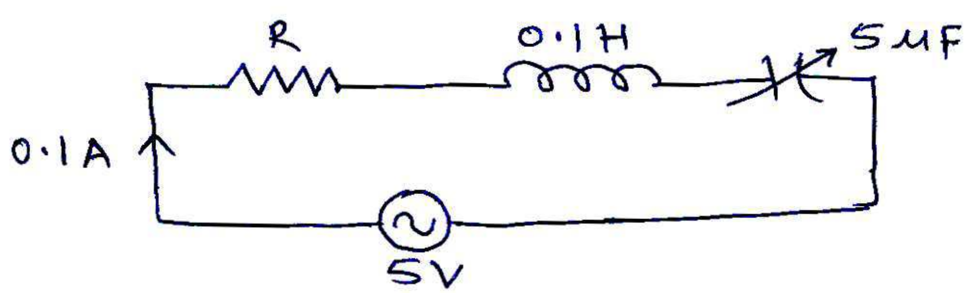


3. (*a*) For the network shown below, find the current expression i.e. $i(t)$ when the switch is changed from the position 1 to 2 at $t = 0$. [6]



(*b*) In a series RLC circuit, a maximum current of 0.1 A flows through the circuit when the capacitor is of 5 μF with a fixed frequency and a voltage of 5 V.

Determine the frequency at which the circuit resonates, the quality factor, the value of resistance and the bandwidth. [6]

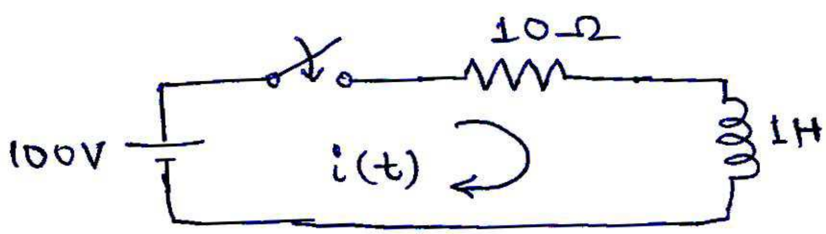


Or

4. (*a*) In the figure given below, the switch is closed at $t = 0$. Find :

$$i, \ \frac{di}{dt} \text{ and } \frac{d^2i}{dt^2}$$

at $t = 0^+$. [6]



(*b*) Derive the expression for bandwidth of a series RLC resonance circuit. [6]

5. (*a*) Explain the following terms used in filter theory :

(*i*) Attenuation constant,

(*ii*) Phase constant, and

(*iii*) Characteristic impedance. [6]

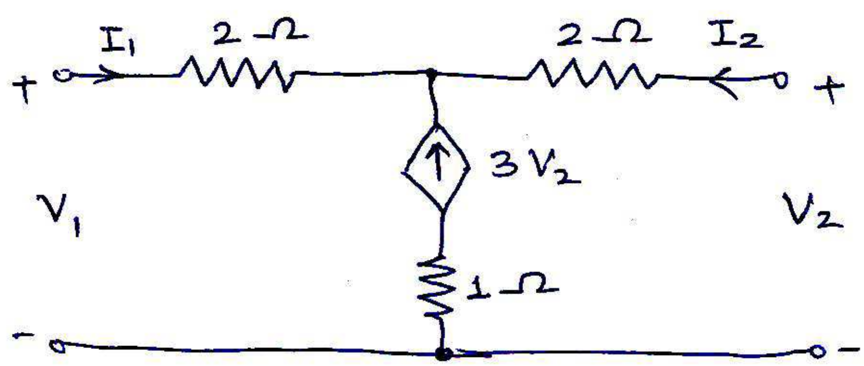
(*b*) Write a short note on attenuators. Also derive the relation between decibel and Neper. [7]

Or

6. (*a*) A π section filter network consists of a series arm inductor of 20 mH and two shunt-arm capacitors of 0.16 μF each. Calculate the cut-off frequency, attenuation and phase shift at 15 kHz. [6]

(*b*) Design a T-section band-pass, constant K type filter with cut-off frequency of 4 kHz and 10 kHz and nominal characteristic impedance of 500 Ω. [7]

7. (*a*) Find Y-parameters of the network shown below. [6]



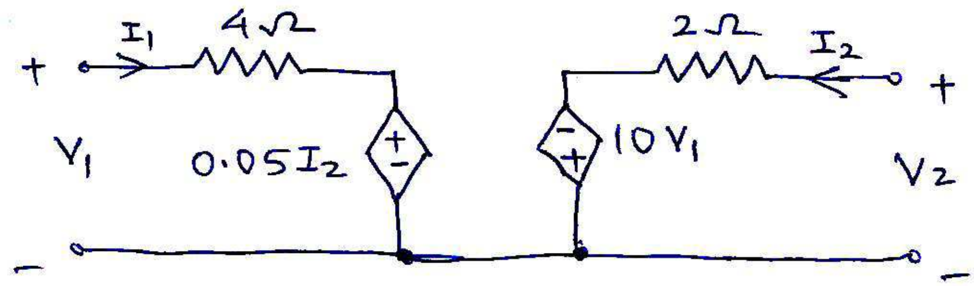
(*b*) Explain the following :

(*i*) Network functions for one and two port networks.

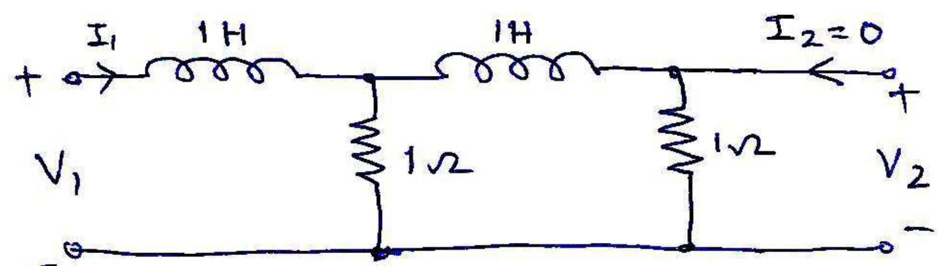
(*ii*) Pole-zeros of network functions. Also state its significance. [7]

Or

8. (*a*) Calculate the open-circuit impedance parameters for the network shown below and also check for symmetry and reciprocity of the network. [6]



(*b*) Determine the voltage transfer function $\frac{V_2}{V_1}$, for the network shown below. [7]



Total No. of Questions—8] [Total No. of Printed Pages—4

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[4657]-545

S.E. (E & TC/Electronics) (First Semester) EXAMINATION, 2014

DATA STRUCTURES AND ALGORITHMS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2** and Q. No. **3** *or* Q. No. **4** and Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8**.

(*ii*) Assume suitable data if necessary.

(*iii*) Write output of programs if necessary.

(*iv*) Draw neat diagrams wherever necessary.

1. (*a*) Define recursion with example in detail. [4]

(*b*) Write a function in 'C' to sort numbers using bubble sort. [4]

(*c*) Differentiate between static memory and dynamic memory allocation. [4]

Or

2. (*a*) Write algorithm to add two polynomials using array of structures. [4]

(*b*) Define pointers and write function 'swap' to swap two numbers using pointers. [4]

(*c*) Explain bitwise operators with example in detail. [4]

3. (*a*) Differentiate between SLL and DLL. [4]

(*b*) Write function PUSH to implement stack using array. [4]

(*c*) Name types of queues. Explain any *one* in detail. [4]

Or

4. (*a*) Write a function in 'C' to delete a node in SLL. [4]

(*b*) Explain operation insert in linear queue. [4]

(*c*) Convert the following infix expression to postfix using stack : [4]

a + b*(c/d $ a)/b.

5. (*a*) Define BST. Create BST for the following numbers : [5]

56, 34, 89, 11, 45, 67, 6, 78.

Show preorder traversal.

(*b*) Explain threaded binary tree with an example. [4]

(*c*) Define the following terms with example : [4]

(*i*) Strictly binary tree

(*ii*) Completely binary tree.

Or

6. (*a*) Write a function in 'C' to search a number in BST. [5]

(*b*) For the following numbers create AVL tree : [4]

6 5 4 3 2 1.

(*c*) Explain expression trees with *one* example. [4]

7. (*a*) Using Dijkstra's algorithm find out shortest path four source node ⓐ for the given graph : [5]

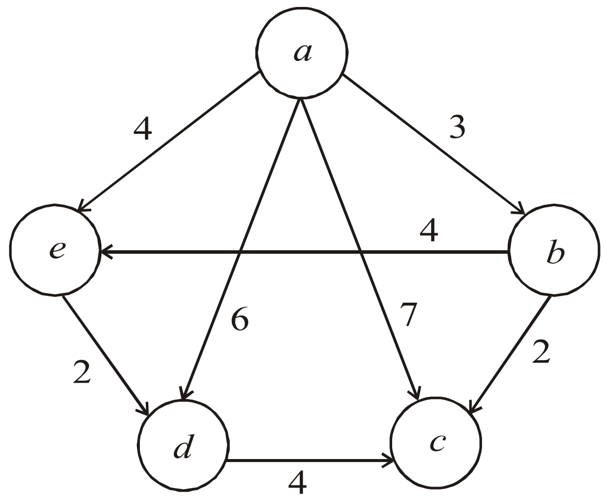

Fig. 1

(*b*) Represent the given graph using adjacency matrix : [4]

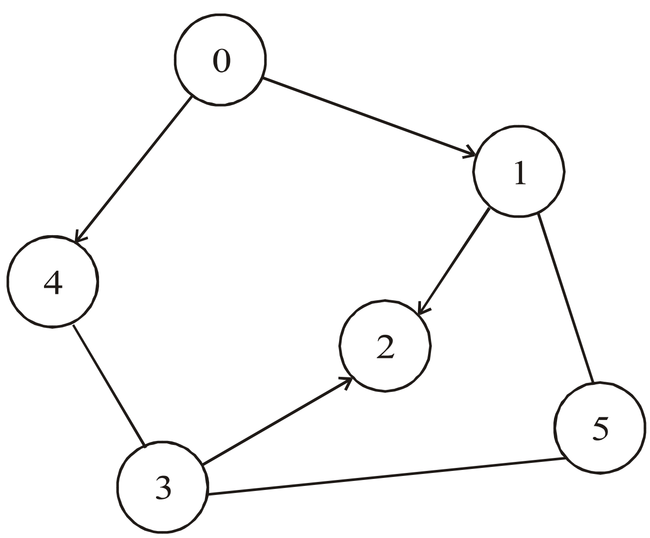

Fig. 2

(*c*) Explain Kruskal's algorithm with an example. [4]

Or

8. (*a*) Explain graph traversal methods with suitable example. [5]

(*b*) Explain Prim's algorithm with suitable example. [4]

(*c*) Define with example : [4]

(*i*) Connected graph

(*ii*) Path.

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

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[4657]-550

S.E. (Electronics & Telecommunication)

(I Sem.) EXAMINATION, 2014

DIGITAL ELECTRONICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Figures to the right indicate full marks.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Assume suitable data, if necessary.

1. (*a*) State the following characteristics of Digital IC's (TTL) : [6]

(*i*) Fan in, Fan out

(*ii*) Noise Margin

(*iii*) Figure of Merit.

(*b*) Implement the following functions using single 8 : 1 MUX : [6]

$f(A, B, C, D) = \pi M(0, 3, 5, 7, 12, 15) + d(2, 9)$.

Or

2. (*a*) Draw and explain the working of 2 input CMOS NOR gate. [6]

(*b*) Design a 2-Bit magnitude comparator using suitable decoder. [6]

3. (*a*) Design a mod-5 ripple counter using a 3-bit ripple counter. [6]

(*b*) Explain : [6]

(*i*) State Table

(*ii*) State Diagram

(*iii*) State Reduction.

Or

4. (*a*) Design and explain the following terms : [6]

(*i*) Melay Machine

(*ii*) Moore Machine

(*iii*) State Table.

(*b*) Design a pulse train generator to generate the following sequence ----10110---- using shift register. [6]

5. (*a*) Give comparison between PROM, PLA and PAL. [5]

(*b*) A combinational circuit is defined by the following functions. Implement this circuit with PLA having 3 input, 4 product terms and 2 outputs : [8]

$F_1(A, B, C) = \Sigma m(0, 1, 3, 4)$

$F_2(A, B, C) = \Sigma m(1, 2, 3, 4, 5)$.

Or

6. (*a*) Explain in detail the architecture of FPGA. [6]

(*b*) Design a BCD to excess 3 code converter and implement it using PAL. [7]

7. (*a*) Write a VHDL code for 2-bit comparator using behavioural modeling style. [7]

(*b*) Describe any *two* modeling styles of VHDL with suitable examples. [6]

Or

8. (*a*) Write a VHDL code for 4-bit ALU using case statement. [7]

(*b*) Explain the following statements with examples : [6]

(*i*) Process

(*ii*) Case

(*iii*) Wait.

Total No. of Questions—8] [Total No. of Printed Pages—3

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[4657]-552

S.E. (First Semester) (Instrumentation and Control)

EXAMINATION, 2014

LINEAR INTEGRATED CIRCUITS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Neat diagrams must be drawn wherever necessary.

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

(*iii*) Use of calculator is allowed.

(*iv*) Assume suitable data if necessary.

1. (*a*) Define output offset voltage of op-amp. List out any *two* offset nullifying techniques and explain any *one* of the two with neat circuit diagram. [6]

(*b*) Derive the closed loop voltage gain equation of differential amplifier with one op-amp. [6]

Or

2. (*a*) IC741 op-amp is used as non-inverting feedback amplifier. What maximum gain can be achieved that will keep frequency response flat to 10 kHz ? [6]

(*b*) Derive the output voltage equation for the voltage series feedback amplifier with neat circuit diagram. [6]

P.T.O.

3. (*a*) With neat circuit diagram, explain how input voltage can be converted into output current using op-amp. [6]

(*b*) Draw the circuit diagrams of : [6]

(*i*) Wien bridge oscillator

(*ii*) Phase shift oscillator

(*iii*) Precision half wave rectifier.

Or

4. (*a*) Implement the following equation using op-amp : [6]

$V_o = 3V_1 + 2V_2 - 5V_3$

where, V_o is the output voltage and

V_1, V_2, V_3 are inputs.

(*b*) Explain working of inverting Schmitt trigger with neat circuit diagram. [6]

5. (*a*) Draw the internal block diagram of IC555 and explain its working. [7]

(*b*) Define any *four* parameters of voltage regulator with unit. [6]

Or

6. (*a*) Explain bistable multivibrator using IC555 with neat circuit diagram. [6]

(*b*) Write a short note on step-down switching regulator. [7]

7. (*a*) Define the following terms related with filter : [6]

(*i*) Pass band

(*ii*) Stop band

(*iii*) Transition band.

(*b*) Derive voltage gain equation of Butterworth first order low pass filter with neat circuit diagram. [7]

Or

8. (*a*) List out any *five* differentiating points between active and passive filter. [5]

(*b*) Design Butterworth first order high pass filter with low cut-off frequency of 1 kHz and pass band gain equal to 2. [8]

Total No. of Questions—8] [Total No. of Printed Pages—3

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[4657]-553

S.E. (Instrumentation and Control)

(I Sem.) EXAMINATION, 2014

BASIC INSTRUMENTATION

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

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

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Write the difference between : [6]

(*i*) Accuracy and Precision

(*ii*) Threshold and Resolution.

(*b*) The disc in a single-phase energy meter rotates 1584 times when monitoring a 110 V, 3 A load at unity power factor over a period of 8 hours. Calculate the meter constant. If the meter disc makes 673 revolutions when measuring the energy supplied to a 110 V, 4 A load for 3 hours, determine the load power factor. [6]

Or

2. (*a*) Sketch and describe the working of slide wire DC potentiometer. Explain the process of standardization. [6]

(*b*) A multimeter having sensitivity of 2,000 Ω/V is used for measurement of voltage across a circuit having output resistance of 10 kΩ. The open circuit voltage of the circuit is 6 V. Find the reading of multimeter when it is set to 10 V range. Find the % error. [6]

3. (*a*) Explain the XY mode of dual trace oscilloscope. Also explain the Alt and Chop mode in dual trace oscilloscope. [6]

(*b*) Schering Bridge circuit with 100 Hz supply frequency connected between terminals *a* and *c*, uses fixed value components of 0.1 μF in arm *ad* and 10 kΩ in arm *bc*. The values of parallel components in arm *dc* at bridge balance are 3.9 kΩ and 3300 pF. If the detector is connected between terminal *b* and *d*, determine the unknown capacitance and its series-resistive component in arm *ab*. [6]

Or

4. (*a*) Write a note on Z-modulation. How is it used for unknown frequency measurement ? [6]

(*b*) Derive the equation for the current through the galvanometer in case of unbalance Wheatstone Bridge. [6]

5. (*a*) Draw block diagram of DMM. Explain the relation between the Digits and the Count of DMM with examples. [7]

(*b*) Explain the Digital Tachometer. [6]

Or

6. (*a*) Explain with the help of block diagram, Digital Phase Meter. [7]

(*b*) What are the different blocks required for Digital Distance Meter ? Explain with neat block diagram. [6]

7. (*a*) What are standard specifications of strip chart recorder ? The chart speed of a recorder is 50 mm/s. One cycle of a signal is recorded over 5 mm. Determine the frequency of the signal. [7]

(*b*) Explain any *three* marking mechanisms in recorders. [6]

Or

8. (*a*) Write a short note on Virtual Instrumentation. [6]

(*b*) Draw and explain block diagram of function generator in detail. [7]

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

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[4657]-554

S.E. (Instru. and Control) (First Semester) EXAMINATION, 2014

PHOTONICS AND INSTRUMENTATION

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6** and Q. **7** *or* Q. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Draw electromagnetic spectrum of light and show different ranges in Hz. [8]

(*b*) Refractive index of plasma tube is 1.4. Calculate the Brewster's angle to get dominant laser beam. [4]

Or

2. (*a*) Write short notes on (any *two*) : [8]

(*i*) Dispersion

(*ii*) Refraction

(*iii*) Scattering.

(*b*) For an Incandescent lamp the design parameters are : [4]

(*i*) Design voltage = 5 V

(*ii*) Rated M.S.C.P. = 0.145

(*iii*) Operated at 4.5 V, then calculate

(*i*) Rerated M.S.C.P.

(*ii*) Reduction factor of lamp

When M.H.S.C.P. = 0.725

3. (*a*) Explain the following types of thermal detector with suitable diagram (any *two*) : [8]

(*i*) Bolometric

(*ii*) Thermovoltaic

(*iii*) Thermopneumatic.

(*b*) Explain in short concept of holographic grating. [4]

Or

4. (*a*) What is Quantum detector ? Explain any *two* types of Quantum detectors. [8]

(*b*) Write a note on Photomultiplier tube. [4]

5. (*a*) Explain the concept of material absorption loss, scattering loss, bending loss. [7]

(*b*) Explain concept of intramodal and intermodal loss. [6]

Or

6. (*a*) What is wave guiding principle ? Explain the term skew rays. [6]

(*b*) What are different modes used in fiber optics ? Explain with diagram. [7]

7. (*a*) What are the different types of telescopes ? Explain astronomical telescope with diagram. [7]

(*b*) Explain with suitable diagram OTDR. [6]

Or

8. (*a*) Explain with suitable diagram camera. [7]

(*b*) Explain basic principle of holography with neat diagram. [6]

Total No. of Questions—**8**]　　　　[Total No. of Printed Pages—**3**

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[4657]-559

S.E. (Instrumentation and Control) (Second Semester)

EXAMINATION, 2014

INDUSTRIAL DRIVES

(2012 PATTERN)

Time : Two Hours　　　　**Maximum Marks : 50**

***N.B.* :—** (*i*) Solve Q. **1** or Q. **2**, Q. **3** or Q. **4**, Q. **5** or Q. **6** and Q. **7** or Q. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, mollier charts, electronic pocket calculator and steam table is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) Explain two transistor model of SCR. [6]

(*b*) Explain in detail 3-ϕ full controlled bridge rectifier with resistive load. [6]

Or

2. (*a*) Give classification of chopper. Explain basic chopper operation. [6]

(*b*) Give classification of Inverter. Explain any *one* in detail. [6]

3. (*a*) With suitable diagram, explain the working of dc generator. [6]

(*b*) Why is starter necessary for induction motors ? [6]

Or

4. (*a*) Explain the armature controlled method of dc shunt motor speed control. [6]

(*b*) Explain torque-slip characteristics of induction motor. [6]

5. (*a*) Explain an alternator with suitable diagram. [7]

(*b*) Why is synchronous motor not self starting ? Explain magnetic locking condition. [6]

Or

6. (*a*) Derive EMF equation of the alternator. [7]

(*b*) Write a short note on Breaking of Induction Motor. [6]

7. (*a*) Explain in detail the construction of stepper motor. [7]

(*b*) Explain the types of DC Servomotors in detail. [6]

Or

8. (*a*) What do you mean by servomotors ? Give its classification. [7]

(*b*) Write a short note on speed control of universal motor. [6]

Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

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[4657]-561

S.E. (Chemical/Printing Engineering)

(I Sem.) EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

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

(*iii*) Use of non-programmable calculator is allowed.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Solve any *two* : [8]

(*i*) $(x+1)^2 \dfrac{d^2y}{dx^2} + (x+1)\dfrac{dy}{dx} + y = 2\sin\left[\log(x+1)\right]$

(*ii*) $\dfrac{d^2y}{dx^2} + y = \operatorname{cosec} x$ (by method of variation of parameters)

(*iii*) $\dfrac{dx}{2z-3y} = \dfrac{dy}{3x-z} = \dfrac{dz}{y-2x}$.

P.T.O.

(*b*) Solve the integral equation : [4]

$$\int_0^\infty f(x) \sin \lambda x \, dx = \begin{cases} 1, & 0 \le \lambda < 1 \\ 2, & 1 \le \lambda < 2 \\ 0, & \lambda \ge 2 \end{cases}$$

Or

2. (*a*) A body weighing 4.9 kg is hung from a spring. A pull of 10 kg will stretch the spring to 5 cm. The body is pulled down 6 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position in time t seconds, the maximum velocity and period of oscillation. [4]

(*b*) By considering Fourier cosine integral of e^{-mx} ($m > 0$), prove that : [4]

$$\int_0^\infty \frac{\cos \lambda x}{\lambda^2 + m^2} \, d\lambda = \frac{\pi}{2m} e^{-mx}, \quad m > 0, \quad x > 0.$$

(*c*) Find the Fourier sine transform of [4]

$$f(x) = \begin{cases} 1, & 0 \le x \le 1 \\ 0, & x > 0 \end{cases}$$

and hence evaluate

$$\int_0^\infty \frac{\sin^3 x}{x} \, dx.$$

3. (*a*) Attempt any *one* : [4]

(*i*) Find Laplace transform of :

$$F(t) = \begin{cases} e^{-4(t-5)} \sin 3(t-5), & t > 5 \\ 0, & t < 5 \end{cases}$$

(*ii*) Find inverse Laplace transform of

$$\log\left(\frac{s+b}{s+a}\right).$$

(*b*) Solve by Laplace transform : [4]

$$\frac{dx}{dt} + 3x + 2\int_0^t x(t)\, dt = t,$$

given $x(0) = 0$.

