[4062] – 180

S.E. (Printing) Examination, 2011
THEORY OF PRINTING MACHINES
(2008 Course)

Time : 3 Hours Max. Marks : 100

Instructions : *1) Answers to the **two** Sections should be written in **separate** books.*
*2) **Neat** diagrams must be drawn **wherever** necessary.*
*3) Black figures to the **right** indicate **full** marks.*
*4) Your answers will be valued as a **whole**.*
*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*
*6) Assume **suitable** data, **if necessary**.*

SECTION – I

1. a) What are quick return mechanisms ? Explain any one with application. **8**

b) Distinguish between :

i) Kinematics and Dynamics

ii) Machine and Mechanism **8**

OR

2. a) How are Kinematic pairs classified ? Explain with examples. **8**

b) Explain any two inversions of slider crank mechanism. **8**

3. a) What are centripetal and tangential components of acceleration ? **4**

b) In the mechanism shown in Fig. 1, crank OA rotates at 210 rpm clockwise. Find acceleration of slider D and angular acceleration of link CD. **12**

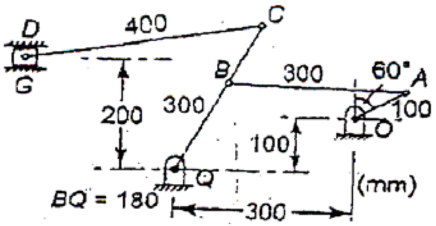

Fig1

OR

P.T.O.

4. a) What is an acceleration image ? Explain its use to find acceleration of offset point on a link. **6**

b) Crank OA of mechanism shown in Figure 2 rotates at 60 rpm. Find angular acceleration of links AC and BD. **10**

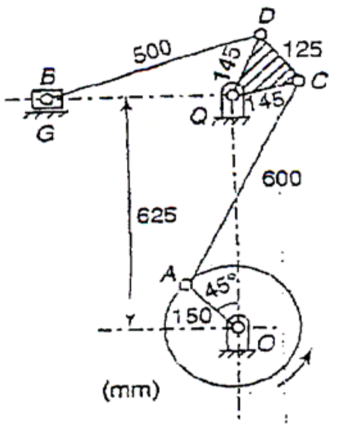

Fig. 2

5. a) What is the Coriolis acceleration component ? How it is determined ? **6**

b) Fig. 3 shows the Scotch Yoke mechanism crank OP has an angular velocity of 10 rad/sec and an angular acceleration of 30 rad/sec^2. Determine acceleration of slider pin the guide and horizontal acceleration of guide. **12**

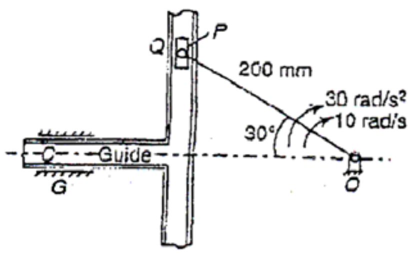

Fig. 3

OR

6. a) In the pump mechanism shown in Fig. 4, OA = 320 mm, AC = 680 mm, OQ = 650 mm. Find : **12**

   i) Sliding acceleration of slider C relative to cylinder walls

   ii) Angular acceleration of piston rod. Take ω_{OA} = 20 rad/sec clockwise.

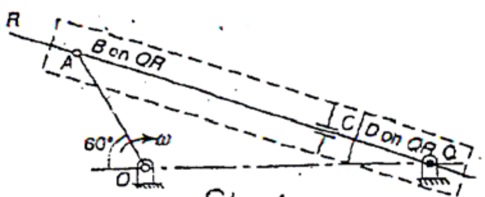

Fig. 4

   b) What is velocity of rubbing ? How it is found ? **6**

SECTION – II

7. a) Explain multi-plate clutch with neat sketch. **6**

   b) A machine is driven by a constant speed shaft running at 300 rpm by a single plate-clutch with both faces effective. The moment of inertia of rotating parts is 5 kg-m^2. External and internal diameters of the plate are 200 mm and 125 mm. Axial load is limited to 0.1 N/mm^2 and μ is 0.25. If the machine is at rest and clutch is suddenly engaged, how much time will be required to reach the full speed by the machine ? Also find the energy dissipated during slipping. **10**

OR

8. a) Explain uniform pressure and uniform wear theory. **6**

   b) A conical clutch has a cone angle of 30°. If pressure between contacting surfaces is limited to 3.5×10^5 N/m^2 and breadth of conical surface is $\frac{1}{3}$ of mean radius, find dimensions of the contacting surfaces to transmit 22 kW at 2000 sec/min. Assume uniform wear theory and μ is 0.15. **10**

9. a) What are various types of brakes ? Describe briefly. **8**

b) A band brake having drum diameter 400 mm provides a braking torque 2000 N-m. The ends of the band are attached to two pins on opposite sides of fulcrum of lever at 100 mm and 20 mm from fulcrum θ = 225° and μ = 0.3. Find operating force at end of lever 600 mm long for both directions of drum rotation. **10**

OR

10. a) Describe the working of a band and block brake. **8**

b) A band and block brake is lined with 12 equal blocks each subtending an angle of 15° at the centre of brake drum of 480 mm diameter. Radial thickness of blocks is 60 mm μ = 0.4 and two ends of the band are attached to the pins on opposite sides of fulcrum of lever at 200 mm and 50 mm. Find least force to be applied at the end of brake lever at a distance of 400 mm from fulcrum to absorb 200 kW at 25 rad/sec. **10**

11. a) Derive the ratio of belt tensions in a flat belt drive. **6**

b) A flat belt of mass 1.2 kg/m is used to connect two pulleys of 1.5 m diameter each and shafts are parallel slipping is found to be at 325 rpm when resisting moment of driven shaft is 1150 N-m. When speed is lowered to 210 rpm the resisting moment on driven shaft is 1465 N-m for slipping. Assuming that belt is obeys Hooke's law and initial tension is constant find coefficient of friction between belt and pulley. **10**

OR

12. a) Derive the expression length of belt for open belt drive. **8**

b) Classify belt drives. **8**

———————

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

[4062]-101

S.E. (Civil) (First Semester) EXAMINATION, 2011

ENGINEERING MATHEMATICS

Paper 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 attempt 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*) Answer to the 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 rules, electronic pocket calculator and steam table is allowed.

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

SECTION I

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

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

(*ii*) $$\frac{d^2y}{dx^2} - y = x\sin x + e^x(1+x^2)$$

P.T.O.

(iii) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = e^x \tan x$ (By variation of parameters)

(iv) $x^2 \frac{d^3y}{dx^3} + 3x\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 \log x$

(v) $\frac{d^2y}{dx^2} + 4y = \sin x \sin 2x$.

(b) Solve the following : [5]

$(D-1)x + Dy = 2t + 1$

.

Or

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

(i)

(ii) $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 2\log x + \frac{1}{x} + \frac{1}{x^2}$

(iii) $\frac{d^2y}{dx^2} + y = x \sin x$ (By variation of parameters)

(iv) $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin[\log(1+x)]$

(v) $\frac{d^3y}{dx^3} - 7\frac{dy}{dx} - 6y = e^{2x}(1+x)$.

(b) Solve : [5]

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

$u\,(1, t) = 0°C$

3. (*a*) The differential equation satisfied by a beam, uniformly loaded with one end fixed and second subjected to a tensile force P is given by :

$$\mathrm{EI}\,\frac{d^2y}{dx^2} - \mathrm{P}y = -\frac{\mathrm{W}x^2}{2}.$$

Show that the elastic curve for the beam under conditions :

$y = 0$ and $\dfrac{dy}{dx} = 0$ when $x = 0$ is given by :

$$y = \frac{\mathrm{W}}{2\mathrm{P}}\left[x^2 + \frac{2}{n^2} - \frac{e^{nx}}{n^2} - \frac{e^{-nx}}{n^2}\right]$$

where $\dfrac{\mathrm{P}}{\mathrm{EI}} = n^2$. [8]

(*b*) The temperature at any point of an insulated metal rod of one meter length is governed by the differential equation :

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

Find $u\,(x, t)$ subject to the following conditions :

(*i*)

(*ii*)

(*iii*) . [8]

Or

4. (*a*) It is found experimentally that a weight of 3 kg. Stretches a spring to 15 cm. If the weight is pulled down 10 cm below equilibrium position and then released :

(*i*) find the amplitude, period and frequency of motion

(*ii*) determine the position, velocity and acceleration as a function of time. [8]

(*b*) Solve the equation :

subject to the following conditions :

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

(*ii*)

(*iii*)

(*iv*) . [8]

5. (*a*) Solve the following system of equations by Gauss-Seidel iteration method :

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

[9]

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

to find y at $x = 0.4$ taking $h = 0.2$. [8]

Or

6. (*a*) Solve the equation :

$$\frac{dy}{dx} = x - y^2 \quad ; \quad y(0) = 1$$

to find y at $x = 0.4$ using modified Euler's method taking $h = 0.2$. [9]

(*b*) Solve the following system of equations by Cholesky's method :

$$2x + 4y \pm z = 5$$

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

$$3x + 2y + 7z = 4$$

. [8]

SECTION II

7. (*a*) The first four moments of a distribution about the value 4 of a variable are –1.5, 17, –30 and 108. Find the moments about the mean. Calculate coefficient of Skewness and Kurtosis. [6]

(*b*) From a group of ten students, marks obtained by each student in papers of Mathematics and Electronics are given as :

Marks in Mathematics (x)	**Marks in Electronics (y)**
23	25
28	22
42	38
17	21
26	27
35	39
29	24
37	32
16	18
46	44

Calculate coefficient of correlation. [6]

(*c*) Probability of man now aged 60 years will live upto 70 years of age is 0.65. Find the probability of out of 10 men sixty years old, 8 or more will live upto the age of 70 years. [5]

Or

8. (*a*) For the following distribution find first four moments about the mean : [6]

x	f
2	5
2.5	38
3	65
3.5	92
4	70
4.5	40
5	10

(*b*) The regression equations are $8x - 10y + 66 = 0$ and $40x - 18y = 214$. The value of variance of x is 9.

Find :

(*i*) The mean value of x and y.

(*ii*) The correlation coefficient between x and y.

(*iii*) The standard deviation of y. [6]

(*c*) A random sample of 200 screws is drawn from a population which represents the size of screws. If a sample is distributed normally with a mean 3.15 cm and standard deviation 0.025 cm, find expected number of screws whose size falls between 3.12 cm and 3.2 cm. [5]

Given :

z =	1.2 ,	2.0
Area =	0.3849 ,	0.4772

9. (*a*) The position vector of a particle at time t is :

.

Find the condition imposed on m by requiring that at time $t = 1$, the acceleration is perpendicular to the position vector. [5]

(*b*) Find the directional derivative of :

$$\phi = 4xz^3 - 3x^2y^2z \quad \text{at} \quad (2, \ -1, \ 2)$$

along tangent to the curve

$$x = e^t \cos t, \quad y = e^t \sin t, \quad z = e^t \quad \text{at} \quad t = 0\,.$$ [5]

(*c*) Show that :

is irrotational. Find scalar potential f such that :

$$\overline{\text{F}} = \nabla\phi\,.$$ [6]

Or

10. (*a*) If a particle P moves along the curve $r = a e^{\theta}$ with constant angular velocity w, then show that the radial and transverse components of its velocity are equal and its acceleration is always perpendicular to radius vector and is equal to $2r$w^2. [5]

(*b*) Find the function $f(r)$ so that $f(r)\bar{r}$ is solenoidal. [5]

(c) Establish any *two* : [6]

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

(ii) $$\nabla \left(\frac{\bar{a} \cdot \bar{r}}{r^n} \right) = \frac{\bar{a}}{r^n} - \frac{n(\bar{a} \cdot \bar{r})\bar{r}}{r^{n+2}}$$

(iii) $$\nabla \cdot \left(\frac{\bar{a} \times \bar{r}}{r} \right) = 0.$$

11. (a) Verify Green's theorem for the field :

$$\bar{\mathrm{F}} = x^2 \, \hat{i} + xy \, \hat{j}$$

over the region R enclosed by $y = x^2$ and the line $y = x$. [6]

(b) Evaluate :

$$\iint_s (x^3 \, \hat{i} + y^3 \, \hat{j} + z^3 \, \hat{k}) \cdot d\bar{s}$$

where s is the surface of the sphere $x^2 + y^2 + z^2 = 16$. [6]

(c) Evaluate :

$$\iint_s (\nabla \times \bar{\mathrm{F}}) \cdot d\bar{s}$$

where $$\bar{\mathrm{F}} = (x^3 - y^3) \, \hat{i} - xyz \, \hat{j} + y^3 \, \hat{k}$$

and s is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the plane $x = 0$. [5]

Or

12. (*a*) Evaluate :

$$\int_c \bar{\mathrm{F}} \,.\, d\bar{r}$$

where $\bar{\mathrm{F}} = (2xy + 3z^2)\,\hat{i} + (x^2 + 4yz)\,\hat{j} + (2y^2 + 6xz)\,\hat{k}$

and c is the curve $x = t$, $y = t^2$, $z = t^3$ from $t = 0$ to $t = 1$. [6]

(*b*) Show that the velocity potential :

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

satisfies the Laplace's equation. Also determine the stream lines. [6]

(*c*) Show that :

$$\iiint_v \frac{dv}{r^2} = \iint_s \frac{\bar{r}.\hat{n}}{r^2}\, ds.$$ [5]

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

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S.E. (Civil) (I Sem.) EXAMINATION, 2011

BUILDING MATERIALS AND CONSTRUCTION

(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*) Comment, if no foundation is provided to the building. [4]

(*b*) Define Plinth. Explain step by step procedure of plinth filling with sketch. [6]

(*c*) Explain the following terms with sketches : [6]

(*i*) Queen Closer

(*ii*) Corbel

(*iii*) Through Stone

(*iv*) Toothing.

Or

2. (*a*) Comment, if foundation is provided above the ground level. [4]

(*b*) Differentiate between shallow foundation and deep foundation with definition sketches. [6]

(*c*) State functions of Bond in masonry. Explain Flemish Bond. [6]

3. (*a*) Explain laying of concrete block with sketch. [4]

(*b*) Write short notes on the following : [6]

(*i*) Reinforced Brick Column

(*ii*) Cavity Wall.

(*c*) Define formwork. State the essential requirements of form-work to be provided for bridge construction. [6]

Or

4. (*a*) Define hallow concrete block. Explain detailed procedure of manufacturing of concrete blocks. [6]

(*b*) Explain different combinations of composite masonry with sketches. [4]

(*c*) Draw the sketch of beam formwork. Give names of maximum parts, also mention their sizes. [6]

5. (*a*) Explain with a neat sketch the construction of concrete flooring. [6]

(*b*) Explain with neat sketches the following terms : [6]

(*i*) Skirting

(*ii*) Dado

(*iii*) Bed Plates

(*iv*) Gable end.

(*c*) Write a short note on Lean to Roof. [6]

Or

6. (*a*) State the different brand names of flooring tiles available in market. Also state their sizes available in market. [6]

(*b*) Explain step by step procedure of fixing A.C. sheet with sketches. [6]

(*c*) Draw sketch of sloping roof truss and show on it principal rafter, common rafter, Ridge cover, Effective span. [6]

SECTION II

7. (*a*) Draw neat and labelled sketch of paralled door. Show different parts with dimensions. [6]

(*b*) Explain casement window with sketch. [6]

(*c*) State the functions of weather shed. Explain defects in painting. [6]

Or

8. (*a*) Define the following technical terms : [6]

(*i*) Meeting style

(*ii*) Hold fast

(*iii*) Chajja

(*iv*) Scaffolding.

(*b*) Write down the methods of construction of arches and describe how the arch opening is constructed in Residential building. [6]

(*c*) Explain objectives of plastering. State market names of paints. [6]

9. (*a*) Explain step by step procedure of Design of doglegged staircase. [6]

(*b*) Explain safety measures to be adapted in construction of Residential building. [4]

(*c*) State the types of shoring. Describe ranking shores. [6]

Or

10. (*a*) Write short notes on Escalators. [4]

(*b*) Explain the following technical terms with sketches : [6]

(*i*) Newel Post

(*ii*) Tread

(*iii*) Nosing

(*iv*) Balustrade.

(*c*) Which safety measures will be suggest in case of high rise building in crowded area ? [6]

11. (*a*) What is timber ? Explain the defects in timber with sketches. [6]

(*b*) Write short notes on : [6]

(*i*) Thatch

(*ii*) Glass Cladding.

(*c*) Write down Engineering properties of : [4]

(*i*) Timber

(*ii*) Gypsum.

Or

12. (*a*) What is seasoning of timber ? Explain any *one* method of it. [6]

(*b*) State different types of Glasses and Plastics used in construction. [6]

(*c*) Write a short note on ceramic product. [4]

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

[4062]-103

S.E. (Civil) (First Semester) EXAMINATION, 2011

STRENGTH OF MATERIALS

(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 write indicate full marks.

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

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

SECTION I

1. (*a*) A mild steel bar of 25 mm diameter and 200 mm gauge length has an extension of 0.15 mm under a maximum load of 75 kN. The load at elastic limit is 160 kN and maximum load is 250 kN. Total extension is 55 mm. The diameter at fracture is 18.5 mm.

Find :

(*i*) Elastic limit stress

(*ii*) Young's Modulus

(*iii*) Percentage elongation

(*iv*) Percentage reduction in area. [8]

(*b*) A rod is composed of three segments as shown in Fig. 1 and held in two rigid supports. Find stress developed in each material if the temperature of the system is raised by 50ºC under the following two conditions :

(*i*) If supports are perfectly rigid supports

(*ii*) If right hand support yield by 0.20 mm.

Assume for steel – $E_s = 200$ GN/m^2, $\alpha_s = 1.2 \times 10^{-5}/\,^{\circ}$C,

for copper – $E_c = 100$ GN/m^2, $\alpha_c = 1.8 \times 10^{-5}/\,^{\circ}$C,

for aluminium – $E_a = 100$ GN/m^2, $\alpha_a = 1.8 \times 10^{-5}/\,^{\circ}$C. [8]

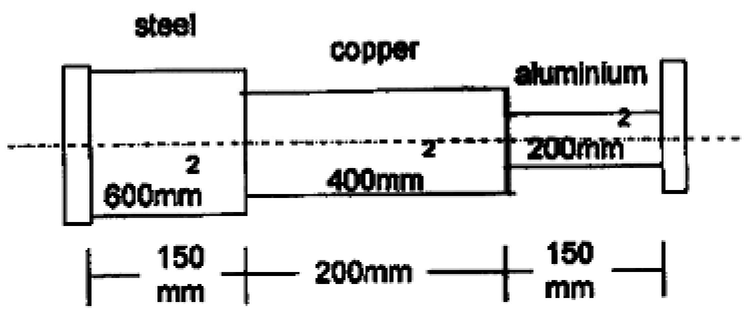

Fig. 1

Or

2. (*a*) A mild steel bar 200 mm long and 80 mm × 60 mm in cross-section is subjected to a longitudinal axial compression of 720 kN. Determine the value of the lateral forces necessary to prevent any transverse strain. Evaluate the resultant alternation in length. E = 200 GPa and $\mu = 0.25$ [8]

(*b*) A tie bar has enlarged ends of square cross-section 60 mm × 60 mm as shown in Fig. 2. If the middle portion of the bar is also a square section, find the size and length of middle portion if stresse there is 140 N/mm^2 and total elongation is 0.14 mm. Take $E = 2 \times 10^5$ N/mm^2. [8]

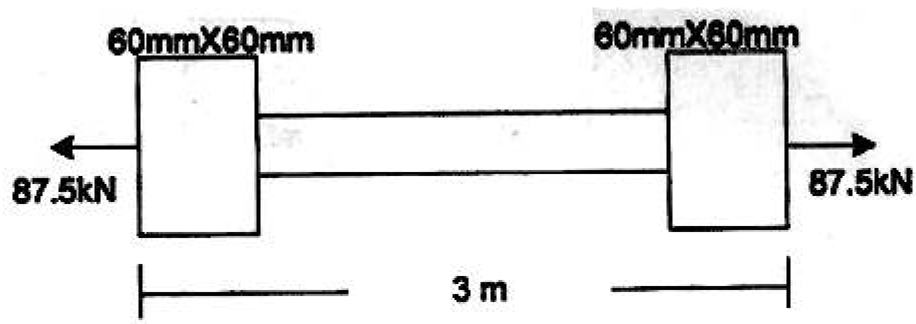

Fig. 2

3. (*a*) Draw S.F. and B.M. diagram for beam shown in Fig. 3. Show all important points on the diagrams. [10]

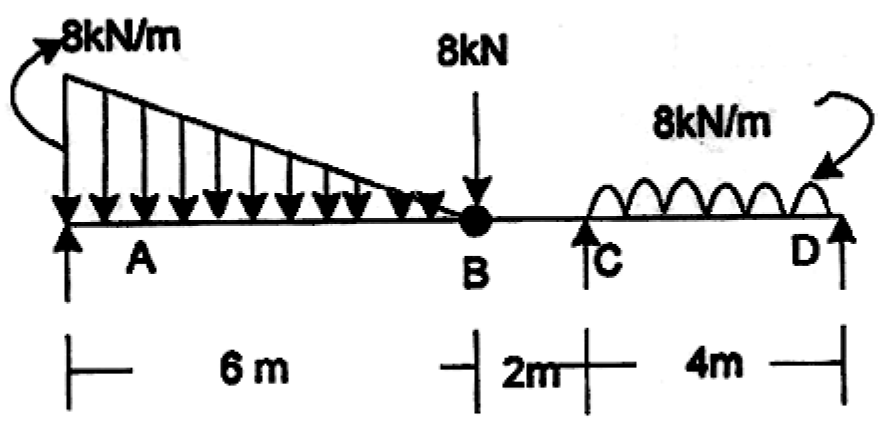

Fig. 3

(*b*) Derive expression for S.F. and B.M. for simply supported beam carrying uniformly distributed load whose intensity varies uniformly from zero at each end to 'w' per unit run at mid span. Also plot SFD and BMD. Assume length of bar 'L' m. [8]

Or

4. (*a*) Construct the corresponding loading diagram and B.M.D. for the beam whose S.F. diagram is as shown in Fig. 4. [10]

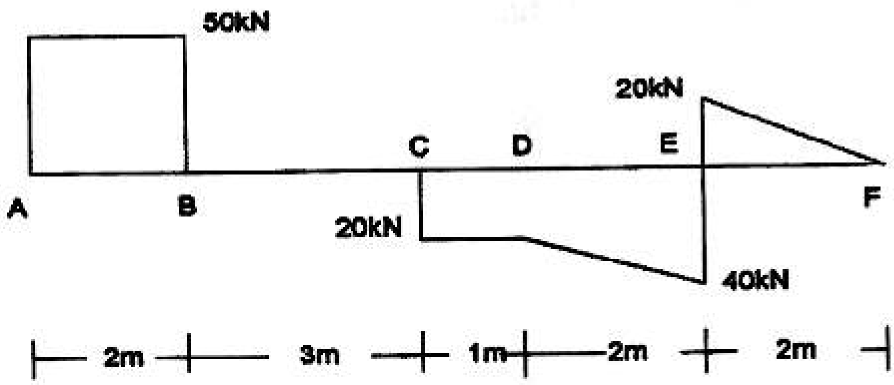

Fig. 4

(*b*) Draw S.F.D. and B.M.D. for the beam shown in Fig. 5. Show all the salient points. [8]

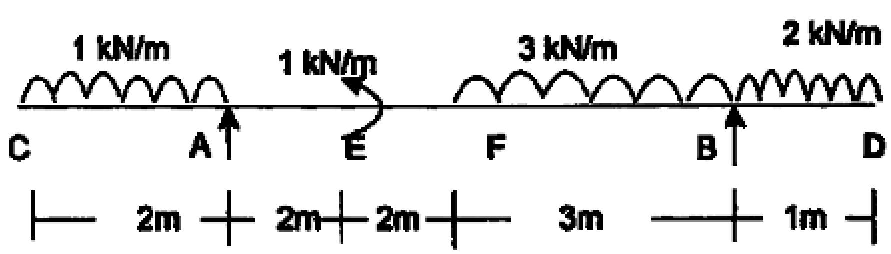

Fig. 5

5. (*a*) A Cast Iron beam of cross-section resembling a rail is symmetrical about a vertical axis in c/s. Total depth = 180 mm, Top Flange = 80 mm × 20 mm, Bottom Flange = 120 mm × 40 mm and Web = 120 mm × 20 mm. If the maximum allowable stress in tension is 30 MN/mm^2 and that of compression is 50 MN/mm^2, find moment of resistance of the cross-section. [8]

(*b*) A hollow box section is as shown in Fig. 6, spans a gap of 5 m and is subjected to a u.d.l. of intensity 30 kN/m including its self weight. Determine the maximum shear stress developed at a section 1.5 m from one end of the section assuming ends simply supported. [8]

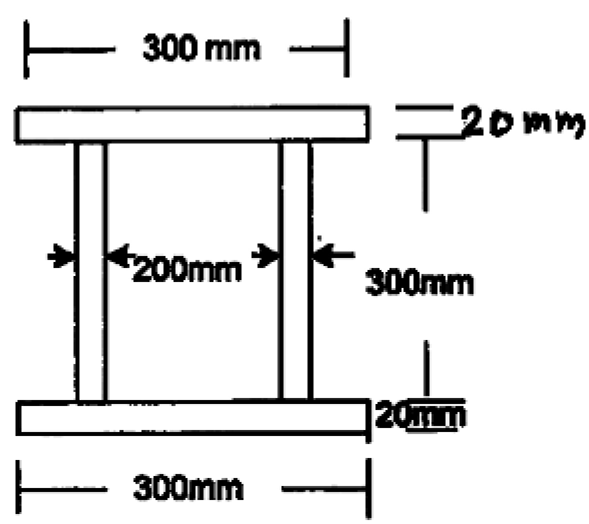

Fig. 6

Or

6. (*a*) A steel section shown in Fig. 7 is subjected to a shear force of 20 kN. Determine shear stresses at important points and sketch shear stress distribution diagram. [8]

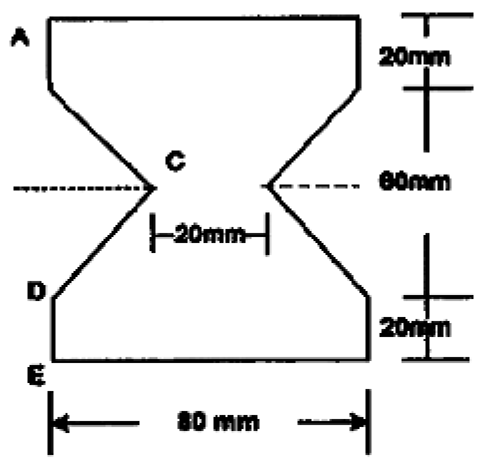

Fig. 7

(*b*) A flitched beam consists of two timber joists 150 mm wide and 350 mm deep with a steel plate 250 mm deep and 15 mm thick fixed symmetrically between the timber joist. Calculate moment of resistance of flitched beam if allowable stress in timber is 7 N/mm^2. Take $E_s = 20\ E_t$. Refer Fig. 8. [8]

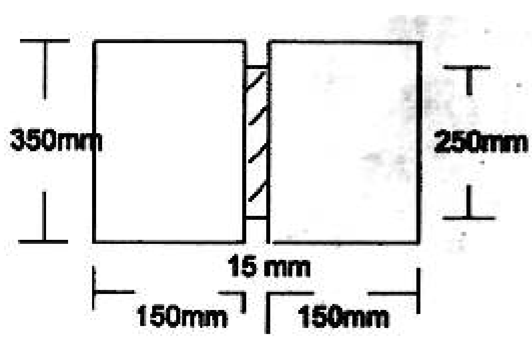

Fig. 8

SECTION II

7. (*a*) Calculate the diameter of shaft required to transmit 60 kW at 160 r.p.m. if the maximum torque is likely to exceed the mean by 30% for maximum permissible shear stress of 55 MPa. Calculate also the angle of twist for length of 1.5 m, G = 80 GPa. [9]

(*b*) For the two bars of same material shown in (*a*) and (*b*) of Fig. 9, find the ratio of maximum stress of bar (*a*) to that of bar (*b*). If two bars are stressed to proportional limit, find the ratio of their proof resilience. [9]

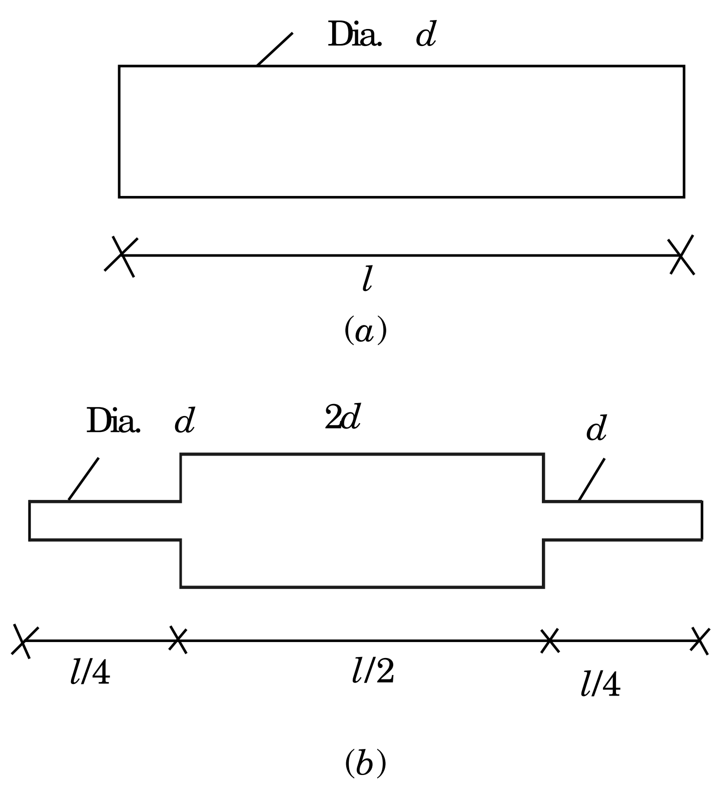

Fig. 9

Or

8. (*a*) A uniform shaft of diameter *'d'* is fixed at the ends and is subjected to twisting couples T_1 = 160 kNmm and T_2 = 300 kNmm as shown in Fig. 10. Find the torque T_a, T_b and T_c in the three portions of shaft. [9]

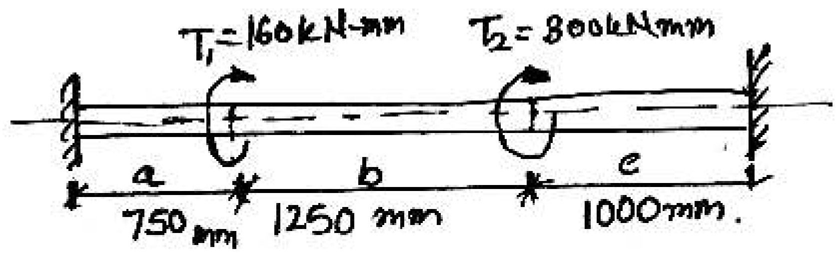

Fig. 10

(*b*) A weight of 2 kN is dropped onto a collar at the lower end of a vertical bar 3 m long and 28 mm in diameter. Calculate the maximum height of drop if the maximum instantaneous stress is not to exceed 140 MPa. What is the corresponding instantaneous elongation ? Also find the dynamic force at instant of maximum elongation. [9]

9. (*a*) A triangular prism is subjected to two-dimensional stress, the planes subjected to stress being perpendicular to the plane of triangle ABC [Fig. 11]. AC is principal plane. On AB there is a tensile stress of 90 MPa having an angle of obliquity of 20° as shown and on BC there is also an oblique stress.

Determine :

(*i*) the angle θ between the planes AC and BC

(*ii*) the tangential normal and resultant stresses on BC and

(*iii*) the value of the principal stress. [8]

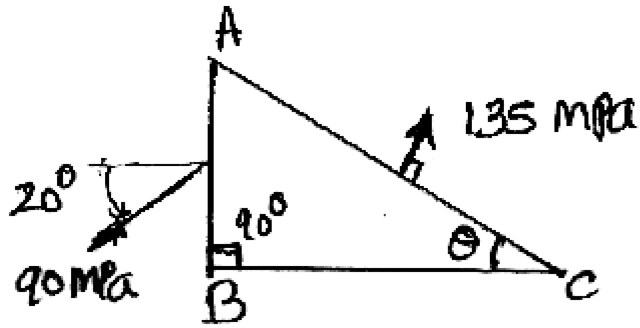

Fig. 11

(*b*) A bolt is subjected to an axial pull of 12 kN together with transverse shear force 6 kN. Determine the diameter of bolt according to maximum shear stress theory if elastic limit in tension 300 MPa. Factor of safety 3. [8]

Or

10. (*a*) At a certain point in an elastic material, normal stresses of 96 MPa tensile and 75 MPa compressive are acting on planes at right angle to each other. The greater principal stress in the material is limited to 120 MPa. To what shearing stress may the material be subjected to on the given planes, and what will be the maximum shearing stress at that point. [8]

(*b*) Derive the expression for equivalent torque 'T_e' and equivalent bending moment 'M_e' when a shaft is under combine action of bending moment 'M' and torsion T. [8]

11. (*a*) An aluminium tube of length 8 m is used as a simply supported column with two ends hinged carrying 1.2 kN axial load. If outer diameter is 50 mm, compute the inner one that would provide factor of safety 2 against buckling. Use E = 70 GPa for aluminum and Euler's formula. [8]

(*b*) A masonry chimney has external diameter 4 m and internal diameter 2 m is subjected to uniform wind pressure is 1500 N/m^2 over an entire height of 66 m. Determine maximum and minimum stresses at base. Unit weight of masonry wall is 22.41 kN/m^3, take $C = \frac{2}{3}$. [8]

Or

12. (*a*) Find by Rankine's formula the safe axial load which an angle iron strut 65 mm × 65 mm × 8 mm, 2 m long, one end fixed, the other hinged, will carry using a factor of safety 3. For the angle, area of section = 976 mm^2, minimum radius of gyration 12.5 mm and σ_c = 320 MPa. $a = \frac{1}{7500}$. [8]

(*b*) A rectangular pier is subjected to compressive load of 500 kN with an eccentricity of 250 mm from both the axes. Find the stress intensities and nature at the four corners of the pier. The dimension of pier 1500 mm × 1000 mm. [8]

Total No. of Questions—**6**]

[Total No. of Printed Pages—**4 + 2** Designs Attached

[4062]-104

S.E. (Civil Engg.) (I Sem.) EXAMINATION, 2011

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*) Figures to the right indicate full marks.

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

SECTION I

1. (*a*) Explain the process of formation of Laterite and Bauxite. [5]

(*b*) Describe the Hardness and Cleavage physical properties of minerals. [6]

(*c*) Explain the process of decomposition of rocks in detail. [5]

Or

(*a*) How does variation in length of transportation lead to the development of the secondary rocks ? Explain in detail. [8]

(*b*) Write a note on Gneissose and Schistose. [4]

(*c*) Write on Primary and Secondary Minerals. [4]

2. Write on the following :

(*a*) Stages of rivers. [6]

(*b*) Field characters of Deccan Trap Basalt. [6]

(*c*) Vindhyan building stone. [4]

Or

(*a*) Write on graded profile and base level of erosion. [4]

(*b*) Write on utility of remote sensing techniques in Civil Engg. [4]

(*c*) Write a comparative account of Peninsular and Extra Peninsular divisions of India. [8]

3. (*a*) How are rocks folded ? Describe various parts and different types of fold with neat sketches. [12]

(*b*) Describe various types of unconformities with neat sketches. [6]

Or

(*a*) Write on orogenic and epierogenic processes. [4]

(*b*) What different features are developed due to tensional type of tectonic forces ? Explain with suitable examples and diagrams. [10]

(*c*) Explain Sill and Phaccolith as Igneous Intrusions. [4]

SECTION II

4. (*a*) What observations and precautions are necessary during drilling ? [8]

(*b*) Describe in detail geological activity of groundwater. [8]

Or

(*a*) Discuss in detail drilling as a method of subsurface geological exploration. Give its limitations. [10]

(*b*) Write a note on confined acquifer and perched acquifer. [6]

5. (*a*) What are Landslides ? Discuss the factors responsible for landslide in Konkan region. [8]

(*b*) Write a note on any *four* Indian Building Stones. [8]

Or

(*a*) What are Earthquakes ? What are the Hazards associated with the Earthquake ? [8]

(*b*) Discuss engineering characteristic of varieties of Deccan Trap Basalt. [8]

6. Geological Investigation for a tunnel project was carried out. The following data is made available by the site geologists. Based on the information provided give your comments and discuss suitability of alignment *x-y* for a tunnel or road along contour 360 m from *x* to *y*. (as shown in Fig. 1)

Description of Lithology :

Bed A — Unjointed Sandstone

Bed B — Unjointed Limestone

Bed C — Jointed Shelly Limestone

Bed D — Calcareous Shell (Joints are dipping towards south with 25° dip amount)

Bed E — Jointed Sandstone (2 sets joints at perpendicular)

Doleritic dyke shows sharp contact with adjacent rock with 3 sets of joints at 90°. Joints are found to be leaky. [18]

Or

Subsurfacial investigations have revealed the following description of rocks :

Bed B — 2 sets of joints roughly at 75° composition of bed is Sandstone with shale laminations

Bed C — Unjointed Porous Limestone

Bed N — Unjointed Siliceous Sandstone

Bed O — Unjointed Dolomitic Limestone

Bed P — Thin Laminated Shale

Bed Q — Jointed Calcareous Sandstone

From the given data discuss the suitability of Dam along *x* to *y* (Fig. 2). [18]

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

[4062]-105

S.E. (Civil) (I Sem.) EXAMINATION, 2011

GEOTECHNICAL 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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Define consistency of soils and show the four states of consistency graphically with appropriate consistency limits. [6]

(*b*) Represent soil as a three phase system and use it to derive relation between porosity and void ratio. [6]

(*c*) State the different methods to determine field density of soil. Explain any *one* of them. [6]

Or

2. (*a*) Write a short note on types of transported soils with examples. [6]

(*b*) Define and explain coefficient of curvature, effective size and uniformity coefficient and state the values of C_u and C_c used to classify the soils. [6]

(*c*) The void ratio and specific gravity of a sample of clay are 0.73 and 2.7 respectively. If the voids are 92% saturated, find the bulk density, dry density and the water content. [6]

3. (*a*) What is Laplace equation ? Derive it from the first principles for two-dimensional flow. [6]

(*b*) State and explain the various factors which affect the permeability of soil. [4]

(*c*) In a falling head permeability test on a silty clay sample, the following results were obtained : sample length 120 mm; sample diameter 80 mm; initial head 1200 mm; final head 400 mm, time for fall in head 6 minutes; stand pipe diameter is 4 mm. Find the coefficient of permeability of soil in mm/sec. [6]

Or

4. (*a*) What do you understand by critical hydraulic gradient ? Derive expression for the same. [6]

(*b*) What is the flow net ? State and explain the important applications of a flow net. [6]

(*c*) Calculate the coefficient of permeability of a soil sample, 6 cm in height and 50 cm^2 in a cross-sectional area, if a quantity of water equal to 450 ml passed down in 10 minutes under an effective constant head of 40 cm. [4]

5. (*a*) Compare light compaction test and heavy compaction test in a tabular form. [5]

(*b*) State and explain the factors affecting the compaction of soil. [5]

(*c*) The optimum moisture content of soil is 14.50% and its maximum dry density is 17.50 kN/m^3. The specific gravity of soil grain is 2.60.

Determine :

(*i*) The degree of saturation and

(*ii*) Percentage of air voids of the soil at OMC. [6]

Or

6. (*a*) Write a short note on Newmark's chart. [4]

(*b*) Draw a typical curve showing the relation between MDD-OMC and explain the terms MDD, OMC and Air voids line. [6]

(*c*) A concentrated load of 30 kN acts on the surface of a homogenous soil mass of large extent. Find the stress intensity at a depth of 8 m and :

(*i*) directly under the load

(*ii*) at a horizontal distance of 6 m. [6]

SECTION II

7. (*a*) Explain step by step, how unconfined compression strength of soil sample is determined in laboratory with sketch. [6]

(*b*) What are advantages and disadvantages of direct shear test ? [6]

(*c*) In a consolidated drained triaxial test, a specimen of clay fails at a cell pressure of 60 kN/m^2. The shear strength parameters are c = 15 kN/m^2 and $f = 20^\circ$. Determine the additional axial stress (deviator stress) required for failure. [6]

Or

8. (*a*) Explain the various drainage conditions under which the shear tests can be carried out. [6]

(*b*) What is liquefaction of sands ? How can it be prevented ? [6]

(*c*) An unconfined compression test yielded a strength of 0.1 N/mm^2. If the failure plane is inclined at 50° to the horizontal, what are the values of the shear strength parameters ? [6]

9. (*a*) Define the terms : Active earth pressure, Passive earth pressure and Earth pressure at rest. [6]

(*b*) Explain the phenomenon of landslides. Also discuss causes and remedial measures. [6]

(*c*) What are the different modes of slope failure ? Give examples. [4]

Or

10. (*a*) Explain Culmann's graphical method of finding critical active pressure. [6]

(*b*) State the assumptions made in the Rankine earth pressure theory. [6]

(*c*) What is stability number ? What is its utility in the analysis of stability of slopes ? [4]

11. (*a*) What are different index properties of rocks ? What is their importance ? [8]

(*b*) State and explain geological classification of rocks in detail. [8]

Or

12. Write short notes on any *four* : (**4** marks each) [16]

(*i*) Shear strength of rocks

(*ii*) Hardness of rocks

(*iii*) Rock permeability

(*iv*) *In situ* stresses in rocks

(*v*) Ring shear test

(*vi*) Slake durability index.

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

[4062]-106

S.E. (Civil) (Second Semester) EXAMINATION, 2011

FLUID MECHANICS–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*) 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*) Define surface tension. Mention any *two* examples involving surface tension. Derive the expression for determining pressure difference between inside and outside of a soap bubble. [6]

(*b*) A vertical cylinder of diameter 20 mm rotates concentrically inside another cylinder of diameter 20.2 mm. Both the cylinders are 50 mm long. The space between the cylinders is filled with liquid of viscosity 0.01 $N.s/m^2$. Calculate torque required to rotate the cylinder at 3000 r.p.m. Also calculate power lost. [6]

(*c*) The performance of a spillway is to be studied by means of a model constructed to a scale of 1 : 9.

Determine :

(*i*) Rate of flow in the model for a prototype discharge of 1400 m^3/s

(*ii*) Energy lost in the prototype if the energy loss in model is 0.3 kW. [6]

Or

2. (*a*) The power developed by a water turbine (P) depends on the rotational speed N, operating head (H), gravitational acceleration (g), diameter (D) and breadth (B) of the runner, density (ρ) and viscosity (μ) of water. Derive an expression for power (P) by dimensional analysis. [8]

(*b*) Define :

(*i*) Bulk modulus of elasticity

(*ii*) Vapour pressure

(*iii*) Capillarity

(*iv*) Froude number. [8]

(*c*) A cylinder contains a liquid of volume of 0.02 m^3 at a pressure of 700 Pa when compressed to reach a volume of 0.019 m^3. The pressure is increased to 1400 Pa. Find bulk modulus of elasticity. [2]

3. (*a*) Define total pressure and centre of pressure. Explain the procedure of computation of the resultant hydrostatic force on a curved surface. [8]

(*b*) Explain the theoretical method of determination of metacentric height. [8]

Or

4. (*a*) A rectangular gate 2 m long and 1.5 m wide lies in a vertical plane with its centre 2.5 m below water surface. Calculate magnitude, direction and location of the total force on the gate. [4]

(b) A block of wood has a horizontal cross-section 480 mm × 480 mm and height h. It floats vertically in water. Sp. gravity of wood is 0.6. Find maximum height of the block so that it can remain in stable equilibrium. [5]

(c) With usual notation prove that for a liquid mass subjected to uniform rotation about its vertical axis : [7]

$$y = \frac{w^2 x^2}{2g}$$

5. (a) What is a flow net ? List the methods of drawing flow nets. What are the uses and limitations of flow nets ? Is flow net analysis applicable to rotational flow ? Give reason. [8]

(b) The velocity potential function ϕ is given as $\phi = -2xy$:

(i) Determine stream function y .

(ii) Determine the velocity and its direction at (2, 2)

(iii) Sketch the streamlines. [8]

Or

6. (a) Define and explain briefly the following : [9]

(i) Circulation and vorticity

(ii) Streamline, streakline and pathline

(iii) Velocity potential.

(*b*) The stream function in a two-dimensional flow field is given as :

Verify whether the flow is irrotational. Determine the direction of streamline at a point P(0, –1). Also determine velocity potential. [7]

SECTION II

7. (*a*) Derive Euler's equation of motion along a streamline and then derive Bernoulli's equation. State clearly the assumptions made. [10]

(*b*) Derive the formula for determination of discharge through an orifice meter. [6]

$y = 2x - 3y + xy$

(*c*) Define : [2]

(*i*) Kinetic energy correction factor

(*ii*) HGL.

Or

8. (*a*) Water discharges at the rate of 90 lit/sec through a 100 mm diameter vertical sharp edged orifice placed under a constant head of 10 m. A point on the jet, measured from the vena contracta has coordinates 4 m horizontal, 0.5 m vertical. Find C_d, C_v, C_c of the orifice. [6]

(*b*) Determine the rate of flow of water through a pipe 250 mm diameter, placed in an inclined position where a venturimeter is inserted, having a throat diameter of 125 mm. The difference of pressure between main and throat is measured by a liquid of sp. gravity 0.7 in an inverted V tube which gives a reading of 240 mm. Take the loss of head between the main and throat as 0.3 times the kinetic head of the pipe. [8]

(*c*) Write a short note on Pitot tube. [4]

9. (*a*) Show that for laminar flow through circular pipe, the maximum velocity is twice the average velocity. [10]

(*b*) A smooth float plate with a sharp leading edge is placed at zero incidence in a free stream of water flowing at 3.5 m/s. Determine the distance from the leading edge where the transition from laminar to turbulent flow may commence. Take viscosity of water as 0.01 poise. Also calculate boundary layer thickness at the transition point. [6]

Or

10. (*a*) Write short notes on :

(*i*) Falling sphere viscometer

(*ii*) Boundary layer separation and its control. [8]

(*b*) Two horizontal plates kept at 100 mm apart have laminar flow of oil of viscosity 1.5 $N.s/m^2$ between them. The maximum velocity of flow is 2 m/s.

Find :

(*i*) Discharge per meter width

(*ii*) Shear stress at the plate

(*iii*) Velocity gradient at the plate

(*iv*) Pressure difference between two points 15 m apart. [8]

11. (*a*) Derive Karman–Prandtl equation for velocity distribution in turbulent flow near hydrodynamically smooth boundary. [10]

(*b*) In a pipe of diameter 100 mm carrying water, the velocities at the pipe centre and 20 mm from the pipe centre are found to be 2.5 m/s and 2.3 m/s respectively. Find the wall shear stress. [6]

Or

12. (*a*) A 1800 m long, 250 mm diameter pipe connects two reservoirs with difference in water levels equal to 16 m. Neglecting minor losses, find the discharge. Take $f = 0.02$. To increase the discharge by 25% another pipe of same diameter and same friction factor is connected to original pipe midway and connected to the lower reservoir, find the length of new pipe. [12]

(*b*) Explain hydrodynamically smooth and rough boundaries with a neat sketch. [4]

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

[4062]-107

S.E. (Civil) (Second Semester) EXAMINATION, 2011

BUILDING PLANNING

(2008 PATTERN)

Time : Four Hours **Maximum Marks : 100**

***N.B.* :—** (*i*) Assume suitable data if necessary

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

(*iii*) 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*) State different objectives of D.P. and parameters of quality of urban life. [8]

(*b*) Explain the utility of 6-D form, 7/12 form. [8]

Or

2. (*a*) Write a short note on land use zoning and mention the requirements of each of them. [6]

(*b*) State and explain various aspects which are considered to declare a building as a green building. [6]

(*c*) What are the different methods opted for RWH ? Explain any *one* in detail. [4]

3. (*a*) What is F.A.R. ? What are the areas exempted while calculating F.A.R. ? [6]

(*b*) Explain the necessity of building byelaws. [6]

(*c*) What is artificial lighting ? Give necessity of artificial lighting. [6]

Or

4. (*a*) Explain the following terms with sketches :

(*i*) Building line

(*ii*) Control line

(*iii*) Marginal distances. [9]

(*b*) Differentiate between summer and winter air-conditioning. [9]

5. (*a*) What are different acoustical defects ? Explain any *one* in detail. [6]

(*b*) What factors influence fire development in a building ? [6]

(*c*) What factors affect designing and planning of electrical services ? [4]

Or

6. Describe the various methods adopted in achieving noise control. [6]

Explain the terms : Fire load, Evacuation time. [4]

Explain one-pipe and two-pipe plumbing system. [6]

SECTION II

7. Plan a residential building having G + 1 framed structure with the following requirements. Calculate the total built up area and give schedule of doors and windows. The ext wall thickness is 230 mm and int wall thickness is 150 mm. (Refer Table No. 1) Indicate N-line. [20]

Or

8. Plan a residential building having G + 1 load bearing structure with the following requirements. Calculate the total built up area and give schedule of doors and windows. Assume suitable wall thicknesses. (Refer Table No. 1) Indicate N-line : [20]

Table No. 1

Sr. No.	**Type of Unit**	**No. of Units**	**Internal Area of Unit in Sq. m.**
1	Living room	01	18
2	Bed-room	02	12
3	Additional bed-room with attached toilet	01	16
4	Kitchen	01	12
5	W.C.	01	1.5
6	Bath	01	2.8
7	Staircase	01	Use suitable dimensions

9. It is proposed to construct a Public Health Centre with the following data : [20]

(1) Lounge : 30 sq. m

(2) Reception : 20 sq. m

(3) Administration office : 20 sq. m

(4) Doctor's cabins : 15 sq. m.

(5) Nurse's room : 15 sq. m.

(6) Labour room : 15 sq. m.

(7) Wards two numbers : 20 sq. m each

(8) Store : 15 sq.m.

Assume any other special requirement stating its importance clearly and draw to a scale of 1 : 50 or suitable :

(*a*) Line plan showing location of doors and windows.

(*b*) Schedule of openings.

(*c*) Suggest suitable material for painting of walls.

Or

10. It is proposed to construct a Single-Storeyed shopping complex with the following data : [20]

(1) Entrance : of suitable size.

(2) Big shops : 6 nos., 30 m^2 each.

(3) Small shops : 10 nos., 20 m^2 each.

(4) Telephone booths : 4 nos. of suitable size.

(5) Separate sanitary blocks for ladies and gents.

(6) Staircase for future expansion.

(7) All passages 2.5 m wide.

(8) RCC framed structure.

(9) Assume additional data if necessary :

(*a*) Draw to a scale of 1 : 50 or suitable, line plan with northline.

(*b*) Locate all openings and columns

(*c*) Show the details of furniture arrangement with dimensions in any one shop.

11. Draw to a scale of 1 : 50 or otherwise a *one* point perspective of an object shown in Fig. 1 : [10]

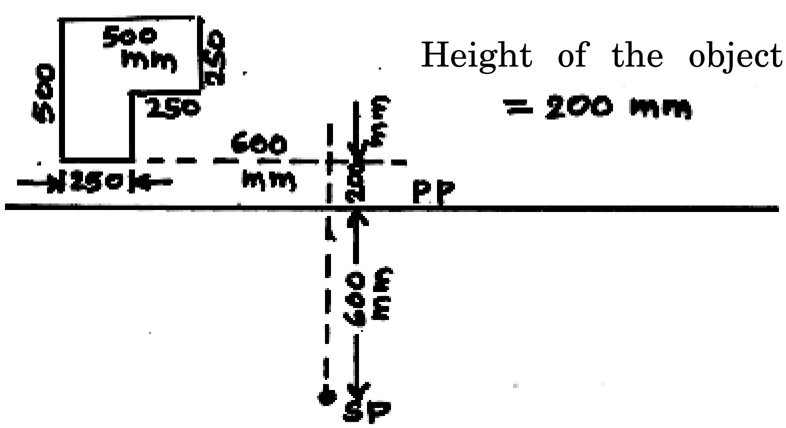

Fig. 1

Or

12. Draw to a scale of 1 : 50 or otherwise a *two* point perspective of an object shown in Fig. 2. [10]

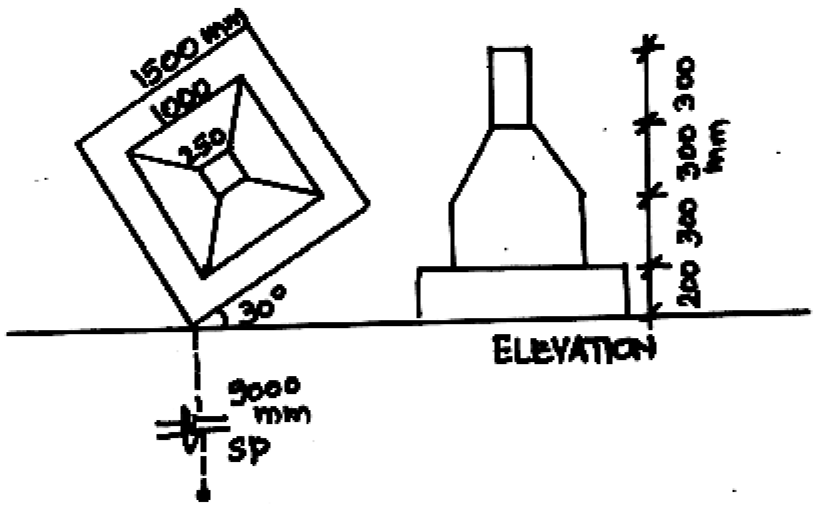

Fig. 2

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

[4062]-108

S.E. (Civil) (Second Semester) EXAMINATION, 2011

SURVEYING

(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*) Distinguish between the following : [6]

(*i*) Fore-bearing and Back-bearing

(*ii*) Dip and Declination.

(*iii*) Whole circle bearing and Reduced bearing.

P.T.O.

(*b*) Explain with sketches the following accessories used in plane table surveying : [6]

(*i*) U-fork with Plumb-Bob

(*ii*) Alidade.

(*c*) The following observations were recorded in running a compass traverse survey. Calculate included angles. Apply usual check : [6]

Line	**FB**	**BB**
AB	120°30'	300°00'
BC	30°00'	209°00'
CD	333°30'	150°30'
DE	260°30'	80°00'
EA	210°00'	31°00'

Or

2. (*a*) Draw the sectional view of prismatic compass and show the following parts on it : [6]

(*i*) Glass cover

(*ii*) Brake pin

(*iii*) Agate cap

(*iv*) Eye vane.

(*b*) What is local attraction ? Explain how it is detected. [6]

(*c*) State the method of plane table surveying. Explain any *one* method with sketch. [6]

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

(*i*) Compensator

(*ii*) Reciprocal levelling.

(*b*) Explain the method of locating contour by direct method with sketch. [4]

(*c*) The following Reciprocal levels were taken with one level on two points, P and Q, 2500 m apart. Calculate difference in elevation between P and Q and the error due to refraction, when the collimation error is 0.004 m in 100 m : [6]

Level at	**Staff Readings on**	
	A	**B**
P	2.500	3.250
Q	1.600	2.320

Or

4. (*a*) Explain the following terms with sketches : [6]

(*i*) Line of collimation

(*ii*) Bench Mark

(*iii*) Contour.

(*b*) Write a short note on two-peg method. [4]

(*c*) Derive the expression for correction for curvature. [6]

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

(*i*) Plunging

(*ii*) Telescope inverted

(*iii*) Face left

(*iv*) Latitude

(*b*) A closed traverse was conducted round the obstacle and the following observations were made. Work out the omitted measurements : [8]

Station	**Line**	**Length**	**WCB**
A	AB	80.80	120°30'
B	BC	72.00	125°00'
C	CD	65.00	35°30'
D	DE	?	330°00'
E	EA	133.60	?

(*c*) Explain step by step procedure of measurement of horizontal angle by method of reiteration. [4]

Or

6. (*a*) Write a short note on adjustment of closed traverse. [6]

(*b*) Explain step by step procedure of measurement of vertical angle by Transit Theodolite. [4]

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

(*i*) Consecutive coordinates

(*ii*) Independent coordinates

SECTION II

7. (*a*) Explain how will you test and adjust the Transit Theodolite to ensure that line of sight perpendicular to horizontal axis. [6]

(*b*) Draw the sketches of different stadia lines. [4]

(*c*) A Tacheometer was set up at a station 'P' and the following readings were obtained on a vertically held staff :

Station	**Staff Station**	**Vertical Angle**	**Hair Readings**	**Remarks**
P	BM	–5° 00' 00"	1.000 1.25 1.450	R.L. of BM
	Q	+ 10°00' 00"	0.900 1.100 1.400	1000.00 m

The constants of instruments were 100 and 0.10. Find the horizontal distance from P to Q and RL of Q. [6]

Or

8. (*a*) Explain any *one* method of carrying out permanent adjustment of Transit Theodolite. [6]

(*b*) What is Tacheometer ? State the situations where it is used. [4]

(*c*) Explain methods of determination of Tacheometric constants. [6]

9. (*a*) Explain the following terms in circular curves with neat sketches : [6]

(*i*) Tangent points

(*ii*) Tangent length

(*iii*) Apex distance.

(*b*) Draw the sketch of compound curve and show various elements on it. [6]

(*c*) What is Transition curve ? State the functions of transition curves. [4]

Or

10. (*a*) Tabulate the data necessary for setting out the curve by offsets from chord produced for the following data : [6]

(*i*) Radius of curve 650 m

(*ii*) Deflection angle of curve 22°

(*iii*) Chainage of intersection point 2100 m

(*iv*) Peg interval 20 m.

(*b*) Explain the procedure of setting out a curve by Rankines method of one Theodolite. [6]

(*c*) Draw sketch of reverse curve. Explain its necessity. [4]

11. (*a*) What is total station ? State the classification based on range of total station. [6]

(*b*) Explain setting out of residential building with proper sketch. [6]

(*c*) Explain marking grade stakes in construction survey of road. [6]

Or

12. (*a*) Explain salient features of total station. [6]

(*b*) Explain the method of transfer of centre line in long tunnels. [6]

(*c*) Describe the method of laying alignment of drainage line. [6]

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

[4062]-109

S.E. (Civil) (Second Semester) EXAMINATION, 2011

CONCRETE TECHNOLOGY

(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*) Use of electronic pocket calculator is allowed.

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

SECTION I

1. (*a*) Fill in the blanks : [6]

(*i*) Specific gravity of cement is ....

(*ii*) The product formed after raw material of cement burnt in kiln at high temperature is called ....

(*iii*) .... imparts colour to cement.

(*iv*) .... is a Bougue's compound which is responsible for early strength of cement.

(*v*) Soundness test on cement is carried out by using .... apparatus.

(*vi*) The minimum percentage of water by mass of cement is required for complete hydration is .... %.

(*b*) State any *three* types of cement and explain the speciality of them. [6]

(*c*) Explain the quality of water required to prepare concrete using the following points :

(*i*) Ideal water

(*ii*) Practicable water

(*iii*) pH value

(*iv*) Avoided water

(*v*) Acid water

(*vi*) Alkaline water. [6]

Or

2. (*a*) What are the restrictions on size of sample for aggregate crushing value test ? Why are they imposed ? [6]

(*b*) List the various tests to be conducted in laboratory on cement. Determine the quantity of water in ml required to conduct all above tests on 400 gms of cement if standard consistency (*pn*) is 27%. [6]

(*c*) Explain Alkali-Aggregate reaction. State factor promoting it and controlling the reaction. [6]

3. (*a*) Draw and explain the deformation time curve of concrete. [4]

(*b*) State types of Young modulus of elasticity of concrete. Draw stress-strain curve for cement, aggregate and concrete. [6]

(*c*) State and elaborate different types of shrinkage. [6]

Or

4. (*a*) Draw and explain the compressive stress-strain curve of concrete. [4]

(*b*) Whatever may be the type of load, concrete always fails in tension. Elaborate the statement. [6]

(*c*) Discuss the causes of bleeding and effect of bleeding and prevention of bleeding. [6]

5. (*a*) Briefly outline the DOE method of concrete mix design. [6]

(*b*) What are the factors which influence the choice of mix proportion ? [6]

(*c*) State relation between target mean strength *f*(*t*) of mix and minimum design strength (fck) at 95% probability (refer table 1.) [4]

Table 1 (Clause 2.2 IS 10262)

Accepted Proportion	***t***
1 in 5	0.84
1 in 10	1.28
1 in 15	1.50
1 in 20	1.65

Or

6. (*a*) Briefly outline the I.S. Code method of mix design. [6]

(*b*) What do you mean by nominal mix, standard mix and design mix ? [6]

(*c*) Discuss the importance of mix design. [4]

SECTION II

7. (*a*) Explain different types of form-work. [4]

(*b*) Explain ultrasonic pulse velocity method. [6]

(*c*) Explain indirect tensile strength of concrete in detail. Draw neat figures. [6]

Or

8. (*a*) Write in short about relation between compressive strength and tensile strength of concrete. Give equations. [4]

(*b*) Write a short note on principle of form-work design. [6]

(*c*) Write short notes on :

(1) Pull-out test and

(2) Marsh cone test. [6]

9. (*a*) Match the following and rewrite in answer-book : [6]

(1) Polymer concrete	(*a*) Used in absence of skilled labour
(2) High density concrete	(*b*) Concrete of high tensile strength
(3) Self-compacting concrete	(*c*) Used for rapid repair of damaged airfield pavements
(4) High performance concrete	(*d*) Useful in tall structures
(5) Fibre reinforced concrete	(*e*) Gives long-term mechanical properties
(6) Light weight concrete	(*f*) Used as biological shields

(*b*) Explain the effect of hot weather concreting. [6]

(*c*) Explain *three* types of polymer concrete. [6]

Or

10. (*a*) Match the following and rewrite in answer-book : [6]

(1) Ferrocement	(*a*) Ghat Ghar dam
(2) Roller compacted concrete	(*b*) Method for under-water concreting
(3) Pumping of concrete	(*c*) It is treatment given to slabs and thin wall to improve the quality of concrete
(4) Tremie method	(*d*) Useful for smaller jobs in city areas
(5) Vacuum concrete	(*e*) It is the method of transporting concrete
(6) Ready mix concrete	(*f*) Boat building material

(*b*) What is high performance concrete ? State the applications of it and requirement for successful production of it. [6]

(*c*) Describe the type of vibrators method used for compaction of concrete. [6]

11. Write short notes on : [16]

(*i*) Permeability of concrete

(*ii*) Acid attack

(*iii*) Evaluation of cracks

(*iv*) Shotcrete.

Or

12. Write short notes on : [16]

(*i*) Carbonation of concrete

(*ii*) Corrosion of reinforcement

(*iii*) Repair by stitching

(*iv*) Repair by jacketing.

[4062] – 110

S.E. (Civil) (Semester – II) Examination, 2011
STRUCTURAL ANALYSIS – I (2008 Course)

Time : 3 Hours Max. Marks : 100

Note: *1) Answer **3** questions from **each** Section.*
*2) Answer to the **two** Sections should be written in **separate** answerbooks.*
*3) **Neat** sketches must be **drawn wherever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) **Use** of Non-Programmable Electronic Scientific calculator is **allowed**.*
*6) **Use** of Cell-Phone is **not** allowed.*
*7) Assume **suitable** data, if necessary.*

SECTION – I

1. a) A simply supported beam of length 4 met. And cross section 200 mm×400 mm is loaded as shown in fig.1-a find **9**

i) Slope at the ends A and B

ii) Deflection under the point loads i.e. at C and D

iii) Location and magnitude of maximum deflection.

Use Macaulay's method take E = 2×10^{4}.

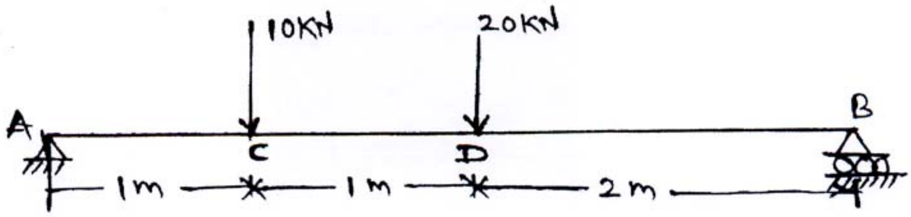

Fig. 1 (a)

b) A cantilever of length 4 met, carries U.D.L 12 KN/m for a length of 2.5 met from fixed end and a point load 10 KN at free end, determine maximum slope and deflection using Moment Area Method. Take E = 6.3×10^{4} KN-m^{2} Ref fig. 1 (b). **9**

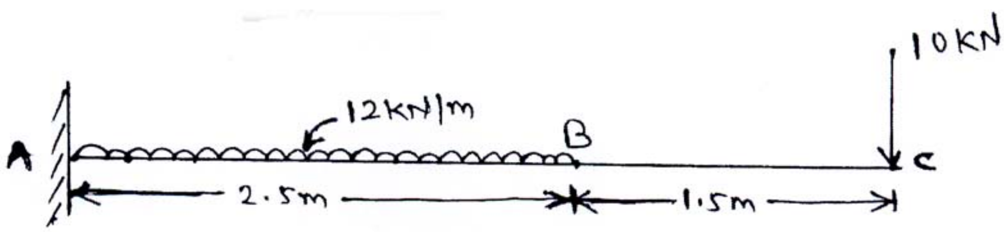

Fig. 1 (b)

OR

P.T.O.

2. a) A beam ABC is simply supported at A and B and free at C as shown in fig. 2 (a).

The span AB carries a U. D. L. of 10 KN/m and the end C carries a point load of 10 KN, if AB = 4 m, and BC = 2 m find

a) Slope and deflection at point C

b) Deflection at the center of span AB

Take EI = 4×10^4 KN-m^2

Use Conjugate beam method. **9**

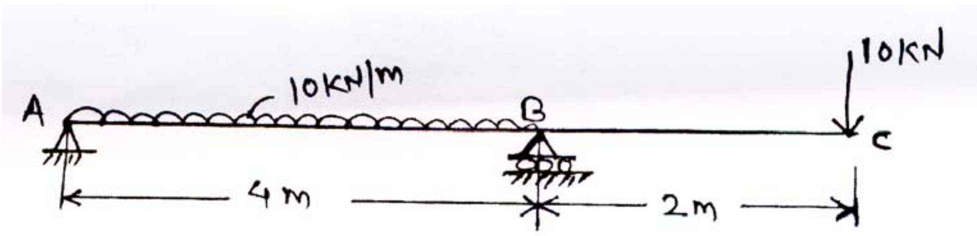

Fig. 2(a)

b) A portal frame ABCD is hinged at A and roller supported at D. The frame carries loading as shown in fig. 2 (b), find horizontal deflection at roller support D, Take EI = 35×10^3 KN-m^2. **9**

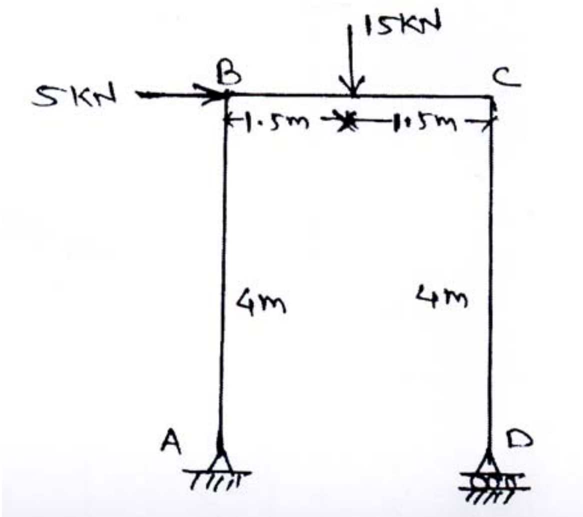

Fig. 2(b)

3. a) A fixed beam of 4 met. Span carries U.D.L 10 KN/M over the entire span and a point load 10 KN at mid span find fix end moments by first principle and check the values with standard formula. **8**

b) A continuous beam ABC is fixed at A and C and simply supported at C, if AB = 4 met, BC = 6 met, the span AB carries a point load of 10 KN at one met from A and span BC carries U.D.L of 4 KN/m, find reactions and support moments using theorem of three moments and draw SFD and BMD. **8**

OR

4. a) Analyze the beam shown in fig. 4 (a) by principle of least work and draw SFD and BMD. **8**

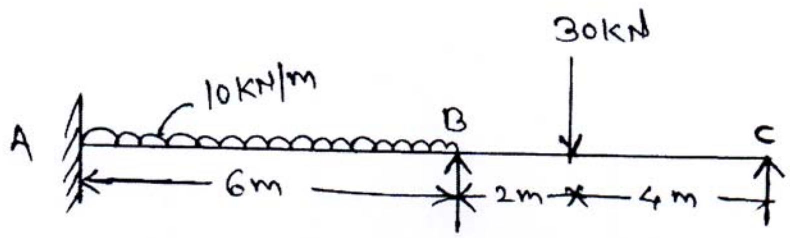

Fig. 4 (a)

b) Analyze the Portal frame by Strain energy method as shown in fig. 4 (b) and draw B.M.D. **8**

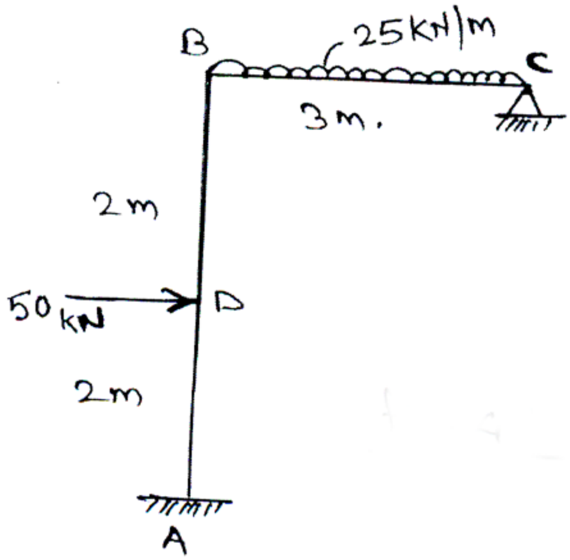

Fig. 4 (b)

5. Determine the reaction at support and the forces in the members of truss shown in fig. (5). The sectional area of the member in mm^2 are shown in bracket. All members are of same material. **16**

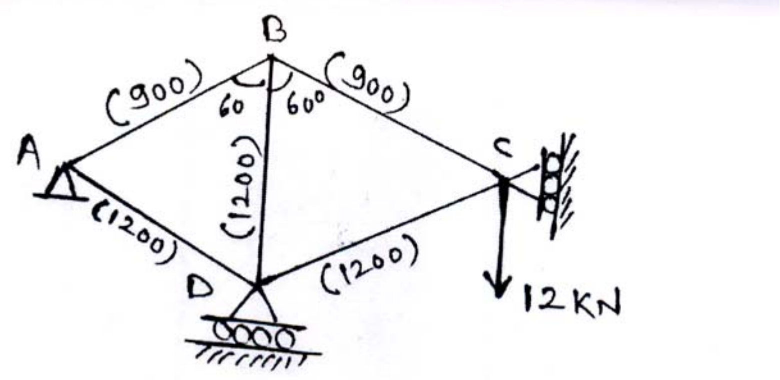

Fig. 5

OR

6. For the truss shown in fig. (6), find vertical deflection at point D. The C/S area of top chord and vertical member is 1875 mm^2 whereas for lower chord and diagonals is 1250 mm^2. Take E = 200 Gpa. **16**

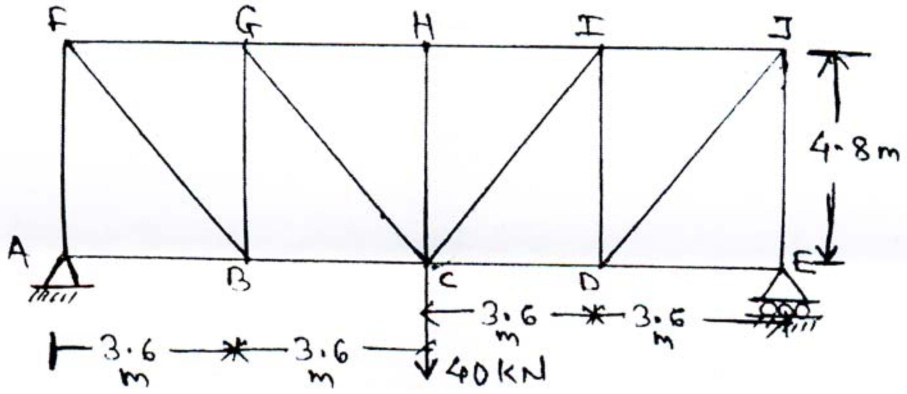

Fig. 6

SECTION – II

7. a) Establish the relation between load factor and factor of safety. **4**

b) For the beam section shown in fig. 7 (b) determine the plastic modulus and fully plastic moment. **7**

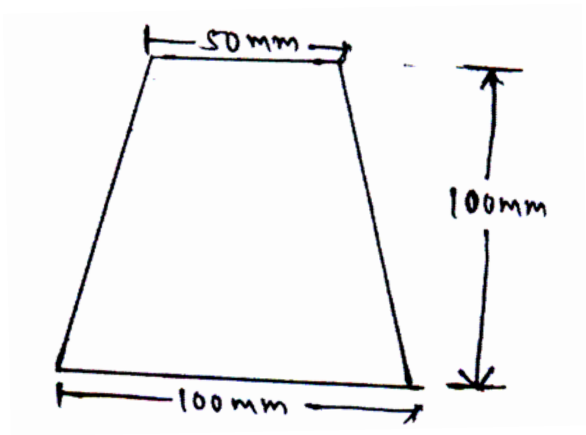

Fig. 7 (b)

c) For the square beam section shown in fig. 7 (c) find the shape factor and fully plastic moment, Take fy = 250 N/mm^2. **7**

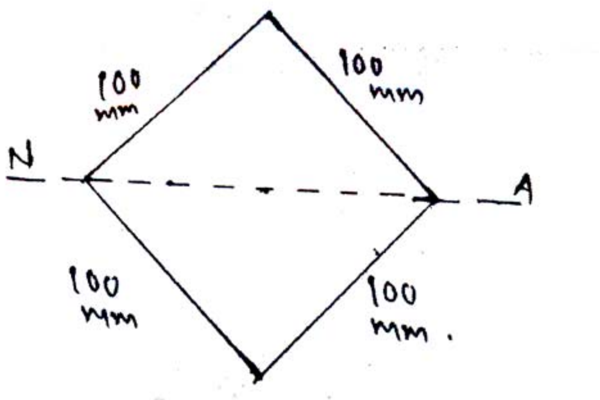

Fig. 7 (c)

OR

8. a) Fig. 8 (a) shows a continuous beam ABC, find the value of W at collapse. Also draw B.M.D. at collapse. Note that plastic moment for span AB and BC are Mp and 1.5 Mp. respectively. **9**

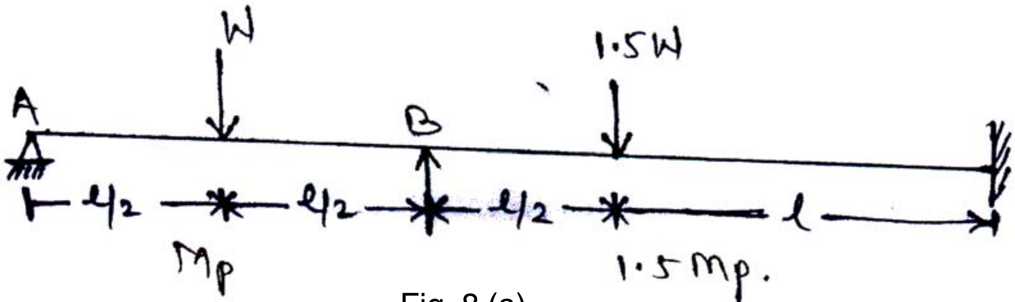

Fig. 8 (a)

b) A portal frame is loaded as shown in fig. 8 (b). If all member have fully plastic moment Mp. Find the plastic moment required. The columns are hinged at base. **9**

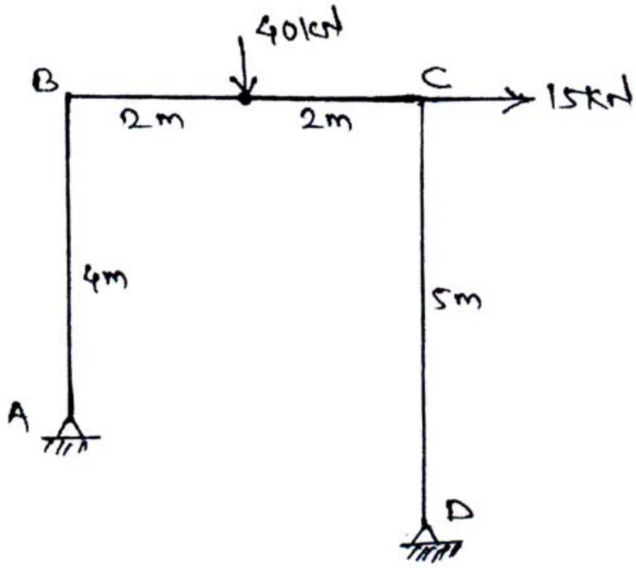

Fig. 8 (b)

9. a) Draw the ILD for forces in member U3U4, L1L2, U3L3, L1U2 for the through type bridge truss as shown in fig. 9 (a). **8**

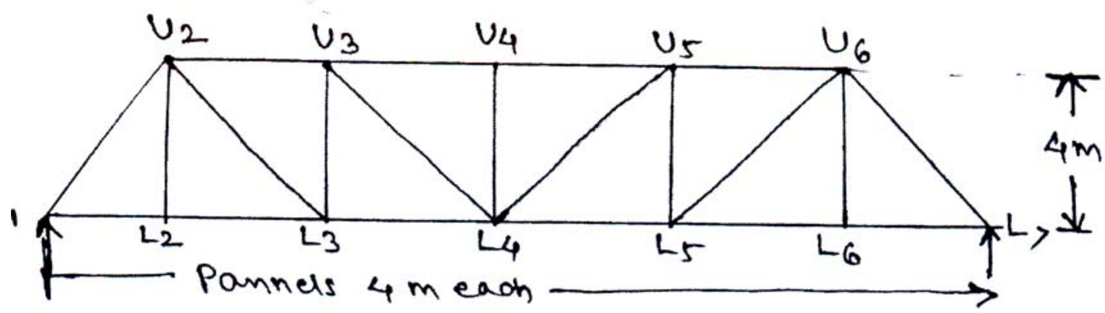

Fig. 9 (a)

b) A compound beam ABCD has hinged support at A and D and roller support at B, there is an internal hinge at C to connect beam ABC and CD. The span AB = 15 m, BC = 10 m, CD = 30 m, construct ILD for the following,

1) Reaction at A
2) Reaction at B
3) S.F. at mid span AB
4) B.M. at mid span of AB Ref. fig. 9 (b). **8**

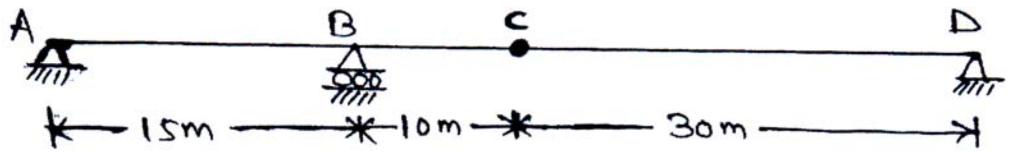

Fig. 9 (b)

OR

10. a) A beam ABV of span 4 m is simply supported at end. It is loaded with U.D.L. as shown in fig. 10 (a) find the reaction. **8**

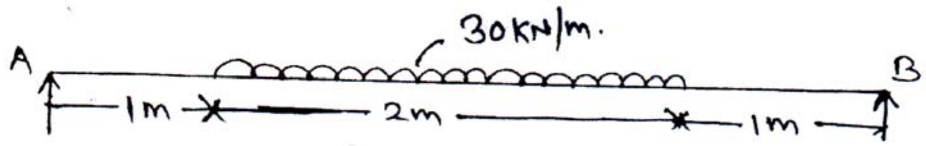

Fig. 10 (a)

b) A beam ACDB is as shown in fig. 10 (b). Find the reaction at support, S.F at 4 m from support C and B.M. at 4 m from support c using ILD. **8**

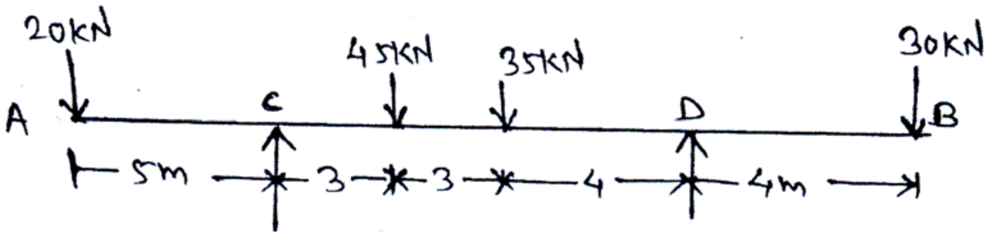

Fig. 10 (b)

11. a) Two wheel load 200 KN and 80 KN spaced 0.8 m apart roll on the girder shown in fig. 11 (a). Find the maximum positive and negative B.M that can occur at the section C. **8**

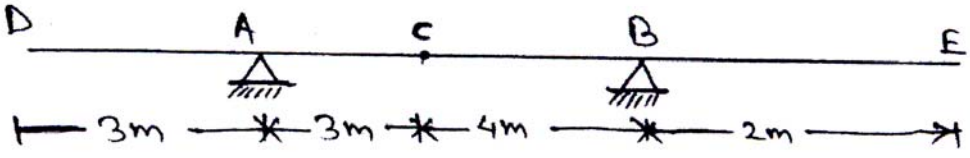

Fig. 11 (a)

b) Two wheel load 80 KN and 100 KN spaced at 3 m apart. These loads are moving on a girder CD of span 13 m. Any wheel load can lead the other. Find the maximum positive and maximum negative S.F. at 5 m from point C. **8**

OR

12. a) Two wheel loads 40 KN and 70 KN spaced at one meter. Find the position of loads to get maximum positive shear, maximum negative shear and maximum positive B.M. and maximum negative B.M. for the beam shown in fig. 12 (a) at section E. **8**

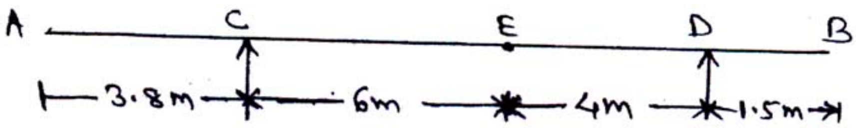

Fig. 12 (a)

b) Find the maximum positive S.F. maximum negative S.F. maximum positive and negative B.M. at E. A UDL of 100 KN/m may occupy any position on the girder ACDB. as shown in fig. 12 (b). **8**

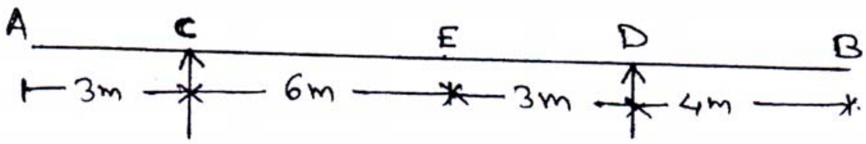

Fig. 12 (b)

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4**

[4062]-110A

S.E. (Civil) (Second Semester) EXAMINATION, 2011

ENGINEERING ECONOMICS AND MANAGEMENT

(2003 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*) What do you mean by equilibrium price and equilibrium quantity ? Explain them in relation with demand and supply curve. [8]

(*b*) Why is it said that "Economics is the flow of finance" ? [6]

(*c*) Define the terms :

(1) Investment

(2) Value

(3) Price

(4) Goods. [4]

Or

2. (*a*) Explain the terms "Elasticity of Supply" and "Elasticity of Demand" with suitable sketch. [6]

(*b*) Explain the "Law of Diminishing Marginal Utility" with suitable example. [8]

(*c*) State the importance of Economics for Civil Engineering. [4]

3. (*a*) Draw life-cycle of product with suitable example. [8]

(*b*) Define productivity. Explain various types of productivity. [4]

(*c*) What are various types of competitions ? Explain any *one* of them. [4]

Or

4. (*a*) What are the factors of production ? Describe characteristics of each of them. [8]

(*b*) Explain the advantages and disadvantages of small scale and large scale production. [8]

5. (*a*) Explain in brief : [8]

(1) Interest

(2) Working capital

(3) Prime cost

(4) Overhead cost.