(*c*) Find directional derivative of $\phi = e^{2x-y-z}$ at (1, 1, 1) along the line $2(x - 2) = y + 1 = z - 1$. [4]

Or

4. (*a*) Attempt any *one* : [4]

(*i*) Prove that :

$$\bar{a} \cdot \nabla\left[\bar{b} \cdot \nabla\left(\frac{1}{r}\right)\right] = \frac{3(\bar{a} \cdot \bar{r})(\bar{b} \cdot \bar{r})}{r^5} - \frac{(\bar{a} \cdot \bar{b})}{r^3}.$$

(*ii*) Prove that :

$$\nabla^2\left[r^n \log r\right] = \left[n(n+1)\log r + 2n + 1\right] r^{n-2}.$$

(*b*) Verify whether the following vector field is irrotational if so, find scalar potential ϕ such that $\overline{F} = \nabla\phi$. [4]

(*c*) The transfer function of second order system is given as : [4]

$$G(s) = \frac{10}{s^2 + 1.6s + 4}$$

Determine overshoot and $y(t)_{max}$.

5. (*a*) Find the work done in moving a particle once round the circle $x^2 + y^2 = 1$, $z = 1$ under the field of force : [4]

$$\overline{F} = (2x + y - z)\overline{i} + \left(x - 3y + z^2\right)\overline{j} + \left(3x^2 - 4y^3\right)\overline{k}.$$

(*b*) Evaluate : [5]

$$\iint_S \left[(z\sin y)\overline{i} + y\overline{j} + z^3\overline{k}\right] \cdot d\overline{S}$$

over the cylinder $x^2 + y^2 = 1$, $z = 0$, $z = 1$.

(*c*) Evaluate : [4]

$$\iint_S \left(\nabla \times \overline{F}\right) \cdot d\overline{S}$$

where

$$\overline{F} = (x - y)\overline{i} + \left(x^2 + yz\right)\overline{j} - 3xy^2\overline{k},$$

S is the surface of cone $z = 4 - \sqrt{x^2 + y^2}$ above xy-plane.

Or

6. (*a*) Evaluate : [4]

$$\int_C \bar{F} \cdot d\bar{r}$$

where

$$\bar{F} = (x - y)\bar{i} + y^2\bar{j} + (z - 2)\bar{k}$$

along the curve $x = 2t$, $y = t^2$, $z = 3t$ from $t = 0$ to $t = 1$.

(*b*) Prove that : [4]

$$\iint_S (\phi\nabla\psi - \psi\nabla\phi) \cdot d\bar{S} = \iiint_V \left(\phi\nabla^2\psi - \psi\nabla^2\phi\right) dV$$

where V is the volume bounded by surface S.

(*c*) Use Stokes' theorem to evaluate : [5]

$$\iint_S \left(\nabla \times \bar{F}\right) \cdot d\bar{S}$$

where

$$\bar{F} = \left(x - z^2\right)\bar{i} + (y - 3x)\bar{j} + z^3 y\bar{k},$$

S is the surface $x^2 + y^2 + z^2 - 4z = 1$ above the plane $z = 0$.

7. (*a*) A tightly stretched string with fixed end points $x = 0$ and $x = l$ is initially in a position given by : [7]

$$y(x,\ 0) = \sin^3\left(\frac{\pi x}{l}\right).$$

If it is released from rest from this position, find the displacement y at any distance x from one end and at any time t.

(*b*) Solve the equation : [6]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

where $u(x,\ t)$ satisfies the following conditions :

(*i*) $u(0,\ t) = 0$

(*ii*) $u(l,\ t) = 0$ for all t

(*iii*) $u(x,\ 0) = x$ in $0 < x < l$

(*iv*) $u(x,\ \infty)$ is finite.

Or

8. (*a*) Use Fourier transform to solve : [7]

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

where $u(x,\ t)$ satisfies the conditions :

(*i*) $\left(\frac{\partial u}{\partial x}\right)_{x = 0} = 0,\ t > 0$

(*ii*) $u(x,\ 0) = \begin{cases} x, & 0 < x < 1 \\ 0, & x > 1 \end{cases}$

(*iii*) $|u(x,\ t)| < M.$

(*b*) Solve the equation : [6]

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$$

with conditions :

(*i*) $u(0, y) = 0$

(*ii*) $u(\pi, y) = 0$

(*iii*) $u(x, \infty) = 0$

(*iv*) $u(x, 0) = u_0$ for $0 < x < \pi$.

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

Seat No.	

[4657]-562

S.E. (Chem.) (I Sem.) EXAMINATION, 2014

CHEMISTRY—I

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer *four* questions.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) What is aromaticity ? Discuss Huckel's rule to explain the aromaticity of benzenoid and non-benzenoids. [6]

(*b*) Derive the integrated rate expression for first-order reaction. [6]

Or

2. (*a*) Give reasons : [6]

(*i*) Pyridine is a weaker base than pyrrole.

(*ii*) Acetic acid is weaker than monochloroacetic acid.

(*iii*) *p*-methoxy phenol is weaker acid than phenol.

(*b*) Explain activated complex theory for reaction rates. [6]

3. (*a*) Give the important parts of a gas chromatograph. [6]

(*b*) Give the experiment and equation for molar mass of solute in elevation in boiling point. An aqueous solution of a non-volatile solute boils at 100.17°C. At what temperature would it freeze ?

For water k_b = 0.52 KKgmol^{-1} and k_f = 1.86 KKgmol^{-1}. [7]

Or

4. (*a*) Derive the equations relating degree of dissociation for solution of electrolyte. A 0.5% aqueous solution of KCL was found to freeze at –0.24°C. Calculate the Vant Hoff factor. [7]

(*b*) Write a short note on Thin layer chromatography. [6]

5. (*a*) Give mechanism of Favorskii rearrangement. [6]

(*b*) Predict the product : [6]

(*i*) $CH_3CH_2CHOHCH_3 \xrightarrow{65\%\ H_2SO_4}$

(*ii*) $C_6H_5N_2Cl + C_6H_5OH \xrightarrow{H^+}$

(*iii*) $C_6H_6 \xrightarrow{\text{acetic anhydride}}$

Or

6. (*a*) Write short notes on the following : [6]

(*i*) Reformatsky rearrangement

(*ii*) Claisen rearrangement

(*iii*) Activating group.

(*b*) Discuss the mechanism of E_1 and E_2 reactions. [6]

7. (*a*) Electrophiles attack furan preferentially at position 2 and 5. Explain why ? [7]

(*b*) Give *two* methods each for the synthesis of the following : [6]

(*i*) Pyrrole

(*ii*) Pyridine

(*iii*) Furan.

Or

8. (*a*) Describe briefly color and constitution of a dye. [7]

(*b*) Describe synthesis of the following : [6]

(*i*) Crystal violet

(*ii*) Phenolphthalein.

Total No. of Questions—8] [Total No. of Printed Pages—3

Seat No.	

[4657]-563

S.E. (Chemical Engineering) (I Sem.) EXAMINATION, 2014

CHEMICAL ENGINEERING FLUID MECHANICS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

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

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Assume suitable data, if necessary.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

1. (*a*) Draw shear stress-shear rate diagram and explain rheological behaviour of different fluids. [6]

(*b*) What is dynamic viscosity and kinematic viscosity ? State their units of measurements. [6]

Or

2. (*a*) The velocity distribution for flow over a flat plate is given by $u = 1.5y - y^2$. Where u is the point velocity in meter per second at a distance y meter above the plate. Determine the velocity gradient and shear stress at $y = 5$ and $y = 10$ cm. Assume the dynamic viscosity as 10 poise. [6]

(*b*) What is the limitation of Bernoulli's equation ? [2]

(*c*) Explain the concept of atmospheric, absolute, gauge and vacuum pressure. [4]

3. (*a*) Derive Hagen-Poiseuille equation, highlighting the assumptions made. [8]

(*b*) A laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.5 m/s. Find mean velocity and radius at which this occurs. [4]

Or

4. (*a*) An oil of specific gravity 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take $C_d = 0.98$. [6]

(*b*) Compare between an orificemeter and venturimeter. [6]

5. (*a*) Explain the concept of Boundary layer. [5]

(*b*) Explain Buckingham's π-theorem in detail. [8]

Or

6. (*a*) Derive on the basis of dimensional analysis suitable parameters to present thrust developed by propeller. Assume that thrust P depends upon angular velocity ω, speed V, diameter D, dynamic viscosity μ, mass density ρ, speed of sound in medium C. [7]

(*b*) Explain laminar boundary layer, turbulent boundary layer and laminar sub-layer. [6]

7. (*a*) What is equivalent pipe ? Derive Dupit's equation. [8]

(*b*) Explain operating characteristics of centrifugal pump. [5]

Or

8. (*a*) Explain different types of losses occurring through pipes. [5]

(*b*) An oil of specific gravity 0.9 and viscosity 0.06 poise is flowing through a pipe of diameter 200 mm at the rate of 60 liters/s. Find the head lost due to friction and power required to maintain the flow for a 500 m length. [8]

Total No. of Questions—8] [Total No. of Printed Pages—3

Seat No.	

[4657]-564

S.E. (Chemical) (First Sem.) EXAMINATION, 2014

CHEMICAL ENGINEERING MATERIALS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt *All* questions.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Your answers will be valued as a whole.

1. (*a*) Define the following terms : [6]

(*i*) Creep

(*ii*) Fatigue

(*iii*) Hardness

(*iv*) Resilience

(*v*) Toughness

(*vi*) Malleability.

(*b*) Write the difference between destructive and non-destructive testing of materials. [3]

P.T.O.

(*c*) Define the following terms : [3]

(*i*) Lattice points

(*ii*) Unit Cell

(*iii*) Atomic Packing Factor.

Or

2. (*a*) Define Material and explain the classification of materials. [6]

(*b*) Define Hardness. What are the different hardness tests ? Explain any *one* in brief. [6]

3. (*a*) Write short notes on the following : [8]

(*i*) Rolling

(*ii*) Bending

(*iii*) Central punching

(*iv*) Welding.

(*b*) Define Nanotechnology. State the applications of Nanomaterials in chemical industry. [5]

Or

4. (*a*) Explain in detail about Fullerenes and Bucky Balls. [7]

(*b*) Write short notes on the following : [6]

(*i*) Welding

(*ii*) Rolling

(*iii*) Riveting.

5. (*a*) Explain in brief about Scanning Tunneling Microscopy. [6]

(*b*) Write a short note on X-ray diffraction. [6]

Or

6. Explain principle and working of Transmission Electron Microscope (TEM). [12]

7. (*a*) Explain crystalline and non-crystalline ceramics with examples and state their applications. [7]

(*b*) Discuss Thermal, Electrical and Mechanical properties of ceramic materials. [6]

Or

8. (*a*) Write a short note on Organic Protective Coatings. [6]

(*b*) Discuss in detail applications of ceramic materials. [7]

Total No. of Questions—8] [Total No. of Printed Pages—4+1

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[4657]-565

S.E. (Chemical Engg.) (First Semester) EXAMINATION, 2014

PROCESS CALCULATIONS

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6**, Q. No. **7** *or* **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) A saturated solution of salicylic acid ($C_7H_6O_3$) in methanol contains 64 kg salicylic acid per 100 kg of methanol. Find the composition of the solution in weight % and mole %. [5]

(*b*) A gas mixture contains nitrogen and other gases. The average molecular weight of the gas mixture is calculated as 18.74 if the molecular weight of nitrogen is taken as 14 and as 30.08 if it is taken as 28. Find the mole percent of nitrogen in the gas mixture. If the other two components are CO_2 and O_2, find their mole percent. [7]

P.T.O.

Or

2. (*a*) The strength of a phosphoric acid sample solution is found to be 35% P_2O_5 by weight. Determine the purity of the flakes. (Atomic weight of P = 31). [5]

(*b*) A 100 kg mixture of 27.8% acetone (A) and 72.2% chloroform (B) by weight is to be extracted with a mixed solvent containing water (S_1) and acetic acid (S_2). The original mixture and the solvent are well shaken, allowed to attain equilibrium and separated into two layers. The composition of the two layers is given below : [7]

	Composition, weight %			
Layer	A	B	S_1	S_2
Upper layer	7.5	3.5	57.4	31.6
Lower layer	20.3	67.3	2.8	9.6

Find the quantities of the two layers and composition of the mixed solvent added.

3. (*a*) In the manufacture of chlorine, feed containing HCl gas and air are fed to the oxidizer. The product leaving the oxidizer is found to contain 13.2% HCl, 6.3% O_2, 42.9% N_2, 30% Cl_2 and 7.6% water by weight. Calculate the excess air used, the composition of feed (by weight) entering the reactor and conversion. [7]

(*b*) 100 kg of tin is melted in a jacketed open pan. The jacket is fed with vapours which are condensed to supply the heat required for the process. Calculate the amount of vapours required. Data for tin : Molecular weight = 118.7, M.P. = 505 K, latent heat of fusion = 7201 kJ/kg, heat capacity of solid c = 21.14 + 0.02 T kJ/kmol K, where T is in K. Latent heat of vapour used in jacket = 278 kJ/kg. [6]

Or

4. (*a*) The reaction between ethylene and hydrogen bromide to form ethyl bromide is carried out in a continuous reactor. The product stream is analyzed to give 50 mol % C_2H_5Br and 33% HBr. Calculate the conversion of the limiting reactant and the percentage excess of the other. The feed stream contains ethylene and hydrogen bromide only. [6]

(*b*) Obtain an empirical equation for calculating the heat of reaction at any temperature T(K) for the reaction $CH_4(g) + C_2H_4(g) \rightarrow C_3H_8(g)$, ΔH_R^0 at 298 K = – 82.66 kJ/mol. Specific heat data is given below where $C_P = a + bT$ (kJ/kmol K) : [7]

Gas	***a***	***b* × 10³**
CH_4	19.2494	52.1135
C_2H_4	4.1261	155.0213
C_3H_8	–4.2227	306.264

5. (*a*) Define absolute humidity, molal humidity, relative humidity and percentage humidity. Give the relation between molal and absolute humidity. [6]

(*b*) Wet solid containing 30% moisture is to be dried to a water content of 2% by circulating hot air. Fresh air contains 0.018 kg water vapour/kg dry air and exhaust air contains 0.095 kg/kg moisture. Calculate the volumetric flowrate of fresh air for drying 100 kg/h wet solids, if this air is available at 300 K and 101.325 kPa. [7]

Or

6. (*a*) A solution of ferric chloride in water contains 64% $FeCl_3$ by weight. Calculate the amount of $FeCl_3.6H_2O$ which will crystallize at 300 K from 1000 kg feed solution. The solubility of ferric chloride in water at 300 K is 68.3% by weight of $FeCl_3$. (Atomic weight of Fe = 63). [7]

(*b*) Define dry bulb temperature, wet bulb temperature, relative saturation, percentage saturation, vapor pressure. [6]

7. (*a*) Calculate the gross and net calorific in value in kJ/kg of a gas mixture at 298 K containing CH_4 : 89.4%, C_2H_6 : 5%, C_3H_8 : 1.9%, C_4H_{10} : 1%, CO_2 : 0.7% and N_2 : 2%. The GCV data (kJ/mol) : CH_4 : 890.65, C_2H_6 : 1560.69, C_3H_8 : 2219.17, C_4H_{10} : 2877.4. The latent heat of water = 2432.5 kJ/kg. [8]

(*b*) Define calorific value, GCV and NCV. [4]

Or

8. (*a*) A furnace is fired with fuel oil. The Orsat analysis of the flue gases indicates 10.6% CO_2, 6% O_2 and rest N_2 by volume. Find the percentage excess air used. [6]

(*b*) What is proximate and ultimate analysis ? [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-570

S.E. (Chemical) (Second Semester) EXAMINATION, 2014

MECHANICAL OPERATIONS

(2012 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Your answers will be valued as a whole.

(*vi*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vii*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the significance of size reduction in chemical process industries ? [4]

(*b*) Differentiate between crushing and grinding. [4]

(*c*) A material is crushed in a Blake jaw crusher such that the average size of particle is reduced from 50 mm to 10 mm with the consumption of energy of 13.0 kW(kg/s). What would be the consumption of energy needed to crush the same material of average size 75 mm to an average size of 25 mm : [10]

(*i*) Assuming Rittinger's law applies ?

(*ii*) Assuming Kick's law applies ? Which of these results would be regarded as being more reliable and why ?

P.T.O.

Or

2. (*a*) Explain the importance of screening in Chemical Industry. [4]

(*b*) Explain the critical speed of a ball mill. [6]

(*c*) How is the screen analysis performed on standard screen series ? Explain in detail. [8]

3. (*a*) Describe with a sketch the working of closed loop pneumatic conveying system with its flow-sheet. [8]

(*b*) Describe with a neat sketch the construction of Bucket elevators. [8]

Or

4. (*a*) Describe with neat sketch construction of screw conveyor. List advantages, disadvantages and industrial applications. [8]

(*b*) State the advantages and limitations of pneumatic conveyors. [6]

(*c*) Explain 'shape factor'. [2]

5. (*a*) What is degree of mixing and rate of mixing in case of dry solids and derive the necessary equations. [8]

(*b*) With the help of neat sketch distinguish between radial flow and axial flow impellers. [8]

Or

6. (*a*) Write short notes on : [8]

(*i*) Mixing index

(*ii*) Sigma mixer.

(*b*) Describe with neat sketches "Prevention of swirling and vortex formation". [8]

SECTION II

7. (*a*) Describe with a neat sketch the working of plate and frame filter press. [8]

(*b*) What are the various factors which affect the rate of filtration ? Derive an expression to calculate the rate of filtration. [8]

Or

8. (*a*) Describe with a neat sketch the working of Kelly filter. [8]

(*b*) Compare pressure filter and vacuum filter. [4]

(*c*) Explain the operating cycle of centrifuge filter. [4]

9. (*a*) Describe sedimentation operation with a neat sketch of typical commercial equipment. [10]

(*b*) Describe with neat sketches the aggregate and particulate fluidization. Give typical examples of both. [8]

Or

10. (*a*) Distinguish between free settling and hindered settling. [4]

(*b*) Explain mechanism of sedimentation and classify equipments used for sedimentation. [6]

(*c*) What is minimum fluidization ? Derive an expression for it. [8]

11. Write short notes on : [16]

(*i*) Froth floatation

(*ii*) Gravity settling tank

(*iii*) Fabric filters

(*iv*) Electrostatic precipitator.

Or

12. (*a*) Explain jigging separation technique with neat diagram. [6]

(*b*) What is screen efficiency and screen effectiveness ? [6]

(*c*) Describe with a neat sketch 'Bag filter'. [4]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-571

S.E. (Computer Engineering/Information Technology)

(II Sem.) EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt **4** questions : Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of electronic non-programmable calculator is allowed.

(*v*) Assume suitable data whenever necessary.

1. (*a*) Solve any *two* : [8]

(*i*) $\left(D^2 + 6D + 9\right)y = x^{-3}e^{-3x}$

(*ii*) $\left(D^2 - 2D + 2\right)y = e^x \tan x$ (by variation of parameters method)

(*iii*) $x^2 \dfrac{d^2y}{dx^2} - 3x\dfrac{dy}{dx} + 5y = x^2 \sin(\log x)$.

(*b*) Find the Fourier sine and cosine transforms of e^{-mx}, $m > 0$. [4]

Or

2. (*a*) The currents x and y in the coupled circuits are given by :

$$(\mathrm{LD} + 2\mathrm{R})x - \mathrm{R}y = \mathrm{E}$$

$$(\mathrm{LD} + 2\mathrm{R})y - \mathrm{R}x = 0.$$

Find the general values of x and y in terms of t. [4]

(*b*) Find the inverse z-transform (any *one*) : [4]

(*i*) $\mathrm{F}(z) = \dfrac{10z}{(z-1)(z-2)}$ (by inversion integral method)

(*ii*) $\mathrm{F}(z) = \dfrac{z}{\left(z - \frac{1}{4}\right)\left(z - \frac{1}{5}\right)}, \ |z| > \dfrac{1}{4}.$

(*c*) Solve the difference equation : [4]

$$f(\mathrm{K} + 1) - f(\mathrm{K}) = 1, \ \mathrm{K} \geq 0, \ f(0) = 0.$$

3. (*a*) The first four moments about 44.5 of a distribution are –0.4, 2.99, –0.08 and 27.63. Calculate moments about mean, coefficients of Skewness and Kurtosis. [4]

(*b*) The incidence of a certain disease is such that on the average 20% of workers suffer from it. If 10 workers are selected at random, find the probability that : [4]

(*i*) exactly 2 workers suffer from disease.

(*ii*) not more than 2 workers suffer.

(c) Find the directional derivative of :

$$\phi = 4xz^3 - 3x^2y^2z$$

at (2, –1, 2) along a line equally inclined with coordinate axes. [4]

Or

4. (a) A random sample of 200 screws is drawn from a population which represents size of screws. If a sample is normally distributed with a mean 3.15 cm and S.D. 0.025 cm, find expected number of screws whose size falls between 3.12 cm and 3.2 cm. [4]

[Given : For $z = 1.2$, area = 0.3849; for $z = 2$, area = 0.4772]

(b) Show that (any *one*) : [4]

(i) $\nabla \cdot \left(\dfrac{\bar{a} \times \bar{r}}{r} \right) = 0$

(ii) $\nabla^4 \left(r^2 \log r \right) = \dfrac{6}{r^2}$.