(*b*) Explain the importance of Reserve Bank of India. [8]

Or

6. (*a*) Differentiate between shares and debentures. [4]

(*b*) Explain the concept of 'depreciation'. [4]

(*c*) Explain the concept of Built Operate and Transfer System which is applied to Highway constructions. [8]

SECTION II

7. (*a*) Discuss briefly contribution of Henry Fayol to Scientific Management. [4]

(*b*) Explain line and staff organization. [4]

(*c*) Explain functional organisation with respect to its merits and demerits. [4]

(*d*) Write a short note on the types of ownership. [4]

Or

8. (*a*) Write short notes on : [2,2]

(*i*) Private sector

(*ii*) Joint venture.

(*b*) State the contribution made by Taylor in the development of management. [4]

(*c*) Write a short note on Joint stock company. [4]

(*d*) Explain Deming's P.D.C.A. cycle. [4]

9. (*a*) "Recruitment is a positive process and selection is a negative process." Comment. [4]

(*b*) Describe nature and scope of Human resource planning. [4]

(*c*) Explain in short cost benefit analysis. [4]

(*d*) Write a note on "Decision Tree". [4]

Or

10. (*a*) List different methods of training and explain any *one* in detail. [4]

(*b*) What are factors affecting decision-making ? [4]

(*c*) Define leadership. Briefly explain styles of leadership. [4]

(*d*) Explain the term 'motivation'. Why is it necessary ? [4]

11. (*a*) What are trade unions ? Discuss their role in construction industry. [4]

(*b*) What do you mean by strike ? List the various forms of strikes. [6]

(*c*) Explain the importance of M.I.S. in a construction industry. [4]

(*d*) What is quality circle ? Discuss its objective. [4]

Or

12. (*a*) What is collective bargaining ? [4]

(*b*) Explain in short work-study and time and motion study. [6]

(*c*) What is Kaizen technique ? Explain in short. [4]

(*d*) Explain in brief Industrial dispute. [4]

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

[4062]-111

S.E. (Mech. Engg.) (First Semester) EXAMINATION, 2011

APPLIED THERMODYNAMICS

(2008 PATTERN)

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

N.B. **:—** (*i*) Answer Q. Nos. **1** *or* **2**, **3** *or* **4**, **5** *or* **6** from Section I and Q. Nos. **7** *or* **8**, **9** *or* **10**, **11** *or* **12** from Section II.

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

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

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

SECTION I

1. (*a*) State Clausius and Kelvin-Planck statements of second law and prove their equivalence. [8]

(*b*) A reversible heat pump is used to maintain a temperature of 0°C in a refrigerator when it rejects the heat to the surroundings at 27°C. Determine COP of the machine and work input required if the heat removal rate is 25 kW.

If the required input to run the pump is developed by reversible engine which receives heat at 673 K and rejects heat to the atmosphere. Determine overall COP of the system. [8]

Or

2. (*a*) Explain the principle of increase of entropy. [8]

(*b*) A reversible heat engine takes 900 kJ heat from a source at 700 K. The engine develops 350 kJ of network and rejects heat to two low temperature reservoirs at 600 K and 500 K. Determine engine thermal efficiency and heat rejected to each low temperature reservoir by using Clausius inequality. [8]

3. (*a*) Explain the following : [9]

(*i*) Available and unavailable energy

(*ii*) Principal reasons for irreversibility

(*iii*) Helmholtz and Gibbs function.

(*b*) Calculate the decrease in available energy when 20 kg of water at 90°C mixes with 30 kg of water at 30°C, the pressure being taken as constant and the temperature of surrounding is 10°C. (C_p for water 4.18 kJ/kgK). [8]

Or

4. (*a*) A gas has a density of 1.875 kg/m^3 at pressure of 1 bar and temperature of 15°C. A mass of 0.9 kg of this gas requires heat transfer of 175 kJ to raise the temperature from 15°C to 250°C while pressure of the gas remains constant. Determine :

(*i*) Characteristic gas constant

(*ii*) C_p of gas

(*iii*) C_v of gas

(*iv*) Change in internal energy during the process

(*v*) Work. [10]

(*b*) What is throttling ? Give *two* examples. [3]

(*c*) Write expression for heat, work and change in internal energy of ideal gas during constant volume process, in a close system. [4]

5. (*a*) 1 kg of steam at a pressure of 17.5 bar and dryness 0.95 is heated at constant pressure until it is completely dry saturated. Calculate : [9]

(*i*) Increase in volume

(*ii*) Quantity of heat supplied

(*iii*) Change in entropy.

(*b*) Explain with neat sketch working of 'combined separating and throttling' calorimeter for measuring dryness fraction. State the equation for true dryness fraction. [8]

Or

6. (*a*) With the help of T-S diagram, explain the effect of the following parameters on the performance of Rankine cycle :

(*i*) Effect of superheat

(*ii*) Condenser pressure. [8]

(*b*) A steam turbine receives superheated steam at a pressure of 17 bar and having degree of superheat of 110°C. The exhaust pressure is 0.07 bar and expansion of steam takes place isentropically. Calculate :

(*i*) The heat supplied and heat rejected

(*ii*) Network output

(*iii*) Thermal efficiency

(*iv*) Specific steam consumption.

Neglect pump work. [9]

SECTION II

7. (*a*) Explain bomb calorimeter with neat sketch. [8]

(*b*) The ultimate analysis of dry coal burnt in a boiler is C 84%. H_2 9%, and incombustibles 7% by mass. Determine the mass of dry flue gases per kg of coal burnt, if the volumetric composition of flue gas is : [8]

CO_2	8.75%
CO	2.25%
O_2	8%
N_2	81%

Or

8. (*a*) Define HCV and LCV. [5]

(*b*) Explain Orsat's apparatus for exhaust gas analysis. [5]

(*c*) The following results are obtained when sample of gas is tested by gas calorimeter :

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 gas = 28 kg

Temperature of water at inlet = 10°C

Temperature of water of 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. [6]

9. (*a*) Explain Vane compressor with sketch. [6]

(*b*) Prove that condition for minimum work required for a two stage reciprocating air compressor is :

$$P_2 = \sqrt{P_1 \cdot P_3}$$

where P_1-intake and P_3-delivery pressure. [8]

(*c*) A single stage, single acting compressor delivers air from 1 bar to 7 bar. Assuming compression follow the law $PV^{1.35}$ = constant and clearance 5% of the swept volume, find volumetric efficiency of a compressor. [4]

Or

10. (*a*) Draw and explain actual PV diagram for single stage reciprocating air compressor. [6]

(*b*) Define :

Isothermal efficiency

Volumetric efficiency

Free air delivered in case of compressor. [6]

(*c*) Free air to be compressed from 1 bar to 15 bar pressure. Two alternatives are available i.e. single stage and multistage compression. Assuming polytropic index 1.3, justify which alternative should be used by calculating work. Assume perfect intercooling. [6]

11. (*a*) State advantages of artificial draught over natural draught in boiler. [5]

(*b*) Explain :

(*i*) Boiler efficiency

(*ii*) Boiler accessories with *three* examples. [5]

(*c*) What is equivalent evaporation ? A boiler evaporates 3.6 kg of water per kg of coal into dry saturated steam at 10 bar. The temperature of feed water is 32°C. Find equivalent evaporation 'from and at 100°C'. [6]

Or

12. (*a*) Explain water level indicator with sketch. [5]

(*b*) Explain heat balance sheet, method of its preparation and significance for a boiler. [5]

(*c*) In a boiler test 1250 kg of coal consumed in 24 hrs. Mass of water evaporated is 13000 kg and mean effective pressure is 7 bar. Feed water temperature was 40°C and heating value of coal is 30,000 kJ/kg. Taking enthalpy of 1 kg of steam at 7 bar as 2570 kJ, find equivalent evaporation per kg of coal and boiler efficiency. [6]

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

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S.E. (Mechanical) (I Sem.) EXAMINATION, 2011

METALLURGY

(Common to Sandwich)

(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. Solve the following :

(*a*) Define recrystallization and recrystallization temperature. Explain the factors affecting recrystallization process. [6]

(*b*) Explain the following crystalline defects with sketches :

(*i*) Point defects

(*ii*) Line defects. [8]

(*c*) Distinguish between Slip and Twinning. [4]

Or

2. Solve the following :

(*a*) Explain the effect of grain size on mechanical properties of materials. [4]

(*b*) Explain the phenomenon of strain hardening with the curve. [4]

(*c*) Distinguish between hot and cold working. [4]

(*d*) Comment on the effect of crystal structure on the plastic deformation of materials. What is the role of dislocations during plastic deformation ? [6]

3. Solve the following :

(*a*) Define the following and show on stress-strain curve of M.S. :

(*i*) Yield stress

(*ii*) Ductility

(*iii*) Modulus of toughness

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

(*b*) Explain the principle of ultrasonic flow inspection and state its applications. [4]

(*c*) Explain the standard creep curve and state its use. [4]

Or

4. Solve the following :

(*a*) Suggest suitable hardness testing method for the following and give justification. (Any *four*) :

(*i*) Pearlite phase

(*ii*) Lathe bed

(*iii*) Rubber sole of shoe

(*iv*) Self-lubricating bearings

(*v*) Cutting tools. [8]

(*b*) Explain with neat sketch the fatigue test in detail. [6]

(*c*) Explain the principle of Radiography. [2]

5. Solve the following :

(*a*) Explain the following transformations with neat sketches :

(*i*) Eutectoid

(*ii*) Eutectic. [6]

(*b*) Explain the factors affecting graphitization of cast iron. [4]

(*c*) What is pearlite ? Explain the co-relation between grain size of pearlite and mechanical properties. [4]

(*d*) Explain the "weld decay" phenomenon. [2]

Or

6. Solve the following :

(*a*) Draw Fe-Fe_3C phase equilibrium diagram. Label all phases, temperatures and critical lines. State the use of Fe_3-Fe_3C diagram. [6]

(*b*) Draw microstructures of Gray and Malleable cast irons. [4]

(*c*) State composition, properties and applications of maraging steel. [4]

(*d*) Explain the effect of silicon on microstructure and mechanical properties of cast iron. [2]

SECTION II

7. Solve the following :

(*a*) Draw the microstructures of the following and state their applications (any *three*) :

(*i*) Annealed 0.2% carbon steel

(*ii*) Normalised 0.2% carbon steel

(*iii*) Hardened and tempered tool steel

(*iv*) 0.8% C steel. [6]

(*b*) Draw TTT curve for 0.8% carbon steel and explain the following treatments :

(*i*) Martempering

(*ii*) Austempering. [8]

(*c*) Explain the pack carburizing process. [4]

Or

8. Solve the following :

(*a*) Explain the following heat treatments (any *three*) :

(*i*) Annealing

(*ii*) Normalising

(*iii*) Spheroidizing

(*iv*) Hardening and tempering. [6]

(*b*) Explain the crystal structure and properties of martensite. [6]

(*c*) Distinguish between the following :

(*i*) Carburising and Nitriding

(*ii*) Flame and Induction hardening. [6]

9. Solve the following :

(*a*) List the powder production processes and explain any *one* of them. [4]

(*b*) Explain characteristics of metal powder. [4]

(*c*) State advantages and applications of powder metallurgy technique. [4]

(*d*) Distinguish between brass and bronze. [4]

Or

10. Solve the following :

(*a*) State the non-ferrous alloys for the following components and justify (any *three*) :

(*i*) Cartridge cases

(*ii*) Heat exchanger tubes

(*iii*) Piston

(*iv*) Water tap. [6]

(*b*) Explain the production of self-lubricating bearings. [4]

(*c*) Explain the following terms :

(*i*) Sintering

(*ii*) Compacting

(*iii*) Green strength. [6]

11. Solve the following :

(*a*) Give the classification of composites based on reinforcing material and matrix material. Explain the polymer matrix composites with *one* example. [6]

(*b*) Write a note on dispersion strengthened composites and state the applications. [6]

(*c*) State properties and applications of refractories. [4]

Or

12. Solve the following :

(*a*) Explain the effects of high working temperatures on mechanical properties of materials. State *two* examples. [5]

(*b*) Explain the effects of cryogenic temperatures on mechanical properties of materials. State *two* examples. [5]

(*c*) Compare between the following (any *two*) :

(*i*) Hybrid and non-hybrid composites

(*ii*) Flake and particulate composites

(*iii*) Whisker reinforced and fiber reinforced composites. [6]

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

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S.E. (Mech.) (Sem. I) (Common to Sandwich)

EXAMINATION, 2011

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*) Figures to the right indicate full marks.

(*iii*) Draw suitable sketches wherever necessary.

(*iv*) Assume suitable data wherever necessary.

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

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

SECTION I

UNIT I

1. (*a*) What is kinematic viscosity ? Why is it so called ? Give its unit. [4]

(*b*) Explain : [6]

(*i*) Streak Line

(*ii*) Vapor Pressure

(*iii*) Ideal Fluid

(*iv*) Compressibility.

(*c*) A piston 100 mm in diameter, 125 mm in length moves in a vertical cylinder of 100.4 mm diameter. The annular space between the piston of the cylinder is filled with lubricating oil of dynamic viscosity equal to 0.08 PaS. If the weight of the piston is 30 N, at what velocity the piston would slide. [8]

Or

2. (*a*) What is flow net ? Enlist different methods to draw the flow nets. [4]

(*b*) Distinguish between the following with *one* example : [6]

(*i*) Uniform and non-uniform flow

(*ii*) Rotational and irrotational flow

(*iii*) One, two and three-dimensional flow.

(*c*) A stream function is given by $Y = 3xy$.

Determine : [8]

(*i*) Whether flow is possible ?

(*ii*) Whether flow is rotational or irrotational ?

(*iii*) The potential function f.

(*iv*) Acceleration components at (1, 1).

UNIT II

3. (*a*) Prove that the centre of the pressure of a plane surface is always below the centre of gravity when immersed in liquid. [6]

(*b*) Explain the term Metacentre and stability of floating body. [4]

(*c*) A rectangular barge 21 m long, 5 m wide has the water line 1.6 m and the centre of gravity 2 m above the bottom. Determine the metacentric height. [6]

Or

4. (*a*) State and prove hydrostatic law. [4]

(*b*) State and explain Pascal's law. [4]

(*c*) A square plate of diagonal 1.5 m is immersed in water with its diagonal vertical and upper corner 0.5 m below the free surface of water. Find the hydrostatic force on the plate and the depth of centre of pressure from free surface of water. [8]

UNIT III

5. (*a*) Derive an expression for Bernoulli's equation along a streamline. State the assumptions made. What are limitations of the Bernoulli's equation ? [10]

(*b*) Explain HGL and TEL with figure. [6]

Or

6. (*a*) For a given flow, show that the reading of differential manometer remains unchanged irrespective of the inclination of venturimeter. [8]

   (*b*) A pump is pumping water at the rate of 7536 lt/min. The pump inlet is 40 cm in diameter and the vacuum pressure over there is 15 cm of Mercury. The pump outlet is 20 cm in diameter and it is 1.2 m above the inlet. The pressure at the outlet is 107.4 kN/m^2. Estimate the power added by the pump. [8]

SECTION II

UNIT IV

7. (*a*) Laminar flow takes place in a circular tube. At what distance from the boundary does the local velocity equal to the average velocity ? Derive. [8]

   (*b*) A 1/10 model of an airplane is tested in a variable density wind tunnel. The prototype plane is to fly at 400 km/hr speed under atmospheric conditions. The pressure used in the wind tunnel is 10 times the atmospheric pressure. Calculate the velocity of air in the model. To what prototype value would a measured drag of 500 N in the model correspond ? [10]

Or

8. (*a*) The discharge Q over a small weir is known to depend upon the head 'H' over a weir, the weir height 'P', gravity 'g', width of the weir 'L' and fluid properties density 'r' dynamic viscosity 'μ' and surface tension 's'. Express the relationship between the variables in the dimensionless form. [8]

(*b*) There is a horizontal crack 40 mm wide and 2.5 mm deep in a wall of thickness 100 mm. Water leaks through the crack. Find the rate of leakage of water through the crack if the difference of pressure between the two ends of crack is 0.02943 N/cm^2. Take the viscosity of water equal to 0.01 poise. [10]

UNIT V

9. (*a*) A straight 25 cm pipeline 5 km long is laid between two reservoirs having a difference in level of 40 m. To increase the capacity of the system an additional 2.5 km long 25 cm pipe is laid parallel from the first reservoir to the midpoint of the original pipe. Assuming friction factor as 0.025 for both the pipes; find the increase in discharge due to installation of the new pipe. [10]

(*b*) What is siphon ? On what principle does it work ? Explain. [6]

Or

10. (*a*) A pipeline, 300 mm in diameter and 3200 m long is used to pump up 50 kg per second of an oil whose density is 950 kg/m^3 and whose kinematic viscosity is 2.1 stokes. The center of the pipeline at the upper end is 40 m above than that at the lower end. The discharge at the upper end is atmospheric. Find the pressure at the lower end and draw H.G.L and T.E.L. [10]

(*b*) Describe Prandtl mixing length theory for finding the shear stress in Turbulent flow. [6]

UNIT VI

11. (*a*) Explain the basic of Computational Fluid Dynamics. [6]

(*b*) For the following velocity profiles in the boundary layer on a flat plate, calculate the displacement thickness in terms of the nominal boundary layer thickness d : [10]

(*i*) $u/U = h$

(*ii*) $u/U = 2h - h^2$

where $h = y/d$

Or

12. (*a*) Explain boundary layer separation and its control. [6]

(*b*) A kite has a planform area of 0.025 m^2 and is flying in a wind of velocity 25 km/hr. The kite has a net weight of 1.2 N. When the string is inclined at an angle of 15° to the vertical, the tension in the string was found to be 3 N. Evaluate the coefficients of lift and drag. Take density of air equal to 1.15 kg/m^3. [10]

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

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S.E. (Mechanical) (I Sem.) EXAMINATION, 2011

ENGINEERING MATHEMATICS—III

(Common to Mech. Sandwich/Prod./Prod. S/W and Industrial)

(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**.
Section II : Attempt 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 electronic pocket calculator is allowed.

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

SECTION I

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

(*i*) $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = e^{e^x}$

(*ii*) $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} + 5y = 10\sin x$

(*iii*) $\dfrac{d^2y}{dx^2} + y = \operatorname{cosec} x$ (Use method of variation of parameter)

(*iv*) $\dfrac{d^2y}{dx^2} - 2\dfrac{dy}{dx} = e^x \sin x$

(*v*) $x^3\dfrac{d^3y}{dx^3} + 2x^2\dfrac{d^2y}{dx^2} + 2y = 10\left(x + x^{-1}\right).$

(*b*) Solve :

$$\frac{dx}{dt} + 2x - 3y = t, \quad \frac{dy}{dt} - 3x + 2y = e^{2t}.$$ [5]

Or

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

(*i*) $\frac{d^3y}{dx^3} + \frac{dy}{dx} = \cos x + 2^x$

(*ii*) $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = e^{2x}\sec^2 x$ (Use method of variation of parameter)

(*iii*) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = x \,.\, \cos x$

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

(*v*) $\frac{dx}{y^2} = \frac{dy}{x^2} = \frac{dz}{x^2y^2z^2}.$

(*b*) A body of weight W = 1 N is suspended from a spring stretches it 4 cm. If the weight is pulled from down 8 cm below the equilibrium position and then released, find the displacement of the body from its equilibrium position in time '*t*', also velocity and period of oscillation. [5]

3. (*a*) Find Laplace transform of (any *two*) : [6]

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

(*ii*) $t \,.\, e^{3t} \,.\, \sin 2t$

(*iii*) $\displaystyle\int_0^t \frac{1 - e^{-t}}{t}\, dt.$

(*b*) Solve by using Laplace transform

$$y'' - 2y' + y = e^{-2t}, \; y(0) = y'(0) = 0.$$ [5]

(*c*) Find cosine Fourier transform of :

$$\begin{aligned} F(x) &= x && \text{if } 0 < x < \frac{1}{2} \\ &= 1 - x && \text{if } \frac{1}{2} < x < 1 \\ &= 0 && \text{if } x > 1. \end{aligned}$$ [6]

Or

4. (*a*) Find Inverse Laplace transform of (any *two*) : [8]

(*i*) $\log \left(\dfrac{s^2 + b^2}{s^2 + a^2} \right)$

(*ii*) $\dfrac{2s + 5}{s^2 + 4s + 13}$

(*iii*) $\dfrac{1}{s^3 \left(s^2 + 1\right)}.$

(*b*) Evaluate :

$$\int_0^{\infty} t \,.\, e^{-3t} \sin t \,.\, dt. \qquad [4]$$

(*c*) Solve the Integral equation :

$$\int_0^{\infty} \mathrm{F}(x) \sin \lambda x \,.\, dx = \begin{cases} 1 & 0 \le \lambda < 1 \\ 2 & 1 \le \lambda < 2 \\ 0 & \lambda \ge 2 \end{cases} \qquad [5]$$

5. (*a*) Solve the equation :

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

subject to the conditions $u = 0$, when $x = 0$ and $x = \pi$

$\frac{\partial u}{\partial t} = 0$ when $t = 0$ and $u(x, 0) = x$, $0 < x < \pi$. [8]

(*b*) A homogeneous rod of conducting material of length 100 cm has its ends kept at zero temperature and the temperature initially is

$$\begin{aligned} u(x, 0) &= x, && 0 \le x \le 50 \\ &= 100 - x, && 50 \le x \le 100. \end{aligned}$$

Find $u(x, t)$. [8]

Or

6. (*a*) Use Fourier transform to solve the equation : [8]

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

subject to the following conditions :

(*i*) $u(0, t) = 0 \quad t > 0$

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

(*iii*) $u(x, t)$ is bounded.

(*b*) Solve the equation [8]

$$\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$$

with conditions :

(*i*) $v = 0$, when $y \to \infty$ for all x

(*ii*) $v = 0$, when $x = 0$ for all values of y

(*iii*) $v = 0$, when $x = 1$ for all values of y

(*iv*) $v = x(1 - x)$, when $y = 0$ for $0 < x < 1$.

SECTION II

7. (*a*) Calculate the first four moments about the mean of the distribution. Also find b_1 and b_2 : [7]

x	f
2.0	4
2.5	36
3.0	60
3.5	90
4.0	70
4.5	40
5.0	10

(*b*) An urn contains 8 white and 10 red balls. Second urn contains 11 white, 12 red balls. One ball is drawn at random from the first urn and put into the second urn without noticing its colour. A ball is then drawn at random from the second urn. What is the probability that it is white ? [5]

(*c*) The mean and variance of Binomial distribution are 4 and 2 respectively. Find $p(r \; ^{3} \; 2)$. [4]

Or

8. (*a*) A manufacturer of cotter pins knews that 3% of his product is defective. If he sells cotter pins in boxes of 100 pins and guarantees that not more than 6 pins will be defective in a box, find the probability that a box will fail to meet the guaranteed quality. [5]

(*b*) Obtain regression lines for the following data : [7]

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

(*c*) Heights of students follow normal distribution with mean 190 cm and variance 70 cm. In a school of 800 students how many are expected to have heights above 200 cm. [z = 1.195, A = 0.3840] [4]

9. (*a*) If

$$\bar{r} \;'\; \frac{d\bar{r}}{dt} = 0,$$

show that $\bar{r}$ has constant direction. [5]

(*b*) Find the directional derivative of $\phi = xy^2 + yz^3$ at $(1, 2, 1)$ along a direction equally inclined with coordinate axes. [4]

(*c*) Establish the following vector identities (any *two*) : [8]

(*i*)

(*ii*) $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$

(*iii*) $\nabla \cdot \left(\frac{\bar{a} \times \bar{r}}{r}\right) = 0.$

Or

10. (*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 value of m so that at time $t = 1$, the acceleration is normal to the position vector. [5]

(*b*) If the directional derivative of $\phi = axy + byz + czx$ at $(1, 1, 1)$ has maximum magnitude 4 in a direction parallel to z-axis, find the values of a, b, c. [6]

(*c*) Verify whether :

$$\bar{F} = (y\sin z - \sin x)\,\bar{i} + (x\sin z + 2yz)\,\bar{j} + \left(xy\cos z + y^2\right)\bar{k}$$

is irrotational and if so, find the corresponding scalar potential ϕ. [6]

11. (*a*) Find work done by the force

$$\overline{F} = (x^2 - yz)\,\overline{i} + (y^2 - zx)\,\overline{j} + (z^2 - xy)\,\overline{k}$$

in taking a particle from (1, 2, 1) to (2, –5, 7). [5]

(*b*) Use the divergence theorem to evaluate

$$\iint_S (y^2z^2\,\overline{i} + z^2x^2\,\overline{j} + x^2y^2\,\overline{k}) \cdot d\overline{S}$$

where S is the upper part of the sphere $x^2 + y^2 + z^2 = 16$ above the xoy plane. [6]

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

$$\int_C 4y\,dx + 2z\,dy + 6y\,dz,$$

where C is the curve of intersection of $x^2 + y^2 + z^2 = 4z$ and $z = x + 2$. [6]

Or

12. (*a*) Evaluate :

$$\int_C \overline{F} \cdot d\overline{r}$$

for $\overline{F} = (2y + 3)\,\overline{i} + xz\,\overline{j} + (yz - x)\,\overline{k}$ along the straight line joining (1, 2, 1) to (2, 1, 3). [5]

(*b*) Evaluate :

$$\iint_S xz^2\, dy\, dz + \left(x^2y - z^2\right) dz\, dx + \left(2xy + y^2z\right) dx\, dy,$$

where S is the surface enclosing a region bounded by hemisphere $x^2 + y^2 + z^2 = a^2$ above the xoy plane. [6]

(*c*) Verify Stokes' theorem for

$$\bar{\mathrm{F}} = -y^3\,\bar{i} + x^3\,\bar{j}$$

and the closed curve C is the boundary of the ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1.$$ [6]

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

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S.E. (Mechanical) (I Sem.) EXAMINATION, 2011

MANUFACTURING PROCESSES

(2008 PATTERN)

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

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

(*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*) State the principles of centrifugal casting and state its types, advantages and limitations. [8]

(*b*) Write down the procedure for the following sand tests : [8]

(*i*) Moisture content test

(*ii*) Permeability test

(*iii*) Clay content test

(*iv*) Compression strength test

Or

2. (*a*) Explain in brief various allowances provided on pattern. Also draw neat sketches of segmental pattern and lagged-up pattern. [8]

(*b*) Explain the construction and working of hot chamber die casting process. State the advantages and limitations of the process. [8]

UNIT II

3. (*a*) Explain the different types of forging defects with reference to causes and remedies. [8]

(*b*) Sketch and explain the working of "Universal rolling mill" and "Planetary rolling mill". [8]

Or

4. (*a*) Describe with neat sketches the operation of wire drawing and tube drawing. [8]

(*b*) Define extrusion process. Compare direct extrusion and indirect extrusion. [8]

UNIT III

5. (*a*) Compare with neat sketches leftward and rightward welding techniques. Specify the merits and limitations of both the techniques. [10]

(*b*) What is the purpose of coating on an arc welding electrode ? [8]

Or

6. (*a*) Distinguish between brazing, soldering and braze welding processes. [10]

(*b*) Describe various types of adhesives and their applications. [8]

SECTION II

UNIT IV

7. (*a*) Define taper. How is the amount of taper expressed ? Describe set over method of taper turning on a lathe. [8]

(*b*) What is multi-start thread ? Explain with schematic diagram the principle of thread cutting on a lathe. [10]

Or

8. (*a*) Why are chucks used ? List various types of chucks used in lathes. Describe any *one* in brief. [8]

(*b*) Calculate the machining time required to reduce 60 mm diameter Shaft to 50 mm diameter for a length of 1500 mm with depth of cut of 2 mm for rough cut and 1 mm for finish cut. Given : [10]

(*i*) Cutting speed = 30 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).

UNIT V

9. (*a*) Differentiate between : [8]

(*i*) Gang milling and Straddle milling

(*ii*) Up milling and Down milling.

(*b*) Explain working principle of Universal dividing head. [8]

Or

10. (*a*) Draw a neat labelled sketch of Sensitive Drilling Machine. Explain its construction and working. [8]

(*b*) Calculate the machining time required for producing 20 holes on an M.S. plate of 40 mm thickness with the following data : [8]

(*i*) Drill diameter = 30 mm

(*ii*) Cutting speed = 25 m/min

(*iii*) Feed = 0.1 mm/rev.

(*iv*) Overrun = 0.5 × Drill diameter (mm).

UNIT VI

11. (*a*) Explain dressing, truing and balancing of grinding wheel. [8]

(*b*) Outline various factors that influence the selection of grinding wheel. Explain the meaning of any *four* letters mentioned in the specification printed on a grinding wheel. [8]

Or

12. (*a*) Briefly explain the process of burnishing. [8]

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

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

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S.E. (Mechanical) (IInd Sem.) EXAMINATION, 2011

THEORY OF MACHINES AND MECHANISMS–I

(2008 PATTERN)

Time : Four Hours **Maximum Marks : 100**

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

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

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

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

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

SECTION I

UNIT I

1. (*a*) Fill in the blanks with *correct* alternative and rewrite the complete sentences. [6]

1. One ternary joint is equivalent to........................binary joints.

(*a*) 1

(*b*) 2

(*c*) 3

(*d*) 4

2. A screw pair has.........................DOF (degrees of freedom).

(*a*) 1

(*b*) 2

(*c*) 3

(*d*) 4

3. Equivalent Linkage of a 'Cam Follower Pair' with radial cam driving reciprocating follower is a.........................and that of a 'Spur gear pair' is a.......................... .

(*a*) Crank-Rocker mechanism

(*b*) Double slider mechanism

(*c*) Four bar mechanism

(*d*) Slider crank mechanism

4. In a 4 revolute 'Grashoffian chain', if the shortest link is grounded, we get........................... .

(*a*) double rocker mechanism

(*b*) crank rocker mechanism

(*c*) double crank mechanism

(*d*) structure

5. Track rod of 'Davis steering gear mechanism' is a.............................link.

(*a*) binary

(*b*) ternary

(*c*) quaternary

(*d*) fluid

(*b*) Fig. 1 shows schematic of a mechanism. Redraw the sketch on the answer-book. Find out the total number of kinematic links and number of kinematic pairs. Hence find out the degrees of freedom for the mechanism. [4]

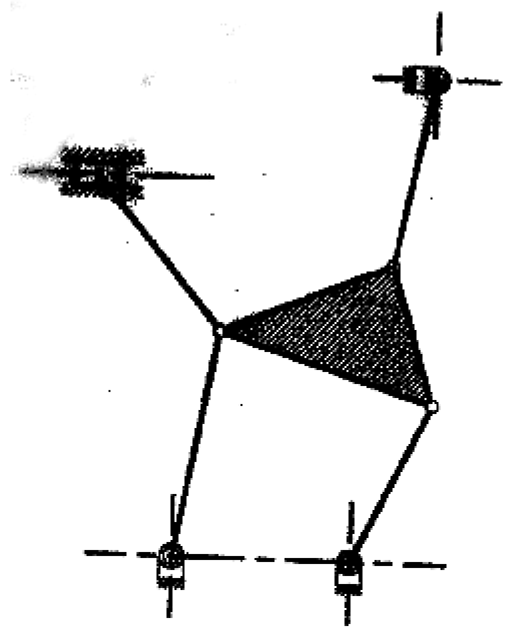

Fig. 1

(*c*) Compare 'Davis' and 'Ackermann' steering gear mechanisms. [6]

Or

2. (*a*) In case of an elliptical trammel, prove that any point on the coupler rod traces perfect ellipse. Hence locate that point on the coupler, which will trace circle. [6]

(*b*) Fig. 2 shows schematic of a mechanism. Redraw the sketch on the answer-book. Find out the total number of kinematic links and number of kinematic pairs. Hence find out the degrees of freedom for the mechanism. [4]

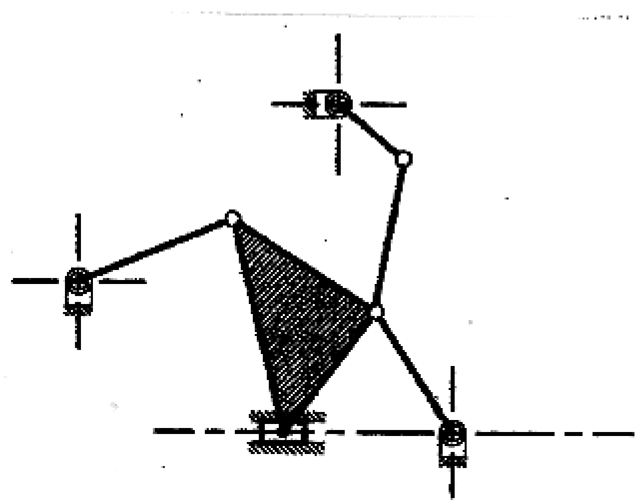

Fig. 2

(*c*) With the help of a neat sketch explain the construction and working of 'Pantograph' or 'Geneva Mechanism'. [6]

UNIT II

3. (*a*) Fig. 3 shows a mechanism in which crank OA is rotating anticlockwise at 20 rad/s. At the instant shown, find out the velocity and acceleration of sliders B and D as well as the angular acceleration of link AB using relative method (polygon method).

(Use scale 1 mm $\circ$ 10 mm/s for the velocity polygon and 1 mm $\circ$ 200 mm/s^2 for the acceleration polygon). [12]

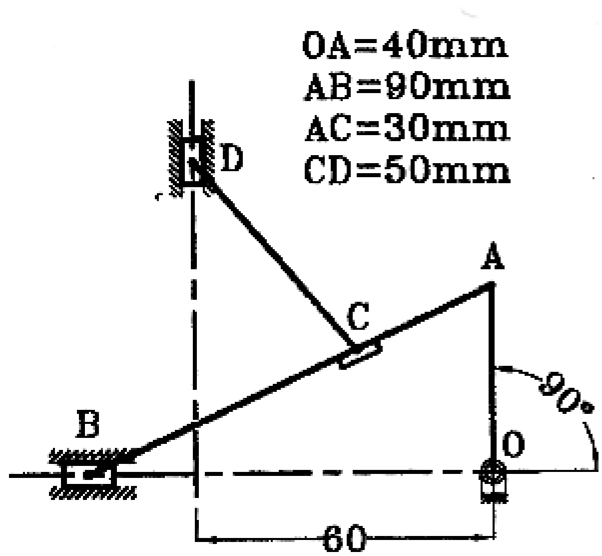

Fig. 3

(*b*) With the help of supporting sketch, explain the concept of 'Velocity Image Principle'. [4]

Or

4. (*a*) Fig. 4 shows a mechanism in which crank OA is rotating clockwise at 240 rpm. At the instant shown, locate all ICRs for the mechanism and find out the velocity of slider E as well as the angular velocity of link BC using ICR method. [10]

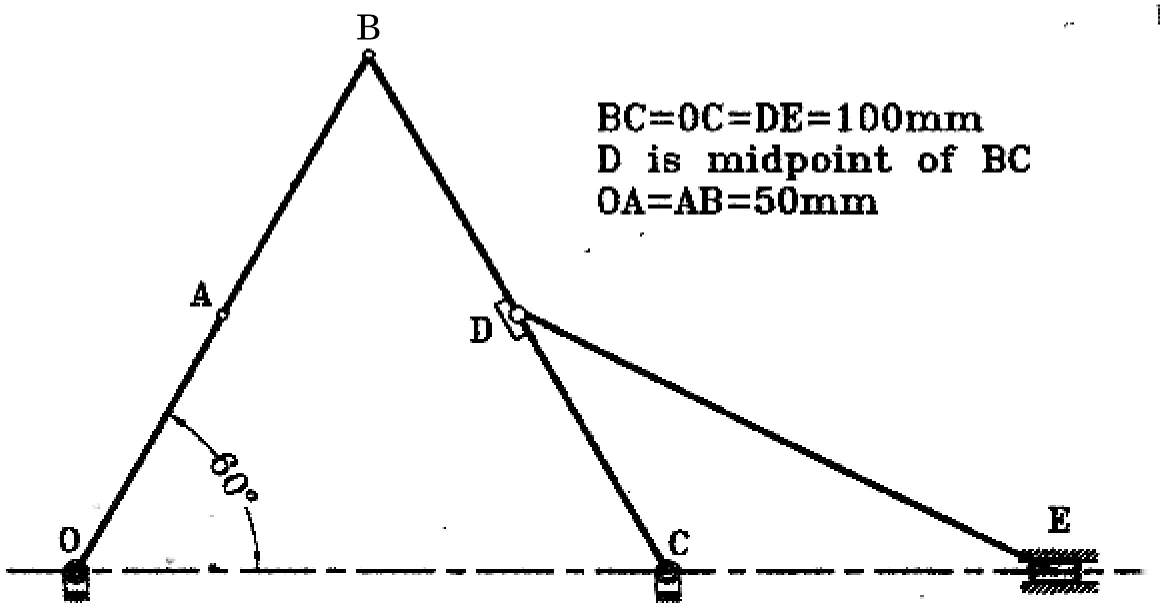

Fig. 4

(*b*) With the help of supporting sketch, explain the concept of 'Body centrode and Space centrode'. [6]

UNIT III

5. Fig. 5 shows a mechanism in which crank OA is rotating clockwise at 30 rad/s. Lever CD drives slider F through coupler EF as shown. At the instant shown, find out the acceleration of slider F as well as the angular acceleration of Link EF.

(Use scale 1 mm ◦ 10 mm/s for the velocity polygon and 1 mm ◦ 300 mm/s^2 for the acceleration polygon). [18]

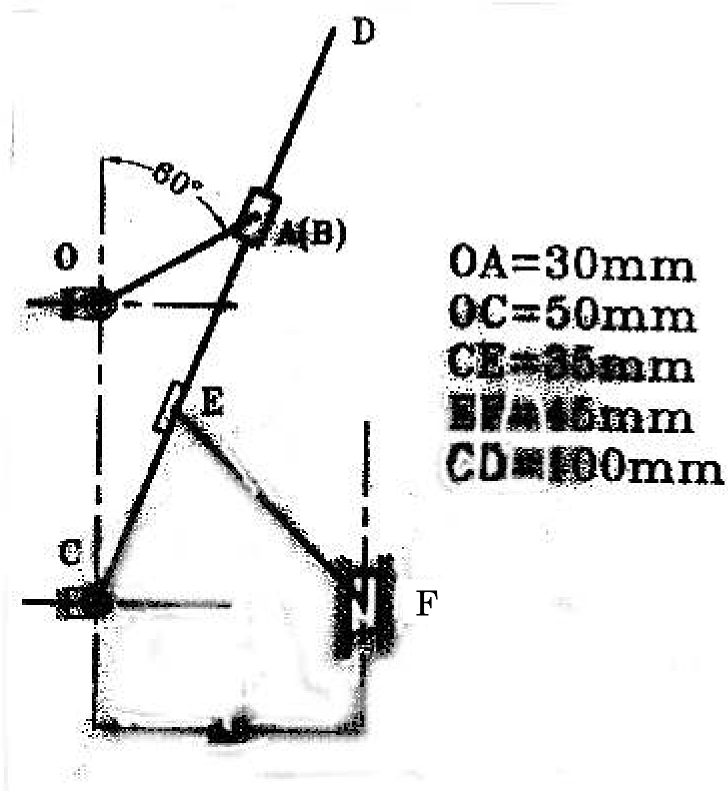

Fig. 5

Or

6. (*a*) State whether the following statements are *true* or *false* and justify your answer : [6]

(1) We will have to consider 'Coriolis component of acceleration' while analyzing a normal scotch yoke mechanism.

(2) Shape of acceleration polygon remains unchanged if we reverse the direction of rotation of input link.

(3) In all mechanisms involving trunnion, coriolis component must be considered in the acceleration analysis.

(*b*) In an IC engine mechanism, crank radius is 40 mm and connecting rod length is 160 mm. The crank is rotating at 10 rad/s clockwise. At a particular instant the crank is at 40º from TDC position. For this position of the mechanism, find out the velocity and acceleration of piston and angular velocity and angular acceleration of connecting rod using Klein's construction method. [12]

SECTION II

UNIT IV

7. (*a*) Show that the velocity ratio of shafts connected by Hooke's joint is given by the following equation, where a is the angle between the shafts and q is the angle turned by driving shaft from the position when its fork lies is the planes of shaft axes :

$$(\cos\alpha) / (1 - \sin^2\alpha \, . \, \cos^2\theta) \, . \qquad [8]$$

(*b*) The four bar mechanism ABCD is shown in the following Fig. 6 which is driven by link 2 at w_2 = 45 rad/sec, counterclockwise.

Find the angular velocities of link 3 and link 4 by using complex number method. [8]

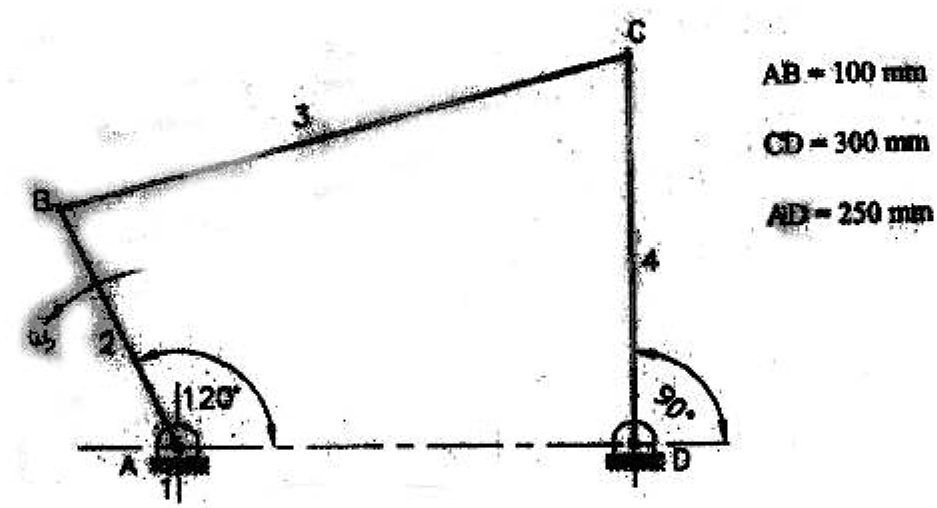

Fig. 6

Or

8. (*a*) In an IC engine mechanism, the stroke of the slider is 180 mm and the obliquity ratio is 4.25. The crank rotates uniformly at 900 rpm clockwise. Find :

(*i*) Velocity and acceleration of piston and

(*ii*) Angular velocity and angular acceleration of connecting rod, when the crank is at 30° past the ODC. [8]

(*b*) Two shafts are connected by a universal joint. The driving shaft rotates at a speed of 1200 rpm. Determine the greatest permissible angle between the shaft axes so that the total fluctuation of speed does not exceed 100 rpm. Also calculate the maximum and minimum speed of shaft. [8]

UNIT V

9. (*a*) Explain with the help of neat sketches : [6]

(*i*) Angle relationship for function generation

(*ii*) Precision positions and structural error

(*iii*) Path generation.

(*b*) Design a four bar mechanism with input link a, coupler link b, output link c. Angle q and j for three successive positions are given in the table below : Use Freudenstein method :

Position	**1**	**2**	**3**
q	30	50	70
j	40	75	100

Draw the mechanism in second position. [10]

Or

10. (*a*) A four bar mechanism is to be designed, by using three precision points, to generate the function $y = x^{1.5}$ for the range 1 £ x £ 4. Assume 30º starting position and 120º finishing position for the input link and 90º starting position and 180º finishing position for the output link, find the values of x, y, q and j corresponding to the three precision points. [8]

(*b*) Synthesis the four bar mechanism ABCD, in which the length of the fixed link AD is 400 mm and the crank AB is of 120 mm long. The initial position makes an angle 60º with link AD, the angle between the fixed link AD and 2nd position is 120º and the angle between the third position and link AD is 180º. The angle between the first and second and second and third position of the output link are the 60º and 30º respectively. Draw the mechanism in the first position by inversion method. [8]

UNIT VI

11. (*a*) The following data relate to a connecting rod of a reciprocating engine : [12]

Mass = 55 kg

Distance between bearing centers = 850 mm

Diameter of small end bearing = 75 mm

Diameter of big end bearing = 100 mm

Time of oscillation when the connecting rod is suspended from small end 1.83 seconds. Time of oscillation when the connecting rod is suspended from big end = 1.68 seconds. Determine :

(1) The radius of gyration of the rod about an axis passing through the centre of gravity and perpendicular to the plane of oscillation;

(2) The moment of inertia of the rod about the same axis; and

(3) The dynamically equivalent system for the connecting rod constituted of two masses, one of which is situated at the small end.

(*b*) Draw and explain turning moment diagram of a 4 stroke cylinder engine. State significance of it. [6]

Or

12. (*a*) With the help of neat schematic diagram, derive frequency equation of bifilar suspension system. [6]

(*b*) The piston diameter of an internal combustion engine is 125 mm and the stroke is 220 mm. The connecting rod is 4.5 times the crank length and has a mass of 50 kg. The mass of the reciprocating parts is 30 kg. The centre of mass of connecting rod is 170 mm from the crank pin centre and the radius of gyration about an axis through the centre of mass is 148 mm. The engine runs at 320 rpm. Find the magnitude and the direction of the inertia force and the corresponding torque on the crankshaft when the angle turned by the crank is 140° from the inner dead centre. [12]

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

[4062]-117

S.E. (Mech.) (Second Sem.) EXAMINATION, 2011

INTERNAL COMBUSTION ENGINES

(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*) Derive an expression for thermal efficiency of a Diesel cycle with usual notations. Hence show that the efficiency of the Diesel cycle is lower than that of Otto cycle for the same compression ratio. Comment why the higher efficiency of Otto cycle compared to Diesel cycle have no practical importance. [9]

(*b*) The mean effective pressure of an ideal Diesel cycle is 8 bar. If the initial pressure is 1.03 bar and the compression ratio is 12, determine the cut-off ratio and the air-standard efficiency. Take $\frac{C_p}{C_v}$ for air as 1.4. [9]

Or

2. (*a*) How do the specific heats vary with temperature ? What is the physical explanation for this variation ? [5]

(*b*) Compare Air-standard cycle, fuel-air cycle and actual cycle of a gasolene engine. [5]

(*c*) Fuel supplied to an SI engine has a calorific value 42000 kJ/kg. The pressure in the cylinder at 30% and 70% of the compression stroke are 1.3 bar and 2.6 bar respectively. Assuming that the compression follows the law $pV^{1.3}$ = constant, find the compression ratio. If the relative efficiency of the engine compared with the air-standard efficiency is 50%, calculate the fuel consumption in kg/kW hr. [8]

3. (*a*) Describe with suitable sketches the following systems of a modern carburettor :

(*i*) Main metering system

(*ii*) Economiser system and

(*iii*) Choke. [9]

(*b*) A four-cylinder, four stroke square engine running at 40 rev/sec. has a carburettor venturi with 3 cm throat. Assuming the bore to be 10 cm, volumetric efficiency 75%, the density of air to be 1.15 kg/m^3 and coefficient of air flow to be 0.75. Calculate the suction at the throat. [7]

Or

4. (*a*) What action can be taken with regard to the following variables, in order to reduce the possibility of detonation in an S.I. engine ? Justify your answers by reasons :

(*i*) Mass of charge induced

(*ii*) Spark timing

(*iii*) Distance of flame travel and

(*iv*) Engine speed. [8]

(*b*) Explain the phenomenon of pre-ignition. How pre-ignition leads to detonation and vice-versa ? Explain how pre-ignition can be detected ? [8]

5. (*a*) Explain the stages of combustion in a CI engine. [6]

(*b*) What is the importance of delay period ? Should the delay period be zero ? [4]

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

(*i*) Pre-combustion chamber

(*ii*) M combustion chamber.

Or

6. (*a*) How do the injection timing and the fuel quality affect the engine knock ? [4]

(*b*) Discuss the requirements of an ideal injection. [4]

(*c*) Describe the principle of a helix bypass pump and draw sketches for different types of plunger helix in use. [8]

SECTION II

7. (*a*) Explain any *one* type of Electronic Ignition System. [8]

(*b*) What do you mean by drive train mechanism ? Explain with sketches. [8]

Or

8. (*a*) What is governing of IC engines ? Explain Hit and Miss governing. [8]

(*b*) What do you mean by intake and exhaust system ? Explain with sketches various parts of intake and exhaust systems in brief. [8]

9. (*a*) What are the various methods for measuring friction power ? Describe the 'Motoring method' of measurement of friction power. [8]

(*b*) A 4-cylinder petrol engine with 80 mm bore and 110 mm stroke length working on 4-stroke principle develops torque 140 N-m at 4500 rpm. The clearance volume per cylinder is 0.065 litres. Fuel consumption is 16 kg/hr. Take C.V. of fuel as 42500 kJ/kg and was 1.4 for air.

Calculate :

(*i*) B.P.

(*ii*) bmep

(*iii*) Brake thermal efficiency and

(*iv*) Relative efficiency. [10]

Or

10. (*a*) Explain the limitations of Supercharging. [4]

(*b*) Describe with a sketch the principle of a hydraulic dynamometer. [8]

(*c*) A single cylinder engine running at 2000 rpm develops a torque of 10 N-m. The indicated power of the engine is 2.3 kW. Find the loss due to friction power as the percentage of brake power. [6]

11. (*a*) Enlist the specifications of an automotive engine. [8]

(*b*) Explain exhaust gas recirculation system to control oxides of nitrogen. [8]

Or

12. (*a*) Explain Hybrid Electric-vehicle (HEVs). [8]

(*b*) Explain :

(*i*) Compressed Natural Gas (CNG)

(*ii*) Liquefied Petroleum Gas (LPG). [8]

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

[4062]-118

S.E. (Mech./Mech. S/W/Prod./Prod. S/W)

(Second Semester) EXAMINATION, 2011

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*) Your answers will be valued as a whole.

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

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

SECTION A

1. (*a*) Reactive power of three-phase balance circuit is to be measured by one wattmeter method. Explain with the help of neat circuit diagram and phasor diagram. [6]

(*b*) Explain various components of three-phase HT bill. [6]

(*c*) What is LED lighting ? State the merits and demerits of use of LED lights over conventional bulbs, tubes and CFLs. [6]

P.T.O.

Or

2. (*a*) Draw and explain block diagram of single-phase energy meter. What is energy meter constant ? [6]

(*b*) State the drawbacks of low power factor and explain any *one* method of power factor improvement used in practice. [6]

(*c*) The three-phase power is measured by a two wattmeter method. The readings of two wattmeter are $W_1 = 2000$ W and $W_2 = 500$ W. Calculate the total power and p.f. of the circuit. Also calculate current drawn from 400 V, 50 Hz, three-phase supply if load is delta connected. [6]

3. (*a*) With the help of connection diagram explain various types of three-phase transformer connection. [8]

(*b*) The output of a three-phase induction motor running at 4% slip is 36.775 kW. Find the rotor copper loss and motor efficiency if the stator losses and mechanical losses are 3000 W and 1500 W respectively. [8]

Or

4. (*a*) Why does three-phase induction motor need a starter ? Explain with the help of diagram a three-phase DOL starter. [8]

(*b*) Explain with neat diagram a typical layout of a distribution transformer substation. (Single line diagram only). [8]

5. (*a*) Why is single-phase motor not self-started ? Explain construction, working of capacitor start split phase technique to make single-phase motor self-started with the help of circuit diagram. Also state the advantages of this method and applications. [8]

(*b*) Derive from first principle emf generated in three-phase alternator per phase and on line basis. Also state the effect of coil span and winding distribution on the emf generated. [8]

Or

6. (*a*) A three-phase, 50 Hz, star connected, 2000 kVA, 2300 V alternator gives a short circuit current of 600 A for a certain field excitation. With the same excitation, open circuit voltage was 900 V. If the resistance per phase for armature winding is 0.06 Ω. Find out full load regulation at :

(*i*) unity power factor

(*ii*) 0.8 p.f. lagging. [8]

(*b*) With the help of neat simple diagram explain merits, demerits of salient and non-salient type synchronous generator. [8]

SECTION B

7. (*a*) Universal motor—construction, working, characteristics and applications. [8]

(*b*) State the various methods used for speed control of D.C. series motor. Explain in detail any *one* method with neat circuit diagram. [8]

Or

8. (*a*) A 230 V, d.c. shunt motor draws current of 8A at no load from supply and runs at 1200 rpm. Find the speed of the motor when on load it will draw a current of 38A from supply. Assume :

(*i*) flux remains constant

(*ii*) armature resistance 0.25 Ω

(*iii*) shunt field resistance 115 Ω. [8]

(*b*) Draw and explain electrical and mechanical characteristics for the following d.c. motors :

(*i*) Shunt motor

(*ii*) Series motor

(*iii*) Compound motor (cumulative). [8]

9. (*a*) State and explain various turn on methods used for SCR. Also state any *five* specifications of SCR. [8]

(*b*) Explain construction, working, characteristic and applications of GTO. [8]

Or

10. (*a*) Draw and explain V-I characteristic of SCR. Show on the characteristic forward-reverse-conduction regions. [8]

(*b*) Construction, working and output characteristic of enhancement type MOSFET. Also state applications of MOSFET. [8]

11. (*a*) State *two* applications of the following industrial motors/ drives :

(*i*) D.C. shunt motor

(*ii*) D.C. series motor

(*iii*) D.C. compound motor (Cumulative type)

(*iv*) Induction three-phase motor

(*v*) Single-phase induction motor (Split phase)

(*vi*) Stepper motor

(*vii*) Three-phase synchronous motor

(*viii*) Single-phase shaded pole motor. [10]

(*b*) With the help of neat circuit diagram explain step down chopper operation. Also derive formula for output voltage in terms of duty cycle 'α' (alpha). [8]

Or

12. (*a*) State the advantages of electrical drives. State the merits and demerits of individual and group drive. [9]

(*b*) With the help of neat diagram explain stator voltage control of three-phase induction motor. [9]

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

[4062]-119

S.E. (Mech./Mech S/w) EXAMINATION, 2011

(For Mechanical Branch-II Sem. and
For Mechanical Sandwich–I Sem.)

STRENGTH OF MACHINE ELEMENTS

(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

UNIT I

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

(*i*) Modulus of Rigidity

(*ii*) Margin of Safety

(*iii*) Poisson's ratio

(*iv*) Statistically inderminate structures.

P.T.O.

(*b*) A rod of steel is 20 meters long at a temperature of 20°C. Find the free expansion of the rod when the temperature is raised by 65°C. Find the temperature stress produced :

(*i*) when the expansion of rod is prevented

(*ii*) when the rod is permitted to expand by 5.8 mm.

Take $\alpha = 12 \times 10^{-6}$ per °C, $E = 2 \times 10^{5}$ N/mm^2. [6]

(*c*) A solid right circular cone hangs vertically and its diameter base is hang at the ceiling as shown in Fig. 1. Derive the expression for strain energy stored in bar due to its self weight. Assume specific weight of the cone is γ and modulus of elasticity as 'E'. [6]

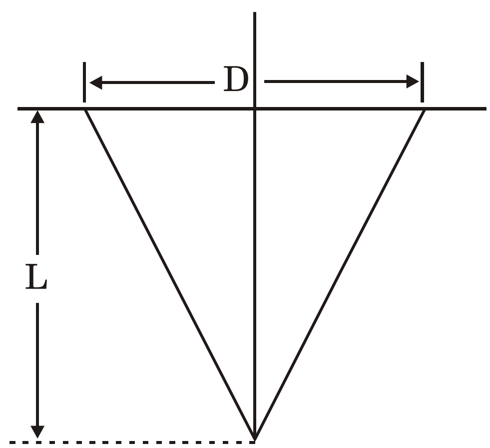

Fig. 1

Or

2. (*a*) Derive the equation for the relation between modulus of elasticity and bulk modulus. [4]

(*b*) Calculate the modulus of rigidity and bulk modulus of a cylindrical bar diameter 30 mm and length 1.5 meter if a longitudinal strain in the bar during a tensile test is four times the lateral strain. Find the change in volume, when the bar is subjected to a hydrostatic pressure of 100 N/mm^2. Take E = 1×10^5 N/mm^2. [6]

(*c*) Water under pressure 8 N/mm^2 is suddenly admitted on to a plunger of 80 mm diameter, attached to a rod of 25 mm diameter, 2.5 meter long. Find the maximum instantaneous stress developed and deformation of the rod. Take E = 210 GPa. [6]

UNIT II

3. (*a*) The shear force diagram for a beam is shown in Fig. 2. Identify the location and nature of supports. Draw the loading and bending moment diagrams and determine the position and magnitude of maximum bending moment and position of any point of contraflexures. [10]

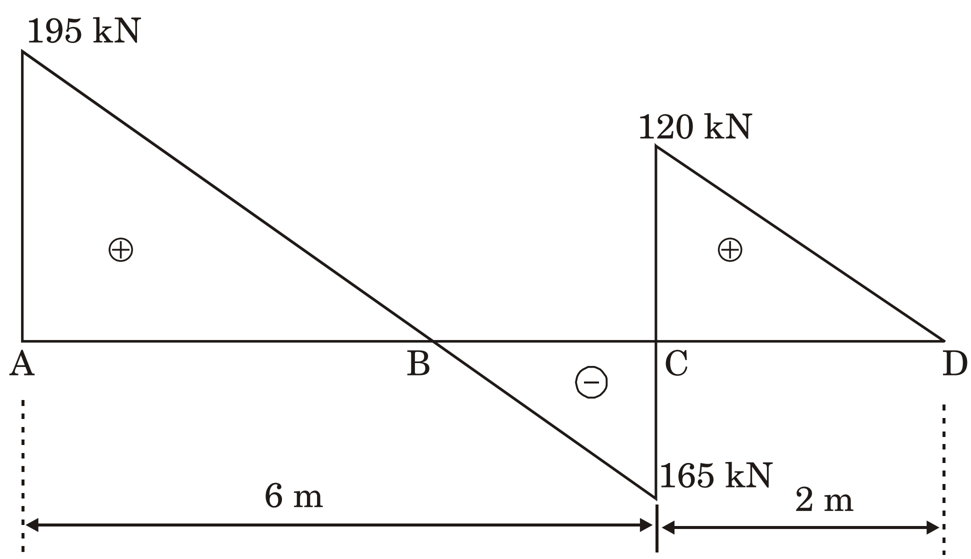

Fig. 2

(*b*) Derive the equations for slope and maximum deflection for a simply supported beam 'AB' of length 'L' carrying a uniformly distributed load '*w*' N/m over its entire span, as shown in Fig. 3. [8]

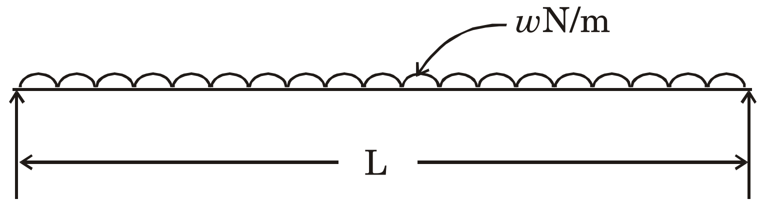

Fig. 3

Or

4. (*a*) The beam ABC as shown in Fig. 4 is hinged to the wall at 'A'. A vertical bracket 'BD' is firmly fixed to the beam at 'B' and 'DE' is hinged to the bracket at 'D' and the wall at 'E'. Draw shear force and bending moment diagrams for the beam ABC when it carries an uniformly distributed load of 30 kN/m over portion 'AB' as shown in Fig. 4 and a point load of 30 kN at 'C'. [10]

Fig. 4

(*b*) A rolled steel joist 600 mm × 210 mm is simply supported at its ends on a span of 10 meters and carries a uniformly distributed load of 12.5 kN/m run including its own weight. If the maximum deflection is not to exceed 20 mm and the maximum stress due to bending is not to exceed 140 N/mm^2. Find the greatest value of an additional concentrated load which may be added to the joist to the middle of the span. For a joist, take $I_{XX} = 7.2868 \times 10^8$ mm^4 and $E = 2 \times 10^5$ N/mm^2. [8]

UNIT III

5. (*a*) Derive the expressions for normal and shear stresses on an oblique plane of a rectangular body which is subjected to two direct stresses in two mutually perpendicular directions as shown in Fig. 5. [6]

σ_y

σ_x σ_x

σ_y

Fig. 5

(*b*) A square pin is required to resist a pull of 40 kN and a shear force of 15 kN. Derive a suitable section (i.e. side of a square pin) according to strain energy theory. Maximum elastic stress in tension is 350 N/mm^2. Poisson's ratio is 0.3 and factor of safety of 2.5. [8]

(*c*) Define :

(*i*) Principle planes

(*ii*) Principle stresses. [2]

Or

6. (*a*) Explain : [8]

(*i*) Maximum principle stress theory

(*ii*) Maximum shear stress theory.

(*b*) Fig. 6 shows normal and tangential stresses on two planes. Determine the principal stresses. [8]

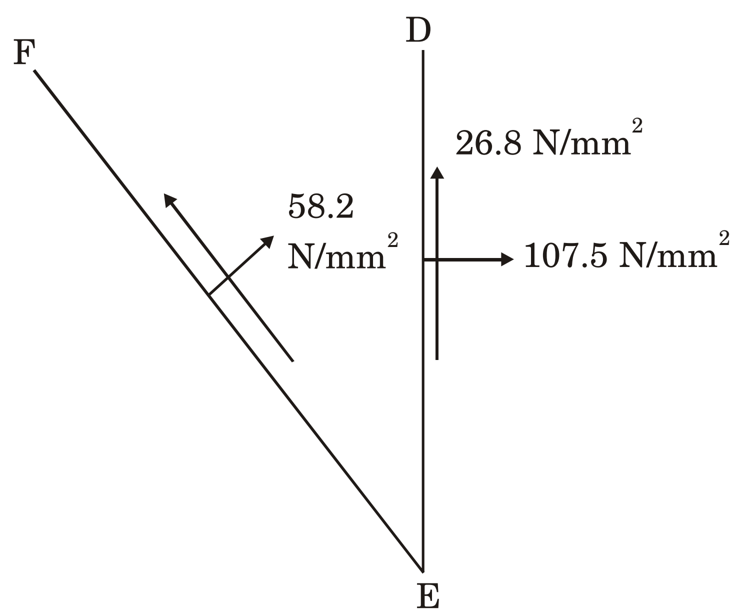

Fig. 6

SECTION II

UNIT IV

7. (*a*) What is pure bending ? Write the assumption made in pure bending for the beam. Derive an equation for bending moment M in terms of Modulus of elasicity E, Radius of curvature R and Moment of inertia I. [8]

(*b*) A 'C' section shown in Fig. 7 (*a*) is used as a beam of 1 m length, fixed at one end and free at the other. It carries 90 kN vertical load at free end and a couple of 50 kNm as shown in Fig. 7(*b*). Compute shear stresses at critical points in the section and plot the shear stress variation. [8]

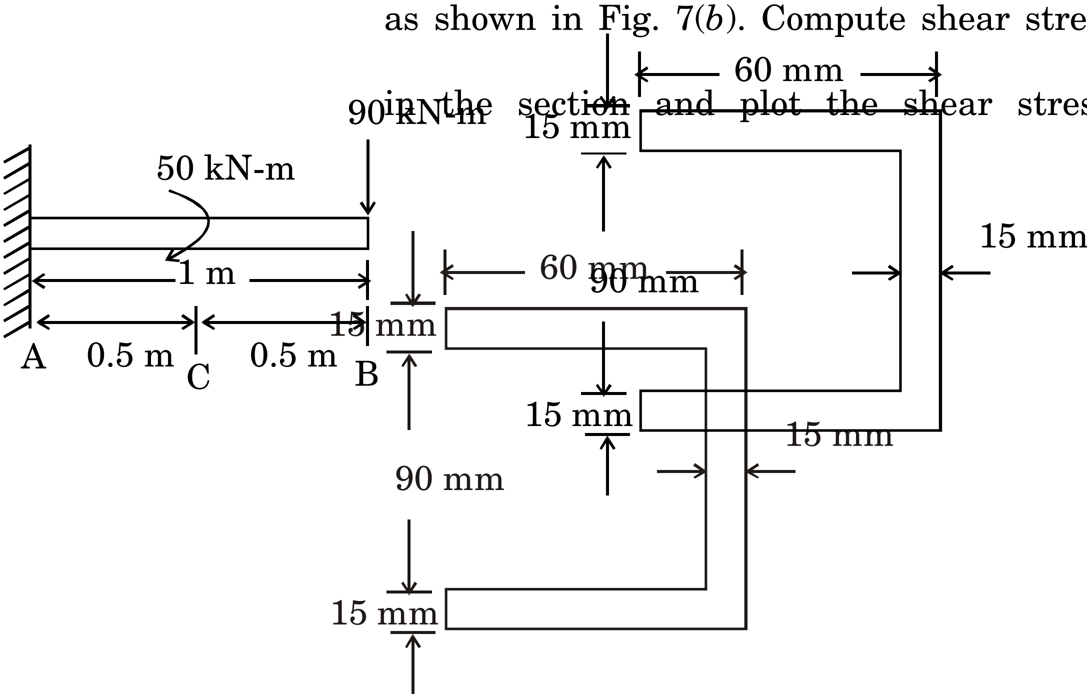

Fig. 7(*a*) Fig. 7(*b*)

Or

8. (*a*) A section used for machine component is as shown in Fig. 8. The machine component is used as a simply supported beam with 4 m length and carries a uniformly distributed load throughout the span. If allowable stresses in tension and compression are 25 MPa and 45 MPa respectively. Calculate the intensity of uniformly distributed load. [8]

Fig 8

(*b*) A simply supported beam having I section as shown in Fig. 9 carries a central load '*w*' kN over a span of 'L' m. If the maximum shear stress is to be 45 N/mm^2 when maximum bending stress is 150 N/mm^2. Calculate the value of central applied load '*w*' and span 'L'. [8]

Fig 9

UNIT V

9. (*a*) A composite shaft ABC is fixed at ends A and C as shown in Fig. 10. It is subjected to 500 Nm torque at B. Determine (*i*) Relative torque at A and B (*ii*) Maximum shear stress in each material (*iii*) Angle of twist at B. [8]

$G_{Brass} = 40$ GPa $\quad\quad G_{steel} = 79$ GPa

Fig. 10

(*b*) From the first principle, derive equation for Euler load P_E for a column with lower end fixed and upper end hinged. Hence show that effective length of this column is 0.707L where L is the length of equivalent pin ended i.e. column carrying same load. [8]

Or

10. (*a*) A solid shaft of 160 mm diameter has the same cross-sectional area as that of hollow shaft of the same material of inside diameter 110 mm.

(*i*) Find the ratio of power transmitted by the two shafts of same angular velocity (*ii*) Compare angle of twist in equal lengths of these shafts when stressed equally. [8]

(*b*) A solid circular bar 25 m long and 120 mm diameter was found to extend 1.2 mm under tensile load of 52 kN. The bar is used as strut. Determine crippling load and also safe load taking F.O.S. 3 with the following end condition :

(*i*) Both ends are fixed

(*ii*) One end fixed and other end hinged

(*iii*) Both ends are pin Jointed.

Use Euler's equation. [8]

UNIT VI

11. (*a*) Explain briefly the requisites of Design Engineer. [4]

(*b*) Explain briefly the various phases involved in the process of design of machine elements. [4]

(*c*) A knuckle joint is subjected to an axial load of 25 kN. It is made of plain carbon steel with yield strength in tension 380 N/mm^2. Design the joint with factor of safety 2.5. Assume the compressive strength of the material to be 20% more than the tensile strength. Allowable shear stress is 0.577 of the tensile strength of the material. [10]

Or

12. (*a*) Write a short note on preferred size. [4]

(*b*) Explain the term 'Design for Environment'. [6]

(*c*) A beam of circular cross-section of dia. 12 mm has its centre line curved to radius 60 mm. Find the intensity of maximum stress in the beam when it is subjected to a moment of 45 kN-mm. [8]

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

[4062]-120

S.E. (Mechanical) (II Sem.) EXAMINATION, 2011

PRODUCTION TECHNOLOGY

(2008 PATTERN)

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

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

(*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*) Sketch a Merchant's circle force diagram and explain the different quantities involved. State the various assumptions made. [6]

(*b*) During machining of C-25 steel with 0-10-6-6-8-90-1 mm (ORS) shaped tripled carbide cutting tool, the following observations have been made :

Depth of cut	=	2 mm
Feed	=	0.2 mm/rev
Speed	=	200 m/min
Tangential cutting force	=	1600 N
Feed thrust force	=	850 N
Chip thickness	=	0.39 mm

Calculate :

(*i*) Shear angle

(*ii*) Normal force at shear angle

(*iii*) Friction force

(*iv*) Kinetic coefficient of friction

(*v*) Specific cutting energy. [12]

Or

2. (*a*) With neat sketch explain the tool signature in ORS system. [6]

(*b*) The following equation for tool life is given for a turning operation, $VT^{0.13} f^{0.77} d^{0.37} = C$, A 60 minute tool life was obtained while cutting at V = 30 m/min, f = 0.3 mm/rev and d = 2.5 mm. Determine the change in tool life if the cutting speed, feed and depth of cut are increased by 20% individually and also taken together. [12]

UNIT-II

3. (*a*) Describe with neat sketch the detail terminology of pull type internal broach. [8]

(*b*) Explain the principle of Gear Shaping and Gear Shaving. [8]

Or

4. (*a*) Classify the different thread cutting methods. Explain the process and principle of thread rolling with neat sketch. [8]

(*b*) Explain various types of broaching machines. [8]

UNIT-III

5. (*a*) Draw block diagram of NC and DNC machine system. Compare NC and DNC system. [8]

(*b*) Differentiate between absolute and incremental positioning system in a CNC. [8]

Or

6. (*a*) What is a machining center ? List the main advantages of a machining center. [6]

(*b*) Explain the following M-codes and G-codes : [10]

(*i*) G90

(*ii*) G02

(*iii*) G63

(*iv*) G41

(*v*) M05

(*vi*) M06

(*vii*) M11

(*viii*) M30.

SECTION-II

UNIT-IV

7. (*a*) Differentiate between blanking die and piercing die. [8]

(*b*) What are the various types of strippers ? Explain their function with the help of suitable sketches. [10]

Or

8. (*a*) Define 'spring back' and explain how allowances may be made to compensate for its harmful effects. [8]

(*b*) Calculate the bending force for channel bending for the following data :

Thickness of blank = 3.2 mm

Bending length = 900 mm

Die radius = punch radius = 9.5 mm

Ultimate tensile strength of the material = 400 N/mm^2

K = 0.67 for channel bending. [10]

UNIT-V

9. (*a*) Draw a Schematic diagram of 'Electro-discharge Machining' and explain its working principle and process parameters. [8]

(*b*) Differentiate USM and AJM with respect to the following points : [8]

(*i*) Principle of working

(*ii*) Process parameters

(*iii*) Accuracy

(*iv*) Application.

Or

10. (*a*) What is LASER ? Explain how LASER is used to machine the parts and state its process characteristics. [8]

(*b*) Draw a Schematic diagram of Water Jet Machining. State its applications. [8]

UNIT-VI

11. (*a*) Define Jig and Fixture. Differentiate between them with suitable example. [8]

(*b*) What are the different types of jigs ? Discuss any *two* with the help of suitable sketches. [8]

Or

12. (*a*) Explain the concept of '3-2-1' principle of location for a long cylinder. [8]

(*b*) Explain different types of drill bushes with neat sketches. [8]

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

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S.E. (Mechanical Sandwich) (I Sem.) EXAMINATION, 2011

THERMAL ENGINEERING—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*) 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*) Explain Boyle's law and Charles' law as applied to perfect gas. Which of these laws can be used to evaluate absolute zero temperature and how ? [8]

(*b*) Write first law equations for non-flow and steady flow systems. A turbine operates with an inlet velocity of 40 m/s and an inlet enthalpy of 3433.8 kJ/kg. At the outlet, which is 2 m lower than the inlet, the enthalpy is 2675.5 kJ/kg and the velocity is 162 m/s. If the heat loss from the turbine is 1 kJ/kg, determine the work output/kg. [8]

Or

2. (*a*) What is availability ? Derive an expression for availability of steady flow system. [6]

   (*b*) Derive an expression for entropy change of an irreversible process. Determine the change in entropy for the vaporization of 2 kg of saturated water to saturated steam at 200°C. Heat supplied is 1959.7 kJ/kg. [6]

   (*c*) State and explain principle of increase of entropy. [4]

3. (*a*) What is air-preheater ? Where is it installed ? State the advantages of air-preheater. [6]

   (*b*) Discuss various heat losses in a boiler. [6]

   (*c*) Differentiate between water tube and fire tube boiler. [4]

Or

4. (*a*) The following observations were made during a boilder trial :

Mass of feed water per hour	635 kg
Temperature of feed water	65°C
Steam pressure	10.5 bar
Oil fired per hour	52 kg
High calorific value	44900 kJ/kg

Percentage composition of oil by mass	C = 84.75; H_2 = 13; S = 1.25
Analysis of dry flue gases by volume	CO_2 = 12.4; O_2 = 4.3; N_2 = 83.3
Temperature of gases leaving the boiler	362°C
Specific heat of dry flue gases	1.005 kJ/kg/K
Boiler room temperature	21°C
Throttling calorimeter temperature at outlet	125°C
Pressure of steam after throttling	101 mm of Hg
Barometer reading	760 mm of Hg
Heating surface of boiler	20 m^2
Specific heat of superheated steam	2.1 kJ/kg/K
Partial pressure of steam in flue gases	0.07 bar.

Draw up a complete heat balance sheet and calculate the boiler efficiency and equivalent evaporation per kg of fuel and m^2 of heating surface per hour. [12]

(*b*) Distinguish between forced draught and induced draught. [4]

5. (*a*) Explain the steam formation process on T-s plane. [6]

(*b*) A steam turbine receives superheated steam at a pressure of 17 bar and having a degree of superheat of 110°C. The exhaust pressure is 0.07 bar and the expansion of steam takes place isentropically. Calculate :

(*i*) the heat supplied

(*ii*) the heat rejected

(*iii*) net work done

(*iv*) the thermal efficiency. [8]

(*c*) Define :

(*i*) efficiency ratio

(*ii*) work ratio

(*iii*) specific steam consumption

(*iv*) dryness fraction. [4]

Or

6. (*a*) Explain combined Separating and Throttling Calorimeter method for measuring dryness fraction of steam. [6]

(*b*) A vessel contains 2 kg of steam at a pressure of 8 bar. Find the amount of heat, which must be rejected, so as to reduce the quality of steam in the vessel to be 70%. [8]

(*c*) What is internal work ? Derive an expression for the external work done during evaporation :

(*i*) when the steam is wet

(*ii*) when the steam is dry

(*iii*) when the steam is superheated. [4]

SECTION II

7. (*a*) The volumetric analysis of a gas is CO_2 14%, CO 1%, O_2 5% and N_2 80%. Calculate the fuel gas consumption by mass. [8]

(*b*) Enlist basic requirements of fuel used in S.I. engine. [4]

(*c*) Discuss the effect of volatility on :

(*i*) starting and warmp up

(*ii*) acceleration. [4]

Or

8. (*a*) Explain the construction and working of Orsat apparatus. [8]

(*b*) Discuss construction and working of Bob-Calorimeter. [8]

9. (*a*) Why does actual cycle differ from fuel-air cycle ? List out the major losses. [8]

(*b*) An engine working on duel cycle takes air at 1 bar and 20°C. The maximum pressure of the cycle is limited to 70 bar. The compression ratio of the engine is 15. Find out air standard efficiency and MEP of the cycle. Assume heat added at constant volume is equal to heat added at constant pressure. [8]

Or

10. (*a*) Differentiate between air-cycle and fuel-air cycle. State the assumption made for the analysis of fuel-air cycles. [6]

(*b*) The inlet condition of air in a diesel cycle are 1 bar and 310 K. The maximum pressure of the cycle is 33 bar and cut-off occurs at 6% of the stroke, considering air as working substance, determine :

(*i*) compression ratio

(*ii*) percentage clearance

(*iii*) heat supplied and heat rejected

(*iv*) thermal efficiency

(*v*) MEP considering 1 kg of air taken in. [10]

11. (*a*) Derive an expression for minimum work required for two-stage reciprocating air-compressor. [8]

(*b*) A single acting reciprocating air compressor has cylinder diameter and stroke of 200 mm and 300 mm respectively. The compressor sucks air at 1 bar and 27°C and delivers at 8 bar while running at 100 rpm. Find :

(*i*) Indicated power of the compressor

(*ii*) Mass of air delivered by the compressor per minute

(*iii*) Temperature of air delivered by the compressor.

The compressor follows the law $pv^{1.25} = C$. [6]

(*c*) Enlist use of compressed air. [4]

Or

12. (*a*) Derive an expression for volumetric efficiency of compressor. [4]

(*b*) Discuss various methods used for controlling the capacity of reciprocating compressors. [10]

(*c*) State advantages of multi-stage compression. [4]

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

[4062]-122

S.E. (Mechanical Sandwich)

(Second Semester) EXAMINATION, 2011

THEORY OF MACHINE AND MACHINE DESIGN—I

(2008 PATTERN)

Time : Four 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 electronic pocket calculator is allowed.

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

SECTION I

1. (*a*) Explain with neat sketches inversions of double slider crank chain with practical applications. [6]

(*b*) Write short notes on : [10]

(*i*) Degree of freedom in mechanism.

(*ii*) Davis steering gear mechanism.

Or

2. (*a*) State and explain Grashof's law for a four bar chain. [5]

(*b*) State and prove condition for correct steering for a four wheeled vehicle. [6]

(*c*) Explain Hooke's joint and its applications. [5]

3. (*a*) State and prove Kennedy's theorem of three centers in line. [6]

(*b*) The mechanism shown in Fig. 1, in which the crank OA rotates at 120 rpm in clockwise direction. Determine by using relative velocity and relative acceleration method : [12]

(*i*) Velocity and acceleration of piston D

(*ii*) Angular velocity and angular acceleration of link AB.

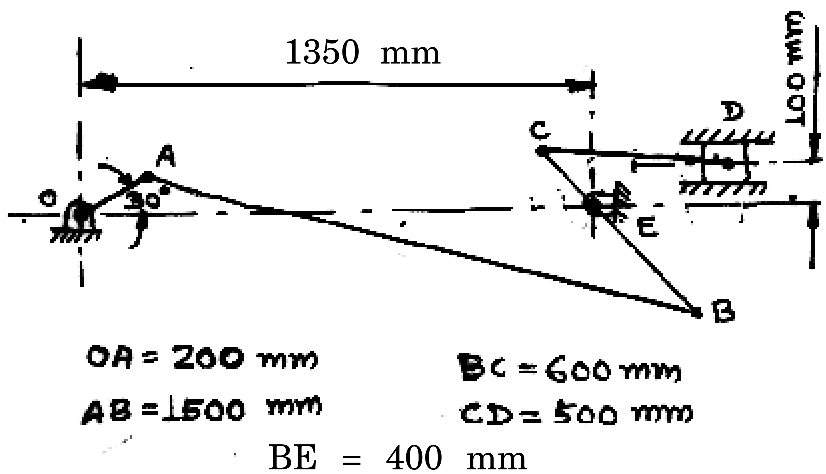

Fig. 1

Or

4. (*a*) What is the significance of the "loop closure" equation in kinematics ? [4]

(*b*) The mechanism shown in Fig. 1, in which the crank OA rotates at 120 rpm in clockwise direction. Determine by using instantaneous centre method : [14]

(*i*) Velocity of pin B and piston D

(*ii*) Angular velocities of link AB and CD.

5. (*a*) Derive the frequency equation for bifilar suspension. [6]

(*b*) In a slider crank mechanism, the crank is 200 mm long and connecting rod 750 mm long. Find analytically, the velocity and acceleration of slider and angular velocity and angular acceleration of connecting rod when the slider has moved through 350 mm from top dead centre position. The crank rotates at uniform speed of 600 r.p.m. [10]

Or

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

(*i*) Dynamically equivalent system

(*ii*) Correction couple.

(*b*) The connecting rod of an engine has mass of 10 kg. It is 480 mm long and its centre of gravity is 380 mm from the gudgeon pin centre. The frequency of oscillation of connecting rod is 45 oscillations per minute when suspended, from centre of small end. Determine dynamically equivalent two mass system keeping one mass at small end. [8]

SECTION II

7. (*a*) Explain stresses in butt welds. [4]

(*b*) A belt pulley is keyed to the shaft midway between the supporting bearings kept at 1000 mm apart. The shaft transmits 20 kW power at 400 rpm. The pulley has 400 mm diameter. The angle of wrap of belt on pulley is 180° and the belt tension acts vertically downwards. The ratio of belt tensions is 2.5. The shaft is made of steel having an ultimate tensile strength and a yield strength of 400 N/mm^2 and 240 N/mm^2 respectively. The combined shock and fatigue factos in bending and torsion are 1.5 and 1.25 respectively. The permissible angle of twist in shaft is 0.25° per metre length and the permissible lateral deflection is 1 mm per meter length. Design the shaft on the basis of strength and rigidity.

Take G = 80×10^3 N/mm^2 and E = 200×10^3 N/mm^2. [12]

Or

8. (*a*) Explain with neat sketches, design of rigid flange coupling. [8]

(*b*) A circular bar of 30 mm diameter is welded to a steel plate by an annular fillet weld. The face of 5 kN is applied on the bar at a distance of 100 mm from the plane of the weld. If the allowable shear stress in the weld material is 80 N/mm^2, determine the size of the weld. [8]

9. (*a*) A square threaded, triple start power screw, used in a screw jack, has a nominal diameter of 50 mm and a pitch of 8 mm. The screw jack is used to lift a load of 7.5 kN. The coefficient of thread friction is 0.12 and collar friction is negligible. If the length of nut is 48 mm, calculate : [8]

(*i*) the maximum shear stress in the screw body

(*ii*) the bearing pressure.

(*b*) A helical torsion spring of mean diameter 50 mm is made of a round wire of 5 mm diameter. A torque of 4 N-m is applied on this spring. Find the bending stress and the angular deflection of the spring. The modulus of elasticity for the spring material is 210×10^3 N/mm^2. Assume the number of effective turns as 6. [8]

Or

10. (*a*) A two start, trapezoidal screw is used in a screw jack to raise a load of 300 N. The screw has a nominal diameter of 100 mm and a pitch of 12 mm. The coefficient of screw friction is 0.15. Neglecting the collar friction, determine : [8]

(*i*) the torque required to raise the load

(*ii*) the torque required to lower the load

(*iii*) the screw efficiency.

(*b*) A helical compression spring is made of 1.6 mm diameter wire with spring index 6. The permissible shear stress for the spring wire is 345 N/mm^2, while modulus of rigidity is 80 GPa. If the stiffness of the spring is 1.8 N/mm, determine : [8]

(*i*) the required number of coils

(*ii*) the allowable deflection.

11. (*a*) Derive the condition for maximum power transmitting capacity of belt drive based on friction capacity. [9]

(*b*) A rimmed flywheel, made of gray cast iron (mass density = 7100 kg/m^3), is used on a punching press running at a mean speed of 200 rpm. The punching operation consists of one quarter revolution during which the flywheel is required to supply 3000 N-m of energy. The coefficient of fluctuation of speed is limited to 0.2. The rim which contributes 90% of the required mass moment of inertia, has a mean radius limited to 0.5 m, due to space limitations. If the cross-section of the rim is square, determine its dimensions. [9]

Or

12. (*a*) Explain 'slip' and 'creep' of belt. [4]

(*b*) A fan is driven by an open belt drive from 30 kW, 1000 rpm electric motor. The fan pulley diameter is 900 mm, while the motor pulley diameter is 250 mm. The centre distance between the shafts is 2.25 m and the coefficient of friction between the belt and the pulley is 0.25. The allowable tensile stress in the belt is limited to 2 MPa. The density of the belt material is 950 kg/m^3 and the belt width is 100 mm. Calculate the belt thickness. [10]

(*c*) Define : [4]

(*i*) Coefficient of fluctuation of speed

(*ii*) Coefficient of fluctuation of energy.

Total No. of Questions—**12**]   [Total No. of Printed Pages—**4+2+ 1 diagram**

[4062]-123

S.E. (Mech./SW) (Second Semester) EXAMINATION, 2011

THERMAL ENGINEERING—II

(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 with neat sketch aqua-ammonia vapour absorption refrigeration system. [6]

(*b*) Compare vapour absorption refrigeration system and vapour compression refrigeration system. [4]

(*c*) A refrigerating system working on Bell-Coleman cycle receives air from cold chamber at –5°C and compresses it from 1 bar to 4.5 bar. The compressed air is then cooled to temperature of 37°C before it is expanded in expander. Calculate cop of the system when compression and expansion are : [8]

(*i*) Isentropic

(*ii*) Follows lane $PV^{1.25}$ = constant.

Or

2. (*a*) Give classification of Refrigerants. [5]

(*b*) Describe effect of suction superheat on performance of vapour compression refrigeration cycle. [5]

(*c*) An ammonia refrigerating machine fitted with expansion valve works between temperature limits of –10°C and 30°C. The vapour is 95% dry at the end of isentropic compression and fluid leaving condenser is at 30°C. Assuming actual cop as 60% of theoretical calculate kg of ice produced per kW hour at 0°C from water at 10°C. Latent heat of ice is 335 kJ/kg. Take the following properties : [8]

Temp. °C	**Liquid Heat** kJ/kg	**Latent Heat** kJ/kg	**Liquid Entropy** kJ/kg K	**Entropy of dry sat. Vapour** kJ/kg K
30	323.08	1145.80	1.2037	4.9842
–10	135.37	1297.68	0.5443	5.4770

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

(*i*) By pass factor

(*ii*) Degree of saturation

(*iii*) DPT.

(*b*) What is comfort ? Explain comfort chart. [4]

(*c*) A sleeve psychrometer reads 40°C dry bulb temperature and 28°C wet bulb temperature. Assuming barometric pressure as 1.013 bar, determine : [6]

(*i*) Humidity ratio

(*ii*) Relative humidity

(*iii*) Dew point temperature

(*iv*) Enthalpy of mixture per kg of dry air.

Or

4. (*a*) Explain with neat sketch summer air conditioning. [6]

(*b*) Show the following processes on skeleton of psychrometric chart : [4]

(*i*) Dehumidification of moist air by cooling.

(*ii*) Adiabatic mixing of two streams.

(*c*) One kg of air at 40°C dry bulb temperature and 50% relative humidity is mixed with 2 kg of air at 20°C dry bulb temperature and 20°C dew point temperature. Calculate the temperature and specific humidity of mixture. [6]

5. (*a*) Describe any *two* types of expansion devices used in refrigeration system. [6]

(*b*) State the principles of duct sizing and explain the static regain method in detail. [6]

(*c*) Write a short note on air washer. [4]

Or

6. (*a*) Explain common refrigeration controls. [6]

(*b*) Explain types of filters used in air conditioning system. [6]

(*c*) Explain 'pressure losses' in duct. [4]

SECTION II

7. (*a*) Compare air cooling and water cooling in IC engine. [6]

(*b*) Explain with neat sketch battery ignition system. [6]

(*c*) An engine uses 6.5 kg of oil per hour of calorific value 30,000 kJ/kg. If B.P. of engine is 22 kW and mechanical efficiency 85%, calculate : [6]

(*i*) Indicated thermal efficiency

(*ii*) Brake thermal efficiency

(*iii*) Specific fuel consumption in kg/kWh.

Or

8. (*a*) What are the requirements of good injection system. [5]

(*b*) Explain functions of lubrication system. [5]

(*c*) The following data were recorded from test on single cylinder four stroke oil engine : [8]

Cylinder bore = 150 mm, Engine stroke = 250 mm, area of indicator diagram = 450 mm^2, length of indicator diagram = 50 mm, indicator spring rating = 1.2 mm, Engine speed = 420 rpm, brake torque = 217 Nm, fuel consumption = 2.95 kg/h, C.V. of fuel = 44000 kJ/kg, cooling water rate of flow = 0.068 kg/sec., cooling water temperature rise = 45 K.

Calculate :

(*i*) Mechanical efficiency

(*ii*) Brake thermal efficiency

(*iii*) Specific fuel consumption

(*iv*) Draw up energy balance in kW.

9. (*a*) Explain stages of combustion in SI engine. [6]

(*b*) Explain the phenomenon of pre-ignition ? How pre-ignition leads to detonation and vice versa. [5]

(*c*) What are F-head combustion chambers ? Discuss *two* important F-head designs. [5]

Or

10. (*a*) What is delay period ? Discuss variables affecting delay period. [6]

(*b*) Explain how induction swirl is created. What are requirements of injector with this type of swirl ? [5]

(*c*) Explain the phenomenon of diesel knock. [5]

11. (*a*) What are the sources of emission from SI engine ? [5]

(*b*) Explain with neat sketch pulse type turbochanging. What are its advantages ? [5]

(*c*) What is supercharging ? How is it achieved ? What are its advantages ? [6]

Or

12. (*a*) Discuss various methods of control for exhaust emission from petrol engines. [7]

(*b*) What are the limitations of turbochanging ? [3]

(*c*) How can smoke intensity be measured ? Describe with neat sketch Bosch type smokemeter. [6]

Total No. of Questions—**6**] [Total No. of Printed Pages—**3**

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S.E. (Mechanical) (II Sem.) EXAMINATION, 2011

MANUFACTURING ENGINEERING

(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 wherever necessary.

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

SECTION I

1. (*a*) Explain pattern making allowances. [6]

(*b*) Explain different types of patterns. [5]

(*c*) Explain defects in casting. [5]

Or

(*a*) Explain investment casting. [8]

(*b*) Explain various properties of moulding stand. [8]

2. (*a*) Explain forging process in detail. [8]

(*b*) Explain extrusion process in detail. [8]

Or

(*a*) Explain with sketch wire drawing and tube drawing. [8]

(*b*) Explain forming process in detail. [8]

3. Write short notes on (any *three*) : [18]

(*a*) Types of resistance welding

(*b*) Difference between Soldering, Brazing and Welding

(*c*) Types of adhesives

(*d*) SMAW.

SECTION II

4. (*a*) Explain types of lathes in detail. [8]

(*b*) Explain construction and working of lathe. [8]

Or

(*a*) Explain different taper turning methods. [8]

(*b*) Explain thread cutting. [8]

5. (*a*) Explain types of milling machine with applications. [8]

(*b*) Explain different milling process. [8]

Or

(*a*) Explain twist drill geometry. [8]

(*b*) Explain planer and boring machine. [8]

6. Write short notes on (any *three*) : [18]

(*a*) Types of abrasive maching

(*b*) Grinding wheel designation

(*c*) Honing and buffing process

(*d*) Burnishing process.

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

[4062]-125

S.E. (Mech. S/W) (II Sem.) EXAMINATION, 2011

COMPUTER APPLICATIONS

(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*) 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*) Find a positive root of

$$3x - \sqrt{1 + \sin x} = 0$$

by successive approximation method. [8]

(*b*) Represent Newton-Raphson method, graphically. [2]

(*c*) Draw a flowchart for Numerical Integration by Simpson's $\frac{1}{3}$rd rule. [6]

Or

2. (*a*) By dividing the range into ten equal parts, evaluate :

$$\int_0^{\pi} \sin x \, dx$$

by Trapezoidal rule and Simpson's $\frac{1}{3}$rd rule. Verify your answer with integration. [10]

(*b*) Draw a flowchart for Modified Newton-Raphson method to determine the roots of equation correct upto three decimal places. [6]

3. (*a*) Using Newton's divided difference formula, find the value of $f(2)$, $f(8)$, $f(15)$ with given following table : [10]

x	$f(x)$
4	48
5	100
7	294
10	900
11	1210
13	2028

(*b*) A curve is passing through the following points :

x	y
1	3
2	9
3	19
4	33
5	51

Find slope of tangent at $x = 1.5$. [6]

Or

4. (*a*) Using Lagrange's Interpolation for the following data points, state degree of the polynomials and find the value of function at $x = 3.5$: [6]

x	y
1	3.5
2	–5
3	0
4	24

(*b*) Find the first two derivatives of $(x)^{1/3}$ at $x = 50$ and $x = 56$, given the table below : [10]

x	$y = x^{1/3}$
50	3.6840
51	3.7084

52	3.7325
53	3.7563
54	3.7798
55	3.8030
56	3.8259

5. (*a*) Using 'LU Decomposition Method', solve the following set of simultaneous equations :

$$x + y + z = 1$$
$$4x + 3y - z = 6$$
$$3x + 5y + 3z = 4.$$ [8]

(*b*) Solve, using 'Gauss-Seidel Method' with partial pivoting upto an accuracy of 0.001 :

$$7x + 20y + 3z = 111$$
$$23x - 11y + 7z = 161.5$$
$$10x + 13y + 22z = 190.5.$$ [10]

Or

6. (*a*) Apply 'Gauss-Jordan Method' to find the solution of the following system :

$$10x + y + z = 12$$
$$2x + 10y + z = 13$$
$$x + y + 5z = 7.$$ [8]

(*b*) Draw a flowchart for 'Gauss Elimination Method'. [10]

SECTION II

7. (*a*) Fit the curve $y = ae^{bx}$ using the following data :

x	y
2.30	33
3.10	39.10
4.0	50.36
4.92	67.20
5.91	85.60
7.20	125

Find the values of a and b. [10]

(*b*) Explain with example the following type of errors : [6]

(1) Absolute Error

(2) Relative Error

(3) Truncation Error.

Or

8. (*a*) It is known that tensile strength of plastic increases as a function of time when it is Heat treated. The following data is collected :

Time (min)	**Tensile strength** (N/mm^2)
10	4.2
20	17.8

30	49.6
40	48.6
50	64.4
60	104.8

Use the least square criterion to fit a straight line to this data. [10]

(*b*) Write a short note on error propagation. [6]

9. (*a*) Solve the following differential equation using Modified Euler's equation $dy/dx = 1 + xy$ for the boundary conditions $y(0) = 1$, find $y(0.1)$ and $y(0.2)$ upto accuracy 0.001. [10]

(*b*) Write a computer program for Q. **9 (*a*)**. [6]

Or

10. (*a*) Using Runge-Kutta 4th order method solve $dy/dx = x\text{^}2 + y\text{^}2$ for the boundary conditions $y(1) = 1.5$, find $y(1.2)$, $h = 0.1$. [10]

(*b*) Write a computer program for Q. **10 (*a*)**. [6]

11. (*a*) Solve the boundary value problem $d^2y/dx^2 - 64y + 10 = 0$ with $y(0) = y(1) = 0$. Using finite difference method, calculate $y(0.25)$, $y(0.5)$ and $y(0.75)$ taking step size $h = 0.025$. [12]

(*b*) Draw flowchart for $du/dt = d^2u/dx^2$ for the following condition with explicit finite difference method at $x = 0$ and $x = 1$, $u = 0$ for all values of t. At $t = 0$, $u = \sin(px)$ for $0 < x < 1$, $Dx = 0.1$ and $Dy = Dt = 0.001$. Find all values of u for $t = 0$ to $t = 0.002$. [6]

Or

12. (*a*) Solve the equation $d^2u/dt^2 = 100 d^2u/dx^2$ for the following condition at $x = 0$ and $x = 3$, $u = 1$ for all values of t. At $t = 0$, $u = 4x$ for $0 < x < 3$, $Dx = 1$ and $Dy = Dt = 0.1$. Find all values of u for $t = 0$ to $t = 0.3$. [12]

(*b*) Draw flowchart for Q. **12** (***a***). [6]

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

[4062]-132

S.E. (Production & Production Sandwich)

(First Semester) EXAMINATION, 2011

STRENGTH ANALYSIS OF MACHINE ELEMENTS

(2008 PATTERN)

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

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

(*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 :

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

where,

E = Young's modulus,

K = Bulk modulus

μ = Poisson's ratio. [6]

(*b*) A steel tie bar of f 40 mm and 2 m long is subjected to a pull of 80 kN as shown in Fig. 1. To what length the bar should be bored centrally so that the total extension of the bar will increase by 20% under the same pull, the bore being 20 mm diameter. (Take E = 2×10^5 N/mm^2) [10]

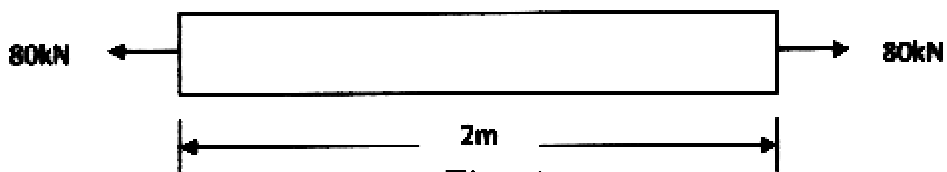

Fig. 1

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*) Two steel rods and one copper rod each of 20 mm diameter together support a load of 50 kN as shown in Fig. 2. Find the stresses in each rod. Take E = 200 GPa for steel and E = 100 GPa for copper respectively. [10]

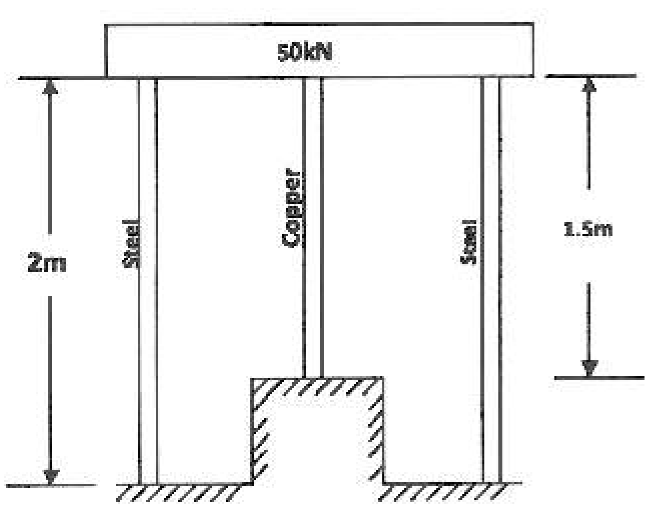

Fig. 2

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]

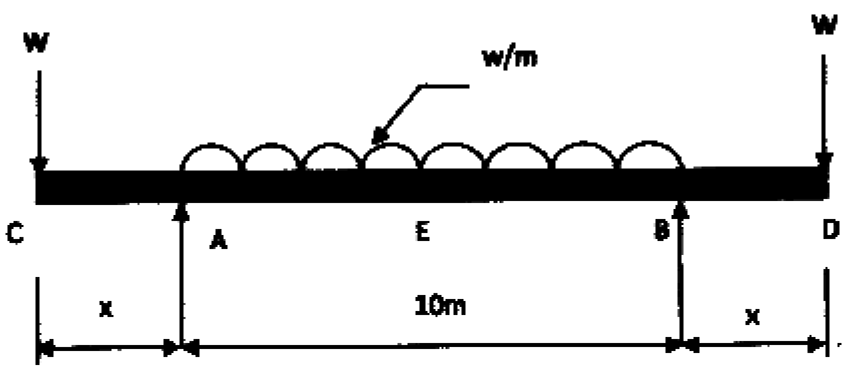

Fig. 3

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 (UDL) 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*) Shear force diagram for a loaded beam is shown in Fig. 4. Determine the loading on the beam and hence draw bending moment diagram. Locate the point of contraflexure, if any. [10]

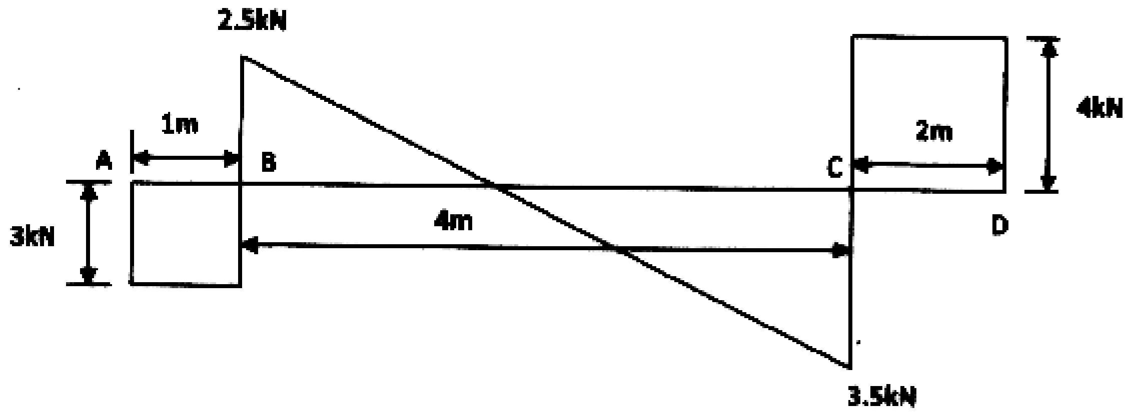

Fig. 4

UNIT III

5. (*a*) Prove the relations :

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

s = 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 the value of the compressive stress in the bottom flange ? [10]

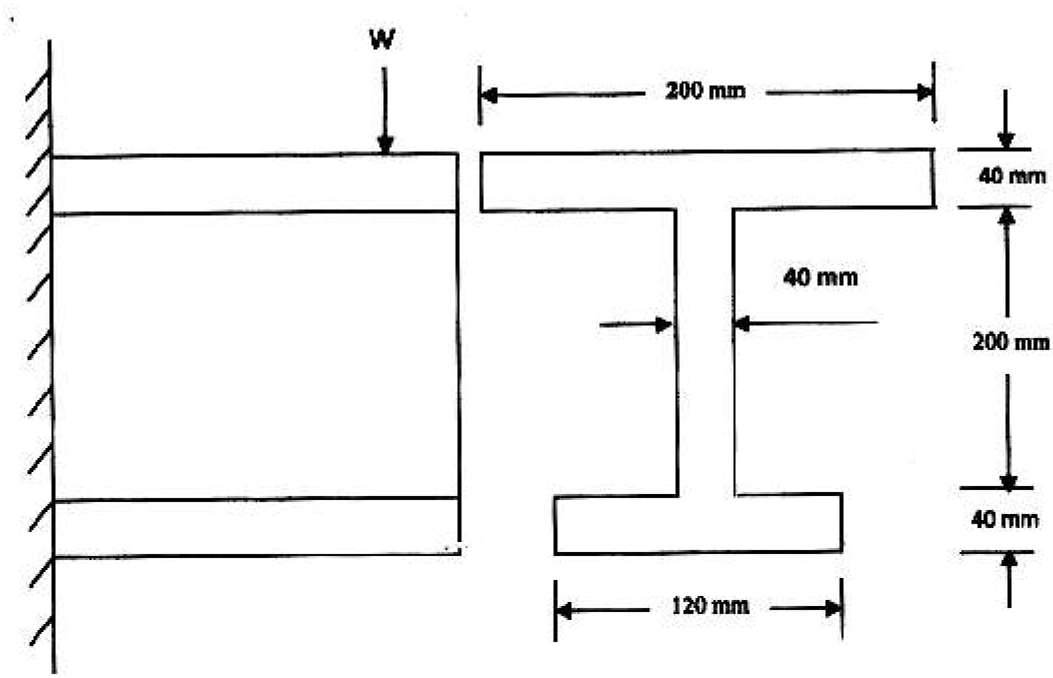

Fig. 5

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 a biaxial stress condition. [8]

(*b*) Draw Mohr's stress circle for a biaxial stress system having two direct stresses of 30 MPa (tensile) and 20 MPa (compressive). Determine the magnitude and the direction of the resultant stresses on planes which make angles of :

(*i*) 25º,

(*ii*) 70° with the 30 MPa stress.

Also find the normal and shear stresses on these planes. [8]

Or

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

(*b*) Two bars each of length l and of the same material are each subjected to the same axial tensile force P. The first bar has a uniform diameter $2d$. The second bar has a diameter d for length $l/3$ and a diameter $2d$ for the remaining length. Compare the strain energies of the two bars. [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 diameter ratio 3/5 is required to transmit 450 kW at 120 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 60 N/mm^2 and the twist in a length of 2.5 m must not exceed 1°. Calculate the minimum external diameter of the shaft satisfying these conditions. Take the modulus of the rigidity, $C = 8 \times 10^4\ N/mm^2$. [8]

UNIT VI

11. (*a*) An 80 mm wide and 180 mm deep cantilever is of 3 m span. It carries a uniformly distributed load of intensity 6 kN/m on a 2 m length of span starting from the free end. Determine the slope and the deflection at the free end. E = 205 GPa. [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 steel bar of rectangular section 30 mm × 40 mm pinned at each end is subjected to axial compression. The bar is 1.75 m long. Determine the buckling load and the corresponding axial stress using Euler's formula. Determine the minimum length for which Euler's equation may be used to determine the buckling load, if the proportional limit of the material is 200 N/mm^2. Take $E = 2 \times 10^5$ N/mm^2. [10]

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

[4062]-133

S.E. (Prod.) (First Semester) EXAMINATION, 2011

MACHINE TOOL OPERATIONS

(2008 PATTERN)

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

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

(*ii*) Use separate answer-sheet for each Section.

(*iii*) Assume suitable data, if required.

SECTION I

1. (*a*) Explain principle of thread cutting mechanism used in lathe with suitable sketch. [6]

(*b*) Discuss various terms used in lathe specification with suitable sketches. [6]

(*c*) Compare Capstan and Turret lathe with suitable sketches. [6]

Or

2. (*a*) Explain all geared headstock with suitable sketch. [6]

(*b*) Explain various types of rests used in lathe with suitable sketches. [6]

(*c*) The pitch of leadscrew is 12 mm and the pitch of the thread to be cut is 3 mm. Find change gears and draw a suitable sketch. [6]

3. (*a*) Explain working of sensitive drilling machine with suitable sketch. [8]

(*b*) Explain types of drills with suitable sketches. [8]

Or

4. (*a*) Discuss various types of reamers with suitable sketches. [8]

(*b*) Explain working of floating holder used in drilling machine with suitable sketch. [8]

5. (*a*) List various types of milling machines and explain column and knee type with suitable sketch. [8]

(*b*) Explain working of universal dividing head with suitable sketch. [8]

Or

6. (*a*) Explain upmilling and downmilling with suitable sketches. [8]

(*b*) Index 63 divisions by compound indexing. [8]

Plate I	**Plate II**	**Plate III**
15	21	37
16	23	39
17	27	41
18	29	43
19	31	47
20	33	49

SECTION II

7. (*a*) Explain working of hydraulic mechanism used in shaper with suitable sketch. [9]

   (*b*) Explain working of Automatic feed mechanism used in shaper with a suitable sketch. [9]

Or

8. (*a*) Explain open and cross belt mechanism used in planer with suitable sketch. [9]

   (*b*) Explain various types of broaching machines with suitable sketches. [9]

9. (*a*) Explain internal centreless grinding with suitable sketch. [8]

   (*b*) Explain types of bonds used in grinding wheels. [8]

Or

10. (*a*) Explain grit, grade, structure of wheels. [8]

    (*b*) Explain mounting of grinding wheel with suitable sketch. [8]

11. (*a*) Explain metal spraying with suitable sketch. [8]

    (*b*) Explain lapping with suitable sketch. [8]

Or

12. Write short notes on the following : [16]

(*i*) Buffing

(*ii*) Superfinishing

(*iii*) Honing.

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

[4062]-134

S.E. (Production & Production Sandwich)

(First Semester) EXAMINATION, 2011

MATERIAL SCIENCE

(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 should 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 required.

SECTION I

1. (*a*) Derive the expression for critical resolved shear stress of a single crystal. [4]

(*b*) Distinguish between cold working and hot working. [4]

(*c*) Show the following planes and directions in a cubic cell : [4]

(100), (101)

(*d*) What is composite material ? Explain its basic types with minimum *one* example. [6]

P.T.O.

Or

2. (*a*) State various imperfections in crystals. Explain point defect in detail. [4]

   (*b*) What is strain hardening ? Explain the variations in mechanical properties with a graph. [5]

   (*c*) What are the mechanisms of plastic deformation ? Explain. [4]

   (*d*) What is steel ? Explain classification of steels based on % carbon with its mechanical properties and minimum one use of each type. [5]

3. (*a*) Write a short note on Microhardness tester. [4]

   (*b*) Draw self-explanatory diagram for the following : [4]

      (*i*) S-N diagram for low carbon steel

      (*ii*) Stress-strain diagram for Cu.

   (*c*) Write a short note on magnetic particle test. [5]

   (*d*) FCC metals are more ductile than BCC metal. Explain. [3]

Or

4. (*a*) Suggest suitable hardness tester for the following applications and explain in brief : [9]

      (1) Gray cast Iron plate

      (2) Razor blade

      (3) Ferrite phase in steel

(*b*) Explain X-ray radiography with neat diagram, advantages, disadvantages and application. [4]

(*c*) Write a short note on Brinell hardness tester. [3]

5. (*a*) The atomic radii of Al is 0.143 nm and Si is 0.117 nm respectively. Is it possible to form solid solution ? Explain. [4]

(*b*) Undercooling is necessary for pure metals. Explain. [2]

(*c*) What are the uses of eutectic alloys. [2]

(*d*) Two materials A and B are having 100% solubility in each other in liquid as well as in solid phase. Plot an equilibrium diagram from the given data and discuss slow cooling of 35% alloy from its liquidus temperature to room temperature.

Wt. of B	**Liquidus Temperature ºC**	**Solidus Temperature ºC**
0	1084	1084
20	1200	1165
40	1275	1235
60	1345	1310
80	1440	1380
100	1455	1455

[8]

Or

6. (*a*) What is Gibbs phase rule ? Explain it with reference to cooling cure for eutectic alloy. [4]

(*b*) What do you understand by non-equilibrium cooling. What are its effects on eutectic transformation ? [4]

(*c*) Define the following : [2]

(1) Phase

(2) Solid Solution.

(*d*) Draw an equilibrium diagram for materials having no solubility in liquid as well as in solid state. [3]

(*e*) What is coring ? Explain the factors responsible for coring. [3]

SECTION II

7. (*a*) Is grain refinement is strengthening Mechanism ? Explain in brief. [4]

(*b*) Explain with neat diagram working and principle of Resistance pyrometer. [5]

(*c*) Strengthening by precipitation is not possible for every alloy. Explain. [4]

(*d*) Explain the principle and working of total radiation pyrometer. [5]

Or

8. (*a*) Write short notes on : [16]

(*i*) Thermocouples

(*ii*) Martensitic transformation

(*iii*) Age hardening

(*iv*) Disappearing filament pyrometer

(*b*) What is Hall-Petch equation ? [2]

9. (*a*) Write short notes on : [8]

(*i*) Physical vapour deposition

(*ii*) Thermal spray coating

(*b*) Corrosion can be controlled by controlling the atmosphere. Explain. [4]

(*c*) Explain cathodic protection. [4]

Or

10. (*a*) Design of component can prevent corrosion of metal ? Explain with examples. [6]

(*b*) Explain electroplating. [4]

(*c*) Write a short on anodising. [4]

(*d*) What is anodic coating ? [2]

11. (*a*) What is powder metallurgy ? Compare its advantages and disadvantages over other conventional processes. [6]

(*b*) Explain chemical processes of powder manufacturing. [4]

(*c*) Define the following : [2]

(1) Apparent density

(2) Green strength

(*d*) What is sintering ? Explain its stages. [4]

Or

12. Write short notes on : [16]

(1) Manufacturing of cemented carbides

(2) Manufacturing of self-lubricating bearing.

(3) Mechanical processes in powder manufacturing (min. 3 methods)

(4) Compaction process.

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

[4062]-135

S.E. (Prod./Prod. S/W) (Second Semester) EXAMINATION, 2011

THEORY OF MACHINES

(2008 PATTERN)

Time : Four 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*) List inversion of single slider crank chain. Explain any *two* with neat sketches. [6]

(*b*) What do you understand by degree of freedom ? For a plane mechanism, derive an expression for Grubler's equation. [6]

(*c*) What is meant by kinematic pair ? How are kinematic pairs classified ? Give example of each type. [4]

P.T.O.

Or

2. (*a*) How can cam-follower mechanism be converted into its equivalent mechanism by using the equivalent linkage concept ? [6]

(*b*) State and explain Grashoff's criterion as applied to 4-bar chain. How is it useful in studing the inversion of 4-bar chain ? [6]

(*c*) What do you mean by straight line mechanism ? Name the different mechanism which are used for exact straight line motion. [4]

3. (*a*) State and prove Kennedy theorem of Three centres in line. [4]

(*b*) In the mechanism shown in Fig. 1, OA = 300 mm, AB = 600 mm, AC = 1200 mm, BD = 1200 mm. OD is horizontal at the instant shown and OA rotates at 200 rpm clockwise direction. Find :

(*i*) Velocities of C and D

(*ii*) Acceleration of C

(*iii*) Angular velocities of link AC and BD. [14]

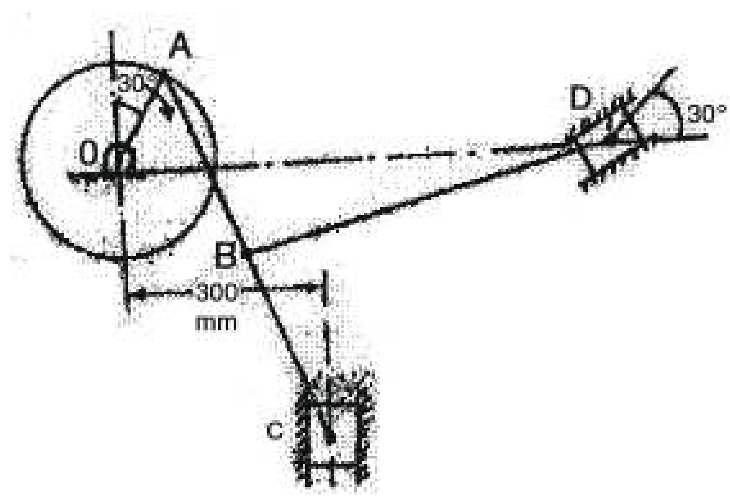

Fig. 1

Or

4. (*a*) In an IC engine mechanism, the stroke length is 40 cm and obliquity ratio is 4. The angular acceleration of connecting rod is found to be 54 rad/s^2 when the crank makes an angle of 45° with IDC while rotating at a uniform angular speed. Determine :

   (*i*) The crank speed in RPM

   (*ii*) Acceleration of piston

   (*iii*) Velocity and acceleration of mid-point of connecting rod

   Use Klein's construction method. [12]

   (*b*) What do you mean by Coriolis component of acceleration ? When will it exist ? [4]

   (*c*) What is the importance of finding acceleration of various points in a mechanism ? [2]

5. (*a*) Explain in detail various types of friction. [8]

   (*b*) Derivation :

$$Q = \frac{2\ W \cot \theta}{\pi P_0}.$$

Assuming "Theory of Ploughing" of soft surface by a hard conical shaped asperity. Show that the volume of wear is given by :

$$Q = \frac{2\ W \cot \theta}{\pi P_0}$$

where, W = load

θ = Semicone angle of asperity

P_0 = Yield pressure of soft material. [8]

Or

6. (*a*) Define "Tribology". Discuss the different areas covered under "Tribology". [5]

(*b*) State the application where friction and wear are useful. [5]

(*c*) Write short notes on (any *two*) :

(*i*) Two body and three body abrasive wear

(*ii*) Surface fatigue wear

(*iii*) Corrosive wear. [6]

SECTION II

7. (*a*) For a flat belt drive, prove that : [6]

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

where, T_1 = Tension on the tight side of the belt

T_2 = Tension on the slack side of the belt.

μ = Coefficient of friction between the belt and pulley surface.

θ = Angle of contact between the belt and pulley.

(*b*) An open flat belt drive connects two parallel shafts 1.2 metres apart. The driving and the driven shaft rotate at 350 rpm and 140 rpm respectively and the driven pulley is 400 mm in diameter. The belt is 5 mm thick and 80 mm wide. The coefficient of friction between the belt and pulley is 0.3 and the maximum tension in the belting is 1.4 MN/m^2. Determine :

(*i*) Diameter of driving pulley

(*ii*) Maximum power that may be transmitted by the belting

(*iii*) Required initial belt tension. [10]

Or

8. (*a*) Obtain an expression for the length of an open belt drive. [6]

(*b*) Distinguish between initial tension and centrifugal tension in a belt. [4]

(*c*) A casting weighing 9 kN hangs freely from a rope which makes 2.5 turns round a drum of 300 mm diameter revolving at 20 rpm. The other end of the rope is pulled by a man. The coefficient of friction is 0.25.

Determine :

(*i*) The force required by the man.

(*ii*) The power to raise the casting. [6]

9. (*a*) With a neat sketch, describe a single shoe brake. What is the advantage of double shoe brake over single shoe brake ? [6]

(*b*) A differential band brake is shown in Fig. 2. The diameter of the drum is 800 mm. The coefficient of friction between the band and the drum is 0.3 and the angle of embrance is 240°. When the force of 600 N is applied at the free end of the lever, find for clockwise rotation of the drum.

(*i*) Maximum and Minimum force in band

(*ii*) The torque which can be applied by the brake. [10]

Fig. 2

Or

10. (*a*) Differentiate between Absorption Dynamometer and Transmission Dynamometer. [4]

(*b*) The maximum braking torque acting on a band and block brake is 8950 Nm shown in Fig. 3. The band is lined with 12 blocks each of which subtends an angle of 15° at the centre of the rotating drum. The coefficient of friction between the band and block is 0.4. The diameter of the drum is 850 mm and the thickness of the blocks is 75 mm. Find the least force required at the end of the lever which is 500 mm long.[12]

30

Fig. 3

11. (*a*) Explain the Trifilar Suspension System. [6]

(*b*) Define and explain the following terms :

(*i*) Inertia force, and

(*ii*) Inertia torque. [4]

(*c*) A rigid link, 500 mm long has mass 2 kg and radius of gyration 200 mm. Replace this link by dynamically equivalent system of two concentrated masses located at the ends of the link. [8]

Or

12. (*a*) Explain D'Alembert's principle. [4]

(*b*) With the help of neat schematic diagram, derive frequency equation of Bifillar Suspension System. [6]

(*c*) A connecting rod has mass 3 kg for 45 oscillations it needs 40 seconds when suspended from small end and 35 seconds when suspended from big end. The distance between the points of suspension is 25 cm. Find the mass moment of inertia of the connecting rod and position of its CG from the small end. [8]

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

[4062]-136

S.E. (Production) (II Sem.) EXAMINATION, 2011

WELDING AND FOUNDRY

(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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain with neat sketch Gas Metal Arc Welding (GMAW) process along with advantages, disadvantages and applications. [10]

(*b*) Explain with neat sketch different types of welding joints. [8]

Or

2. (*a*) Explain arc blow with respect to : [10]

(1) Types

(2) Mechanism

(3) Effects

(4) Remedies.

(*b*) Explain with neat sketch Heat Affected Zone (HAZ) related with arc welding. [8]

3. (*a*) Explain oxyacetylene welding with respect to : [8]

(1) Definition

(2) Working

(3) Advantages and disadvantages

(4) Applications.

(*b*) Compare leftward and rightward gas welding technique with neat sketch. [8]

Or

4. (*a*) Explain the following gas welding equipments with neat sketch : [8]

(1) Cylinder

(2) Pressure regulator

(3) Welding torch

(4) Hose and hose clamps.

(*b*) Compare spot welding and seam welding with neat sketch. [8]

5. (*a*) Explain the thermit welding process with neat sketch. [8]

(*b*) Write a short note on magnaflux testing of weld. [8]

Or

6. (*a*) Explain diffusion welding process with neat sketch. [8]

(*b*) Write a short note on calculation of welding cost. [8]

SECTION II

7. (*a*) Explain with flow sheet necessary steps in sand casting operation. [8]

(*b*) Describe CO_2 moulding with its advantages, disadvantages and applications. [8]

Or

8. (*a*) Explain various types of Cores with neat sketches. [8]

(*b*) With neat sketch explain operation of a Cupola furnace. [8]

9. (*a*) Explain with neat sketches True centrifugal casting and Centrifuge casting. [8]

(*b*) Differentiate between permanent mould casting and pressure die-casting. [8]

Or

10. (*a*) Differentiate between Hot chamber and Cold chamber die-casting. [8]

(*b*) List various casting defects with their causes and remedies. [8]

11. (*a*) Using Caine's method and modulus method calculate the size of cylindrical riser (Height = Diameter) necessary to feed steel slab casting 25 × 25 × 5 cm with side riser, casting is poured horizontally into the mould.

Data for steel casting $a = 0.1$, $b = 0.03$ and $c = 1.0$. [8]

(*b*) Write short notes on : [10]

(*i*) Criteria used for designing of pouring basin

(*ii*) Rules used for riser placement.

Or

12. (*a*) Differentiate between pressurized and un-pressurized gating. [6]

(*b*) Compare directional and progressive solidification of casting. [6]

(*c*) What is casting yield ? Suggest different ways to improve it. [6]

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

[4062]-137

S.E. (Production/Production S/W) (II Sem.) EXAMINATION, 2011

DESIGN OF MACHINE ELEMENTS

(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*) Explain need of standards in design and list down various standards. [6]

(*b*) What are the requisites of Design Engineer ? [4]

(*c*) A cantilever beam of rectangular cross-section is used to support a pulley as shown in Fig. 1. The tension in the wire rope is 5 kN. The beam is made of CI FG200 and the factor of safety is 2.5. The ratio of depth to width of the cross-section is 2.

Determine the dimensions of the cross-section of the beam. [8]

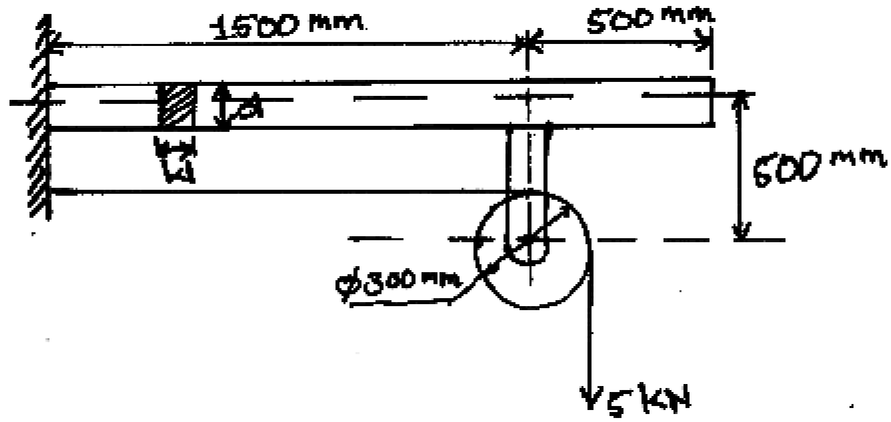

Fig. 1

Or

2. (*a*) What is factor of safety ? Why is it necessary to use ? [4]

(*b*) Design a cotter joint to transmit a load of 100 kN in tension or compression. Assume the following stresses for socket, spigot and cotter :

(1) Allowable tensile stress = 90 N/mm^2

(2) Allowable crushing stress = 170 N/mm^2

(3) Allowable shear stress = 60 N/mm^2. [14]

3. (*a*) A steel shaft made of 40C8 is used to drive a machine. The pulleys X, Y and bearing A and B are located as shown in Fig. 2. Belt tensions are also shown in Fig. 2. Determine the diameter of the shaft using A.S.M.E. code. Yield strength of shaft material is 330 N/mm^2 and ultimate tensile strength is

600 N/mm^2. Take K_b = 1.5 and K_t = 1.2. If the rectangular key is made of the same material, design the key. [12]

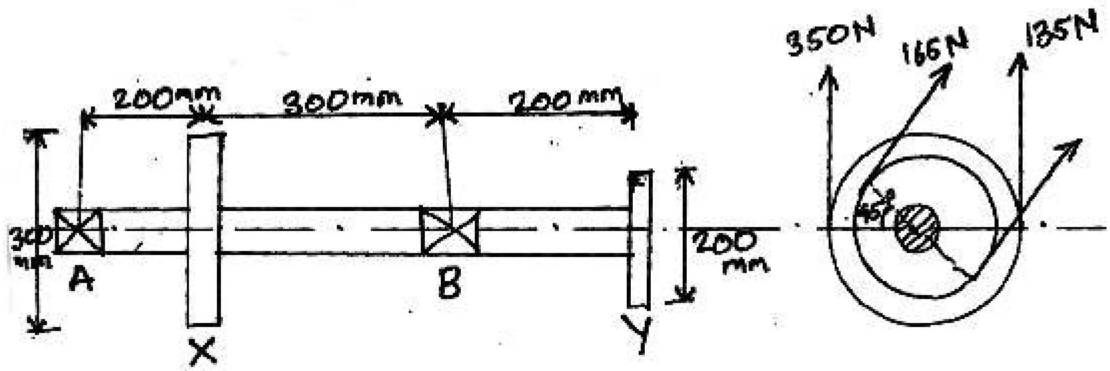

Fig. 2

(*b*) Explain design of shaft based on torsional rigidity. [4]

Or

4. (*a*) It required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. The service factor for the application is 1.5 i.e. The design torque is 1.5 times of rated torque, design the coupling and specify the dimensions of its components also. Material is given by :

(1) Shafts 40C8 (S_{yt} = 380 N/mm^2) FOS 2.5

(2) Key and bolts 30C8 (S_{yt} = 400 N/mm^2) FOS – 2.5

(3) Flanges FG200 (S_{ut} = 200 N/mm^2) FOS – 6. [12]

(*b*) Write a short note on Muff coupling. [4]

5. (*a*) Draw the basic types of screw fasteners. [6]

(*b*) A steel plate is subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts is shown in Fig. 3. The bolts are made of plain carbon steel 45C8 with yield strength 380 N/mm^2. If the required factor of safety is 2, determine the diameter of bolts. [10]

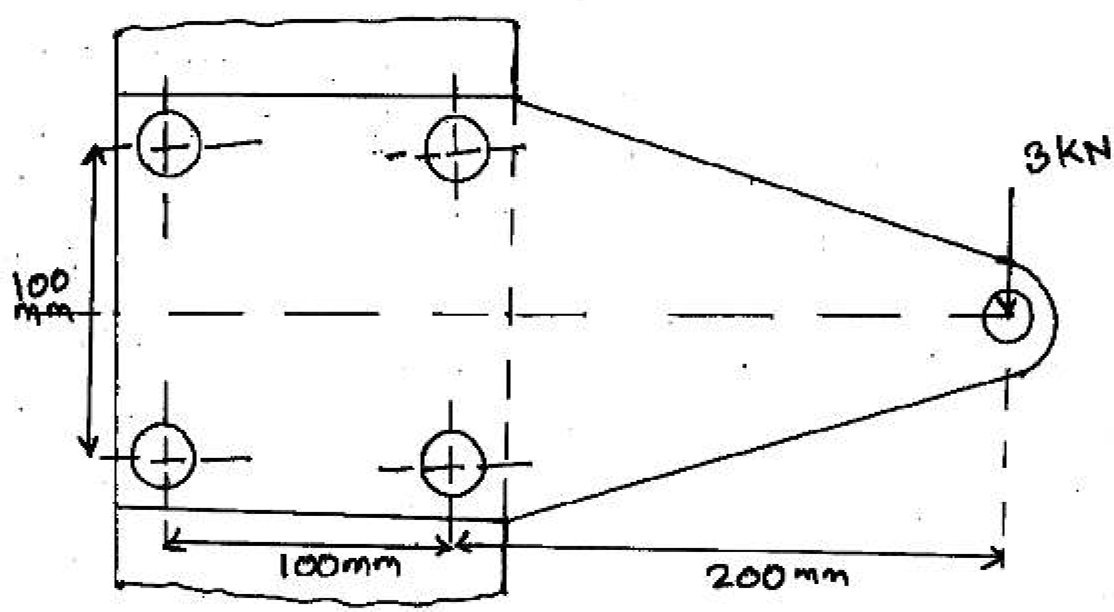

Fig. 3

Or

6. (*a*) State advantages and limitations of the welded joints over threaded joints. [4]

(*b*) A welded connection as shown in Fig. 4. is subjected to an eccentric load of 25 kN. The welding is only on one side. If the permissible shear stress for the weld material is 55 MPa, determine the weld size. [12]

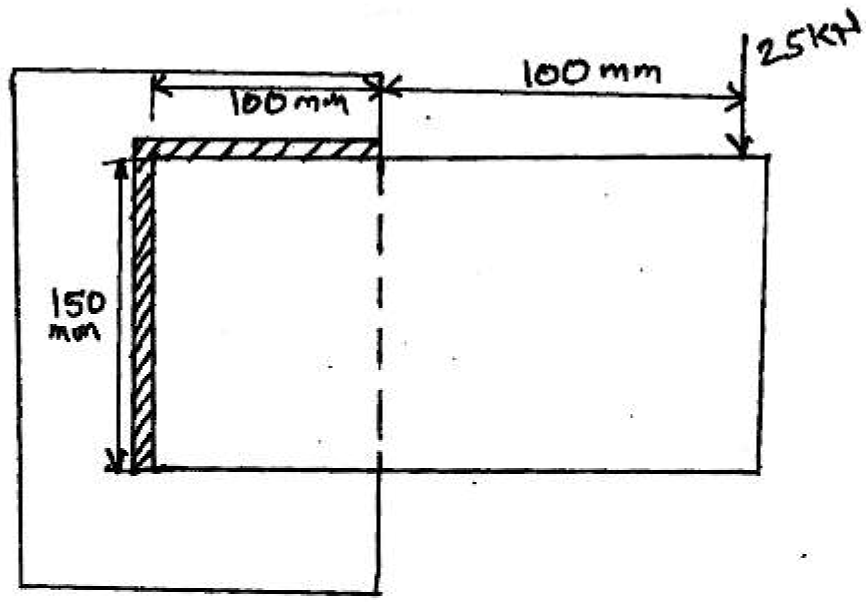

Fig. 4

SECTION II

7. (*a*) Derive the expression for :

(1) Torque required to raise the load against thread friction.

(2) Torque required to lowering the load against thread friction. [6]

(*b*) A steel screw driving a bronze nut is to develop an axial load of 300 kN in an extrusion press. The screw is having single start square threads with an outside diameter of 100 mm and a lead of 16 mm. Determine the nut length if the bearing pressure between screw and nut threads is not to exceed 16 N/mm^2 and shear stress in the nut threads is not be exceed 28 N/mm^2. [10]

Or

8. A 26 × 5 square threaded, single start power screw is used to support a load of 12 kN. The effective diameter of the collar is 46 mm and the coefficient of friction is 0.15. The nut is made of phosphor bronze having 0.12 as coefficient of friction and 6 MPa as allowable bearing pressure. The length of the handle is 300 mm. Calculate :

(1) The force required to raise the load.

(2) The force required to lower the load.

(3) The yield strength of material for a factor of safety of 4.

(4) The overall efficiency of the screw, and

(5) The number of threads in nut. [16]

9. (*a*) What are the different types of spring used in machine design along with application ? [6]

(*b*) A mechanism used in printing machinery consist of a tension spring assembled with a pre-load of 30 N. The wire diameter of spring is 2 mm with a spring index of 6. The spring has 18 active coils. The spring wire is hot drawn and oil tempered having the following material properties :

– Design shear stress = 680 N/mm^2

– Modulus of rigidity = 8×10^4 N/mm^2.

Determine :

(1) The initial shear stress in the wire.

(2) The spring rate, and

(3) The maximum force the spring can take. [10]

Or

10. Design a helical compression for a spring operated pressure relief valve with the following data :

(1) Operating pressure = 1.25 N/mm^2

(2) Valve lift = 3.5 mm at 10% pressure rise over operating pressure

(3) Diameter of valve = 25 mm

(4) Limiting mean coil diameter = 40 mm

(5) Permissible shear stress for spring = 500 N/mm^2

(6) Modulus of rigidity for spring material is = 834 Pa

(7) The available standard spring wire diameters are :

2, 3, 4, 5, 6, 7, 8 and 10 mm. [16]

11. (*a*) What is design for appearance ? [6]

(*b*) Explain the role of the following aspects in the aesthetic design :

(1) Symmetry

(2) Colour

(3) Contrast

(4) Balance

(5) Material

(6) Variety. [12]

Or

12. (*a*) What is concurrent engineering ? What is its significance in the product design ? [6]

(*b*) What is design for manufacturing ? Explain the general principles to be followed while designing the parts for manufacturing. [6]

(*c*) What design for Assembly ? Explain general principles to be followed while designing the parts for Assembly. [6]

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

[4062]-138

S.E. (Production) (Second Semester) EXAMINATION, 2011

INDUSTRIAL ORGANIZATION AND MANAGEMENT

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer any *one* question from each Unit.

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

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

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

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

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

SECTION I

Unit I

1. (*a*) Explain Joint stock company with merits and demerits. [8]

(*b*) Explain :

(*i*) Matrix organization;

(*ii*) Project organization. [8]

P.T.O.

Or

2. (*a*) Explain the functions of an organization. [6]

   (*b*) Discuss evolution of management practices with reference to contributions of F.W. Taylor and Henry Fayol. [10]

Unit II

3. (*a*) Explain Maslow's theory of need hierarchy. What are its limitations ? [10]

   (*b*) Discuss the nature of group dynamics which prevail in informal organization and its impact on individual and organizational effectiveness as a whole. [8]

Or

4. (*a*) Explain McCelland's theory of achievement, affiliation and power. [10]

   (*b*) Discuss trait theory of leadership. What are its limitations ? [8]

Unit III

5. (*a*) Explain break-even analysis and its need in entrepreneurship. [8]

   (*b*) Explain the following sources of finance : [8]

   (*i*) Venture capitalist;

   (*ii*) Angel investors.

Or

6. (*a*) Explain various government supporting agencies to finance entrepreneurial activities. [8]

(*b*) Discuss the various obstacles inhibiting entrepreneurship. [8]

SECTION II

Unit IV

7. (*a*) Discuss the key elements of a customer-driven marketing strategy. [8]

(*b*) Describe, how marketing strategies change during the product's life-cycle. [8]

Or

8. (*a*) What is customer equity ? How can a company increase its customer equity ? [8]

(*b*) Define product and the major classification of products. [8]

Unit V

9. (*a*) What is Human Resource Management ? Discuss its scope and nature. [8]

(*b*) Explain various types of external sources of recruitment. [8]

Or

10. (*a*) Define selection and describe various steps in the selection procedure. [8]

(*b*) What are aims and objectives of Human Resource Management ? Who is responsible for this function ? [8]

Unit VI

11. (*a*) Define Wage. Explain any *three* wage incentive plans. [10]

(*b*) Explain various law enforcing authorities under the Industrial Disputes Act, 1947. [8]

Or

12. (*a*) Explain factor comparison method of job evaluation. [8]

(*b*) Briefly enumerate the provisions of Factory's Act, 1948 related to health and welfare of the workers. [10]

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

[4062]-139

S.E. (Prod. S/W) (I Sem.) EXAMINATION, 2011

MANUFACTURING PROCESSES

(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.

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

SECTION I

UNIT-1

1. (*a*) What is pattern ? Explain any *three* types of pattern with neat sketch. [8]

(*b*) What is core ? Name any *four* core with sketch. [5]

(*c*) Explain methods used for inspection and testing of casting. [5]

Or

2. (*a*) Describe the Shell moulding process with neat sketches. Also state its advantages, limitations and applications. [8]

(*b*) Differentiate between permanent mould casting and sand casting. [4]

(*c*) Sketch and describe the working of hot chamber and cold chamber die casting machines. [6]

UNIT-2

3. (*a*) What do you understand by Forging ? [2]

Explain with neat sketches the following forging operations :

(*i*) Upsetting

(*ii*) Drawing out

(*iii*) Fullering

(*iv*) Bending. [6]

(*b*) A square bar has to be made by Rolling process. Explain the procedure in short with sketches. [6]

(*c*) Name different defects that are occurred in Forging process. [2]

Or

4. (*a*) Neatly draw the process to 'draw wire' and explain. [6]

(*b*) Write short notes on :

(*i*) HERF

(*ii*) Swaging process

(*iii*) Indirect extrusion. [10]

UNIT-3

5. (*a*) Explain with neat sketch '**Submerged arc welding**' process, stating advantages, limitations and area of applications. [8]

(*b*) Explain principle of resistance welding and differentiate between upset welding and flash welding with sketch. [8]

Or

6. (*a*) Describe various types of flames used in gas welding with its applications. [6]

(*b*) Explain with neat sketch LASER beam welding and give its applications. [6]

(*c*) Differentiate between brazing and braze welding process. [4]

SECTION II

UNIT-4

7. (*a*) Write short notes on :

(*i*) Taper turning attachment

(*ii*) Steady and follower rest. [8]

(*b*) Explain in short drilling operation on lathe with suitable sketch. [4]

(*c*) Draw *three* views of single cutting point tool and label it. [6]

Or

8. (*a*) State the function of the following in lathe :

(*i*) Tumbler gears

(*ii*) Chasing dial

(*iii*) Mandrels. [6]

(*b*) Explain the following lathe operations with neat sketch :

(*i*) Eccentric turning

(*ii*) Parting

(*iii*) Knurling. [6]

(*c*) Draw block diagram of lathe machine and show the following parts on it :

(*i*) Tail stock

(*ii*) Head stock

(*iii*) Half nut

(*iv*) Apron mechanism. [6]

UNIT-5

9. (*a*) Draw a neat sketch of a twist drill and show its elements and angles. [6]

(*b*) Describe the following terms related to twist drill :

(*i*) Flank

(*ii*) Flutes

(*iii*) Land

(*iv*) Web. [4]

(*c*) Discuss various types of milling cutters with neat sketches. [6]

Or

10. (*a*) Index 87 divisions by compound indexing method. The hole circle available are :

Plate I 15, 16, 17, 18, 19, 20

Plate II 21, 23, 27, 29, 31, 33

Plate III 37, 39, 41, 43, 47, 49 [6]

(*b*) With the help of sketch, explain the construction and working of radial drilling machine. [6]

(*c*) Differentiate between up and down milling. [4]

UNIT-6

11. (*a*) Write short notes on :

(*i*) Vitrified Bond

(*ii*) Silicate Bond

(*iii*) Resinoid Bond. [6]

(*b*) With the aid of a neat sketch, explain construction and working of tool and cutter grinder. State its applications. [6]

(*c*) Explain the terms 'Loading' and 'Glazing' as applied to grinding wheels. [4]

Or

12. (*a*) What is centreless grinding ? Draw a working setup of centreless grinding process and explain in short. [8]

(*b*) Compare the Honing and Lapping Processes with respect to :

(*i*) Principle of working

(*ii*) Type of abrasive

(*iii*) Area of application

(*iv*) Surface finish. [4]

(*c*) In grinding wheel designation, what do the structure and grade stands for ? [4]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[4062]-140

S.E. (Production S/W) (II Sem.) EXAMINATION, 2011

MANUFACTURING ENGINEERING AND METROLOGY PRACTICES

(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*) The following data were obtained while turning a work piece on lathe :

Cutting Speed = 25 m/min, Depth of Cut = 0.3 mm/rev, Tool Life = 100 min.

The following tool life equation is given this operation $VT^{0.12}f^{0.7}d^{0.3} = C$. If the cutting speed increased 25%, what will be the new tool life ? [8]

(*b*) Draw and explain resolution of resultant cutting force developed by Emst and Merchant Theory. [8]

Or

Explain in detail : [16]

(*i*) Types of Chips

(*ii*) Measurement of cutting forces.

2. Explain the difference between : [16]

(*i*) Capstan and Turret Lathe

(*ii*) Single and Multispindle Automat.

Also draw operational sketch for all above.

Or

Write notes on any *two* of the following : [16]

(*i*) Transfer lines

(*ii*) Planning and Slotting Machine

(*iii*) Cam layout for production machine.

3. With respect to construction of broaching explain the following :

(*i*) Configuration of broaching tools (with neat sketch) [6]

(*ii*) Material for broach [4]

(*iii*) Geometry of broaching teeth and their cutting edges. [8]

Or

Explain any *three* of the following with neat sketches : [18]

(*i*) Gear Hobbing

(*ii*) Gear Shaving

(*iii*) Thread Milling

(*iv*) Thread Rolling.

SECTION II

4. (*a*) Explain different types of coordinate systems used in NC/CNC operations. [10]

(*b*) FMS introduces flexibility in every facets of manufacturing. Explain. [6]

Or

For machining center, explain the following : [16]

(*i*) Principles, working, advantages

(*ii*) Applications and Parts programming.

5. Explain any *two* of the following : [16]

(*i*) Notching

(*ii*) Forming

(*iii*) Coining.

Or

Show Calculations of clearances, center of pressure, different forces, press tonnage, blank size, for press tool applications. [16]

6. Explain the following elements of jigs (any *three*) : [18]

(*i*) Body

(*ii*) Locating Device

(*iii*) Clamping Device

(*iv*) Tool Guide.

Or

Explain general guidelines and procedure for design of fixtures. [18]

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

[4062]-141

S.E. (Electrical) (I Sem.) EXAMINATION, 2011

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.

SECTION I

UNIT I

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

(*b*) Explain with neat sketch working of a pulverised bed combustion system. [8]

Or

2. A steam power plant works on a Rankine cycle. The steam at inlet to the turbine is saturated at a pressure of 35 bar and is exhausted into the condenser at a pressure of 0.30 bar. Consider the pump work. Determine :

(1) Pump work

(2) Turbine work

(3) Net work done

(4) Dryness fraction of the steam entering into the condenser

(5) Specific steam consumption

(6) Work Ratio

(7) Rankine cycle efficiency. [16]

UNIT II

3. (*a*) Compare Carnot cycle with Rankine cycle. [4]

(*b*) Classify boilers. [4]

(*c*) Explain with neat sketch "Boiler draught systems". [8]

Or

4. (*a*) What are the factors considered for selection of a site for thermal power plant ? [4]

(*b*) Explain with neat sketch working of an "Electrostatic precipitator." [6]

(*c*) Write a short note on "Feed water treatment" for the thermal power plant. [6]

UNIT III

5. (*a*) Classify Hydroelectric power plants. [6]

(*b*) Write a short note on "Draft tube and its types". [6]

(*c*) Explain with neat sketch "Centrifugal Governing Mechanism". [6]

Or

6. (*a*) What are the points considered for site selection for Hydro-electric Power Plant ? [6]

(*b*) Explain with neat sketch the working of a "Francis Turbine". [6]

(*c*) Write a short note on "Hydroelectric Power Plant Development Programme of India". [6]

SECTION II

UNIT IV

7. (*a*) Explain with neat sketch the working of "CANDU" Nuclear Reactor. [8]

(*b*) Explain with neat sketch the working of Diesel engine power plant. [8]

Or

8. (*a*) Explain with neat sketch the working of "Boiling Water Reactor" (B.W.R.). [8]

(*b*) Write applications, advantages and disadvantages of Diesel engine power plant. [8]

UNIT V

9. (*a*) Explain with neat sketch the working of "Closed cycle Gas Turbine power plant". [8]

(*b*) Explain with neat sketch the working of "Open cycle Magneto Hydrodynamic (MHD) system". [8]

Or

10. (*a*) Write a short note on Gas turbine fuels and Gas turbine materials. [8]

(*b*) Explain with neat sketch "Wind Electric Generation System". [8]

UNIT VI

11. (*a*) Discuss the various fixed charges and running charges which are used for calculation of cost of electrical energy. [8]

(*b*) The following data is obtained for a 3000 kW diesel engine power plant. The peak load on the plant is 1800 kW and its load factor is 52%.

Capital Cost per kW installed = Rs. 2,000

Annual Cost = 20% of capital

Annual Operating Cost = Rs. 80,000

Fuel Cost = Rs. 8 per kg

Cost of lubricating oil = Rs. 90 per kg

Fuel consumed = 0.35 kg/kW-hr

Lubricating oil used = 0.030 kg/kW-hr

Determine :

(1) Annual energy generated

(2) Cost of power generation in Rs. per kW/hr. [10]

Or

12. (*a*) Define the following :

(1) Demand factor

(2) Load factor

(3) Plant capacity factor

(4) Plant use factor

(5) Diversity factor. [10]

(*b*) The maximum load on a thermal power plant of 80 MW capacity is 60 MW at annual load factor of 65%. The coal consumption is 0.90 kg per unit of energy generated and cost of fuel (coal) is Rs. 3 per kg. Find the annual revenue earned, if the electric energy is sold at Rs. 3.5 per kW/hr. [8]

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

[4062]-142

S.E. (Electrical) (I Sem.) EXAMINATION, 2011

MATERIAL SCIENCE

(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 Q. No. **1** *or* Q. No. **2**, Q. No. **3** *or* Q. No. **4**, Q. No. **5** *or* Q. No. **6** from Section I.

(*iii*) 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.

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

(*v*) Use of logarithmic table, slide rule and electronic calculator is allowed.

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

***Physical Constants* :**

(1) Angstrom Unit (AU) = 1×10^{-10} metres.

(2) Boltzmann's constant (K) = 1.38×10^{-23} Joule-degree^{-1}.

(3) Charge on electron (e) = 1.601×10^{-19} coulombs.

(4) Mass of electron (m) = 9.107×10^{-31} kg.

(5) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$.

(6) Mass of proton (m_p) = 1.627×10^{-27} kg.

(7) Velocity of light (C) = $2.998 \times 10^{+8}$ metre/second.

(8) Electron volt (eV) = 1.602×10^{-19} Joules.

(9) Debye unit = 3.33×10^{-30} coulomb-metre.

(10) Dielectric constant of free space (m_0) = 8.85×10^{-12} farad-metre^{-1}.

SECTION I

1. (*a*) Derive Clausius-Mosotti relation from the first principle applied to dielectric materials. State the assumptions. [8]

(*b*) Calculate the electronic polarizability of Argon atom. Given $\hat{\mathrm{I}}_r$ = 1.0024 at NTP and N = 2.8×10^{25} atoms/m^3. [4]

(*c*) What is meant by loss tangent as referred to polar dielectrics ? Give its significance. [4]

Or

2. (*a*) Write different materials used for photo-voltaic cell. With neat sketch describe its construction and working principle. [8]

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

(*i*) Ferro-electricity

(*ii*) Electronic polarization.

3. (*a*) Discuss the insulating materials used for : [8]

(*i*) Power transformer

(*ii*) Line insulators.

(*b*) State different mechanisms of breakdown in vacuum. Explain any *one* in detail. [8]

Or

4. (*a*) State the properties and applications of : [8]

(*i*) SF_6 gas

(*ii*) Ceramics

(*iii*) Asbestos

(*iv*) Transformer oil.

(*b*) What is meant by Townsend's primary and secondary ionization coefficient ? Explain various factors affecting the breakdown strength of solid insulating materials. [8]

5. (*a*) Explain classification of magnetic materials on the basis of distribution of dipole moments. Give application of each class. [8]

(*b*) Differentiate between :

(*i*) Soft and hard magnetic materials [5]

(*ii*) Permeability and magnetic susceptibility. [5]

Or

6. (*a*) What is Curie temperature for ferromagnetic material ? Explain spontaneous magnetization and Curie-Weiss law. [9]

(*b*) Write short notes on :

(*i*) Magnetic recording materials [5]

(*ii*) Compact discs. [4]

SECTION II

7. State the properties and applications of : [16]

(*i*) Tungsten

(*ii*) Eureka

(*iii*) Kanthal

(*iv*) Nichrome.