(c) A fluid motion is given by :

$$\bar{v} = (y \sin z - \sin x)\hat{i} + (x \sin z + 2yz)\hat{j} + \left(xy \cos z + y^2\right)\hat{k}.$$

Is the motion irrotational ? If so, find the scalar velocity potential. [4]

5. (*a*) Find the work done by the force :

$$\bar{F} = \left(x^2 - yz\right)i + \left(y^2 - zx\right)j + \left(z^2 - xy\right)k$$

in taking a particle from (1, 1, 1) to (3, –5, 7). [4]

(*b*) Use divergence theorem to evaluate :

$$\iint_S \left(y^2z^2\ i + z^2x^2\ j + x^2y^2\ k\right) \cdot d\bar{s}$$

where s is the upper half of the sphere $x^2 + y^2 + z^2 = 9$ above the $x\,o\,y$ plane. [5]

(*c*) Apply Stokes' theorem to evaluate :

$$\int_C (4y\ dx + 2z\ dy + 6y\ dz)$$

where C is the curve $x^2 + y^2 + z^2 = 6z$, $z = x + 3$. [4]

Or

6. (*a*) Find the work done in moving a particle from (0, 1, –1) to $\left(\frac{\pi}{2}, -1, 2\right)$ in a force field : [4]

$$\bar{F} = \left(y^2 \cos x + z^3\right)i + (2y \sin x - 4)\, j + \left(3xz^2 + 2\right)k.$$

(*b*) Evaluate :

$$\iint_S \left[\left(x + y^2\right)i - 2x\, j + 2yz\, k\right] \cdot d\bar{s}$$

where s is the plane $2x + y + 2z - 6 = 0$ considered as one of the bounding planes of the tetrahedron $x = 0$, $y = 0$, $z = 0$, $2x + y + 2z = 6$. [5]

(*c*) Verify Stokes' theorem for :

$$\bar{F} = -y^3 i + x^3 j$$

and the closed curve c is the boundary of the circle $x^2 + y^2 = 1$. [4]

7. (*a*) Find the condition under which :

$$u = ax^3 + bx^2y + cxy^2 + dy^3$$

is harmonic. [4]

(*b*) Evaluate :

$$\oint_C \frac{4z^2 + z}{z^2 - 1}\, dz,$$

where C : $|z - 1| = 3$. [5]

(*c*) Show that :

$$w = \frac{z - i}{1 - iz}$$

maps upper half of z-plane onto interior of unit circle in w-plane. [4]

Or

8. (*a*) Find the harmonic conjugate of : [4]

$$u = r^3 \cos 3\theta + r \sin \theta.$$

(*b*) Evaluate :

$$\oint_C \frac{\sin 2z}{\left(z + \frac{\pi}{3}\right)^4} \, dz,$$

where C : $|z| = 2$. [5]

(*c*) Find the bilinear transformation which maps the points 1, 0, i of the z-plane onto the points ∞, -2, $-\frac{1}{2}(1 + i)$ of the w-plane. [4]

Total No. of Questions—**8**]

[Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-572

S.E. (Computer) (First Semester) EXAMINATION, 2014

DATA STRUCTURES AND PROBLEM SOLVING

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer *four* questions in all.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data if necessary.

1. (*a*) Construct a logical expression for allowing purchasing using credit card if the following rules are satisfied.

The card may be used if the

(*i*) Balance plus sales amount is less than the maximum allowable amount

(*ii*) Last payment was less than 45 days ago

(*iii*) Credit card has not expired. [3]

(*b*) Sort the following data using Quick Sort Algorithm.

65, 70, 75, 80, 85, 60, 55, 50, 45.

Show the output after every pass. [4]

(*c*) Draw the threaded binary tree equivalent for the tree represented by the following array assuming root node of tree starts with index 1 in array : [5]

0	1	2	3	4	5	6	7	8	9	10	11
	10	-	20	-	-	30	-	-	-	-	-

12	13	14	15	16	17	18	19	20	21	22	23
-	40	-	-	-	-	-	-	-	-	-	-

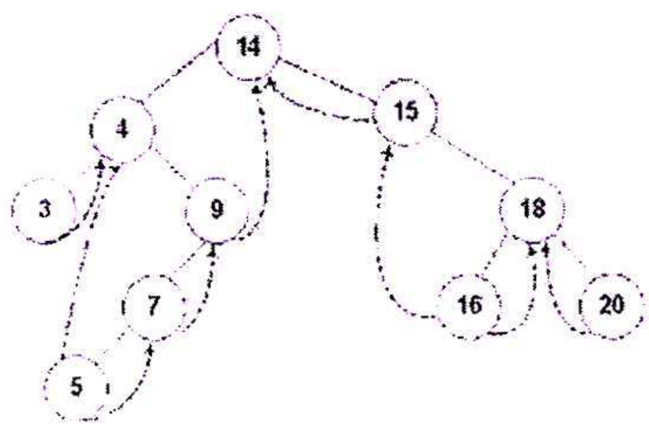
24	25	26	27	28	29	30	31
-	-	50	-	-	-	-	-

Or

2. (*a*) Find the frequency count of the following code : [3]

```
sum = 0;
for(i = 0; i < = n; i++)
for(j = 0; j < = n; j++)
sum = sum + i + j.
```

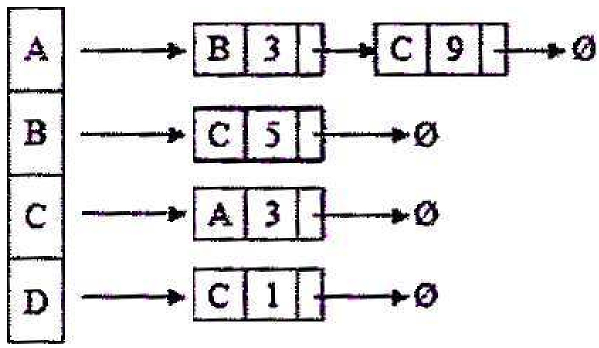
(*b*) Consider the following threaded binary search tree. [4]



Delete the root node of the tree and redraw the tree again with threading by maintaining the property of binary search tree.

(*c*) Write a non-recursive pseudo C/C++ code for any DFS traversal of binary tree. [5]

3. (*a*) Consider the following graph represented using Adjacency List. [4]



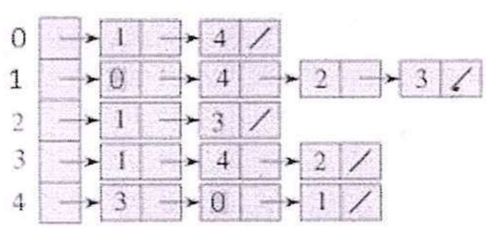
Find the minimum spanning tree for the above graph by using Prim's Algorithm.

(*b*) Write a pseudo C/C++ code for LR and RL rotations in AVL Trees. [6]

(*c*) Enlist various collision resolution techniques. [2]

Or

4. (*a*) Draw the BFS traversal of the following graph represented using adjacency list. [4]

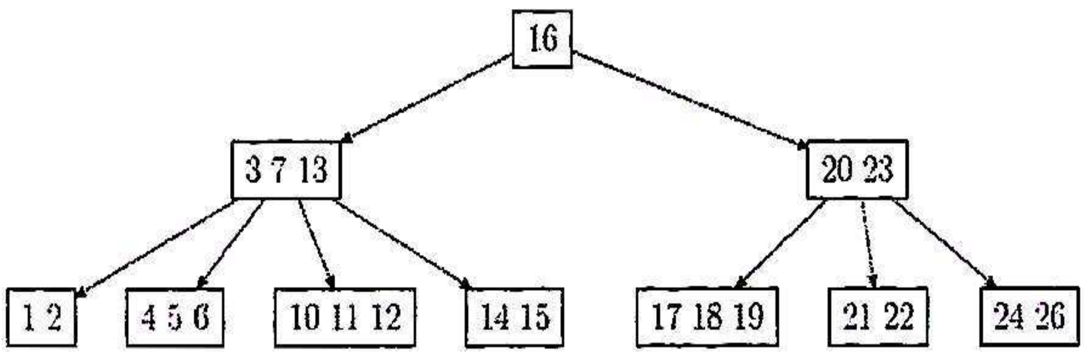


(*b*) Construct the AVL tree for the following data by inserting each of the following data item one at a time : [5]

10, 20, 15, 12, 25, 30, 14, 22, 35, 40.

(*c*) Enlist hash functions to calculate the hash values of the data. [3]

5. (*a*) Consider the following 5 Way B Tree : [6]



Delete root node i.e. a node with key value 16 from the above tree and redraw the tree by maintaining its B Tree property.

(*b*) Build the Min-Heap for the following data : [4]

25, 12, 27, 30, 5, 10, 17, 29, 40, 35.

(*c*) Explain any *three* operations performed on sequential files. [3]

Or

6. (*a*) Write a pseudo C/C++ code to sort the data using heap sort in ascending order. [7]

(*b*) Create a 3 way B tree by inserting the following data one at a time : [6]

5, 3, 21, 9, 1, 13, 2, 7, 10, 12, 4, 8.

7. (*a*) Explain how parallel prefix computation algorithm can be applied to the following example :

5, 3, –6, 2, 7, 10, –2, 8.

Assume the prefix operation as addition. [6]

(*b*) Write a parallel algorithm for odd-even merge sort. Explain the algorithm with suitable example. [7]

Or

8. (*a*) Explain parallel pointer doubling algorithm with suitable example. [7]

(*b*) Write a parallel algorithm to perform the addition of the given numbers using complete binary tree method. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4

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[4657]-573

S.E. (Computer Engineering) (I Semester) EXAMINATION, 2014

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** and Q. No. **7** *or* Q. No. **8**.

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

(*iii*) Assume suitable data, if necessary.

1. (*a*) Do the following conversions : [6]

(*i*) $(101110.0101)_2 \rightarrow (\quad)_{10}$

(*ii*) $(432A)_{16} \rightarrow (\quad)_2$

(*iii*) $(428.10)_{10} \rightarrow (\quad)_2$

(*b*) Reduce the following using K-map techniques : [4]

$$f(A, B, C, D) = \Pi(0, 2, 3, 8, 9, 12, 13, 15).$$

(*c*) What is logic family ? Give the classification of logic family. [2]

Or

2. (*a*) Minimize the following expression using Quine-McClusky : [6]

$$f(A, B, C, D) = \Sigma m\ (0, 2, 3, 6, 7, 8, 10, 12, 13).$$

(*b*) Explain with neat diagram two input CMOS NAND gate. [6]

3. (*a*) Explain Look Ahead Carry generator in detail. [6]

(*b*) Explain with neat diagram working of serial- n serial-out 4-bit shift register. Draw necessary timing diagram. [6]

Or

4. (*a*) Explain rules for BCD addition with suitable example and design one digit BCD adder using IC 7483. [6]

(*b*) Design given sequence generator using J-K FF. Sequence is $1 \rightarrow 3 \rightarrow 5 \rightarrow 6 \rightarrow 7 \rightarrow 1$ [6]

5. (*a*) Draw the ASM chart for the following state machine. A 2-bit up counter is to be designed with output Q_AQ_B, and enable signal 'X'. If X = 0, then counter changes the state as 00 —01 — 10— 11 — 00. If 'X' = 1, then counter should remain in current state. Design the circuit using JK-FF and suitable MUX. [7]

(*b*) Write VHDL code for 4-bit adder using structural modeling style. [6]

Or

6. (*a*) Write a VHDL code for 8 : 1 MUX using Behavioural modeling. [7]

(*b*) Draw an ASM chart, state diagram and state table for synchronous circuit having the following description.

The circuit has control input C, clock and outputs *x*, *y*, and *z*.

(*i*) If C = 1, on every clock rising edge the code on output *x*, *y* and *z* changes from 000 — 010 —100 — 110 — 000 and repeats.

(*ii*) If C = 0, the circuit holds the present state. [6]

7. (*a*) Draw and explain Basic architecture of FPGA in detail. [6]

(*b*) Implement the following functions using PLA : [7]

$f_1(A, B, C) = \Sigma m(0, 3, 4, 7)$

$f_2(A, B, C) = \Sigma m(1, 2, 5, 7)$.

Or

8. (*a*) A combinational circuit is defined by the functions :

$f_1(A, B, C) = \Sigma m(3, 5, 7)$

$f_2(A, B, C) = \Sigma m(4, 5, 7)$.

Implement the circuit with PLA having 3 input and 3 product term with 2 output. [7]

(*b*) Implement 4 : 1 MUX using PAL. [6]

Total No. of Questions—8] [Total No. of Printed Pages—4

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[4657]-574

S.E. (Computer Engg.) (First Semester) EXAMINATION, 2014

OPERATING SYSTEM AND ADMINISTRATION

(2012 COURSE)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Define the following OS terms : [6]

(*i*) Multiprogramming

(*ii*) Multitasking

(*iii*) Multiprocessing

(*iv*) Multithreading

(*v*) Monolithic kernel

(*vi*) Microkernel.

(*b*) Explain the file system data structures of Unix with neat diagram (UFDT, FT and IT). [6]

Or

2. (*a*) Draw and explain the block diagram of system kernel. [6]

(*b*) Draw and explain the 4 state process diagram (inclusive of kernel and user modes). [6]

3. (*a*) Explain the different types of files in unix. Also give the command to display the same. List the different categories of users in unix. [6]

(*b*) Explain the following commands in unix :

grep, ripe, stat, mount, chmod and ln. [6]

Or

4. (*a*) Differentiate between Grub and Lilo. [3]

(*b*) Explain the run levels of Booting process in unix. [6]

(*c*) Explain any *three* characteristics of perl programming. [3]

5. (*a*) Explain in detail signal and kill function with parameters. [4]

(*b*) Explain the following unix commands :

nice, renice, top, prstat, strace. [5]

(*c*) Differentiate between the following : [4]

(*i*) Modern Access Control and Real World Access Control

(*ii*) User mode and Kernel mode.

Or

6. (*a*) Explain the concept of : [6]

(*i*) nobody account

(*ii*) real, effective and save id's

(*iii*) setuid and setgid commands.

(*b*) Explain runaway processes, sudo command and su command. [3]

(*c*) Explain the concept of : [4]

(*i*) shadow password

(*ii*) pseudo users with respect to /bin/false and /bin/nologin.

7. (*a*) Give the entries of /etc/passwd file and /etc/group file. [6]

(*b*) Explain the following : [6]

(*i*) fsck

(*ii*) mkfs

(*iii*) file system mounting.

(*c*) Define disc partitioning. [1]

Or

8. (*a*) Explain the following : [6]

(*i*) useradd

(*ii*) userdel

(*iii*) RAID.

(*b*) List any *three* storage devices. [3]

(*c*) Differentiate between the following : [4]

(*i*) SATA and PATA

(*ii*) Unix and Linux.

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-575

S.E. (Computer Engg.) (First Semester) EXAMINATION, 2014

MICROPROCESSOR ARCHITECTURE

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Explain the following pins of 8086 : [6]

(*i*) $\overline{\text{BHE}}$

(*ii*) ALE

(*iii*) MN/$\overline{\text{MX}}$

(*b*) Explain flag register of 80386. [4]

(*c*) What is the difference between GDT and LDT ? [3]

Or

2. (*a*) What are the functions of the following pins : [6]

(*i*) NMI

(*ii*) ERROR#

(*iii*) $\overline{BE_0} - \overline{BE_3}$.

(*b*) Explain memory organization of 8086. [4]

(*c*) How is logical address converted to physical address in 8086 ? [3]

3. (*a*) What are characteristics of address pipelining in 80386 ? [4]

(*b*) Explain timing diagram for pipelined write cycle. [5]

(*c*) Explain macro in assembly language programming with syntax and example. [3]

Or

4. (*a*) Explain the following instructions of 80386 : [5]

(*i*) SLDT

(*ii*) LEA

(*iii*) OUT

(*iv*) CMP

(*v*) XCHG.

(*b*) Explain timing diagram for read cycle in non-pipelined mode. [4]

(*c*) Enlist and explain any *three* addressing modes of 80386. [3]

5. (*a*) What are the *three* common configurations that support multiprocessing ? Explain. [6]

(*b*) What is single instruction multiple data model for parallel processing ? [4]

(*c*) Define CMP. [3]

Or

6. (*a*) What are the advantages of multicore designing ? [3]

(*b*) What are the advantages of cache memory ? [4]

(*c*) What are the different architectures of multicore ? Explain. [6]

7. (*a*) Explain hyperthreading with advantages and disadvantages. [5]

(*b*) Give the features of SSE. [4]

(*c*) Enlist data types of 64-bit architecture. [3]

Or

8. (*a*) Explain virtualization technology. [5]

(*b*) What are the operating modes of Intel 64-bit architecture ? [4]

(*c*) What are the differences between IA-32 bit Basic Execution Environment and IA-64 bit Basic Execution Environment ? [3]

Total No. of Questions—**8**] [Total No. of Printed Pages—**7**

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[4657]-580

S.E. (Computer Engineering) (I Semester) EXAMINATION, 2014

DISCRETE STRUCTURES

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** from Section I.

(*ii*) Solve Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8** from Section II.

(*iii*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Find DNF of $((p \to q) \cap (q \to p)) \vee$ p. [4]

Find CNF of $p \leftrightarrow (\sim p \vee \sim q)$

(*b*) Consider a set of integers 1 to 500. Find how many if these numbers are divisible by 3 or by 5 or by 11. [2]

(*c*) Show that the set of all divisors of 36 forms a lattice. [6]

P.T.O.

Or

2. (*a*) Explain concept of countably infinite set with example. [3]

(*b*) Use mathematical induction to show that : [3]

$n(n^2 - 1)$ is divisible by 24 where n is any odd +ve number.

(*c*) Consider the following relation on {1, 2, 3, 4, 5, 6} : R = {(i, j) : $|i - j| = 2$}. Is R transitive ? Is R reflexive ? Is R symmetric ? [2]

(*d*) Let R be the relation on the set A = {a, b, c, d, e, f} and R = {(a, c), (b, d), (c, a), (c, e), (d, b), (d, f), (e, c), (f, d)}. Find the transitive closure of R using Warshall's algorithm. [4]

3. (*a*) (*i*) Prove that every cyclic group is an abelian group. [3]

(*ii*) Explain Group Homomorphism and Isomorphism of Group. Take suitable example. [3]

(*b*) (*i*) Under what condition Km, n will have Eulerian circuit ? [4]

(*ii*) How many colours are required to colour Km, n. ? Why ? [2]

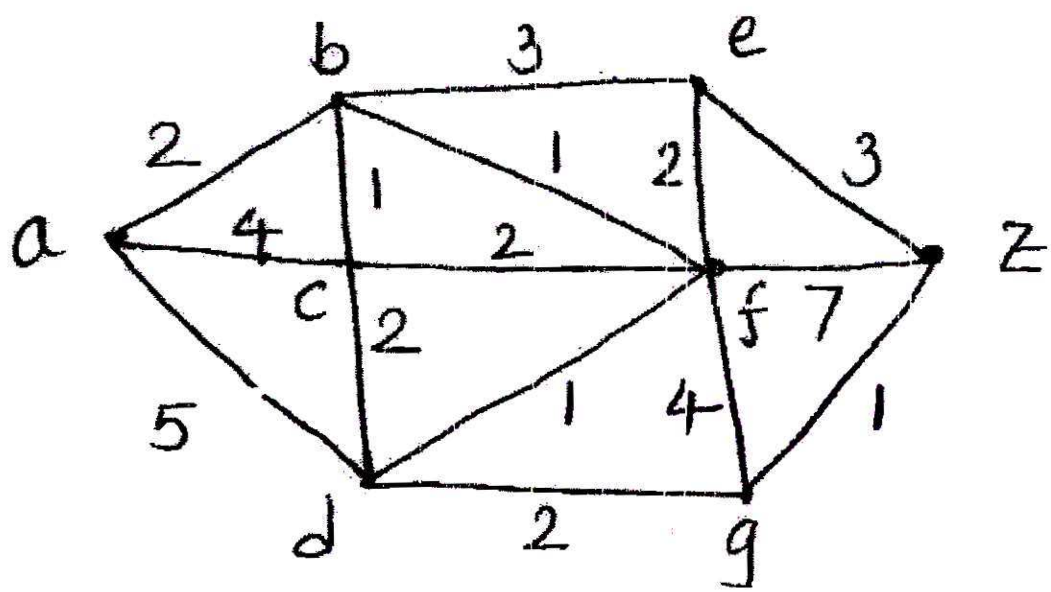
Or

4. (*a*) Prove that :

$$\left((a + b\sqrt{2}), +, *\right)$$

where $a, b \in$ R is integral domain. [6]

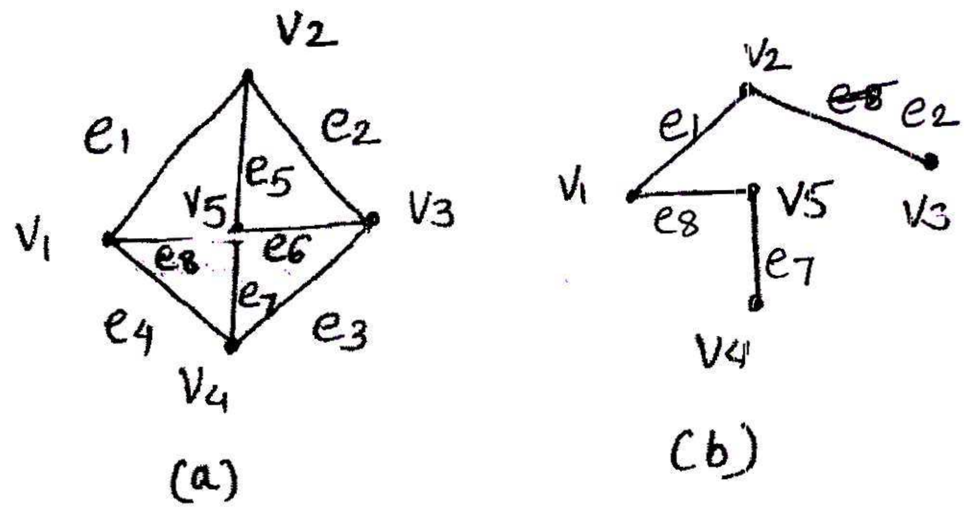
(*b*) Find the shortest path between *a*-*z* for the graph given in figure below using Dijkstra's algorithm. [6]



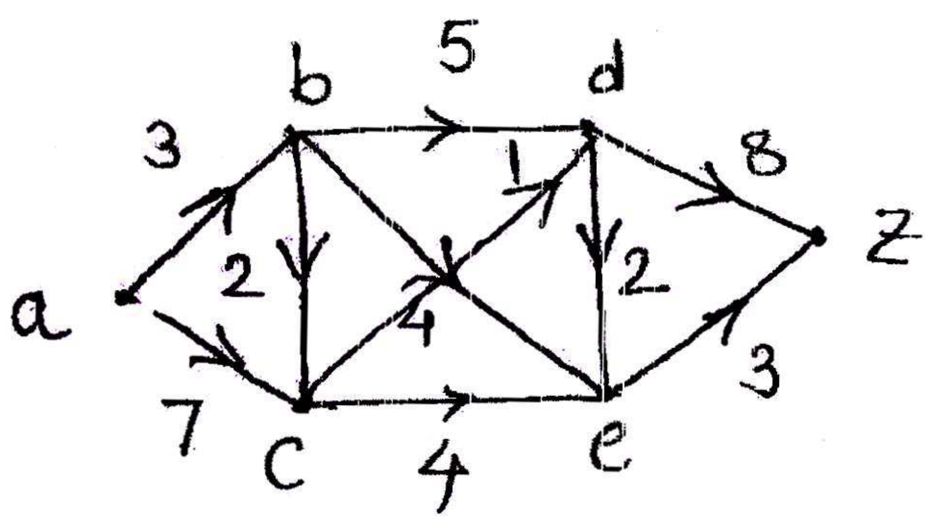
SECTION II

5. (*a*) Prove that the number of vertices is one more than the number of edges in a tree. [3]

(*b*) Find out fundamental cutsets of the following graph with respect to given spanning tree : [3]

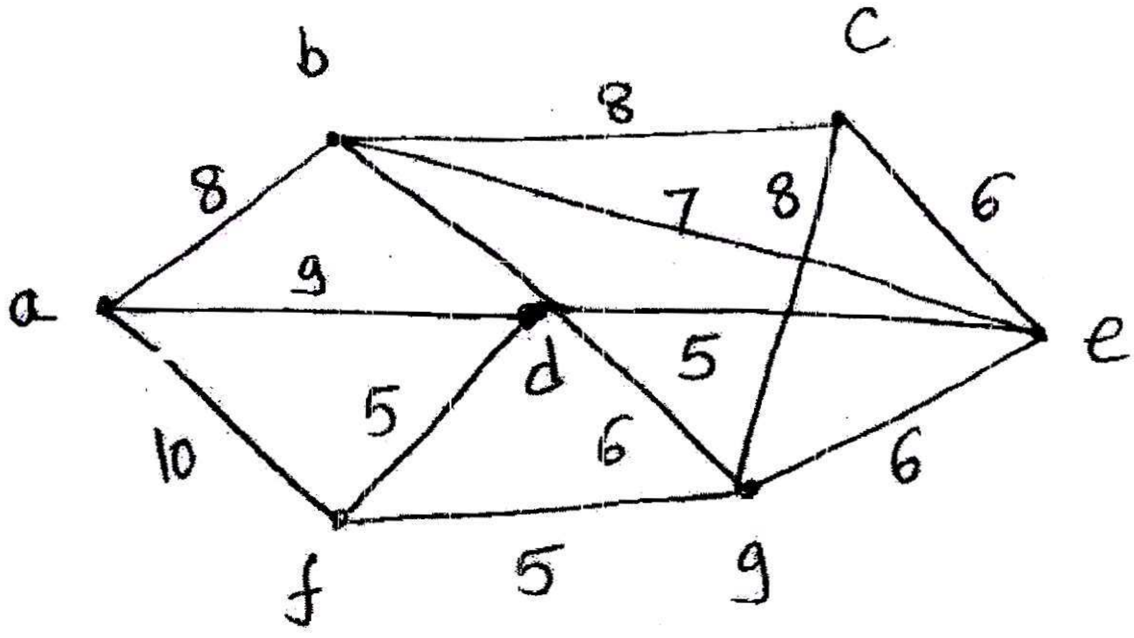


(*c*) Use labelling procedure to find a maximum flow in the transport network given in the following figure. Determine the corresponding minimum cut. [7]



Or

6. (*a*) Find minimum spanning tree for graph given in the following figure using Prim's algorithm. [7]



(*b*) For the following set of weights, construct optimal binary prefix code : [4]

α	5
β	6
γ	6
δ	11
ε	20

(*c*) Define rooted tree. [2]

7. (*a*) A box contains 6 white and 6 black balls. Find number of ways 4 balls can be drawn from the box if : [6]

(*i*) Two must be white

(*ii*) All of them must have same colour.

(*b*) Two computers A and B are to be marketed. A salesman who is assigned the job of finding customers for them has 60 percent and 40 percent chances respectively of succeeding in case of computer A and B. The two computers can be sold independently. Given that he was able to sell at least one computer, what is the probability that computer A has been sold ? [7]

Or

8. (*a*) Out of 5 males and 6 females a committee of 5 is to be formed. Find the number of ways in which it can be formed so that among the person chosen in the committee there are :

(*i*) exactly 3 males and 2 females

(*ii*) at least 2 males and one female. [6]

(*b*) The probability that a trainee will remain in a company is 0.6. The probability that the employee earns more than Rs. 10,000 per month is 0.5. The probability that an employee is a trainee who remains within the company or who earns more than Rs. 10,000 per month is 0.7. What is the probability that an employee earns more than Rs. 10,000 per month ? Given that he is a trainee who stayed with the company. [7]

Total No. of Questions—**8**] [Total No. of Printed Pages—**3**

Seat No.	

[4657]-581

S.E. (I.T.) (First Semester) EXAMINATION, 2014

COMPUTER ORGANIZATION

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Compare IEEE single precision and double precision formats and represent $(-16.75)_{10}$ in single precision format. [6]

(*b*) Explain with examples the following addressing modes of 8086 : [6]

(*i*) Register addressing

(*ii*) Immediate addressing

(*iii*) Base Index with displacement addressing.

Or

2. (*a*) Multiply the following signed 2's complement numbers using Booth's algorithm. [6]

Multiplicand—10011 Multiplier—10101

(*b*) Write a note on MAX/MIN mode of microprocessor 8086. [6]

3. (*a*) Draw and explain programmer's model of microprocessor 8086. [6]

(*b*) Draw and explain single bus organization of CPU. What are its advantages over multiple bus organization ? [7]

Or

4. (*a*) Explain with suitable examples following instructions of 8086 :

(*i*) ADD

(*ii*) MUL

(*iii*) ROL. [6]

(*b*) Explain with suitable block diagram design of CPU using hard-wired control method. [7]

5. (*a*) Compare direct, set associative and fully associative cache memory mapping techniques. [6]

(*b*) What is virtual memory ? Explain virtual to physical address translation. [6]

Or

6. Write short notes on (any *two*) : [12]

(*a*) EEPROM

(*b*) RAID

(*c*) SDRAM.

7. (*a*) Explain the techniques for performing IO in brief. [6]

(*b*) State and explain in brief the use of registers of DMA controller 8237. [7]

Or

8. (*a*) Explain the functions and features of 8255 and 8251. [6]

(*b*) Explain PCI bus with a neat diagram. [7]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-582

S.E. (Information Technology)

(First Semester) EXAMINATION, 2014

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data if necessary.

1. (*a*) (*i*) Subtract $(27.50)_2$ from $(68.75)_2$ using 2's complement method. [4]

(*ii*) Explain the TTL characteristics-speed of operation and Fan-out. [2]

(*b*) Design Full adder using 4 : 1 multiplexer. [6]

Or

2. (*a*) Convert the following numbers, show all the steps : [6]

(*i*) $(101101.10101)_2 = (\quad)_{10}$

(*ii*) $(247)_{10} = (\quad)_8$

(*iii*) $(0.BF85)_{16} = (\quad)_8$

(*b*) Compare TTL and CMOS logic family. Draw CMOS NOR gate. [6]

3. (*a*) Design JK flip-flop using SR flip-flop. [6]

(*b*) Design sequence detector to detect the sequence----1011---- using JK-flip-flop. [7]

Or

4. (*a*) Design and draw logic diagram of Mod-82 counter using IC7490. [6]

(*b*) Draw the ASM chart of washing machine with the following conditions : [7]

(*i*) Start the machine

(*ii*) Drain the previous existing water (*iii*) Choose HOT or COLD water option

(*iv*) Pump in fresh water to fill washer tub

(*v*) Complete Washing cycle

(*vi*) Complete Rinsing cycle

(*vii*) Complete Drying cycle.

Assume the following inputs :

(1) H/C 1 = HOT, 0 = COLD

(2) Start 1 = Start, 0 = Stop

(3) Empty 1 = Washer tub completely empty 0 = Washer tub is full

(4) Time 1 = Time is over 0 = Time is not over.

5. (*a*) Design full subtractor using PLA. [6]

(*b*) Explain difference between PAL and PLA. [6]

Or

6. (*a*) Draw and explain the structural block diagram of FPGA. [6]

(*b*) Explain the difference between CPLDs and FPGAs. [6]

7. (*a*) What is VHDL ? Write features of VHDL. Explain the structure of VHDL module. [6]

(*b*) Explain the following three data objects—

variables, constants and signals

used in VHDL code with respect to need, location of declaration in VHDL module, syntax and example. [7]

Or

8. (*a*) Explain the difference between concurrent and sequential statements with example. [6]

(*b*) Write entity, architecture and package declaration for 3 bit synchronous up/down counter with asynchronous clear input. [7]

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-583

S.E. (Information Technology) (First Semester) EXAMINATION, 2014

FUNDAMENTALS OF DATA STRUCTURES

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. **:—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

1. (*a*) Differentiate between pass by reference and pass by value. [4]

(*b*) Explain the different modes of opening a file in C using fopen( ) function. [6]

(*c*) What will be the output of the following code snippets ? [2]

(1)
```
#define M(x) x * x
main()
{
    printf("%d", M(2+3))
}
```

P.T.O.

(2) Main( )

```
{
    int  x;
    x = 4 + 2% – 8;
    printf("%d", x);
}
```

Or

2. (*a*) What is macro ? What are its advantages and disadvantages ? [4]

(*b*) Explain the use of break and continue keywords in C with suitable example. [4]

(*c*) Write a C function to compare two strings. [4]

3. (*a*) Show the output of each pass using bubble sort to arrange the following numbers in ascending order.

90, 87, 76, 65, 43, 32, 19, 7, 0, –17. [6]

(*b*) Explain the following terms : [3]

(*i*) Data Object

(*ii*) Data Type.

(*c*) What is space complexity of an algorithm ? Explain its importance with example. [3]

Or

4. (*a*) Explain the following terms : [6]

(*i*) Internal sorting

(*ii*) External sorting

(*iii*) Sort stability.

(*b*) Explain the different asymptotic notations. [3]

(*c*) Explain with example the linear data structure. [3]

5. (*a*) Represent the sparse matrix using suitable data structure and write a pseudo C code to find transpose of a spare matrix using slow transpose. [7]

(*b*) Explain the concept of column major address calculation for multidimensional array with suitable example. [4]

(*c*) Represent the following polynomials using arrays : [2]

(*i*) $x^3 + 2xy + y^3 - y + x$

(*ii*) $5x^2 + 10xy + y^2 - 20$.

Or

6. (*a*) Write a pseudo C algorithm for addition of two sparse matrices. Analyze its time complexity. [7]

(*b*) Explain sequential memory organization with example. [4]

(*c*) What is sparse matrix ? Explain how it is represented. [2]

7. (*a*) Suppose a Linked List consists of numerical values. Write a function for finding the maximum element of the List and the product of all the numbers in the List. [7]

(*b*) Write a C code for reversing the Singly Linked List without using additional data structure. [6]

Or

8. (*a*) Write a pseudo code to merge two Sorted Linked Lists into the third. [7]

(*b*) Explain GLL. Represent following polynomial using GLL [6]

(L, (M, (N, (O, P)), Q), R, (S, T), (A, (B, C)))

Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[4657]-584

S.E. (Information Technology)

(First Semester) EXAMINATION, 2014

PROBLEM SOLVING AND OBJECT-ORIENTED PROGRAMMING CONCEPTS

(2012 COURSE)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data if necessary.

1. (*a*) Write a solution to the problem of finding the largest number out of three numbers. Develop algorithm, flowchart, interactivity chart, input-output chart. Also list down three advantages of algorithm and flowchart. [6]

(*b*) List down major types of modules and explain their functions with example. [6]

Or

2. (*a*) Give *three* numbers as an input, print their sum and product. Develop the solution to this problem using sequential logic structure. [6]

(*b*) What is decision logic structure ? How do you use a decision table ? Explain with example. [6]

3. (*a*) What is meant by an ordered array ? Write an algorithm to remove duplicate elements from an ordered array. [6]

(*b*) Write an algorithm for linear search and array order reversal. [6]

Or

4. (*a*) Write a program in C++ for creating array of student object (for 150 students). Create class student with data members as Roll Number, Name, Address, mobile number and member functions as get data and display data. Define member function outside class. [6]

(*b*) Differentiate between Procedural Oriented Programming and Object-oriented Programming. [6]

5. (*a*) What is static data member and static member function ? Write its properties. [7]

(*b*) What are rules for operator overloading ? List the operators which cannot be overloaded. List the operators which cannot be overloaded by using friend function. [6]

Or

6. (*a*) Write a program in C++ to overload unary "–" operator using friend function. [7]

(*b*) Explain constructors and destructors in inheritance. Write a program to demonstrate how constructor and destructors are invoked in multilevel inheritance. [6]

7. (*a*) What is exception handling mechanism in C++ ? Write a program in C++ to handle "divide by zero" exception. [7]

(*b*) Write a note on Sequence Container, Associative Container and Derived Container. [6]

Or

8. (*a*) Write a program in C++ for bubble sort using function template. [7]

(*b*) Write a note on RTTI. [6]

Total No. of Questions—**8**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-589

S.E. (Information Technology) (I Sem.) EXAMINATION, 2014

DISCRETE STRUCTURE

(2012 PATTERN)

Time : Two Hours **Maximum Marks : 50**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of calculator is allowed.

(*v*) Assume suitable data, if necessary.

1. (*a*) During a survey of the ice cream preferences of students, it was found that 22 like mango, 25 like custard apple, 39 like grape, 9 like custard apple and mango, 17 like mango and grape, 20 like custard apple and grape, 6 like all flavours and 4 like none. Then how many students were surveyed ? How many students like exactly one flavour, how many students like exactly two flavours ? [6]

(*b*) What is recurrence relation ? Solve the following recurrence relation :

$$a_r - 7a_{r-1} + 10a_{r-2} = 0$$

given that $a_0 = 0$ and $a_1 = 3$. [6]

Or

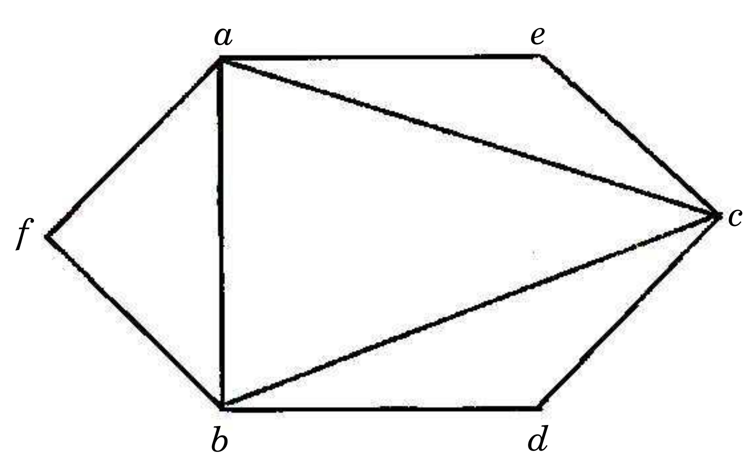
2. (*a*) State the principle of Mathematical Induction, using mathematical induction prove the following proposition : [6]

$$P(n) = 1 + 4 + 7 + \ldots\ldots + (3n - 2) = \frac{n(3n-1)}{2}.$$

(*b*) Let A = {1, 2, 3, 4} and let R = {(1, 1), (1, 2), (1, 4), (2, 4), (3, 1), (3, 2), (4, 2), (4, 3), (4, 4)}. Find Transitive closure of R using Warshall's Algorithm. [6]

3. (*a*) Consider an algebraic system (G, *), where G is the set of all non-zero real number and * is a binary operation defined by $a * b = ab/4$. Show that (G, *) is an abelian group. [6]

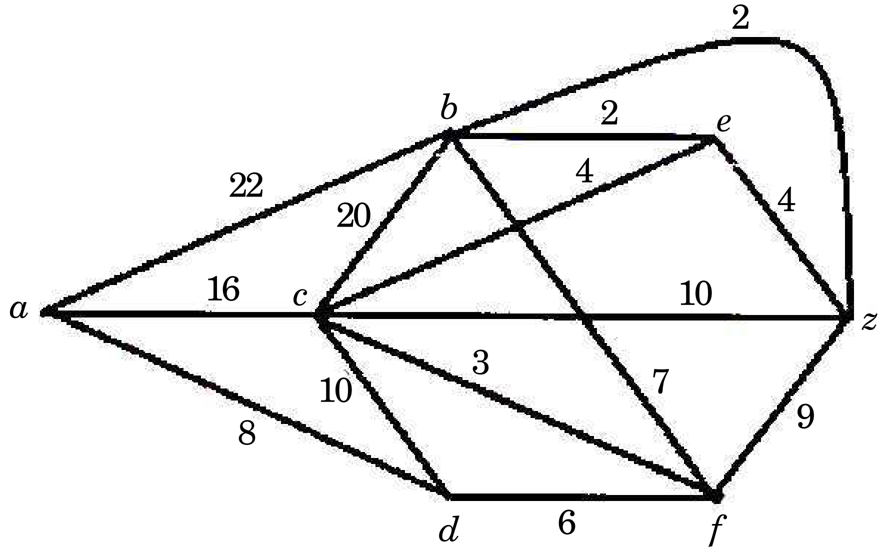
(*b*) What do you understand by factors of a graph ? Find all possible *k*-Factors of the following graph : [6]



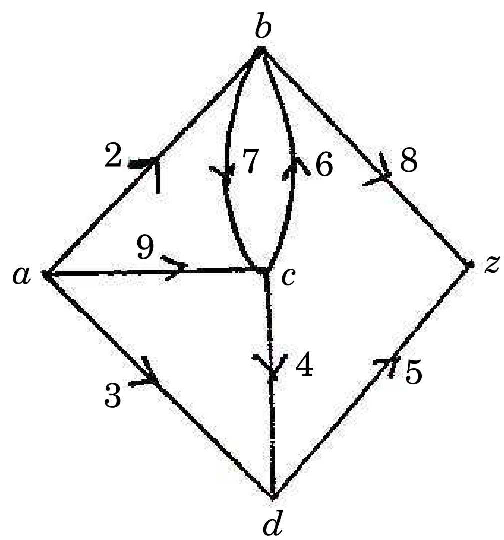
Or

4. (*a*) Find the degree of $[f(x) + g(x)]$, $[f(x) \cdot g(x)]$ where the polynomials are on the integer (mod 8) and operations are addition and multiplication. You have $f(x) = 2x + 4x^2$, $g(x) = 2 + 6x + 4x^2$. [6]

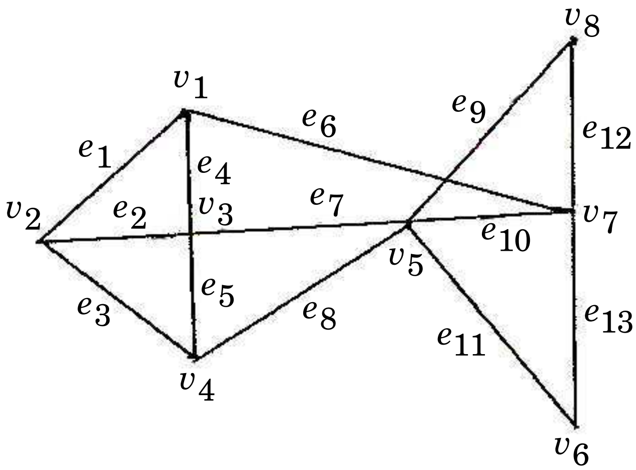
(*b*) Find the shortest path from a to z, using Dijkstra's Algorithm. [6]



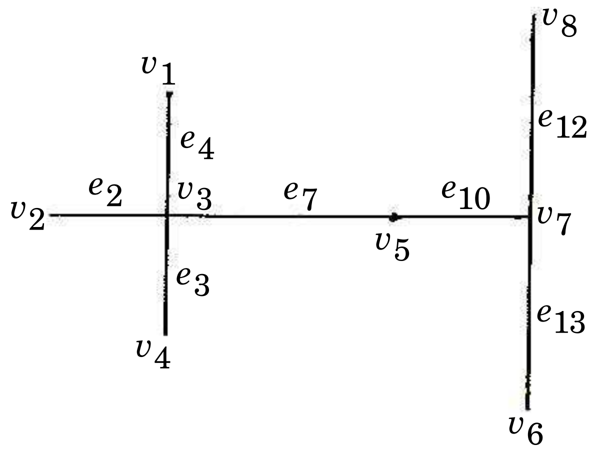
5. (*a*) Determine the maximum flow in the following transport Network. [7]



(*b*) Find fundamental system of cut set for the graph G shown below with respect to the spanning tree T. [6]



(G)



(T)

Or

6. (*a*) Define optimal tree. For the following set of weights, construct optimal binary prefix code. For each weight in the set, give corresponding code words — 8, 9, 12, 14, 16, 19. [7]

(*b*) Use the Kruskal's algorithm to find the minimum spanning tree for the graph shown in the figure. [6]

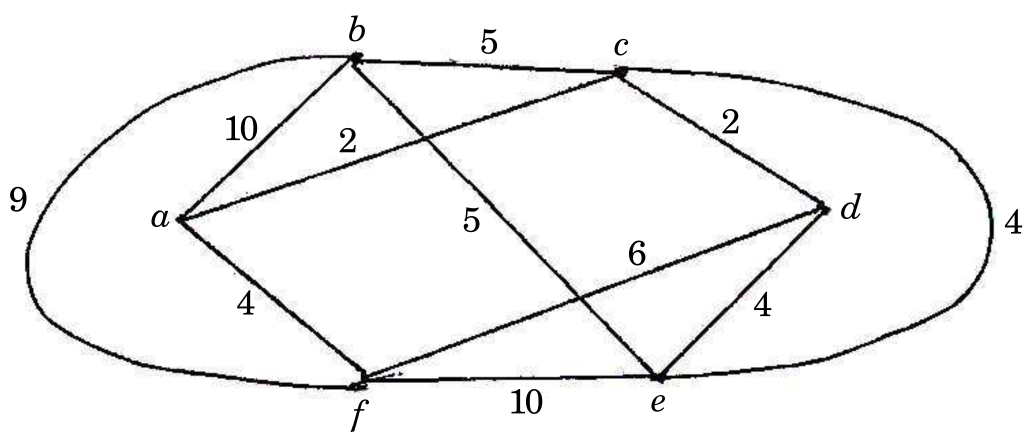


Figure for Kruskal algorithm

7. (*a*) A single card is drawn from an ordinary deck S of 52 cards. Find the probability p that : [6]

(*i*) The card is a king.

(*ii*) The card is a face card (jack, queen or king).

(*iii*) The card is a heart.

(*iv*) The card is a face.

(*b*) Find number of arrangement that can be made out of letters : [7]

(*i*) ASSASSINATION

(*ii*) GANESHPURI.

Or

8. (*a*) In a certain college town, 25% of the students failed in mathematics, 15% failed in chemistry, and 10% failed both in mathematics and chemistry. A student is selected at random : [7]

(*i*) If he failed in chemistry, what is the probability that he failed in mathematics ?

(*ii*) If he failed in mathematics, what is the probability that he failed in chemistry ?

(*iii*) What is the probability that he failed in mathematics or chemistry ?

(*iv*) What is the probability that he failed neither in mathematics nor in chemistry ?