Or

8. (*a*) Why is carbon preferred for brushes in electric machines ? [4]

(*b*) What are the groups into which solders are grouped ? Give their applications. [4]

(*c*) Describe in brief the properties and applications of aluminium as conductive material. [4]

(*d*) Write a short note on 'Thermocouples'. [4]

9. (*a*) What are carbon nanotubes ? Discuss their electrical, mechanical and vibrational properties. Give some applications of carbon nanotubes. [10]

(*b*) Write a short note on 'BN nanotubes'. [6]

Or

10. Write short notes on : [16]

(*i*) Single electron transistor

(*ii*) Molecular machine

(*iii*) Nano wire

(*iv*) Carbon clusters.

11. (*a*) With a neat connection diagram, explain the method for determining dielectric strength of transformer oil as per IS Code of Practice. What inferences will you draw from the test ? [10]

(*b*) What is partial discharge of a dielectric ? Explain a method to determine the partial discharge of solid dielectric in laboratory. [8]

Or

12. (*a*) With a neat connection diagram explain the method for measurement of dielectric strength of air as per IS Code of practice. What inferences will you draw from this test ? [10]

(*b*) Explain loss tangent in dielectric materials. Describe the method of measurement of tan d of a dielectric by schering bridge as per IS code of practice. [8]

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

[4062]-143

S.E. (Electrical) (I Sem.) EXAMINATION, 2011

ANALOG AND DIGITAL ELECTRONICS

(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*) Draw and explain RC coupled BJT amplifier. [8]

(*b*) Compare CC and CE configuration of BJT as an amplifier. [8]

Or

2. (*a*) Compare FET and BJT amplifier. [8]

(*b*) Explain push-pull amplifier with neat circuit diagram. [8]

3. (*a*) Explain block diagram of IC741 and ideal parameters of OP-Amp. [8]

(*b*) Explain application of OP-Amp as a ZCD and comparator. [10]

Or

4. (*a*) Compare ideal and practical integrator. Draw input and output waveforms of ideal integrator for ramp and sinusoidal input. [8]

(*b*) What is instrumentation amplifier ? Draw its circuit using OP-Amp and explain it. Also give its application. [10]

5. (*a*) Draw and explain IC555 as an astable multivibrator with neat connection diagram, state application. [8]

(*b*) What is voltage regulation ? Why is it necessary ? State and explain any *four* parameters of voltage regulator. [8]

Or

6. (*a*) Draw and explain connection diagram for first order high pass filter. [8]

(*b*) How can Op-Amp be used generator ? Also draw the necessary waveform of the operation. [8]

SECTION II

7. (*a*) Convert the following numbers into its equivalent BCD : [6]

(*i*) $(2F9A)_{16}$

(*ii*) $(247.36)_8$.

(*b*) Explain Excess-3 code and Gray code. [6]

(*c*) Simplify the following expression using K-map :

$$Y = A\bar{B}C + \bar{A}\bar{B}C + \bar{A}BC + A\bar{B}\bar{C} + \bar{A}\bar{B}\bar{C}.$$ [6]

Or

8. (*a*) Using Boolean Algebra show that :

(*i*) $\bar{A}BC\bar{D} + BC\bar{D} + B\bar{C}\bar{D} + B\bar{C}D = B\left(\bar{D} + \bar{C}\right)$ [4]

(*ii*) $AB + \overline{AC} + A\bar{B}C(AB + C) = 1$ [3]

(*iii*) $\bar{A}B\bar{C}D + \bar{A}BCD + ABD = BD.$ [3]

(*b*) Explain SOP and POS form of K-map for *three* variables. [8]

9. (*a*) Explain Master-slave J-K flip-flop with truth table. [8]

(*b*) With the help of neat circuit diagram and related timing diagram explain twisted ring counter. [8]

Or

10. (*a*) Design and explain the operation of MOD5 synchronous counter with related timing diagram. [8]

(*b*) With the help of neat circuit diagram explain the operation of 4-bit parallel in serial out shift register. [8]

11. (*a*) Explain the working of semiconductor memories. Also explain Dynamic RAM. [8]

(*b*) Explain the working of 4 : 1 multiplexer using logic gate circuit and truth table. [8]

Or

12. (*a*) Explain the working of successive Approximation Analog to Digital Converter with advantages and disadvantages. [8]

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

(*i*) ROM

(*ii*) PROM.

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

[4062]-144

S.E. (Electrical) (I Sem.) EXAMINATION, 2011

ELECTRICAL MEASUREMENTS AND 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.

(*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 in detail the classification of the measuring instruments. [8]

(*b*) With a neat sketch describe construction and working of PMMC instrument. Derive the torque equation for this instrument. Comment on shape of scale. [10]

Or

2. (*a*) Which three forces are required for satisfactory operation of an analog indicating instrument ? State the function of each force. [6]

(*b*) What are shunts and multipliers ? What are the disadvantages of shunt ? [6]

(*c*) The inductance of a moving iron ammeter is given by the expression $L = (12 + 5q - 2q^2)$ mH, where q is the angular deflection in radians from zero position. Determine :

(*i*) the spring constant

(*ii*) the angular deflection in radians for a current of 10 A, if the deflection for a current of 5 A is 30°. [6]

3. (*a*) Draw circuit diagram of Kelvin's double bridge. Derive expression for unknown resistance with usual notations. [8]

(*b*) In a Maxwell's inductance comparison bridge arm *ab* consists of a coil with inductance L_1 and resistance r_1 in series with a non-inductive resistance R. Arm *bc* and *cd* are each a non-inductive resistance of 100 Ω. Arm *ad* consists of standard variable inductor L of resistance 32.7 Ω. Balance is obtained when $L_2 = 47.8$ mH and R = 1.36 Ω. Find the resistance and inductance of the coil in the arm *ab*. [4]

(*c*) The four impedances of an bridge are :

$Z_1 = 400\ \Omega \angle 50°$, $Z_2 = 200\ \Omega \angle 30°$, $Z_3 = 800\ \Omega \angle -50°$, $Z_4 = 400\ \Omega \angle -40°$.

Find out whether the bridge is balanced under these conditions. [4]

Or

4. (*a*) Write a short note on megger and earth tester. [8]

(*b*) Draw circuit diagram of Anderson's bridge. Derive the equation for unknown inductance and draw the phasor diagram. [8]

5. (*a*) Explain two wattmeter method for measuring power in a (R + L) load. Draw the phasor diagram. [8]

(*b*) Write a short note on digital multi-meter. [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*) An energy meter has constant of 3200 imp/kWh rated for 220 V, 5 A. Calculate total number of impulses in one minute for full load at unity power factor. In a test run at half load, the meter takes 59.5 sec to complete 30 impulses, calculate error of meter. [6]

(*b*) Derive torque equation of single-phase induction type energy meter with the help of phasor diagram. [8]

(*c*) Show a neat connection diagram of a three-phase energy meter used for measurement of energy incorporating CT and PT. [4]

Or

8. (*a*) A 230 V single-phase energy meter has constant load of 5 A passing through it for 8 hours at 0.9 P.F. If the meter LED makes 26500 impulses during this period, find the meter constant in imp/kWh. Calculate the power factor of the load if the number of impulses are 11230 when operating at 230 V and 6 A for 5 hours. [6]

(*b*) Which are the possible errors in an induction type single phase energy meter explain and give compensation for the errors ? [4×2] (*c*) What is creeping error in an induction type energy meter ? How is it overcomed ? [4]

9. (*a*) Describe low pressure measurement by McLeod guage. [8]

(*b*) In an experiment, the voltage across a 10 kW resistor is applied to CRO. The screen shows a sinusoidal signal of total vertical occupancy 3 cm and total horizontal occupancy of 2 cm. The front panel controls of V/div and time/div are on 2 V/div and 2 ms/div respectively. Calculate the rms value of the voltage across the resistor and its frequency. Also find rms value of current. [6]

(*c*) Explain vacuum pressure. [2]

Or

10. (*a*) Explain pressure capacitance transducer with a neat diagram. Write advantages and disadvantages of capacitive transducer. [8]

(*b*) Explain front panel controls of CRO : [8]

(1) Time/div

(2) Volt/div

(3) dual ch.

(4) invert

(5) x-position

(6) y-position

(7) xy-mode

(8) CH1 CH2.

11. (*a*) Explain any *two* types of head type flowmeters. [8]

(*b*) Explain level measurement by mechanical method. [8]

Or

12. (*a*) Explain construction, working and application of load cell with a neat diagram. [8]

(*b*) Describe displacement measurement by LVDT in detail. [8]

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

[4062]-145

S.E. (Elect. Engg.) (Second Semester) EXAMINATION, 2011

POWER SYSTEM–I

(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*) 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*) Define the following terms associated with load characteristics :

(*i*) Load factor

(*ii*) Demand factor

(*iii*) Diversity factor

(*iv*) Annual plant use factor. [8]

(*b*) What are the objectives of tariff ? Explain the role of incentives and penalties to encourage the customers to keep load factor and power factor high. [8]

Or

2. (*a*) What do you understand by load curve and load duration curve ? What information is obtained from them ? [6]

(*b*) The maximum demand on a power plant is 60 MW. The plant capacity factor is 0.6 and the utilization factor is 0.8. Find :

(*i*) Load factor

(*ii*) Plant capacity

(*iii*) Reserve capacity

(*iv*) Annual energy production. [6]

(*c*) Write a short note on time of day tariff. [4]

3. (*a*) Write a short note on PLCC equipment. [6]

(*b*) Derive the expression for voltage distribution across the units of a string of suspension insulators. Define string efficiency. Name only any *two* methods used for improving the string efficiency. [10]

Or

4. (*a*) Write a note on control room equipments in a generating station. [8]

(*b*) Each line of a three-phase system is suspended by a string of three similar insulators. If the voltage across the line unit is 18 kV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is (1/10)th of the capacitance of the insulator itself. Also find the string efficiency. [8]

5. (*a*) Derive the expression for inductance per phase of a three-phase overhead transmission line with unsymmetical spacing between conductors (with transposition). [8]

(*b*) Find the inductive reactance/ph/km of a double circuit three-phase transmission line as shown in Fig. 1. The conductors are transposed and radius of each is 0.7125 cm. The frequency is 50 Hz. [10]

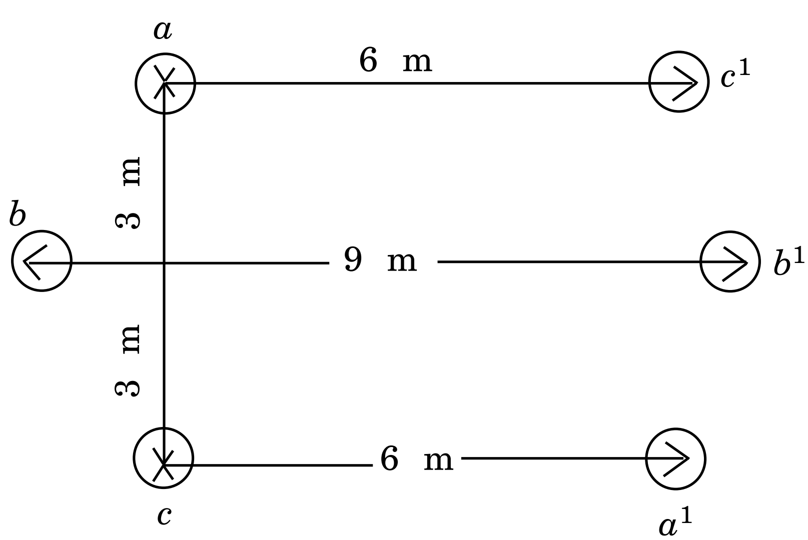

Fig. 1

Or

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

(*b*) Explain the concept of GMD and GMR. [6]

(*c*) A three-phase 50 Hz overhead transmission line consists of three conductors each of diameter 25 mm. The spacing between the conductors is as follows :

A – B = 3 m, B – C = 5 m, C – A = 3.2 m.

Find the inductance and inductive reactance per phase per km of the line. [6]

SECTION II

7. (*a*) Derive expressions for line-to-line capacitance and line-to-neutral capacitance for a single-phase overhead transmission line. [8]

(*b*) A 50 Hz overhead transmission line consisting of three conductors each of diameter 2 cm and spaced 2.5 m. Calculate the capacitance per phase per km for the following arrangement between conductors :

(*i*) Equilateral spacing

(*ii*) Horizontal spacing with transposition. [8]

Or

8. (*a*) Derive an expression for the capacitance to neutral of a three-phase line with equilateral spacing. [8]

(*b*) A 40 km long, single-phase line has two parallel conductors each 5 mm in diameter and 1.5 m apart. The height of conductors above ground is 7 m. Find the capacitance of the line :

(*i*) Neglecting the effect of earth

(*ii*) Including the effect of earth. [8]

9. (*a*) Give classification of transmission lines based on length. Explain the influence of power factor on the performance of a transmission line. [8]

(*b*) Derive the expression for ABCD constants of a long transmission line in hyperbolic form. [8]

Or

10. (*a*) Obtain the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with nominal pi method. Draw the phasor diagram. [8]

(*b*) Calculate ABCD constants for a three-phase, 50 Hz, long transmission line with the following parameters :

$R = 24 \quad \Omega$

$L = 0.192 \ H$

$C = 1.28 \times 10^{-6} \ F$

$G = 0.$ [8]

11. (*a*) Derive an expression for sag and tension of a overhead transmission line supported between the towers of the same height. [10]

(*b*) A 33 kV, three-phase, 50 Hz underground cable is 4 km long. It uses three-single core cables where each cable has a core diameter of 2.25 cm and the radial thickness of insulation is 0.6 cm. The relative permittivity of the dielectric is 3. Find :

(*i*) Capacitance of the cable/phase

(*ii*) Maximum stress in the cable. [8]

Or

12. (*a*) Write a short note on XLPE cables. [6]

(*b*) Explain different types of cable faults. [6]

(*c*) A transmission line has a span of 180 m between level supports. Line conductor has a cross-sectional area of 1.3 cm^2 and it weighs 1 kg/m. If the breaking stress of conductor is 4000 kg/cm^2. Calculate the maximum sag for a safety factor of 4. Assume a maximum wind pressure of 100 kg/m^2 of the projected surface. [6]

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

[4062]-146

S.E. (Electrical Engg.) (II Sem.) EXAMINATION, 2011

ELECTRICAL MACHINE—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*) Assume suitable data, if necessary.

SECTION I

1. (A) A 1ϕ, 10 kVA, 500/250 V, 50 Hz, transformer has the following constants :

— Resistance : Primary 0.2 Ω, Secondary 0.5 Ω

— Reactance : Primary 0.4 Ω, Secondary 0.1 Ω

— Resistance of equivalent exciting circuit referred to Primary R_0 = 1500 Ω

— Reactance of equivalent exciting circuit referred to Primary, X_0 = 750 Ω

What would be the readings of instruments when connected primary for open circuit and short circuit test ? [8]

(B) Explain core type and shell type single phase transformer. [8]

Or

2. (A) A 230/230 V, 3 kVA, transformer gave the following results :

O.C. test : 230 V, 2 Amp, 100 W

S.C. test : 15 V, 13 Amp, 120 W

Determine the regulation and efficiency at full load 0.8 p.f. lagging. [8]

(B) Derive the condition for maximum efficiency for a transformer. Also derive kVA supplied at maximum efficiency. [8]

3. Write short notes on any *three* of the following special transformer :

(*a*) Scott Connection

(*b*) 'T' Connection

(*c*) V-V Connection

(*d*) 3 f Y-D Connection. [18]

Or

4. (A) Derive the current shared by each transformer when two 1 f transformers A and B are connected in parallel. Also derive formula for circulating current. Assume transformers with unequal voltage ratio. [9]

(B) What are necessary conditions for parallel operations of 1-phase and 3-phase transformer ? [9]

5. (A) Draw construction diagram of d.c. machine. Give working of any *four* parts of machines. [8]

(B) Explain demagnetising and cross-magnetising effects for a d.c. machine. [8]

Or

6. (A) Explain power flow diagram of a d.c. motor. [8]

(B) Explain significance of back e.m.f. in d.c. motors and derive its equations. [8]

SECTION II

7. (A) What is the necessity of starter and explain four point starter ? [8]

(B) A 20-HP (14.92 kW), 230 V, 1150 rpm, 4 pole, d.c. shunt motor has a total of 620 conductors arranged in two parallel paths and yielding an armature circuit resistance of 0.2 W. When it delivers rated power at rated speed it draws a line current of 74.8 A and a field current of 3 A. Calculate the :

(*i*) Flux per pole

(*ii*) Torque developed

(*iii*) Rotational losses

(*iv*) Total losses

expressed as a percentage of power. [8]

Or

8. (A) Define commutation. State the different methods to improve commutation and explain any *one* of them. [8]

(B) A series motor is run on a 440 V circuit with a regulating resistance of RW for speed adjustment. The armature and field coils have a total resistance of 0.3 W on a certain load with R = zero, the current is 20 A and speed is 1200 rpm. With another load and R = 3 W, the current is 15 A. Find the new speed and also the ratio of the two values of the power output of the motor. Assume the field strength at 15 A to be 80% of that at 20 A. [8]

9. (A) A 4 pole, 50 Hz, 3-phase induction motor has rotor resistance per phase of 0.03 W and reactance of 0.12 W per phase. What is the value of speed at maximum torque ? Find the amount of external resistance per phase required to be inserted to obtain 75 percent of maximum torque at start. [8]

(B) Derive the condition for maximum torque under running condition. [8]

Or

10. (A) Explain the theory for production of rotating field by 3-phase current fed to symmetrical 3-phase winding. [8]

(B) The power input to a 400 V, 60 Hz, 6 pole, 3-f induction motor running at 1140 rpm is 40 kW at 0.8 p.f. lag. Stator losses are 1 kW and the friction and windage losses are 2 kW. Calculate the :

(*i*) slip

(*ii*) rotor copper loss

(*iii*) brake h.p.

(*iv*) efficiency

(*v*) input current. [8]

11. (A) Draw and explain equivalent circuit of an induction motor. [9]

(B) Draw and explain how to construct the circle diagram of an Induction motor. [9]

Or

12. (A) What are different types of Induction motor starter ? Draw and explain Star-delta starter. [9]

(B) Write a short note on speed control of Induction motor. [9]

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

[4062]-147

S.E. (Electrical) (II Sem.) EXAMINATION, 2011

NETWORK ANALYSIS

(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*) 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*) Define lumped, distributed, unilateral and bilateral networks with examples. [6]

(*b*) By using graphical method find the dual of the given network. shown in Fig. 1. [4]

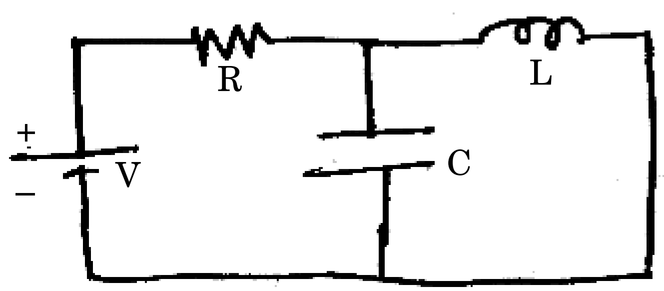

Fig. 1

(*c*) Determine the voltage across 3 W resistor using Moh analysis shown in Fig. 2. [8]

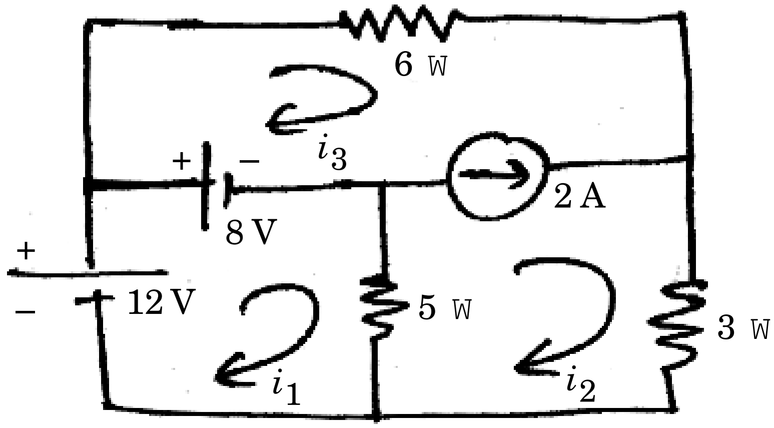

Fig. 2

Or

2. (*a*) Explain the concept of supermesh and supermode with example. [6]

(*b*) Write the short note on coupled circuit and dot convention. [4]

(*c*) Find the node voltages V_1 and V_2 for the network shown in Fig. 3. [8]

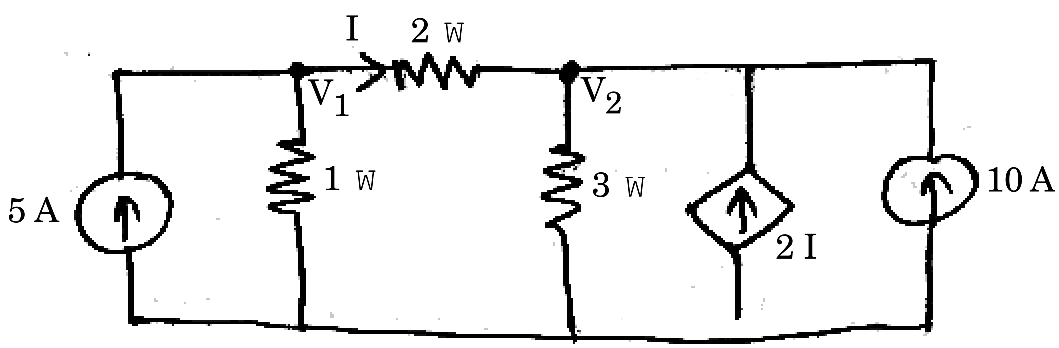

Fig. 3

3. (*a*) State and explain substitution and Milliman's theorem. [8]

(*b*) Determine the voltage across the capacitor by using superposition theorem for the network shown in Fig. 4. [8]

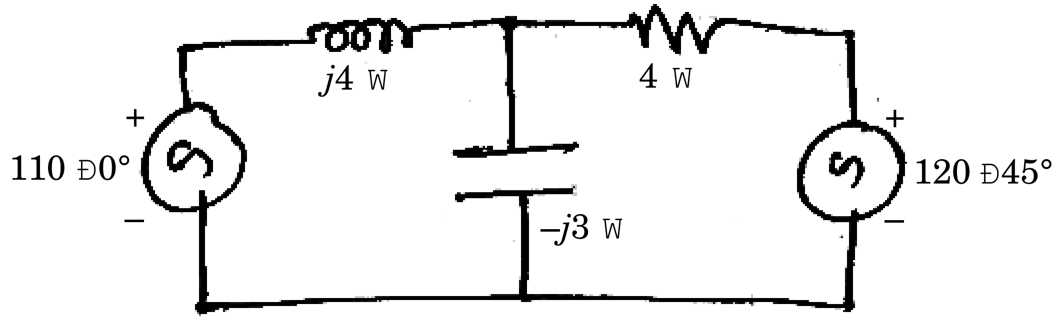

Fig. 4

Or

4. (*a*) Find the Thevenin's equivalent circuit across the terminals AB for the network shown in the Fig. 5. [8]

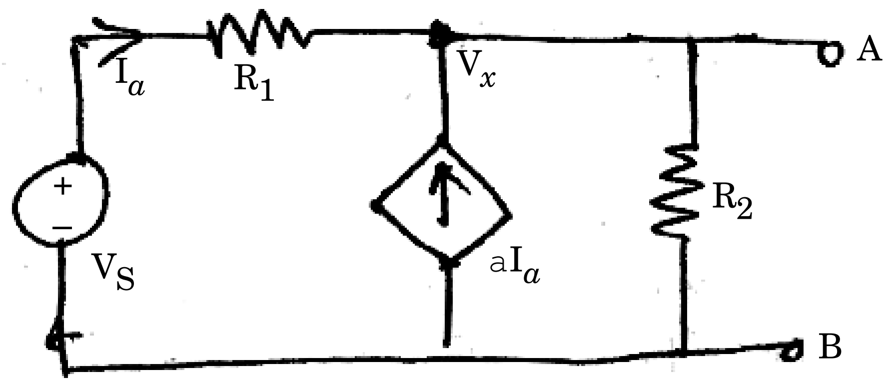

Fig. 5

(*b*) Verify the Reciprocity theorem for the network shown in the Fig. 6. [8]

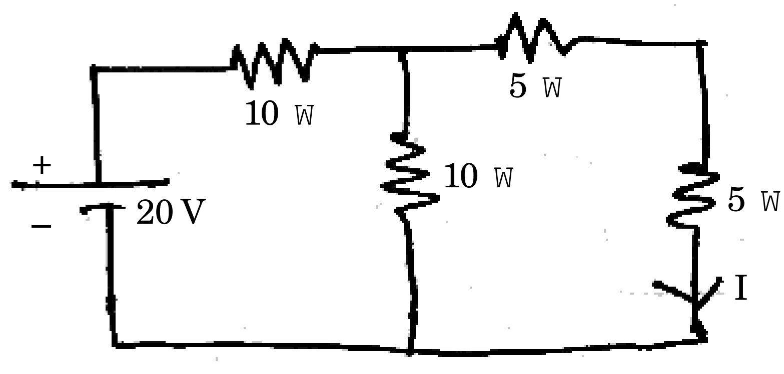

Fig. 6

5. (*a*) For the network shown in Fig. 7, find the expression for current $i(t)$ when the switch is closed at $t = 0$ by using classical method. Also obtain the expression for $V_R(t)$ and $V_L(t)$. Assume initial current in the inductance is zero. [6]

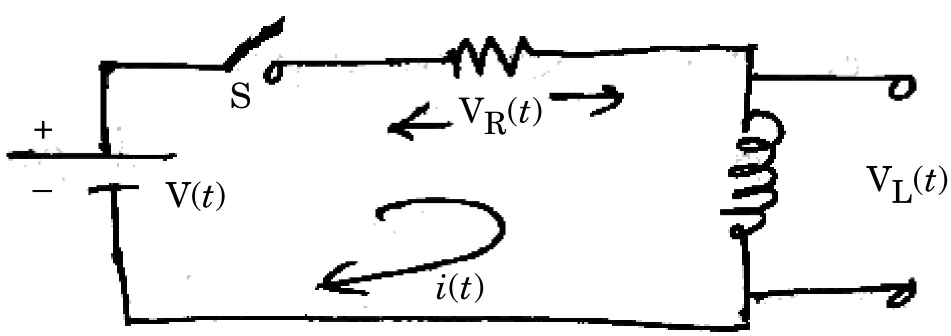

Fig. 7

(*b*) State and explain any *four* properties of Laplace Transform. [4]

(*c*) Write a short note on initial and final conditions in the network. [6]

Or

6. (*a*) State and explain standard time signals. [6]

(*b*) Find the L.T. of the signal $f(t) = \sin \omega t \; u(t)$. [4]

(*c*) Determine $i(t)$ for $t \geq 0$ in RC series circuit as shown in Fig. 8 by using Laplace Transform. [6]

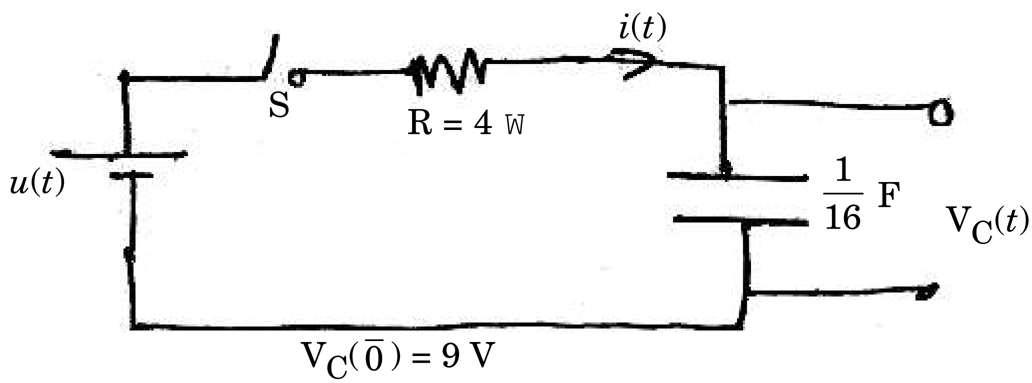

Fig. 8

SECTION II

7. (*a*) Explain the 2-port parameters : [6]

(*i*) *z*-parameters

(*ii*) *h*-parameters.

(*b*) Derive the inter-relationship between *z*-parameters and *y*-parameters. [4]

(*c*) Find *y*-parameters for the network shown in Fig. 9. [8]

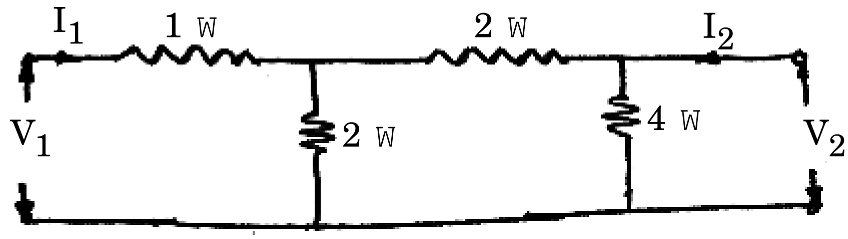

Fig. 9

Or

8. (*a*) Explain cascade connection of two port network parameter using ABCD parameters. [6]

(*b*) State and explain the maximum power transfer theorem for AC Network. [6]

(*c*) For the network shown in Fig. 10, find the insertion loss in dB when a network N is inserted between the load and the source. [6]

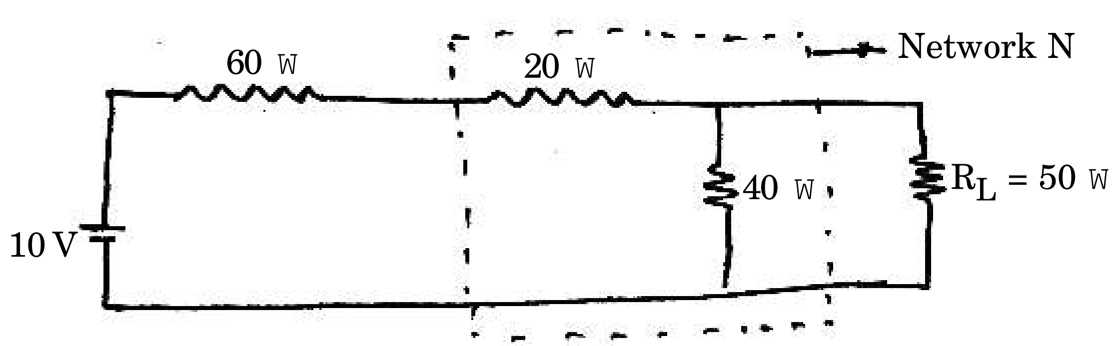

Fig. 10

9. (*a*) What are Fourier coefficients ? Write a short note on evaluation of Fourier coefficients, of Fourier series. [8]

(*b*) Determine the Fourier series for the waveforms shown in Fig. 11. [8]

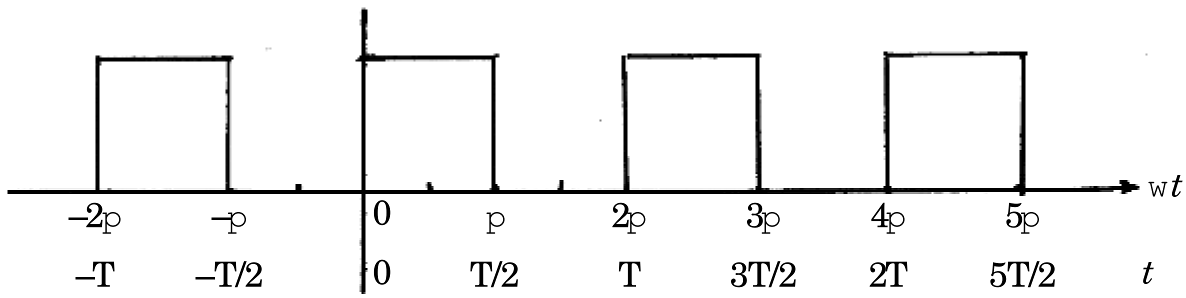

Fig. 11

Or

10. (*a*) What is low pass filter ? Derive the relation for cut-off frequency for low pass filter in terms of L&C. [8]

(*b*) Explain the following terms in relation with filter and give significance of each : [8]

(*i*) Pass band

(*ii*) Stop band

(*iii*) Cut-off frequency.

11. (*a*) State the restrictions on pole and zero locations for driving point function and transfer function. [8]

(*b*) Write a short note on location of pole-zeros and time domain response. [8]

Or

12. (*a*) For the given network function, give the pole-zero locations and also draw the pole-zero plot on s-plane :

$$F(s) = \frac{2(s+2)}{s(s+3)(s+2+j2)(s+2-j2)}. \quad [8]$$

(*b*) Determine the driving point impedance at terminals 1 – 1¢ for the network shown in Fig. 12. [8]

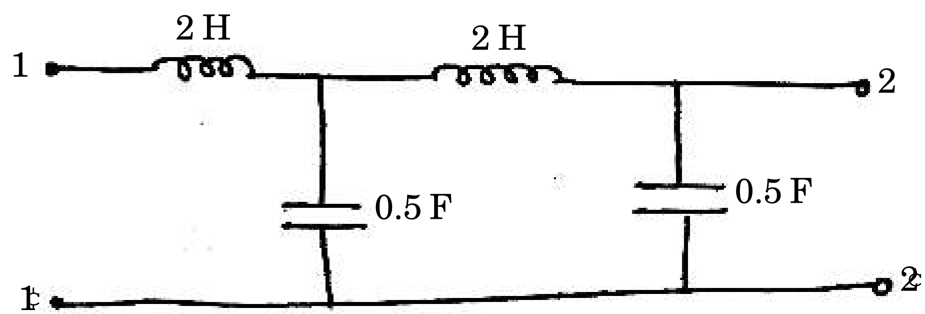

Fig. 12

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

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S.E. (Electrical) (II Sem.) EXAMINATION, 2011

DIGITAL COMPUTATIONAL TECHNIQUE

(2008 PATTERN)

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

N.B. **:—** (*i*) In Section I, attempt Q. **1** *or* Q. **2**, Q. **3** *or* Q. **4**, Q. **5** *or* Q. **6**. In Section II, attempt Q. **7** *or* Q. **8**, Q. **9** *or* Q. **10**, Q. **11** *or* Q. **12**.

(*ii*) Answer 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

1. (A) Explain concept of significant digit with example. [6]

(B) For the polynomial $f(x) = 2x^3 - 6x + 13$. Find $f(2)$, f ¢(2), f ¢¢(2) and f ¢¢¢(2) using synthetic division. [6]

P.T.O.

(C) Explain Descarte's rule of sign to find number of real positive, negative and imaginary roots. [6]

Or

2. (A) Explain truncation error and round off error with example. [6]

(B) Explain significance of absolute and relative error. [4]

(C) Solve :

$$x^4 - 5x^3 + 20x^2 - 40x + 60 = 0$$

using Lin-Bairstow method. Perform two iterations taking $p_0 = -4$ and $q_0 = 8$. [8]

3. (A) Find the root of the equation $xe^x = \cos x$ using Regula-Falsi method correct to four decimal places. Take intervals as (0.4, 1). [8]

(B) Explain bisection method to find the root of a transcendental equation. [8]

Or

4. (A) Explain Newton-Raphson method to find root of equation with two variables. [8]

(B) Find negative real root of the equation $x^2 + 4 \sin x = 0$, correct to four decimal places using NR method. [8]

5. (A) Explain Gauss-Seidel method to solve linear simultaneous equation. [8]

(B) Apply Gauss-Jordon method to find inverse of :

$$\begin{bmatrix} 2 & 6 & 6 \\ 2 & 8 & 6 \\ 2 & 6 & 8 \end{bmatrix}.$$ [8]

Or

6. (A) Explain Gauss elimination method to solve linear simultaneous equation. [8]

(B) Solve the following system of equation using Gauss-Jacobi method :

$$20x + y - 2z = 17$$
$$3x + 20y + 2z = -18$$
$$2x - 3y + 20z = 25.$$ [8]

SECTION II

7. (A) Derive the equation for Newton's backward interpolation for equally spaced data. [8]

(B) Given that :

x	$f(x) = \sin x$
0.1	0.0993
0.2	0.1980
0.3	0.2955
0.4	0.3894
0.5	0.4797

Find $f(0.35)$ using Bessel's formula. Take $x_0 = 0.3$. [8]

Or

8. (A) Using Lagrange's interpolation formula, find the polynomial for the given data points. Also find $f(3)$: [8]

x	$f(x)$
0	2
1	3
2	12
5	147

(B) From the given data find the value of y at $x = 1.5$, using Newton's appropriate formula : [8]

X	**Y**
1	2.38
2	6.56
3	7.39
4	9.95
5	14.85

9. (A) Why Adam-Bash forth and Milne's method are known as predictor corrector methods ? Give the formulae for both methods. [8]

(B) Using modified Euler's method, find approximate value of y, when $x = 0.4$ of

$$\frac{dy}{dx} = 1 - 2xy.$$

Given that $y(0) = 0$, take $h = 0.2$. [8]

Or

10. (A) Explain Taylor series method for the solution of ordinary differential equation. [8]

(B) Solve using R.K. 4th order method :

$$\frac{dy}{dx} = xy + y^2$$

$y(0) = 1$ to get y at $x = 0.2$, take $h = 0.1$. [8]

11. (A) Using Simpson's (3/8)th rule to evaluate :

$$\int_1^2 \frac{\sin x}{x}\, dx.$$

Taking 10 equal intervals. [10]

(B) Derive the formula for Trapezoidal rule for numerical integration using Newton-Cotes formula. [8]

Or

12. (A) Compute the integral Trapezoidal rule with 10 points : [10]

(*a*) $\int_0^5 e^{-x^2}\, dx$

(*b*) $\int_0^1 x^3 e^{x-1}\, dx.$

(B) Derive Newton-Cotes formula for numerical integration. [8]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[4062]-149

S.E. (Elect.) (Second Sem.) EXAMINATION, 2011

MICROPROCESSOR FUNDAMENTAL AND PROGRAMMING

(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*) 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. Draw and explain the architecture of 8085 microprocessor and explain function of each block. [16]

Or

(*a*) Explain with example various addressing modes of 8085. [8]

(*b*) Compare the following instructions of 8085 microprocessor : [8]

(*i*) LDA C000 and LHLD C000

(*ii*) RRC and RAR

(*iii*) JMP A000 and PCHL

(*iv*) ANI 00 and XRA A

2. (*a*) Explain timing diagram of (*i*) OPCode fetch (*ii*) I/V Read cycle. [8]

(*b*) Write an assembly language program to separate odd and even numbers stored in memory array. The starting address of array is A000H and number of numbers in array are 10 H. [8]

Or

(*a*) Explain in detail interrupt structure of 8085. [8]

(*b*) Write an assembly language program to add OBH hexadecimal numbers stored in memory array whose starting address is E000H. The result is more than 8 bit. Store lower byte of result at F000H and Higher byte result at F00LH. [8]

3. (*a*) Explain in detail various data transfer schemes. [8]

(*b*) Explain receiver section of 8251 USART in detail for synchronous as well as asynchronous communication. [10]

Or

(*a*) Explain serial communication and RS 232 signals. [8]

(*b*) Explain command instruction and status word format of 8251. [10]

SECTION II

4. (*a*) Specify the handshake signals and their functions if port B of 8255 is set up as input port in mode 1. [8]

(*b*) Explain with the help of diagram mode 1 and mode 2 of 8254. [8]

Or

(*a*) List operating modes of 8255. Give its control word format in BSR mode. Write a program to set and reset PCO bit in BSR mode. Assume delay subroutine is available. [8]

(*b*) Draw and explain functional block diagram of 8254. [8]

5. (*a*) Draw and explain interfacing diagram of ADC0809 with 8085 microprocessor for measurement of power factor. [8]

(*b*) Draw interfacing diagram of DAC 0808 with 8085 microprocessor and write an assembly language programme for generation of positive going ramp. [8]

Or

With the help of block diagram and flow chart explain application of 8085 microprocessor for measurement of (*a*) Frequency (*b*) Energy. [16]

6. With the help of block diagram and flow chart explain the following applications of 8085 microprocessor (1) control of stepper motor (2) measurement of speed. [18]

Or

With the help of block diagram and flow-chart explain the following applications of 8085 microprocessor : (1) Control of DC motor (2) Measurement of flow. [18]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[4062]-140A

S.E. (Production) (S/W) (Second Semester) EXAMINATION, 2011

PRODUCTION AND INDUSTRIAL MANAGEMENT—I

(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*) 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) Explain the contribution made by F.W. Taylor in Scientific Management. [8]

(B) Define Organization and explain the principles of Organization. Draw any *one* Organization Chart. [8]

Or

(A) Explain the partnership firm with its Characteristics, Advantages and Disadvantages. [8]

(B) Whether management is an Art or a Science ? Give your comments. [8]

2. (A) Explain the principle of plant layout with *one* example. [8]

(B) Define Production Planning and Control. Discuss various function of it in detail. [8]

Or

(A) Define maintenance, state different types of maintenance. Explain any *one* in detail. [8]

(B) List out different type of production system. Explain any *two* systems along with example. [8]

3. (A) Explain and construct an outline process chart with suitable illustration of assembly operation. [10]

(B) What is micro-motion study ? How is it carried out ? Enlist various therbligs. [8]

Or

(A) Define method study. What are different steps of method study ? What are objective of method study ? [8]

(B) Define ergonomic. Explain its importance in industry. [6]

(C) Explain the criteria for full body muscular work. [4]

SECTION II

4. (A) Explain various types of allowances that are considered in calculation of standard. [8]

(B) The following data refers to a time study taken on job :

Element Number	**Observed time** (in Min)	**Observed Rating** (%)	**Frequency**
1	1.20	90	1
2	0.50	95	1
3	3.20	100	1
4	1.80	100	1
5	1.20	90	1
6	2.00	90	1/5
7	3.00	100	1/5

Assuming relaxations allowance as 12%, contigency allowance as 3% and policy allowance as 10%. Calculate standard time and issue time. [8]

Or

(A) What are work element ? Explain various types of work element in detail with example. [8]

(B) Explain MTM in detail. [8]

5. (A) Define motivation and explain its importance. Describe Maslows Hierarchy need. [8]

(B) Differentiate between various styles of leaderships. State their advantages and disadvantages. [8]

Or

(A) Explain various qualities of successful entrepreneur. [8]

(B) Define group dynamics. Explain the characteristics and objective of group dynamics. [8]

6. Write short notes on the following : [18]

(1) Break-even analysis

(2) Job Evaluation

(3) Sources of Finance.

Or

(A) Explain the following : [12]

(1) Merit Rating along with example.

(2) Recruitment procedure.

(B) Explain the procedure for how you will calculate selling price of product by considering various expenses incurred. [6]

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

[4062]-140(B)

S.E. (Production/Prod. Sand/Ind. Engg.)

(II Sem.) EXAMINATION, 2011

MANUFACTURING PROCESSES—I

(2003 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*) Explain the functions of pattern in the casting. Write properties of good pattern materials. List and explain common pattern materials. [8]

(*b*) Write the procedure for PERMEABILITY test for moulding sand with sketch. [8]

Or

2. (*a*) Sketch the 'Cupola' and label the essential parts. Explain in brief working principle and different zones of cupola. [8]

(*b*) State and explain different types of cores. What are the common allowances provided on pattern and why ? [8]

3. (*a*) Explain with neat sketch 'Hot chamber die casting'. [8]

(*b*) What are the common defects in castings ? State their causes and remedies. [8]

Or

4. (*a*) Describe centrifugal casting process and to what workpiece configuration it is best suited. [8]

(*b*) Explain in detail continuous casting process. [8]

5. (*a*) Why are chucks used ? List various types of chucks used in lathe. Explain magnetic chuck. [6]

(*b*) Explain bevel gear feed reversing mechanism. [6]

(*c*) What are Mandrels ? Why are they used ? List them. [6]

Or

6. (*a*) Explain all geared headstock. [6]

(*b*) Define : [6]

(*i*) Depth of cut

(*ii*) Feed

(*iii*) Machining time.

(*c*) What are the different operations performed on lathe ? [6]

SECTION II

7. (*a*) List various tool holding devices in drilling machine and explain : [6]

(*i*) socket

(*ii*) three jaw self centering chuck.

(*b*) Discuss reamer nomenclature. [6]

(*c*) What is reamer ? When is it used ? List various types of reamers and explain any *two*. [6]

Or

8. (*a*) Draw a neat sketch and describe sensitive drilling machine. [6]

(*b*) Write a short note on 'Twist drill geometry'. [6]

(*c*) Differentiate between multispindle and gang drilling machine. [6]

9. (*a*) Write short notes on : [6]

(*i*) Differential indexing

(*ii*) Milling cutter.

(*b*) Differentiate between upmilling and downmilling. [6]

(*c*) Determine the cutting time in cutting a 125 mm long keyway using HSS end mill of 20 mm diameter having four cutting teeth. The depth of keyway is to be 4.5 mm, feed per tooth is 0.1 mm and cutting speed is 90 m/min. [4]

Or

10. (*a*) Explain 'Quick return mechanism'. [8]

(*b*) Find indexing movement necessary for 81 divisions by differential indexing method using the following Brown and Sharp index plates :

Plate I — 15, 16, 17, 18, 19, 20 hole circles

Plate II — 21, 23, 27, 29, 31, 33 hole circles

Plate III — 37, 39, 41, 43, 47, 49 hole circles

Change gears : with 24 (2 Nos.), 28, 32, 40, 44, 48, 56, 64, 72, 86, 100 teeth available. [8]

11. (*a*) Explain operating faults in grinding wheel and also explain selection of grinding wheel. [8]

(*b*) What is centreless grinding ? Describe centreless grinding machine. [8]

Or

12. (*a*) What for lapping is used ? How much stock is left for lapping ? How does it differ from grinding ? [8]

(*b*) Explain superfinishing process. [4]

(*c*) Describe surface broaching. [4]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4+1**

[4062]-140(C)

S.E. (Production/Sandwich) (II Sem.) EXAMINATION, 2011

INDUSTRIAL ELECTRONICS

(2003 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*) Explain the V-I characteristics of SCR. Define the terms :

(*i*) Forward Breakover voltage

(*ii*) Holding current

(*iii*) Latching current

(*iv*) Critical rate of rise of voltage

(*v*) Critical rate of rise of current. [8]

P.T.O.

(*b*) Explain with the help of circuit diagram, any *one* method of providing foldback current limit for power supply protection. [8]

Or

(*a*) Explain the construction, characteristics and working of Power MOSFET. [8]

(*b*) Draw the circuit diagram of a light dimmer using SCR and UJT. Explain its working with the help of relevant waveforms. [8]

2. (*a*) What are the limitations of basic differentiator circuit ? Explain the operation of a practical differentiator, with its frequency response. [10]

(*b*) Draw the circuit diagram of a 4-bit bi-directional shift register. Explain its working with the help of relevant waveforms. [8]

Or

(*a*) What is the need for an Instrumentation Amplifier ? Draw the circuit diagram of an Instrumentation Amplifier using three op-amps. Derive the equation for its output voltage. [10]

(*b*) Draw the logic diagram of master-slave J-K flip-flop and explain its operation. How is the race around condition eliminated in master-slave J-K flip-flop ? [8]

3. (*a*) Draw the block diagram of a Fuzzy Logic Controller and hence explain its working. [8]

(*b*) What is a Programmable Logic Controller (PLC) ? What are the advantages of using it ? State its applications. [8]

Or

(*a*) Draw the Block Diagram of a CNC machine and explain its working. What are the advantages of using a CNC machine ? [8]

(*b*) Write short notes on :

(*i*) Stepper Motor controller

(*ii*) PID controller. [8]

SECTION II

4. (*a*) State the different types of Pressure Transducers. Explain how LVDT can be used as a secondary transducer for pressure measurement. [10]

(*b*) What is the difference between Thermocouple and RTD ? Enumerate the applications and limitations of each. [8]

Or

(*a*) What are the different types of flowmeters ? Explain the working of an Electromagnetic flowmeter. [8]

(*b*) Write short notes on :

(*i*) Actuators

(*ii*) Proximity Sensors. [10]

5. (*a*) Define Laplace Transform of a function $f(t)$. State and prove the following properties of Laplace Transform :

(*i*) Initial Value Theorem

(*ii*) Shifting Theorem. [8]

(*b*) Explain any *one* type of first order system. Determine its Transfer Function. Find out the dynamic response of this system for a unit step input. [8]

Or

(*a*) What are the advantages of using Laplace Transform ? State and prove the following properties of Laplace Transform :

(*i*) Final Value Theorem

(*ii*) Integration Theorem. [8]

(*b*) Explain any *one* type of second order system. Determine its Transfer Function. Find out the dynamic response of this system for a unit step input. [8]

6. (*a*) Explain the use of computers in the automation of Thermal Power Plant. [8]

(*b*) Draw the block diagram of a Supervisory Control and Data Acquisition System and explain its working. [8]

Or

(*a*) Explain the use of computers in the automation of Steel plant. [8]

(*b*) Draw the block diagram of a Distributed Control System (DCS). Explain the function of each block. [8]

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

[4062]-150

S.E. (Electrical) (Second Sem.) EXAMINATION, 2011

INSTRUMENTATION

(2003 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 and electronic pocket calculator is allowed.

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

SECTION I

1. (*a*) Explain generalised block diagram of measurement scheme, considering various stages as—detection stage, intermediate stage and display stage. [8]

(*b*) Explain the following types of instruments : [8]

(1) Null and deflection type

(2) Analog and digital type

(3) Self-generating and power type

(4) Manual and automatic.

P.T.O.

Or

2. (*a*) What do you mean by 'order' of a system ? Derive expression for step response of first order system. With the neat sketch, explain nature of this response. [8]

   (*b*) With reference to process characteristics, explain : [8]

   (1) Process equation

   (2) Process load

   (3) Process lag

   (4) Self regulation.

3. (*a*) Explain the use of Lissajous' figures for measurement of frequency, magnitude and phase angle of a signal. [8]

   (*b*) State advantages of electrical transducers over other types of transducers. [4]

   (*c*) Explain resistive transducer in detail. [4]

Or

4. (*a*) Draw and explain block diagram of dual trace and dual beam CRO. [8]

   (*b*) What is transducer ? How are they classified ? State factors affecting selection of transducers. [8]

5. (*a*) Explain total radiation pyrometers in detail. [6]

   (*b*) Explain with neat sketch, use of Bourden tube for pressure measurement. [6]

   (*c*) With a neat diagram, explain ultrasonic method of level measurement. [6]

Or

6. (*a*) With a neat diagram, explain resistance thermometer. [6]

(*b*) Explain with neat sketch, use of McLeod gauge for pressure measurement. [6]

(*c*) Explain any *one* electrical method for level measurement. [6]

SECTION II

7. (*a*) State importance of displacement measurement. Write a note on "RVDT". [8]

(*b*) Define strain. List types of strain gauges. Explain any *one* of them. [8]

Or

8. (*a*) Explain ultrasonic flowmeter with its advantages. [6]

(*b*) State Bernoulli's theorem applied to fluid flow and explain the significance of each term. [4]

(*c*) How does load cell help in measurement of displacement ? Explain construction and working of a load cell. [6]

9. (*a*) Why are recorders necessary in instrumentation ? Explain various parts of recorders. [8]

(*b*) What is importance of final control element in instrumentation ? Draw block diagram and explain its operation. [8]

Or

10. (*a*) Explain actuator and classify actuators according to principle of operation. Explain each one in brief. [8]

(*b*) Explain construction, working, advantages and applications of magnetic tape recorder. [8]

11. (*a*) Explain importance of PLC in today's world of Automation. Draw and explain the block diagram of PLC. [8]

(*b*) What do you mean by SCADA system ? Explain its importance. Also explain supervisory master unit and supervisory remote unit. [10]

Or

12. (*a*) What do you mean by Ladder diagram ? Draw and explain Ladder diagram for "Road traffic light control" with delay of 5 sec. [10]

(*b*) Explain with the help of the block diagram the role of SCADA in sub-stations. [8]

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

[4062]-151

S.E. (E&TC/Elex.) (First Semester) EXAMINATION, 2011

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*) Your answers will be valued as a whole.

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

SECTION I

1. (*a*) Sketch the following signal

$$x(t) = \begin{cases} 5 - t & 4 \le t \le 5 \\ 1 & -4 \le t \le 4 \\ t + 5 & -5 \le t \le -4 \\ 0 & \text{otherwise} \end{cases}$$

Also determine total energy of signal $x(t)$. [8]

P.T.O.

(*b*) Check whether the following systems are : [8]

(*i*) Static/Dynamic

(*ii*) Causal/Non-causal

(*iii*) Stable/Unstable

(*iv*) Time invarient/Time varient

(I) $y(t) = x(t + 10) + x^2(t)$

(II) $y[n] = \frac{1}{3}\{x[n] + x[n - 1] + x[n - 2]\}$.

Or

2. (*a*) Sketch the following signals : [8]

(*i*) $x(t) = -u(t + 3) + 2u(t + 1) - 2u(t - 1) + u(t - 3)$

(*ii*) $x(t) = \sum_{k = -\infty}^{\infty} \delta(t - 3k)$

(*iii*) $x[n] = \left(\frac{1}{3}\right)^n . u[n]$

(*b*) Determine whether the signals are periodic or non-periodic :

(*i*) $x[n] = \cos^2\left(\frac{\pi}{8}n\right)$

(*ii*) $x[t] = \cos\left(\frac{\pi}{3}t\right) + \sin\left(\frac{\pi}{4}t\right)$

Determine energy or power of signal

$$x(t) = 6 \; . \; e^{-j5t}$$

$$x[n] = \left(\frac{1}{2}\right)^n . \; u[n].$$ [8]

3. (*a*) Evaluate the convolution integral for input $x(t)$ and impulse response $h(t)$ shown in Fig. 1 and Fig. 2. [12]

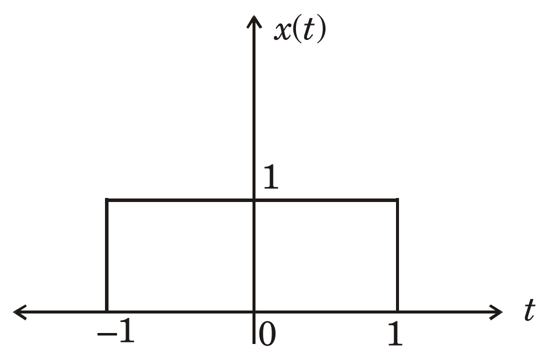

Fig. 1

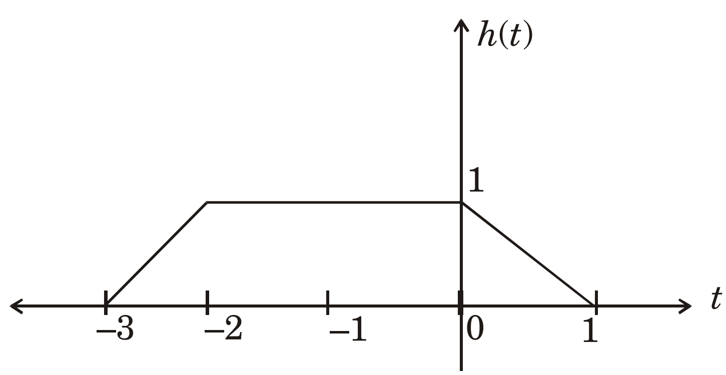

Fig. 2

(b) For each of the following impulse responses determine whether corresponding system is memoryless, causal and stable, justify answer. [6]

$$h(t) = e^{-2t} \; . \; u(t).$$

Or

4. (a) Evaluate the convolution integral for input $x(t)$ and impulse response $h(t)$

$$x(t) = \text{rect}(t)$$

$$h(t) = \text{rect}(t).$$ [8]

(b) Find the step response of the first order recurssive system with impulse response $h[n] = \left(\frac{1}{3}\right)^n . \, u[n]$. [8]

(c) State *three* properties of convolution. [2]

5. (a) Find Fourier Transform of sin c function. Plot its magnitude spectrum $x(t) = \sin \; c(t)$. [8]

(b) State Dirichlet conditions for existence of Fourier Series. [3]

(c) Find Fourier series of the following functions : [5]

$$x(t) = \sin \; \omega_0 \; t.$$

Or

6. (a) Find Fourier Transform of the following function using properties :

$$y(t) = \frac{d}{dt}\left\{te^{-3t}.u(t) * e^{-2t} . \, u(t)\right\}.$$ [8]

(*b*) State and prove the following properties of CTFT : [8]

(*i*) Time scaling

(*ii*) Convolution.

SECTION II

7. (*a*) Determine Laplace Transform and sketch its ROC : [8]

(*i*) $x(t) = e^{-2t} \cdot u(t) + e^{-3t} \cdot u(t)$

(*ii*) $x(t) = \sin 3t \cdot u(t)$

(*b*) State and prove properties of Laplace Transform : [8]

(*i*) Differentiation in time domain

(*ii*) Frequency shifting.

Or

8. (*a*) Find the Laplace transform of

$$x(t) = (t - 2)^3 \quad \text{for } t > 2$$
$$= 0 \quad \text{otherwise}$$ [8]

(*b*) Find $f(\infty)$, final value of the function whose Laplace Transform is given as

$$F(s) = \frac{5}{s} - \frac{1}{s-4}.$$ [4]

(*c*) State properties of ROC of LT. [4]

9. (*a*) Find autocorrelation, PSD and power of the signal

$$x(t) = 7 + 6 \sin (200 \quad \pi t + 30°).$$ [10]

(*b*) Show that autocorrelation and ESD form Fourier pair of each other. [6]

Or

10. (*a*) Show that autocorrelation and ESD form Fourier pair of each other, for the following function

$$x(t) = e^{-5t} \ . \ u(t).$$ [10]

(*b*) Define, prove and write the properties of the following : Cross-correlation of energy signal. [6]

11. (*a*) A box contains 5 yellow, 7 pink and 4 green balls. A ball is drawn at random. Find the probability that it is :

(*i*) Pink

(*ii*) Not green

(*iii*) Green *or* Yellow. [8]

(*b*) Explain two-distribution function. [6]

(*c*) Define the terms : [4]

(*i*) Mean value

(*ii*) Moment

(*iii*) Standard deviation

(*iv*) Mean square.

Or

12. (*a*) Two dice are thrown at random several times. The random variable assigns the sum of the numbers appearing on dice to each outcome (event). Find the CDF for random variable. [8]

(*b*) State the properties of PDF. [4]

(*c*) Find the mean, second moment and standard deviation of 'X' when

$$F_x(X) = Ae^{-Ax}\, u(x). \qquad [6]$$

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+1**

[4062]-152

S.E. (Electronics/E&TC) (First Sem.) EXAMINATION, 2011

SOLID STATE DEVICES AND CIRCUITS

(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*) The parameters of *n*-channel E-MOSFET are $K = 0.2\ mA/V^2$, $\lambda = 0.01\ V^{-1}$, $V_T = 1.2\ V$. Calculate the output resistance for :

(*i*) $V_{GS} = 2\ V$

(*ii*) $V_{GS} = 4\ V$. [8]

(*b*) Explain construction, operation and characteristics of *p*-channel E-MOSFET. [8]

P.T.O.

Or

2. (*a*) Describe the characteristics, specifications and applications of switching diode. [7]

(*b*) Explain the following non-ideal characteristics of MOSFET :

(*i*) Breakdown effect

(*ii*) Temperature effect

(*iii*) Subthreshold conduction. [9]

3. (*a*) Determine the d.c. bias point for the EMOSFET circuit in Fig. 1. Assume $k = 0.4$ mA/V^2, $V_T = 3$ V. [10]

Fig. 1

(*b*) Explain BiCMOS circuits of MOSFET. [6]

Or

4. (*a*) A common source amplifier using EMOSFET is shown in Fig. 2. Assume for this device $I_{D(ON)} = 200$ mA at $V_{GS(ON)} = 4$ V. $V_T = 2$ V and $g_m = 23$ mS, $V_{in} = 25$ mV. Find :

(*i*) V_{GS}

(*ii*) I_D

(*iii*) V_{DS}

(*iv*) a.c. output voltage. [14]

Fig. 2

(*b*) Define :

(*i*) Threshold voltage

(*ii*) Transconductance. [2]

5. (*a*) For the amplifier circuit shown in Fig. 3 using a transistor whose parameters are h_{ic} = 1100 Ω, h_{fc} = –51, h_{rc} = 1, h_{oc} = 25 μA/V.

Calculate :

(*i*) A_V

(*ii*) A_{V_S}

(*iii*) R_i & R_i'

(*iv*) R_o & R_o'

(*v*) A_{I_S}. [12]

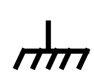

Fig. 3

(*b*) Give comparison of CE, CB, CC amplifiers performance parameters. [6]

Or

6. (*a*) Find the input resistance, voltage gain, output resistance and current gain for the amplifier in Fig. 4.

Assume $h_{ib} = 21.6\ \Omega$, $h_{fb} = -0.98$

$h_{rb} = 2.9 \times 10^{-4}$, $h_{ob} = 0.49\ \mu A/V$. [12]

Fig. 4

(*b*) Explain integrated circuit biasing. [6]

SECTION II

7. (*a*) A transistor connected in common emitter configuration has $C_{bc} = 6$ pF, $C_{be} = 15$ pF, $h_{fe} = 100$, $R_i = 1$ K, $R_L' = 2$K. Determine :

(*i*) Miller input capacitance

(*ii*) Total input capacitance

(*iii*) Miller output capacitance. [9]

(*b*) (*i*) Define lower 3dB frequency, upper 3dB frequency and bandwidth of an amplifier. [3]

(*ii*) Explain effect of cascading on frequency response. [4]

Or

8. (*a*) The following transistor measurement are made at $I_C = 5$ mA, $V_{CE} = 10$ V and at room temperature

$h_{fe} = 100, \quad h_{ie} = 600 \quad \Omega$

$|A_{ie}| = 10$ at 10 MHz; $C_c = 3$ pF.

Find :

(*i*) F_β

(*ii*) f_T

(*iii*) C_e

(*iv*) $r_{b'e}$

(*v*) $r_{bb'}$ [12]

(*b*) Explain Gain bandwidth product. [4]

9. (*a*) The circuit of Fig. 5 is to have an overall transconductance gain of –1 mA/V, a voltage gain of –4, and desensitivity of 50. If $R_s = 1$ K, $h_{fe} = 150$.

Find :

(*i*) R_e

(*ii*) R_L

(*iii*) R_{if}. [12]

Fig. 5

(*b*) Draw an equivalent circuit of a voltage amplifier. What are the ideal values of R_i and R_o ? [6]

Or

10. (*a*) The circuit of Fig. 6 has the following parameters : $R_C = 4$ K, $R' = 40$ K, $R_S = 10$ K, $h_{ie} = 1.1$ K, $h_{fe} = 50$, and $h_{re} = h_{oe} = 0$. [12]

Find :

(*i*) A_{VF}

(*ii*) R_{if}

(*iii*) R'_{OF}.

Fig. 6

(*b*) Draw the electrical model of a piezoelectric crystal. Sketch the reactance *Vs.* frequency function. [6]

11. (*a*) Show that the maximum conversion efficiency of the idealized class-B push pull circuit is 78.5 percent. [7]

(*b*) For distortion reading of $D_2 = 0.15$, $D_3 = 0.01$ and $D_4 = 0.05$ with $I_1 = 3.3$ A and $R_C = 4\ \Omega$.

Calculate :

(*i*) Total harmonic distortion

(*ii*) Fundamental power component

(*iii*) Total Power. [9]

Or

12. (*a*) Explain origin of cross-over distortion. Describe a method to minimise this distortion. [6]

(*b*) For a Class-B amplifier providing a 22 V peak signal to 8 Ω load and a power supply of V_{CC} = 25 V. Find

(*i*) Input power

(*ii*) Output power

(*iii*) Circuit efficiency. [10]

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

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S.E. (E&TC) (First Sem.) EXAMINATION, 2011

NETWORK ANALYSIS

(2008 PATTERN)

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

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

(*ii*) Answer question Nos. **1** *or* **2**, **3** *or* **4** and **5** *or* **6** from Section I and question Nos. **7** *or* **8**, **9** *or* **10** and **11** *or* **12** from Section II.

(*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*) Obtain Thevenin's equivalent of the circuit shown in Fig. 1. [6]

Fig. 1

P.T.O.

(*b*) Using Nodal analysis, determine the node voltages V_A and V_B for the circuit shown in Fig. 2. [6]

Fig. 2

(*c*) State and explain Maximum power transfer theorem. [6]

Or

2. (*a*) Using superposition theorem, calculate current '*i*' for the circuit shown in Fig. 3. [6]

Fig. 3

(*b*) Using Mesh analysis, calculate currents I_1 and I_2 for the circuit shown in Fig. 4. [6]

Fig. 4

(*c*) State and explain Millman's theorem. [6]

3. (*a*) Define and explain Q-factor of resonating circuits. [4]

(*b*) For a series resonant circuit with R = 100 Ω, L = 50 mH and C = 0.1 μF, calculate : [6]

(*i*) Resonant frequency

(*ii*) Frequency at which voltage across capacitor is maximum and

(*iii*) Frequency at which voltage across inductor is maximum.

(*c*) Justify : Parallel Resonance circuit is a 'Current Magnifier'. [6]

Or

4. (*a*) Explain the use of Twin T network as a Notch filter. [4]

(*b*) For the circuit shown in Fig. 5, determine the resonant frequency and bandwidth.

Calculate the generator current at resonance for maximum power transfer. [6]

Fig. 5

(*c*) A series RLC circuit consists of R = 100 Ω and L = 20 mH. At what frequency the circuit would resonate to achieve a Q factor of 10. What value of capacitor should be selected for the above setup ? [6]

5. (*a*) Design a symmetrical T attenuator with the following specifications :

R_0 = 600 Ω and attenuation α = 20 dB. [4]

(*b*) Design a constant-k low pass (T & π section) filter with f_c = 10 kHz and to work with characteristic resistance of 600 Ω. [6]

(*c*) Draw and explain *m*-derived 'T'-section high pass filter. Explain the graphical determination of cut-off frequency. [6]

Or

6. (*a*) Define the units of attenuation : [4]

(*i*) Neper

(*ii*) Decibels.

Derive the relationship between them.

(*b*) Determine the characteristic impedance and propagation constant of the network shown in Fig. 6 at a frequency of 400 Hz. [6]

Fig. 6

(*c*) Design a matching L-section to match a symmetrical T-network with $Z_{0T} = 1\ k\Omega$ to a symmetrical π-network with $Z_{0\pi} = 500\ \Omega$. [6]

SECTION II

7. (*a*) In the circuit shown in Fig. 7, the switch is moved from position 1 to 2 at $t = 0$. The steady state being reached for $t < 0$. Find $i(t)$ after switching plot $i(t)$. [8]

Fig. 7

(*b*) For the circuit shown in Fig. 8, using Laplace Transformation find $i(t)$ and $v_L(t)$ for all $t > 0$. [8]

Fig. 8

Or

8. (*a*) State and explain any *four* properties of Laplace Transform. Obtain Laplace transform for the following : [8]

(*i*) $x(t) = A \cos \omega t \,.\, u(t)$

(*ii*) $x(t) = e^{-at} .\, u(t)$.

(*b*) Determine $i(t)$ for $t > 0$ in the RC circuit shown in Fig. 9. Define Time constant for RC circuit. [8]

Fig. 9

9. (*a*) Find the h-parameters for the network shown in Fig. 10. [8]

Fig. 10

(*b*) Define driving point function for a one-port network. Calculate driving point impedance function for the network shown in Fig. 11. Locate poles and zeros in the s-plane. [8]

Fig. 11

Or

10. (*a*) Find the condition of symmetry and reciprocity for the following parameters : [8]

(*i*) Z-parameters

(*ii*) Y-parameters.

(*b*) Calculate the Transmission parameters for the network shown in Fig. 12. [8]

Fig. 12

11. (*a*) A generator of 1 V, 1 kHz supplies power to a 50 km open wire line terminated by 200 Ω resistance, with the following parameters :

R = 10.4 Ω/km; L = 3.67 mH/km

G = 0.8 μmho/km; C = 8.35 nF/km.

Calculate :

(*i*) Characteristic impedance

(*ii*) Propagation constant

(*iii*) Reflection coefficient. [6]

(*b*) Find the expression for input impedance of an open-circuited transmission line. [6]

(*c*) Explain the concept of standing waves with respect to transmission lines. Establish a relation between VSWR and reflection coefficient. [6]

Or

12. (*a*) Calculate the primary constants for a transmission line having :

$Z_0 = 692 \angle 12° \ \Omega$ and $\gamma = 0.0363 \angle 78°$ at frequency $f = 1$ kHz. [6]

(*b*) A line 10 km long has the following secondary constants :

$$Z_0 = 600 \angle 0^\circ \ \Omega;$$

$$\alpha = 0.1 \text{ neper/km};$$

$$\beta = 0.05 \text{ rad/km}.$$

Calculate the receiving end current and voltage when 20 mA current is sent down the transmission line while the receiving end is short circuited. [6]

(*c*) State and explain primary and secondary line constants for a transmission line. [6]

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

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S.E. (Electronics/E & TC) (First Semester) EXAMINATION, 2011

DIGITAL LOGIC DESIGN

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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*) What is digital comparator ? Design two bit digital comparator and implement using logic gates. [10]

(*b*) Design four bit binary to gray code converter and implement using logic gates. [8]

Or

2. (*a*) Minimize the following equation using K-map and realize it using NAND gates only. [10]

$$Y = \Sigma M\ (0, 1, 2, 3, 5, 7, 8, 9, 11, 14)$$

P.T.O.

(*b*) Design and implement the following function using 8 : 1 MUX.

$$Y = \Sigma M\ (4,\ 5,\ 8,\ 9,\ 11,\ 12,\ 13,\ 15)$$ [8]

3. (*a*) Draw and explain SR flip-flop using NAND gates. [8]

(*b*) Convert D to T flip-flop and vice versa. [8]

Or

4. (*a*) Design and implement the following counter-states using JK flip-flop and avoid the lockout condition : [8]

$$0 - 2 - 4 - 6 - 7 - 0.$$

(*b*) Design MOD5 asynchronous counter, and also draw the waveforms and mention significance of glitch. [8]

5. (*a*) Write short notes on :

(*i*) Library [2]

(*ii*) Entity [2]

(*iii*) Architecture with modelling style. [4]

(*b*) Explain the difference between signal and variable used in VHDL. [8]

Or

6. (*a*) Write a VHDL code for four bit ALU using case when statement. [8]

(*b*) Write a VHDL code for JK flip-flop with asynchronous reset. [8]

SECTION II

7. (*a*) Compare Mealy and Moore sequential machine with reference to block diagram, state diagram, hardware and speed. [8]

(*b*) Design and implement 1011 sequence detector using Mealy machine. [10]

Or

8. (*a*) Design and implement digital hardware for the following Fig. (*a*) using D flip-flop and identify the sequence. [8]

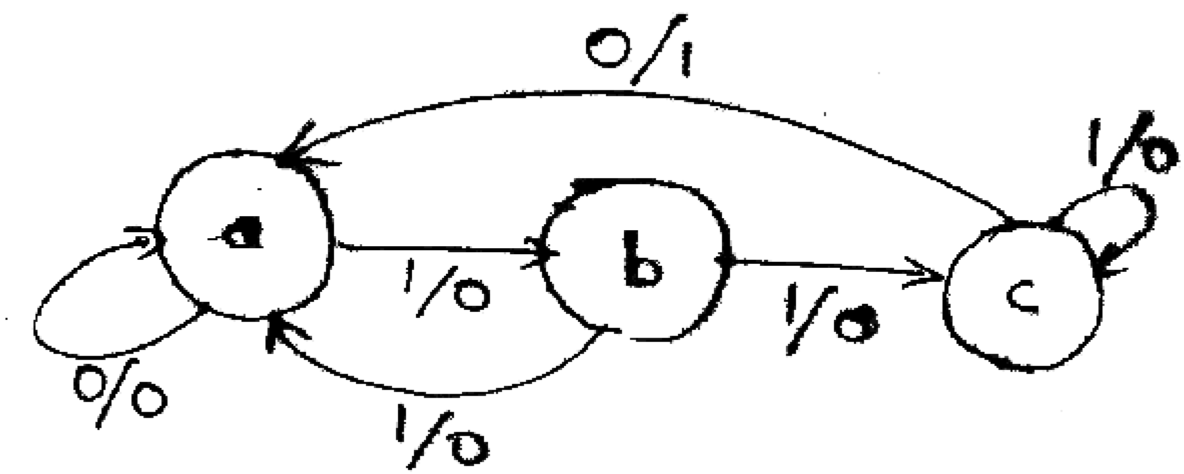

Fig. (*a*)

(*b*) Design and implement the ASM chart for a 3 bit binary counters having one enable line E such that E = 1 (Counting enabled), E = 0 (counting disabled). [10]

9. (*a*) Write a short note on classification of logic families in detail. [8]

(*b*) State the following characteristics of digital IC's (TTL). [8]

(*i*) Speed of operation

(*ii*) Fan in fan out

(*iii*) Noise Margin

(*iv*) Voltage parameter

Or

10. (*a*) Draw and explain two input totem pole output TTL NAND gate. [8]

(*b*) Draw CMOS circuit for NAND gate and NOR gate. [8]

11. (*a*) Design a combinational logic circuit using PROM, the circuit accepts three bit binary number and generates its equivalent excess 3 code. [8]

(*b*) Explain in detail the architecture of PLDs. [8]

Or

12. (*a*) Implement the function using PLA. [8]

$$F_1 = \bar{A}B + A\bar{C} + \bar{A}B\bar{C}$$

$$F_2 = \overline{A\bar{C} + \bar{B}C}$$

(*b*) Design 16K × 8 RAM using two 4K × 8 RAM ICs. [8]

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

[4062]-155

S.E. (E & TC) (First Semester) EXAMINATION, 2011

POWER DEVICES AND MACHINES

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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 steady state characteristics of power BJT with construction. [5]

(*b*) Compare power BJT with power MOSFET. [5]

(*c*) Explain reverse recovery characteristics of power diode. Derive expression for Q_{RR} and I_{RR}. [5]

(*d*) The reverse recovery time of a power diode is 3 μs and rate of fall of diode current is 30 A/μs. Determine :

(*i*) Q_{RR}

(*ii*) I_{RR} [3]

P.T.O.

Or

2. (*a*) Draw and explain construction and switching characteristics of *n*-channel enhancement power MOSFET. [6]

(*b*) What is latch up in IGBT ? Explain how to avoid it. [4]

(*c*) Explain forward and reverse bias Safe Operating Area in power IGBTs. [5]

(*d*) Compare power MOSFET with IGBT. [3]

3. (*a*) Draw and explain construction and steady state characteristics of SCR with their performance parameters. What is the effect of gate current on SCR characteristics ? [7]

(*b*) Explain synchronized UJT gate triggering circuit with suitable waveforms. [5]

(*c*) Compare SCR with TRIAC. [4]

Or

4. (*a*) Draw two transistor analogy of SCR. Show that :

$$I_A = (I_{CBO1} + I_{CBO1})/(1 - (\alpha_1 + \alpha_2))$$

Also explain regenerative action of transistors in SCR. [7]

(*b*) Explain different triggering modes of TRIAC with proper layer diagrams. [6]

(*c*) Compare SCR with GTO. [3]

5. (*a*) Describe the working of single phase fully controlled bridge converter for R-L load in the following modes :

(1) Rectifying mode

(2) Inversion mode.

Also derive an expression for its average output voltage. [8]

(*b*) A single phase semi-converter is operated from 120 V, 50 Hz AC supply. The load resistance is 10 Ω. If the average output voltage is 25% of the maximum possible average output voltage, determine :

(*i*) Firing angle

(*ii*) rms and average output current. [6]

(*c*) Why are anti-parallel SCRs preferred over TRIAC in high power and frequency circuits ? [2]

Or

6. (*a*) Draw and explain single phase AC voltage controller for R load with waveforms. Derive an expression for its output voltage. [6]

(*b*) A single phase fully controlled bridge rectifier is given 230 V, 50Hz supply. The firing angle is 45° and load is highly inductive. Determine :

(*i*) Average output voltage

(*ii*) O/P rms voltage

(*iii*) Power factor. [6]

(*c*) Compare symmetrical and asymmetrical configurations of single phase semi-converters with R-L load. [4]

SECTION II

7. (*a*) Draw a circuit diagram of step up chopper. Derive an expression for average output voltage for a step up chopper in terms of duty cycle only. [6]

(*b*) A step down DC chopper has a resistive load of R = 15 Ω and input voltage V_S = 200 V. When the chopper remains ON, its voltage drop is 2.5 V. The chopper frequency is 1 kHz. If the duty cycle is 50%, determine : [6]

(*i*) Average output voltage

(*ii*) rms output voltage

(*iii*) Chopper efficiency

(*c*) Explain with block schematic working of Online UPS. [4]

Or

8. (*a*) Explain 180° mode in three phase inverters for R load with circuit and waveforms. [5]

(*b*) Explain with block schematic working of SMPS. What are its advantages over linear power supply ? [5]

(*c*) Single phase full bridge inverter has a resistive load of R = 3 Ω, dc input voltage is 50 V.

Calculate :

(*i*) rms O/P voltage at the fundamental frequency E1

(*ii*) Output power Po

(*iii*) Average and peak currents of each thyristor. [6]

9. (*a*) Explain construction, working principle of universal motor. [6]

(*b*) Explain torque-current and torque-speed characteristics of a dc shunt motor. [6]

(*c*) A 4 pole lap wound DC motor has 540 conductors. Its speed is 1000 rpm, flux per pole is 25 mWb connected to 230 V dc supply. Armature resistance is 0.8 Ω.