(*b*) 12 persons are made sit around a table. Find the number of ways they can sit such that 2 specific persons are not together. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-59

S.E. (Instru. and Control) (Second Semester)

EXAMINATION, 2014

DRIVES AND CONTROL

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data if necessary.

SECTION I

1. (*a*) Describe the basic principle of generator. Explain the classification of d.c. generators in detail with circuit diagrams. [8]

(*b*) In a long shunt compound generator, the terminal voltage is 230 V. When generator delivers 150 A, determine : [8]

(*i*) Induced EMF

(*ii*) Total power generated.

Given that the shunt field, series field and armature resistances are 92 ohm, 0.05 ohm and 0.032 ohm respectively.

Or

2. (*a*) Write the necessity of the starter in d.c. motors. Explain the three point starter in detail in shunt motor. [8]

(*b*) A 440 V shunt motor has armature resistance of 0.8 ohm and the field resistance of 200 ohm. Determine the back e.m.f. when giving an output of 7.46 kW at 85% efficiency. [8]

3. (*a*) Write the difference between squirrel-cage rotor and phase-wound rotor in induction motor in detail. Which type is mostly used in industries and why ? [8]

(*b*) Explain the working and construction of alternator. [8]

Or

4. (*a*) Write the working principle of induction motor. Why does rotor rotate in it ? [8]

(*b*) Derive the expression for maximum torque generation in 3-phase induction motor. [8]

5. Write short notes on (any *two*) : [18]

(*a*) Servomotors

(*b*) Universal motor

(*c*) Half stepping and full stepping in stepper motors.

Or

6. (*a*) Write a working principle of stepper motors. Mention the *two* applications of it. Why is the stepper motor widely used in automation systems ? [9]

(*b*) With a neat diagram explain the characteristics of Universal motor. State any *four* applications of Universal motor. [9]

SECTION II

7. (*a*) Describe the following terms as applicable to SCR :

(*i*) Latching

(*ii*) Holding current

(*iii*) Reverse breakover voltage

(*iv*) dv/dt rating. [8]

(*b*) Explain in detail the construction of SCR and also the necessity of gate triggering in SCR. [8]

Or

8. (*a*) Write the construction, working and characteristics of UJT. [8]

(*b*) With neat diagrams, explain the Class C and Class D commutation circuits for SCRs. [8]

9. (*a*) Explain the working principle of full wave controlled rectifier with waveforms. [9]

(*b*) What are choppers ? Explain the methods of classification of choppers. [9]

Or

10. (*a*) Give the classification of inverters. Explain any *one* in detail. [9]

(*b*) With neat diagrams and waveforms, explain the working of three-phase half wave controlled rectifier with resistive load. [9]

11. Write short notes on (any *two*) : [16]

(*a*) Braking of induction motor

(*b*) Three-phase SCR drive in DC motor control

(*c*) Dynamic breaking of separately excited d.c. motor.

Or

12. (*a*) With a neat block diagram, explain the chopper controlled d.c. motor. [8]

(*b*) Give the methods by which speed of the induction motors can be varied. Explain any *one* in detail. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-61

S.E. (Printing, Chemical, Poly., Petroleum,

Petroleum & B.Tech) (First Semester)

EXAMINATION, 2014

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) In Section I, solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**.

(*ii*) In Section II, solve Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Solve the following (any *three*) : [12]

(*i*) $(D^3 + D)y = \cos x$

(*ii*) $(D^2 + D)y = \dfrac{1}{1 + e^x}$

(*iii*) $(D^2 + 5D + 6)y = x^2 e^{-x}$

(*iv*) $(D^2 - 6D + 9)y = x^{3x} \sec^2 x$

(By method of variation of parameters)

(*v*) $x^2 \dfrac{d^2y}{dx^2} - x\dfrac{dy}{dx} + 4y = x \cos(\log x)$

(*b*) Solve : [5]

$$\frac{dx}{3z - 4y} = \frac{dy}{4x - 2z} = \frac{dz}{2y - 3x}$$

Or

2. (*a*) Solve the following (any *three*) : [12]

(*i*) $(D^2 + 5D + 4)y = 7x + 9$

(*ii*) $(D^2 + D + 1)y = x \sin x$

(*iii*) $(D^2 + 1)y = \tan x$

[By method of variation of parameters]

(*iv*) $(x+1)^2 \dfrac{d^2y}{dx^2} + (x+1)\dfrac{dy}{dx} + y = \log(x+1)$

(*v*) $(D^2 + 2D + 1)y = e^{-x} \log x$

(*b*) Solve : [5]

$$\frac{dx}{dt} + y = e^t, \ \frac{dy}{dt} + x = e^{-t}$$

3. (*a*) A body weighing 20 kg is hung from a spring. A pull of 40 kg wt. will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position at time 't' seconds, the maximum velocity and the period of oscillation. [8]

(*b*) Solve :

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$$

subject to the conditions :

(*i*) $u(0, t) = 0$

(*ii*) $u(\mathrm{L}, t) = 0$ for all t

(*iii*) $u(x, 0) = \mathrm{L}x - x^2$; $0 < x < \mathrm{L}$

(*iv*) $u(x, \infty)$ is finite. [8]

Or

4. (*a*) A string is stretched and fastened to two points 'L' apart. The motion is started by displacing the string in the form $u = a \sin \frac{\pi x}{\mathrm{L}}$ from which it is released at time $t = 0$. Find the displacement $u(x, t)$ from one end. [8]

(*b*) The differential equation satisfied by a beam uniformly loaded with one end fixed and second subjected to a tensile force 'P' is given by :

$$\mathrm{EI}\,\frac{d^2y}{dx^2} - \mathrm{P}y = \frac{-wx^2}{2}$$

Show that the elastic curve for the beam under the conditions :

$$y = 0,\ \frac{dy}{dx} = 0$$

when $x = 0$ are given by :

$$y = \frac{w}{2\mathrm{P}}\left[x^2 - \frac{2}{n^2} - \frac{e^{nx}}{n^2} - \frac{e^{-nx}}{n^2}\right],\ \text{where } \mathrm{EI} = \frac{\mathrm{P}}{n^2}\ .$$ [8]

5. (*a*) Using Fourier integral representation, show that : [5]

$$\int_0^\infty \frac{2}{1+\lambda^2}\cos\lambda x\, d\lambda = \begin{cases} 0 & ;\ x < 0 \\ \pi/2 & ;\ x = 0 \\ \pi e^{-x} & ;\ x > 0 \end{cases}$$

(*b*) Solve the integral equation : [5]

$$\int_0^\infty f(x)\cos\lambda x\, dx = e^{-\lambda};\ \lambda > 0$$

(c) Using Fourier transform, solve :

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} \quad ; \quad 0 < x < \infty$$

$$t > 0$$

subject to the conditions :

(i) $u(0, t) = 0$

(ii) $u(x, 0) = \begin{cases} x & ; \quad 0 < x < 1 \\ 0 & ; \quad x \geq 1 \end{cases}$ [7]

Or

6. (a) Find the Fourier sine transform of : [5]

$$f(x) = \begin{cases} \pi & ; \quad 0 \leq x \leq \pi \\ 0 & ; \quad x > \pi \end{cases}$$

(b) Find the inverse Fourier cosine transform of : [5]

$$F_c(\lambda) = \begin{cases} 1 - \lambda & ; \quad 0 \leq \lambda \leq 1 \\ 0 & ; \quad \lambda > 1 \end{cases}$$

(c) Find the Fourier cosine transform of : [7]

$$f(x) = \begin{cases} \pi/2 \cos x & ; \; 0 \leq x \leq \pi \\ 0 & ; \; x > \pi \end{cases}$$

and hence show that :

$$\int_0^\infty \frac{\lambda \sin \lambda\pi}{1 - \lambda^2} \, d\lambda = \frac{\pi}{2}.$$

SECTION II

7. (*a*) Obtain Laplace transform of the following (any *three*) : [12]

(*i*) $\dfrac{1 - \cos t}{t}$

(*ii*) $t \int_0^t e^{-4t} \sin 3t \, dt$

(*iii*) $e^{3t} \, t \cos 2t$

(*iv*) $\cos t \, . \, U(t-1)$

(*b*) Using Laplace transform, evaluate : [4]

$$\int_0^\infty t^2 e^{-3t} \sinh 2t \, dt$$

Or

8. (*a*) Find inverse Laplace transform of the following (any *three*) : [12]

(*i*) $\dfrac{s+1}{(s^2+2s+2)^2}$

(*ii*) $\log \left(\dfrac{s^2+a^2}{s^2+b^2} \right)$

(*iii*) $\dfrac{11s^2 - 2s + 5}{(s-2)(s+1)(2s-1)}$

(*iv*) $\dfrac{e^{-5s}}{(s-2)^4}$

(*b*) Find the Laplace transform of the periodic function : [4]

$$f(t) = \begin{cases} t, & 0 < t < 2 \\ (t-2), & 2 < t < 4 \end{cases} \quad \text{and}$$

$$f(t+4) = f(t).$$

9. (*a*) Show that : [6]

$$\overline{\mathrm{F}} = (6xy + z^3)\,\overline{i} + (3x^2 - z)\,\overline{j} + (3xz^2 - y)\,\overline{k}$$

is irrotational. Find scalar ϕ such that $\overline{\mathrm{F}} = \nabla\phi$.

(*b*) If directional derivative of : [6]

$$\phi = ax^2y + by^2z + cz^2x$$

at (1, 1, 1) has maximum magnitude 15 in the direction parallel to :

$$\frac{x-1}{2} = \frac{y-3}{-2} = \frac{z}{1},$$

hence find the values of a, b, c.

(*c*) Verify Stokes' theorem for : [6]

$$\overline{\mathrm{F}} = xy^2\,\overline{i} + y\,\overline{j} + z^2x\,\overline{k}$$

for the surface of rectangular lamina bounded by :

$$x = 0,\ y = 0,\ x = 1,\ y = 2,\ z = 0$$

Or

10. (*a*) Evaluate :

$$\iint_S 2x^2 y \, dy \, dz - y^2 \, dz \, dx + 4xz^2 \, dx \, dy$$

over the curve surface of the cylinder :

$$y^2 + z^2 = 9$$

bounded by $x = 0$ and $x = 2$. [6]

(*b*) With usual notations, prove that (any *two*) : [6]

(*i*) $\nabla \cdot \left[r \, \nabla \left(\frac{1}{r^4} \right) \right] = \frac{8}{r^5}$

(*ii*) $\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r^4} \right) = \frac{-2}{r^4} \bar{a} + \frac{4}{r^6} (\bar{a} \cdot \bar{r}) \bar{r}$

(*iii*) $\nabla^4 [r^2 \log r] = \frac{6}{r^2}$

(*c*) Find work done in moving a particle once around the circle :

$$\frac{x^2}{25} + \frac{y^2}{16} = 1, \; z = 0$$

under the field of force given by :

$$\overline{F} = (2x - y + z) \, \bar{i} + (x + y - z^2) \, \bar{j} + (3x - 2y + 4z) \, \bar{k}$$

Is the field conservative ? [6]

11. (*a*) Solve the following differential equation using Laplace transform : [5]

$$\frac{d^2y}{dt^2} - 3\frac{dy}{dt} + 2y(t) = e^{-t}, \ y(0) = 0, \ y'(0) = 0$$

(*b*) The transfer function of a second order system is given as :

$$G(s) = \frac{10}{2s^2 + 0.3s + 0.5}$$

Determine its properties such as overshoot, $y(t)_{max}$, period of oscillation. [6]

(*c*) Obtain the equation of streamlines in case of steady motion of fluid defined by : [5]

$$\bar{q} = (y - z)\,\bar{i} + (z - x)\,\bar{j} + (x - y)\,\bar{k}$$

Or

12. (*a*) Using the Laplace transform, solve the following differential equation : [5]

$$\frac{dy}{dt} + 3y(t) + 2\int_0^t y(t)\,dt = 1, \ \ y(0) = 0$$

(*b*) Is the motion represented by :

$$(y + z)\,\bar{i} + (z + x)\,\bar{j} + (x + y)\,\bar{k}$$

Irrotational ? If so, find the corresponding velocity potential. [6]

(*c*) Find the surface of equipressure in case of steady motion of a fluid which has a velocity potential : [5]

$$\phi = xy + yz + zx$$

and is under the action of force :

$$\overline{F} = (mz + ny)\,\bar{i} + (nx + lz)\,\bar{j} + (ly + mx)\,\bar{k}\,.$$

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-62

S.E. (Chemical) (First Semester) EXAMINATION, 2014

CHEMISTRY–I

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat labelled diagrams must be drawn wherever necessary.

(*iv*) Use of log table, slide rule, Mollier charts, pocket calculator, steam table is allowed.

(*v*) Assume suitable data if necessary.

SECTION I

1. (*a*) Draw the resonating structure of : [6]

(*i*) Nitrobenzene

P.T.O.

(*ii*) Phenoxide ion

(*iii*) Benzaldehyde

(*b*) Give reason :

(*i*) Formic acid is stronger than acetic acid

(*ii*) γ-chorobutyric acid is a weaker acid than α-chlorobutyric acid.

(*iii*) Pyrrole is weaker base than pyridine. [6]

(*c*) Write the postulates of molecular orbital theory. Draw the MO diagram for CO molecule and find its bond order. [6]

Or

2. (*a*) Explain the concept of Aromaticity by giving suitable example. [6]

(*b*) Draw the MO diagram for the O_2 molecule and find its bond order. [6]

(*c*) Discuss the orbital structure of carbocation and carbanion. Give *two* methods of generation of each. [6]

3. (*a*) What are the effects of the following factors on S_N1 and S_N2 reaction ? [6]

(1) Nature of nucleophile

(2) Nature of substrate

(3) Nature of leaving group

(4) Nature of solvent.

(*b*) Explain the mechanism of Reformatsky rearrangement. [6]

(*c*) Write a note on Friedel-Craft alkylation. [4]

Or

4. (*a*) Write a short note on Claisen and Beckmann rearrangement. [6]

(*b*) Discuss the mechanism of E_1 and E_2 reaction of alkyl halides. [6]

(*c*) Name the factor that favour elimination over nucleophilic substitution. [4]

5. (*a*) What is Kohlrausch's law ? Discuss its application. [6]

(*b*) What are potentiometric titration ? Mention the types and describe the redox titration in detail. [6]

(*c*) A cell with electrode 2 sq. cm and 10 cm apart is filled with 0.1 N NaCl solution. The equivalent conductance is 106.7 mhos cm^2 per equivalent. If applied voltage is 50 volts, calculate current in amperes. [4]

Or

6. (*a*) What is titration curve ? Discuss the titration curve for the neutralization of : [6]

(*i*) a strong acid with a strong base

(*ii*) a strong acid with a weak base.

(*b*) Describe the variation of equivalence conductance with dilution. [6]

(*c*) Explain the following terms :

(*i*) Cell constant

(*ii*) Specific conductance

(*iii*) Equivalent conductance. [4]

SECTION II

7. (*a*) Derive an integrated rate equation for first order reaction and give its characteristics. [6]

(*b*) Define and explain : [6]

(*i*) Molecularity and order of reaction

(*ii*) Half life time

(*iii*) Complex reaction

(*c*) The first order reaction takes 50 minutes to undergo 25% reaction. Find its rate constant. [4]

Or

8. (*a*) Explain steady state approximation with suitable example. [6]

(*b*) Derive Arrhenius equation and explain energy of activation. How is it calculated graphically ? [6]

(*c*) Explain any *two* methods for the determination of rate of reaction. [4]

9. (*a*) Explain the principle, technique and applications of T.L.C. [6]

(*b*) Explain construction, working and applications of H_2–O_2 fuel cell. [6]

(*c*) Explain any *two* detectors used in gas chromatography. [4]

Or

10. (*a*) Explain construction, working and application of polymer electrolyte membrane fuel cell. [6]

(*b*) Give the instrumentation of high performance liquid chromatography. [6]

(*c*) Give uses of column chromatography. [4]

11. (*a*) Explain diazotisation reaction and its application in synthesis of azo dyes. [6]

(*b*) Give the synthesis and uses of the following dyes : [6]

(*i*) Crystal violet

(*ii*) Phenolphthalein.

(*c*) Explain any *two* methods of synthesis of : [6]

(*i*) Pyrrole

(*ii*) Furan.

Or

12. (*a*) Explain the classification of dyes on the basis of mode of application. [6]

(*b*) Write a note on Skraup synthesis of quinoline. [6]

(*c*) Draw orbital picture of pyrrole, furan and pyridine. [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-63

S.E. (Chemical Engineering) (First Semester) EXAMINATION, 2014

CHEMICAL ENGINEERING FLUID MECHANICS (C.E.F.M.)

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is the difference between dynamic viscosity and kinematic viscosity ? State their units of measurement. [6]

(*b*) Write a short note on types of flow. [6]

(*c*) What is rheology ? How are fluids classified according to their rheological behaviour ? [6]

Or

2. (*a*) Explain the Newton's law of viscosity. [6]

(*b*) Determine the specific gravity of a fluid having viscosity 0.08 poise and kinematic viscosity 0.028 stokes. [6]

(*c*) Define density and specific weight, specific volume and specific gravity. [6]

3. (*a*) Derive an expression for the pressure difference across two limbs of a differential manometer containing two guage fluids, mutually immiscible. [8]

(*b*) Express pressure intensity of 500 mm of water column into : [8]

(*i*) height of liquid of density 600 kg/m^3

(*ii*) oil of specific weight 8 kN/m^3.

Or

4. (*a*) State desirable properties of a good manometric fluid along with their examples. [8]

(*b*) Explain with neat sketch the working of an inclined single column manometer. [8]

5. (*a*) For laminar flow through inclined circular pipe show that : [8]

$$\frac{U_{max}}{u} = 2.$$

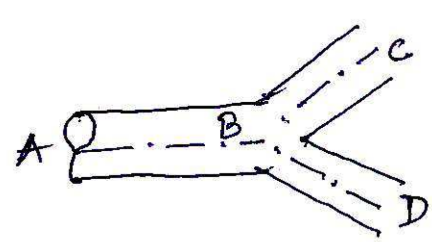
(*b*) State and explain the physical significance of continuity equation and Bernoulli's equation. [8]

Or

6. (*a*) For laminar flow through horizontal circular pipe, show that : [8]

$$u = \left[1 - \left(\frac{r}{rw}\right)^2\right].$$

(*b*) A pipe AB branches into two pipes C and D as shown in figure below. The pipe has diameter of 45 cm at 'A', 30 cm at 'B', 20 cm at 'C' and 15 cm at 'D'. Determine the discharge at 'A', if the velocity at A is 2 m/sec. Also determine the velocities at B and D, if velocity at C is 4 m/sec. [8]



SECTION II

7. (*a*) Calculate the momentum thickness for the following boundary layer velocity flow : [10]

$$\frac{u}{u_\infty} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3.$$

(*b*) What are the methods of dimensional analysis ? Describe the Rayleigh's method for dimensional analysis. [8]

Or

8. (*a*) Derive the continuity and Euler's equation of motion for boundary layer flow. [10]

(*b*) With suitable example, describe in detail the method of dimensional analysis using Buckingham's π theorem. [8]

9. (*a*) Explain in detail the concept of Drag and Drag coefficient. [8]

(*b*) What are the different types of fluidization ? Explain in short. [8]

Or

10. (*a*) For Stokes' law region show that : [8]

$$C_D = \frac{24}{NRe}.$$

(*b*) What is the effect of surface roughness on the friction drag coefficient in laminar and turbulent flow ? [4]

(*c*) What is terminal settling velocity ? How is it determined ? [4]

11. (*a*) Draw a neat sketch and explain the working of rotameter. [8]

(*b*) A venturimeter is used to measure flow rate of water. Calculate the flow rate of water in lit/sec, if mercury manometer reads 18 cm. The pipe diameter is 75 mm while throat diameter is 25 mm. Take coefficient of venturimeter = 0.97 and specific gravity of mercury is 13.6. [8]

Or

12. (*a*) Describe construction, working and characteristics of a centrifugal pump. [8]

(*b*) What is cavitation in pump ? What is its significance ? [4]

(*c*) Enlist different minor and major losses. Explain any *one*. [4]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4**

Seat No.	

[4657]-64

S.E. (Chemical) (First Semester) Examination, 2014

CHEMICAL ENGINEERING MATERIALS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Your answers will be valued as a whole.

(*vi*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

SECTION I

1. (*a*) Define Poisson's ratio and its applications. [3]

(*b*) Define the following terms : [8]

(*i*) Malleability

(*ii*) Ductility

(*iii*) Resilience

(*iv*) Toughness.

(*c*) Draw stress-strain curve showing elastic and plastic limit of metal. [5]

P.T.O.

Or

2. (*a*) Write the classification of Engineering Materials. [3]

   (*b*) Explain Necking in brief. [4]

   (*c*) Define factor of safety and give its applications. [6]

   (*d*) Define the term Hardness. [3]

3. (*a*) Write a short note on Brinell Hardness Test. [6]

   (*b*) Explain impact test in detail. [10]

Or

4. (*a*) Write a short note on Brinell Hardness Test. [6]

   (*b*) Explain Rockwell Hardness of materials. Draw a neat sketch. [10]

5. (*a*) Draw Iron-Iron carbide equilibrium diagram. [6]

   (*b*) Explain various phases observed in Iron-Iron carbide equilibrium diagram. [6]

   (*c*) Explain different reaction involved in Iron-Iron carbide equilibrium diagram. [6]

Or

6. Write short notes on (any *three*) : [18]

   (*i*) Insulations

   (*ii*) Refractories

(*iii*) Types of steels

(*iv*) Methods of welding

(*v*) Bending

(*vi*) Rolling.

SECTION II

7. (*a*) Explain the different methods of prevention of corrosion. [12]

(*b*) Write a short note on Dry corrosion. [4]

Or

8. (*a*) Find out the nature of film when chromium oxides to chromium oxide. The atomic weight of chromium and oxygen is 52 and 16 respectively. Density of chromium and chromium oxide is 7.2 gm/cm^3 and 10.28 gm/cm^3. [6]

(*b*) What is an oxide film ? Explain its formation and growth mechanism. [10]

9. Write short notes on : [16]

(*i*) Vulcanization of rubber

(*ii*) Nylon-6

(*iii*) Applications of Teflon

(*iv*) Stress relaxation.

Or

10. (*a*) Define polymerization. Explain addition and condensation polymerization. [10]

(*b*) Define Vulcanization of rubber. [6]

11. (*a*) Write short notes on : [8]

(*i*) Process of vitrification

(*ii*) Applications of Ceramic materials.

(*b*) Explain the different mechanical properties of Ceramics. [10]

Or

12. Explain the following : [18]

(*a*) Refractories

(*b*) Glass and its types in detail

(*c*) Applications of ceramics and glasses in chemical industries.

Total No. of Questions—**12**]

[Total No. of Printed Pages—**8+2**

Seat No.	

[4657]-65

S.E. (Chemical) (First Semester) EXAMINATION, 2014

PROCESS CALCULATIONS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4** and Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10** and Q. No. **11** *or* Q. No. **12** from Section II.

(*iii*) Draw neat sketches wherever necessary.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, calculator and steam table is permitted.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) A compound is found to contain 62.4% Ca and 37.6% C. [6]

(*i*) How many gram atoms of Ca and C present in 100 gm of the compound ?

(*ii*) Suggest an empirical formula for the compound.

(*b*) An aqueous solution contains 6% urea (NH_2CONH_2), 19% NH_3 and 65.6% NH_4NO_3 (by mass). Calculate the available nitrogen content of the solution. [6]

(*c*) Sodium chloride weighing 600 kg is mixed with 200 kg potassium chloride. Find the composition of the mixture in mass % and mole %. [6]

Or

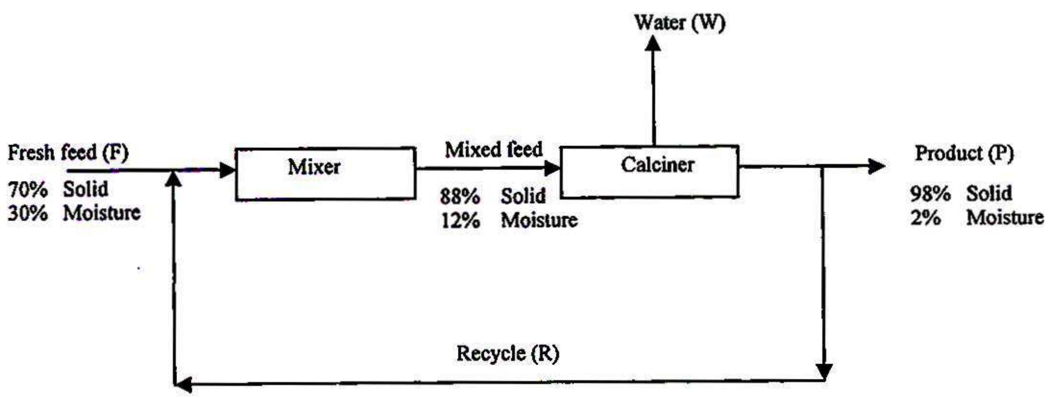
2. (*a*) The potential energy of a body at a height of 15 m is 2.0 kJ. If the body is moving at a velocity of 50 m/sec, what is its kinetic energy ? [6]

(*b*) The flow rate of water through pipe is reported as 15 cubic feet per minute. Calculate the mass flow rate in kg/sec. [6]

(*c*) An aqueous solution of acetic acid of 27% conc. (by mass) has density 1140 kg/m^3. Find the normality, molarity and molality of the solution. [6]

3. (*a*) The average molar mass of a flue gas sample is calculated by two engineers. One engineer uses the correct molar mass of 28 for N_2 and determines the average molar mass to be 30.08. The other engineer, using an incorrect value of 14, calculates the average molar mass to be 18.74. Calculate the volume % of N_2 in the flue gases. [6]

(*b*) For the drying operation shown in Fig. 1, what fraction of the dried product must be recycled ? [10]



Or

4. (*a*) For carrying out nitration reaction, it is desired to have a mixed acid containing 39% HNO_3, 42% H_2SO_4 and 19% H_2O. Nitric acid of 68.3% strength and sulfuric acid of 98% strength is available. Calculate the quantities of nitric acid and sulfuric acid required to prepare 1000 kg of mixed acid. [10]

(*b*) Ammonia is recovered from a gas mixture containing 25% CO_2 and 75% NH_3 (by volume) by scrubbing with water. Assuming that CO_2 is insoluble in water, determine the percent of ammonia in the entering gas that is absorbed if the gas leaving the scrubber analyzes 35% NH_3. [6]

5. In a Deacon process for manufacturing chlorine, hydrochloric acid gas is oxidized with air. The reaction is :

$$4HCl + O_2 \rightarrow 2Cl_2 + 2H_2O$$

If the air is used in excess of 30% of that theoretically required and if the oxidation is 80% complete, calculate the composition of the gases leaving the reaction chamber, when 1000 kg of HCl gas is charged in the reactor. [16]

Or

6. A mixture of pure carbon dioxide and hydrogen is passed over a nickel catalyst. The temperature of the catalyst bed is 588 K and the reactor pressure is 2 MPa g. The analysis of the gases leaving the reactor showed CO 57.1%, H_2 41.1% CH_4 1.68% and CO_2 0.12% (by volume) on a dry basis. The reactions taking place in the reactor are :

$$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$$

and $$CO_2 + H_2 \rightarrow CO + H_2O$$

Find :

(*a*) The conversion of CO_2 per pass;

(*b*) Yield of CH_4 in terms of CO_2 reacted and;

(*c*) The composition of the feed [16]

SECTION II

7. (*a*) Tin is melted in an open pan using a jacket. The jacket is fed with vapors of an eutectic mixture of diphenyl-diphenyl oxide at 171 kPa a. Tin is fed to the pan at 30°C. Calculate the quantity of eutectic mixture of diphenyl-diphenyl oxide condensed per 100 kg of tin melted at its melting temperature : [10]

Given data of Tin (Sn) :

Molar mass, M = 118.7

Melting point = 505 K

Latent heat of fusion, λ_f = 7201 kJ/kmol

Heat capacity of solid tin, $C_{ms} = 21.14 + 0.02T$ kJ/(kmol.K)

Latent heat at 171 kPa a, λ_v = 278 kJ/kg (*b*) Calculate the energy required to dissociate one kilogram of sodium bicarbonate at 298 K. [6]

$2NaHCO_3(s) = Na_2CO_3(s) + CO_2(g) + H_2O(g)$

Given data : Standard heat of formation at 298 K

Component	**ΔH_f kJ/mol**
$Na_2CO_3(s)$	–1130.68
$NaHCO_3(s)$	–950.81
$H_2O(g)$	–241.82
$CO_2(g)$	–393.51

Or

8. (*a*) Calculate the standard heat of reaction at 298.15 K, when gaseous ammonia is dissolved in water to form 2% by weight of solution. [8]

Given data :

Component	**ΔH_f kJ/mol**
$NH_3(g)$	–49.94
$NH_4OH(l)$	–361.20
$H_2O(l)$	–285.83

(*b*) Pyrites fines are roasted in chamber plant for making sulfuric acid. The gases leaving the roaster at 775 K (502°C) and have molar composition SO_2 7.09%, O_2 10.55%, SO_3 0.45% and N_2 81.91%. Calculate the heat content of 1 kmol gas mixture over 298.15 K (25°C), using the heat capacity data :

SO_2 : $C^{\circ}_{PSO_2} = 24.7706 + \left(62.9481 \times 10^{-3}\right)T$

O_2 : $C^{\circ}_{PO_2} = 26.0257 + \left(11.7551 \times 10^{-3}\right)T$

SO_3 : $C^{\circ}_{PSO_3} = 22.0376 + \left(121.624 \times 10^{-3}\right)T$

N_2 : $C^{\circ}_{PN_2} = 29.5909 - \left(5.141 \times 10^{-3}\right)T$

C°_P is in kJ/(kmol.K) [8]

9. Oil is to be extracted from a meal by a continuous counter-current extractor. The unit is charged with 1000 kg/hr meal based on oil free solids. Untreated meal contains 0.4 kg oil and 0.025 kg benzene per kg of oil-free meal. A fresh solvent is benzene containing 1.5% oil (mass %).

The ratio of the fresh solvent to the oil-free meal is kept at 0.065 kg/kg. The solid meal retains 0.507 kg solution per kg solid. The solution retained by the meal contains 11.83% oil (by mass). Make a complete material balance and find the composition and the amount of overflow from the extractor. [16]

Or

10. (*a*) Crystals of $MgCl_2.6H_2O$ have solubility of 190 gm per 100 gm ethanol at 298 R. It is desired to make 1500 kg of saturated solution. Calculate the quantities of the crystals and ethanol required to make the solution. Also find the composition of the saturated solution by mass. [6]

(*b*) The dry bulb temperature and dew point of ambient air were found to be 29° C and 18° C respectively. The barometer reads 100 kPa absolute. [10]

Compute :

(*i*) Absolute humidity

(*ii*) %RH,

(*iii*) % saturation

(*iv*) Humid heat and

(*v*) Humid volume.

11. (*a*) A sample fuel oil has C/H ratio 9.33 (by mass) and contains sulfur to the extent of 1.3 (mass). The GCV of the fuel is measured to be 41785 kJ/kg at 298.15 K. Calculate its NCV at 298.15 K.

Latent heat of water vapor at 298.15 K = 2442.5 kJ/kg [6]

(*b*) A fuel gas constitutes of CO_2 : 3.4%, C_6H_6 : 1.5%, O_2 : 0.3%, CO : 17.4%, H_2 : 36.8%, CH_4 : 24.9% and N_2 : 12.0% (on mole basis). It is burnt with air in a furnace. The pyrite analyzer indicated 10.0 mol% CO_2 (on dry basis) in the flue gases.

Find :

(*i*) The percentage excess air used and

(*ii*) The complete Orsat analysis. [12]

Or

12. A gas mixture consisting of 80% ethane and 20% oxygen (by mole) is burned in an engine with 100% excess air. 80% of the ethane goes to CO_2, 10% to CO and 10% remains unburned. If 100 kg/hr of gas mixture is fed to the burner, calculate the composition of the exhaust gases on : [18]

(*i*) Wet basis and

(*ii*) Dry basis.

Total No. of Questions—**12**]   [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-70

S.E. (Chemical Engg.) (Second Semester) EXAMINATION, 2014

MECHANICAL OPERATIONS

(2008 PATTERN)

Time : Three Hours   **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Your answers will be valued as a whole.

(*vi*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vii*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Derive an expression to determine critical speed of Ball Mill. [6]

(*b*) Differentiate between differential and cumulative screen analysis. [4]

(*c*) A material is crushed in a Blake jaw crusher and the average size of particle reduced from 50 mm to 10 mm size with the consumption of energy at the rate of 13 kW/(kg/s). What will be the consumption of energy needed to crush the same material of average size 80 mm to an average size of 30 mm. Assuming Rittinger's law and Kick's law applies ? [8]

Or

2. (*a*) Derive an expression to determine roll diameter from size of the feed and size of the product in Roll crusher. [8]

(*b*) A screen of 10 mesh size made out of 0.1 cm thick wire is used for separation by screening. The ratio of overflow to underflow obtained is 0.75. The screen analysis of two fractions show that overflow contains 88% oversize material and underflow contains 25% oversize material. Calculate the % oversize and % undersize in the feed. Calculate the efficiency based on combined effectiveness. [8]

(*c*) State the principle of Fluid energy Mill. [2]

3. (*a*) Describe with a neat sketch a pneumatic conveyor. [8]

(*b*) Explain the working principle of a screw conveyor. [4]

(*c*) Write a short note on Chain and Flight conveyors. [4]

Or

4. (*a*) State the advantages and disadvantages of Belt conveyors. [6]

(*b*) What are the factors to be considered in the selection of conveyors ? [6]

(*c*) Write a short note on Bucket elevators. [4]

5. (*a*) Describe in brief any *one* of mixer used for mixing of paste and plastic materials. [8]

(*b*) A soil containing 18% moisture was mixed in a large muller mixer with 10 weight % of a tracer which consists of dextrose and picric acid. After 5 minutes of mixing 10 random samples were taken from the mixture analysed for the tracer. The measured concentrations in the sample were in weight percent tracer, 10.28, 9.20, 7.8, 11.03, 10, 11.51, 9.25, 9.65, 10.65 and 10.77. Calculate the mixing Index I_P and the standard deviation S. [8]

Or

6. (*a*) Distinguish between radial flow and axial flow impellers with neat sketches. [8]

(*b*) Explain the applications of Mixing and Agitation. [4]

(*c*) Explain different flow patterns in mixing. [4]

SECTION II

7. (*a*) Explain with neat sketches construction, working and advantages, disadvantages of plate and frame filter press. [8]

(*b*) A Rotary vacuum drum filter operating at 2 r.p.m., filters 1000 lit/min. Operating under the same vacuum and neglecting the resistance of the filter cloth, at what speed must the filter be operated to give a filtration rate of 2000 lit/min ? [8]

Or

8. (*a*) Explain the principles of centrifugal filtration. [4]

(*b*) Explain the operating cycle of centrifuge. [4]

(*c*) A plate and frame filter press, filtering a slurry, gave a total of 8 m^3 of filtrate in 1800 seconds and 11 m^3 in 3600 seconds, when filtration was stopped. Estimate the washing time in seconds if 3 m^3 of wash water was used. The resistance of the filter cloth can be neglected and a constant pressure is used throughout. [8]

9. (*a*) Describe in brief cyclone separator with a neat diagram. [8]

(*b*) Describe with neat sketches the aggregate and particulate fluidization. Give typical examples of both types. [8]

(*c*) Explain the working principle of Dorr thickener. [2]

Or

10. (*a*) What will be the settling velocity of a spherical particle of 0.4 mm diameter in an oil of specific gravity 0.82 and viscosity 10^{-3} NS/m^2. The specific gravity of steel is 7.87. [8]

(*b*) Explain Kynch theory of sedimentation. State assumptions of it. [6]

(*c*) State applications of fluidization technique. [4]

11. (*a*) Describe in brief electrostatic precipitator with a neat diagram. [8]

(*b*) Explain working of Bag Filter. [4]

(*c*) Explain working of magnetic head pulley. [4]

Or

12. (*a*) Describe in brief electroflotation plant with neat diagram. [8]

(*b*) Write short notes on the following : [8]

(*i*) Hydrocyclone

(*ii*) Solid bowl centrifuge.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

Seat No.	

[4657]-71

S.E. (Computer Engg.) (First Semester) EXAMINATION, 2014

PROGRAMMING AND PROBLEM SOLVING

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer any *three* questions from each Section.

(*ii*) Answer *three* questions from Section I and *three* questions from Section II.

(*iii*) Answers to the two Sections should be written in separate answer-books.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Figures to the right indicate full marks.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the difference between variables and constants. [4]

(*b*) Consider any *one* problem and solve that problem using six steps of problem solving. Explain each step in detail. [8]

(*c*) Compare an algorithmic solutions and heuristics solution. Support your answer with suitable example. [4]

Or

2. (*a*) Draw interactivity chart and IPO chart to balance your cheque book. [8]

(*b*) Define a function. Explain each category with a suitable example. [4]

(*c*) Set up an equation to calculate the following : [4]

(*i*) The average of three numbers.

(*ii*) The sale price of an item given an original price and a discount percentage.

3. (*a*) Explain what is meant by the cohesion a module and the coupling of modules. [6]

(*b*) Using negative logic, write the algorithms and draw the flowcharts for the following set of conditions : [6]

R = 50 for S < = 1000

R = 100 for S = 1001 – 4000

R = 250 for S = 4001 – 8000

R = 75 for S > 8000.

(*c*) What is Data Dictionary ? Build a data dictionary for the parameters in the problem. Calculate salary of an employee, according to destination, No. of days worked, wages per day and deductions. [6]

Or

4. (*a*) Broadband Internet connection charges the following rates for the use of internet : [12]

First 1 GB : Free

Extra usage > 1 GB : Re. 1

All customers are charged monthly rental of Rs. 250 and service tax of 12.5% on total bill amount. Describe and explain complete steps of solution development to read name of customers, tariff of internet usage and print out the total amount to be charged.

(*b*) Distinguish between the parameter techniques a call by value and call by reference with suitable example. [6]

5. (*a*) Design an algorithm that will reverse the digits in a given number. For e.g. algorithm should convert the number 251 to the number 152. [8]

(*b*) Design and explain an algorithm to find the sum of the digits of an integer number. [8]

Or

6. (*a*) Design pseudo algorithm to check given non-negative integer number is palindrome or not. [8]

(*b*) Given an integer *n* devise pseudo algorithm that will find its smallest exact divisor other than one. [8]

SECTION II

7. (*a*) Write short notes on the following : [8]

(*i*) Table look up technique

(*ii*) Pointer technique.

(*b*) Write an algorithm to find the frequency of each vowel in a line of text. [8]

Or

8. (*a*) Write pseudo algorithm to rearrange the elements in an array so that they appear in reverse order. [8]

(*b*) Write pseudo algorithm for finding *k*th smallest element. [8]

9. (*a*) Explain algorithm for line editing. [8]

(*b*) Explain algorithm for left right justification of given text. [8]

Or

10. (*a*) Write pseudo algorithm for linear pattern search. [8]

(*b*) Explain the following algorithm : [8]

(*i*) Count number of spaces on each line for given text

(*ii*) Search keyword from given text.

11. (*a*) Write a program in C++ for a Video CD Library that need to track Customers, Video CD's and its rentals and late fees :

(*i*) Design classes you would create the application

(*ii*) Write what methods would be needed for the classes

(*iii*) Print the customer and its rentals. [8]

(*b*) Can we use the same function name for a member function of a class and an outside function in the same program file ? If yes, how are they distinguished ? If no, give reasons. [4]

(*c*) Explain the following features of an object oriented programming with suitable examples : [6]

(*i*) Polymorphism

(*ii*) Encapsulation.

Or

12. (*a*) Explain the following terms : [9]

(*i*) Static member functions

(*ii*) Access specifier

(*iii*) Friend function.

(*b*) Write a C++ program to implement the concept of polymorphism. [5]

(*c*) Distinguish between object and classes. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-72

S.E. (Computer/I.T.) (First Semester) EXAMINATION, 2014

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Answer any *three* questions from each Section.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of calculator is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Convert the following Hexadecimal numbers into their equivalent binary, decimal and octal numbers : [12]

(*i*) A72E

(*ii*) BD6.7

(*iii*) 0.BF85

(*iv*) DF.

(*b*) Perform the following BCD Addition; also represent the answer in valid BCD : [6]

(*i*) 7+1

(*ii*) 7+4

(*iii*) 9+8.

Or

2. (*a*) Express the following numbers in binary format. Write step by step solution : [6]

(*i*) $(762)_{\text{octal}}$

(*ii*) $(246)_{\text{decimal}}$

(*iii*) $(1101.11)_{\text{decimal}}$

(*b*) Solve the following equations using corresponding minimization techniques : [12]

(*i*) $Z = f(A, B, C, D) = \Sigma m(0, 2, 5, 6, 8, 10, 13, 15)$

(*ii*) $Z = f(A, B, C, D) = \Pi M(4, 5, 6, 7, 14, 15)$.

3. (*a*) Solve by Quine-McClusky technique : [10]

$$Z = f(A, B, C, D) = \Sigma(0, 1, 3, 7, 8, 9, 11, 15).$$

(*b*) Explain standard TTL characteristics in brief. [6]

Or

4. (*a*) Draw 2-i/p 2 input CMOS NAND gate. [8]

(*b*) Compare TTL and CMOS logic family. Also draw CMOS-NOR gate. [8]

5. (*a*) Design and implement BCD to Excess-3 code converter using logic gates. Starting with truth table show K-maps and circuit diagram of your design. [8]

(*b*) Design and implement 3-bit an Even Parity Generator and Checker. [8]

Or

6. (*a*) Design and implement the following equation using single 8 : 1 multiplexer :

$$F(A, B, C, D) = \Sigma(0, 2, 5, 8, 10, 15).$$

Explain the truth table of your circuit in short. [8]

(*b*) Design and implement two bit comparator using basic gate only. [8]

SECTION II

7. (*a*) With the help of internal block diagram explain how counter IC 7490 can be used as : [8]

(*i*) BCD counters

(*ii*) MOD-6 counter.

(*b*) How will you convert JK flip-flop into D flip-flop and T flip-flop ? Explain application of D and T flip-flop in sequential circuits ? [10]

Or

8. (*a*) What is the difference between Asynchronous and Synchronous Counter ? Draw and explain 3 bit Synchronous Up-Down counter, also draw necessary timing diagram. [10]

(*b*) Design the following sequence generator using T flip-flops. Use synchronous counter. Design methodology 0 — 1 — 7 — 4 — 2 — 0 and repeats. [8]

9. (*a*) What is ASM chart ? Design ASM chart for 3-bit Up-Down counter. [8]

(*b*) Write VHDL code for Half Adder in Structural and Dataflow modeling. [8]

Or

10. Draw ASM chart for the following state machine :

A two bit counter with output 'Q1 Q0' and enable signal 'X' is to be designed. If X = 0, Counter changes the state as '00—01—10—00'. If X = 1, Counter should remain in the present state. Design circuit using JK ff and suitable MUX. [16]

11. (*a*) Draw and explain structural diagram of CPLD and FPGA. Also explain difference between the two types of devices. [8]

(*b*) Implement 4 : 1 MUX using suitable PAL. [8]

Or

12. (*a*) What is Bus ? Explain in brief different types of Bus used by a Microprocessor. [8]

(*b*) With a neat block diagram explain microprocessor architecture. [8]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-73

S.E. (Computer) (First Semester) EXAMINATION, 2014

DATA STRUCTURES AND ALGORITHM

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is Recursion ? What are its advantages and disadvantages ? [6]

(*b*) Explain with example fwrite, ftell, fseek functions for file handling in C. [6]

(*c*) Write a recursive function for the following : [4]

$$f(n) = n, \text{ if } n = 0, 1$$
$$= f(n) * f(n/2) \text{ otherwise.}$$

Or

2. (*a*) What is user defined data types and built-in data types ? Explain with example. [5]

(*b*) Write a recursive function for the following and show step by step function working for $f(5)$: [8]

$$f(n) = n, \quad \text{if } n = 0, 1$$
$$= f(n-1) + f(n-2) \quad \text{otherwise.}$$

(*c*) Write differences in binary mode and text mode of a file. [3]

3. (*a*) What is the frequency count of the following :

```
int fact(int n)
{
    if(n==1)
    {
        return(1);
    }
    else
        return(n*fact(n-1));
}
```

Find out time complexity. [6]

(*b*) Write 'C' functions to perform multiplication of two matrix. What is its time complexity ? [6]

(*c*) Explain any *two* Asymptotic notations with example. [4]

Or

4. (*a*) Write an ADT for an Array. [4]

(*b*) Write pseudocode for addition of two matrices and find out its frequency count. [8]

(*c*) What do you mean by space and time complexity ? Explain with an example. [4]

5. (*a*) Explain concept of sparse matrix with example. Compare it with normal matrix. [6]

(*b*) Explain how two-dimensional array A[1 : m, 1 : n] is represented in computer memory using row major and column major representation. Explain formula using both methods for computing the address of any element A[i, j] where [12]

$$1 <= i <= m \text{ and } 1 <= j <= n.$$

Or

6. (*a*) Write ADT for sparse matrix. Write an algorithm to find simple transpose. [12]

(*b*) Write a 'C' function to implement polynomial addition using array. Explain time complexity for above function. [6]

SECTION II

7. (*a*) Sort the following numbers step by step by using radix sort. Also comment on how many passes and comparisons required in radix sort :

655, 307, 8, 99, 11, 75, 101, 2023, –6, 04. [10]

(*b*) Write an algorithm for merge sort. [6]

Or

8. (*a*) What do you mean by stable sorting method ? Explain Quick sort method and comment on its stability. [8]

(*b*) Write an algorithm for linear search. Explain its best case, worst case and average case complexity with example. [8]

9. (*a*) Write pseudocode to reverse singly linked list. [4]

(*b*) Write a node structure for Generalized linked list in 'C'. Explain use of union in it. Show Graphical representation for the following GLL : [12]

(1, 2, (3, (4), 5, (6, 7), 8), 9).