Calculate :

(*i*) induced emf

(*ii*) armature current

(*iii*) armature torque. [6]

Or

10. (*a*) Derive an expression for torque of a dc motor. Obtain condition for maximum power. [6]

(*b*) A 400 V, 4 pole, 3 phase, 50 Hz star connected induction motor has a rotor resistance per phase equal to 0.01 Ω and 0.1 Ω respectively.

Determine :

(*i*) Starting torque

(*ii*) slip at which maximum torque will occur

(*iii*) speed at which maximum torque will occur

(*iv*) maximum torque. [6]

(*c*) Explain torque speed characteristics of a three-phase induction motor. [6]

11. (*a*) Give the classification of stepper motor. Explain working of any *one* stepper motor. [5]

(*b*) Draw and explain various types of 3-phase transformer connection along with relation between phase and line voltages and currents. [8]

(*c*) Compare voltage (potential) transformer with current transformer. [3]

Or

12. (*a*) Explain construction and working of AC servomotor. [5]

(*b*) Explain construction and working principle of BLDC motor. Also draw its speed-torque characteristics. [6]

(*c*) Explain overvoltage protection circuit with suitable diagrams in a motor. [5]

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

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S.E. (E & TC, Electronics) (Second Sem.) EXAMINATION, 2011

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

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

***N.B.* :—** (*i*) 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**. 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**.

(*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 whenever necessary.

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

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

SECTION I

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

(*i*) $(D^2 + 2D + 2)y = x^3 - 4x$

(*ii*) $(D^3 + D^2 - D - 1)y = 4\sin x \cos x$

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

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

(*v*) $\dfrac{dx}{x^2 + y^2} = \dfrac{dy}{2xy} = \dfrac{dz}{z(x + y)^2}$

(*b*) Solve the system of equations :

$$\frac{dx}{dt} + 4x + 3y = t;$$

$$\frac{dy}{dt} + 2x + 5y = e^t.$$ [5]

Or

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

(*i*) $(D - 1)^3 y = e^x + 2^x + 3$

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

(*iii*) $(D^2 - 2D + 2)y = e^x \tan x$ (by method of variation of parameters)

(*iv*) $(D^2 + 2D + 1)y = xe^{-x} \cos x$

(*v*) $(2x - 7)^2 \dfrac{d^2y}{dx^2} - 6(2x - 7) \dfrac{dy}{dx} + 8y = 5\log(2x - 7)$

(*b*) An uncharged condenser of capacity C is charged by applying an e.m.f. $E \sin\left(\dfrac{t}{\sqrt{LC}}\right)$, though leads of self-inductance L and negligible resistance. If initial current is zero, then prove that at any time t, the charge is $\dfrac{EC}{2}\left\{\sin\left(\dfrac{t}{\sqrt{LC}}\right) - \dfrac{t}{\sqrt{LC}} \cos\left(\dfrac{t}{\sqrt{LC}}\right)\right\}$. [5]

3. (*a*) If imaginary part of the analytic function $f(z) = u + iv$ is $y(3x^2 - y^2)$, then find its real part and also express $f(z)$ in terms of z. [6]

(*b*) Evaluate :

$$\oint_C \frac{z^2 + 2z}{(z + 1)(z^2 - 9)} dz \text{ over } |z - 3| = 5. \quad [5]$$

(*c*) Show that under the transformation $w = \sinh z$ the lines parallel to x-axis get mapped to ellipse in w–plane and the lines parallel to y-axis get mapped to hyperbolas in w–plane. [5]

Or

4. (*a*) If $f(z) = u + iv$ is an analytic function and $u = v^2$, then show that $f(z)$ is constant. [5]

(*b*) By using Cauchy's integral formula evaluate $\oint_C \frac{e^z}{(z+1)^2 (z + 2)^2} dz$ over $|z + 1| = \frac{1}{2}$. [6]

(*c*) Find the bilinear transformation which maps the point –2, 0, 2 of z–plane into the points 0, i, $-i$ of w–plane respectively. [5]

5. (*a*) Find the Fourier integral representation of

$$f(x) = \begin{cases} -3, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$$ and hence evaluate $\displaystyle\int_0^{\infty} \frac{\sin\lambda \cos\lambda x}{\lambda}\, d\lambda$,

deduce the value of $\displaystyle\int_0^{\infty} \frac{\sin\lambda}{\lambda}\, d\lambda$. [6]

(*b*) Solve the integral equation : [5]

$$\int_0^{\infty} f(x) \sin\lambda x \, dx = \begin{cases} 1 - \lambda & 0 \le \lambda \le 1 \\ 1 + \lambda & 1 < \lambda \le 2 \\ 0 & \lambda > 2 \end{cases}$$

(*c*) Find Z-transform of the following (any *two*) : [6]

(*i*) $f(k) = (k + 2)(k - 3) \; k \ge 0$

(*ii*) $f(k) = 4(3^{k+1}) + 5(4^{k+1}), \; k \ge 0.$

(*iii*) $f(k) = \dfrac{\sin k}{k} \; k \ge 0.$

Or

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

$$e^{-x} \cosh 2x = \frac{2}{\pi} \int_0^{\infty} \frac{3 - \lambda^2}{(\lambda^2 + 1)(\lambda^2 + 9)} \cos\lambda x \, d\lambda$$

(*b*) Solve the difference equation : [5]

$$f(k + 1) - f(k) = 1, \; k \ge 0, \; f(0) = 0$$

(c) Find inverse Z-transform of the following (any *two*) : [6]

(i) $F(z) = \dfrac{z^3}{(z-2)(z-3)^2}, \ |z| > 3$

(ii) $F(z) = \left(\dfrac{z}{z-4}\right)^3$ (by using inversion integral method)

(iii) $F(z) = \dfrac{1}{(z-2)(z-3)}, \ |z| > 3$

SECTION II

7. (a) From the tabulated values of x and y given below, prepare forward difference table. Find the polynomial passing through the points and estimate the value of y, when $x = 1.5$, also find the slope of the curve at $x = 1.5$. [6]

x	***y***
0	5
2	29
4	125
6	341
8	725

(b) Evaluate $\int_0^3 \dfrac{dx}{1+x}$ with 7 ordinates by using Simpson's $\dfrac{3}{8}$th rule and hence calculate log 2. [5]

(*c*) Use Euler's modified method to find the value of y satisfying the equation $\dfrac{dy}{dx} = \log(x + y)$, $y(1) = 2$, for $x = 1.2$ and $x = 1.4$ correct upto three decimal places by taking $h = 0.2$. [5]

Or

8. (*a*) With the usual notations establish the following : [6]

(*i*) Operational equivalence

$$\text{D}\tilde{\text{N}} = \tilde{\text{N}}\text{D} = \text{d}^2$$

(*ii*) Operational equivalence

$$\text{m}^2 = 1 + \frac{\text{d}^2}{4}$$

(*b*) Compute $y(0.1)$ and $y(0.2)$ by Runge-Kutta method of 4th order for the differential equation $\dfrac{dy}{dx} = xy + y^2$, $y(0) = 1$, $h = 0.1$. [5]

(*c*) A solid of revolution is formed by rotating about x-axis, the area between x-axis, the lines $x = 0$ and $x = 1$ and a curve through the axis.

Given :

x	y
0.00	1.000
0.25	0.9886
0.50	0.9589
0.75	0.8489
1.0	0.9415

Estimate the volume of solid formed. [5]

9. (*a*) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ along the tangent to the curve $x = e^t \cos t$, $y = e^t \sin t$, $z = e^t$, at $t = 0$. [5]

(*b*) Show that $\bar{F} = f(r)\,\bar{r}$ is always irrotational, and find $f(r)$ such that $\bar{F}$ is solenoidal also. [6]

(*c*) Show that $\nabla^2 f(r) = f''(r) + \frac{2}{r} f'(r)$, hence show that $\nabla^4 (r^2 \log r) = \frac{6}{r^2}$. [6]

Or

10. (*a*) Show that :

$$\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r^3} \right) = \frac{-\bar{a}}{r^3} + \frac{3(\bar{a} \cdot \bar{r})}{r^5}\bar{r}.$$ [5]

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

(c) Find the values of constants a, b, c so that the directional derivative of ϕ, $\phi = axy^2 + byz + cz^2x^2$ at (2, 1, 1) has a maximum magnitude 12 in the direction parallel to x-axis. [6]

11. (*a*) Evaluate $\iint_S (x^3\bar{i} + y^3\bar{j} + z^3\bar{k}).\,d\bar{s}$, where s is surface of the sphere $x^2 + y^2 + z^2 = 16$. [6]

(*b*) Find the work done in moving a particle over round the ellipse $\frac{x^2}{16} + \frac{y^2}{4} = 1$, $z = 0$ under the field of force given by :

$\bar{F} = (2x - y + z)\,\bar{i} + (x + y - z^2)\bar{j} + (3x - 2y + 4z)\,\bar{k}$. [6]

(*c*) Using Stokes' theorem, evaluate :

$$\oint_C (2x - y)dx - yz^2 dy - y^2 z\, dz$$

where c is the circle $x^2 + y^2 = 1$, corresponding to the surface of sphere of unit radius. [5]

Or

12. (*a*) Verify Stokes' theorem for $\bar{F} = x^2\bar{i} + xy\bar{j}$, for the surface of a square lamina bounded by $x = -1$, $x = 1$, $y = -1$, $y = 1$ in XOY plane. [6]

(*b*) Prove that :

$$\iint_s (\phi \nabla \psi - \psi \nabla \phi) \cdot d\bar{s} = \iiint_v (\phi \nabla^2 \psi - \psi \nabla^2 \phi) dv.$$ [5]

(*c*) Maxwell's equations are given by :

$$\nabla \cdot \bar{E} = 0,\ \nabla \cdot \bar{H} = 0,\ \nabla \times \bar{E} = -\frac{\partial \bar{H}}{\partial t},\ \nabla \times \bar{H} = -\frac{\partial \bar{E}}{\partial t}$$

show that $\bar{E}$ and $\bar{H}$ satisfy $\nabla^2 u = \dfrac{\partial^2 u}{\partial t^2}$. [6]

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

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S.E. (Electronics/E. & T.C.) (II Semester) EXAMINATION, 2011

INTEGRATED CIRCUITS AND APPLICATIONS

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer any **3** questions from Section I and any **3** 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*) Design a dual input, balanced output differential amplifier with constant current bias (using diodes) to satisfy the following requirements : Ad = 40, Supply current to constant current bias circuit = 4mA, Supply voltage is ±10V. [10]

(*b*) Explain how to improve CMRR of differential amplifier. Draw and explain any *one* current source. [8]

P.T.O.

Or

2. (*a*) State the values for all ideal parameters of op-amp. Explain virtual short and virtual ground concept related to op-amp. [8]

(*b*) Explain the current mirror circuit with necessary derivation. [10]

3. (*a*) State the reasons for limiting the value of slew rate. An op-amp has slew rate of 2 V/μs. Find the rise time for an output voltage of 10 V amplitude resulting from a rectangular pulse input if the op-amp is slew-rate limited. [8]

(*b*) Explain the effect of temperature on : [8]

(*i*) Input bias current

(*ii*) Input offset current

(*iii*) Input offset voltage

(*iv*) Output offset voltage.

Or

4. (*a*) What is the need of frequency compensation ? Explain the effect of internal frequency compensation on frequency response of op-amp. [6]

(*b*) Define the following and state the typical values for op-amp LM741 and LF351. [10]

(*i*) CMRR

(*ii*) PSRR

(*iii*) Slew rate

(*iv*) Input offset current

(*v*) Input offset voltage

5. (*a*) Design a practical integrator with input signal of 2 Vpp and cut-off frequency of 5 kHz for DC voltage gain of 10. [4]

(*b*) Explain with circuit diagram the working of the following : [12]

(1) AC integrator circuits

(2) Summing integrator

(3) Augmenting integrator

Or

6. (*a*) Draw and explain the integrator working with run, set and hold modes. [8]

(*b*) Explain the effect of offset and bias parameters on integrator circuit. Also explain the other sources of error in integrator. [8]

SECTION II

7. (*a*) Explain with neat circuit diagram working of non-inverting Schmitt trigger using op-amp. Also derive the equation for the trigger points. [8]

(*b*) Draw and explain the working of the sample and hold circuit using op-amp. [8]

Or

8. (*a*) What are the requirements of instrumentation amplifier ? Draw and explain the instrumentation amplifier with active guard drive. [8]

(*b*) Using IC 741 op-amp with a supply of ±12 V, design an inverting Schmitt trigger circuit to have V_{UT} = 3V, V_{LT} = –3V. Also find the hysteresis voltage and draw the hysteresis curve for the given design. [8]

9. (*a*) State the specification and errors associated with ADC. Also state the applications of ADC. [8]

(*b*) Draw and explain the block diagram of IC 9400 for frequency to voltage conversion using IC 9400. [8]

Or

10. (*a*) List the various methods of DA conversion, state the advantages and disadvantages of each. [10]

(*b*) Write a short note on : Sigma-delta ADC. [6]

11. (*a*) State the advantages of active filter. Also with the help of circuit diagram explain the operation of second order high pass filter. Also draw the characteristics. [10]

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

(*i*) Frequency synthesizer using PLL.

(*ii*) FM Demodulator using PLL.

Or

12. (*a*) Draw and explain pin diagram for IC 565 and explain how it works as a phase detector circuit. [8]

(*b*) Explain the working of : [10]

(*i*) Op-amp based audio amplifier circuit.

(*ii*) Active tome control circuit.

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

[4062]-158

S.E. (E & TC) (Second Semester) EXAMINATION, 2011

ELECTROMAGNETICS

(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**, Q. No. **7** or Q. No. **8**, Q. No. **9** or Q. No. **10**, Q. No. **11** or Q. No. **12**.

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

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

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

SECTION I

1. (*a*) State and prove Gauss law. [6]

(*b*) The spherical region $0 < r < 10$ cm contains a uniform volume charge density $\rho_V = 4\mu C/m^3$. Find total charge for $0 < r < 10$ cm and flux density D just outside the region. [6]

(*c*) State and prove Divergence Theorem. [6]

P.T.O.

Or

2. (*a*) Find the flux density $(\overline{D})$ due to uniform line charge using Gauss law. [6]

(*b*) The spherical surfaces $r = 1$, 2 and 3 carry surface charge densities of 20, –9 and 2 nC/m^2 respectively.

(*i*) How much electric flux leaves the surface $r = 5$?

(*ii*) Find $\overline{D}$ at P(1, –1, 2). [6]

(*c*) An infinitely long, uniform, charge is located at $y = 3$, $z = 5$. If $\rho_L = 30$ nC/m, find E at :

(*i*) the origin

(*ii*) P_c (5, 6, 1). [6]

3. (*a*) Derive the expression for electric field and potential due to an electric dipole. [8]

(*b*) A parallel plate capacitor shown in the Figure 1 contains three dielectric layers as :

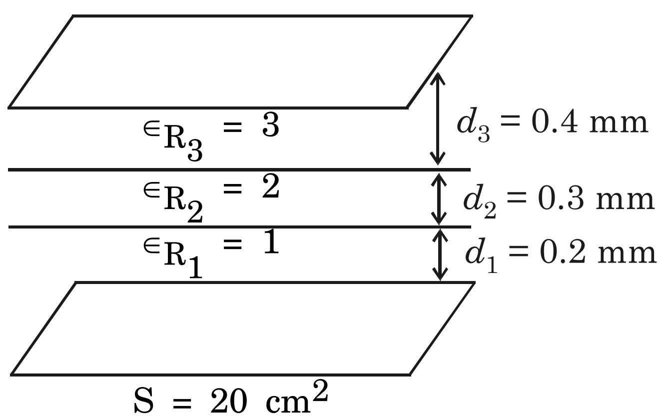


Fig. 1

Find (*a*) Capacitance C, (*b*) the percentage of total stored energy located in each of the three regions. [8]

Or

4. (*a*) Given the potential field $V = 10\ y(x^3 + 5)V$

(*i*) Find E at the surface $y = 0$.

(*ii*) Show that the surface $y = 0$ is an equipotential surface.

(*iii*) If it is known that the surface $y = 0$ is a conductor, find the total charge in the region $0 < x < 2$, $y = 0$, $0 < z < 1$. Assume that $\in = \in_0$ and that $V > 0$ in the region outside the conductor. [8]

(*b*) What is Laplace equation ? Derive expression for parallel plate capacitor using Laplace's equation. [8]

5. (*a*) Find the expression for $\overline{H}$ at any point in cylindrical coordinate system due to a filamentary conductor carrying a current I on the z-axis from $-\infty < z < \infty$ using Biot-Savart's Law. [8]

(*b*) Given points are A(1, 2, 4), B(–2, –1, 3) and C(3, 1, –2). Let the differential current element with I = 6 A and $|\overline{dL}| = 10^{-4}$ m is located at point A. The direction of $\overline{dL}$ is from A to B. Find $\overline{dH}$ at C. [8]

Or

6. (*a*) State and explain the Stokes' theorem. Also explain the physical significance of curl. [6]

(*b*) Find the vector magnetic field intensity in Cartesian coordinates at $P_2(1.5, 2, 3)$ caused by current filament of 24A in the a_z direction on the z-axis and extending from :

(*i*) $z = 0$ to $z = 6$

(*ii*) $z = 6$ to $z = +\infty$ [10]

SECTION II

7. (*a*) Derive the boundary condition at an interface between two magnetic medium. [9]

(*b*) A unit vector directed from region 1 to region 2 at the planar boundary between two perfect dielectrics is given as :

$\bar{a}N_{12} = -(2/7)\,\bar{a}_x + (3/7)\bar{a}_y + (6/7)\,\bar{a}_z$. Assume $\in_{R_1} = 3$, $\in_{R_2} = 2$ and $\bar{E}_1 = 100\bar{a}_x + 80\bar{a}_y + 60\bar{a}_z$ V/m. Find $\bar{E}_2$. [9]

Or

8. (*a*) Region 1 is the semi-infinite space in which $2x - 5y > 0$ while region 2 is defined by $2x - 5y < 0$. Let $\mu_{r_1} = 3$, $\mu_{r_2} = 4$ and $\bar{H}_1 = 30a_x$ A/m.

Find :

(*i*) $|\bar{B}_1|$

(*ii*) $|\overline{B_{N_1}}|$

(*iii*) $|\overline{H_{t_1}}|$

(*iv*) $|\bar{H}_2|$ [12]

(*b*) Derive the boundary condition for steady electric field at an interface between two perfect dielectric materials. [6]

9. (*a*) In a non-magnetic material ($\in_R = 0$, $\mu = \mu_0$, $\sigma = 0$). Find η, electric field using Maxwell's equation and Poynting vector, given $\overline{H} = 30 \cos (2p \, ' \, 10^8 t - 6x)\overline{a}_y$. mA/m . [8]

(*b*) What is Poynting vector ? What is its significance ? Derive the expression for Poynting vector V. [8]

Or

10. (*a*) Write the Maxwell equation in point form and integral for time varying fields. [4]

(*b*) A point charge of $5 \cos 10^{-7}\pi t$ μC is located at $P_1(0, 0, 5)$ while $-5 \cos 10^7 \pi t$ μC is at P_2 (0, 0, –15) both in free space. Find potential at P(r = 3000, $\theta = 0°$, $\phi = 0°$) at t = 150 ns. [6]

(*c*) What is uniform plane wave ? What is meant by transverse electromagnetic wave ? [6]

11. (*a*) Explain the method of moments used to find solution of integral equation with suitable example. [10]

(*b*) Explain the procedure to draw electric field lines by numerical methods. [6]

Or

12. (*a*) What is field plotting ? Explain procedure to draw equipotential lines. [6]

(*b*) Consider the potential system shown in Fig. 2 set the initial values at the free nodes equal to zero and calculate the potential at free nodes for four iterations using finite difference method. [10]

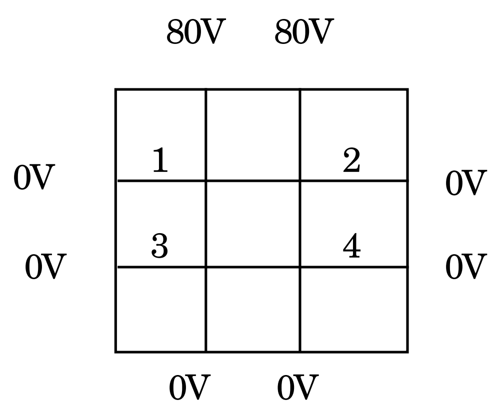


Fig. 2

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

[4062]-159

S.E. (E&TC) (Second Semester) EXAMINATION, 2011

DATA STRUCTURES

(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*) Explain the following with reference to Data Structures in 'C' : [6]

(*i*) Static and dynamic

(*ii*) Linear and non-linear

(*iii*) Primitive and non-primitive.

(*b*) Explain parameter passing call by value and call by reference with suitable example. [8]

(*c*) Explain the term 'scale factor' in brief. [2]

Or

2. (*a*) What is Recursion ? How does recursion work ? Generate the *n*th term of Fibonacci sequence with recursion. [6]

(*b*) Define ADT. Explain ADT for Array. [6]

(*c*) Discuss in brief the difference between Arrays and Structures. [4]

3. (*a*) What is a pointer ? Discuss the significance of pointer declaration and pointer initialization with apppropriate example. [4]

(*b*) Explain the algorithm of binary search with appropriate example. [8]

(*c*) Write a function in 'C' to check whether a string is a palindrome. [4]

Or

4. (*a*) What is the purpose of structure in 'C' ? Explain the same with a suitable example with the significance of the dot operator. [6]

(*b*) Discuss the difference between Linear search and Indexed sequential search with an example each. [4]

(*c*) Sort the following by selection sort method. Show steps in detail : [6]

25 17 31 13 2

5. (*a*) Discuss static and dynamic memory allocation. Name and explain in brief the dynamic memory allocation functions. [6]

(*b*) Define GLL with node declaration. Represent the following polynomial using GLL : [8]

$$9x^6 + 7xy^5 + 20xz$$

(*c*) Compare and contrast SLL and DLL. [4]

Or

6. (*a*) Write the algorithm with appropriate illustrations to perform the following operations on a Singly Linked List (SLL) : [8]

(*i*) Add Node (Start, End & Intermediate)

(*ii*) Delete Node (Start, End & Intermediate).

(*b*) With a suitable example discuss representation and implementation of a polynomial using singly linked list. [6]

(*c*) What is a circular linked list ? Explain it with respect to singly linked list. [4]

SECTION II

7. (*a*) Discuss stack as a data structure with its peculiarities and explain the operations ADD and DELETE with proper illustrations for both static and dynamic representations. [8]

(*b*) Given the following Infix notations, find their equivalent Prefix and Postfix notations : [8]

(*i*) (A + B)*C

(*ii*) (A – B)/(C – D)

(*iii*) ((A + B)* (C – D))/E

(*iv*) (A + B *C)/(X + Y/Z).

Or

8. (*a*) Compare stacks and queues. Explain the concept of circular queue with an example. [6]

(*b*) Give the algorithm for evaluating a postfix expression with a suitable example. [6]

(*c*) Explain the concept of priority queue and illustrate the same using SLL. [4]

9. (*a*) Define binary tree. What are its types ? Explain with suitable figures. [4]

(*b*) Define the following terms with respect to trees : [6]

(*i*) Terminal nodes

(*ii*) Root

(*iii*) Ancestor

(*iv*) Subtree

(*v*) Level of a node

(*vi*) Depth of a tree

(*c*) For the given data draw a Binary Search Tree and show the array representation of the same : [6]

100 80 45 55 110 20 70 65

Or

10. (*a*) With a suitable example of a Binary Search Tree, write the recursive functions for in-order and post-order traversal. Compare the two and comment on their recursive nature. [8]

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

(*i*) Breadth First Search (BFS)

(*ii*) Depth First Search (DFS)

Consider a suitable example for both the techniques.

11. (*a*) Define the term Graph. With the help of a suitable example give adjacency matrix representation and adjacency list representation for the same. [9]

(*b*) Write an algorithm for Depth First Search for a graph. [9]

Or

12. (*a*) What is meant by a Spanning Tree ? Give any *one* algorithm to construct a minimum spanning tree. [9]

(*b*) Explain with a suitable example the algorithm for finding the shortest path between two vertices of a graph. [9]

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

[4062]-160

S.E. (Electronics and Telecommunication) (II Sem.)

EXAMINATION, 2011

COMMUNICATION THEORY

(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, wherever necessary.

(*v*) Draw well-labelled diagram.

SECTION I

1. (*a*) State and compare different SSB generation methods. [8]

(*b*) With neat diagram explain ring modulator for DSBSC generation. Draw waveform and spectrum for DSBSC. [10]

Or

2. (*a*) An AM transmitter has carrier of 500 W which is modulated upto a depth of 40%. Find the total power in the transmitted wave and also the power efficiency in the following cases :

(*i*) Standard AM

(*ii*) SSBSC. [8]

(*b*) What is baseband transmission ? What are its limitations ? State advantages of modulation. [10]

3. (*a*) An angle modulated signal with carrier frequency $\omega_c = 2\pi \times 10^6$ is described by the equation :

$$\phi_{Em}(t) = 10 \cos (\omega_c t + 0.2 \sin 1000 \pi t)$$

(*i*) Find the power of modulated signal.

(*ii*) Find the modulation index.

(*iii*) Find the frequency deviation.

(*iv*) Estimate the bandwidth. [8]

(*b*) Why is FM known as constant bandwidth system ? Compare between NBFM and WBFM. [8]

Or

4. (*a*) Explain Armstrong method of FM generation with suitable block diagram. [8]

(*b*) A carrier is frequency modulated with a sinusoidal signal of 2 kHz resulting in frequency deviation of 5 kHz :

(*i*) Find bandwidth of modulated signal.

(*ii*) The amplitude of modulating sinusoid is increased by a factor of 3 and its frequency is halved. Find the maximum frequency deviation and bandwidth of new modulated signal. [8]

5. (*a*) Explain with suitable diagram importance of pre-emphasis and De-emphasis in the performance of FM system. [8]

(*b*) What are the different types of distortions that occur in a typical diode detector circuit ? Explain with proper waveforms. [8]

Or

6. (*a*) Draw the block diagram of FM superheterodyne radio receiver. Explain working of each block mentioning the typical frequencies at different points. [10]

(*b*) What is tracking ? Explain different types of tracking in radio receiver. [6]

SECTION II

7. (*a*) Derive the Friss formula for noise factor of amplifier in cascade. [6]

(*b*) Explain in detail : [6]

(*i*) Johnson noise

(*ii*) Low frequency noise

(*iii*) White noise.

(*c*) An amplifier has a bandwidth of 4 MHz with 10 kΩ as the input resistor. Calculate the r.m.s. noise voltage at the input to this amplifier if room temperature is 25°C. [4]

Or

8. (*a*) Define :

(*i*) Noise figure

(*ii*) Noise temperature

(*iii*) Noise bandwidth

(*iv*) SNR. [4]

(*b*) Three amplifiers 1, 2 and 3 have the following characteristics : F_1 = 9dB, G_1 = 48 dB, F_2 = 6dB, G_2 = 35 dB, F_3 = 4 dB, G_3 = 20 dB

The amplifiers are connected in tandom. Determine which combination gives the lowest noise factor referred to input. Also calculate overall noise figure. [6]

(*c*) Explain effect of amplification on the signal to noise ratio. [6]

9. (*a*) Explain the performance of AM in presence of noise. [8]

(*b*) Draw and explain performance of SSB in presence of noise. [8]

Or

10. (*a*) Explain performance of FM in presence of noise. [8]

(*b*) With the help of mathematical expression explain which is superior PM or FM. [8]

11. (*a*) Explain band limited and time limited signals. [6]

(*b*) What is Nyquist criteria ? State sampling theorem in time domain. Draw the spectrum showing aliasing and guardband. [6]

(*c*) Draw and explain DM with waveforms. [6]

Or

12. (*a*) Why is ideal sampling not used for practical application ? Draw the circuit for flat top sampling method and explain with the waveforms. [6]

(*b*) Draw and explain slope overload and granular noise. How to overcome them ? [6]

(*c*) Draw PCM transmitter and explain it. Also enlist the drawbacks of PCM. [6]

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

[4062]-160A

S.E. (E&TC) (Second Semester) EXAMINATION, 2011

CONTROL SYSTEMS

(2003 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*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

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

SECTION I

1. (*a*) Compare with proper examples :

(*i*) Open loop and closed loop control systems

(*ii*) Linear and non-linear control systems. [8]

(*b*) Find the transfer function of the given electrical network shown in Fig. 1. [8]

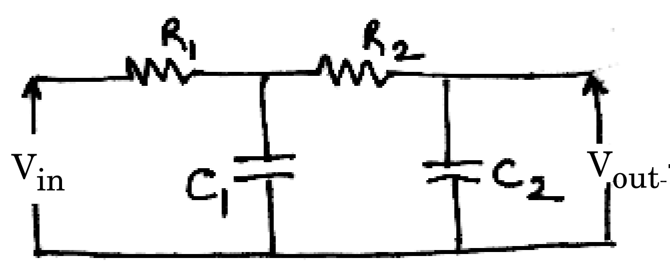


Fig. 1

P.T.O.

Or

2. (*a*) Obtain the transfer function of the system shown in Fig. 2 using Mason's gain formula. [8]

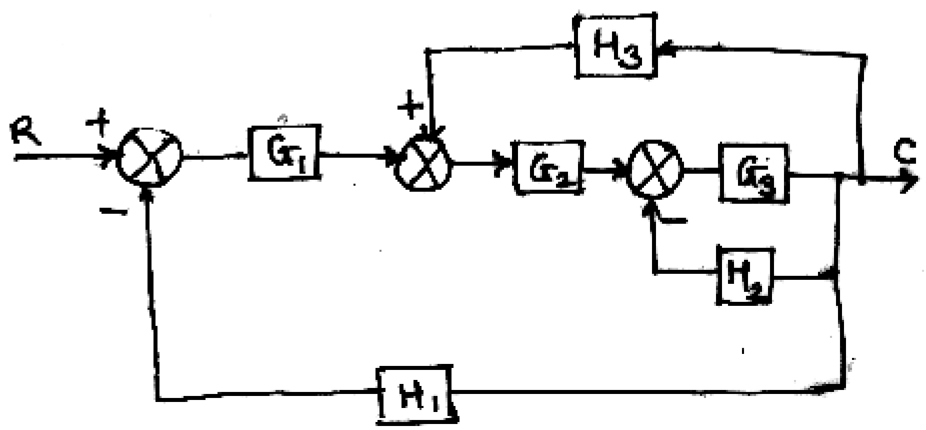


Fig. 2

(*b*) With proper examples and diagrams distinguish between feedback control system and feedforward control system. [8]

3. (*a*) What are static error coefficients ? Derive their values and steady state errors for type-1 and type-2 system with :

(*i*) Unit step input

(*ii*) Unit ramp input. [8]

(*b*) A unity feedback system has :

$$G(s) = \frac{k}{s(s+10)(s^2+4s+5)}.$$

Determine the range of k for the closed loop system to be stable. [8]

Or

4. (*a*) Sketch the root locus of a system having :

$$G(s)\, H(s) = \frac{k\,(s+5)}{(s^2+4s+20)}.$$

Comment on stability. [10]

(*b*) State Routh's Hurwitz criteria for stability. State its advantages and limitations. [6]

5. (*a*) State and explain mapping theorem. [6]

(*b*) A feedback control system has :

$$G(s)\, H(s) = \frac{100\ (s+3)}{s(s+1)\,(s+5)}.$$

Draw Bode plot and comment on stability. [12]

Or

6. (*a*) Explain frequency domain specifications. [6]

(*b*) A feedback control system has the open loop transfer function :

$$G(s)\, H(s) = \frac{100}{s(s+5)}.$$

Draw the Nyquist plot and determine the closed loop stability. [12]

SECTION II

7. (*a*) What are the advantages of state space technique over transfer function approach ? [4]

(*b*) Explain the state model of a multiple input, multiple output control system with a block diagram. [4]

(*c*) Obtain the state transition matrix of the system : [8]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}.$$

Or

8. (*a*) What is state transition matrix ? What are its properties ? [8]

(*b*) Obtain state space model for the system having transfer function : [8]

$$\frac{Y(s)}{U(s)} = \frac{3s + 4}{s^2 + 5s + 6}.$$

9. (*a*) Explain the working of synchro-transmitter receiver as error detector. [8]

(*b*) With neat sketch explain the capacitance type level measurement technique. [8]

Or

10. (*a*) Explain the basic principle of electromagnetic flowmeter with neat diagram. [8]

(*b*) Sketch piezoelectric type accelerometer. Where is it used ? [8]

11. (*a*) Explain the operation of ON-OFF type controller. State its drawbacks and explain how these drawbacks are overcome in continuous controllers. [8]

(*b*) Explain with PLC ladder diagram a bottle filling system. [10]

Or

12. Write short notes on :

(*i*) PID controller

(*ii*) Architecture and operating modes of PLC.

(*iii*) Ladder diagram for elevator control. [18]

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

[4062]-160B

S.E. (E&TC) (Second Semester) EXAMINATION, 2011

ELECTRONIC CIRCUITS AND APPLICATIONS

(2003 PATTERN)

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

***N.B.* :—** (*i*) Answer *three* questions from Section I and *three* questions from Section II with internal option for every question.

(*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*) A symmetrical square wave of 5 kHz and voltage swing of ± 10 V is applied to the circuit shown in Fig. 1. Assume $R_f = 0$, $R_r = 2\ M\Omega$, $V_\gamma = 0$. Plot V_o and V_i waveforms indicating

P.T.O.

maximum, minimum and constant values. [6]

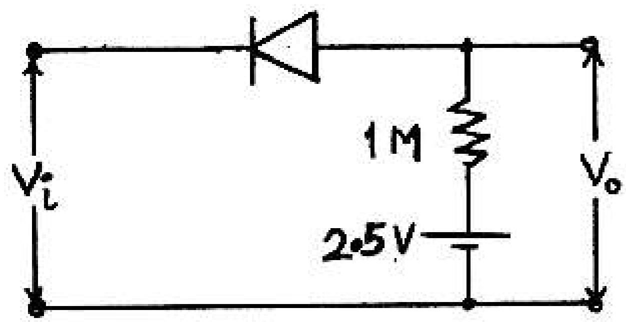


Fig. 1

(*b*) Define scaling and discuss two types scaling of MOS devices for VLSI technology. [4]

(*c*) Draw the circuit diagram and explain operation of voltage tripler showing polarities and values of capacitor voltages. Explain clearly :

(*i*) Why D_1 does not conduct in second positive half cycle ?

(*ii*) How C_3 gets charged to 2 Vm voltage. [6]

Or

2. (*a*) Draw the circuit diagram and explain operation of positive series biased clipper assuming ideal diodes with the help of i/p and o/p waveforms. Draw the output waveform if the diodes are practical diodes written by piecewise linear equivalent. [6]

(*b*) State I–V relation for *n* channel EMOSFET in terms of W/L ratio for $V_{GS} > V_T$ for both linear region and saturation region. [2]

(*c*) Analyze the circuit shown in Fig. 2 and with proper justification, sketch output voltage V_o for $V_i = 40 \sin \omega t$. Indicate all voltage levels properly. [8]

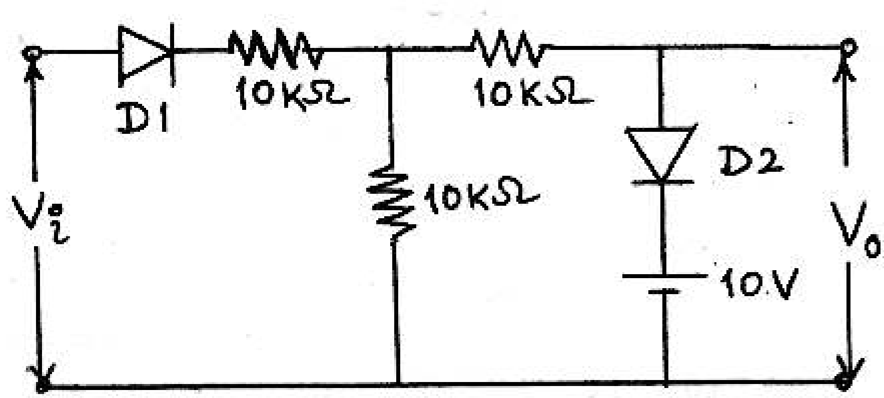


Fig. 2

3. (*a*) Explain necessity of anti-saturation circuit for transistors. Draw and explain any *one* anti-saturation circuit for transistors. [6]

(*b*) Draw neat diagrams showing construction of vertically diffused MOSFETs namely VMOS, DMOS and explain. [6]

(*c*) Compare power BJT and power MOSFET. [4]

Or

4. (*a*) Explain primary and secondary breakdown in case of BJT. [4]

(*b*) Prove that choosing VCE < VCC/2 ensures thermal stability for a transistor used in self bias configuration. [6]

(*c*) Explain thermal runaway for BJT and explain why it does not exist in MOSFETs. [6]

5. (*a*) Compare the following classes of amplifiers based on area of application and conduction angle of a single transistor in the circuit : [4]

Class A, Class B, Class C, Class D.

(*b*) Discuss what is meant by 'large signal' amplifiers and why *h* parameter analysis is not valid for it. The last stage of typical audio amplifier system is a power amplifier working as large signal amplifier. Justify this statement. [5]

(*c*) Why emitter follower configuration is preferred in complementary symmetry power amplifier ? [2]

(*d*) For an ideal class B push pull amplifier shown in Fig. 3, V_{cc} = 20 V, R_L = 20 ohm, output transformer has $N_2 = 2\ N_1$. The transistors have h_{FE} = 20. For max output voltage swing, find out output signal power and collector dissipation per transistor. [7]

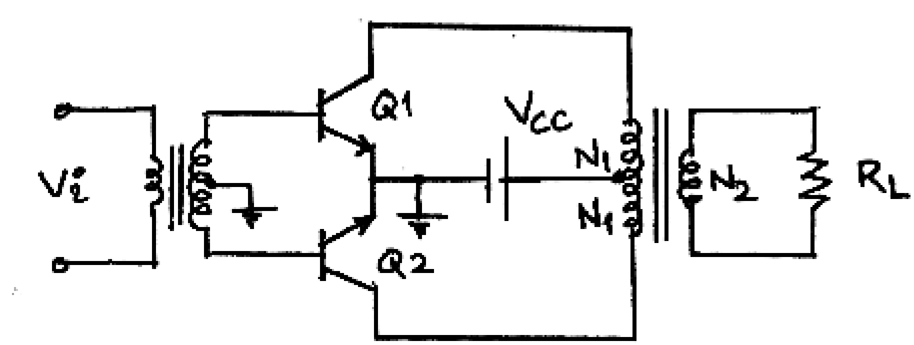


Fig. 3

Or

6. (*a*) Explain cross-over distortion for push-pull class B operation and modifications in the circuit to eliminate it. [6]

(*b*) Define conversion efficiency and total harmonic distortion and explain their importance as performance parameters of power amplifiers. [4]

(*c*) Prove that the output of a large signal amplifier contains frequencies that are not present in the input using equation of dynamic transfer curve of a transistor used as a large signal amplifier. Prove that push pull arrangement eliminates even harmonics and thus reduces this distortion. [8]

SECTION II

7. (*a*) The input to the amplifier shown in Fig. 4 is a current step of 0.2 mA. Find output voltage as a function of time if :

(*i*) $C_L = 0$; neglect output time constant

(*ii*) $C_L = 0.1\ \mu F$ neglect input time constant. [8]

g_m = 50 mA/V

r_{bb}' = 100 Ω

$r_{b'e}$ = 1 kΩ

C_e = 100 pF

C_c = 3 pF

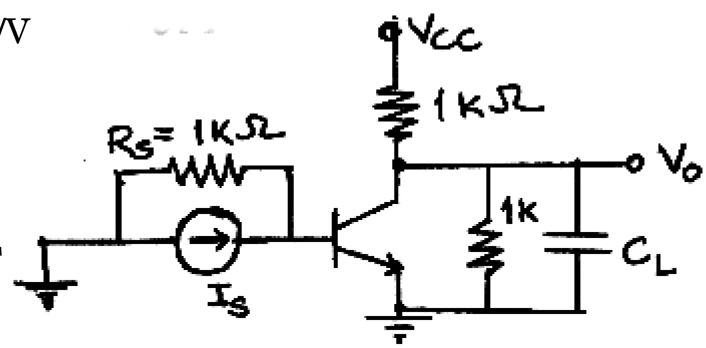


Fig. 4

(*b*) Define transition and diffusion capacitances for *pn* junction and explain how they get applied to BJT. State typical range of their values and explain why they are neglected for audio frequencies and become effective at radio frequencies. [8]

Or

8. (*a*) Draw the circuit diagram and explain operation of double tuned amplifiers. [4]

(*b*) For a single stage CE amplifier, what value of R_s will a voltage gain bandwidth of :

(*i*) half the value for R_s = 0 ?

(*ii*) twice the value for R_s =

Assume g_m = 50 mA/V, $r_{bb'}$ = 100 ohm, $r_{b'e}$ = 1 K, $r_{b'c}$ = 1 K, r_{ce} = 80 K, C_c = 3 pF and C_e = 100 pF. With this value of R_s, find midband voltage gain = V_o/V_s is designed to have with R_L = 500 ohms.

Use approximate analysis. Draw equivalent circuit and state approximations used clearly. [12]

9. (*a*) Explain why LC oscillators are generally not used at low frequencies. [2]

(*b*) Draw equivalent circuit and frequency characteristics of crystal, and explain crystal oscillator. [6]

(*c*) Explain with the help of equivalent circuits, four types of amplifiers namely voltage, current, transresistance and transconductance. State clearly conditions of R_i and R_o with respect to R_s and R_L respectively. [8]

Or

10. For the circuit shown in Fig. 5, find topology of feedback, draw the basic amplifier and find out desensitivity factor D, input resistance R_{if}, current gain $A_{If} = I_o/I_s$, voltage gain $A_{vf} = V_o/V_s$. Assume $h_{fe} = 200$, $h_{ie} = 2$ kohm. [16]

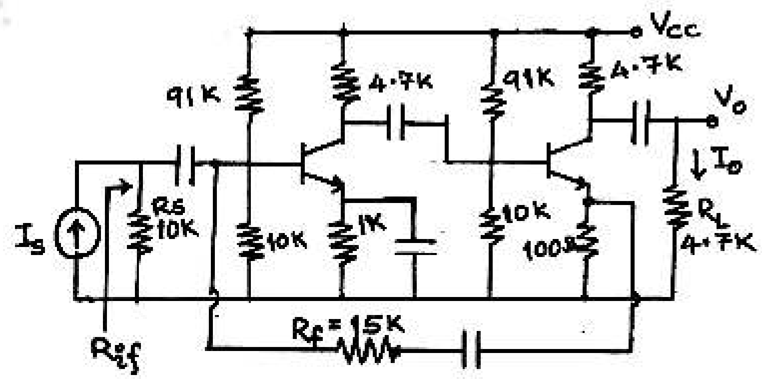


Fig. 5

11. (*a*) Draw the circuit diagram for fixed voltage regulator using 7824 in current boosting configuration. Find power dissipation rating of external pass transistor if the input to the regulator is 30 V dc and R_L = 10 ohms. [6]

(*b*) Define output resistance, load regulation, line regulation for regulators. [3]

(*c*) Explain regulating action of transistorized series regulator circuit with the help of neat circuit diagram. State the equation of output voltage in terms of reference voltage. [9]

Or

12. (*a*) Design a transistorized series regulator for variable output voltage of 5 V to 12 V dc and I_{Lmax} = 1 A. [12]

(*b*) Draw the circuit diagram and explain working of foldback current limiting. [6]

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

[4062]-160C

S.E. (Electronic CS/E&TC) (Second Semester) EXAMINATION, 2011

ELECTRICAL, CIRCUIT AND MACHINES

(2003 COURSE)

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

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

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

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

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

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

SECTION I

1. (*a*) Draw a neat sketch showing constructional details of a 4-pole D.C. machine and label all the parts. What are the functions of interpole and brushes ? Which material is used for these parts ? [8]

(*b*) Draw and explain external characteristics for :

(*i*) D.C. differential compound generator.

(*ii*) D.C. cumulative compound generator. [6]

(*c*) Explain field winding speed control method for D.C. series motor. [4]

P.T.O.

Or

2. (*a*) Draw a neat sketch of 3-point starter and label all the parts. [4]

(*b*) Suggest a suitable D.C. motor with justification for applications in :

(*i*) Electric traction

(*ii*) Lathe machine

(*iii*) Centrifugal Pump. [6]

(*c*) A 500 volt, D.C. Shunt motor has armature resistance of 1.2 Ω and Shunt Field resistance of 500 Ω. It runs at no load with a speed of 1000 r.p.m. taking line current 4 amp. Calculate the speed of motor when it is loaded and taking a line current of 26 amp. Also calculate speed at this load, if a resistance of 2.3 W is connected in series with the armature. [8]

3. (*a*) Develop approximate equivalent circuit of transformer with usual notations. State the mathematical expressions for R_{01}, X_{01}, Z_{01}. [8]

(*b*) A 10 kVA, 500/250 volt, single phase transformer gave the following test results :

O.C. test – 500 volt, 1.5 amp, 120 watt (H.V. side)

S.C. test – 20 volt, 18 amp, 125 watt (H.V. side)

Find :

(*i*) Magnetising component of current

(*ii*) Efficiency at full load, unity power factor

(*iii*) Regulation at full load, 0.8 power factor lag. [8]

Or

4. (*a*) Explain with its application the following connections for a 3-phase transformer : [6]

   (*i*) Star-star connection

   (*ii*) Delta-delta connection.

   (*b*) Derive the e.m.f. equation of single phase transformer with usual notations. [4]

   (*c*) A 100 kVA, 2200/440 volt, 50 Hz, single phase transformer has primary and secondary resistances of 0.35 Ω and 0.01 Ω respectively. The leakage reactances of primary and secondary are 1.2 Ω and 0.036 Ω respectively. Calculate the voltage regulation on full load at 0.8 power factor lagging. [6]

5. (*a*) Explain method of power measurement in a R–L, 3-phase, star connected load using two wattmeters. Draw a respective phasor diagram. [8]

   (*b*) A 3-phase, 220 V, 50 Hz, 10 kW I.M. has full load efficiency of 87% and draws a line current of 40 amp at full load. Find the readings on two wattmeters connected in the circuit to measure input power to I.M. Also determine power factor and reactive power of motor. [8]

Or

6. (*a*) A single wattmeter is used to measure reactive power in a 3-phase R–L load. The applied voltage is 415 volt with a current of 20 amp. The wattmeter reads 8 kW for this current. Determine power factor of the circuit and active power. [6]

(*b*) Draw a diagram showing arrangement to measure power with a wattmeter using CT, PT. Explain it in brief. [5]

(*c*) Write a short note on energy audit. [5]

SECTION II

7. (*a*) Derive the equation of full load torque developed by three phase induction motor and hence sketch the torque slip characteristics of three phase induction motor. [6]

(*b*) What is the necessity of starter for three phase induction motor ? Explain with connection diagram the working of D.O.L. starter. [6]

(*c*) A three phase induction motor draws 60 kW power from the supply. The stator losses are found to be 3 kW. The rotor e.m.f. is found to make 120 complete oscillations per minute when the supply frequency is 50 Hz. Determine :

(*i*) The copper loss at the rotor circuit

(*ii*) The gross mechanical power output

(*iii*) Efficiency and line current if mechanical losses are 2 kW. [6]

Or

8. (*a*) Explain the working principle of induction motor and concept of rotating magnetic field. [6]

(*b*) Explain V/F control method used for controlling the speed of three phase induction motor. [4]

(*c*) A 3-phase, slip-ring induction motor gives a reading of 55 V across slip rings on open circuit when at rest with normal stator voltage applied. The rotor is star-connected and has an impedance of $(0.7 + j5)$ ohm per phase. Find the rotor current and phase difference between rotor voltage and rotor current :

(*i*) at standstill with the slip rings joined to a star connected starter with a phase impedance of $(4 + j3)$ ohm and

(*ii*) the machine is running normally with a 5 percent slip. [8]

9. (*a*) Write a short note on synchronous impedance method for determining regulation of an alternator. [5]

(*b*) State advantages of using a stationary armature and rotating field system in case of three-phase alternators. [3]

(*c*) A three-phase 6 pole star connected alternator has 5 slots per pole per phase on its stator with 2 conductors per slot. The air gap flux is sinusoidally distributed and equal to 0.15 Wb. The stator has double layer winding with coil span 4 slots less than the pole pitch. If the alternator runs at 1000 r.p.m., calculate the no load terminal voltage. [8]

Or

10. (*a*) Explain why a three-phase synchronous motor is not self-starting. How is it made self-starting ? [6]

(*b*) How does the power factor and armature current of a synchronous motor, working with a constant input, depend on its excitation ? [8]

(*c*) A three-phase 16-pole alternator has 144 slots. Find distribution factor if armature winding of alternator is distributed in the slots. [2]

11. (*a*) Using double revolving field theory explain why single-phase motor is not self-starting. [8]

(*b*) Discuss with suitable diagram the construction and operation of shaded pole motor. [4]

(*c*) Explain the characteristics of a Universal Motor. [4]

Or

12. Write short notes on any *four* : [16]

(*a*) A.C. servomotors

(*b*) Stepper motors

(*c*) Split phase induction motors

(*d*) Reluctance motors

(*e*) Hysteresis motors.

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

[4062]-161

S.E. (Instru. & Control) (First Semester) EXAMINATION, 2011

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.

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

SECTION I

1. (*a*) What do you mean by input impedance and output impedance of an instrument ? Also explain impact of loading on measurement. [8]

(*b*) Solve the following :

(*i*) Full scale reading of voltmeter is 100 V. The accuracy of voltmeter is specified as ±1% of true value. What is probable range of reading shown by voltmeter while measuring voltage of 50 V ? [4]

(*ii*) A voltmeter has a uniform scale with 200 divisions, the full scale reading is 200 V and 1/10 of a scale division can be estimated with fair degree of certainty. Determine the resolution of instrument. [4]

Or

2. (*a*) Explain general documented procedure for calibration of equipment. [8]

(*b*) A 100 V range voltmeter is connected across the terminals A and B of the circuit shown in Fig. 1. Find the reading of voltmeter under open circuit and loaded conditions. Find the accuracy and loading error. The voltmeter has a resistance of 1200 kΩ. [8]

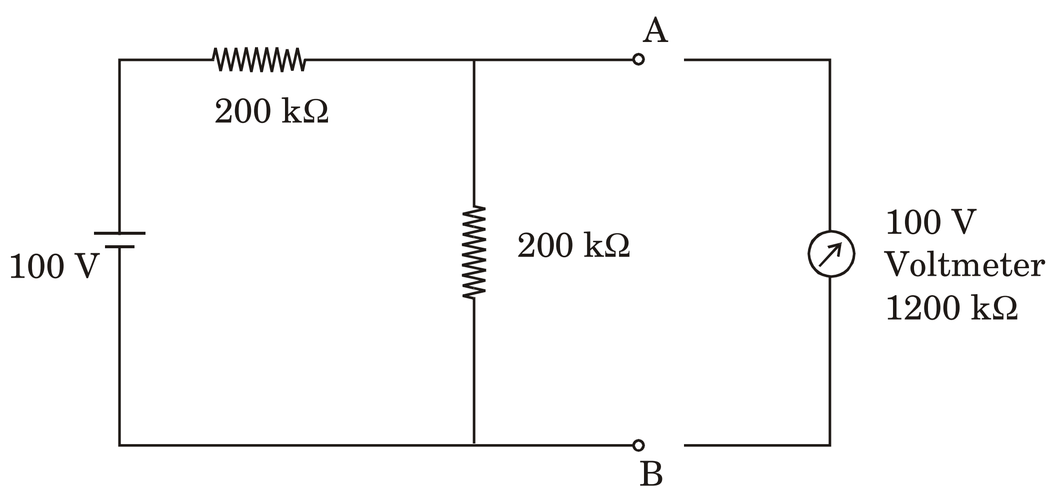


Fig. 1

3. (*a*) Explain the construction and working of attraction type and repulsion type of moving iron instrument. [8]

(*b*) Explain the construction and working of Single Phase Energy-meter. [8]

Or

4. (*a*) Explain the construction and working of self balancing type of potentiometer. [8]

(*b*) With the help of neat diagram explain the working of d'Arsonval Galvanometer. [8]

5. (*a*) Derive the bridge balancing condition in Wheatstone bridge. [8]

(*b*) What are the limitations of Wheatstone bridge ? [2]

(*c*) The four arms of Maxwell's capacitance bridge at balance are : [8]

arm ab – an unknown inductance L_1 having resistance of R_1

arm bc – a resistance of 1000 Ω

arm cd – a capacitor of 0.5 μF in parallel with resistance of 1000 Ω

arm da – resistance of 1000 Ω

Find unknown inductance and its resistance.

Or

5. (*a*) In Wheatstone bridge show that :

$$\theta = \frac{\text{SiES}\Delta\text{R}}{(\text{R}_0 + \text{G})(\text{R} + \text{S})^2}$$

where :

θ = Deflection of Galvanometer

E = Supply voltage of bridge

ΔR = Change in the unknown resistance arm

R_0 = The Thevenin equivalent of the bridge

G = Resistance of Galvanometer

R, S = Arms of the bridge. [9]

(*b*) Explain how frequency is measured by Wien bridge and also show that in Wien bridge [9]

$$f = \frac{1}{2\pi \text{RC}}$$

SECTION II

7. (*a*) Write down specifications of Digital Multimeter. Explain any *two* specifications in detail. [8]

(*b*) Write a short note on Digital Kilowatt Hour Meter. [8]

Or

8. (*a*) Explain each block in detail involved in measurement of temperature digitally. [8]

(*b*) With the help of neat block diagram explain the working of Digital Tachometer with typical specifications. [8]

9. (*a*) Draw the basic block diagram of CRO. Explain in detail the working of Delay Line. [8]

(*b*) Explain how phase can be measured in Y-t and X-Y mode with diagrams using CRO. [8]

(*c*) List the advantages of Digital Storage Oscilloscope. [2]

Or

10. (*a*) Explain how frequency can be measured using Z-modulation. [4]

(*b*) Calculate the period and frequency of the waveform shown in Fig. 2 when the Time/Div knob is set to 2 μsec/cm. [4]

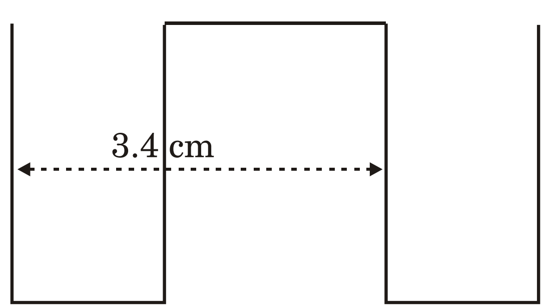


Fig. 2

(*c*) List the various controls on the front panel of a CRO. State the function of various controls on the front panel of a CRO. [10]

11. (*a*) Explain the difference between Virtual Instruments and traditional Instruments with block diagram. [8]

(*b*) Write a note on X-Y recorder. [8]

Or

12. (*a*) Write a note on multichannel recorder. [8]

(*b*) Explain the block diagram of function generator in detail. [8]

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

[4062]-162

S.E. (Instru. Engg.) (I Sem.) EXAMINATION, 2011

LINEAR INTEGRATED CIRCUITS—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*) 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) How Noise Figure (NF) is associated with signal power and noise power ? State the equation. [4]

(B) What is inherent noise ? (With reference to Op-amp.) [2]

(C) What is interference noise ? [2]

(D) How are these tackled with Op-amp ? [4]

(E) Match the *correct* pairs : [6]

N_{rms}	$K\left(\sqrt{1/f}\right)$
Resistance Noise (e)	$\sqrt{\frac{1}{T}\int h_i^2\, dt}$
Pink Noise	$\sqrt{4KTR}$

P.T.O.

Or

2. (A) How to measure input resistance of an op-amp (IC-741) in non-inverting mode ? Let voltage gain be equal to 1.0. Explain with neat circuit diagram. [8]

(B) How to measure input bias current in a closed loop circuit using IC 741 ? Explain with circuit diagram. [8]

(C) Use of step up transformer decreases signal power. State True *or* False. [2]

3. (A) Refer the amplifier circuit (Refer Fig. 1), Q_1 and Q_2 are identical transistors. How does this circuit work ? Two cases of inputs are given :

Case 1 : $V_{in1} = +V_P$ (+ve peak voltage), $V_{in2} = 0$

Case 2 : $V_{in2} = +V_P$, $V_{in1} = 0$.

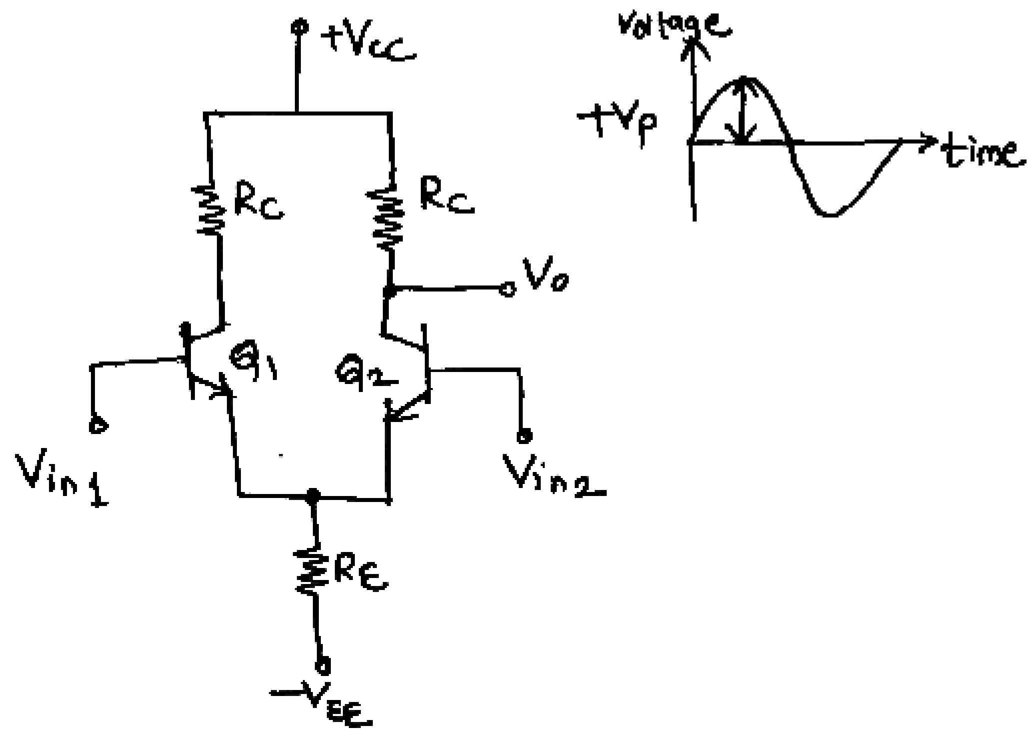


Fig. 1

Also draw waveform V_o with respect to V_{in1} and V_{in2}. [10]

(B) How op-amp acts as buffer amplifier ? Where is it used ? Explain. [6]

Or

4. (A) For inverting and non-inverting op-amps; derive the equations of voltage gain. [10]

(B) Draw neat circuit diagrams for both parts of question A. [6]

5. (A) Why external feedback resistor R_F is inserted in practical integrator circuit using op-amp ? [4]

(B) Why external feedback capacitor C_F is inserted in practical differentiator circuit using op-amp ? [4]

(C) Why external input resistor R_i is inserted in practical differentiator ? Explain. [4]

(D) State the limitations of op-amp practical differentiator. [4]

Or

6. (A) Let V_{CC} = +/– 15 Volts DC. Two stages of non-inverting amplifiers are connected as shown (Refer Fig. 2) :

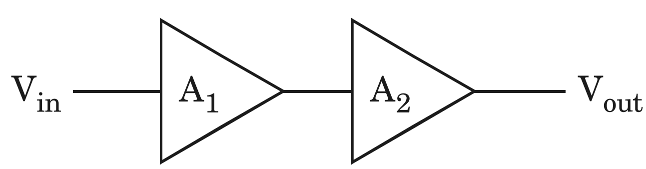


Fig. 2

Let $A_1 = A_2 = 6$.

For given inputs calculate output voltage V_{out}.

V_{in}	V_{out}
10 milli-volts	?
50 milli-volts	?
+1 volts	?
–1.5 volts	?

Show calculations for each answer. [8]

(B) Write a short note on Instrumentation amplifier. [8]

SECTION II

7. (A) Design a Schmitt trigger for the given data :

$$V_{UT} = V_{LT} = 2.5 \text{ volts.}$$

Let saturation voltage = +/– 12 volts. Show the calculations with circuit. [10]

(B) An open loop circuit using op-amp has inputs connected as shown in table below; show the calculations for output voltages V_{CC} = +/– 15 volts. [8]

Pin 2 voltage	**Pin 3 voltage**	V_{output}
+2 Volts DC	+1 Volt DC	?
+1 Volt DC	+2 Volts DC	?
1 Volt peak to peak sine wave 100 Hertz	Zero volt	Draw input-output waveforms

Or

8. (A)

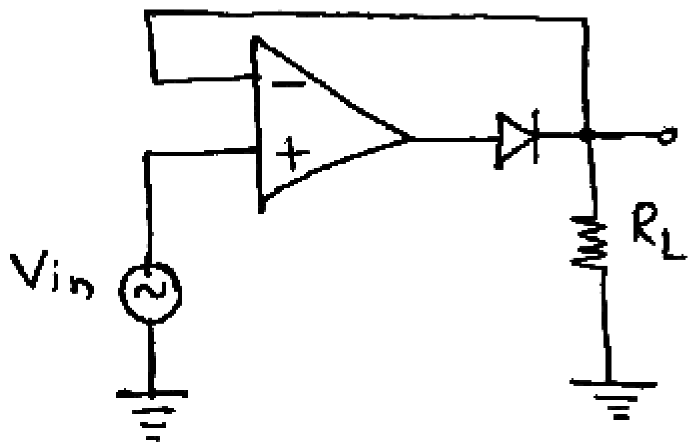


Fig. 1

Why 741 op-amp and diode 1N4007 is not preferred in the above (Refer Fig. 3) precision half wave rectifier ? Explain. [6]

(B) State Barkhausen criteria. [4]

(C) Explain how Wien Bridge oscillator works with circuit diagram. [8]

9. (A) State the equation for time required for a capacitor to charge through a resistor R from some starting voltate (V_{START}) towards Aiming voltage (V_{aim}) to a stop voltage (V_{stop}). [4]

(B) How much current (maximum) can be drawn from IC 555 ? [2]

(C) How astable multivibrator using IC 555 is designed ? Explain. [8]

(D) Enlist pin names of IC 555. [2]

Or

10. (A) Draw a neat circuit diagram with transformer, rectifier, IC 7805, filter capacitors that will generate +5 Volts DC. [8]

(B) Write a short note on switching regulators. [8]

11. (A) Draw frequency responses of ideal Low Pass, High Pass, Band Pass, Band Reject filters. [8]

(B) Draw practical frequency responses of above filters. [8]

Or

12. (A) How order of a filter is decided ? [2]

(B) What is the effect of order of filter on filter response ? [2]

(C) What are the design steps of a first order high pass filter ? [6]

(D) How to design a band pass filter ? [6]

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

[4062]-163

S.E. (Instrumentation) (First Semester) EXAMINATION, 2011

PRINCIPLES OF SENSORS AND TRANSDUCERS

(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*) Draw neat sketches wherever necessary.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts electronic pocket, calculator and steam table is permitted.

SECTION I

1. (*a*) Define sensors and transducers. Explain in detail classification of transducers based on transduction principle. [6]

(*b*) List the types of error in measurement. Give their causes and state the remedies. [6]

(*c*) What is calibration ? Explain the standards available for calibration at various laboratories. [6]

Or

2. (*a*) Define Instrumentation. Draw and explain the basic stages of measurement system. [6]

(*b*) What do you mean by the order of a measuring system ? What are the different standards inputs given to the measuring system for evaluation of its parameters ? [6]

(*c*) An experiment performed once gave a reading that showed a deviation of 10 percent. If it is repeated 65 times, what is the likely deviation ? [6]

3. (*a*) Explain with diagram bimetallic and fluid expansion system for temperature measurement. [8]

(*b*) Define atmospheric pressure and absolute pressure. Give units of pressure. Explain with diagram capsules. [8]

Or

4. (*a*) Explain with diagram torsion bar for torque measurement. Explain in brief principle of gyroscope. [8]

(*b*) Draw and explain force measurement using spring. List different types of load cells. [8]

5. (*a*) Define specific gravity. Explain with diagram air bubbler system for density measurement. [8]

(*b*) Explain with neat diagram level to force convertor and viscosity to torque convertor. [8]

Or

6. (*a*) Explain working principle with neat diagram for flow measurement using Pitot tube. [8]

(*b*) Write a short note on : [8]

(*i*) Hydrometer

(*ii*) Rotameter.

SECTION II

7. (*a*) Explain the working principle of LVDT. State its advantages, disadvantages and applications. [9]

(*b*) A capacitive transducer uses two quartz diaphragms of area 750 mm^2 separated by distance of 3.5 mm. A pressure of 900 kN/m^2 when applied to the top diaphragms produces a deflection of 0.6 mm. The capacitance is 370 Pf when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of 900 kN/m^2. [9]

Or

8. (*a*) State the principle of strain gauge. Draw and explain different types of strain gauges (any *two*). [9]

(*b*) Draw and explain moisture measurement using resistive transducer. Give its applications. [9]

9. (*a*) Describe the principle of operation of Hall-effect sensor. How can it be used in displacement sensing ? [8]

(*b*) What are Peltier and Seeback effect ? How are they responsible in thermo-emf generation ? Give the list of different types of thermocouples. [8]

Or

10. (*a*) Explain piezoelectric phenomena. List piezoelectric materials. Explain with neat diagram piezoelectric transducer for force measurement. [8]

(*b*) Explain with neat diagram electromagnetic flow-meter. Distinguish between 'Photovoltaic', 'Photoemissive' and 'Photoconductive' cells. [8]

11. (*a*) List different digital input-output devices. Draw and explain magnetic tape recorder. [8]

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

(*i*) Analog and Digital readout system

(*ii*) Data logger.

Or

12. (*a*) Explain with neat diagram Feedback transducer system. [8]

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

(*i*) Analog tape recorder

(*ii*) Self-balancing system.

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

[4062]-164

S.E. (Instrumentation & Control Engineering)

(First Sem.) EXAMINATION, 2011

AUTOMATIC CONTROL 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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the block diagram of control systems in detail with neat example. [6]

(*b*) Give the different types of control system. [4]

(*c*) Obtain equivalent electrical circuits for the given mechanical systems in Fig. 1, using Force to voltage and Force to current analogy. Also draw circuit diagrams of results obtained. [8]

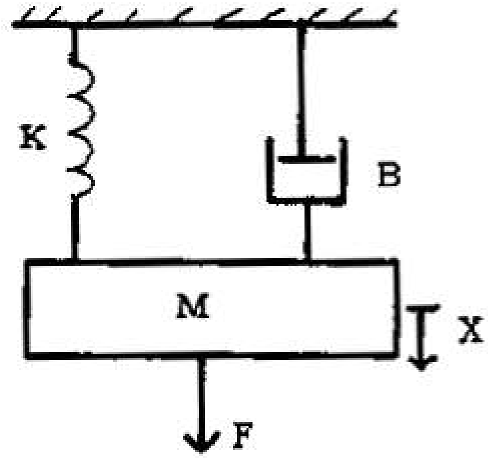


Fig. 1

Or

2. (*a*) For mechanical system shown in Fig. 2, write system equations at balance condition. Draw voltage and current analogous circuit. [10]

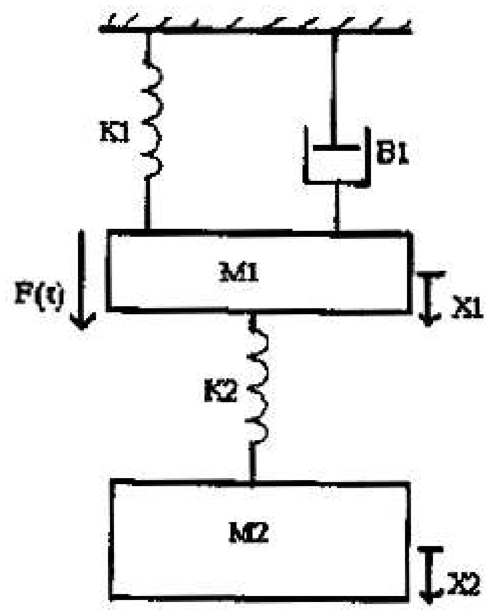


Fig. 2

(*b*) Compare the following control systems : [8]

(*i*) Feedback and feed forward control systems.

(*ii*) Causal and non-causal control systems.

(*iii*) Stable and unstable control systems.

(*iv*) Time variant and time invariant control systems.

3. (*a*) Define transfer function of control system. Derive the transfer function for canonical form of control system. Write merits and demerits of transfer function. [8]

(*b*) Find the transfer function of the control system given by its signal flow graph in Fig. 3. [8]

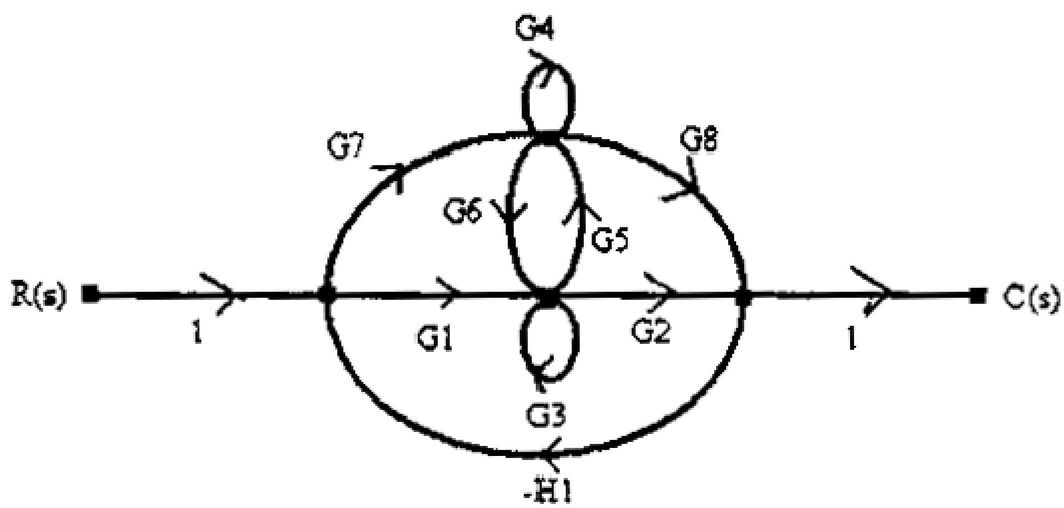


Fig. 3

Or

4. (*a*) Give Masson's gain formula. [2]

(*b*) Compare block diagram reduction technique with signal flow graph technique. [4]

(*c*) Determine overall transfer function shown in Fig. 4. Use block diagram reduction rules. [10]

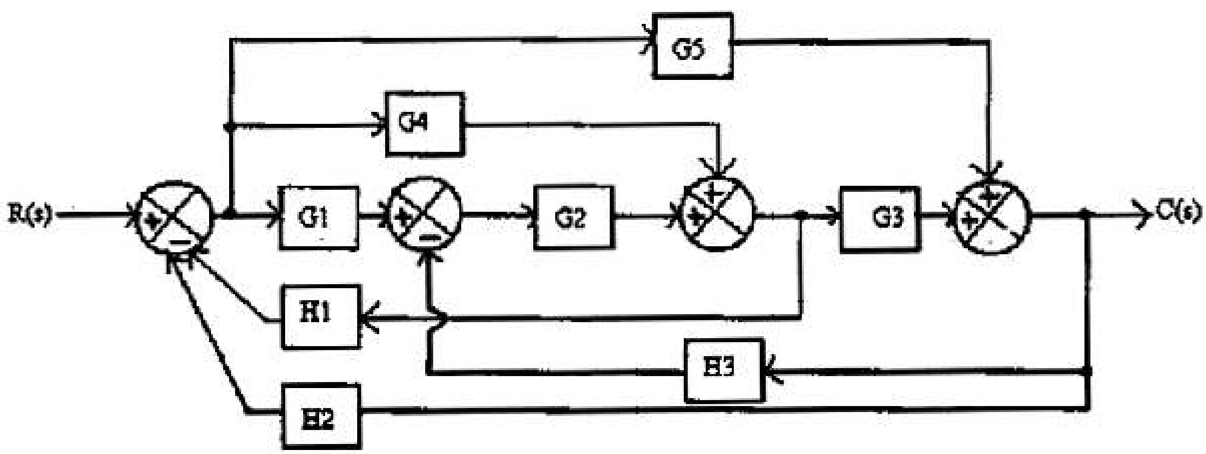


Fig. 4

5. (*a*) Define the following terms with respect to control systems : [4]

(*i*) Order

(*ii*) Type

(*iii*) Poles

(*iv*) Zeros.

(*b*) Derive the expression for response of second order control system if unit step signal is applied. Draw graph for the same. Also mention all the terms on the graph. [8]

(*c*) Calculate the transient response parameters for the system if :

$$G(s) = \frac{6}{s(s+4)}, \; H(s) = 1. \qquad [4]$$

Or

6. (*a*) Find k_1 and k_2 for the feedback system with :

$$G(s) = \frac{k_1}{s(s+1)}, \quad H(s) = 1 + k_2 s.$$

The peak overshoot of the system is 1.2% and corresponding time is 1 second. [8]

(*b*) An unity feedback system has a loop transfer function : [8]

$$G(s) = \frac{10(s+1)}{s(s+2)(s+5)}.$$

Determine :

(*i*) Gain of the system

(*ii*) All static error coefficients

(*iii*) Steady state error when input is $r(t) = 3 + 10t$.

SECTION II

7. (*a*) Define BIBO stability. Find the range of k for stability of a unity feedback system with :

$$G(s) = \frac{k}{s(s+2)(s+4)(s+6)}.$$

Also find $k_{\max}$ and ω_{mar}. Use Routh's stability method. [8]

(*b*) Draw root locus of the control system with :

$$G(s)\,H(s) = \frac{k}{s(s+3)(s+6)}.$$

Obtain value of k with $\xi = 0.6$ from root locus. [10]

Or

8. (*a*) The system characteristics equation is given by :

$$s^5 + 2s^4 + 4s^3 + 6s^2 + 2s + 5 = 0.$$

Comment on stability using Routh's array method. [6]

(*b*) The loop transfer function for a control system with :

$$GH(s) = \frac{k(s+6)}{s\left(s^2 + 4s + 5\right)}.$$

Sketch complete Root locus. Mark salient points, comment on the stability. [12]

9. (*a*) Write correlation between time domain and frequency domain specifications. [6]

(b) For the system having open loop transfer function :

$$G(s)\,H(s) = \frac{10}{s(s+1)(s+10)}.$$

Determine stability of the system using Bode plot. [10]

Or

10. (a) Define : [6]

(i) Bandwidth

(ii) Resonant frequency

(iii) Phase margin

(iv) Gain margin

(v) Gain crossover frequency

(vi) Phase crossover frequency.

(b) Given :

$$G(s) = \frac{4(s+0.5)}{s(s+0.2)(s+1)}, \quad H(s) = 1.$$

Draw Bode plot. Find gain margin, phase margin. Comment on the stability of system. [10]

11. (a) Define polar plot. Find the polar plot of unity feedback system with a pole at origin i.e. :

$$G(s) = \frac{1}{s}.$$ [8]

(*b*) Define : [8]

(*i*) State

(*ii*) State variables

(*iii*) State space

(*iv*) State equations.

Or

12. (*a*) Write short notes on Mapping Theorem and Principle of Argument. [6]

(*b*) Determine the transfer function of the control system represented by the following State-Space model :

$$\frac{dx(t)}{dt} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & 4 & 6 \end{bmatrix} x(t) + \begin{bmatrix} 0 \\ 0 \\ 3 \end{bmatrix} u(t)$$

$$y(t) = \begin{bmatrix} 1 & 0 & 1 \end{bmatrix} x(t) + \begin{bmatrix} 1 \end{bmatrix} u(t).$$ [10]

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

[4062]-165

S.E. (Instrumentation and Control) (Second Semester)

EXAMINATION, 2011

DIGITAL TECHNIQUES

(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*) Assume suitable data, if necessary.

SECTION I

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

(*i*) $(725.63)_8$ to binary

(*ii*) $(2AC5.D)_4$ to decimal

(*iii*) $(22.64)_{10}$ to Hexadecimal

(*iv*) $(101101.1101)_2$ to Octal.

(*b*) Simplify the following Boolean function by using a Quine McCluskey method : [10]

$$F(A, B, C, D) = \sum m(0, 2, 3, 6, 7, 8, 10, 12, 13).$$

Or

2. (*a*) (*i*) Convert aray number 1110 to its BCD equivalent. [2]

(*ii*) Represent 'PASS' in ASCII code. [2]

(*iii*) Encode the binary word 1011 into seven bit even Parity Hamming code. [3]

(*iv*) Perform following decimal additions in Excess 3 code. [3]

(*b*) (*i*) Write DeMorgan's Theorems and verify the truth table. [4]

(*ii*) Find the complement of each function : [4]

(1)

(2) $F_2 = X(\overline{Y}\overline{Z} + YZ)$.

3. (*a*) Write short notes on : [8]

(*i*) EPROM

(*ii*) PROM.

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

(*i*) SR Flip-Flop to JK Flip-Flop

(*ii*) D Flip-Flop to T Flip-Flop.

Draw the truth table, excitation table K-Map and connection diagram for each conversion.

Or

4. (*a*) Write types of Semiconductor Memories. Explain any *one* in detail. [4]

(*b*) What is race around condition ? How is it avoided ? [4]

(*c*) Implement the following function using PLA : [8]

$$A(X, Y, Z) = \sum m\,(1, 2, 4, 6)$$

.

5. (*a*) Design 'Divide by 128 Counter' using IC 7493. Explain the 'Reset Logic' for the same. [8]

(*b*) Design the counter that goes through the states 0, 1, 2, 4, 0 using D Flip-Flops. [8]

B(K, Q, E) S)∑m∑(0, 1, 6, 3, 4, 8, 9, 1 5)

Or

6. (*a*) Design a non-sequential Ripple counter which will go through the states 3, 4, 5, 7, 8, 9, 10, 3, 4................Draw Bush diagram. [10]

(*b*) Design 'MOD 120 Counter' by using IC 7490 and IC 7492. [6]

SECTION II

7. (*a*) Implement the following Boolean function by using '8 : 1 MUX' : [8]

.

(*b*) Explain the function of the following pins of seven segment decoder Driver IC 7447 : [8]

(*i*)

(*ii*) $\overline{\text{RBI}}$

(*iii*) $\overline{\text{BI/RBO}}$

(*iv*) A0-A3.

Or

8. (*a*) Design '4 : 16 decoder' by using two '3 : 8 decoder'. [8]

(*b*) Implement the following Boolean function by using '3 : 8 decoder' and external gates : [8]

$$F_1 (A, B, C) = \sum m (1, 3, 5, 7)$$

.

9. (*a*) Define the following : [10]

(*i*) Fan-in

(*ii*) Fan-out

(*iii*) Noise margin

(*iv*) Propagation delay

(*v*) Power dissipation.

(*b*) Compare 'Totempole output' with open collector output. [8]

Or

10. (*a*) Explain interfacing of 'TTL' to 'CMOS' and 'CMOS to TTL'. Also explain worst case condition. [10]

(*b*) Give the comparison between TTL and CMOS families. [8]

11. (*a*) Explain frequency counter with the help of neat diagram. Draw the timing diagram to show clears counter and counter is counting. [8]

(*b*) Design 'Sequence Generator' to generate the sequence '1101011' by shift register method. [8]

Or

12. (*a*) Design a 'Sequence Generator' to generate the sequence '1101011' by Flip-Flop (counter) method. [8]

(*b*) Describe in detail 'Minutes and Hours' section of digital clock with the help of circuit diagram. [8]

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

[4062]-166

S.E. (Instrumentation) (II Sem.) EXAMINATION, 2011

APPLIED 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*) 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*) What is Analog Switch ? Explain with neat diagram IC-CD4051 can be used as a Analog Switch. [10]

(*b*) Where is Sample and Hold circuit required ? Explain Sample and Hold circuit with a neat diagram. [8]

Or

2. (*a*) For a 8-bit SAR type ADC, Analog input to comparator is 4.219 V. If the reference voltage to the internal DAC of SAR is +5 V and 8-bit DAC's output is :

$$V_{DAC} = V_r \, . (b_1\, 2^{-1} + b_2\, 2^{-2} + b_3\, 2^{-3} + b_4\, 2^{-4} + b_5\, 2^{-5} + b_6\, 2^{-6} + b_7\, 2^{-7} + b_8\, 2^{-8})$$

Find out digital output of this ADC. [10]

(*b*) Rearrange the following seven given steps of 8-bit SAR ADC IC0809 in the proper sequence of operation.

Given steps :

(*i*) 8-bit digital output

(*ii*) Output Enable (OE)

(*iii*) Address Latch Enable (ALE)

(*iv*) Analog Input (Va)

(*v*) START of conversion

(*vi*) End of conversion

(*vii*) Address lines selection.

Also comment on proper sequence of operation. [8]

3. (*a*) For a 4-bit DAC three input resistances are 10 kW each, five resistances of 20 kW each and a feedback resistor of 10 kW is given. If the 4-bit digital input is :

$$b_0 = b_1 = b_2 = b_3 = \text{‘1’}.$$

Find out equivalent analog output if the reference voltage is +5 V. Show the calculations and comment on ‘type’ of DAC with neat circuit diagram. [8]

(*b*) Explain the following characteristics of Digital to Analog Converters :

(*i*) Conversion Resolution

(*ii*) Accuracy of DAC

(*iii*) Reference Voltage

(*iv*) Monotonacity. [8]

Or

4. (*a*) Explain how digital to analog conversion takes place in Weighted Register type 4-bit DAC with neat circuit diagram. [8]

(*b*) Explain how current output of DAC IC0808 is converted into voltage output for suitable reference voltage using circuit or block diagram.

Also comment on DAC principle used in IC0808. [8]

5. (*a*) Draw the construction and characteristics of the following power devices :

(*i*) Silicon Controlled Rectifier

(*ii*) Bidirectional Diode Thyristor. [8]

(*b*) Explain with neat diagram the working principle of *n*-channel depletion type mosfet for any *one* mode of operation. Also draw the symbols. [8]

Or

6. (*a*) For a SCR given things are : (Refer Fig. 1)

$V_{GT} = 0.7$ V, $I_{GT} = 2$ mA and $I_H = 2$ mA.

Find out :

(*i*) What is output voltage when SCR is off ?

(*ii*) What is the input voltage that triggers the SCR ?

(*iii*) What is the value of V_{CC}, that makes SCR off ? Assume V_{AK} in conduction region = 0.7 V.

(*iv*) If all resistances shown in Fig. 1 are doubled. If the gate trigger current of SCR is 1.5 mA, what is the input voltage that triggers the SCR ? [8]

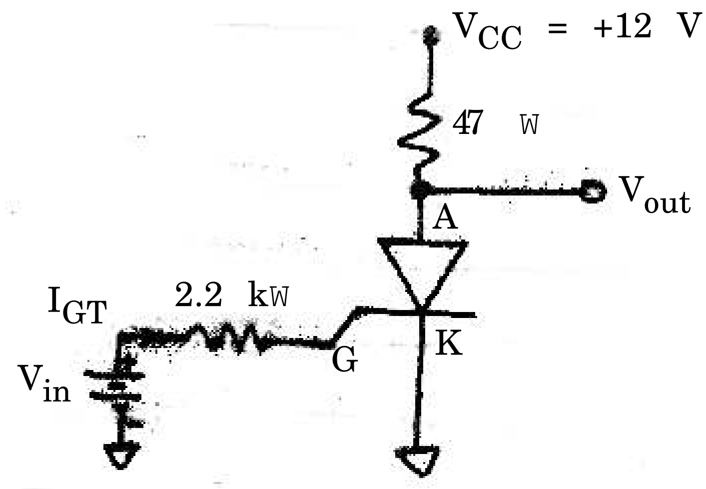


Fig. 1

(*b*) Draw the symbols and characteristics of the following power devices :

(*i*) Bidirectional Triode Thyristor

(*ii*) Insulated Gate Bipolar Transistor. [8]

SECTION II

7. (*a*) How the batteries stores electrical energy and delivers electrical energy ? Explain with a neat diagram. [8]

(*b*) Explain the following performance specifications of batteries :

(*i*) Battery capacity

(*ii*) Charging time

(*iii*) Self discharge

(*iv*) Gassing voltage

(*v*) Characteristic curves. [10]

Or

8. (*a*) Design adjustable voltage and current regulator using IC L-200 with neat diagram for the following specifications :

Required output voltage is 5 V with 100 mA current, when the input voltage is 12 V. [8]

(*b*) List out and compare at least *five* types of batteries with their voltage capacity and battery materials used as electrodes. [10]

9. (*a*) Explain by using phase comparator, low-pass filter and voltage controlled oscillator the basic concept of phase locked loop. [8]

(*b*) Guess the IC with neat block diagram that has the following internal blocks ? Also explain the same :

(*i*) Constant current source

(*ii*) Buffer

(*iii*) Schmitt trigger

(*iv*) Inverting amplifier. [8]

Or

10. (*a*) Explain with neat diagram, how input voltage can be converted into frequency output. [8]

(*b*) Design a voltage controlled oscillator for a desired frequency of 2.5 kHz, if the modulating voltage is 7/8 (V_{CC}). [8]

11. (*a*) Explain the importance of modulation. Also explain the concept of Amplitude Modulation with neat diagrams. [8]

(*b*) What is TDM ? Explain this concept in detail. [8]

Or

12. (*a*) What is ASK and FSK ? Explain ASK concept with neat diagram. [8]

(*b*) What is called 'Isolation' ? Explain signal isolation technique with neat diagram. [8]

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

[4062]-167

S.E. (Instru.) (Second Semester) EXAMINATION, 2011

TRANSDUCERS AND SIGNAL CONDITIONING

(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.

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

(*vi*) Your answer will be valued as a whole.

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

SECTION I

1. (*a*) Explain the following stages of signal conditioner : [8]

(*i*) Linearization

(*ii*) Signal conversions

(*iii*) Filtering

(*iv*) Analog to digital converters with examples.

(*b*) Explain different methods to convert resistance into voltage and current with neat sketch. [10]

P.T.O.

Or

2. (*a*) Discuss different causes that generate error in temperature measurement with RTD. How can these errors be avoided ? [8]

(*b*) It is required that the accuracy of the resistance thermometer should be 2°C. The power dissipation of the sensor is 2 mW/°C and the resistance coefficient at 26°C is 0.004 Ω/°C and resistance at 26°C is 110. Find the maximum excitation current required. Also design Wheatstone Bridge for same. [10]

3. (*a*) If resistance of strain gauge is 350 Ω and if there is 5% change in resistance by the application of force, prove that sensitivity increases if we use half and full bridge configuration over quarter bridge configuration. [10]

(*b*) Explain semiconductor strain gauge with working principle, material and applications. [6]

Or

4. (*a*) Explain piezoelectric sensor with neat diagram, working principle, material and necessity of charge amplifier. [8]

(*b*) Discuss different source of error in strain gauge. How can they be eliminated ? [8]

5. (*a*) Explain working and signal conditioning of inductive proximity switch. [8]

(*b*) Explain Absolute encoder with neat diagram and signal conditioning circuit. How can resolution and sensitivity of encoder be increased ? [8]

Or

6. (*a*) Explain signal conditioning of LVDT in respect to phase demodulation, phase detection. [8]

(*b*) Explain working of optical tachometer with necessary signal conditioning circuit. [8]

SECTION II

7. (*a*) Explain different signal conditioning schemes for capacitive transducer. [8]

(*b*) For certain level measurement system electromechanical level gauge is used to measure level. The output of sensor is 0 to 10 k ohm for the level of 0 to 20 meter. Design suitable signal conditioning circuit for having output 0 to 10 V. [10]

Or

8. (*a*) Explain ultrasonic level measurement with necessary signal conditioning circuit. [9]

(*b*) Explain different radiation detection techniques in nuclear sensors. [9]

9. (*a*) Explain vortex flow meter with necessary signal conditioning circuit. [8]

(*b*) State excitation considerations for electromagnetic flow meter. [8]

Or

10. (*a*) Explain turbine flow meter along with necessary signal conditioning scheme. [8]

(*b*) What is the principle of magnetic flow meter ? What are the advantages of it over turbine flow meter ? [8]

11. (*a*) Explain glass electrode in detail along with necessity of thermocompensator, and operating range of glass electrode. [8]

(*b*) Explain conductivity meter along with cell constant and selection of cell. [8]

Or

12. (*a*) Why vibration measurement is necessary ? Explain any *one* method to measure vibrations. [8]

(*b*) Explain capacitive microphone along with advantages and disadvantages. [8]

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

[4062]-168

S.E. (Instrumentation & Control)

(Second Semester) EXAMINATION, 2011

PHOTONICS AND 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.

(*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 following : [12]

(*i*) Nature of light

(*ii*) Electromagnetic spectrum

(*iii*) Propagation of light.

(*b*) Light having frequency range of 10^6 Hz. Calculate wavelength in meter and explain Snell's law. [6]

Or

2. Differentiate the following properties of light with suitable diagram : [18]

(*i*) Polarization and Coherence

P.T.O.

(*ii*) Absorption and Transmittance

(*iii*) Scattering and Dispersion

(*iv*) Diffraction and Interference.

3. (*a*) Explain principle and working of gas discharge lamp with suitable diagram. Enlist the advantages and application of it. [12]

(*b*) Describe Natural Sources of light. [4]

Or

4. (*a*) Explain types of spectra for line, band and continuous light sources. [4]

(*b*) For an incandescent lamp, the design parameters are : [12]

(*i*) Design voltage = 5 V

(*ii*) Design current = 0.145 Amp

(*iii*) M.S.C.P. at design voltage = 0.16

(*iv*) Lamp life = 10,000 Hrs.

If this lamp is operated at 4.5 V, then calculate :

(1) Rerated M.S.C.P.

(2) Rerated life

(3) Rerated current.

5. Explain the following terms related to light emitting diode : [16]

(*i*) Electroluminescent process

(*ii*) Choice of LED materials

(*iii*) LED structures

(*iv*) Application of LED.

Or

6. (*a*) Explain basic steps required for generation of laser beam. What are different properties of laser ? State advantages and drawbacks of laser. [12]

(*b*) Describe various infrared sources of light. [4]

SECTION II

7. Differentiate the following : [18]

(*i*) PIN photodiode and Avalanche photodiode

(*ii*) Phototransistors and photomultiplier tube

(*iii*) Thermal detectors and quantum detectors.

Or

8. Write short notes on any *three* : [18]

(*i*) Bolometer

(*ii*) IR detectors

(*iii*) Solar cells

(*iv*) CCD devices.

9. (*a*) What are the different types of mirrors ? Explain any *two* with geometrical ray diagrams. [8]

(*b*) Explain the following on any *two* : [8]

(*i*) Lenses

(*ii*) Polarizer

(*iii*) Beam splitter.

Or

10. Differentiate the following : [16]

(*i*) Dispersion prism and reflection prism

(*ii*) Absorption filter and interference filter

(*iii*) Concave grating and diffraction grating

(*iv*) Plane mirror and spherical mirror.

11. Explain working principle of the following with suitable diagrams for any *two* : [16]

(*i*) Cameras

(*ii*) Astronomical telescope

(*iii*) Abbe's refractometer.

Or

12. Describe the following on any *two* : [16]

(*i*) Photographic lenses

(*ii*) Microscopes

(*iii*) Optical projection system

(*iv*) Monochromator.

S.E. (Instrumentation & Control) Examination, 2011
DRIVES AND CONTROL
(2008 Course)

Time : 3 Hours Total Marks : 100

Instructions : *1) Answer **three** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) **Use** of logarithmic tables, slide rule, Mollier chart, Electronic pocket calculator is **allowed**.*
*5) Assume suitable data if **necessary**.*

SECTION – I

1. a) Explain the working principle of generator ? Explain different types of windings in generators. **8**

b) A long shunt compound generator delivers a load current of 50 A at 500 V and has armature series field resistances of 0.05 ohm, 0.03 ohm and 250 ohm resp. Calculate the generated voltage and the armature current. Allow 1 V per brush for contact drop. **8**

OR

2. a) Explain the voltage equation of motor. Also the condition for the maximum power. **8**

b) A DC motor takes an armature current of 110 A at 480 V. The armature circuit resistance is 0.2 ohm. The machine has 6-poles and the armature is lap connected with 864 conductors. The flux per pole is 0.05 Wb. Calculate :

i) Speed

ii) The gross torque developed by the armature. **8**

3. a) Explain the reason why does the rotor rotate in induction motor. **8**

b) A 3 phase induction motor is wound for 4 poles and is supplied from 50-Hz system. Calculate :

i) The synchronous speed

ii) The rotor speed when slip is 4%

iii) Rotor frequency when rotor runs at 600 rpm. **8**

OR

4. a) Explain the relation between torque and slip with their characteristics. **8**

b) Explain the construction and working principle of synchronous motor. **8**

5. a) Give the types of stepper motors. Explain any one in detail. **9**

b) Write short note on : Switched Reluctance Motor. **9**

OR

6. Write short notes on : **18**

1) Servomotors

2) Characteristics of induction motors

3) Speed control of Universal motors.

SECTION – II

7. a) With neat diagram and characteristics explain the working of DIAC. **8**

b) Explain in working principle, construction and operation of UJT. **8**

OR

8. a) Explain in detail the construction and operation of IGBT. **8**

b) Compare SCR and TRIAC. **8**

9. a) Draw the circuit diagram and explain the operation of step down chopper with the help of waveforms. **8**

   b) Distinguish between the chopper and controlled rectifiers. **8**

OR

10. a) With a neat diagram explain the working of half bridge inverter with inductive load. **8**

    b) How choppers are classified ? Explain class B chopper in detail. **8**

11. a) Explain in detail the working principle and construction of separately excited DC motors. **9**

    b) Write short note on : three phase SCR drive in DC motor control. **9**

OR

12. Write short notes on : **18**

    1) Braking of induction motor

    2) Close loop control system for DC motor control.

———————————

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

[4062]-170

S.E. (Instrumentation and Control) (Second Semester)

EXAMINATION, 2011

MATERIALS AND PROCESSES FOR SENSORS

(2003 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*) Discuss the material selection for thermocouple and RTD. [8]

(*b*) What are the requirements of a good conductor material ? Enlist commonly used conductor materials. [8]

Or

2. (*a*) Explain the properties required for strain gauge. [8]

(*b*) Enlist the guidelines for material selection of bimetallic strip. [8]

3. (*a*) What are the various factors affecting selection of elastic materials ? Give examples of any *two* elastic transducers. [8]

(*b*) Enlist the applications of piezoelectric material. [8]

Or

4. (*a*) Explain the properties of elastic materials. [8]

(*b*) Explain polarization and magnetostrictive effect. [8]

5. (*a*) Explain the term service performance of ceramic. [8]

(*b*) List various methods of corrosion control and explain any *two* of them in detail. [10]

Or

6. (*a*) Explain the types of Corrosion. [8]

(*b*) Explain properties and uses of the following insulators :

(*i*) Glass

(*ii*) Insulating Resins. [10]

SECTION II

7. (*a*) Discuss the material selection criteria for LVDT. [8]

(*b*) Give properties and applications of soft magnetic materials. [8]

Or

8. (*a*) Suggest any *two* materials for the following and justify :

(*i*) Bourdon gauge

(*ii*) Transformer. [8]

(*b*) Discuss effect of temperature on ferromagnetism. [8]

9. (*a*) What are various requirements of fiber optic materials ? [8]

(*b*) What is meant by biocompatible materials ? Explain their properties. [10]

Or

10. (*a*) Enlist various materials used for Laser and compare the performance of Lasers based on spectral response and optical power. [8]

(*b*) What is radioactivity ? What are various radioactive elements ? Explain various applications of radioactive elements. [10]

11. (*a*) Compare thick and thin film technology. [8]

(*b*) What is anodizing ? Explain the setup of anodizing. [8]

Or

12. (*a*) Explain Ion Plating. [8]

(*b*) Write a note on Nanotechnology. [8]

Total No. of Questions—**10**] [Total No. of Printed Pages—**4+2**

[4062]-170A

S.E. (Instrumentation and Control)

(Second Semester) EXAMINATION, 2011

NETWORK THEORY

(2003 PATTERN)

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

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

(*ii*) Question Nos. **5** and **10** are compulsory. Out of the remaining attempt **2** questions from Section I and **2** questions from Section II.

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

(*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*) Find the equivalent resistance and obtain current in each resistance as shown in Fig. 1 : [8]

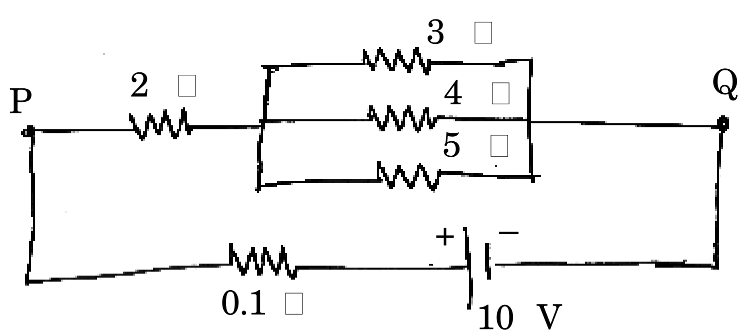


Fig. 1

(*b*) Determine equivalent capacitance across terminal ($a - b$). Find the charging time to charge these capacitances by a steady direct current of a constant magnitude of 10 A as shown in Fig. 2 : [8]

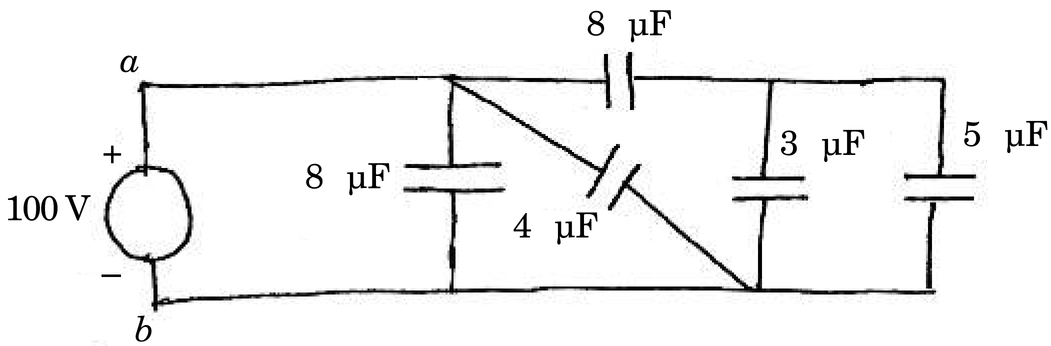


Fig. 2

Or

2. (*a*) List various nodes and loops in the circuit shown in Fig. 3 : [8]

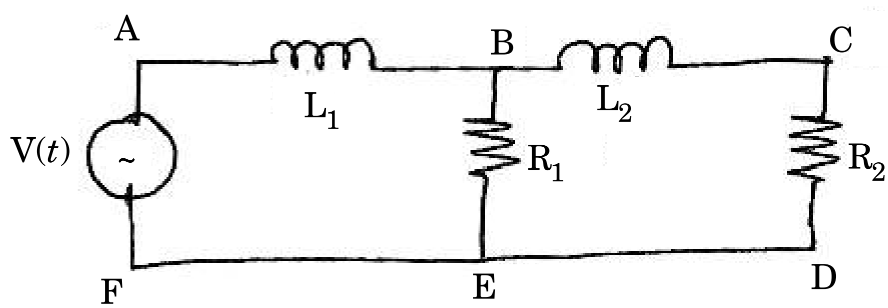


Fig. 3

(*b*) Determine the voltage drop across the pure resistance RL. If the control current in the dependent current source is 1 Amp. as shown in Fig. 4. Assume RL = 2 □ : [8]

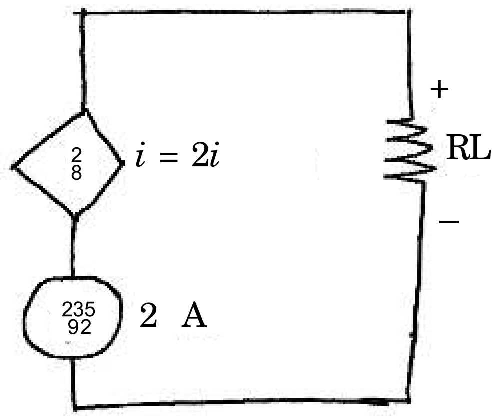


Fig. 4

3. (*a*) Explain the following rules :

(*i*) voltage divider [4]

(*ii*) current divider. [4]

(*b*) Check whether the polynomial is Hurwitz or not : [8]

(*i*) $s^4 + 7s^3 + 4s^2 + 18s + 6$

(*ii*) $s^4 + s^3 + 6s^2 + 3s + 6$.

Or

4. (*a*) State properties of RL driving point impedance functions. [8]

(*b*) The driving point impedance of a one port LC network is given by : [8]

$$z(s) = \frac{8(s^2 + 4)(s^2 + 25)}{s(s^2 + 16)}.$$

Find first foster form of network.

5. (*a*) State and prove superposition theorem. [10]

(*b*) Find Norton equivalent to the left of *x*-*y* terminals in Fig. 5 : [8]

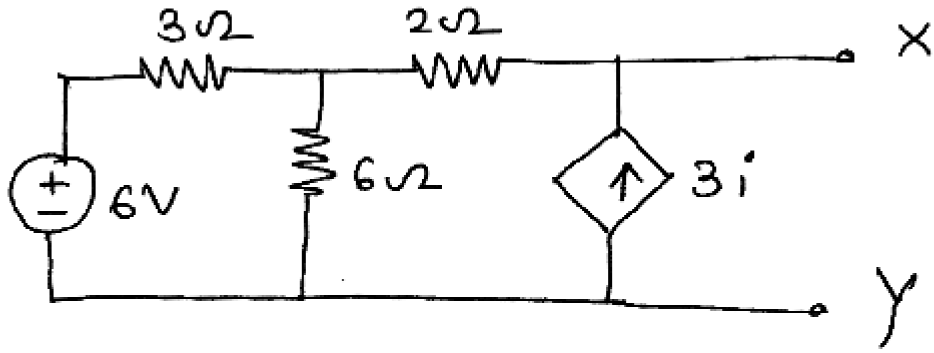


Fig. 5

SECTION II

6. (*a*) Find the driving point impedance *z*(*s*) for the Network shown in Fig. 6 : [8]

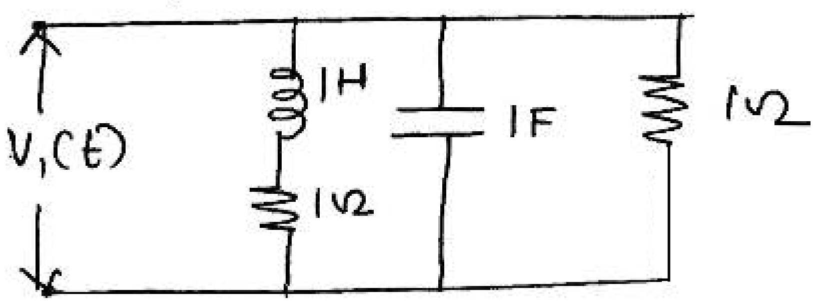


Fig. 6

(*b*) Obtain the current transfer ratio of the network shown in Fig. 7 : [8]

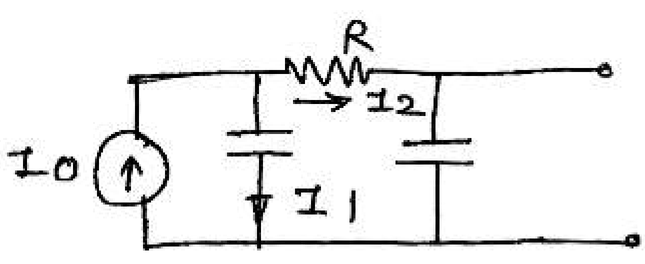


Fig. 7

Or

7. (*a*) Define and explain with formula two and one port network functions. [8]

(*b*) In the Network 'S' is switched on at $t = 0$. Find the driving point impedance and source current in 'S' domain as shown in Fig. 8 : [8]

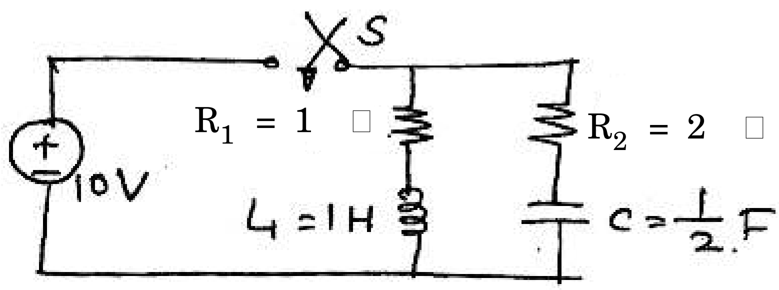


Fig. 8

8. (*a*) Write short notes on 'Z' and 'Y' parameters :

(*i*) Network diagram [2]

(*ii*) Basic equations [2]

(*iii*) Conditions of symmetry and reciprocity [2]

(*iv*) Relationship between Z and Y parameters. [2]

(*b*) Explain ABCD parameters with formula. [8]

Or

9. (*a*) Mention H parameters and draw equivalent network of two port network in terms of *h*-parameters. [8]

(*b*) State the condition for reciprocity and symmetry and also draw the equivalent network for :

(*i*) Z parameters [4]

(*ii*) Y parameters. [4]

10. (*a*) Explain basic types of filters. [10]

(*b*) Obtain a system function H(*s*) that exhibits the Chebyshev characteristics with not more than 1 dB ripple in pass band and attenuation of 20 dB at $\frac{1}{16}$ = 2 rad/sec. [8]

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

[4062]-171

S.E. (Chem/Petro/Polymer/Printing/Bio-tech)

(First Semester) EXAMINATION, 2011

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

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

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

(*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

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

(*i*) $(D^2 - 2D + 5)y = 10 \sin x$

(*ii*) $\left(D^2 + 6D + 9\right)y = \frac{1}{x^3}e^{-3x}$

(*iii*) $\frac{d^2y}{dx^2} + \frac{dy}{dx} = \frac{1}{1+e^x}$

(*iv*) $(D^2 + 4)y = \sec 2x$

(By using method of variations)

(*v*) $x^2 \frac{d^2y}{dx^2} - 4x\frac{dy}{dx} + 6y = x^5$

(*b*) Solve : [5]

$$\frac{dx}{1} = \frac{dy}{3} = \frac{dz}{5z + \tan(y - 3x)}.$$

Or

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

(*i*) $(D^2 + 3D + 2)y = \sin e^x$

(*ii*) $(D^4 + D^2 + 1)y = 53x^2 + 17$

(*iii*) $(D^2 - 2D + 1)y = xe^x \sin x$

(*iv*) $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 2\sin[\log(1+x)]$.

(*v*) $(D^2 - 2D + 2)y = e^x \tan x$

(By using method of variations)

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

$$\frac{du}{dx} + v = \sin x$$

$$\frac{dv}{dx} + u = \cos x.$$

3. (*a*) A mass m suspended from the end of helical spring is subjected to a periodic force $f = \text{F} \sin \frac{1}{16}t$ in the direction of its length. The force f is measured positive vertically downward and at zero time, m is at rest. If the spring stiffness is k, show that the displacement of mass m at time t from the commencement of spring is given by :

$$x = \frac{\text{F}}{m(p^2 - \omega^2)}\left[\sin \omega t - \frac{\omega}{p} \sin pt\right]$$

where $p^2 = \dfrac{k}{m}$. [8]

(*b*) Solve the equation $\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} = 0$ with the conditions : [8]

(*i*) $v = 0$ when $y \to \infty$ for all x

(*ii*) $v = 0$ when $x = 0$ for all values of y

(*iii*) $v = x(1 - x)$ when $y = 0$ for $0 < x < 1$.

Or

4. (*a*) In a heat exchange, the temperatures x and y of two liquids, satisfy the equations :

$$4\frac{dx}{dt} = y - x = 2\frac{dy}{dx}.$$

Find the temperatures x and y as a function of time, given that $x = 20$ and $y = 100$ at time $t = 0$. [8]

(*b*) A bar with insulated sides is initially at temperature 0°C throughout. The end $x = 0$ is kept at 0°C for all time and the heat is suddenly applied so that $\frac{\partial u}{\partial x} = 10$ at $x = l$ for all time. Find the temperature function $u(x, t)$ [8]

5. (*a*) Express the function

$$f(x) = \begin{cases} 1 & \text{when } |x| \le 1 \\ 0 & \text{when } |x| > 1 \end{cases}$$

as a Fourier integral.

Hence evaluate :

$$\int_0^\infty \frac{\sin \lambda \cos \lambda x}{\lambda} d\lambda .$$ [6]

(*b*) Using Fourier integral, show that :

$$\int_0^\infty \frac{\lambda^3 \sin \lambda x}{\lambda^4 + 4} d\lambda = \frac{\pi}{2} e^{-x} \cos x$$

where $x > 0$. [6]

(*c*) Find the Fourier cosine transform of the function : [5]

$f(x) = \cos x$ if $0 < x < a$

$= 0$ if $x > a$.

Or

6. (*a*) Find Fourier sine transform of $f(x) = e^{-\beta x}$, $0 < x < \infty$ and hence show that : [5]

$$\frac{\pi}{2} e^{-\beta x} = \int_0^\infty \frac{\lambda \sin \lambda x}{\beta^2 + \lambda^2} d\lambda$$

for $\beta > 0$.

(*b*) Solve the integral equation : [5]

$$\int_0^{\infty} f(x) \cos \lambda x \, dx = e^{-\lambda}$$

where $\lambda > 0$.

(*c*) Determine the distribution of temperature in the semi-infinite medium $x > 0$, when the end $x = 0$ is maintained at zero temperature and initial distribution of temperature is $f(x)$. Use Fourier transform. [7]

SECTION II

7. (*a*) Find Laplace Transform (any *three*) : [12]

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

(*ii*) $\dfrac{\cos 2t - \cos 3t}{t}$

(*iii*) $f(t) = \begin{cases} t/5 & 0 \le t < 5 \\ 1 & t > 5 \end{cases}$

(*iv*) $t^2 U(t - 2) - \cosh t \, \delta(t - 4)$.

(*b*) Evaluate : [4]

$$\int_0^{\infty} \frac{e^{-3t} - e^{-6t}}{t} dt .$$

Or

8. (*a*) Find Inverse Laplace Transform (any *three*) : [12]

(*i*) $\dfrac{e^{-3s}}{\sqrt{s+4}}$

(*ii*) $\tan^{-1}\left(\dfrac{1}{s}\right)$

(*iii*) $\dfrac{2s+5}{s^2-2s-3}$

(*iv*) $\dfrac{1}{(s+1)(s^2+1)}$ (Use convolution theorem)

(*b*) Find the Laplace Transform of the periodic function with period 2 : [4]

$$f(t) = 4 - t^2,\ 0 < t < 2, \text{ given } f(t+2) = f(t).$$

9. (*a*) Find the directional derivative of $\phi = xy^2 + yz^3$ at the point $(1, -1, 1)$ along the tangent to the curve $x = e^t \cos t$, $y = e^t \sin t$, $z = e^t$ at $t = 0$. [6]

(*b*) Show that :

$$\bar{F} = (2xz^3 + 6y)\,\hat{i} + (6x - 2yz)\,\hat{j} + (3x^2z^2 - y^2)\hat{k}$$

is irrotational. Find the scalar potential ϕ such that :

$$\bar{F} = \nabla\phi.$$ [6]

(*c*) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ for :

$$\bar{F} = (2xy + 3z^2)\,\hat{i} + (x^2 + 4yz)\,\hat{j} + (2y^2 + 6xz)\hat{k}$$

along the curve $x = t$, $y = t^2$, $z = t^3$ from $t = 0$ to $t = 1$. [6]

Or

10. (*a*) Establish the vector identities (any *two*) : [6]

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

(*ii*) $\nabla \times \left[\bar{a} \times (\bar{b} \times \bar{r}) \right] = \bar{a} \times \bar{b}$

(*iii*) $\nabla \cdot \left(\frac{\bar{a} \times \bar{r}}{r} \right) = 0$

(*b*) Evaluate $\iint_S (x\,\hat{i} + y\,\hat{j} + z^2\,\hat{k}) \cdot d\bar{S}$, where S is the curved surface of the cylinder $x^2 + y^2 = 4$ bounded by the planes $z = 0$ and $z = 2$, using divergence theorem. [6]

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

$$\iint_S (\nabla \times \bar{F}) \cdot d\bar{S}, \text{ where}$$

$\bar{F} = (x^3 - y^3)\,\hat{i} - xyz\,\hat{j} + y^3\,\hat{k}$ and S is the surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the plane $x = 0$. [6]

11. (*a*) Solve the differential equation using Laplace transform method : [6]

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 3y = 10e^{-2t}$$

with $y(0) = 0$, $y'(0) = 0$.

(*b*) Show that the velocity potential $\phi = \frac{1}{2}a(x^2 + y^2 - 2z^2)$ satisfies the Laplace's equation. Also determine the stream lines. [5]

(*c*) The transfer function of a second order system is given as : [5]

$$G(s) = \frac{10}{s^2 + 1.6s + 4} \quad \text{with } (\tfrac{1}{18} < 1)$$

Find overshoot, $y(t)_{max}$ and period of oscillations.

Or

12. (*a*) Solve by using Laplace Transform method : [6]

$$\frac{dy}{dt} + 3y(t) + 2\int_0^t y(t)\, dt = t,$$

given $y(0) = 0$.

(*b*) Find the surfaces of equipressure in case of steady motion of a liquid which has velocity potential □ = log x + log y + log z under the action of force $\overline{F} = yz\,\hat{i} + zx\,\hat{j} + xy\,\hat{k}$. [5]

(*c*) The transfer function of an non-interacting system is given by :

$$G(s) = \frac{R_2}{(T_1 s + 1)(T_2 s + 1)} = \frac{H_2(s)}{Q(s)}$$

where R_2 is process gain and T_1, T_2 are time constants. Determine the height level of second tank if unit step change is made in the inlet flow $Q(t)$. [5]

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

[4062]-172

S.E. (Printing) (First Semester) EXAMINATION, 2011

STRENGTH OF MACHINE ELEMENTS

(2008 PATTERN)

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

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

(*ii*) Use separate answer-books for Sections A and B.

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

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

(*v*) Draw neat diagrams wherever necessary.

SECTION I

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

(*i*) Allowable stress

(*ii*) Thermal stress

(*iii*) Bulk modulus

(*iv*) Lateral strain. [8]

(*b*) Draw and explain typical stress-strain diagram for ductile materials indicating all the salient points. [4]

(*c*) A steel circular bar PQRS fixed rigidly at P and S, is subjected to axial loads of 60 kN and 120 kN at Q and R as shown in Fig. 1. Find loads shared by each part of the bar and displacement of the points Q and R. Take E for steel as 207 GPa. [6]

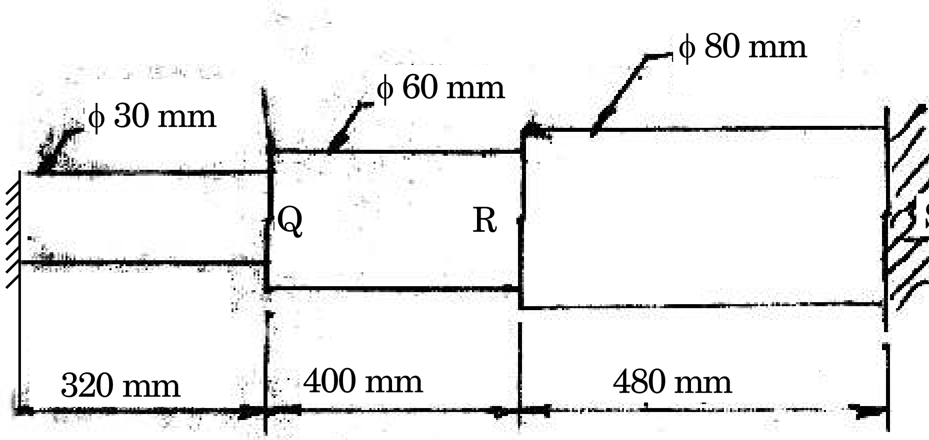


Fig. 1

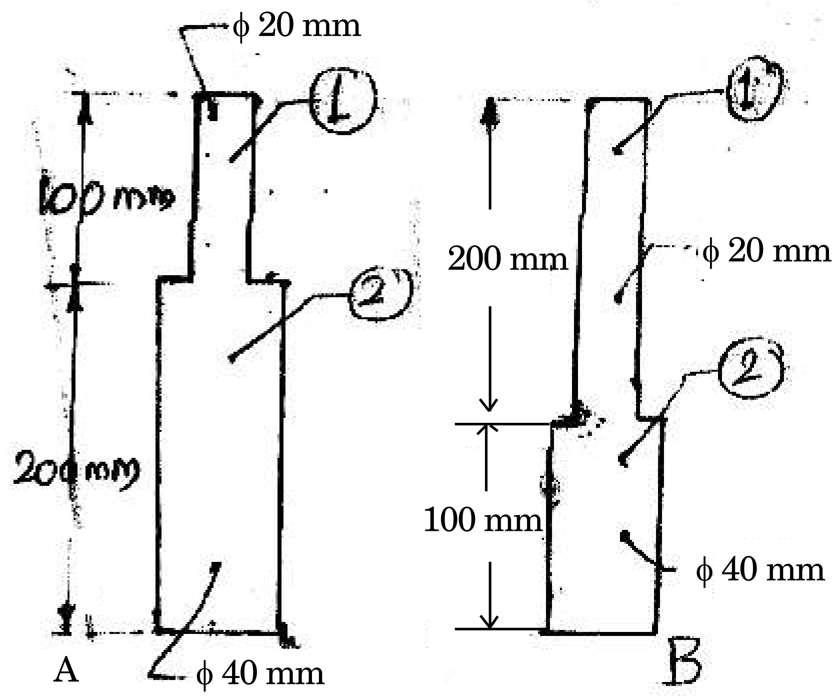
P.T.O.

Or

2. (*a*) Show that with usual notations, elongation of the bar of length '*l*', density 'ρ' due to self weight is given by : [8]

$$d_l = \frac{9.81\, r\, l^2}{2E}$$

(*b*) Two similar bars A and B are each 300 mm long as shown in Fig. 2. If bar A receives an axial blow, which produces a maximum stress of 200 MPa :



Calculate :

(*i*) Maximum stress produced by the same blow on the bar B

(*ii*) Ratio of energy stored by bars A and B, if bar B is stressed to 200 MPa. [10]

3. (*a*) A beam of span 20 m is loaded as shown in Fig. 3. Draw SFD and BMD. [12]

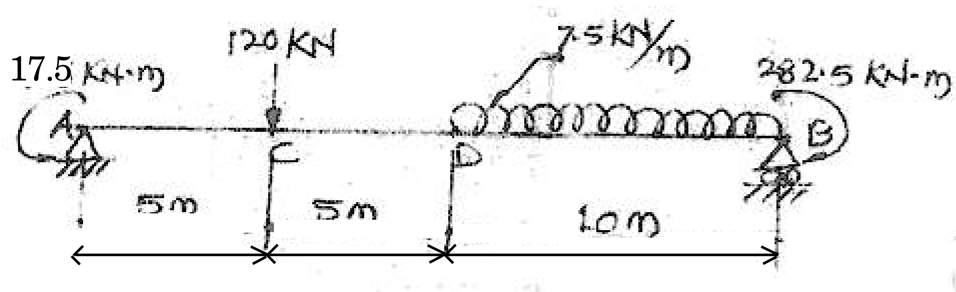


Fig. 3

(*b*) Explain the concept of shearing force and bending moment diagram for a cantilever with uniformly distributed load of intensity '*w*' and span '*l*'. [4]

Or

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

(*i*) SFD

(*ii*) BMD

(*iii*) Point of contraflecture.

(*b*) A beam AB 10 metres long carries UDL of 20 kN/m over its entire length together with concentrated load 50 kN at the left end A and 80 kN at end B. The beam is to be supported at two points 6 metres apart such that the reaction is same at each support. Determine position of supports and plot SFD and BMD. [10]

5. (*a*) Explain the significance of the following terms : [6]

(*i*) Neutral axis

(*ii*) Moment of resistance

(*iii*) Section modulus.

(*b*) Calculate the intensity of uniformly distributed load that a SSB of span 4 m and cross-section as shown in Fig. 4 can carry, if the permissible stresses are 120 MPa, in compression and 40 MPa, in tension. Also draw bending stress distribution diagram. [10]

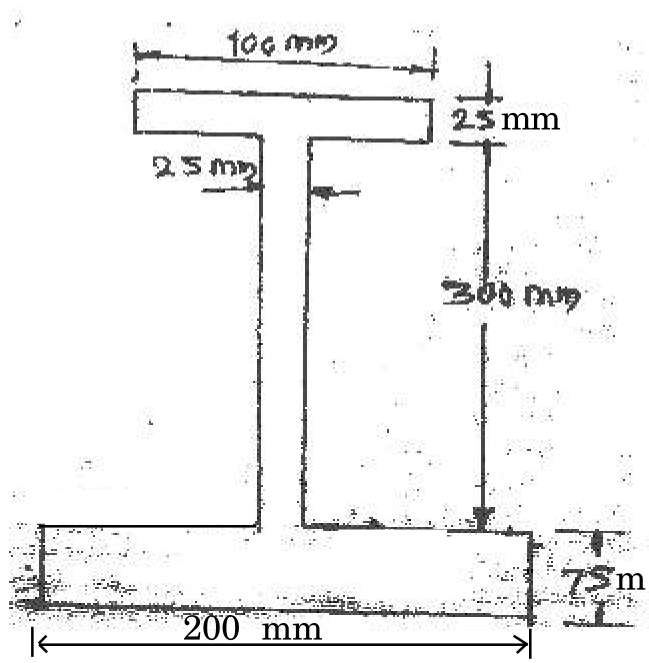


Fig. 4

Or

6. (*a*) Draw shear stress distribution for the following sections :

(*i*) Rectangular

(*ii*) Solid circle

(*iii*) Hollow circle

(*iv*) T-section

(*v*) I-section. [10]

(*b*) A T-section as shown in Fig. 5 is subjected to a vertical shear force of 100 kN. If M.I. about N.A. is 0.0001134 m^4, calculate :

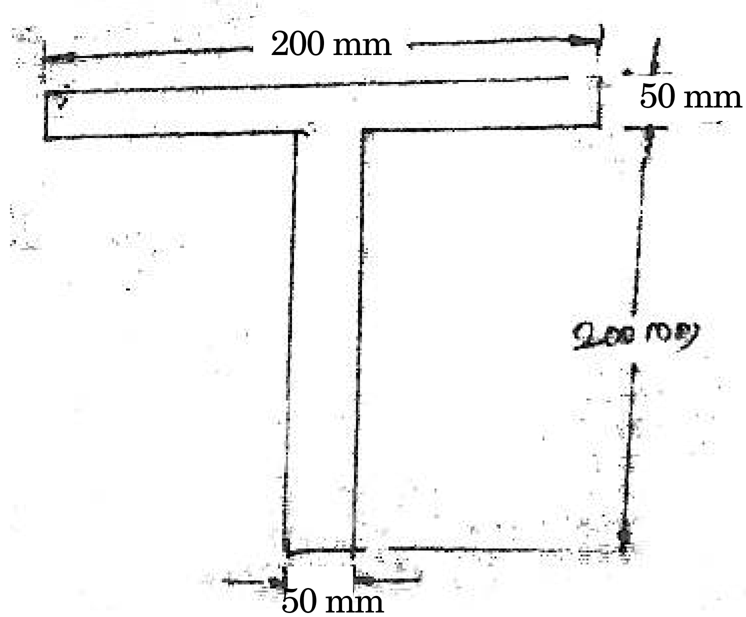


Fig. 5

(*i*) Shear stress in the web at the junction of web and flange

(*ii*) Shear stress in the flange at the junction flange and web. [6]

SECTION II

7. (*a*) Derive torsion equation with usual notations, for solid circular shaft. [8]

(*b*) A hollow shaft is subjected to a torque of 40 kN.m and a bending moment of 30 kN.m. If the ratio of outer to internal diameter of the shaft is 2 and if maximum shear stress is not to exceed 80 MPa, calculate diameter of the shaft. [8]

Or

8. (*a*) Derive Euler's formula for buckling load for column with both ends hinged. [8]

(*b*) Define and explain the following terms : [8]

(*i*) Column and strut

(*ii*) Short and long column

(*iii*) Slenderness ratio

(*iv*) Buckling load.

9. A shaft is subjected to maximum torque of 10 kN.m and maximum bending moment of 7.5 kN.m at a particular section. If the allowable equivalent stress in simple tension is 160 MPa, find diameter of the shaft according to :

(*i*) Maximum shear stress theory

(*ii*) Strain energy theory.

Take Poisson's ratio = 0.24. [16]

Or

10. (*a*) The principal stresses at a point across two perpendicular planes are 75 MPa (tensible) and 35 MPa (tensile). Find normal, tangential and resultant stress and its obliquity on a plane at 20° with major principal plane. [8]

(*b*) A shaft of 100 mm diameter is subjected to bending moments of 4000 N.m and a torque of 6000 N.m. Calculate principal stresses induced and their location. [8]

11. (*a*) For a cantilever of span 'L' loaded with UDL of intensity 'W' per unit length over its entire span, show that the deflection at free end is given by : [8]

$$y = \frac{WL^4}{8\,EI}$$

(*b*) A SSB of span 10 m carries point loads of 30 kN, 120 kN and 60 kN respectively at 2 m, 5 m and 9 m from its left support. Determine position and magnitude of maximum deflection. Take E = 200 GPa and I = 700 × 10^6 mm^4

Use Macaulay's method. [10]

Or

12. (*a*) With usual notations derive [10]

$$M = EI \frac{d^2y}{dx^2}$$

(*b*) A girder of uniform section is simply supported over a span of 3 metres. If the point load at the mid span is 30 kN and $I_{xx} = 15.614 \times 10^{-6}$ m^4, calculate :

(*i*) Central deflection

(*ii*) The slopes at the ends of the beam.

Take E = 200 GPa. [8]

Total No. of Questions—**6**] [Total No. of Printed Pages—**2**

[4062]-173

S.E. (Printing) (First Sem.) EXAMINATION, 2011

BASIC ELEMENTS OF PRINTING TECHNOLOGY

(2008 PATTERN)

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

N.B. **:—** Solve any *three* questions from each Section.

SECTION I

1. Describe any *four* types of originals for print production. [16]

Or

What are the basic properties of an ideal original ? [16]

2. What is lithography ? Explain in detail. [16]

Or

Compare Intaglio and Gravure printing. [16]

3. Discuss the various stages in finishing of a hard bound book. [18]

Or

Explain UV lamination and film lamination in detail. [18]

SECTION II

4. Discuss in detail : [18]

(1) Bleed

(2) Cut marks

(3) Registration marks.

Or

What is Imposition ? Explain with example for a 8 page layout. [18]

5. What is additive and subtractive theory ? Write in detail. [16]

Or

Write notes on : [16]

(*a*) Grey balance

(*b*) Ink deficiency.

6. What are file formats ? Describe any *three*. [16]

Or

What are compressible and non-compressible file formats ? [16]

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

[4062]-174

S.E. (Printing) (I Sem.) EXAMINATION, 2011

PRINTING DIGITAL ELECTRONICS

(2008 PATTERN)

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

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

Section I : Q. No. **1** *or* Q. No. **2**; Q. No. **3** *or* Q. No. **4**; Q. No. **5** *or* Q. No. **6**.

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*) Assume suitable data, if necessary.

SECTION I

1. Perform the following conversions : [18]

(*a*) $(99)_{10}$ to BCD and Binary and Hexadecimal.

(*b*) $(326)_8$ to Decimal and Binary and Hexadecimal.

(*c*) $(ABB)_{16}$ to Octal, Decimal and Binary.

Or

2. (*a*) What are Gray Codes ? Design a four bit Binary to Gray Code Converter. Draw truth table, K-maps and neat diagram. [10]

(*b*) State and explain the different Codes. State the rules to be followed for addition of BCD numbers. [8]

3. (*a*) The logical circuit shown in Fig. 1 with inputs A, B, C and D is used to turn the Light Indicator (Y) of a printing machine ON and OFF. Write a Boolean expression for the light indicator output Y and prepare a truth table for the same. [8]

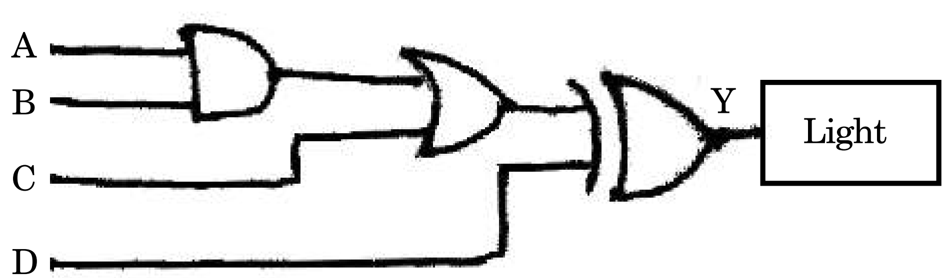


Fig. 1

(*b*) The functionality of a printing machine with four variables A, B, C, D is expressed as :

$f(A, B, C, D) = \Sigma m(0, 1, 5, 8, 9, 13, 14, 15) + d(3, 4, 7, 10, 11)$.

Simplify using K-map and draw simplified diagram using NAND gates only. [8]

Or

4. (*a*) The logic circuit in Fig. 2 is being used to activate two alarms labeled D and B. The inputs X and Y represent the Temperature and Pressure sensor outputs respectively. Write a Boolean expression for the outputs D and B. Prepare a truth table of the circuit. [8]

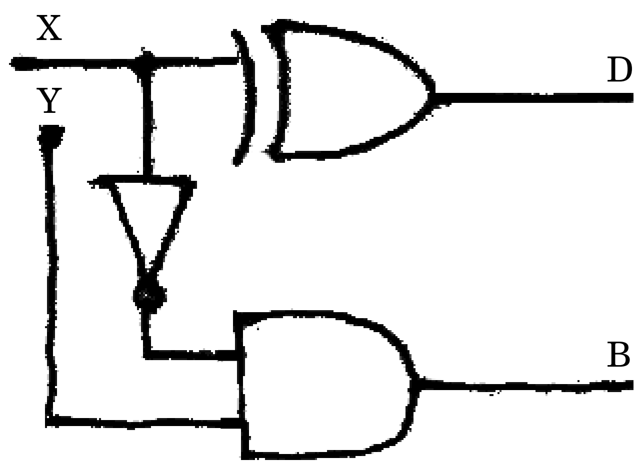


Fig. 2

(*b*) Simplify the following Boolean expressions and implement using basic gates : [8]

(*i*) $X = \left(\bar{A} + B\right)\left(A + B + \bar{D}\right) D$

(*ii*) $Z = \bar{A}\bar{B}C + \bar{A}BC + ABC.$

5. (*a*) Perform the following : [8]

(*i*) Multiply $(11011)_2$ by $(1010)_2$

(*ii*) Divide $(1111101)_2$ by $(101)_2$.

(*b*) Prepare a truth table and draw K maps for a Full Adder circuit. Draw the simplified diagram. [8]

Or

6. (*a*) Design : [8]

(*i*) One Bit Comparator and

(*ii*) Half Adder Circuit.

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

(*i*) $(25)_2 - (18)_2$ using 2's complement method.

(*ii*) Perform BCD addition and express the result in BCD form :

$$(99)_{10} + (99)_{10}.$$

SECTION II

7. (*a*) Draw and explain clocked RS Flip-Flop. Draw a neat truth table and its timing diagrams. [10]

(*b*) Design and explain Mod 10 counter. Draw timing diagrams. [8]

Or

8. (*a*) Draw and explain MS J-K flip-flop. Draw relevant timing diagrams. [10]

(*b*) Explain any *one* application of counter that may be used in the field of Printing. [8]

9. (*a*) Explain Programmable Logic Devices. Draw and explain a PLA with example. [8]

(*b*) Write short notes on Display devices. State their applications. [8]

Or

10. (*a*) Explain LED, Seven segment LED display and LCD. [8]

(*b*) What is DAC ? Explain the working of any *one* type of DAC with a neat diagram. [8]

11. (*a*) State and explain the role of Digital Electronics in Printing industry. [8]

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

(*i*) Joystick

(*ii*) Digital camera.

Or

12. Write short notes on : [16]

(*a*) Digital scanner

(*b*) Operation of mouse

(*c*) Input-Output devices of a computer

(*d*) Serial and Parallel ports.

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[4062]-175

S.E. (Printing) (First Semester) EXAMINATION, 2011

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*) Draw the schematic diagram of Offset Lithographic Printing Machine, label the parts and explain the function of each in brief. Also explain the importance of various metals used from printing point of view in brief. [12]

(*b*) List down the characteristics of LDPE material. [4]

Or

(*a*) Draw the schematic diagram of Gravure Printing Machine, label the parts and explain the function of each in brief. Also explain the importance of various metals used printing point of view in brief. [12]

(*b*) List down the characteristics of PP material. [4]

P.T.O.

2. (*a*) Draw the schematic diagram of photographic film, label the diagram and explain the function of each in brief. [10]

(*b*) Explain the term Adhesion. Also explain Natural and Synthetic adhesives in brief. [6]

Or

(*a*) With the help of schematic diagram, explain the procedure of preparing the film Negative and Positive. [10]

(*b*) Differentiate between any *two* methods of preparing the screen. [6]

3. Explain any *three* : [18]

(*a*) Paste ink and its characteristics

(*b*) Liquid ink and its characteristics

(*c*) Rheological properties of an ink

(*d*) Factors deciding the formulation of an ink.

Or

Explain any *three* : [18]

(*a*) Pigments in the ink

(*b*) Vehicles in the ink

(*c*) Additives in the ink

(*d*) Triple roll mill.

SECTION II

4. (*a*) Explain any *two* in brief : [8]

(*i*) Solvent resistance of an ink

(*ii*) Cobb factor of paper

(*iii*) Light fastness of an ink

(*iv*) Grain direction of paper.

(*b*) Explain Absorption and Evaporation drying of an ink. [8]

Or

(*a*) Explain any *two* in brief : [8]

(*i*) Viscosity

(*ii*) Tack

(*iii*) Yield

(*iv*) Thixotropy

(*v*) Length

(*b*) Describe the method of measuring the viscosity of liquid ink. [8]

5. (*a*) Explain the importance of 'Paper per capita consumption' on the development of nation. [8]

(*b*) Draw a neat diagram of cellulose fiber and explain the importance of each part in paper making. [8]

Or

(*a*) Comment on any *two* : [8]

(*i*) Semichemical pulp

(*ii*) Chemical pulp

(*iii*) Mechanical pulp

(*iv*) Export potential of paper products.

(*b*) State the merits and demerits of hardwood pulp and softwood pulp. [8]

6. (*a*) Draw a neat diagram of Fourdrinier machine and label the parts. [10]

(*b*) Comment on any *two* : [8]

(*i*) Bursting strength

(*ii*) Acidity and pH of paper

(*iii*) Opacity of paper

(*iv*) Coated paper

(*v*) Importance of BIS/TAPPI standards.

Or

(*a*) Explain in detail the importance of combination of Fourdrinier machine and Multivat cylinder mould machine in the production of thick boards. [10]

(*b*) State the importance of fillers in paper industry with reference to printing. [8]

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

[4062]-176

S.E. (Printing) (Second Semester) EXAMINATION, 2011

ELECTRICAL MACHINES AND UTILIZATION

(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 starting and reversing of d.c. shunt motor. [8]

(*b*) A 25 kW, 250 V, dc shunt generator has armature and field resistance of 0.06 Ω and 100 Ω respectively. Determine the total armature power developed when working : [8]

(*i*) As generator delivering 25 kW output and

(*ii*) As a motor taking 25 kW input.

P.T.O.

Or

2. (*a*) Explain torque equation in detail for d.c. motor and give relation between torque and voltage. [8]

(*b*) A 250 V shunt motor drives a 700 Nm torque load when running at 1200 rpm. The armature resistance is 0.008 □ and shunt field resistance is 55 □, the motor efficiency is 90%, calculate the value of the dynamic braking resistor that will be capable of 375 Nm torque at 1050 rpm. [8]

3. (*a*) Explain the double revolving theory for 1-□ induction motor. [8]

(*b*) It is desired to install a 3-□ cage induction motor restricting the maximum line current drawn from a 400 V, 3-□, supply to 120 A. If the starting current is six time full load current, what is the maximum permissible full load kVA of the motor when : [8]

(*i*) it is directly connected to the mains ?

(*ii*) it is connected through an autotransformer with 60% tapping ?

(*iii*) it is connected to star-delta starter ?

Or

4. (*a*) Explain torque-slip and torque power characteristic with operating modes for 3-□ induction motor. [8]

(*b*) A 100 HP, 400 V, 50 Hz star connected induction motor has a star connected slip ring rotor with a transformation ratio of 2.5. The rotor resistance per phase is 0.02 □ and inductance 0.6 mH. Stator losses in the motor can be assumed negligible. Calculate : [8]

(*i*) Rotor starting current per phase on normal voltage with slip-rings short circuited.

(*ii*) The rotor power factor at starting.

(*iii*) The rotor current at 3% slip.

(*iv*) The rotor power factor at 3% slip.

5. (*a*) Explain reluctance type stepper motor with working. [8]

(*b*) A 4-pole, 400 V, 50 Hz, 3-□ star connected synchronous motor has a synchronous reluctance of 2.0 □ per phase. The resistance of the stator winding is negligible. The field excitation is so adjusted that the excitation voltage is equal to the supply voltage on application of load, the rotor is retarded by four mechanical degrees. Find the armature current drawn by the motor. [10]

Or

6. (*a*) Explain selection of motors depending on load characteristics. [8]

(*b*) A 10 kW, 400 V, 3-□ star connected synchronous motor has per phase synchronous impedance of 0.4 + j3 □. Find the angle of retard and the voltage to which the motor must be excited to give a full load output at 0.8 power factor leading. Assume the efficiency at full load is 85%. [10]

SECTION II

7. (*a*) What do you mean by reactive power ? Explain reactive power measurement by using two wattmeter method. [8]

(*b*) A 3-□, 10 kVA load has a power factor of 0.34 □. The power is measured by two wattmeter method. Find the reading of each wattmeter when : [8]

(*i*) Power factor is leading

(*ii*) Power factor is lagging.

Or

8. (*a*) Explain in detail various types of limit switches, proximity switches, microswitches. [8]

(*b*) A 400 V, 3-□ star connected induction motor drawn a line current of 20 A and input power of 12 kW. The sequence is R-Y-B. A wattmeter has its current coil in line Y and the pressure coil connected across B-R. Sketch the connection diagram and phasor diagram. Hence find the reading on wattmeter. [8]

9. (*a*) Explain types of furnaces used in electrical heating. [8]

(*b*) An electric furnace consuming 5 kW takes 15 minutes to just melt 4 lbs of aluminium, the initial temperature being 15°C, find the efficiency of the furnace. Specific heat of aluminium 0.212, melting point 658°C and latent heat of fusion 76.8 cal per gm. [8]

Or

10. (*a*) Explain temperature control methods of furnaces. [8]

(*b*) A 20 kW, 1-□, 220 V resistance oven uses a circular nichrome wire for its heating element. If the wire temperature is not to exceed 1100°C and the temperature of the charge to be 400°C. Calculate the size and length of the wire required. Assume radiating efficiency 0.6, emissivity 0.9 and specific resistivity of wire material is 1.09×10^{-6} □m. [8]

11. (*a*) Explain design of flood lighting and explain the design considerations. [8]

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

(*i*) Space to height ratio

(*ii*) Absorption factor

(*iii*) Coefficient of utilization

(*iv*) Beam factor.

Or

12. (*a*) Write a short note on energy conservation in printing industry. [8]

(*b*) A light source having an intensity of 400 C_P in all directions is fitted with a reflector so that it directs 80% of its light along a beam having a divergence of 15. Determine the average illumination produced on a surface normal to the beam direction at a distance of 8 m. [10]

Total No. of Questions—**6**] [Total No. of Printed Pages—**3**

[4062]-178

S.E. (Printing) (II Sem.) EXAMINATION, 2011

PRINT FINISHING

(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. (1) Draw a neat labelled diagram of constructional parts of Book. [18]

Or

(2) Draw and explain the tools and equipments used in Book Binding.

2. (1) List down the raw-materials used in print finishing. Also explain the properties and requirements of the material. [16]

Or

(2) Write short notes on the following (any *two*) :

(*a*) Reinforcing materials

(*b*) Covering materials

(*c*) Securing materials

(*d*) Miscellaneous materials.

3. (1) Explain stages of forwarding and pre-forwarding operations. [16]

Or

(2) Write short notes on (any *two*) :

(*a*) Numbering

(*b*) Perforating

(*c*) Spiral binding.

SECTION II

4. (1) Draw a Plant Layout for an ideal print finishing setup. [18]

Or

(2) Explain the general responsibilities of store-keeper.

5. (1) State considerations for costing of a Book Binding Job. [16]

Or

(2) What care will you take to protect the paper in storage ?

6. (1) Draw a neat labelled diagram of Cutting machine. [16]

Or

(2) Write short notes on (any *two*) :

(*a*) Wire stitching machine

(*b*) Wet and heat seal lamination

(*c*) Cutting machine

(*d*) Perfect binding.

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

[4062]-179

S.E. (Printing) (Second Sem.) EXAMINATION, 2011

MICROPROCESSOR AND MICROCONTROLLER TECHNIQUES IN PRINTING

(2008 PATTERN)

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

N.B. **:—** (*i*) Answer *three* questions from Section I and *three* questions from II 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 following pins of 8085 microprocessor (any *four*) : [8]

(*i*) ALE

(*ii*) RST 7.5

(*iii*) IO/M

(*iv*) INTR

(*v*) TRAP.

P.T.O.

(*b*) What are different resisters available in 8085 microprocessor? Explain in detail the typical use of each register. [10]

Or

2. (*a*) Draw and explain the block diagram of 8085 in detail. [10]

(*b*) Explain address and data buses of 8085 in detail. [8]

3. (*a*) Explain any *four* branching (jump) instructions in 8085 with suitable example. [8]

(*b*) Explain unconditional jump and different conditional jump instructions in 8085. [8]

Or

4. (*a*) Explain the following instructions in 8085 with suitable example :

(*i*) MOV A, B

(*ii*) ADD B

(*iii*) MVI B, 32

(*iv*) LXI H, 2000

(*v*) DCR B. [10]

(*b*) Explain Flag register in 8085 microprocessor. [6]

5. (*a*) Draw pin diagram of 8051 microcontroller and explain different pins in detail. [10]

(*b*) Explain SCON (Serial port control register) in 8051 microcontroller. [6]

Or

6. (*a*) Explain memory management in 8051 microcontroller. [10]

(*b*) Explain program status word (PSW) in 8051 microcontroller. [6]

Section II

7. (*a*) Explain different addressing modes in 8051 microcontroller. [10]

(*b*) Explain the following instructions in 8051 (any *four*) : [8]

(*i*) ADD A,#12

(*ii*) MUL AB

(*iii*) ORL A,#36

(*iv*) CLR A

(*v*) ADD A,@Rn

Or

8. (*a*) Explain any *five* logical operation instructions in 8051 microcontroller. [10]

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

(*i*) RS 232

(*ii*) IEEE 488.

9. (*a*) Draw and explain block diagram of Programmable Interrupt controller 8259. [10]

(*b*) Draw and explain transmitter section in programmable communication Interface USART IC 8251. [6]

Or

10. (*a*) Draw and explain block diagram of Programmable Interval Timer IC 8253. Explain control word for the same. [8]

(*b*) Explain any *one* mode of programmable peripheral IC 8255. [8]

11. (*a*) Explain concept of PLC. [8]

(*b*) Write program for printer interface with 8085 microprocessor. [8]

Or

12. (*a*) Explain use of microprocessor in paper cutting machine. [8]

(*b*) Explain any *one* application of microprocessor 8085 in field of printing. [8]

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

[4062]-181

S.E. (Chemical) (First Semester) EXAMINATION, 2011

CHEMISTRY—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.

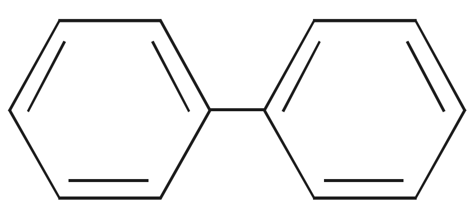
(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

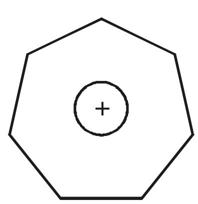
(*vi*) Assume suitable data, if necessary.

SECTION I

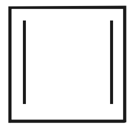
1. (*a*) Write the postulates of the molecular orbital theory. Draw the MO diagram for the O_2^- molecule and find its bond order. [6]

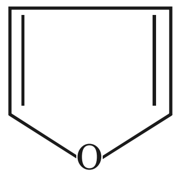
(*b*) Show whether the following compounds are aromatic : [6]

(*i*) 

(*ii*) 

P.T.O.

(*iii*) 

(*iv*) 

(*c*) Give reasons for the following : [6]

(*i*) Aniline is a weaker base than cyclohexylamine

(*ii*) Monochloroacetic acid is stronger than acetic acid

(*iii*) Pyrrole is a weak base.

Or

2. (*a*) What are the conditions for resonance ? Draw the resonance structures of : [6]

(*i*) Benzaldehyde

(*ii*) Phenol

(*iii*) Aniline.

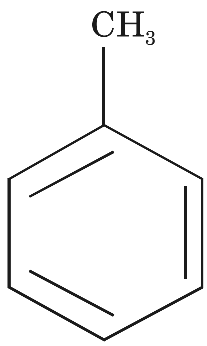
(*b*) Discuss the orbital structure of carbocation and carbanion. Give *two* methods of generation of each. [6]

(*c*) Draw the shapes of the molecular orbitals formed by the overlap of different atomic orbitals. [6]

3. (*a*) Compare the S_N1 and S_N2 reactions on the basis of mechanism, stereochemistry and energy profile diagram. [6]

(*b*) Write a short note on Friedel-Crafts acylation reaction. [4]

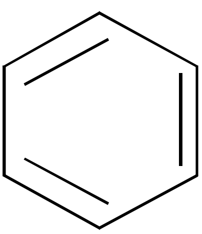
(*c*) Predict the product : [6]

(*i*)  $\xrightarrow[\text{con } H_2SO_4]{HNO_3}$

(*ii*) $H_3C-CH_2-\underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3 \xrightarrow[\text{Polar Solvent}]{NaOEt}$

(*iii*) $Ph-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow[H^+]{NH_2OH}$

(*iv*) $CH_3-CH_2-CH = CH_2 \xrightarrow{HBr}$

(*v*)  $+ C_{15}H_{13}OH \xrightarrow[AlCl_3]{\text{anhydrous}}$

(*vi*) $CH_3CH_2COCl \xrightarrow{NaNH_2}$

Or

4. (*a*) Write a note on E1 and E2 mechanism. [6]

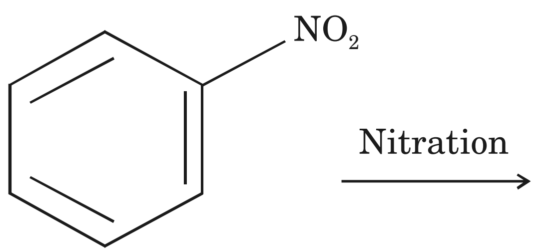
(*b*) Explain the following : [4]

(*i*) Toluene undergoes electrophilic substitution reactions faster than benzene.

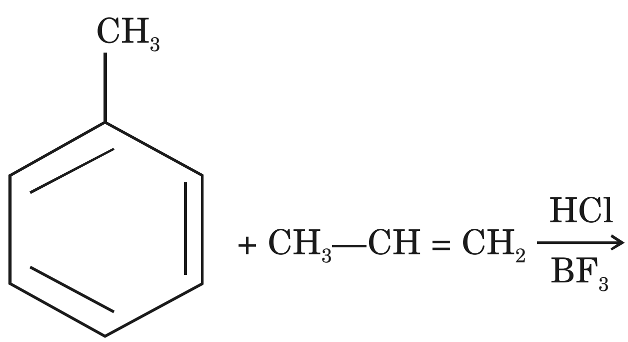
(*ii*) $—OCH_3$ group is activating and o, p directing.

(*c*) Complete the following reactions : [6]

(*i*)

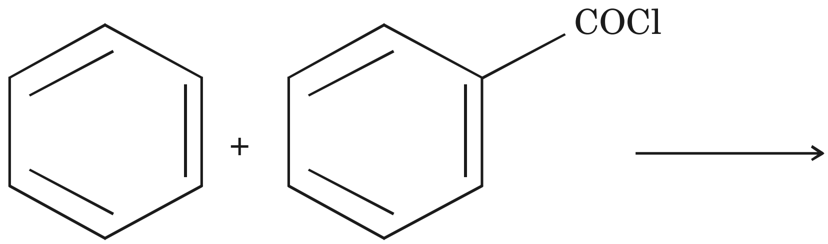


(*ii*)



(*iii*) $$CH_3—\underset{\underset{\displaystyle O}{\|}}{C}—CH_3 + Br—CH_2COOC_2H_5 \xrightarrow[(ii)\ H^+,\ H_2O]{(i)\ Zn,\ ether}$$

(*iv*)

(*v*) 

(*vi*) $H_3C—\underset{}{\overset{CH_3}{\overset{|}{C}}} = CH—CH_3 + HCl \longrightarrow$

5. (*a*) Define conductometric titrations and explain the titration curve for neutralization of a strong acid with a strong base and a strong acid with a weak base. [6]

(*b*) Discuss the principle, applications and interferences of Flame photometry. [6]

(*c*) The resistance of 0.5 N solution of a salt occupying a volume between 2 electrodes 1.2 cm apart and having area 2.2 cm^2 was found to be 25 ohm. Calculate the equivalent conductance of the solution. [4]

Or

6. (*a*) What are ion selective electrodes ? Describe any *one* of them. [4]

(*b*) Explain Kohlrausch's law. At 18°C the equivalent conductance at infinite dilution of NH_4Cl, NaOH and NaCl are 129.8, 217.4 and 108.9 ohm^{-1} cm^2. Calculate the equivalent conductance at infinite dilution of NH_4OH. If equivalent conductance of 0.001 N solution of NH_4OH at 18°C is 9.33, calculate the degree of dissociation of NH_4OH at this concentration. [6]

(*c*) What are potentiometric titrations ? Mention the types and describe the redox titrations in detail. [6]

SECTION II

7. (*a*) Derive the integrated rate expression for a second order reaction involving reactants with equal initial concentration. [6]

(*b*) For a second order reaction 2 AB ${}^{23}_{11}$ $A_2 + B_2$ the rate constant is 2.4×10^{-4} lit mol^{-1} sec^{-1}. How long will it take to decompose to 50% if AB is maintained at 100 kPa and 700 K in a closed vessel. [4]

(*c*) Explain the following : [4]

(*i*) Energy of activation

(*ii*) Quantum yield of photochemical reaction.

(*d*) State Stark-Einstein's law of photochemical equivalence. [2]

Or

8. (*a*) Derive the photochemical rate law for the reaction between H_2 and Cl_2. [6]

(*b*) Explain the activated complex theory and derive the expression for rate equation. [6]

(*c*) The rate constant of a second order reaction is 5.70×10^{-5} lit mol^{-1} s^{-1} at 25°C and 1.64×10^{-4} lit mol^{-1} s^{-1} at 40°C. Calculate the activation energy for the reaction. [4]

9. (*a*) What is gas chromatography ? Discuss its instrumentation. [6]

(*b*) Define fuel cell. Explain the construction, reactions and applications of alkaline fuel cell. [6]

(*c*) Explain the principle and technique of thin layer chromatography. [4]

Or

10. (*a*) Explain the principle, technique and applications of column chromatography. [6]

(*b*) Write a note on lithium batteries with various compositions. [6]

(*c*) Define : [4]

(*i*) Primary Battery

(*ii*) Power density

(*iii*) Fuel cell

(*iv*) Charge-Discharge cycle.

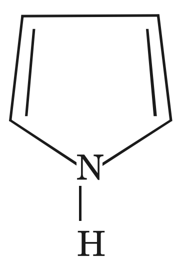
11. (*a*) Discuss the classification of dyes on the basis of chemical structure. [6]

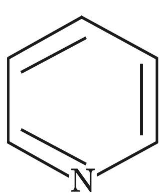
(*b*) Write any *two* methods of synthesis of : [6]

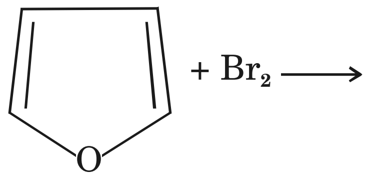
(*i*) Furan

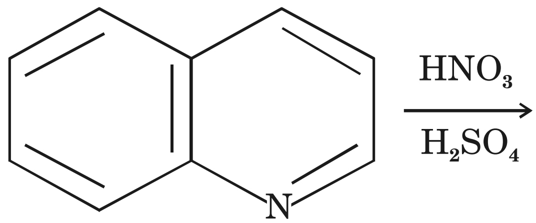
(*ii*) Pyridine.

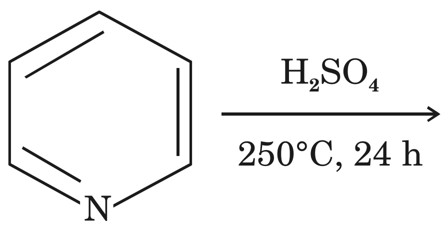
(*c*) Complete the reactions : [6]

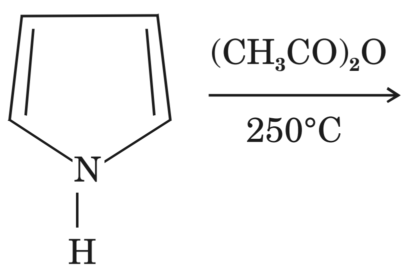
(*i*)  $+ CHCl_3 + KOH \longrightarrow$

(*ii*)  $\xrightarrow{NaNH_2}$

(*iii*) 

(*iv*) 

(*v*) 

(*vi*) 

Or

12. (*a*) Give *one* method of synthesis and use of the following dyes : [6]

(*i*) Methyl orange

(*ii*) Alizarin.