Or

10. (*a*) Write a function to perform multiplication of two polynomial using circular linked list. Explain time complexity of it. [12]

(*b*) Write and explain node structure in C to represent polynomial using GLL. [4]

11. (a) Write an algorithm to convert prefix expression to postfix expression. Comment on its time complexity. [8]

(b) Convert the following infix expression to postfix expression and evaluate the postfix expression with the following values : [10]

$$(a - (b * c) * e \wedge f + (g/h))$$

$$a = 10, \ b = c = 4, \ e = 2,$$

$$f = 3, \ g = 5, \ h = 1.$$

Or

12. Write short notes on : [18]

(a) Stack application

(b) Different types of Queue

(c) Multistack.

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-74

S.E. (Computer/Information Technology) (First Semester)

EXAMINATION, 2014

HUMANITIES AND SOCIAL SCIENCES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. (*a*) India is a land of diversified culture. Discuss. [6]

(*b*) Explain the institution of marriage and types of families with their salient features. [10]

P.T.O.

Or

(*a*) Explain in brief : [10]

(*i*) Panchayat Raj for rural development

(*ii*) Structure of Indian society.

(*b*) Explain in brief importance of Sociology. [6]

2. (*a*) Explain the salient features of Policy on National Education in brief. [8]

(*b*) India needs to improve upon health sector. Comment. [8]

Or

(*a*) Explain the social impact of industrial development in brief. [8]

(*b*) Differentiate between Social Change and Social Progress. [8]

3. Write short notes on the following : [18]

(*i*) Private Sector in India for Economic Development

(*ii*) Green Revolutions in India

(*iii*) Consumer Awareness.

Or

(*a*) Technology can change the Indian Agriculture Sector to increase production. Explain. [9]

(*b*) India is a land of greater opportunities for investments in Infrastructure sector. Explain. [9]

SECTION II

4. Explain in brief :

(*i*) Air Pollution [5]

(*ii*) Energy Resources in India [5]

(*iii*) Global Population Growth. [6]

Or

(*i*) Global Warming [5]

(*ii*) Loss of Bio-diversity [5]

(*iii*) Components of Ecosystems. [6]

5. (*a*) Discuss the challenges faced by Indian Economy. [8]

(*b*) Discuss the priorities and problems in the Five Year Plans. [8]

Or

(*a*) Explain the need for Planned Economic Development of India. [8]

(*b*) Explain the Law of Demand and Supply. [8]

6. Write short notes on the following : [18]

(*i*) Financial Institutions of India

(*ii*) Reserve Bank of India

(*iii*) International Economy.

Or

(*i*) Ration Analysis [18]

(*ii*) Cost Analysis

(*iii*) Budget Analysis.

Total No. of Questions—**12**] [Total No. of Printed Pages—**15**

Seat No.	

[4657]-79

S.E. (Computer/IT) (First Sem.) EXAMINATION, 2014

DISCRETE STRUCTURES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) **Section I :** Attempt Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**.

(*ii*) **Section II :** Attempt Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

(*iii*) Answers to the two Sections should be written in separate answer-books.

(*iv*) Neat diagrams must be drawn wherever necessary.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Show that :

$$1^2 + 2^2 + \text{.........} + n^2 = \frac{n(n+1)(2n+1)}{6}$$

for $n \geq 1$ by mathematical induction. [4]

(*b*) Among the integers 1 to 1000 :

(*i*) How many of them are not divisible by 3, nor by 5, nor by 7 ?

(*ii*) How many are not divisible by 5 and 7 but divisible by 3 ? [6]

(*c*) Obtain the CNF and DNF of the following formulae given below :

(*i*) $p \cap (p \to q)$

(*ii*) $\sim (p \vee q) \rightleftarrows (p \cap q)$. [6]

Or

2. (*a*) Construct truth table to determine whether each of the following is tautology or a contradiction :

(*i*) $(p \cap q) \cap \sim (p \vee q)$

(*ii*) $(p \to q) \leftrightarrow (q \vee \sim p)$. [4]

(*b*) Negate the following in such a way that the symbol ~ does not appear outside the bracket :

(*i*) $\forall x \, (x^2 > x)$

(*ii*) $\exists x \, (x^2 = 2)$. [4]

(*c*) For the universe of all integers let $P(x)$, $Q(x)$, $R(x)$, $S(x)$ and $T(x)$ be the following statements :

$P(x)$: $x > 0$

$Q(x)$: x is even

$R(x)$: x is a perfect square

$S(x)$: x is divisible by 4

$T(x)$: x is divisible by 5

Write the following statements in symbolic form :

(*i*) At least one integer is even.

(*ii*) There exists a positive integer that is even.

(*iii*) If x is even, then x is not divisible by 5.

(*iv*) No even integer is divisible by 5.

(*v*) There exists an even integer divisible by 5.

(*vi*) If x is even and x is perfect square, then x is divisible by 4. [6]

(*d*) Define subset and powerset along with example. [2]

3. (*a*) Let G be the set of all non-zero real numbers and let :

$$a * b = \frac{ab}{2}.$$

Show that (G, *) is an abelian group. [6]

(*b*) If R is a ring such that $a^2 = a, \ \forall a \in R$, prove that :

$$a + a = 0, \quad \forall a \in R.$$ [6]

(*c*) Define each of the following :

(*i*) Groups

(*ii*) Rings

(*iii*) Normal subgroups

(*iv*) Homomorphism of groups. [4]

Or

4. (*a*) Define each of the following :

(*i*) Cyclic group

(*ii*) Subgroups

(*iii*) Cosets

(*iv*) Subrings. [4]

(*b*) Let G be a group for a fixed element G, let $Gx = \{a \in G : ax = xa\}$. Show that Gx is a subgroup of G for all $x \in G$. [6]

(*c*) Let $G = \{e, a, a^2, a^3, a^4, a^5\}$ be a group under the operation of $a^i a^j = a^r$ where $i + j = r \pmod 6$. Prove that G and Z_6 are isomorphic. [6]

5. (*a*) Let

$$R = \{(1, 4)\ (2, 1)\ (2, 5)\ (2, 4)\ (4, 3)\ (5, 3)\ (3, 2)\}.$$

Use Warshall's algorithm to find the matrix of transitive closure. [6]

(*b*) Show that if 7 colours are used to paint 50 bicycles, at least 8 bicycles will be the same colour. [6]

(*c*) Solve the recurrence relation :

$$a_n = 5a_{n-1} - 6a_{n-2},\ n \geq 2$$

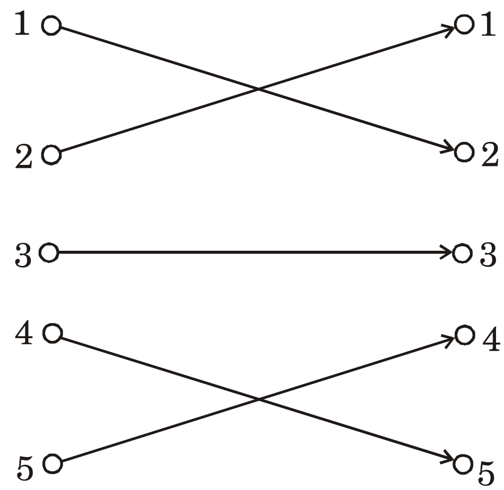
given $a_0 = 1,\ a_1 = 4$. [6]

Or

6. (*a*) Let

$$A = \{1, 2, 3, 4, 5\},\ g : A \rightarrow A$$

is as shown in figure.



Find the composition gog, $go\,(gog)$. Determine whether each is one-to-one or onto function. [6]

(*b*) Let A is set of factors of positive integer m and relation is divisibility on A.

i.e. $R = \{(x, y) \mid x, y \in A, x \text{ divides } y\}$

For $m = 45$, show that POSET $(A, \leq)$ is a lattice. Draw Hasse diagram and give join and meet for the lattice. [6]

(*c*) Let R be a binary relation on the set of all positive integers such that :

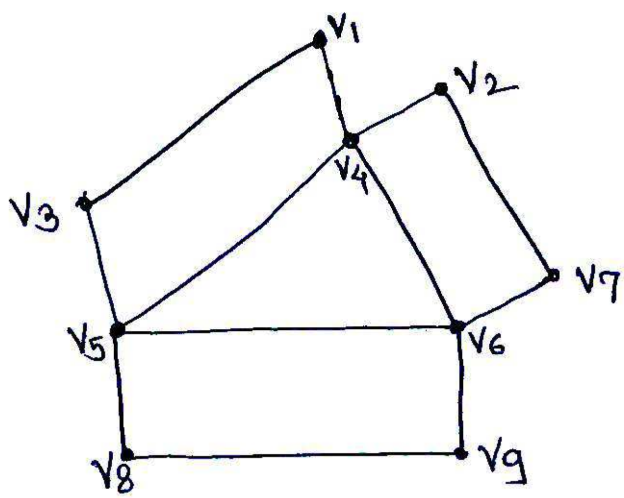
$$R = \{(a, b) \mid a - b \text{ is an odd positive integer}\}$$

Is relation R reflexive, symmetric, antisymmetric, transitive, equivalence and partial ordering relation ? [6]

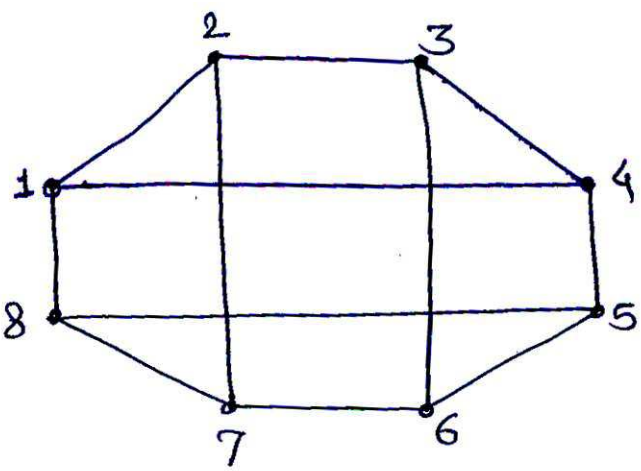
SECTION II

7. (*a*) Determine whether or not each of the graph is bipartite. In each case give the bipartition set or explain why the graph is not bipartite. [6]

(*i*)

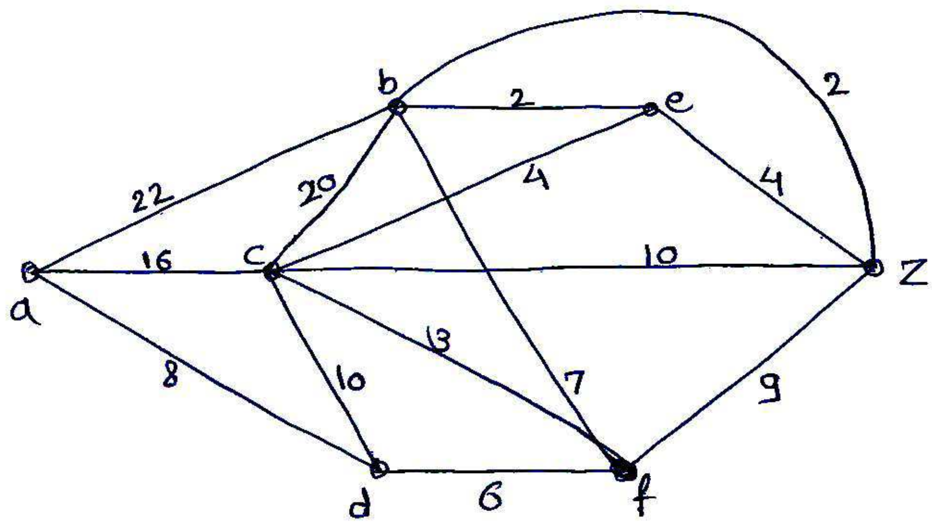


(*ii*)



(*b*) Show that in a connected planar linear graph with 6 vertices and 12 edges, each of the region is bounded by 3 edges. [4]

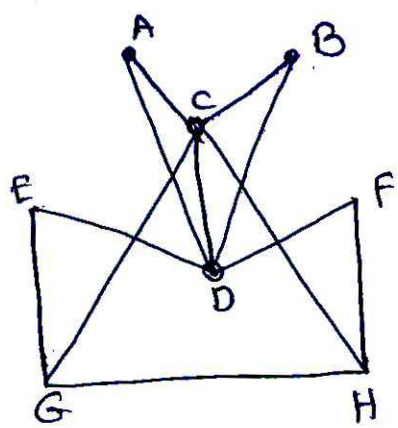
(*c*) Use Dijkstra's algorithm to find the shortest path from a to z. [8]



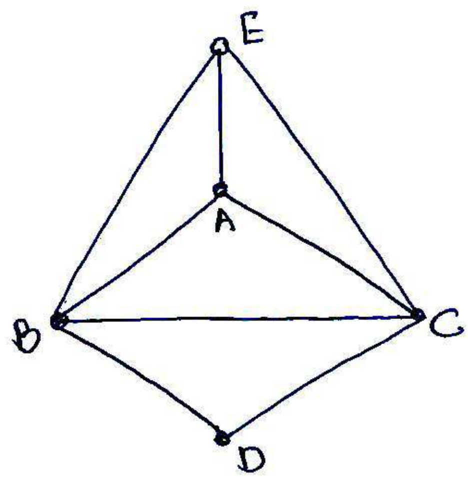
Or

8. (*a*) Determine whether the following graphs are Hamiltonian or Eulerian. [4]

(*i*)

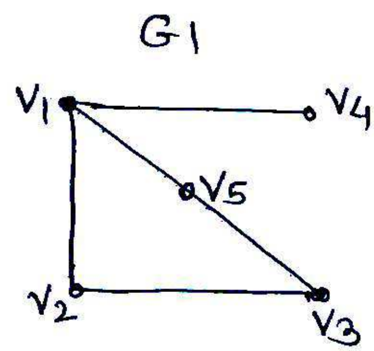


(*ii*)

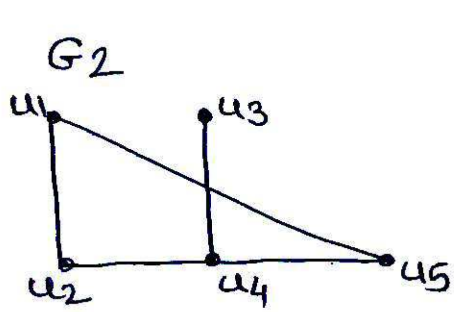


(*b*) Find the adjacency matrices A_1 and A_2 of the graph G_1 and G_2. [4]

(*i*)



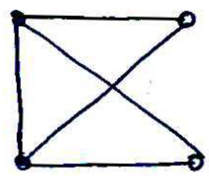
(*ii*)



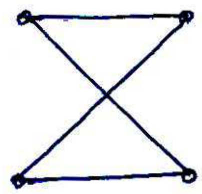
(*c*) For each of the ten pairs of graphs :

[*i–ii*, *i–iii*, *i–iv*, *i–v*, *ii–iii*, *ii–iv*, *ii–v*, *iii–iv*, *iii–v*, *iv–v*] label the graphs so as to exhibit an isomorphism or explain why the graphs are not isomorphic. [10]

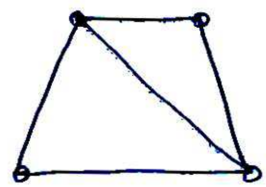
(*i*)



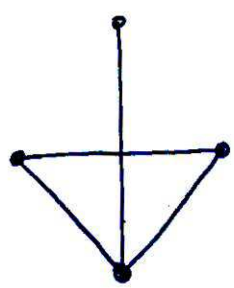
(*ii*)



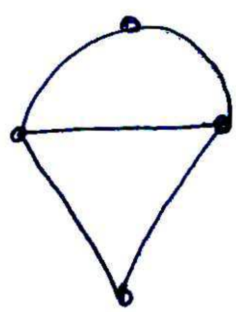
(*iii*)



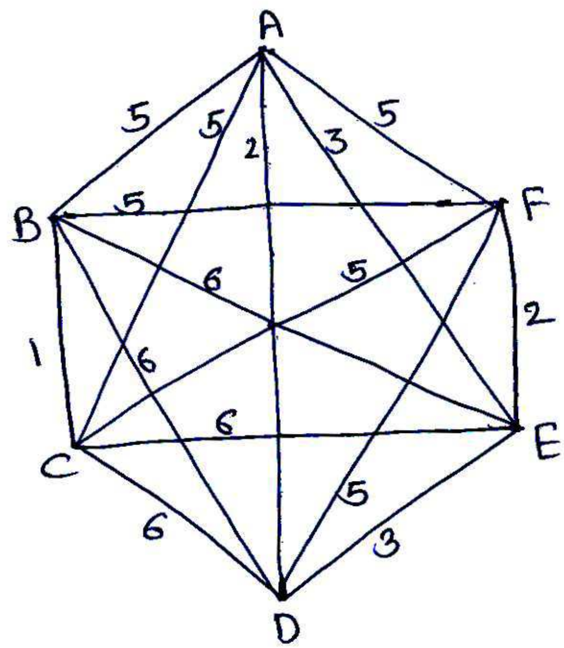
(*iv*)



(*v*)



9. (*a*) Find minimal spanning tree using Kruskal's algorithm. [6]



(*b*) Construct an optimal tree for the weights :

8, 9, 10, 11, 13, 15, 22.

Find the weight of the optimal tree. [6]

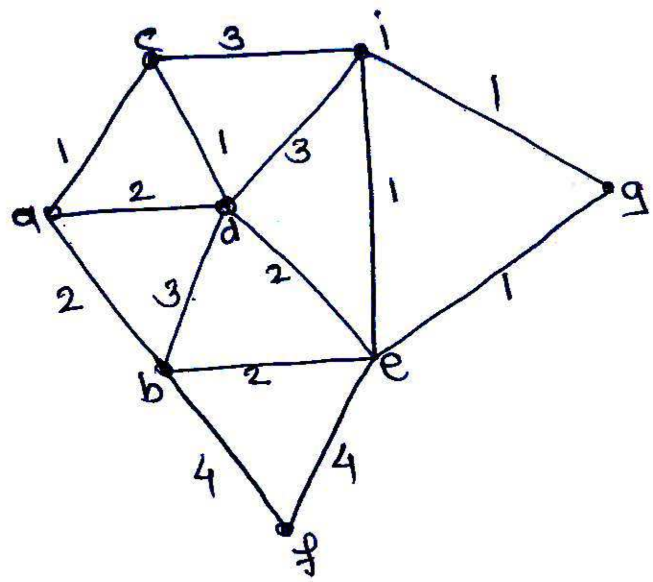
(*c*) Define the following terms with example : [4]

(*i*) Binary Tree

(*ii*) Optimal Binary Tree.

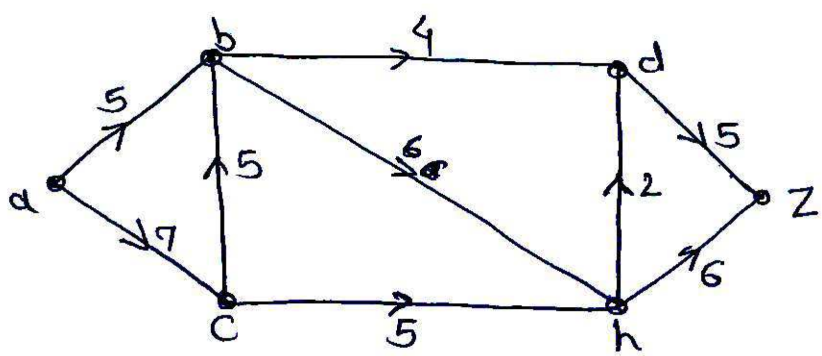
Or

10. (*a*) Use Prim's algorithm to construct minimal spanning tree starting from vertex a. [6]



(*b*) Define spanning tree and minimum spanning tree along with example. [2]

(*c*) Find maximum flow in the transport network using labelling procedure. Determine the corresponding minimum cut. [8]



11. (*a*) A husband and wife appear in an interview for two vacancies in the same post. The probability of husband's selection is 1/3 and that of wife's selection is 1/2. What is the probability that :

(*i*) both of them will be selected ?

(*ii*) only one of them will be selected ?

(*iii*) none of them will be selected ? [6]

(*b*) A group of people is comprised of six from Maharashtra, seven from Gujrat and eight from Goa.

(*i*) In how many ways can a committee of six be formed with two people from each state ?

(*ii*) In how many ways can a committee of seven be formed with at least two people from each state ? [4]

(*c*) There are three bags : Bag A contains 1 white, 2 red, 3 green balls; Bag B contains 2 white, 3 red, 1 green ball; Bag C contains 3 white, 1 red, 2 green balls. Two balls are drawn from a bag chosen at random. They are found to be 1 white and 1 red. Find the probability that two balls come from bag B. [6]

Or

12. (*a*) A company purchased 10,000 transistors; 5000 from supplier A, 3000 from supplier B and 2000 from supplier C. It is known that 2% of supplier A are defective, 4% of supplier B are defective and 5% of suppplier C are defective :

(*i*) If transistor from 10,000 is selected at random, what is the probability that it is defective ?

(*ii*) If transistor selected at random is defective, what is the probability that it is from supplier A ?

(*iii*) Given that transistor selected at random is not from supplier A, what is the probability that it is defective ? [6]

(*b*) A coin is tossed ten times and the sequence of heads and tails observed.

(*i*) How many different sequences are possible ?

(*ii*) In how many of these sequences are there exactly four heads ? [4]

(*c*) In a bolt factory there are four machines A, B, C, D manufacture 20%, 25%, 10% and 45%. Of the total bolts respectively 2% of the bolts manufactured by A, 4% by B, 2% by C and 5% by D are found to be defective. A bolt is chosen at random and is found to be defective. What is the probability that it is manufactured by C ? [6]

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-81

S.E. (Information Technology) (First Semester) EXAMINATION, 2014

COMPUTER ORGANIZATION

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answer Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I and Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12** from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Compare Restoring and Non-Restoring division algorithm. Divide the following numbers using restoring division algorithm and justify your answer :

Dividend = $(21)_{10}$; Divisor = $(03)_{10}$. [10]

P.T.O.