(*b*) Describe any *two* methods of synthesis of pyrrole. Discuss the electrophilic substitution reactions of pyrrole. [6]

(*c*) Write the chemical reactions for : [6]

(*i*) Reduction of pyridine by raney nickel

(*ii*) Action of sodamide on quinoline

(*iii*) Reaction between acetylene and hydrogen cyanide passed through red hot tube.

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

[4062]-182

S.E. (Chemical) (First Semester) EXAMINATION, 2011

CHEMICAL ENGINEERING FLUID MECHANICS

(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*) Neat diagrams must be drawn wherever necessary.

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

(*iv*) Use of non-programmable electronic pocket calculator, Mollier charts, steam tables and statistical table are allowed.

(*v*) Answer Section I and Section II on separate-sheets.

(*vi*) If required, make suitable assumptions.

SECTION I

1. (*a*) Discuss the time dependent rheological behaviours of the fluids. [6]

(*b*) The velocity distribution for flow over a flat plate is given by [10]

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

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 $y = 0$, $y = 7.5$ and $y = 15$ cm. Assume dynamic viscosity as 8.63 poises.

(*c*) Distinguish between laminar and turbulent flow. [2]

P.T.O.

2. (*a*) Justify the following : [6]

(*i*) Stram lines are always perpendicular to the equipotential lines.

(*ii*) Viscosity of gases increases with increase in temperature.

(*iii*) Viscosity of liquids decreases with increase in temperature.

(*b*) Draw shear stress shear rate curves and give examples of the following : [9]

(*i*) Pseudoplastic fluid

(*ii*) Dilatent fluid

(*iii*) Bingham plastic fluid.

(*c*) State and explain the Newton's law of viscosity. [3]

3. (*a*) Explain with neat sketches the working of an inclined tube manometer. [8]

(*b*) A U-tube manometer filled with mercury is connected between two points in a pipeline. If the manometer reading is 26 mm of Hg, calculate the pressure difference between the points when : [8]

(*i*) water is flowing through the pipe

(*ii*) air at atmospheric pressure and 20°C is flowing in the pipe.

Density of mercury = 13.6 gm/cc, Density of water = 1 gm/cc, Molecular weight of air = 28.8.

4. (*a*) An inclined manometer is installed across a pipeline carrying water to measure the pressure drop due to friction. The manometer is filled with organic liquid of specific gravity 1.6 and its reading is 5 cm. The angle between the vertical and inclined limbs is 60°. Calculate the pressure drop. [6]

(*b*) For two-dimensional steady state flow of incompressible fluid show that : [10]

$$\frac{du}{dx} + \frac{dv}{dy} = 0.$$

5. (*a*) Derive Hagen-Poiseuille equation, highlighting the assumptions made. [8]

(*b*) Water is pumped from a reservoir to a height of 1000 m from the reservoir level, through a pipe of 15 cm I.D. at an average velocity of 4 m/s. The pipe is 2000 m long and the overall efficiency of pump is 70%, what is the energy required for pumping ?

Take friction factor $f = 0.046 \ \mathrm{Re}^{-0.2}$. [8]

6. (*a*) For laminar flow through circular pipe prove that the mean velocity is half the maximum velocity. [8]

(*b*) Water is flowing through a pipe of diameter 250 mm with a velocity of 3 m/sec. Find the head loss due to friction for a length of 5.5 m, if the coefficient of friction f is given by $f = [0.03 + (0.08/Re^{0.3})]$ where kinematic viscosity = 0.01 stokes. [8]

SECTION II

7. (*a*) A thin plate is moving in still atmospheric air at a velocity of 5 m/sec. The length of the plate is 0.6 m and width 0.5 m. Calculate : [10]

(*i*) The thickness of the boundary layer at the end of the plate and

(*ii*) Drag force on one side of the plate.

Take density of air as 1.24 kg/m^3 and kinematic viscosity 0.15 stokes.

(*b*) With suitable example, describe in detail the method of dimensional analysis using Buckingham's 4)12-theorem. [8]

8. (*a*) Explain the growth of Boundary layer for a flow over a flat plate. Indicate Laminar, Turbulent and Laminar sublayer of boundary layer. [6]

(*b*) Calculate the displacement thickness for the following boundary layer velocity flow : [8]

$$\frac{u}{u_\infty} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3 .$$

(*c*) Define and derive an equation for momentum thickness. [4]

9. (*a*) A 2 m deep bed of solids is to be backwashed with water. The average particle size of the solids in the bed is 2 mm and the specific gravity of the solid is 1.2. Find the minimum fluidization velocity. [8]

(*b*) Derive Ergun equation for pressure drop through a packed bed. [8]

10. (*a*) Derive an expression for minimum fluidization velocity. [8]

(*b*) Discuss advantages and disadvantages of fluidization. [4]

(*c*) Describe the particulate and aggregative fluidization. [4]

11. (*a*) Derive equation for flow through venturimeter. [8]

(*b*) An orificemeter having an inside diameter of 4 cm is located in a 8 cm pipe. Water is flowing through the line and the mercury manometer measures the differential pressure over the instrument. The leads are filled with water. When the manometer reading is 35 cm, what is the flow rate of water per minute ? [8]

12. (*a*) Explain phenomenon of cavitation in pumps. How can it be prevented ? [4]

(*b*) 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 $c_d = 0.98$. [8]

(*c*) Enlist different minor losses in pipelines. [4]

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

[4062]-183

S.E. (Chemical) (First Semester) EXAMINATION, 2011

CHEMICAL ENGINEERING MATERIALS

(2008 COURSE)

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*) 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*) Wrtie the classification of Engineering Materials. [6]

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

(*i*) Ductility

(*ii*) Malleability

(*iii*) Shear stress

(*iv*) Factor of safety

(*v*) Necking.

Or

2. (*a*) A steel rod of 30 mm diameter, 280 mm long is subjected to axial forces alternating between maximum compression of 15 kN and a maximum tension of 5 kN. Find the difference between the greatest and least length of the rod. E = 210 GPa. [12]

(*b*) Draw and explain stress-strain curve for ductile materials. [4]

3. (*a*) Write the difference between destructive and non-destructive hardness test. [4]

(*b*) Explain Rockwell Hardness of materials. Draw a neat sketch. [12]

Or

4. (*a*) Write a short note on Brinell hardness test. [6]

(*b*) Explain various types of Impact test. [10]

5. Draw Iron-iron carbide equilibrium diagram. Explain various reactions involved and different phases involved. [18]

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*) Write short notes on : [8]

(*i*) Dry corrosion

(*ii*) Wet corrosion.

(*b*) What is an oxide film ? Explain its formation and growth mechanism. [8]

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*) Explain in detail any *two* methods of prevention of corrosion. [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. [8]

(*b*) Define the term 'stereoisomerism'. [4]

(*c*) Explain elastic and plastic deformation of polymers. [4]

11. (*a*) Explain the process of vitrification. [4]

(*b*) Write the applications of Ceramic materials. [4]

(*c*) Explain the different mechanical properties of Ceramics. [10]

Or

12. (*a*) Explain Glass and its types in detail. [6]

(*b*) Write a short note on 'Refractories'. [6]

(*c*) Give and explain the applications of Ceramics and Glasses in chemical industries. [6]

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

[4062]-184

S.E. (Chemical) (First Sem.) EXAMINATION, 2011

CHEMICAL 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*) Draw neat sketches wherever necessary.

(*iii*) Use of logarithmic tables, slide rule, Mollier charts, calculator and steam table is permitted.

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

SECTION I

1. (*a*) Sodium chloride weighing 600 kg is mixed with 200 kg potassium chloride. Find the composition of the mixture in mole %. [3]

(*b*) Determine the weight percentage of the constituent elements of potassium sulphate ? [3]

(*c*) 17.2 gm of N_2O_4 gas, when heated to 100°C at 720 mm Hg undergoes 90% dissociation according to the reaction $N_2O_4 \rightarrow 2\,NO_2$. Calculate the volume occupied by the gas mixture. [10]

P.T.O.

Or

2. (*a*) 1000 litres of a mixture of H_2, N_2 and CO_2 at 150°C was found to have the following ratio for the partial pressures of the gases : P_{H_2} : P_{N_2} : P_{CO_2} is 1 : 4 : 3. If the total pressure is 2 atm absolute, calculate :

(*i*) mole fraction of each of these gases

(*ii*) weight fraction of each of these gases

(*iii*) average molecular weight and

(*iv*) weight of CO_2 in kg. [10]

(*b*) An aqueous solution of Acetic Acid of 30% concentration (by mass) has density 1040 kg/m^3. Find Molarity, Normality and Molality of the solution. [6]

3. (*a*) Pure sulphur is burnt in a burner at the rate of 0.3 kg/sec. Fresh dry air is supplied at 303 K and 100 kPa. The gases from the burner contain 16.5% SO_2, 3.5% O_2 and rest N_2 on SO_3 free volume basis. The gases leave the burner at 1073 K and 101.3 kPa absolute. Calculate :

(*i*) the fraction of sulphur burnt into SO_3

(*ii*) the percentage excess air over the amount required to oxidise the sulphur to SO_2 and

(*iii*) the volume of dry air in m^3/sec. [10]

(*b*) A mixture is separated into two fractions. The first fraction contains 50% of A and 50% of B. The second fraction contains 25% of A and 75% of B. The weight of the second fraction is twice that of first. What is the composition of the original mixture ? [6]

Or

4. It is required to make 1000 kg mixed acid containing 62% H_2SO_4, 30% NNO_3 and 8% Water. The three acids required for blending are :

(*i*) The spent acid containing 11.3% HNO_3, 44.3% H_2O and remaining H_2SO_4,

(*ii*) Aqueous 92% HNO_3 and

(*iii*) Aqueous 97% H_2SO_4.

All percentage is by mass. Calculate the quantities of each of acid. [16]

5. Formaldehyde is manufactured by the catalytic oxidation of methanol using an excess of air according to the reaction I. A secondary oxidation II also occurs if the conditions are not properly controlled.

$$CH_3OH + 0.5O_2 \rightarrow HCHO + H_2O \quad ....I$$

$$HCHO + 0.5O_2 \rightarrow HCOOH \quad ....II$$

In a test run the product gases have the following composition by volume : CH_3OH = 8.6%; HCHO = 3.1%; HCOOH = 0.6%; H_2O = 3.7%; O_2 = 16.0%; N_2 = 68%. Calculate the following :

(*i*) Percentage conversion of methanol to formaldehyde

(*ii*) Percentage of methanol lost due to reaction II

(*iii*) Molar ratio of methanol to air. [18]

Or

6. In a process to manufacture HCl, common salt and sulphuric acid are heated together. The HCl gas produced is cooled and absorbed in water to produce 31.5% HCl (by weight). Some HCl is lost during absorption. To produce 1 ton of 31.5% HCl, 550 kg of common salt and 480 kg of 98% H_2SO_4 were taken. The reaction goes to completion. Calculate :

(*i*) Which reactant is in excess ?

(*ii*) What is the amount of HCl lost ?

(*iii*) Calculate the composition and quantity of residue left behind when 50% of water is distilled off. [18]

SECTION II

7. (*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. Given Data :

Component	**ΔH_f kJ/mol**
$NH_3(g)$	–49.94
$NH_4OH(l)$	–361.20
$H_2O(l)$	–285.83

[8]

(*b*) Pyrites fines are roasted in chamber plant for making sulphuric 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 contain of 1 kmol gas mixture over 298.15 K (25°C), using heat capacity data :

SO_2 : $C°_{PSO2} = 24.7706 + (62.9481 \times 10^{-3})T$

O_2 : $C°_{PO2} = 26.0257 + (11.7551 \times 10^{-3})T$

SO_3 : $C°_{PSO3} = 22.0376 + (121.624 \times 10^{-3})T$

N_2 : $C°_{PN2} = 29.5909 - (5.141 \times 10^{-3})T$

($C°_P$ is in kJ/kmol K). [8]

Or

8. Sulphur dioxide gas is oxidised in 100% excess air with 80% conversion to sulphur trioxide. Gas enter the converter at 673 K and leave at 773 K. How much heat is absorbed in the heat exchanger of the converter per kmol of sulphur dioxide fed ? Standard Heat of Reaction = –98900 kJ per kmol of SO_2.

Mean heat capacity of Sulphur trioxide, sulphur dioxide, oxygen and nitrogen are 3.725, 2.648, 1.785 and 1.706 kJ/kmol K respectively. [16]

9. An air conditioning plant is employed to maintain 300 K DBT & 50% RH in an auditorium. The air flow rate to the auditorium is measured to be 5.806 m^3/sec at 290 K at 83.5% RH. The effluent air from auditorium is partially recycled and is mixed with the incoming fresh air. The fresh air is fed at the rate of 1.25 m^3/sec at 308 K having 70% RH. The mixed air is found to have 302.5 K at DBT and 54% RH and is passed through a/c plant to make it suitable for auditorium. The total pressure can be assumed to be 101.3 kPa. Calculate :

(*a*) Moisture added in auditorium/removed in a/c plant

(*b*) The recycle ratio and the moles of air recycled per mole of fresh ambient air. [18]

Or

10. (*a*) A solution of ethyl alcohol containing 8.6% alcohol is fed at the rate of 1000 kg/h to a continuous distillation column. The product (distillate) is a solution containing 95.5% alcohol. The waste solution from the column carries 0.1% of alcohol. All percentages are by mass. Calculate the mass flow rates of top and bottom products in kg/h and the percentage loss of alcohol. [10]

(*b*) A solution of potassium dichromate in water contains 15% potassium dichromate by weight. 1000 kg of this solution is evaporated to remove some amount of water. The remaining solution is cooled to 298 K. If the yield of potassium dichromate crystals is 75%, calculate the amount of water evaporated. Solubility of potassium dichromate in water is 115 kg per 1000 kg water. [8]

11. (*a*) Explain briefly Proximate Analysis and Ultimate Analysis of coal. [6]

(*b*) Give the classification of fuels. [2]

(*c*) Crude oil is found to contain 87.1% carbon, 12.5% hydrogen and 0.4% sulphur (by mass). Its GCV at 298.15 K is measured to be 45071 kJ/kg oil.

(*i*) Calculate its NCV at 298.15 K and

(*ii*) Give complete analysis of flue gases.

Data : Latent heat of water vapour at 298.15 K = 2442.5 kJ/kg. [8]

Or

12. (*a*) 100 kg/hr of coke containing 90% carbon and 10% ash (by wt.) is burnt with 30% excess air. 95% of the carbon is burnt, out of which 98% is burnt to carbon dioxide and rest to carbon monoxide. Determine flue gas composition. [8]

(*b*) The Orsat analysis of the flue gases from a boiler house chimney gives contain 11.4% CO_2, 4.2% O_2 and 84.4% N_2 on mole basis. Assuming that the complete combustion has taken place :

(*i*) Calculate the % excess air used

(*ii*) Find the carbon : hydrogen ratio in the fuel. [8]

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

[4062]-185

S.E. (Chemical) (II Sem.) EXAMINATION, 2011

CHEMISTRY—II

(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 the characteristics of catalysis with examples. [6]

(*b*) Explain Adsorption theory of catalysis. [6]

(*c*) Give the mechanism of metal oxide catalysis. [6]

Or

2. (*a*) Give the assumptions of Langmuir adsorption theory and explain the isotherm. [6]

(*b*) Write a note on catalysis enzyme. [6]

(*c*) Describe the adsorption and catalytic properties of zeolites. [6]

3. (*a*) Write a note on mutarotation. [6]

(*b*) Define carbohydrates. How are they classified ? [6]

(*c*) Give the characteristics of enzymes. [4]

Or

4. (*a*) What are amino acids ? How are they related to polypeptides and proteins ? [6]

(*b*) What are the different structures of proteins ? [6]

(*c*) Predict the products :

(*i*) Glucose + HNO_3 ®

(*ii*) Glucose + Acetic anhydride ® [4]

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

(*i*) Chromophore

(*ii*) Bathochromic shift

(*iii*) Auxochrome.

(*b*) Explain the instrumentation in U.V.-visible spectrophotometer. [6]

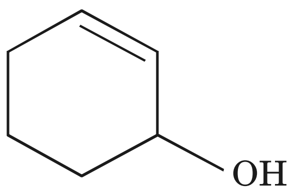
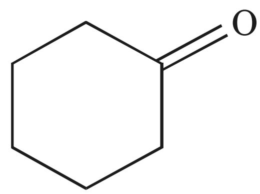
(*c*) Explain the applications of I.R. spectroscopy. [4]

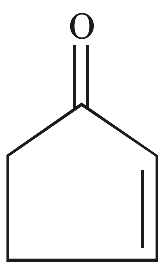
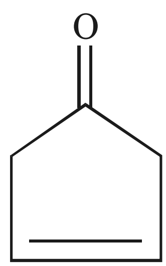
Or

6. (*a*) Give the principle and instrumentation of IR spectroscopy. [6]

(*b*) Show the fundamental vibration modes for H_2O and CO_2 molecule. [6]

(*c*) How will you distinguish the following pairs each other by U.V. spectroscopy : [4]

(*i*)  and 

(*ii*)  and 

SECTION II

7. (*a*) Explain the following properties of transition metals : [6]

(*i*) Tendency to form complexes

(*ii*) Coloured compounds of transition metals.

(*b*) Define the following terms with examples : [6]

(*i*) Ligand

(*ii*) Co-ordination number

(*iii*) Double salt.

(*c*) Give postulates of V.B.T. [4]

Or

8. (*a*) Discuss the splitting of *d*-orbitals in octahedral complex. [6]

(*b*) What is EAN ? Calculate it for : [6]

(*i*) $[Fe(CN)_6]^{-4}$

(*ii*) $[Co(NH_3)_6]^{+3}$.

(*c*) Give the limitation of CFT. [4]

9. (*a*) Explain working and application of membrane bioreactors. [6]

(*b*) Explain any *three* principles involved in green chemistry. [6]

(*c*) Give a note on bioremediation. [4]

Or

10. (*a*) Give the traditional and greener routes for the synthesis of :

(*i*) Indigo due

(*ii*) Ibuprofen. [6]

(*b*) Explain the various types of fermentations. [6]

(*c*) Give the scope and importance of biotechnology. [4]

11. (*a*) What are the sources of waste water generation in paper mill ? Describe the quality of waste water and methods for its treatment. [6]

(*b*) Write notes on : [6]

(*i*) Chemical oxygen demand

(*ii*) Ultrafiltration.

(*c*) Explain electrodialysis. How is it used in industrial water purification ? State its applications. [6]

Or

12. (*a*) Describe the characteristics of dairy industry waste water. How can it be treated by biological methods ? [6]

(*b*) Write a note on municipal waste water treatment plant. [6]

(*c*) Explain : [6]

(*i*) Reverse osmosis

(*ii*) Disposal of Hazardous waste.

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

[4062]-186

S.E. (Chemical) (Second Semester) EXAMINATION, 2011

HEAT TRANSFER

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

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

SECTION I

1. (*a*) Explain 'Newton's Law of Cooling'. [4]

(*b*) Explain in detail 'Modes of Heat Transfer'. [5]

(*c*) A steam pipe 190 × 180 mm in dia. is covered with two layers of insulation. The thickness of the first layer is 40 mm and second layer is 60 mm. The thermal conductivity of pipe and insulating layers are 60, 0.16 and 0.09 kcal/m hr°C respectively. The temperature of the inner surface of steam pipe is 400°C and that of the outer surface of insulation layer is 60°C. Determine the quantity of heat loss per meter length of steam pipe and layer contact temperature. [9]

Or

2. (*a*) By algebraic Rayleigh method of dimensional analysis derive the following relationship for Natural Convection heat transfer process (□, e and f are numerical cont.) :

$$\mathrm{Nu} = a\left[\mathrm{Pr}^{e} \times \mathrm{Gr}^{f}\right].$$ [9]

(*b*) Calculate the heat flow rate per unit length through a long tube of inner dia. 4 cm and outer dia. 8 cm, K = 0.59 W/mk. The inner wall of the tube is at 80°C saturated steam at 120°C is condensing on the outer surface of the tube h_0 = 6000 W/m^{2}K. [9]

3. (*a*) Derive expression for rate of heat flow through composite cylinder constructed from different material. [8]

(*b*) An aluminium rod 35 mm in dia. and 120 mm long protrudes from a wall which is maintained at 550 K (277°C) into the environment maintained at 298 K (25°C). Estimate the heat lost by assuming that the rod end is insulated. Also find the fin efficiency and temperature at the end of the fin. [8]

Data :

k = 250 W/m.K (for aluminium)

h between the rod surface and environment = 20 W/m^{2}K.

Or

4. (*a*) Derive expression of steady state heat transfer rate for the following cases when k is linear function of temperature i.e. $k = k_0 (1 + \square T)$:

(*i*) Plane wall

(*ii*) Hollow cylinder. [8]

(*b*) A steel pipe with an outside dia. of 115 mm and a wall thickness of 5 mm is covered with 50 mm thickness of 85% magnesia. The surface temperature on the inside of the pipe is 423 K (150°C) and that on the outside of insulation is 305 K (32°C). Calculate : [8]

(*i*) The heat flow per meter of length

(*ii*) The temperature at the outer surface of the steel pipe and

(*iii*) The conductance of the pipe and insulation based on its inside surface area.

k for steel = 48.08 W/mK

k for insulation = 0.07 W/mK.

5. (*a*) Explain : [8]

(*i*) Thermal boundary layer

(*ii*) Velocity boundary layer.

(*b*) Air at the temperature of 525 K (252°C) flows over a flate plate 0.4 m wide and 2 m long at a velocity of 8 m/s. If the plate is to be maintained at 355 K (82°C). Calculate the rate of heat to be removed continuously from the plate. [8]

Data :

Properties of air at the mean temperature are :

Kinematic viscosity – 3.90×10^{-4} m^2/s

Thermal conductivity – 36.4×10^{-3} W/mK

$$N_{Pr} = 0.69.$$

Or

6. (*a*) Distinguish between filmwise and dropwise condensation. Which of these two gives higher transfer coefficient ? Why ? [4]

(*b*) Explain critical heat flux in pool boiling. [4]

(*c*) A 30 cm long glass plate is hung vertically in the air at 300 K (27°C). The plate is maintained at 356 K (77°C). Calculate the average heat transfer coefficient for natural and forced convection. [8]

Data :

The properties of air at 325 K (52°C) are :

$\nu = 18.41 \times 10^{-6}$ m^2/s, $k = 28.15 \times 10^{-3}$ W/(m.K), $N_{Pr} = 0.7$,

$\beta = 3.077 \times 10^{-3}$ K^{-1}.

Take free stream velocity of air = 4 m/s.

SECTION II

7. (*a*) What are different laws of radiation ? Explain any *two* laws. [10]

(*b*) A small object at 47°C is placed in a large furnace whose interior is maintained at 927°C using the following data calculate the rate of absorption by and emission of radiation from this object : [8]

Absorptivity (□)	**Temp. (T°K)**
0.78	320
0.67	600
0.55	1200

Or

8. (*a*) What is specular and diffuse reflection ? Explain radiosity, Irradiation and radiation shields. [10]

(*b*) A thermosflask with evacuated space to reduce the heat losses having surfaces facing each other of emissivity 0.02. If contents of the flask are at 380°K and the ambient temperature is 298° K, compute the heat loss from the flask. If same effect is to be achieved by using insulating material of conductivity 0.04 W/m°K, what would be the thickness required ? [8]

9. (*a*) How are heat exchanger classified ? Explain. [8]

(*b*) It is required to cool 250 kg/hr of hot liquid with inlet temperature of 393°K using parallel flow arrangement 1000 kg/hr of cooling water is available for cooling purpose at a temperature of 283°K. Taking overall heat transfer coefficient of 1160 W/m^{2}K and heat transfer surface area of 0.25 m^2, calculate the outlet temperature of liquid and water and the effectiveness of heat exchanger. [8]

Data :

Specific heat of water = 4187 J/kg°K

Specific heat of liquid = 3350 J/kg°K.

Or

10. (*a*) Explain shell and tube heat exchanger in detail. [8]

(*b*) 20 kg/sec of water at 360°K entering a heat exchanger is to be cooled to 340 K by using cold water at 300°K flowing at rate of 25 kg/sec. If the overall heat transfer coefficient is 1500 W/m^2°K, calculate heat transfer area required in :

(*i*) co-current flow concentric pipe heat exchanger, and

(*ii*) countercurrent flow concentric pipe heat exchanger. [8]

11. (*a*) What is evaporation ? Explain classification of evaporator. [8]

(*b*) An evaporator operating at atmospheric pressure is fed at the rate of 10,000 kg/hr of week liquor containing 4% caustic soda. Thick liquor leaving the evaporator contains 25% caustic soda. Find the capacity of the evaporator. [8]

Or

12. (*a*) What is multiple effect evaporator ? Explain different feed arrangement in detail. [8]

(*b*) A single effect evaporator is used to concentrate 20,000 kg/hr of solution having concentration of 5% salt to a concentration of 20% salt (by weight). Steam is fed to the evaporator at a pressure corresponding to saturation temperature of 399°K. The evaporator is operating at atmospheric pressure and boiling point rise is 7°K. Calculate heat load and economy. [8]

Data :

Feed temperature = 298°K

Specific heat of feed = 4.0 kJ/kg°K

Latent heat of condensation of steam at 399°K = 2185 kJ/kg

Latent heat of vaporization of water at 373°K = 2257 kJ/kg.

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

[4062]-187

S.E. (Chemical) (Second Semester) EXAMINATION, 2011

PRINCIPLES OF DESIGN

(2008 PATTERN)

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

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

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

(*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*) What are the various properties to be considered while designing machine elements ? [4]

(*b*) An equilateral triangular bar of 15 mm side and 2.5 m long is found to contract in length by 2 mm. Calculate the push on the bar if $E = 2 \times 10^5$ MPa. [6]

(*c*) A mild steel flat plate 150 mm wide, 20 mm thick and 6 m long carries an axial load of 200 kN. Find the compressive stress and strain with $E = 2 \times 10^5$ MPa. [6]

Or

2. (*a*) What are design factors and design procedures used in machine design ? [4]

(*b*) A metal rod having 16 mm diameter fractured at a tensile force of 90 kN. Another hollow circular rod of 25 mm ID made of same metal has to withstand a tensile force of 40 kN. If factor of safety is 3, determine the required wall thickness. [6]

(*c*) The diameter of a piston of a steam engine is 300 mm and the maximum steam pressure is 0.7 N/mm^2. If the maximum permissible stress for the piston and rod material is 40 MPa, find the size of the piston rod. [6]

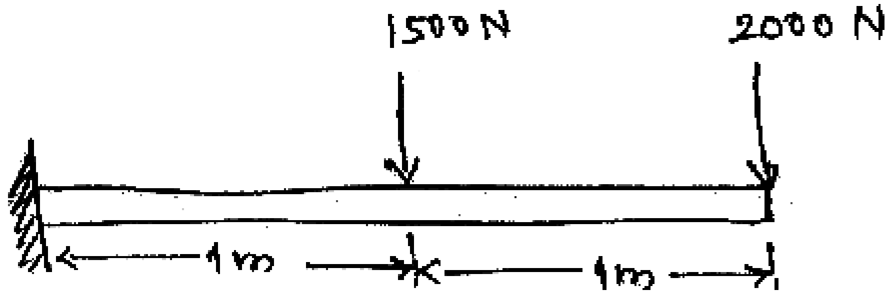
3. (*a*) An axle 1.5 m long supported in bearing at its ends carries a fly wheel weighing 40 kN at the centre. If the strees (bending) is not to exceed 65 MPa, find the diameter of the axle. [6]

(*b*) A solid steel shaft 100 mm in diameter is subjected to a bending moment M and a twisting moment T. The maximum principal stress produced in the shaft is 120 MPa. If the maximum bending stress due to M is equal to the maximum shear stress due to T, find the values of M and T. [12]

Or

4. (*a*) A shaft is transmitting 100 kW at 180 rpm. If the allowable shear stress in the material is 60 MPa, find the suitable diameter for the shaft. The shaft is not to twist more than 1° in a length of 3 meters. Take C = 80 GPa. [8]

(b) Draw SFD and BMD for the beam shown in the figure. [10]



5. (a) Define equivalent twisting moment and equivalent bending moment. State when these two terms are used in design of shafts. [8]

(b) Explain with neat sketches muff coupling and flange coupling used to connect two shafts. [8]

Or

6. (a) A solid circular shaft is subjected to a bending moment of 3500 N-m and a torque of 12000 N-m. The shaft is made of carbon steel having ultimate tensile 700 MPa and ultimate shear stess of 500 MPa. Assume a factor of safety as 5, determine the diameter of the shaft. [8]

(b) What is key ? Explain the various types of keys. How are keys classified ? Draw neat sketches of different types of keys and state their application. [8]

SECTION II

7. (*a*) Explain with the help of neat sketches, compare flat belt with V-belt. [6]

(*b*) A belt 100 mm wide and 10 mm thick is transmitting power at 1000 m/min. The driving tension is 1.5 times the tension on slack side. If the safe permissible stress on the belt section is 1.65 MPa, calculate the maximum power that can be transmitted at this speed. Assume the density of leather as 1200 kg/mm^3. [6]

(*c*) What are bearing ? Give classification of bearings. [4]

Or

8. (*a*) What are the factors upon which the coefficient of friction between the belt and the pulley depends ? [4]

(*b*) A ball bearing is subjected to a radial load of 2250 N and an axial load of 1250 N. The values of X and Y factors are 0.56 and 1.6 respectively. The shaft is rotating at 720 rpm and the life of bearing should be 3500 hrs. Calculate the dynamic load capacity of the bearing. [12]

9. (*a*) What is a cotter joint ? Draw neat sketch of socket and spigot cotter joint showing all parts and their dimensions. [4]

(*b*) Describe with sketches the various types of pipe joints commonly used. [6]

(*c*) What do you understand by the term 'strength of welded joint' ? Sketch and discuss the various types of welded joints used in pressure vessels. What are the considerations involved ? [6]

Or

10. (*a*) Find out the dimensions of a flanged joint for a cast iron pipe 250 mm diameter to carry a pressure of 0.7 N/mm^2.

For cast iron—Allowable tensile stress σ_t = 14 N/mm^2 and Corrosion allowance = 6 mm [8]

(*b*) What are various types of welding joints used in pressure vessels ? Discuss with neat sketches. [4]

(*c*) A plate 100 mm wide and 10 mm thick is to be welded to another plate by means of double parallel fillets. The plates are subjected to a static load of 80 kN. Find the length of weld if the permissible shear stress in the weld does not exceed 55 MPa. [4]

11. (*a*) A cast iron pipe of internal diameter 200 mm thickness 50 mm carries water under a pressure of 5 N/mm^2. Calculate the tangential and radial stresses at radius 100 mm, 130 mm and 150 mm. [6]

(*b*) What are various types of valves ? With neat sketch explain the construction of globe valve. [6]

(*c*) Give the classification of pumps and their selection criterion. [6]

Or

12. (*a*) Select suitable valve types for the following applications :

(*i*) Manual control of the water flow into a tank used for making up batches of sodium hydroxide solution.

(*ii*) Valves in a line where cleanliness and hygiene are essential requirements.

State the criterion used in the selection of each application. [4]

(*b*) Liquid chlorine is unloaded from rail tankers into a storage vessel. Given the following information, calculate the NPSH available at the inlet to the pump, at a maximum flow rate of 4.50 kg/sec. The total length of the pipeline from tanker to the pump inlet is 50 m. The vertical distance from the tank outlet to pump inlet is 10 m. Steel pipe of 50 mm internal diameter is used. Miscellaneous friction losses are equivalent to 1000 times pipe diameter. The vapour pressure of chlorine is 685 kN/m^2, density is 1275 kg/m^3, and viscosity is 0.363×10^{-3} $N\text{-sec}/m^2$. The pressure in the tanker is 721 kN/m^2. Friction factor $f = 0.046(\mathrm{Re})^{-0.2}$. [10]

(*c*) A seamless pipe carries 2400 m^3 of steam per hour at a pressure of 1.4 N/mm^2. The velocity of flow is 30 m/sec. Assuming the tensile stress as 40 MPa, find the inside diameter of the pipe and its wall thickness.

For steel pipe corrosion allowance = 3 mm. [4]

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

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S.E. (Chemical Engineering) (Second Semester)

EXAMINATION, 2011

THERMODYNAMICS–I

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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*) A tank containing 20 kg water at 293 K is fitted with a stirrer that delivers work to the water at a rate of 0.25 kW. How long does it take for the temperature of water to rise to 303 K if no heat is lost from the water ? For water C_p = 4.18 kJ/kg°C. [8]

(*b*) Explain the phase rule and discuss the degree of freedom for any system. [8]

P.T.O.

Or

2. Air at 1 bar and 298K is compressed to 5 bar and 298 K by two mechanically reversible processes :

(*a*) Cooling at constant pressure followed by heating at constant volume.

(*b*) Heating at constant volume followed by cooling at constant pressure.

Calculate the heat and work requirements and ΔE and ΔH of the air for each path. C_V = 20.78 J/mol. k, C_P = 29.10 J/mol. K. For air PV/T = constant. At 298 K and 1 bar the molar volume of air is 0.026 m^3/mol. [16]

3. An ideal gas initially at 600 K and 10 bar undergoes a four step mechanically reversible cycle in a closed system. In step 12, pressure decreases isothermally to 3 bar, in step 23 pressure decreases at constant volume to 2 bar, in step 34 volume decreases at constant pressure and in step 41, the gas returns adiabatically to its initial state.

Calculate Q, W, ΔE and ΔH for each step of cycle.

Data : $C_P = (7/2)R$, $C_V = (5/2)R$. [16]

Or

4. (*a*) What do you understand by an equation of state ? What are the limiting conditions to be satisfied by such equation ? [8]

(*b*) Derive the expression for work done and heat transferred for a polytropic process. [8]

5. Methanol is syathesized according to the following reaction :

$$CO(g) + 2H_2(g) \rightarrow CH_3OH(g)$$

The standard heats of formation at 298 K are –110.125 kJ/mol for CO and –200.600 kJ/mol for methanol. The specific heats are given as :

$C_P(CH_3OH) = 19.382 + 101.564 \times 10^{-3}T - 28.683 \times 10^{-6}T^2$

$C_P(CO) = 28.068 + 4.631 \times 10^{-3}T + 2.5773 \times 10^4T^{-2}$

$C_P(H_2) = 27.012 + 3.509 \times 10^{-3}T + 6.9006 \times 10^4T^{-2}$ [18]

Or

6. (*a*) Pure CO is mixed with 100% excess air and completely burnt at constant pressure. The reactants are originally at 400 K. Determine the heat added or removed if the products leave at 600K. The standard heat of reaction at 298 K is –283.028 kJ per mol CO burned. The mean specific heats applicable in the temperature range of this problem are 29.10, 29.70, 29.10 and 41.45 J/mol. K respectively for CO, O_2, N_2 and CO_2. [12]

(*b*) Discuss sensible heat effects. [6]

Section II

7. (*a*) An ideal gas, C_P = (7/2)R, is heated slowly in a steady flow heat exchanger from 343 K to 463 K by another stream of the same ideal gas which enters at 593 K. The flow rates of the two streams are the same and heat losses from the exchanger are negligible.

(*i*) Calculate the molar entropy changes of the two gas streams for both parallel and countercurrent flow in the exchanger.

(*ii*) What is ΔS_{Total} in each case ?

(*iii*) Repeat part (*a*) and (*b*) for countercurrent flow if the heating stream enters at 473 K. [10]

(*b*) Prove that entropy is a state function. [6]

Or

8. (*a*) One mole of an ideal gas, C_P = 7/2)R and C_V = (5/2)R is compressed adiabatically in a piston cylinder device from 2 bar and 298 K to 7 bar. The process is irreversible and requires 35% more work than a revessible adiabatic compression from the same initial state to the same final pressure. What is the entropy change of the gas ? [10]

(*b*) Explain third law of thermodynamics with entropy concept. [6]

9. (*a*) Derive Maxwell relations. [10]

(*b*) Show that :

$$ds = \frac{C_V}{T} dT - \frac{(\P V / \P T)_P}{(\P V / \P P)_T} dV$$ [8]

Or

10. (*a*) Show that :

(*i*) $\left(\frac{\partial E}{\partial T}\right)_V = C_V$

(*ii*) $\left(\frac{\partial H}{\partial T}\right)_P = C_P$

For an ideal gas $\left(\frac{\partial E}{\partial V}\right)_T = 0$ and $\left(\frac{\partial H}{\partial T}\right)_P = 0$. [10]

(*b*) Show that the ratio of isothermal compressibility to adiabatic compressibility is equal to $\frac{C_P}{C_V}$ *or* $\gamma = \frac{k}{k_S}$. [8]

11. (*a*) From a reservoir at 327ºC, 1000 J of heat is transferred to an engine that operates on the Carnot cycle. The engine rejects heat to a reservoir at 27ºC. Determine the thermal efficiency of the cycle and the work done by the engine. [6]

(*b*) Write a note on refrigerator capacity. [4]

(*c*) A refrigeration machine operating at a condenser temperature of 290 K, needs 1 kW of power per ton of refrigeration. Determine :

(*i*) The coefficient of performance

(*ii*) The heat rejected to a condenser

(*iii*) the lowest temperature that can be maintained. [6]

Or

12. (*a*) An air refrigeration machine rated at 10 ton is used to maintain the temperature of a cold room at 261 K when the cooling water is available at 293 K. The machine operates between pressures of 1.013 bar and 4.052 bar. Assume a S–K approach in the cooler and the refrigerator. The specific heat of air may be taken as 1.008 kJ/kg.K and $\gamma = 1.4$. Calculate the COP and air-circulation rate. [9]

(*b*) What are the properties of a refrigerant which are required to be considered for its selection ? [7]

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

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S.E. (Chemical) (Second Semester) EXAMINATION, 2011

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*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.

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

SECTION I

1. (*a*) What will be the power required to crush 100 tons/hr of limestone of 80% of the feed passes through 2 inch screen and 80% of the product passes through 1/8 inch screen ?

Data : The work index for limestone is 12.74. [8]

(*b*) Differentiate between Grizzles and Trommels. [6]

(*c*) Explain critical speed of Ball-mill. [4]

P.T.O.

Or

2. (*a*) Draw a neat sketch of a smooth roll crusher and explain its operation. [8]

   (*b*) Define sphericity for spherical and non-spherical particles. [4]

   (*c*) Explain different factors influence on the size of the product in Ball-mill. [6]

3. (*a*) State the advantages and limitations of Belt Conveyor. [6]

   (*b*) Describe with a sketch the working of closed loop pneumatic conveying system with its flow-sheet. [8]

   (*c*) Why is it necessary to clean the belt ? [2]

Or

4. (*a*) Describe with neat sketch the construction of Bucket elevators. List advantages, disadvantages and industrial applications. [8]

   (*b*) Explain close loop pneumatic conveying system with its flow sheet. [8]

5. (*a*) State different operations which need mixing and explain agitation equipment in detail. [8]

   (*b*) With the help of neat sketch distinguish between axial flow and radial flow impellers. [8]

Or

6. (*a*) Explain the necessity of mixing in chemical industries ? [6]

(*b*) Explain in brief power consumption of impellers. [8]

(*c*) Explain the importance of baffles in agitated vessels. [2]

SECTION II

7. (*a*) Describe with a neat sketch the working of plate and frame filter press. [6]

(*b*) What are the various factors which affect the rate of filtration ? Derive an expression to calculate the rate of filtration. [10]

Or

8. (*a*) Describe with a neat sketch the working of Rotary drum filter. [8]

(*b*) State factors to be considered while selecting filtration equipment and enlist characteristics of filter media. [8]

9. (*a*) Describe with neat sketches the aggregate and particulate fluidization. Give typical examples of both. [8]

(*b*) Describe with neat sketch the sedimentation operation. Also sketch typical commercial equipment. [8]

Or

10. (*a*) Define fluidization. State the applications of fluidization technique. [8]

(*b*) Distinguish between Free settling and Hindered settling. [4]

(*c*) Explain spouted Bed. [4]

11. (*a*) Explain the principle of magnetic separation methods. [6]

(*b*) Explain froth floatation with neat diagram. [6]

(*c*) Explain Jigging separation technique with neat diagram. [6]

Or

12. (*a*) Explain the principle of electrostatic precipitation in gas cleaning. [6]

(*b*) Explain capacity and effectiveness of Screen. [4]

(*c*) Describe with neat sketches operation of Batch centrifuge and Continuous centrifuge. [8]

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

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S.E. (Poly./Petro./Petrochem.) (First Sem.) EXAMINATION, 2011

ENGINEERING 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 diagrams must be drawn wherever necessary.

(*iv*) Figures to 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*) What is inductive effect ? Explain +I and –I effect with suitable examples. [6]

(*b*) Define and explain the following terms : [6]

(*i*) Homolysis and Heterolysis

(*ii*) Electrophile and Nucleophile.

P.T.O.

(*c*) Explain the following : [4]

(*i*) Aniline is weaker base

(*ii*) Formic acid is stronger than acetic acid.

Or

2. (*a*) Explain the relative stability of 1°, 2° and 3° carbonium ion. [6]

(*b*) Write brief notes on : [6]

(*i*) Carbene and free radicals

(*ii*) Aromaticity.

(*c*) Explain +R and –R effect with suitable example. [4]

3. (*a*) Discuss the reaction mechanism for the following : [8]

(*i*) Friedel-Craft acylation

(*ii*) Dehydration of isopropanol.

(*b*) What is Grignard reagent ? Explain the synthetic importance of the GR in the preparation of primary, secondary and tertiary alcohol from aldehyde and ketone. [6]

(*c*) Explain Favorskii rearrangement with suitable example. [4]

Or

4. (*a*) Discuss the orientation effect of activating and deactivating groups in electrophilic aromatic substitution. [8]

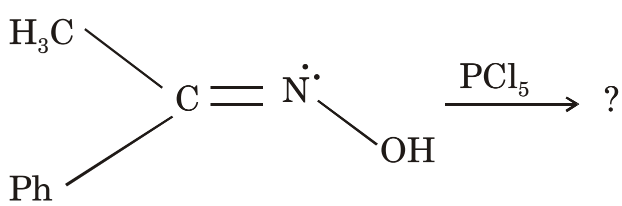
(*b*) Discuss the various factors affecting the rate of S_N1 and S_N2 reaction. [6]

(*c*) Predict the products : [4]

(*i*) $H_3C-\underset{}{\overset{CH_3}{\overset{|}{C}}}=CH_2 \xrightarrow{HCl} ?$

(*ii*) Toluene $\xrightarrow[150°C]{CH_2SO_4} ?$

(*iii*)



(*iv*) Acetone $\xrightarrow[\text{warm}]{\text{dil. NaOH}} ?$

5. (*a*) What is optical isomerism ? Explain the optical activity of the compound containing two dissimilar asymmetric carbon atoms. [6]

(*b*) Give reasons : [6]

(*i*) Conformation of ethane cannot be isolated ?

(*ii*) Equatorial-1-methyl in methyl cyclohexane is more stable than axil-1-methyl in methylcyclohexane.

(*c*) Predict the products : [4]

(*i*) Pyrrole + $CH_3Cl \xrightarrow{NaOH}$?

(*ii*) Quinoline

(*iii*) Furan + Acetyl chloride $\xrightarrow{AlCl_3}$?

(*iv*) Thiophene + Acetic anhydride $\xrightarrow{ZnCl_2}$?

Or

6. (*a*) Give any *one* method for the preparation of : [6]

(*i*) Indole

(*ii*) Thiophene

(*iii*) Pyridine.

(*b*) Explain electrophilic and nucleophilic substitution reaction of pyridine with suitable examples. [6]

(*c*) Explain, why anticonformation of *n*-butane is more stable. [4]

SECTION II

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

(*b*) Derive using kinetic gas equation (*i*) Graham's law of diffusion (*ii*) Boyle's law. [6]

(*c*) Oxygen at one atmospheric pressure and zero degree centigrade has density 1.429 g/Lit. Find RMS velocity of oxygen molecule. [4]

Or

8. (*a*) Derive van der Waal's equation of a state for real gases. [6]

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

(*c*) Calculate pressure exerted by one mole of methane in 250 ml container at 300°K using van der Waal's equation and ideal gas equation. [4]

9. (*a*) What is meant by Galvanic cells ? Explain different types of cells with *one* example each. [6]

(*b*) What is battery ? Explain alkaline Zn-MnO_2 battery with proper diagram and reactions. [6]

(*c*) Explain electro-osmosis in case of 'sols'. [4]

Or

10. (*a*) Explain construction and charging-discharging mechanism in case of Li-ion batteries. [6]

(*b*) Give construction and working of H_2-O_2 fuel cell. [6]

(*c*) Give any *two* methods of preparation of colloids. [4]

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

(*b*) Explain experimental set-up for depression in freezing point. [6]

(*c*) 2.5% solution of $Ca(NO_3)_2$ in water boils at 100. 162°C. Calculate degree of dissociation of the salt (M = 164). [6]

Or

12. (*a*) What is Raoult's law ? Explain it with the help of graph for ideal solutions. [7]

(*b*) Show that relative vapour pressure lowering is a colligative property. [6]

(*c*) Calculate osmotic pressure of solution of cane sugar having 12.5g/500 ml concentration at 27°C. Find strength of urea solution which is isotonic with this solution. (Molecular wt. of urea = 60 and cane sugar = 342). [5]

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

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S.E. (Poly./Petro.) (First Sem.) EXAMINATION, 2011

ENGINEERING MATERIALS SCIENCE AND TECHNOLOGY

(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*) Neat diagrams must be drawn wherever necessary.

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

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

SECTION I

1. (*a*) Differentiate between crystalline and amorphous materials. [5]

(*b*) Explain the "magic effects" on properties of nano-materials. [5]

(*c*) What are the "defects" in crystalline materials ? Explain the effects of defects on properties of crystalline materials. [6]

Or

2. (*a*) Define and explain "Fracture toughness".

An aircraft component tested for fracture toughness at 300 MPa stress, fracture is observed. It has an internal crack length of 4 mm and its constant related to geometry $\gamma = 1$; calculate fracture toughness of the component. [6]

(*b*) What are dislocations ? Explain any *one* dislocation with its sketch. [5]

(*c*) Classify different strengthening mechanisms and explain any *one* of them. [5]

3. (*a*) Explain eutectoid reaction with the sketch of Fe-Fe_3C phase equilibrium diagram. [5]

(*b*) Draw and explain microstructure of tempered hyper-eutectoid steel. What is the need of tempering heat treatment ? [6]

(*c*) Draw a microstructure of a welded joint and its heat affected zone. [5]

Or

4. (*a*) Draw and differentiate between transgrannular and intergrannular microstructures of fractures. [6]

(*b*) Why fine grained microstructures have better engineering properties than coarse grained structures ? [5]

(*c*) What is the meaning of "Invariant Point" on a phase equilibrium diagram ? With the help of Gibb's phase rule comment on the degree of freedom of the invariant point. [5]

5. (*a*) What are the advantages of Vicker's hardness test ? A material is tested for hardness on Vicker's machine, load selected is 20 kg and the diagonal of the square impression is 0.429 mm. What will be its hardness value ? [6]

(*b*) What are intrinsic semiconductors ? The mobilities of electrons and holes in a sample of intrinsic germanium at room temperature are 0.39 and 0.19 m^2/V-sec respectively; elctronic charge is 1.6×10^{-19}C. If the electron and hole densities are each equal to $2.5 \times 10^{19}/m^3$, calculate the electrical conductivity and resistivity of germanium. [6]

(*c*) Explain with sketch an "optical wave guide". What are its applications ? [6]

Or

6. (*a*) What is "ductility" of a material ? A specimen tested in a standard tension test; the data of the test is as given below :

Maximum load = 3100 kg

Final length at fracture = 67.5 mm

Diameter at fracture = 9.5 mm

% Elongation = 35%

What will be the initial length of the specimen ? [6]

(*b*) What are ferromagnetic materials ? Explain the effects of temperature and stress on the ferromagnetic materials. [6]

(*c*) What are thermal stresses ? If a bar of brass 0.35 m long is heated from 15°C to 95°C while its ends are rigidly fixed; and the rod is stress free at 15°C. The modulus of elasticity of brass is 100 GPa and linear coefficient if thermal expansion of the bar is 20×10^{-6}/°C. Determine the type and magnitude of stress developed. [6]

SECTION II

7. (*a*) Explain the role of "critical length" for effective strengthening of the fragmented fibre-reinforced composites.

Calculate critical fibre length of silicon carbide fragmented fibres used in a composite with epoxy matrix.

The fibre diameter is 0.01 mm; and its ultimate strength is 20 GPa. The shear yield strength of the epoxy matrix is 0.1 GPa. [6]

(*b*) What are the functions of "matrix" phase in fibrous composites ? [5]

(*c*) Why most of the advanced reinforced composites are having "carbon fibres" ? Give *one* example. [5]

Or

8. (*a*) Suggest the suitable composites for the following applications and justify your selection (any *four*) : [12]

(*i*) Filament-wound rocket motor cases

(*ii*) Turbine engines

(*iii*) Cutting tool inserts for machining hard metal alloys

(*iv*) A friction component in an aircraft

(*v*) Light weight orthopedic components

(*vi*) Automotive bodies to decrease vehicle weight.

(*b*) Write a short note on "Elastic behaviour" of continuous fibre composite loaded in transverse direction. [4]

9. Write short notes on (any *four*) : [16]

(*i*) Galvanic series

(*ii*) Crevice corrosion

(*iii*) Weld decay in stainless steel

(*iv*) Hydrogen embrittlement

(*v*) Swelling and dissolution in polymers.

Or

10. (*a*) Explain different methods of corrosion prevention. [6]

(*b*) Illustrate with sketches the "adhesive wear". [5]

(*c*) What is Pilling Bedworth ratio ? How does it help to decide protective or non-protective oxides ? [5]

11. Explain the following with sketches (any *three*) : [18]

(*i*) Steps in sintering process of material powders

(*ii*) Fabrication and processing of clay products

(*iii*) The press and blow technique for producing a glass bottle

(*iv*) Injection molding for polymeric materials.

Or

12. Select the proper processing technique for the following materials and explain the process (any *three*) : [18]

(*i*) Transparent window glass

(*ii*) Large plastic gear

(*iii*) Connecting rod for I.C. Engine

(*iv*) Sanitary lavatory ware.

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

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

EXAMINATION, 2011

CHEMICAL PROCESS CALCULATIONS

(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*) Figures to the right indicate full marks.

(*iii*) Use of electronic calculators, steam table is allowed.

(*iv*) Draw neat sketch wherever necessary.

SECTION I

1. (*a*) A steam table gives the specific volume of superheated steam at 1200 kPa and 925 K to be 0.3534 m^3/kg. How does it compare with the value obtained by the ideal gas equation ? [4]

P.T.O.

(*b*) 100 liters each of 30° API gasoline, kerosene of 40° API and isopentane of 96° API are mixed. What is the density of the resultant mixture in kg/m^3 and its specific gravity in degree(°) API ? Assuming no volume change or mixing. Density of water = 999 kg/m^3. [6]

(*c*) A chemist is interested in preparing 500 ml of 1 N, 1 molar and 1 molal solution of H_2SO_4. Assuming the density of solution to be 1.075 gm/cm^3. Calculate the quantity of H_2SO_4 to be taken to prepare these solutions. [6]

Or

2. (*a*) One kmol of CO_2 occupies a volume of 0.381 m^3 at 313 K. Compare the pressures given by the 1. Ideal Gas Law 2. van der Waals equation.

Take the van der Waals constants to be $a = 0.365$ N m^4/mol and $b = 4.28 * 10^{-5}$ m^3/mol. [6]

(*b*) Define NTP and STP. How many kilograms of liquid propane will be formed by the liquefaction of 500 liters of the gas at NTP ? [4]

(*c*) The flue gas has the following percent composition by volume : CO_2 = 14, SO_2 = 0.50, CO = 2, O_2 = 2.5 and N_2 = 81.

Determine :

(1) the average molecular weight of the gas

(2) the composition of gas in weight percent

(3) the density of the gas at 320 K and 1.5 bar

(4) the specific gravity at 320 K and 1.5 bar [6]

3. (*a*) An aqueous solution of ethanol containing 10% by weight ethanol is continuously distilled at a rate of 1000 kg/h in a distillation column. Ten percent of the feed is recovered as distillate product which contains 60% ethanol and 40% water. Calculate the weight of alcohol lost in the bottom product, and calculate and composition of the bottom product. [8]

(*b*) With the help of neat block diagram explain the total mass balance and component balance with proper equations on the following unit operations. Also define the percentage recovery of the desired component. The unit operations are 1. Gas Absorption 2. Solid-Liquid Extraction. [8]

Or

4. (*a*) Reflux ratio is defined as the ratio of the amount of condensate recycled to the distillation column to the amount of condensate withdrawn as distillate product. In the following operation. An aqueous solution of methanol containing 20% (by weight) is to be separated into a distillate product containing 97% (by weight) methanol and a bottom product containing 2% (by weight) methanol. For treating 100 kg of feed with a reflux ratio of 3.5 on a weight basis. Calculate the amounts of distillate and bottoms product and calculate the amount of vapor condensed in the consdenser per kg of feed. [8]

(*b*) Hydrogen sulphide is stripped from a gaseous mixture containing 26% H_2S and 74% inerts by a solution in a tower. The tower operates at 4 bar and 330 K. The gases leave the tower with an H_2S content of 8%. Assuming that H_2S is alone removed and nothing else is added as the gases pass through the tower. The feed to the tower is 3000 m^3/hr. Calculate :

(1) The amount of H_2S recovered from the gas

(2) The percentage recovery of H_2S. [8]

5. (*a*) 1 kg of nitrogen is mixed with 3.5 m^3 of hydrogen at 300 K and 101.325 kPa and sent to the ammonia converter. The product leaving the converter contains 13.7% ammonia, 70.32% hydrogen and 15.98% nitrogen. [9]

(1) Identify the limiting reactant.

(2) What is the percent excess of the excess reactant ?

(3) What is the percent conversion of the limiting reactant ?

(*b*) The Orsat analysis of a flue gas produced by the combustion of a pure hydrocarbon fuel with an excess of dry air is found to be 8.5% CO_2, 1% CO, 5% O_2 and 85.5% N_2.

Calculate :

(1) The % excess of air used for combustion.

(2) The weight ratio of C : H in the fuel. [9]

Or

6. (*a*) The oil containing 7% sulphur by weight is to be hydrodesulpharised so that sulphur content is reduced to 0.5%, sulphur in oil is present in form of thiophene. Reaction of hydrodesulphurization is as follows :

$$C_4H_4S_{(l)} + 4H_2(g) \rightarrow C_4H_{10}(g) + H_2S(g)$$

For 5000 kg/hr of oil fed to hydrodesulphuriser, calculate :

(1) Hydrogen required in kg/hr

(2) Butane and H_2S produced in kg/hr

(3) kg/hr of desulphurised oil produced. [9]

(*b*) KNO_3 crystals are produced from concentrated KNO_3 solutions having 60% KNO_3 in crystallizer. Fresh feed of KNO_3 solution of 15% concentration is passed through the evaporator at the rate of 2000 kg/hr. The crystallization takes place at 38ºC. Crystals formed content 95% KNO_3 by weight. The solubility of KNO_3 at 38ºC is 0.6 kg/kg water. Calculate the mass flow rate of recycle stream. [9]

SECTION II

7. (*a*) Mixtures of *n*-hexane (A) and heptane (B) are expected to behave ideally. The pressure over the system is 101.3 kPa. Construct the boiling point (T-*x*-*y*) diagram.

T(K)	P_A^S (kPa)	P_B^S (kPa)
342	101.3	39.3
343	104	40.3
348	122	46.4
353	141.3	56.8
358	163.3	66.4
363	187.3	78.4
368	210.2	90
372.4	253.3	101.3

[8]

(*b*) Define with expressions :

(1) Absolute saturation humidity

(2) Percentity

(3) Humid heat

(4) Wet bulb temperature [8]

Or

8. (*a*) Explain the utility of Raoult's law and also its limitations. [4]

(*b*) A liquid mixture containing 65 mol% benzene and 35 mol% toluene is subjected to flash vaporization at 363 K and 101.3 kPa. The vapour pressure of benzene at this temperature is 136.09 kPa and the pressure of toluene is 54.21 kPa. Flash vaporization is essentially an equilibrium stage operation. Calculate :

(1) The exit vapour composition

(2) The exit liquid composition

(3) The mole percent of the feed that is vaporized [8]

(*c*) Define :

(1) Dew Point Temperature

(2) Bubble Point Pressure. [4]

9. (*a*) Flue gases leaving the boiler stack at 523 K have the following composition CO_2 = 11.31%, H_2O = 13.04%, O_2 = 2.17% and N_2 = 73.48% (by volume). Calculate the heat lost in 1 kmole of gas mixture above 298 K using the heat capacity Data given below : [9]

$$C^0{}_P = a + bT + cT^2 + dT^3, \text{ kJ/(kmole. K)}$$

Gas	**A**	$\boldsymbol{b \times 10^3}$	$\boldsymbol{c \times 10^6}$	$\boldsymbol{d \times 10^9}$
CO_2	21.3655	64.2841	–41.0506	9.7999
H_2O	32.4921	0.0796	13.2107	–4.5474
O_2	26.0257	11.7551	–2.3426	–0.5623
N_2	29.5909	–5.141	13.1829	–4.968

(*b*) Two kilogram of ice at 0ºC is heated so that it is completely converted to steam at 150ºC and 101.3 kPa. What is the enthalpy change accompanying the process. The heat of fusion of water at given 0ºC and 101.3 kPa is 335 kJ/kg. The heat capacity equation of liquid water is $C_p = 18.296 + 47.212 * 10^{-2} T - 133.88 * 10^{-5} T^2 + 1314.2 * 10^{-9} T^3$ and heat capacity of water vapor at 101.3 kPa is given by : [9]

$C_p = 30.475 + 9.652 * 10^{-3} T + 1.189 * 10^{-6} T^2$, where C_p is in kJ/kmol K and T is in K. Use steam table wherever necessary.

Or

10. (*a*) What is Clapeyron equation ? Water is to be boiled at 150ºC. Estimate the pressure required for this operation using Claperyon equation. [6]

(*b*) A stream flowing at a rate of 15000 mol/hr containing 25 mole% N_2 and 75 mole % H_2 is to be heated from 25ºC to 200ºC. Calculate the heat to be transferred. C_p data is as follows :

Gas	**A**	**,b * 10^3^**	**,c * 10^6^**	**,d * 10^9^**
N_2	25.5909	–5.41	13.1829	–4.968
H_2	28.6105	1.0194	–0.1476	0.769

[6]

(*c*) Write a short note on estimation of heat of mixing. [6]

11. (*a*) Write a short note on Standard Heat of Reaction. [4]

(*b*) In a commercial process, chlorine is manufactured by burning hydrogen chloride gas using air. For good conversion air is used in 35% excess of that theoretically required. Assume that the oxidation is 80% complete and the dry air and hydrogen chloride gas enter the burner at 298.15. Calculate the composition of dry gases leaving the burner and the adiabatic reaction temperature of the product gas stream.

Data : Heat of formation in kJ/mol are :

For $H_2O(g)$ = –241.82 and for HCl(g) = –92.31.

The C_p data is given as follows :

Gas	A	,b * 10^3	,c * 10^6	,d * 10^9
HCl	30.3088	–7.609	13.2608	–4.3336
O_2	26.0257	11.755	–2.3426	–0.5623
Cl_2	28.5463	23.8795	–21.3631	6.4726
H_2O	32.4921	0.0796	13.2107	–4.5474
N_2	29.5909	–5.141	13.1829	–4.968

[12]

Or

12. (*a*) Write a short note on estimation of theoretical flame temperature. [4]

(*b*) The gases entering a sulfur converter contain 2.1% SO_3, 8.5% SO_2, 9.6% O_2 and 79.8 N_2. The only reaction taking place is sulfur dioxide to sulfur trioxide. Assuming no addition or removal of any material except the single product stream. The outlet gases contain 82.46% N_2. Calculate :

(1) the percentage conversion of sulfur dioxide to sulfur trioxide

(2) the heat removed per 100 gm mole of gas entering if the reaction takes place isothermally at 450ºC.

Data : Heat of formation at 18ºC in cal/gm mol for SO_2 = –7.0940 cal/gm mol, SO_3 = –94,390 cal/gm mol. And average specific heat in cal/gm mol ºC = SO_3 = 12.32; SO_2 = 10.91; O_2 = 7.4; N_2 = 7. [12]

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

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S.E. (Petro-chemical/Petroleum/Polymer)

(First Sem.) EXAMINATION, 2011

MOMENTUM TRANSFER

(2008 PATTERN)

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

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

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

(*iii*) Use of electronic calculators, steam table is allowed.

(*iv*) Draw neat sketch wherever necessary.

SECTION I

1. (*a*) Define fluid and explain in brief any *three* applications involving fluid mechanics. [1+6]

(*b*) Explain bulk modulus of elasticity and its importance in classifying fluid flows. [6]

(*c*) 1000 litres of fluid weighs 800 kg. Determine :

(*i*) Specific volume

(*ii*) Specific mass

(*iii*) Specific weight

(*iv*) Specific gravity

(*v*) Whether fluid will sink in water. [5]

P.T.O.

Or

2. (*a*) Explain viscosity index and its application in lubrication mechanics. Can this index be more than 100 or less than zero ? Explain. [5+2]

(*b*) A shaft of 400 mm 'dia' and 500 mm length, rotates in a sleeve of 404 mm, dia. speed of rotation is 300 rpm and a torque of 2000 Nm is required to rotate it. Determine the viscosity of the fluid sandwiched between the shaft and the sleeve. [6]

(*c*) Explain 'continuum hypothesis' and its important in fluid mechanics. When does it fail ? [5]

3. (*a*) Explain the following :

(*i*) 2 ways of recording pressure

(*ii*) 2 types of pressure

(*iii*) 2 systems of pressure measurement. [6]

(*b*) Convert a pressure of 2000 Pa into :

(*i*) GPa absolute

(*ii*) MPa gauge

(*iii*) 'cm' of mercury gauge. [6]

(*c*) Explain principle, manometric equation of simple U-tube manometer with a sketch. [4]

Or

4. (*a*) With a neat diagram explain absolute pressure, gauge pressure, standard atmospheric pressure, suction pressure. Also explain relationship between absolute pressure and gauge pressure. [6]

(*b*) Convert a gauge pressure of '1 m' water head into :

(*i*) GPa absolute

(*ii*) MPa gauge

(*iii*) 'cm' of air absolute. [6]

(*c*) Discuss ideal requirements of manometric fluids. [4]

5. (*a*) Differentiate with examples between :

(*i*) Micro-approach and macro-approach

(*ii*) Lagrangian approach and Eulerian approach

(*iii*) Uniform flow and non-uniform flow

(*iv*) Streamline and pathline. [8]

(*b*) Derive continuity equation for 3D, steady, compressible fluid flows from basic principles. [8]

Or

6. (*a*) Explain practical applications involving : [4]

(*i*) Laminar flow

(*ii*) Compressible flow

(*iii*) Steady flow

(*iv*) Turbulent flow.

(*b*) For a velocity field determined by

$$\vec{V} = 3xyi + 4yz\hat{j} + 6(zx - t^2)\hat{k},$$

determine :

(*i*) velocity at (1, 1, 1) at $t = 2$ seconds

(*ii*) acceleration at (1, 1, 1) at $t = 1$ second

(*iii*) rotation at (1, 1, 1) at $t = 3$ seconds

(*iv*) whether flow is steady and uniform. [8]

(*c*) Explain concepts of stream tube, timeline with sketches and examples. [4]

SECTION II

7. (*a*) List out various forces acting on fluids in motion and explain which forces are considered in deriving :

(*i*) Reynolds equation

(*ii*) Navier-Stokes equation

(*iii*) Euler's equation.

Why some forces are neglected in the above equations ? [8]

(*b*) Steady laminar flow takes place at an axial velocity of 1.0 m/s in a pipe of 100 mm diameter and 2 m length. Determine :

(*i*) Pressure drop along flow direction

(*ii*) Rate of flow

(*iii*) Velocity at 10 mm from centre

(*iv*) Shear stress at 20 mm from boundary

(*v*) Friction factor. [10]

Or

8. (*a*) Explain 4 modifications to the Bernoulli equation; indicating the necessity for the same. What is HGL and EGL ? [4+2]

(*b*) Derive velocity distribution equation in laminar flow from basics, for pipe flow. [6]

(*c*) Explain working of Pitot tube with a neat sketch. What is Prandtl Pitot tube ? [4+2]

9. (*a*) Describe the liquid gas, liquid solid, gas solid multiphase systems encountered in chemical and process engineering. [4]

(*b*) Define Hold up and Slip in gas-liquid multiphase flows. Draw a flow pattern map for horizontal two-phase flow through pipe. [4]

(*c*) Air flows over a flat plate 1 m long 4 m/s. Determine 1. The boundary layer thickness at the end of the plate. 2. Shear stress at the middle of the plate and 3. Total drag per unit length on the sides of the plate. Take $\rho = 1.226$ kg/m^3 and $\upsilon = 0.15 * 10^{-4}$ m^2/sec for air. [8]

Or

10. (*a*) Draw a neat sketch of the thermal boundary layer and diffusion boundary layer for a flow over flat plate. Explain the significance of Boundary layer theory in heat and mass transfer. [8]

(*b*) A mixture of gas and oil flow through a pipeline. Use Lockchart-Martinelli correlation to find the pressure gradient per unit length. Data :

Pipe relative roughness $\varepsilon = 0.0001$, Pipe diameter D = 150 mm, Liquid flow rate = 20 kg/s, Gas flowrate = 2 kg/s, Liquid viscosity $\mu L := 0.005$ Pa.s, Gas viscosity $\mu G = 1.35\ 10^{-5}$ Pa.s, Liquid density $\rho L = 710$ kg m^{-3}, Gas density $\rho G = 2.73$ kg m^{-3}. [8]

11. (*a*) Crude oil is to be transported from an oil-field to a refinery located at 750 kilometers away from the source through a steel pipe line 40 cm internal diameter. The difference in level between the two is negligible.

Calculate :

(*i*) Horse power theoretically required to overcome friction in the line.

(*ii*) Since maximum allowable pressure at any section of the line is 30 kg/cm^2 it will be necessary to insert additional pumping stations at suitable intervals along the line. Each station increases the pressure which drops to 1.7 kg/cm^2 at the inlet to the next pumping station. What is the smallest number of pumping station required ?

Data : For crude oil sp.gr = 0.87 and $\mu = 47$ cp, flow rate = 48000 barrels per day (1 barrel = 0.16 m^3) and $f = 0.0014 + 0.125/Re^{0.32}$. [8]

(*b*) The rate of discharge Q of a centrifugal pump depends upon the mass density ρ of fluid; pump speed N (rpm), the diameter of impeller D, the pressure P and the viscosity μ of fluid. Show using Buckingham's method that Q can be represented by $Q = (ND^3)\phi\left[\left(\frac{gH}{N^2D^2}\right), \left(\frac{\mu}{ND^2}\right)\right]$. [8]

Or

12. (*a*) State in brief the classification of gas moving machinery such as Fans, Blowers and Compressors with respect to their construction and applications. [8]

(*b*) Determine the annual (365 days) cost of pumping oil at a rate of 300 liters per hour having specific gravity 0.9 and viscosity 30 cp through a line of 25 cm diameter and 50 km long. It may be assumed that efficiency of pump together with motor is 50% and the power costs Rs. 2 per kWh. [8]

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+1**

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S.E. (Pet./Petro.-Chemi./Polymer) (I Sem.) EXAMINATION, 2011

STRENGTH OF MATERIALS

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer Q. No. **1** *or* **2**, Q. No. **3** *or* **4**, Q. No. **5** *or* **6** from Section I and Q. No. **7** *or* **8**, Q. No. **9** *or* **10**, Q. No. **11** *or* **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*) Your answers will be valued as a whole.

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

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

SECTION I

1. (*a*) Derive an expression for deformation of a body due to self weight. [4]

(*b*) Derive volumetric strain expression for a rectangular body subjected to an axial force. [4]

(*c*) A composite bar made up for aluminium bar and steel bar is firmly held between two unyielding supports as shown in Fig. 1(*c*). An axial load of 2 kN is applied at 'B'. Find the stresses in each material. Also find extension of AB portion.

Take : E for Aluminium = 70 GPa

E for Steel = 200 GPa. [10]

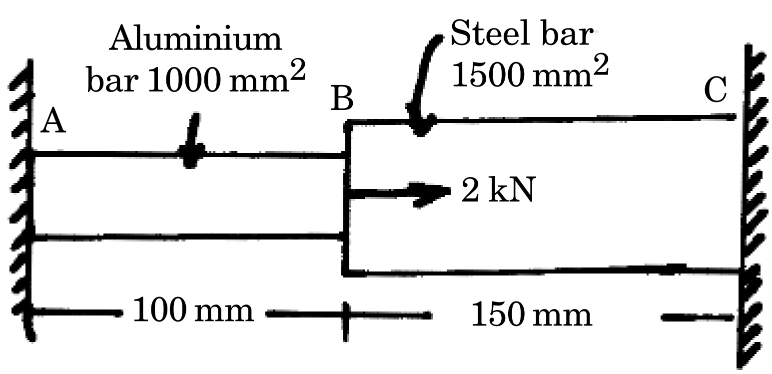

Fig. 1(*c*)

Or

2. (*a*) Define thermal stress and strain and write expression for them. [4]

(*b*) A square bar of 20 mm side is held between two rigid plates and loaded by an axial force of 3 kN as shown in Fig. 2(*b*). Find the reactions at the ends A and C and the extension of the portion AB. Take E = 200 GPa. [6]

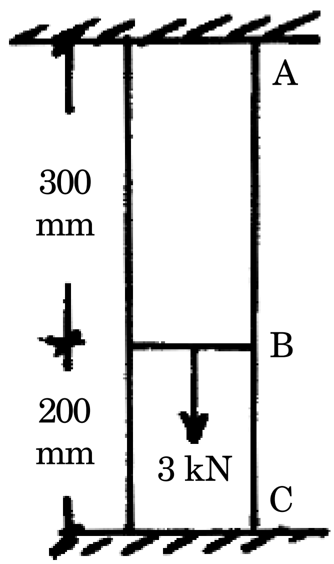

Fig. 2(*b*)

(*c*) A steel cube block of 50 mm side is subjected to a force of 6 kN (Tensile), 8 kN (Compressive) and 4 kN (Tensile) along *x*, *y* and *z* direction. Determine change in volume of a block. Refer Fig. 2(*c*).
Take E = 200 kN/mm^2 and m = 0.3. [8]

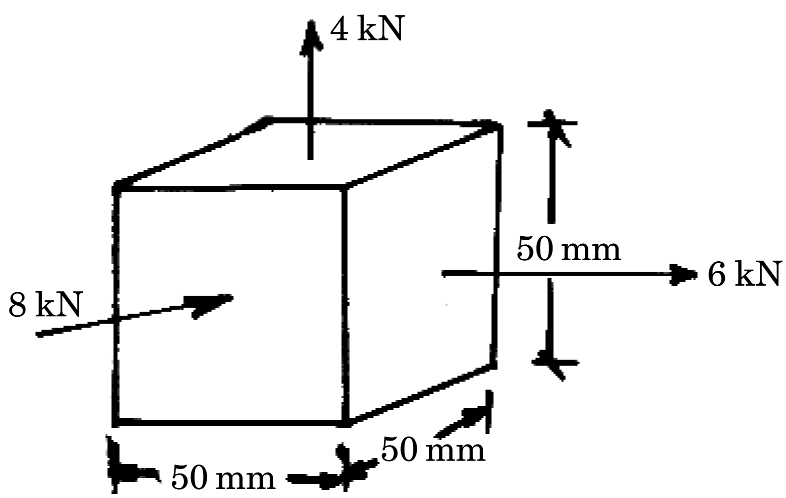

Fig. 2(*c*)

3. (*a*) Define Polar Moment of Inertia and write the expressions for polar moment of inertia for solid and hollow shafts. [4]

(*b*) Derive an expression for the stresses on an oblique section of a rectangular body subjected to direct stresses in two mutually perpendicular directions. [4]

(*c*) A shaft is transmitting 100 kW at 180 rpm. If the allowable stress in the material is 60 N/mm^2, determine the suitable diameter for the shaft. The shaft is not to twist more than 1° in a length of 3 metres. Take G = 80 kN/mm^2. [8]

Or

4. (*a*) Obtain a relation for the torque and the power transmitted by a solid shaft. [4]

(*b*) Derive an expression for the angle of twist in the case of a member of circular cross-section subjected to torsional moment. [4]

(*c*) A point is subjected to a tensile stress of 60 N/mm^2 and a compressive stress of 40 N/mm^2 acting on two mutually perpendicular planes, and a shear stress of 10 N/mm^2 on these planes. Determine principal as well as maximum shear stresses by Mohr's method. [8]

5. (*a*) Write assumptions for Lame's theory for thick cylinders. [2]

(*b*) A spherical vessel 3 metres diameter is subjected to internal pressure of 2 N/mm^2. Find thickness of a plate required, if the maximum stress is not to exceed, 80 N/mm^2. Take efficiency of the joint as 75%. [6]

(*c*) An air vessel of a torpedo is 500 mm diameter, and 10 mm thick, the length being 2 metres. Find the change in diameter and length when charged to 10 N/mm^2 internal pressure. Take E = 200 kN/mm^2 and Poisson's ratio = 0.3. [8]

Or

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

(*b*) A thick metallic cylindrical shell of 150 mm internal diameter is required to withstand an internal pressure of 8 N/mm^2. Find the necessary thickness of a shell, if the permissible tensile stress is 20 N/mm^2. [8]

SECTION II

7. (*a*) Draw SFD and BMD for beam AB loaded as shown in Fig. 7(*a*). [9]

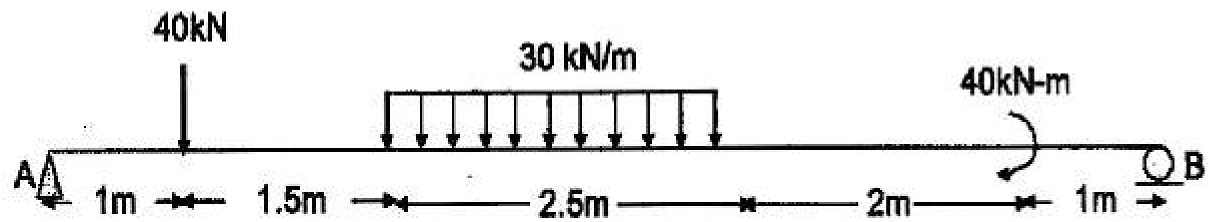

Fig. 7(*a*)

(*b*) A simply supported beam of span 4 m uses a T section with flange 100 × 20 deep and web 150 × 15 wide. The section is symmetric @ vertical axis. The beam carries uniformly distributed load of 5 kN/m throughout the span. Draw the bending stress diagram. [9]

Or

8. (*a*) Draw SFD and BMD for beam AB loaded as shown in Fig. 8(*a*). [9]

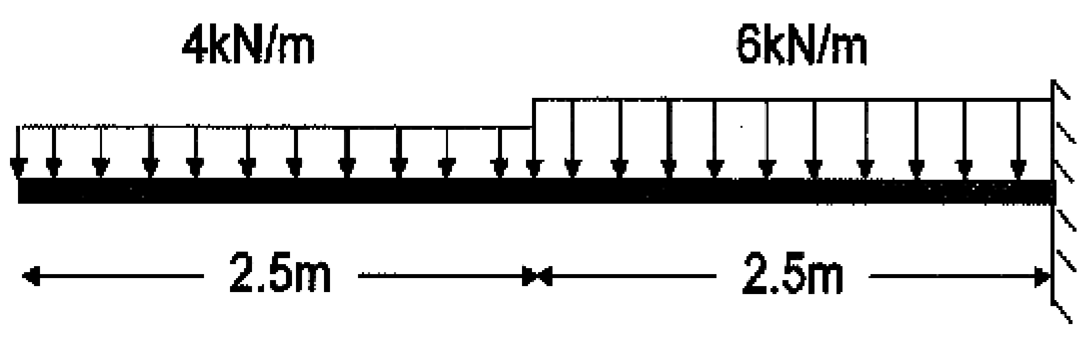

Fig. 8(*a*)

(*b*) A symmetric I section is 150 wide and 250 deep. The flange thickness and web thickness is 20 mm. This section is used for cantilever beam having a span of 4 m and subjected to uniformaly distributed load. Find the maximum u.d.l. that can be supported if E = 210 GPa and maximum allowable bending stress is 200 MPa. [9]

9. (*a*) A rectangular beam of 250 mm depth is subjected to shear force of 75 kN. Determine the width of the beam, if the maximum shear stress is limited to 4.5 MPa. [8]

(*b*) A cast iron column having 80 mm external diameter and 60 mm internal diameter is 2 m long with both ends fixed. Using Rankine's formula, find the crippling load. Assume f_y = 600 MPa and Rankine's constant = (1/1600). [8]

Or

10. (*a*) A timber box beam of span 6 m carries a concentrated vertical load at mid span of 6 kN. The cross-section of the beam is shown in Fig. 10(*a*). Each screw can transmit a shear force of 700 N. Find out the spacing of the screws. [8]

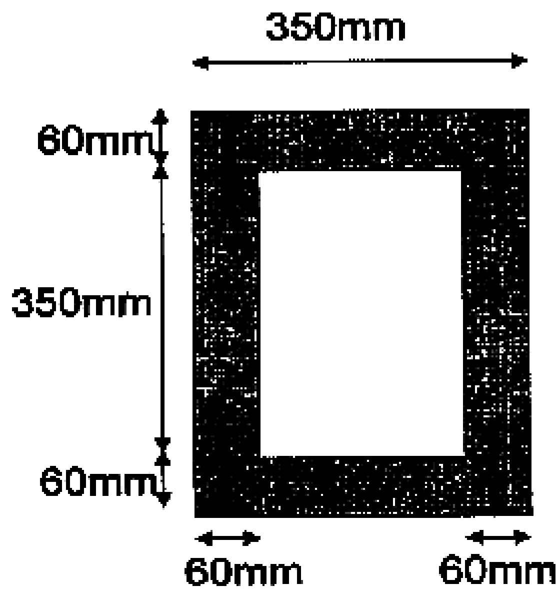

Fig. 10(*a*)

(*b*) Derive an expression for Euler's critical load for a column having both ends hinged. [8]

11. (*a*) Determine the stress resultant at four corners of column subjected to eccentric load of P = 7000 kN, shown in Fig. 11(*a*). [8]

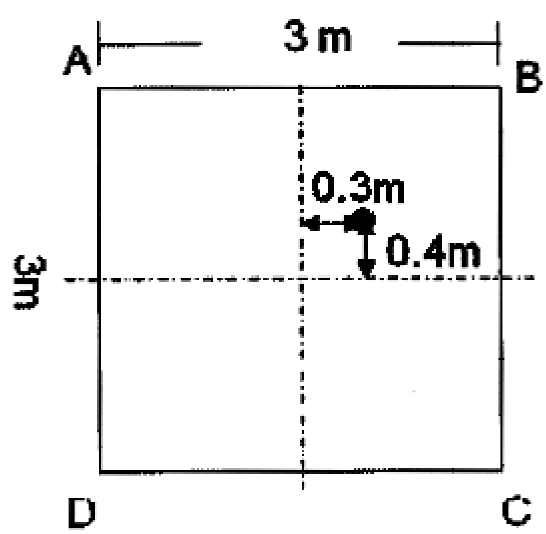

Fig. 11(*a*)

(*b*) For a simply supported beam of span L and loaded with two point loads W kN, at L/3 from both supports. Determine the maximum values of slope and deflection. [8]

Or

12. (*a*) What is core of section ? Derive the limiting value of core for a solid circular section. [8]

(*b*) Determine the slope and deflection at B. AB = 2 m, BC = 2 m and CD = 1 m. [8]

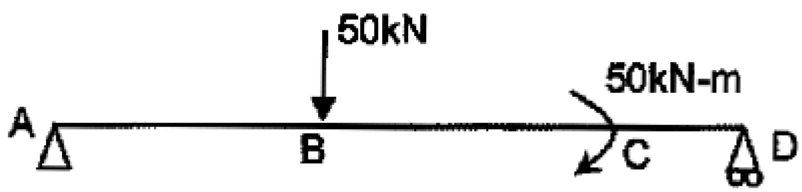

Fig. 12(*b*)

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

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S.E. (Poly./Petro/Petro-Chemical)

(Second Sem.) EXAMINATION, 2011

ENGINEERING CHEMISTRY—II

(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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain in brief the physical and chemical properties of α-amino acids. [6]

(*b*) Discuss the chemical reaction of glucose with the following reagents : [6]

(*i*) Periodic acid

(*ii*) Phosphoric acid

(*iii*) Nitric acid.