(*b*) Draw IEEE standards for single precision and double precision floating point numbers. Represent $(-84.25)_{10}$ in single precision and double precision format. [8]

Or

2. (*a*) Explain Booth's algorithm to multiply the following pair of numbers : [10]

$$\text{Multiplicand} = (15)_{10} \quad \text{multiplier} = (-\ 6)_{10}.$$

(*b*) Draw IAS (Von Neumann) Architecture and explain function of registers in it. [8]

3. (*a*) State design factors in design of instruction format. Draw instruction format for INTEL Processor and explain various fields in it. [8]

(*b*) Explain with examples the following addressing modes of 8086 : [8]

(*i*) Immediate addressing mode

(*ii*) Register indirect addressing mode

(*iii*) Base index with displacement

(*iv*) Direct addressing mode.

Or

4. (*a*) Draw timing diagram for memory read cycle of 8086 in Minimum Mode and list operations in each T state. [8]

(*b*) Write a note on MAX/MIN mode of 8086. [8]

5. (*a*) Draw and explain single bus organization of the CPU, showing all the registers and data paths. [8]

(*b*) Explain design of multiplier control unit using delay element method. [8]

Or

6. (*a*) Explain the sequence of operations needed to perform processor functions : [8]

(*i*) Fetching a word from memory

(*ii*) Performing an arithmetic or logical operation.

(*b*) Compare :

(*i*) Horizontal and vertical microinstruction representation

(*ii*) Hardwired and microprogrammed control unit. [8]

SECTION II

7. (*a*) What is cache coherence and discuss MESI protocol ? [8]

(*b*) Discuss set associative and fully associative cache mapping techniques with respect to mapping function, address structure, merits and demerits. [10]

Or

8. (*a*) What is virtual memory ? Explain address translation mechanism for converting virtual address into physical address with neat diagram. [10]

(*b*) Write short notes on (any *two*) : [8]

(1) SRAM

(2) DVD

(3) RAID

(4) EEPROM.

9. (*a*) What is DMA ? Explain DMA operation with a diagram. Also explain data transfer modes in DMA. [8]

(*b*) Compare : [8]

(*i*) Memory mapped I/O and I/O mapped I/O

(*ii*) Programmed I/O and interrupt driven I/O.

Or

10. (*a*) List the features of IC 8255 and IC 8251. [8]

(*b*) Explain the working principle of the following : [8]

(1) Laser printer

(2) Video displays.

11. (*a*) Compare closely coupled and loosely coupled multiprocessor configurations. Explain loosely coupled multiprocessor configuration. [10]

(*b*) What is cluster ? State the advantages of clustering. [6]

Or

12. (*a*) Compare the following : [8]

(*i*) RISC and CISC

(*ii*) UMA and NUMA.

(*b*) Explain briefly : [8]

(*i*) Instruction level pipelining

(*ii*) Superscalar architecture.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-82

S.E. (I.T.) (First Semester) EXAMINATION, 2014

FUNDAMENTAL OF DATA STRUCTURE

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. **:—** (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two sections should be written in separate answer-books.

(*iii*) Figures to the right indicate full marks.

(*iv*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Write different ways to represent constants in C language. [6]

(*b*) What is structure in C ? Give its applications. [4]

(*c*) What do you mean by precedence and associativity of operators ? [6]

Or

2. (*a*) Explain macro and function with examples. [6]

(*b*) Explain scope of a variable with examples. [4]

(*c*) Write output of the following code segment : [6]

(*i*)
```
char s[10] = "abcde";
char *p = &s[2];
printf("%c %c %c", *p++,(*p)++,*p);
```

(*ii*)
```
printf("%o %x %c", 65, 65, 65);
```

3. (*a*) What is sequential file ? Explain with applications. [6]

(*b*) Explain call by value and call by reference with example. [8]

(*c*) Write a C function to find length of a string without using library functions. [4]

Or

4. (*a*) Is passing a structure to a function by value efficient ? Explain. [4]

(*b*) Write a C program to add and multiply two matrices. [8]

(*c*) What is recursion ? Write and explain recursive function to find Fibonacci series. [6]

5. (*a*) What is an abstract data type ? Explain with an example. [4]

(*b*) Explain linear and non-linear data structures. [6]

(*c*) What do you mean by time complexity of an algorithm ? Explain any *one* notation to analyze time complexity. [6]

Or

6. (*a*) Write an algorithm to find the smallest element in an array of integers and analyze its time complexity. [8]

(*b*) Compare Big Oh, Omega and Theta notations used to analyze time complexity. [6]

(*c*) What is persistent data structure ? [2]

SECTION II

7. (*a*) Write non-recursive pseudo C code for linear and binary search. State their time complexities. [12]

(*b*) Trace the action of recursive merge sort for the given list :[6]

17, 20, 7, 10, 5, 2, 4, –11, 18.

Or

8. (*a*) Write pseudo C code for quick sort and sort the following list in ascending order. Show output after each pass for the following input : [10]

17, 8, –9, 2, 0, –5, 7, 20, 11, 16.

(*b*) Explain similarities and differences between bubble and selection sort. Justify why selection sort is more efficient. [8]

9. (*a*) Write an algorithm to find transpose of a sparse matrix using fast transpose algorithm. Analyze its time complexity. [12]

(*b*) What is sparse matrix ? List its applications. [4]

Or

10. (*a*) Explain column-major representation of a matrix with example. [6]

(*b*) Represent the following polynomial using one-dimensional array. [4]

(*i*) $x^3y^2 - 2xy + y^4x$

(*ii*) $7x^3 + 4x^2y^2 + 6$.

(*c*) Write an algorithm to find transpose of a sparse matrix using simple/slow transpose algorithm. [6]

11. (*a*) Write a function to add two decreasing ordered polynomials with positive exponents, represented using circular SLL with header node exponent field is set to –1. Analyze time complexity. [10]

(*b*) Write a short note on GLL. [6]

Or

12. (*a*) Give node structure to represent a list of integers using DLL and write C functions for the following operations : [8]

(*i*) Display list forward

(*ii*) Display list reverse

(*iii*) Find greatest element in the list.

(*b*) Why linked organization is preferred over sequential organization in list manipulation ? [4]

(*c*) Write applications of linked lists. [4]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8**

Seat No.	

[4657]-92

S.E. (Printing) (First Semester) EXAMINATION, 2014

STRENGTH OF MACHINE ELEMENTS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Answers to the two Sections should be written in separate answer-books.

(*ii*) Neat diagrams must be drawn wherever necessary.

(*iii*) Figures to the right indicate full marks.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts and electronic pocket calculator is allowed.

(*v*) Assume suitable data, if necessary.

SECTION I

Unit I

1. (*a*) Draw stress strain diagram for brittle materials. [8]

(*b*) An axial pull of 35000 N is acting on a bar in both directions (right and left) consisting of three lengths 20 cm, 25 cm and 22 cm. The diameters of bar are 2 cm, 3 cm and 5 cm for lengths 20 cm, 25 cm and 22 cm respectively. If Young's modulus = 2.1×10^5 N/mm^2, determine :

(*i*) Stress in each section

(*ii*) Total extension of bar. [8]

Or

2. (*a*) Define and explain the following terms : [8]

(*i*) Linear strain

(*ii*) Shear stress

(*iii*) Young's modulus

(*iv*) Shear strain.

(*b*) If a tension test bar is found to taper uniformly from (D – a) diameter to (D + a). Prove that the error involved in using mean diameter to calculate the Young's modulus is $(10a/D)^2$ percent. [8]

Unit II

3. Draw shear force and bending moment diagram for a cantilever beam loaded as shown in Fig. 1. [18]

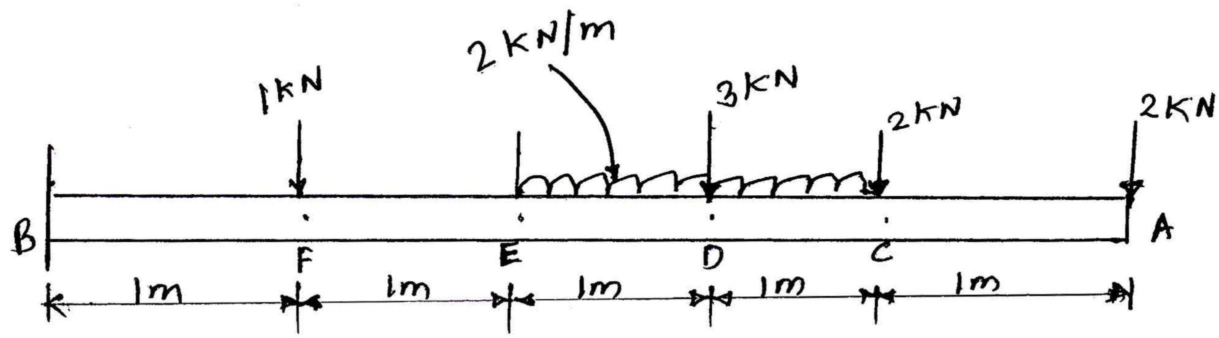


Fig. 1

Or

4. A beam of 8 m span is hinged at each end. It carries a UDL of 2 kN per m on the left half of the beam along with a 25 kN load 6 m from left side. In addition the beam is also subjected to couples of 20 kN-m in counterclockwise direction at left hand support and 30 kN-m in clockwise direction at right hand. The reactions at the supports are 11 kN and 22 kN respectively. Draw shear force and bending moment diagram indicating the principal values. (Refer Fig. 2). [18]

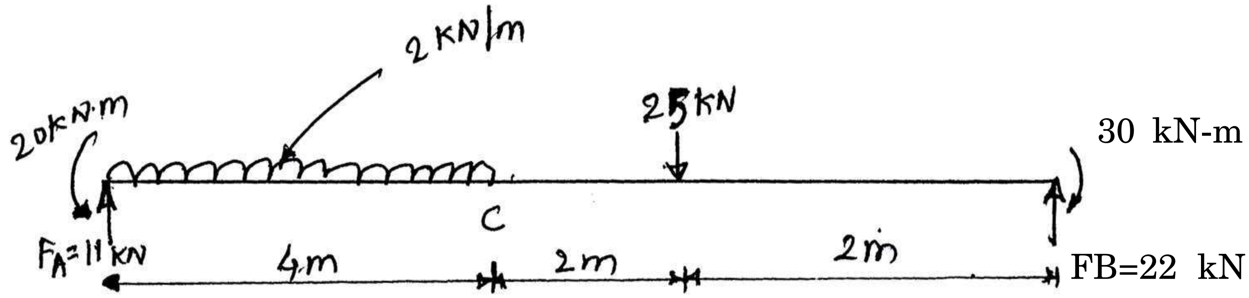


Fig. 2

Unit III

5. (*a*) With usual notation derive bending formula. [8]

(*b*) A symmetrical section 200 mm deep has a moment of inertia 2.26×10^{-5} about neutral axis. Determine the longest span over which when simply supported beam would carry a uniformly distributed load of 4 kN/m run without the stress due to bending exceeding 125 MN/m^2. [8]

Or

6. A beam of cross-section of an isosceleus triangle is subjected to shear force of 30 kN at a section where base width = 150 mm and height = 450 mm. Determine : [16]

(*i*) Horizontal shear stress at the neutral axis.

(*ii*) The distance from the top of beam where the shear stress is maximum.

(*iii*) The value of maximum shear stress.

SECTION II

Unit IV

7. (*a*) State Euler's formula for both ends hinged condition and state assumptions made while deriving it. [8]

(*b*) Determine section of cast iron hollow cylindrical column 3 m long with both ends firmly built in, if it carries an axial load of 800 kN. The ratio of internal to external diameter is 5/8. Use factor of safety 4. Take permissible compressive stress 550 N/mm^2 and Rankine constant for both ends hinged case is 1/1600. [8]

Or

8. (*a*) State assumptions made in theory of pure torsion. [4]

(*b*) Prove that maximum torque transmitted by a circular solid shaft when subjected to torsion is given by :

$$T = \frac{\pi \tau D^3}{16},$$

where D = diameter of solid shaft, τ = maximum shear stress. [8]

(*c*) The shearing stress of a solid shaft is not to exceed 40 N/mm^2, when the torque transmitted is 20000 N-m. Determine the minimum diameter of the shaft. [4]

Unit V

9. (*a*) What is strain energy ? What is stress developed in member if weight w falls through height 'h' on a member of length L ? [6]

(*b*) A machine component is subjected to stresses as shown in Fig. 3.

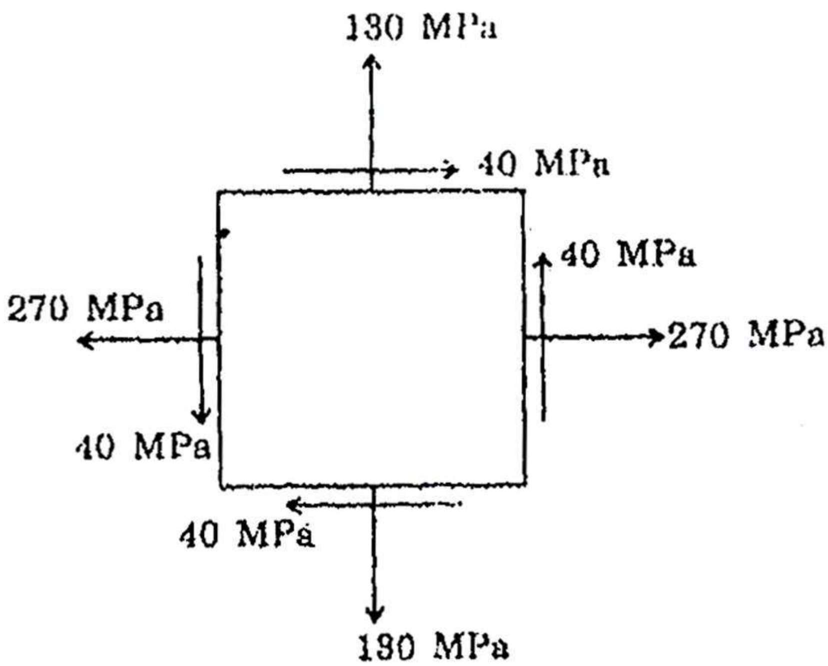


Fig. 3

Calculate :

(*i*) Principal stresses and their directions

(*ii*) Maximum shear stresses and position of maximum shear plane

(*iii*) Normal stress on plane of maximum shear. [10]

Or

10. (*a*) Explain the procedure for Mohr's circle for determining principal planes and principal stresses. [8]

(*b*) Explain Maximum Normal Stress Theory and Maximum Shear Stress Theory. [8]

Unit VI

11. (*a*) Derive equation for slope and deflection for simply supported beam subjected to u.d.l. of intensity '*w*' N/m. Also find maximum deflection. (Refer Fig. 4) [8]

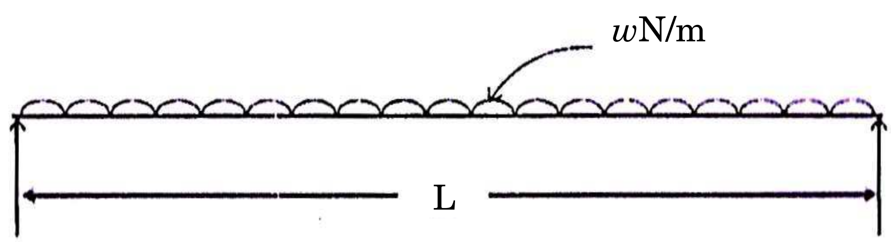


Fig. 4

(*b*) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from left end. Find :

(*i*) Deflection under each load

(*ii*) Maximum deflection

(*iii*) The point at which maximum deflection occurs.

$E = 2 \times 10^5$ N/mm^2, $I = 85 \times 10^6$ mm^4.

Use Macaulay method. [10]

Or

12. (*a*) Explain Macaulay's method for finding slope and deflection. [10]

(*b*) A beam, 3 m long simply supported at its ends, is carrying a point load w at the centre. If the slope at ends of the beam should not exceed 1°. Find the deflection at the centre of the beam. [8]

Total No. of Questions—6] [Total No. of Printed Pages—2

Seat No.	

[4657]-93

S.E. (Printing) (I Sem.) EXAMINATION, 2014

BASIC ELEMENTS OF PRINTING TECHNOLOGY

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Attempt *All* questions.

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

SECTION I

1. Solve any *two* : [18]

(*a*) Explain Computer to Plate for offset printing process.

(*b*) Explain surface preparation for Gravure printing process.

(*c*) Explain the term Typography and its importance in graphic designing.

2. Answer any *one* : [16]

(*a*) Explain the direct and indirect screen printing process.

(*b*) Explain the working principle of Flexo printing machine.

3. Explain any *two* operations : [16]

(*a*) Perfect Binding

(*b*) Spot Lamination

(*c*) Embossing.

P.T.O.

SECTION II

4. Answer any *two* : [16]

(*a*) Explain the different elements of paragraph style.

(*b*) Explain the different stages of designing.

(*c*) Explain *five* different alignments and their applications for page layouting.

5. What different parameters have to consider for Newspaper design ? [16]

Or

What different parameters have to consider for Text book design ?

6. Explain the typographical based software. [18]

Or

Explain the software used for Photo-Editing.

Total No. of Questions—**12**] [Total No. of Printed Pages—**4+1**

Seat No.	

[4657]-94

S.E. (Printing) (First Semester) EXAMINATION, 2014

PRINTING DIGITAL ELECTRONICS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Solve Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6**, Q. No. **7** *or* Q. No. **8**, Q. No. **9** *or* Q. No. **10**, Q. No. **11** *or* Q. No. **12**.

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

(*iii*) Draw neat sketch wherever necessary.

SECTION I

1. Perform the following conversions :

(*a*) (10010011)XS3 to Binary

(*b*) $(326)_8$ to Decimal, Binary and Excess-3

(*c*) $(AFB)_{16}$ to BCD

(*d*) (100100010111)BCD to Binary. [18]

Or

2. (*a*) Find the circuit to convert 4-bit binary numbers to 4-bit Excess-3 numbers. Write Truth table K-maps and circuit. [10]

(*b*) Write short notes on : [8]

(*i*) Bar code and its applications

(*ii*) ASCII code.

3. (*a*) Implement using NAND-NAND logic : [8]

$$Y = AC + BC + AB + D.$$

(*b*) The functionality of a hand held machine is expressed as :

$$f(A, B, C, D) = \Sigma m(4, 6, 10, 12, 13, 15) + d(1.2.3)$$

Minimize using K-map and draw the simplified diagram. [8]

Or

4. (*a*) Compare TTL, CMOS and ECL logic families on the basis of the following : [4]

(*i*) Propagation delay

(*ii*) Noise margin.

(*b*) Prove that : [12]

(*i*) $A \cdot (B + C) = (A.B) + A.C$

(*ii*) $A + \overline{A} \cdot B + A.\overline{B} = A + B$

(*iii*) $A + (B + C) = (A + B) + C$.

5. (*a*) Design a half adder circuit. [4]

(*b*) Design a half subtractor. [4]

(*c*) Design a logic circuit that has 3 inputs and one output. The output is high when the sum of all the bits in a number is 1. The output is low otherwise. [8]

Or

6. (*a*) Design a one bit comparator. [4]

(*b*) Perform the following (any *three*) : [12]

(*i*) $(111101) \times S_3 - (10001) \times S_3$

(*ii*) Perform BCD addition and write your answer in BCD

$$(100111)_2 + (36)_{10}$$

(*iii*) $(11100)_2 \ / \ (110)_2$.

SECTION II

7. (*a*) Explain clocked SR flip-flop with the help of truth table. Using SR flip-flop explain T flip-flop. [10]

(*b*) Design and explain mod 6-counter. Draw timing diagrams. [8]

Or

8. (*a*) Design and explain JK flip-flop. Write truth table. [10]

(*b*) Explain any *one* application of counter in printing. [8]

9. (*a*) What is ADC ? Explain the working of any *one* type of ADC with a neat diagram. [8]

(*b*) Explain Programmable logic with example. [8]

Or

10. (*a*) Explain seven segment LED display. [8]

(*b*) What are memories ? State and explain various types of memories. [8]

11. (*a*) Applications of digital electronics in printing. [8]

(*b*) Write short notes on (any *two*) : [8]

(*i*) Joystick

(*ii*) Floppy Disk

(*iii*) Digital camera.

Or

12. Write short notes on (any *four*) : [16]

(*a*) Digital scanner

(*b*) Operation of mouse

(*c*) Input-Output devices of a computer

(*d*) Serial and Parallel ports

(*e*) Keyboard.

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

Seat No.	

[4657]-95

S.E. (Printing) (First Semester) EXAMINATION, 2014

TECHNOLOGY OF PRINTING MATERIALS

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) *All* questions are compulsory.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Explain the role of Copper as an image carrier in the Gravure Printing. [8]

(*b*) Describe the classification of Polymerization. [8]

Or

(*a*) Explain the role of Aluminium in printing. [8]

(*b*) Explain various types of plastics used in packaging. [8]

P.T.O.

2. (*a*) Explain the procedure of making Negatives and Positives in brief. [8]

(*b*) Explain the role of various ingredients used in Silver Halaid emulsion. [8]

Or

(*a*) Explain the procedure of preparing the screen by Hand duffing method. [8]

(*b*) Explain the role of fountain solution in the lithography. [8]

3. (*a*) Explain the type of ink used in Pad printing process with properties. [9]

(*b*) Explain the role of additives in printing ink along with suitable examples. [9]

Or

(*a*) Explain the procedure of measuring the viscosity of the paste ink. [9]

(*b*) Explain the different types of pigments used in printing inks. [9]

SECTION II

4. (*a*) Explain the Light fastness and Rub resistance properties of ink with suitable examples. [8]

(*b*) Describe the procedure of determining moisture content in the paper. [8]

Or

(*a*) Differentiate between Process inks and Spot/Special inks. [8]

(*b*) Write the importance of thickness of the paper with reference to the procedure of thickness gauge. [8]

5. (*a*) Draw a neat diagram of Fourdrinier machine and name the parts. [8]

(*b*) State the importance of the fillers in the paper. [8]

Or

(*a*) Comment on any *two* : [8]

(*i*) Beater

(*ii*) Conical refiner

(*iii*) Hydrapulper.

(*b*) Describe in detail the theory of internal sizing in the paper. [8]

6. (*a*) Describe in short any *two* : [9]

(*i*) Bursting strength

(*ii*) Acidity and pH

(*iii*) Brightness.

(*b*) Write in detail the procedure of determining the grammage of paper. [9]

Or

(*a*) Comment on any *two* : [9]

(*i*) Tensile strength

(*ii*) Dimensional stability

(*iii*) Opacity.

(*b*) Describe in detail the procedure of determining the ash content in the paper and state the importance of ash content in paper with respect to printing. [9]