(*c*) Draw the chair conformation of the following : [4]

(*i*) α-D-Glucopyranose

(*ii*) β-D-Glucopyranose.

Or

2. (*a*) Give a brief account of primary, secondary and tertiary structure of proteins. [6]

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

(*i*) Mutarotation of glucose

(*ii*) Inversion of sucrose.

(*c*) Write a brief note on 'vitamins and hormones'. [4]

3. (*a*) Discuss any *three* methods used for the synthesis of amines. [6]

(*b*) Outline the various steps involved in the preparation of alkane from : [6]

(*i*) Alkyne

(*ii*) Alkyl halide

(*iii*) Ketone.

(*c*) Write notes on : [6]

(*i*) Friedel-Craft acylation

(*ii*) Hoffmann's degradation of amides.

Or

4. (*a*) Write the possible reaction pathway for the following conversions : [6]

(*i*) Benzene $\rightarrow$ Aniline

(*ii*) Propene $\rightarrow$ *n*-propyl alcohol

(*iii*) Acetic acid $\rightarrow$ Ethylacetate.

(*b*) Explain the following reactions with suitable examples : [6]

(*i*) Koch reaction

(*ii*) Rosenmund reduction

(*iii*) Clemmensen reduction.

(*c*) Identify compounds [A] and [B] in the following sequence of reaction. (Rewrite the reaction) : [6]

(*i*) $CH_3{-}CH_2{-}Cl \xrightarrow{\text{Aq. NaOH}} [A] \xrightarrow{KMnO_4} [B]$

(*ii*) $Ph{-}CH_2{-}\overset{\overset{\large OH}{|}}{C}H{-}CH_3 \xrightarrow[\text{acetone}]{H_2CrO_7} [A] \xrightarrow{H_2N\text{-}NH_2} [B]$

(*iii*) $Ph{-}CH_2OH \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} [A] \xrightarrow[H_2SO_4]{Na_2Cr_2O_7} [B]$

(*iv*) $Ph{-}\overset{\overset{\large CH_3}{|}}{C}H{-}CH_3 \xrightarrow[[OH^-]]{KMnO_4} [A] \xrightarrow{SOCl_2} [B]$

5. (*a*) Using infra-red spectroscopy, how will you distinguish between : [6]

(*i*) Acetone and acetaldehyde

(*ii*) Phenol and cyclohexanol

(*iii*) R–COCl and R–COR'.

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

(*i*) Trans-stilbene absorbs at higher wavelength than cis-stilbene.

(*ii*) How does the ring size affect the IR frequency of carbonyl compounds.

(*c*) How many signals are expected in NMR spectra of the following compounds. Justify your answer : [4]

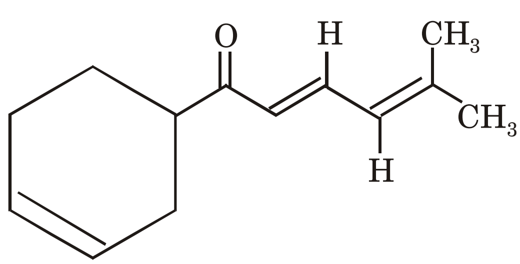
(*i*) Ethylmethyl ether

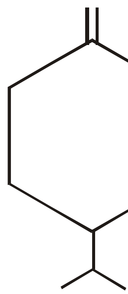
(*ii*) Ethanol.

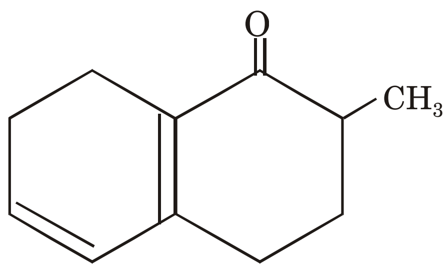
Or

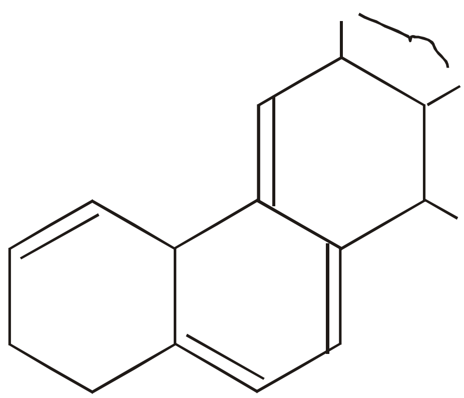
6. (*a*) Find the λ_{max} for the following dienes : [6]

(*i*)



(*ii*) 

(*iii*) 

(*iv*) 

(*b*) Suggest the probable structure for the following compounds : [6]

(*i*) C_4H_6 – ν_{max} : 1620, 990, 910 cm^{-1}

(*ii*) C_4H_6 – ν_{max} : 3300, 2100 cm^{-1}.

(*c*) Explain the effect of hydrogen bonding on IR stretching frequency. [4]

SECTION II

7. (*a*) Draw valence bond representation for nitrogen molecule. Why is it stable molecule ? [6]

(*b*) Draw molecular orbital diagram for carbon monoxide molecule. [6]

(*c*) Find atomic number of an element if the quantum numbers for the last electron are as :

$$n = 3, \quad l = 2, \quad m = 0, \quad s = -\frac{1}{2}. \qquad [4]$$

Or

8. (*a*) What is meant by hybridisation ? Explain it in case of ammonia molecule. [6]

(*b*) Draw molecular orbital diagram for oxygen molecule and explain its magnetic properties. [6]

(*c*) Write electronic configuration of chromium atom and write quantum numbers for last electron of chromium. [4]

9. (*a*) What is meant by transition elements ? Explain with examples, number of oxidation states shown by elements of first transition series. [6]

(*b*) Explain on the basis of crystal field theory magnetic properties of iron complexes considering ammonia and water molecules as ligands separately. [6]

(*c*) Find CFSE for the following complex ions :

(*i*) $[Co(H_2O)_6]^{3+}$

(*ii*) $[Co(CN)_6]^{3-}$. [4]

Or

10. (*a*) Explain on the basis of V.B.T. $[NiCl_4]^{2-}$ is paramagnetic and $[Ni(CO)_4]$ is dimagnetic though both are tetrahedral. [6]

(*b*) With proper examples explain Werner's theory of transition metal complexes. [6]

(*c*) Find EAN of the metal ion in the following complexes : [4]

(*i*) $[Fe(H_2O)_6]Cl_2$

(*ii*) $[Cr(CO)_6]$.

11. (*a*) With the help of diagram, explain working of atomic absorption spectrometer. [7]

(*b*) Explain principles of thermogravimetric analysis. [6]

(*c*) Define :

(*i*) Ionisation potential

(*ii*) Electron affinity.

Explain their trends along the period. [5]

Or

12. (*a*) What is 'chromatography' ? Explain method and applications of paper chromatography. [7]

(*b*) Explain principles of absorption and partition type of chromatography. [6]

(*c*) Define :

(*i*) Atomic radius

(*ii*) Ionic radius.

Explain their trends along the groups. [5]

Given :

Atomic numbers for

Cr = 24, Mn = 25, Fe = 26, Co = 27, Ni = 28.

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4**

[4062]-197

S.E. (Petroleum/Petrochemical/Polymer Engineering) (Second semester) EXAMINATION, 2011

HEAT TRANSFER

(2008 PATTERN)

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

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

(*ii*) Draw neat diagrams wherever necessary.

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

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

(*v*) Use of logarithmic table, electronic pocket calculators is allowed.

SECTION I

1. (*a*) Discuss the different applications of finned surfaces and explain with neat diagrams different common types of fin configurations and define the term effectiveness of fin. [8]

(*b*) Discuss in detail different modes of heat transfer. [8]

Or

2. (*a*) Calculate the rate of the heat transfer per unit area through an aluminum plate 50 mm thick whose one face is maintained at 250°C and other face at 50°C. Thermal conductivity $k_{(Al)}$ = 225 w/m°C. [4]

(*b*) A reactor wall, 320 mm of thick, is made up of an inner layer of Fire Brick (k = 0.84 W/m°C), covered with a layer of insulation (k = 0.16 W/m°C). The reactor operates at a temperature of 1325°C and outside surface temperature is at 25°C. The temperature between the layers is 1200°C. Determine the thickness of fire brick and insulation which gives minimum heat loss. Find the rate of the heat loss per unit area. [8]

(*c*) Discuss the term Critical Thickness of Insulation. [4]

3. (*a*) Discuss the concept of Black Body with neat diagram. [8]

(*b*) Write a note on Absorptivity, Reflectivity and Transmissivity of Radiation and based on above define the following : Black Body, white Body, and Opaque Body. [10]

Or

4. (*a*) Discuss the term Shape factor and derive the necessary expression for the Radiation exchange of heat energy between two Black surfaces. [12]

(*b*) Discuss the term Intensity of Radiation and Total Emissive Power. [6]

5. (*a*) Write a note on heat transfer by Natural Convection. Differentiate between Natural Convection *Vs.* Forced Convection. [8]

(*b*) Discuss with *one* example Method of Dimensional Analysis. [8]

Or

6. (*a*) A tube 5 m long is maintained at 100°C by steam jacketing. A fluid flows through the tube at the rate of 175 kg/hr at 30°C. The diameter of the tube is 2 cm. Find out the average heat transfer coefficient.

Properties of fluid are as below : [8]

$\overline{18}$ = 850 kg/m^3, C_p = 2000 J/kg°C, k = 0.12 W/m°C,

Kinematic viscosity $\bar{.5}$ = 5.1×10^{-6} m^2/sec.

(*b*) Discuss in detail : [8]

(1) Thermal Boundary Layer

(2) Reynolds Analogy.

SECTION II

7. (*a*) Discuss with neat diagrams Parallel flow, Counter current flow and cross flow type of Heat Exchangers. [12]

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

Heat Exchanger Effectiveness and Number of Transfer Units (NTU).

Or

8. (*a*) Discuss in detail the terms Overall Heat Transfer Coefficient. [6]

(*b*) Define the term "Logarithmic Mean Temperature Difference". Derive the necessary equation for the LMTD for Counter current type heat exchanger. [12]

9. (*a*) Discuss Film and Dropwise Condensation. [8]

(*b*) A vertical tube of 60 mm outside diameter and 1.2 m long is exposed to steam at atmosphere pressure. The outer surface of the tube is maintained at 50°C. Calculate the following : [8]

(*i*) The rate of heat transfer, and

(*ii*) The rate of condensation of steam.

The properties of water film at mean temperature are :

$\overline{18}$ = 975 kg/m^3, k = 0.67 W/m°C,

Dynamic viscosity $\mu = 375 \times 10^{-6}$ kg/m.sec.

Assume vapor density is small compared to that of the condensate.

Latent heat of condensation = 2257 kJ/kg.

Or

10. (*a*) Explain the effect of presence of Non-condensable Gases on condensation heat transfer. [6]

(*b*) Explain with neat diagram different regimes of Boling. [10]

11. Define evaporation with its importance and state the classification of evaporators and explain any *one* evaporator in detail. [16]

Or

12. Explain the following terms in detail : Evaporator Capacity, Evaporator Economy, Boiling Point elevation, Material and enthalpy balances for single effect evaporator. [16]

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

[4062]-198

S.E. (Poly/Petro/Petrochem)

(Second Semester) EXAMINATION, 2011

PARTICULATE TECHNOLOGY

(2008 PATTERN)

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

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

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

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

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

(*v*) Use of logarithmic table, slide rule and electronic pocket calculator is allowed.

SECTION I

1. (*a*) Explain in detail general characteristics of particulate solids in bulk. [6]

(*b*) Discuss angle of repose and angle of friction. [6]

(*c*) Define degree of mixing and rate of mixing. [4]

Or

2. (*a*) Describe in detail flow of solids through hoppers. [6]

(*b*) Discuss solid conveyors in detail. [6]

(*c*) Calculate sphericity of a solid particle of cubical shape. [4]

3. (*a*) A certain crusher takes rock whose average particle diameter is 0.025 m and crushes it to a product whose average particle diameter is 0.018 m, at the rate of 20 tons/hour. At this rate, the mill takes 9 hp of power and 0.46 is hp power is required to run it empty. [6]

(*i*) What would be the power consumption for same capacity, if average particle diameter in the product is 0.008 m ?

(*ii*) How much power would be required under conditions given by based on (i) Kick's law.

(*b*) A certain set of crushing rolls has rolls of 150 cm in diameter by 50 cm width of face. They are set so that the crushing surfaces are 1.24 cm apart at the narrowest point. [8]

(*i*) What are the permissible sizes of the feed and maximum actual capacity in metric tons per hour if the actual capacity is 12% of the theoretical ?

(*ii*) After long use, the tires on the rolls of mill have become roughened so that the angle of nip is 32° 30'. What will now be the maximum permissible size of feed and the capacity of rolls ?

(*c*) What is the minimum radius of crushing rolls to reduce 0.06 m pieces of rock to 0.02 m, if the coefficient of friction between rock and roll material is 0.4 ? [4]

Or

4. (*a*) Explain with neat sketch construction and working of gyratory crusher. [6]

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

(*i*) Knife cutter

(*ii*) Colloid mill.

(*c*) Differentiate between crusher and grinder. [4]

5. (*a*) Discuss sedimentation process with a neat sketch. [8]

(*b*) Explain with neat sketch construction and working of continuous thickener. [8]

Or

6. (*a*) Discuss in detail Kynch's theory of sedimentation. [8]

(*b*) A slurry of solid concentration 200 kg/m^3 is fed to sludge thickener with circular basin at rate of 360 m^3/hr. The result of batch settling test are as follows : [8]

Solid Concentration kg/m^3	**Settling velocity mm/s**
400	35
500	22
600	15
700	10
800	7
900	5
1000	4
1100	3

Determine the minimum area and diameter of thickener. Also calculate the underflow volumetric flow rate, if a value of 1250 kg/m^3 for underflow concentration was selected.

SECTION II

7. (*a*) Define fluidization. Explain various regimes of fluidization. [8]

(*b*) Derive expression for minimum fluidization velocity. [8]

Or

8. (*a*) Water trickles by gravity over bed particles, each 1 mm diameter in a bed of diameter 6 cm and height 2 m. The water is fed from reservoir whose diameter is much larger than that of the packed bed, with water maintained at a height of 0.1 m above top of the bed. The bed has a porosity of 0.31. Calculate volumetric flow rate of water if its viscosity is 1 cp. [8]

(*b*) Discuss in detail fluidized bed catalytic cracking. [8]

9. (*a*) Discuss with neat sketch construction and working of rotary drum filter. [8]

(*b*) Derive relationship between thickness of cake and volume of filtrate. [6]

(*c*) Explain in brief delayed cake filtration. [4]

Or

10. Write short notes on the following : [18]

(*i*) Filter selection

(*ii*) Pressure leaf filter

(*iii*) Preliminary treatment of slurries before filtration.

11. (*a*) Explain the principle, construction and working of electrostatic precipitators. [8]

(*b*) Explain with neat sketch magnetic separator. [8]

Or

12. (*a*) Discuss the construction and working of cyclone separator. [8]

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

(*i*) Gravity separator

(*ii*) Inertia or momentum separators.

Total No. of Questions—**6**] [Total No. of Printed Pages—**3**

[4062]-199

S.E. (Poly/Petro/Petrochemical Engineering)

(Second Semester) EXAMINATION, 2011

ELEMENTS OF SOCIAL SCIENCES

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer **3** questions from Section I and **3** 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*) Scarcity of resources is the root cause of economic problem. Explain. [8]

(*b*) Explain the merits and demerits of mixed economies. [8]

Or

(*a*) State and explain different types of Markets. [8]

(*b*) Explain Law of Demand. [8]

2. (*a*) Explain merits and demerits of specialization and division of labour. [8]

(*b*) Government plays a vital role in economic development. Explain. [8]

Or

(*a*) Explain the functions of Money. [8]

(*b*) Explain the different factors of Production. [8]

3. Write short notes on : [18]

(*i*) Rationing of Prices;

(*ii*) Industrial Policy of India;

(*iii*) Vision of India 2020.

Or

(*i*) Law of Diminishing Return;

(*ii*) 5 Year Plans of Economic Development

(*iii*) LPG Model for Economic Development.

SECTION II

4. Explain in brief :

(*a*) Modern families in India. [8]

(*b*) Cultural Diversity of India. [8]

Or

(*a*) Discuss the socio-economic impact of Globalization on Indian society in detail. [10]

(*b*) Explain the importance of study of Civilizations. [6]

5. (*a*) Sustainable Consumption and Sustainable Development go hand in hand. Explain. [8]

(*b*) The entire world is in grief of Religious Fundamentalism. Comment. [8]

Or

(*a*) Explain the importance of "Census of India". [8]

(*b*) Technology leads to social change. Explain. [8]

6. Write short notes on the following : [18]

(*i*) Caste system in India

(*ii*) Communalism

(*iii*) Indian Philosophy.

Or

(*i*) Environment and Ecology

(*ii*) Social Reformers and Reforms

(*iii*) IT Revolution in India.

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

[4062]-201

S.E. (First Semester) EXAMINATION, 2011

(Common to Computer Engineering and IT)

DISCRETE STRUCTURES

(2008 PATTERN)

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

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

(*ii*) 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**.

(*iii*) 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**.

(*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*) Prove using mathematical induction : where n is non-negative number : [6]

$$3 + 3.5 + 3.5^2 + ... + 3.5^n = 3. (5^{n+1} - 1)/4.$$

(*b*) Represent the following statements in logic and find relevant conclusion. Explain rule of inference used : [6]

(*i*) I am either dreaming or hallucinating. If I am hallucinating, I see elephants running down the road. I am not dreaming.

(*ii*) If I play hockey then I am sore the next day. I use medication if I am sore. I did not use medication.

P.T.O.

(*c*) Represent the arguments using quantifiers and finds its correctness : [4]

All students in this class understand logic. Ganesh is a student in this class. Therefore Ganesh understands logic.

Or

2. (*a*) A survey on sample 25 new cars being sold out at a local auto dealer was conducted to see which of three popular options Air Conditioner (A), Radio (R), Power Windows (W) were already installed. The survey found 15 had Air Conditioners, 12 had Radios, and 11 had Power Windows. 5 had Air Conditioner and Power Windows, 9 had Air Conditioner and Radio, 4 had Radio and Power Windows. Three had all three options. Find number of cars which had : [6]

(*i*) only one of the option

(*ii*) at least one of the option

(*iii*) none of the options.

Use principle of inclusion exclusion.

(*b*) Draw Venn diagram and prove the expression. Also write dual of the given expression : [6]

(*i*) $(A \cup B \cup C)^c = (A \cup C)^c \cap (A \cup B)^c$

(*ii*) $(U \cap A) \cup (B \cap A) = A$.

(*c*) For given multi-sets find A $\overline{\text{s-b}}$ B, C $\overline{)(}$ D, A – D, B + C

A = {a, a, b, c, d, d, d, e},

B = {a, b, d, f, g},

C = {b, c, e, e, g, h, h},

D = {a, d, d, e, f, f, g, h}. [4]

3. (*a*) Let Z = {0, 1, 2, ... n – 1}. Let □ be a binary operation such that a □ b = remainder of a.b divided by n. Construct a table for n = 4. Is (Z_4, □) a groupoid, monoid, semi-group, and abelian group. [6]

(*b*) What is homomorphism and automorphism in an algebraic system ? Explain by giving example of each. [4]

(*c*) A central groupoid is an algebraic system (A, *) where * is a binary operation such that : [6]

(a * b) * (b * c) = b □ a, b, c □ A

show that :

(*i*) a * ((a * b) * c) = a * b

(*ii*) (a * (b * c)) * c = b * c.

Or

4. (*a*) Let Z_8 = {0, 1, 2, ... 7}. Let R is relation under the operations addition modulo 7 and multiplication modulo 7. Does this system form ring ? Is it a commutative ring ? [6]

(*b*) Define : [6]

(*i*) integral domain

(*ii*) field

(*iii*) group codes with example of each.

(*c*) What is hamming distance ? Find hamming distance between code words of : [4]

c = {(0 0 0 0), (0 10 1), (1 0 1 1), (0 1 1 1)}.

Rewrite the message by adding even parity check bit.

5. (*a*) R is a relation on set of ordered pairs of positive integers such that (a, b), (c, d) □ R if and only if (a + d) = (b + c). Define this relation. Find if given relation is an equivalence relation. [6]

(*b*) Let A = {1, 2, 3, 4, 6, 9, 12}. Let a relation on A is R = {(a, b) | a divides b □ a, b □ A}. Give list representation of R. Prove that it is a partial ordering relation. Draw Hasse diagram of the same. Prove or disprove if it a lattice. [8]

(*c*) Define partition. X = {1, 2, 3, 4, 5, 6, 7, 8, 9}. Determine whether or not each of the following is a partition of x : [4]

A = [{2, 4, 5, 8}, {1, 9}, {3, 6, 7}]

B = [{1, 3, 6}, {2, 8}, {5, 7, 9}].

Or

6. (*a*) Determine if each is a function. If yes, is it surjective, byjective or injective ? [6]

(*i*) Each person in the earth is assigned a number which corresponds to his age.

(*ii*) Each student is assigned a teacher.

(*iii*) Each country has assigned its capital.

(*b*) Find homogeneous solution of a recurrence relation : [6]

$$a_n = 11a_{n-1} - 39a_{n-2} + 45a_{n-3} \text{ for } a_0 = 5, a_1 = 11, a_2 = 25.$$

(*c*) Write generalized pigeonhole principle. Use any form of pigeonhole principle to solve the given problem : [6]

(*i*) Find minimum number of students in the class to be sure that three of them are born in the same month.

(*ii*) Assume that there are 3 men and 5 women in a party. Show that if these people are lined up in a row at least two women will be next to each other.

SECTION II

7. (*a*) Define graph and multigraph. Give any *two* applications of graph and represent them in graph notation. [6]

(*b*) Use Dijkstra algorithm to find the shortest path from a to f (Refer Fig. 1) : [8]

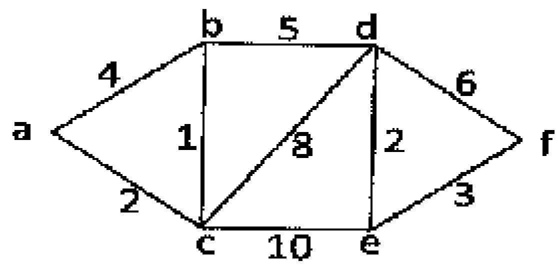


Fig. 1

(*c*) What are self complementary graphs ? Are there any self complementary graphs with 4 and 5 vertices ? If yes, draw them. [4]

Or

8. (*a*) State necessary and sufficient condition for existence of Hamiltonian path and circuit in k_{mn}. [6]

(*b*) Are k_5, k_6 and k_{33} planar graphs ? Which of these non-planar graphs have a property that removal of any vertex and edges incident with the vertex produces a planar graph ? Draw the diagrams and explain. [6]

(*c*) (*i*) What is complement of k_n, and k_{mn} ? [4]

(*ii*) Draw isomorphic graph of a graph shown in Fig. 2 but no crossover of edges : [2]

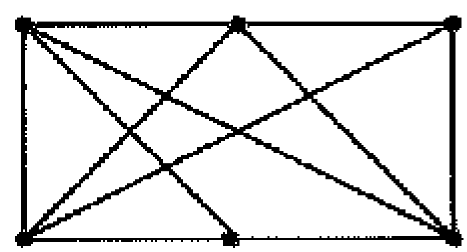


Fig. 2

9. (*a*) Define with example : [6]

(*i*) m-ray tree

(*ii*) search tree

(*iii*) inorder traversal.

(*b*) Use Prim's algorithm to find minimum spanning tree. Take A as starting vertex (Label remaining vertices). (Refer Fig. 3) [6]

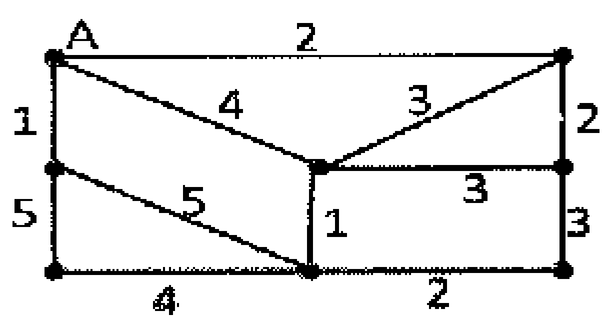


Fig. 3

(*c*) Draw a binary search tree for input data 200, 100, 300, 50, 150, 250, 400, 10, 75, 125, 175. Which is a root, leaf nodes and interior nodes ? [4]

Or

10. (*a*) Use Huffman coding to encode the following symbol with the frequencies listed A : 0.08, B : 0.010, C : 0.12, D : 0.15, E : 0.20, F : 0.35. What is the average number of bits used to encode the character ? [6]

(*b*) Use labeling procedure to find the maximum flow in transport network shown in the Fig. 4. Define corresponding minimal cuts. [8]

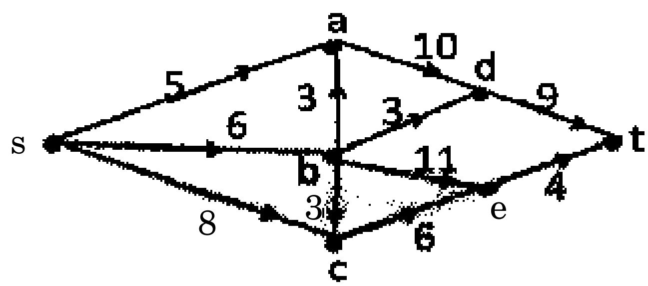


Fig. 4

(*c*) Define pendent vertex and eccentricity of a vertex. [2]

11. (*a*) Three students A, B and C are swimming in the race. A and B have same probability of winning and each is twice as likely to win as C. Find the probability that : [6]

(*i*) B wins

(*ii*) C wins

(*iii*) B or C wins.

(*b*) In a country club 60% of the players play tennis, 40% players play golf, 20% players play both tennis and golf. A member is chosen at random : [6]

(*i*) Find the probability that a member neither plays tennis nor golf.

(*ii*) If a member plays tennis, find the probability that member plays golf.

(*iii*) If a member plays golf, find the probability that member plays tennis.

(*c*) There are 3 bolts and three nuts in a box. Two pairs are chosen at random. Find the probability that one is bolt and one is nut. [4]

Or

12. (*a*) Find number of permutations that can be formed from the letters of the word ELEVEN : [6]

(*i*) How many of them begins and ends with E ?

(*ii*) How many of them have 3 Es together ?

(*iii*) How many of them begins with E and ends with N ?

(*b*) A woman has 11 friends of them six are women : [6]

(*i*) In how many ways can she invite three or more ?

(*ii*) In how many ways can she invite three or more of them if she wants same number of men and women (including herself) ?

(*c*) A student is to answer 10 out of 13 questions in an exam : [4]

(*i*) How many choices has he, if he must answer the first or second questions but not both ?

(*ii*) How many choices has he, if he must answer exactly three out of first five questions ?

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

[4062]-202

S.E. (Computer Engg.)

(First Semester) EXAMINATION, 2011

PROGRAMMING AND PROBLEM SOLVING

(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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Develop a flow chart for the instructions for withdrawing money from an ATM machine. Be sure to include all steps, such as card validation. [8]

(*b*) Evaluate for A = 5, B = 3 and C = 2 : [8]

(*i*) F = A * C \ (A + C)

(*ii*) F = 3 * B / A ^ 2

(*iii*) F = (A + 7 – C) MOD B

(*iv*) F = (C * (B + 3 * A) + 5 * A) / C.

Or

2. (*a*) Draw interactivity chart and IPO chart to balance your check-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 3 numbers

(*ii*) The sale price of an item given an original price and a discount percentage.

3. (*a*) An admission charge for a theater varies according to the age of the person. Using positive logic, develop a solution to print the ticket charges given the age of the person : [8]

Age	**Charges**
over 55	Rs. 150
21—54	Rs. 250
13—20	Rs. 150
3—12	Rs. 100
under 3	free

(*b*) Explain what is meant by the cohesion of a module and the coupling of modules. [5]

(c) What is a Data Dictionary ? Build a data dictionary for the parameters in the problem. Calculate salary of an employee, according to designation, No. of days worked, wages per day and deductions. [5]

Or

4\. (a) Make a decision table and draw a flow chart for the following set of conditions : [8]

Gross Income	Tax Rate
Gross < = 5,000	5%
5,000 – 10,000	8%
10,000 – 15,000	10%
Gross > 15,000	15%

(b) Explain with a suitable example the parameter passing between modules. [5]

(c) Name the major types of modules and explain their functions. [5]

5\. (a) Design an algorithm that for the integers in the range 1 to 100 finds the number that has the most divisors. [8]

(b) 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]

Or

6. (*a*) Design an algorithm to iteratively compute the reciprocal of a number. [8]

(*b*) Design an algorithm that converts binary numbers to hexadecimal. [8]

SECTION II

7. (*a*) Design an algorithm to find the second largest value in an array of n elements. [8]

(*b*) Write an algorithm for searching a number in an array using binary search technique. [8]

Or

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

(*i*) Pointer technique

(*ii*) Table look up technique.

(*b*) An instructor has a class of 25 students. Each student is identified by a number from 1 to 25. All tests are stored in a 2-dimensional array, with each column containing the grades for each test. The instructor would like to enter the student number and the test number and have the grade for that test printed on the monitor. Develop a solution to output the needed information. [8]

9. (*a*) Design and implement a word searching algorithm that on finding a mismatch with the current word simply reads characters to the start of the next word before attempting a match again. [8]

(*b*) Explain algorithm for line editing. [8]

Or

10. (*a*) Design and implement an algorithm that reverses the justification process by removing multiple blanks. Paragraph indentations should be preserved. [8]

(*b*) Design an implement an algorithm that will search a line of text for a particular pattern or substring. [8]

11. (*a*) Explain multiple inheritance. Elaborate your answer with suitable example. [6]

(*b*) Write a C++ program to find the average of *five* numbers. [6]

(*c*) What is the advantage of encapsulation in object oriented program. Explain with a suitable example. [6]

Or

12. (*a*) Explain with a suitable example how code reusability is achieved in C++. [6]

(*b*) Write a C++ program to implement the concept of polymorphism. [6]

(*c*) Explain the following terms : [6]

(*i*) Access specifier

(*ii*) Static member functions.

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

[4062]-203

S.E. (Common to IT) (Computer Engineering)

(First Semester) EXAMINATION, 2011

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*) 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**.

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**.

(*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*) Do the required conversions for the following numbers : [6]

(*i*) $(BF8)_{16} = (\_\_\_\_\_)_{10}$

(*ii*) $(1000)_{10} = (\_\_\_\_\_)_{8}$

(*iii*) $(377)_{8} = (\_\_\_\_\_)_{16}$.

(*b*) What are different ways of representing signed binary numbers ? Explain with examples. [6]

(*c*) Solve the following equation using K map minimization technique. Draw the diagram for the output : [6]

$$Z = f(A,\ B,\ C,\ D) = \Pi M(0,\ 1,\ 6,\ 7,\ 8,\ 9).$$

Or

2. (*a*) Perform the following operations : [8]

(*i*) $(\text{FFFF})_{16} - (10000)_{10} = (\_\_\_\_)_{10}$

(*ii*) $(765)_8 + (365)_8 = (\_\_\_\_)_{16}$

(*iii*) $(658)_{16} + (975)_{16} = (\_\_\_\_)_{16}$

(*iv*) $(1011.101)_2 = (\_\_\_\_)_{10}$.

(*b*) Solve the following equation using corresponding minimization technique. Draw the diagram for the output : [6]

$$Z = f(A, B, C, D) = \Sigma m(2, 4, 6, 11, 12, 14) + d(3, 10).$$

(*c*) What are the advantages of Quine McClusky minimization technique over K map ? [4]

3. (*a*) Define the following terms related to logic families. Mention typical values for standard TTL family : [8]

(*i*) Propagation delay

(*ii*) Fan-out

(*iii*) V_{IL}, V_{IH}

(*iv*) Noise margin.

(*b*) Draw the structure of two input CMOS NAND gate. Explain its working. [4]

(*c*) List differences between CMOS and TTL. [4]

Or

4. (*a*) Explain the working of two input TTL NAND gate with open collector output. Consider various input, output states for explanation. [8]

(*b*) Which specifications of logic families are significant in CMOS-TTL interfacing ? Explain the same when CMOS drives TTL. [8]

5. (*a*) How is BCD addition different from binary addition ? What is the use of 7483 chip ? Draw and explain nine's complementer used in BCD subtractor using 7483. [8]

(*b*) Design 16 : 1 multiplexer using only one 8 : 1 multiplexer and required discrete logic gate for the following function : [8]

$$F(A, B, C, D) = \Sigma m(0, 4, 6, 9, 12, 13).$$

Or

6. (*a*) What do you mean by parity ? How does IC 74180 work ? Design 9 bit even parity generator using the same. [8]

(*b*) Implement two bit comparator using 1 : 16 demultiplexer (active low output). Draw the truth table of two bit comparator and explain the design in steps. [8]

SECTION II

7. (*a*) Design binary sequence generator to generate binary sequence '11010' using MS JK flip-flops. How to avoid lockout condition in designed sequence generator ? [10]

(*b*) Assume 16 MHz clock source in a system. How will you divide this frequency by a factor 4 ? Explain your logic with suitable circuit diagram. [6]

Or

8. (*a*) Draw basic internal architecture of IC 7490. Design a divide-by-20 counter using same. [8]

(*b*) Draw and explain 4 bit bidirectional shift register. [8]

9. (*a*) Draw an ASM chart, state table and state diagram for synchronous circuit having the following description : [10]

"The circuit has a control input X, clock and outputs A and B. If X = 1, on every clock rising edge the code on BA changes from 00-01-10-11-00 and repeats. If X = 0, circuit holds the present state."

(*b*) What is difference between signal and variable in VHDL ? Explain with example. [6]

Or

10. (*a*) Write VHDL description of full substractor using dataflow and structural modeling. [10]

(*b*) State and explain basic components of ASM chart. [6]

11. (*a*) Explain steps for designing circuits using CPLD. [6]

(*b*) Write a short note on FPGA. [6]

(*c*) Explain operations performed in various phases of instruction execution in microprocessor. [6]

Or

12. (*a*) Design 3 : 8 decoder with PLD. [6]

(*b*) Draw and explain the block diagram of simple microprocessor based system. [8]

(*c*) Differentiate between FPGA and CPLD. [4]

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

[4062]-204

S.E. (Computer) (First Semester) EXAMINATION, 2011

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*) Neat diagrams must be drawn wherever necessary.

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

SECTION I

1. (*a*) Write a recursive function to display nth element in Fibonacci series. With the help of stack contents give a trace of Fibonacci function by you for $n = 6$. [6]

(*b*) Explain the following with example with respect to files in 'C' : [10]

(1) Fread

(2) Fwrite

(3) Fseek

(4) Ftell

(5) Fopen.

Or

2. (*a*) What is the difference between text files and binary files ? [6]

(*b*) Write 'C' function to reverse the '*n*' numbers stored in one-dimensional array. [5]

(*c*) What is recursive function ? Explain with *one* example. [5]

3. (*a*) Define algorithm. What are the characteristics of an algorithm ? [6]

(*b*) What is the frequency count of the following : [6]

```
int fact (int n)
{
    int ans = 1;
    while (n 3 1)
    {
        ans = ans * n;
        n = n – 1;
    }
    return (ans);
}
```

Find out time complexity.

(*c*) Explain the following with example :

Linear-Non-linear data structures, static and dynamic data structures. [4]

Or

4. (*a*) What is abstract data type ? Write an ADT for an array. [6]

(*b*) Find the frequency count of each step in the following code and find out time complexity : [6]

```
int i, j;
for (i = 1; i <= n; i++)
for (j = 1; j <= n; j++)
{
    c[i][j] = a[i][j] + b[i][j];
}
```

(*c*) Explain Big 'O', Sigma (W) and Theta (q) notation with example. [4]

5. (*a*) Write an ADT for polynomial. Write pseudocode for 2-polynomial addition using arrays. Find out time complexity of it. [12]

(*b*) Derive the formula to calculate the address of the element in one-dimensional and two-dimensional array using row major representation. [6]

Or

6. (*a*) Explain the steps of fast transpose algorithm for getting the transpose of sparse matrix having maximum '*m*' rows and '*n*' columns. What is the time complexity and space complexity of it ? What are the advantages of fast transpose over simple transpose ? [10]

(*b*) Write an ADT for sparse matrix. [4]

(*c*) What is row major and column major storage representation methods of an array ? [4]

SECTION II

7. (*a*) Write pseudocode for searching an element in a given array using linear search. What is the time complexity of linear search in best case, average case and worst case ? Explain with example. [8]

(*b*) Write a pseudocode for quicksort to sort a given array of *n* numbers. Show the contents of an array after each iteration for the following array :

57 50 79 100 59 40 20 10

What is worst case and average case time complexity of quicksort ? [8]

Or

8. (*a*) Write an algorithm for shell sort. Apply your algorithm to sort the following numbers in ascending order. Show the contents of an array after every iteration :

59 14 66 1 74 22 41 36 54 64

What is time and space complexity of shell sort ? [8]

(*b*) Write pseudocode for Fibonacci search. Apply your algorithm on the following data to search :

9 17 23 38 45 50 57 76 79 90 100

numbers : 9, 100, 10. [8]

9. (*a*) Explain Generalized Linked List (GLL) with node structure in 'C'. Represent the following using GLL :

$(a, b, c, (d, (e, f, c)), g), h, i)$. [10]

(*b*) Write a function to create singly linked list which is sorted while creation. [6]

Or

10. (*a*) Represent the following polynomial equation in Generalized Linked List (GLL) :

$$10x^4y^{10}z^3 + 4x^7y^{10}z^3 + 5x^7y^{10}z^3 + x^3y^{10}z^2 + 8x^3y^{10}z^2 + 8y^{10}.$$

Also give the importance of the tag field in this representation. [8]

(*b*) Write short note on garbage collection and compaction. [4]

(*c*) Write a function to display the singly linked list in reverse without creating new. [4]

11. (*a*) Write a short note on Josephus problem. [4]

(*b*) Write an ADT for stack. [4]

(*c*) Convert the following infix expression into postfix expression by showing the contents of stack for every iteration :

((A/B Ù C) + (D * E)) – (A * F)).

Evaluate the postfix expression obtained for A = 9, B = 3, C = 2, D = 3, E = 17, F = 3. [10]

Or

12. (*a*) List any *four* applications of stack and explain any *one* of them. [4]

(*b*) Explain the concept of multistack with example. [4]

(*c*) Convert the following postfix expression to infix and prefix using stack. Show the contents of stack at every stage :

abcde ÙÙ * —

Evaluate given postfix expression for $a = 50$, $b = 3$, $c = 4$, $d = 2$, $e = 1$. [10]

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

[4062]-205

S.E. (Computer Engineering and IT) (First Semester)

EXAMINATION, 2011

HUMANITIES AND SOCIAL SCIENCES

(Common to I.T.)

(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*) Differentiate between Class and Caste. [6]

(*b*) What is meant by Social Movement ? Give *one* example of Social Movement. [4]

(*c*) Explain the role of Eleventh Finance Commission in Panchayati Raj Institutions. [6]

Or

2. (*a*) Give a brief description of marriage and its types. [8]

   (*b*) Explain the concept of gender role. [4]

   (*c*) Explain in brief Regionalism. [4]

3. (*a*) Explain the special problems faced in the study of human beings. [10]

   (*b*) Explain the factors affecting the social change in brief. [6]

Or

4. (*a*) Who has the responsibility to implement the NSAP at district level ? What are the effective measures used for successful implementation of NSAP ? [6]

   (*b*) Explain the consequences of industrial revolution in detail. [10]

5. (*a*) Explain the impact of technology growth on human society. [8]

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

   (*i*) Public companies

   (*ii*) Private companies

   (*iii*) Foreign companies

   (*iv*) Limited by share

   (*v*) Limited by guarantee.

Or

6. Write short notes on (any *three*) : [18]

(*i*) Rural Employment Act

(*ii*) Green Revolution

(*iii*) Public Sector

(*iv*) Agbiotechnology.

SECTION II

7. (*a*) Explain in brief the human-induced causes of ecosystem degradation. [6]

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

(*i*) Acid rain

(*ii*) Food web

(*iii*) Land slips

(*iv*) Tidal energy

(*v*) Soil erosion.

Or

8. (*a*) Explain the reasons for the loss of biodiversity. [6]

(*b*) What are the characteristics of an Ecosystem ? [4]

(*c*) What precautions should be taken while building nuclear reactors ? [6]

9. (*a*) Explain the method for the Five Year Plan formation. [8]

(*b*) Explain the concept of Equilibrium in Supply and Demand Relationship. [8]

Or

10. (*a*) Discuss the effects of population explosion in India. [8]

(*b*) Define inflation. [2]

(*c*) Write a short note on : India Vision-2020. [6]

11. (*a*) Write detailed note on World Trade Organization (WTO). [10]

(*b*) Explain in brief Break-even analysis. [8]

Or

12. Write short notes on (any *three*) : [18]

(*i*) Balance Sheet

(*ii*) Working of RBI

(*iii*) Classification of ratios

(*iv*) Types of budget.

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

[4062]-206

S.E. (Comp. Engg.) (II Sem.) EXAMINATION, 2011

MICROPROCESSOR AND INTERFACING 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*) Figures to the right indicate full marks.

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

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

SECTION I

1. (*a*) Draw and explain Internal architecture of 8086. [8]

(*b*) Draw and explain Flag register of 8086. [6]

(*c*) Name the signals used for accessing odd and even banks/bytes in 8086. [2]

Or

2. (*a*) Draw and explain 8086 bus activities during a simple write machine cycle. [8]

(*b*) In 8086 execution unit calculates an effective address of 14A3H and DS contains 7000 H, what physical address will the BIU produce ? [2]

(*c*) Write notes on the following 8086 addressing modes with example : [6]

(*i*) INDEXED ADDRESSING MODE

(*ii*) REGISTER ADDRESSING MODE

(*iii*) STRING ADDRESSING MODE.

3. (*a*) Write a delay loop which produces a delay of 500 ms on an 8086 with 5 MHz clock. [8]

(*b*) Identify, list and explain the assembler directive in the following program : [8]

```
;PRESSURE READ PROGRAM
DATA_HERE SEGMENT
PRESSURE DB 0 ;STORAGE FRO PRESSURE
DATA_HERE ENDS
```

```
PRESSURE_PORT EQU 04H ;PRESSURE SENSOR CONNECTED TO
                      ;PORT04H
CORRECTION_FACTOR EQU 07H ;CURRENT CORRECTION FACTOR
                      ;OF  07
CODE_HERE  SEGMENT
ASSUME  CS:CODE_HERE,  DS:DATA_HERE
MOV  AX,  DATA_HERE
MOV  DS,  AX
IN  AL,  PRESSURE_PORT
ADD  AL,  CORRECT_FACTOR
MOV  PRESSURE,  AL
CODE_HERE  ENDS
END
```

Or

4. (*a*) Write PUSHALL macro to save all registers. [4]

(*b*) Write a note on coding templates for 8086 instructions. [6]

(*c*) Show the 8086 instruction or group of instructions which will : [6]

(*i*) Call a near procedure named FIXIT.

(*ii*) Save BX and BP at the start of a procedure and restore them at the end of the procedure.

(*iii*) Return from a procedure and automatically increment the stack pointer by 8.

5. (*a*) Draw and explain IVT. What are its contents ? If interrupt 2 occurs, then to which memory location the 8086 control will point to ? [8]

(*b*) Draw and explain 8259A initialization command word formats and sending order. [10]

Or

6. (*a*) Draw and explain internal block diagram of 8259A. [8]

(*b*) Draw and explain .EXE format of a file when loaded in memory. [8]

(*c*) Why must you use an IRET instruction rather than the regular RET instruction at the end of an interrupt service procedure ? [2]

SECTION II

7. (*a*) Draw and explain in brief 8255A internal block diagram and system connections. [10]

(*b*) Show the mode set control word needed to initialize an 8255A as follows : [4]

– Port A — handshake input;

– Port B — handshake output;

– Port C — bits PC6 and PC7 as outputs.

(*c*) Why must data be sent to a printer on a handshake basis ? [2]

Or

8. (*a*) Write control words for synchronous and asynchronous data transfers for 8251A. [8]

(*b*) Explain : [8]

(*i*) Mechanical key-switches

(*ii*) Membrane key-switches

(*iii*) Capacitive key-switches

(*iv*) Hall effect key-switches.

9. (*a*) Draw and explain internal block diagram of 8253 (Programmable Interval Timer). [8]

(*b*) Show : [8]

(*i*) The command words and assembly language instructions necessary to initialize an 8279 at address 80 H and 82 H as follows : 16-character display, left entry, encoded-scan keyboard, N-key rollover; 1 MHz input clock divided to 100 kHz; blanking character FFH.

(*ii*) The 8279 instructions necessary to write 99 H to the first location in the display RAM and autoincrement the display RAM pointer.

Or

10. (*a*) Draw and explain 8279 (Keyboard and Display Controller). [8]

(*b*) Draw and explain 8237 (Direct Memory Access Controller). [8]

11. (*a*) Explain the use of 8284, 8286 in interfacing memory with 8086. [8]

(*b*) Draw and explain maximum mode of 8086. [10]

Or

12. (*a*) Draw and explain minimum mode of 8086. [8]

(*b*) Draw and explain internal architecture of 8087 (math coprocessor) and its control and status words. [10]

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

[4062]-207

S.E. (Computer) (Second Semester) EXAMINATION, 2011

DATA STRUCTURES

(2008 PATTERN)

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

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

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

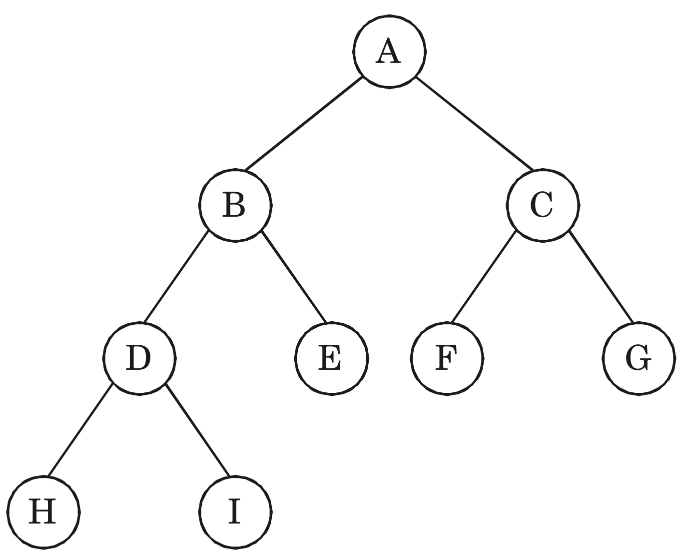
(*iii*) Figures to the right indicate full marks.

SECTION I

1. (*a*) Explain how to convert general tree to binary tree with example. [5]

(*b*) Explain Binary tree representation with example. [5]

(*c*) Represent threaded tree corresponding to the following figure. Also give memory representation of the threaded tree. Write Pseudo code for inorder traversal of the threaded binary tree. [8]



P.T.O.

Or

2. (*a*) Construct Huffman tree based on the following character weights :

E = 15	T = 12	A = 10	O = 08	R = 07	N = 06	S = 05
U = 05	I = 04	D = 04	M = 03	C = 03	G = 02	K = 02

Also give Huffman code assignment at each node. [8]

(*b*) Draw binary search tree for data 52, 35, 12, 18, 20, 23, 52. Write Binary Search Tree search algorithms to find the smallest node, largest node and BST search. [10]

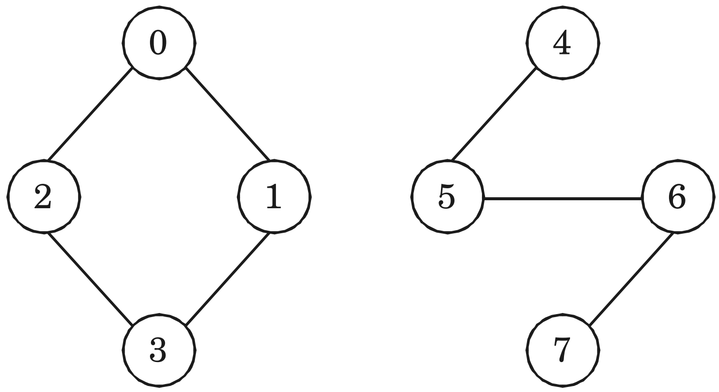
3. (*a*) Write Kruskal's Algorithm and explain it with example. [8]

(*b*) Write Dijakstra's Algorithm for finding shortest path and explain it with example. [8]

Or

4. (*a*) Write algorithm to print a given graph in BFS. Give its time complexity. [8]

(*b*) Give complete specification of the graph ADT. Explain graph representation in the form of adjacency matrix and adjacency list for the following graph. [8]



Graph G1 with two connected components

5. (*a*) Write a program in C/C++ for Word/Text processing using AVL Tree implementation. [8]

(*b*) What is symbol table ? What are operations on symbol table ? Give complete specification of symbol table ADT. [8]

Or

6. (*a*) What is collision ? Explain any *two* methods of handling collision. [8]

(*b*) What is hash function ? What are issues in hashing ? What are rules for designing hash function ? Give types of uniform hash functions. [8]

SECTION II

7. (*a*) Explain in brief MAX heap and MIN heap. Draw MAX heap for given list of elements {40, 80, 35, 90, 45, 50, 70}. [10]

(*b*) What is B tree ? Explain the process for deleting a particular value from B tree. [8]

Or

8. (*a*) State the need of B+ tree. Construct a B+ tree of order 5 for the following data :

30, 31, 23, 32, 22, 28, 24, 29, 15, 26, 27, 34, 39, 36. [10]

(*b*) State algorithm to sort elements of a given array in ascending order using heap sort. Sort the following numbers using heap sort :

48, 0, –1, 82, 108, 72, 54. [8]

9. (*a*) Write a C/C++ program to create a file. Insert records in the file by opening file in append mode. Display all records and search for specific record entered by user. [8]

(*b*) What is file ? List different file opening modes. Explain Index sequential file organization in brief. [8]

Or

10. (*a*) List different file organizations. State features of sequential file organization. What is need of file organizations ? List different primitive operations on files and explain any *two* operations in brief. [10]

(*b*) Explain in brief :

(*i*) Linked file organization

(*ii*) Direct file organization. [6]

11. (*a*) Explain the following terms :

(*i*) Containers

(*ii*) Iterators

(*iii*) Algorithms

(*iv*) Generic programming. [8]

(*b*) Give the implementation of a queue using list in a STL with respect to :

(*i*) Insertion of an element

(*ii*) Delection of an element. [8]

Or

12. (*a*) Write a C++ program using STL to reverse the given array. Use container template stack. [8]

(*b*) What is STL ? What are the components of STL ? Explain each in brief. [8]

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

[4062]-208

S.E. (Computer) (II Sem.) EXAMINATION, 2011

COMPUTER GRAPHICS

(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*) Neat diagrams must be drawn wherever necessary.

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

SECTION I

1. (*a*) Explain Display file structure. [8]

(*b*) (*i*) Write short note on text and line style. [4]

(*ii*) Explain the character generation method. [6]

Or

2. (*a*) Consider the line from (1, 1) to (6, 4). Use Bresenham's line drawing algorithm to rasterize this line and give output pixels. [10]

(*b*) Define the following terms : [8]

(*i*) Pixels

(*ii*) Vectors

(*iii*) Line

(*iv*) Frame buffer.

3. (*a*) Describe scan line algorithm to generate solid area on the screen. [8]

(*b*) Explain the concept of generalized clipping with the help of a suitable example. [8]

Or

4. (*a*) Explain viewing transmission with an example. [8]

(*b*) Explain Sutherland-Hodgman algorithm for clipping. [8]

5. (*a*) Write a note on Parallel and Perspective projection and state their types. [8]

(*b*) Describe 3D viewing transformations. [8]

Or

6. (*a*) Magnify the triangle with vertices A(0, 0), B(1, 1), C(5, 2) to twice its size as well as rotate it by 45°. Derive the translation matrices. [8]

(*b*) What is the necessary for 3D clipping and windowing algorithm ? Explain any *one* 3D clipping algorithm. [8]

SECTION II

7. (*a*) What is a segment ? How do we create it ? Why do we need segments ? Explain in detail the various operations of segments. [10]

(*b*) Describe the steps required to produce real time animation. [8]

Or

8. (*a*) Define animation and explain the methods of controlling the animation. Give different types of animation languages. [10]

(*b*) Write the algorithm for the following : [8]

(*i*) Change of visibility attribute of segments

(*ii*) Delete a segment

(*iii*) Delete all segments.

9. (*a*) Explain : [8]

(*i*) Backface algorithm

(*ii*) Painters algorithm.

(*b*) What is surface rendering ? Explain Gouraud method of shading. [8]

Or

10. (*a*) Why are hidden surfaces algorithms needed ? Explain Z-Buffer Algorithm for hidden surface removal. [8]

(*b*) Explain HSV and CMY color model. [8]

11. (*a*) Write a Pseudo Code to implement DDA arc generation. [8]

(*b*) Explain the procedure to generate fractal lines and from that fractal surfaces. [8]

Or

12. (*a*) Explain B-spline techniques for generating curves with an example. [8]

(*b*) Explain Lagrangian interpolation method. [8]

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

[4062]-209

S.E. (Computer Engineering)

(Second Semester) EXAMINATION, 2011

COMPUTER ORGANIZATION

(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.

SECTION I

1. (*a*) IAS computer is the prototype of all general purpose computers. Draw the structural of IAS computer and explain. [8]

(*b*) Explain the instruction cycle with the help of state diagram. [10]

Or

2. (*a*) Using Booth's algorithm multiply the following : [10]

Multiplicand = +12

Multiplier = –7.

(*b*) Show the circuit arrangement for binary division and give the steps involved in Restoring Division. [8]

3. (*a*) Enlist the features of three bus organization. [8]

(*b*) What are the advantages of hardwired control over microprogrammed control in the control unit design of CPU. [8]

Or

4. (*a*) How the instruction execution is done in 4-stage pipeline ? [8]

(*b*) What are the advantages of pipelining ? [8]

5. (*a*) Explain data hazards in instruction pipelining. [8]

(*b*) Define addressing mode. Explain the following addressing modes with suitable examples : [8]

(*i*) Register

(*ii*) Indirect

(*iii*) Base with index

(*iv*) Relative.

Or

6. (*a*) Differentiate between combinational and sequential ALU. [4]

(*b*) What is the use of one address/two address/three address instructions ? Explain with examples. [6]

(*c*) Give the single precision floating point representation of 18.24. [6]

SECTION II

7. (*a*) What are the differences between SRAM and DRAM memory cell ? Explain with neat diagram. [8]

   (*b*) Define the term memory latency. How the performance is improved in DDR SDRAM ? [8]

Or

8. (*a*) What is the use of cache memory ? Explain direct and set associative mapping. [10]

   (*b*) Give the steps involved in LRU replacement algorithm. [6]

9. (*a*) Compare memory mapped I/O and program controlled I/O. [6]

   (*b*) Define interrupt latency. Enlist the steps involved in handling an interrupt request. [10]

Or

10. (*a*) How is the data transmitted in DMA ? Explain use of DMA controllers in a computer system. [8]

    (*b*) What is bus arbitration ? Describe the centralized and distributed arbitration. [8]

11. (*a*) Explain in detail superscalar architecture. [8]

    (*b*) What are the benefits of clustering ? [6]

    (*c*) What is cache coherence problem ? [4]

Or

12. (*a*) Enlist the characteristics of Non-uniform Memory Access (NUMA). [6]

(*b*) Write short notes on any *three* : [12]

(*i*) USB bus

(*ii*) SMP

(*iii*) Vector computations

(*iv*) Bus allocation schemes.

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

[4062]-210

S.E. (Comp./IT/Electrical/Instru.)

(Second Sem.) EXAMINATION, 2011

ENGINEERING MATHEMATICS—III

(2008 PATTERN)

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

***N.B.* :—** (*i*) 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**.

(*ii*) 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**.

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

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

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

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

SECTION I

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

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

(*ii*) $(D^2 - 4D + 3)y = x^3 e^{2x}$

(*iii*) $(D^2 + 4)y = \tan 2x$ (by using method of variation of parameters)

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

(*b*) Solve :

$$\frac{dx}{dt} + 5x - 2y = t, \quad \frac{dy}{dt} + 2x + y = 0.$$ [5]

Or

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

(*i*) $(D^2 - D - 2)y = 2\log x + \dfrac{1}{x} + \dfrac{1}{x^2}$

(*ii*) $(D^2 - 2D)y = e^x \sin x$

(by using method of variation of parameters)

(*iii*) $(D^2 - 3D + 2)y = xe^{3x} + \sin 2x$

(*iv*) $\dfrac{dx}{y} = \dfrac{dy}{-x} = \dfrac{dz}{2x - 3y}.$

(*b*) An electric circuit consists of a capacitor of 10^{-3}F is in series with an emf of 20 V and inductor of 0.4 H. If charge Q and current I are zero at time $t = 0$, find charge Q at time t. [5]

3. (*a*) If $v = 3x^2y - y^3$, find the analytic function $f(z) = u + iv$ in terms of z. [5]

(*b*) Find bilinear transformation which maps the points 1, $i, -1$ of z-plane into the points i, 0, $-i$ of w-plane respectively. [5]

(*c*) Evaluate :

$$I = \oint_C \frac{4z^2 + z}{(z-1)^2} dz$$

where 'C' is contour $|z - 1| = 2$. [6]

Or

4. (*a*) Show that analytic function with constant modulus is constant. [6]

(*b*) Show that the map $w = \frac{2z+3}{z-4}$ transforms the circle $x^2 + y^2 - 4x = 0$ into the straight line $4u + 3 = 0$. [5]

(*c*) Evaluate :

$$\int_0^{2\pi} \frac{d\theta}{5 + 3\cos\theta},$$

using Cauchy's theorem. [5]

5. (*a*) Find Fourier transform of

$$f(x) = \begin{cases} 1 & -2 \le x < 0 \\ -1 & 0 < x \le 2 \end{cases}$$

Hence show that :

$$\int_0^{\infty} \frac{(\cos 2x - 1)\sin 2x}{x} dx = \frac{-\pi}{2}.$$ [6]

(*b*) Find Fourier cosine transform of the function

$$f(x) = 2e^{-5x} + 5e^{-2x}.$$ [5]

(*c*) Find z-transform of (any *two*) : [6]

(*i*) $f(k) = \sin(3k + 4) \ldots\ldots k \geq 0$

(*ii*)

(*iii*) $f(k) = (k + 2)2^k \ \ldots\ldots\ldots k \geq 0.$

Or

6. (*a*) Find inverse z-transform of (any *two*) : [8]

(*i*) $F(z) = \dfrac{1}{(z-2)(z-3)}$ (by Inversion integral method)

(*ii*) $F(z) = \dfrac{z(z+1)}{z^2 - 2z + 1}$ if $|z| > 1$

(*iii*) $F(z) = \dfrac{z^2}{\left(z - \dfrac{1}{4}\right)\left(z - \dfrac{1}{5}\right)}$ if $|z| < \dfrac{1}{5}$

(*b*) Solve the difference equation : [4]

$$f(k+1) - f(k) = 1, \; f(0) = 0.$$

(*c*) Solve the integral equation : [5]

$$\int_0^{\infty} f(x) \cos \lambda x \, dx = e^{-\lambda} \quad \lambda > 0$$

SECTION II

7. (*a*) Find the first four moments about mean for the following distribution. Also find β_1 and β_2 : [8]

Marks	**No. of Students**
0–10	1
10–20	6
20–30	10
30–40	15
40–50	11
50–60	7

(*b*) Two lines of regression are given by $5y - 8x + 17 = 0$ and $2y - 5x + 14 = 0$. If $\sigma_y^2 = 16$, find :

(*i*) the mean value of x and y

(*ii*) σ_x^2

(*iii*) the coefficient of correlation between x and y. [9]

Or

8. (*a*) A husband and wife appear in an interview for two vacancies in the same post. The probability of husband selection is $\frac{1}{7}$ and that of wife's selection is $\frac{1}{5}$. What is the probability (*i*) both of them will be selected, (*ii*) only one of them will be selected and (*iii*) none of them will be selected ? [6]

(*b*) One percent of articles from a certain machine are defective. What is the probability of (*i*) no defective, (*ii*) one defective and (*iii*) two or more defective in a sample of 100. [6]

(*c*) Mean and variance of binomial distribution are 6 and 2 respectively. Find $P(r > 1)$. [5]

9. (*a*) Find the directional derivative of $\phi(x, y, z) = x^2yz + 4xz^2$ at $(1, -2, 1)$ in the direction of $2i - j - 2k$. Find the greatest rate of increase of ϕ. [5]

(*b*) A fluid motion is given by $\bar{v} = (y \sin z - \sin x) + (x \sin z + 2yz)\hat{j} + (xy \cos z + y^2)\hat{k}$. Is the motion irrotational. If so, find the velocity potential. [6]

(*c*) Find curl curl $\bar{F}$ at the point $(0, 1, 2)$, where

$$\bar{F} = x^2y\, i + xyz\, j + z^2y\, k.$$ [5]

Or

10. (*a*) Attempt any *two* : [6]

(*i*) Prove that :

$$\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r^n} \right) = \frac{(2-n)\bar{a}}{r^n} + \frac{n(\bar{a} \cdot \bar{r})}{r^{n+2}} \bar{r} .$$

(*ii*) Prove that :

$$\bar{b} \times \nabla(\bar{a} \cdot \nabla \log r) = \frac{\bar{b} \times \bar{a}}{r^2} - \frac{2(\bar{a} \cdot \bar{r})(\bar{b} \times \bar{r})}{r^4} .$$

(*iii*) Find the value of $\nabla^2 (r^n \log r)$.

(*b*) If

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

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

$$\bar{F} = (2x + y^2)i + (3y - 4x)j$$

(*c*) Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, –1, 2). [5]

11. (*a*) If

then evaluate $\int_C \bar{F} \cdot d\bar{r}$ around the parabolic arc $y^2 = x$ joining (0, 0) and (1, 1). [5]

(*b*) Evaluate :

$$\iint_S (x^3 i + y^3 j + z^3 k) d\bar{S}$$

where S is the surface of the sphere $x^2 + y^2 + z^2 = 16$. [6]

(c) Evaluate

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

by Stokes' theorem, where $\bar{F} = y^2\hat{i} + x^2\hat{j} - (x + z)\hat{k}$ and C is the boundary of the triangle with vertices (0, 0, 0), (1, 0, 0) and (1, 1, 0). [6]

Or

12. (a) Verify Green's Lemma in the plane for

$$\oint (3x^2 - 8y^2)dy + (4y - 6xy)dy$$

where C is the boundary defined by $x = 0$, $y = 0$ $x + y = 1$. [5]

(b) A vector field is given by $\bar{F} = (\cos y)i + x(1 - \sin y)\, j$. Evaluate the line integral over the circular path given by $x^2 + y^2 = a^2$, $z = 0$. [6]

(c) Evaluate :

$$\iint_S \nabla \times \bar{P} \cdot d\bar{S}$$

for $\bar{F} = y\hat{i} + z\hat{j} + x\hat{k}$, where S is the surface of the paraboloid $z = 1 - x^2 - y^2$, $z > 0$. [6]

Total No. of Questions—**6**] [Total No. of Printed Pages—**4**

[4062]-210(A)

S.E. (Computer Engineering) (II Sem.) EXAMINATION, 2011

FINANCIAL AND INDUSTRIAL MANAGEMENT

(2003 PATTERN)

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

***N.B.* :—** (*i*) Answer *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.

SECTION I

1. Explain the following principles of Management : [16]

(*i*) Unity of Command

(*ii*) Unity of Direction

(*iii*) Division of Labour

(*iv*) Authority and Responsibility

(*v*) Stability.

Or

(*a*) Explain the concept of "Scientific Management by F.W. Taylor" in detail. [10]

(*b*) Explain the different functions of Management. [6]

2. Explain the following concepts : [16]

(*i*) E-Business

(*ii*) E-Commerce

(*iii*) Copyrights and Patents.

Or

(*a*) Explain the role of SEBI in the Indian Stock Markets. [5]

(*b*) What is a Contract ? Explain the conditions of valid contract. [6]

(*c*) Explain the importance of Engineering Economics. [5]

3. Describe the formation of 'Partnerships' along with their salient features, advantages and disadvantages. [18]

Or

Write short notes on the following : [18]

(*i*) Line and Staff structure

(*ii*) MOA and AOA

(*iii*) Public Sector Undertakings.

SECTION II

4. (*a*) Explain the process of communication and varies barriers in effective communication. [10]

(*b*) State and explain different types of recruitments. [6]

Or

(*a*) Explain the concept of 'Manpower Planning'. [8]

(*b*) Explain the importance of training along with different types of training methods. [8]

5. (*a*) Define cost and explain the different elements of cost. [8]

(*b*) Explain the importance of Budgetary Control. [8]

Or

(*a*) Explain the contents of Balance Sheet and the importance of Balance Sheet. [8]

(*b*) Discuss the concepts of working capital and fixed capital. [8]

6. (*a*) Explain the following ratios : [8]

(*i*) Current Ratio

(*ii*) Debt Equity Ratio.

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

(*i*) Overheads and its types

(*ii*) Annuity.

Or

Write short notes on : [18]

(*a*) Depreciation

(*b*) Break-even Analysis

(*c*) Credit Rating for Software Companies.

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

[4062]-210-B

S.E. (Computer) (Second Sem.) EXAMINATION, 2011

ELECTRONIC DEVICES AND CIRCUITS

(2003 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 diagram must be drawn wherever necessary.

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

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

SECTION I

1. (*a*) Draw neat circuit diagram of a voltage divider bias circuit. State the function of each component in the circuit. [8]

(*b*) Define Stability factor. Explain S, S' and S". [8]

Or

2. (*a*) Explain thermal runaway with reference to BJT and FET. [8]

(*b*) A Si. NPN transistor is connected in self bias arrangement has β = 100, V_{CC} = 10 V, R_C = 1.1 K ohm, R_E = 100 ohm, $V_{ce}Q$ = 5 V. Calculate stability factor(s) to ensure thermal stability of the circuit. Assume I_{co} = 1.2 nA and Q = 10*10 degree C/watt. [8]

3. (*a*) State and explain Miller's Theorem. Derive equation for input and output resistance. [8]

(*b*) Explain with neat diagram the effect of biasing resistors on input impedance of simple emitter follower circuit. How is the effect overcome by bootstrap emitter follower circuit ? [8]

Or

4. (*a*) Compare the transistor configuration on the basis of parameters R_{in}, R_o, A_v and A_i. [8]

(*b*) What do you mean by small signal and what for small signal analysis is used ? [8]

5. (*a*) Explain what is the Need of Multistage amplifier and its effect on gain and Bandwidth. [8]

(*b*) What do you understand by large signal amplifier ? Classify them on the basis of Q point position and compare them. [10]

Or

6. (*a*) Draw the '*h*' parameter equivalent circuit of CE-CE cascade amplifier and find R_i, R_o, A_v and A_i. [8]

(*b*) Draw neat circuit diagram of two stages RC coupled cascade amplifier and explain cascade effect on its frequency response of an amplifier. [10]

SECTION II

7. (*a*) Explain the working of *n*-channel JFET. Define forward transconductance (gm), drain resistance (rd) and amplification factor (μ). [8]

(*b*) Explain analysis of common source amplifier with and without source resistance. [8]

Or

8. (*a*) Draw a neat labelled schematic symbol, drain and transfer characteristic of *p*-channel depletion MOSFET. [8]

(*b*) Explain with neat diagram the working of biasing circuits used for EMOSFET. [8]

9. (*a*) Draw and explain with circuit diagram a half wave precision rectifier. [8]

(*b*) Draw and explain with neat diagram instrumentation amplifier using *three* op-amps and derive the expression for output voltage 'V_o'. [8]

Or

10. (*a*) Draw and explain with neat circuit diagram a voltage to frequency converter. [8]

(*b*) Draw and explain with neat circuit diagram a triangular wave generator. [8]

11. (*a*) Draw a block diagram of SMPS. State its various types, specifications and applications. [8]

(*b*) Explain the construction, Operation of Triac and V-I characteristics of Triac with the help of equivalent circuit of it. [10]

Or

12. (*a*) Draw the block diagram of ON LINE UPS and explain. [8]

(*b*) An AC power controller using triac operates at 230 V, 50 Hz AC supply to feed a resistive load of 25 ohm. If the triac turns on at an angle of 45 degree, obtain :

(*i*) RMS value of output current

(*ii*) RMS value of output voltage

(*iii*) RMS value of output power. [10]

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

[4062]-211

S.E. (Information Technology) (I Sem.) EXAMINATION, 2011

COMPUTER ORGANIZATION

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer Question No. **1** *or* **2**, **3** *or* **4** and **5** *or* **6** from Section I and Question No. **7** *or* **8**, **9** *or* **10** and **11** *or* **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*) Draw flowchart of Booth's algorithm for signed multiplication. How bit pair recoding technique achieves faster multiplication. Bit pair recode multipliers $(110110101111001)_2$ and $(0101101010010101)_2$. [10]

(*b*) Draw IEEE standard single precision and double precision floating point formats. Represent $-(99.75)_{10}$ in single precision and double precision IEEE format. [8]

Or

2. (*a*) Draw flowchart of Booth's algorithm for non-restoring unsigned division and divide the following unsigned numbers and justify your answer.

Dividend = $(15)_{10}$, Divisor = $(2)_{10}$. [10]

(*b*) Draw detailed Von Neumann architecture and explain function of registers in it. [8]

3. (*a*) Specify factors which decide instruction length. Draw and explain instruction format for INTEL processors. [8]

(*b*) Draw and explain functional block diagram of 8086. [8]

Or

4. (*a*) State addressing modes for the following instructions and show physical address generation : [8]

(*i*) MOV AX, [BX] [SI]

(*ii*) MOV CX, [DI]

(*iii*) MOV DX, [1234]

(*iv*) MOV BX, [BP] [DI] [0045]

(*b*) Draw timing diagram for memory cycle of 8086 and list operations in each T state. [8]

5. (*a*) Explain design of multiplier control unit using any hardwired design method. [8]

(*b*) For a single bus organization of CPU, write micro-operations and control signals for unconditional branch instruction. [8]

Or

6. (*a*) Draw and explain general block diagram of the microprogrammed control unit. [8]

(*b*) Compare : [8]

(*i*) Hardwired and microprogrammed control

(*ii*) Horizontal and vertical microinstruction format.

SECTION II

7. (*a*) Discuss set associative and fully associative cache mapping techniques with respect to mapping function, address structure, merits and demerits. [10]

(*b*) Discuss page replacement strategies in detail. [8]

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]

(*i*) EEPROM

(*ii*) SRAM

(*iii*) Optical disk

(*iv*) RAID.

9. (*a*) What is DMA ? Explain DMA operation with a diagram. Also explain data transfer modes in DMA. [8]

(*b*) Compare : [8]

(*i*) Programmed I/O and Interrupt driven I/O

(*ii*) Memory mapped I/O and I/O mapped I/O.

Or

10. (*a*) Explain the working principle of the following : [8]

(*i*) Laser printer

(*ii*) Keyboard.

(*b*) Compare : [8]

(*i*) Parallel and serial communication

(*ii*) Synchronous and asynchronous serial communication.

11. (*a*) Draw and explain loosely coupled multiprocessor configuration with its merits. [8]

(*b*) Explain briefly : [8]

(*i*) Instruction pipelining

(*ii*) Superscalar architecture.

Or

12. (*a*) What is cluster ? State advantages of clustering. Explain cluster classification. [8]

(*b*) Compare : [8]

(*i*) UMA & NUMA

(*ii*) RISC & CISC.

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

[4062]-212

S.E. (IT) (I Sem.) EXAMINATION, 2011

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*) Explain logical operators in C with example. [6]

(*b*) Differentiate between union and structure. [4]

(*c*) Define the following terms : [6]

(*i*) Constant

(*ii*) Variable

(*iii*) Precedence of operator.

Or

2. (*a*) Write pseudo C algorithm to find length of a string. [4]

(*b*) Explain enumeration with example. [4]

(*c*) Describe auto, static, register and extern storage classes. [8]

3. (*a*) Explain linear and non-linear data structures. [6]

(*b*) Write characteristics of an algorithm. [4]

(*c*) What is time complexity ? How is time complexity of an algorithm computed ? [6]

Or

4. (*a*) Explain Big-oh, omega, and theta notations. [6]

(*b*) What is frequency count of a statement ? Analyze time complexity of the following code : [6]

(*i*)

```
for(i = 1; i <= n; i++)
for(j = 1; j <= m; j++)
for(k = 1; k <= p; k++)
sum = sum + i;
```

(*ii*)

```
i = n;
while(i 3 1)
   {i--;}
```

(*c*) Differentiate between primitive and non-primitive data structures. [4]

5. (*a*) Explain call by value and call by reference with suitable example. [8]

(*b*) Write recursive functions for the following : [8]

(*i*) To find factorial of a given positive no.

(*ii*) To find sum of digits of given positive no.

Or

6. (*a*) What is pointer ? Explain pointer to a function. [6]

(*b*) Passing a structure to a function by reference is more efficient than passing it by value. Justify. [4]

(*c*) Is it legal to return a point to local auto variable ? Explain your answer with suitable example. [6]

SECTION II

7. (*a*) Write pseudo C algorithm for linear and binary search. [8]

(*b*) Write pseudo C code to sort a list of integers using bubble sort. Show output of each pass for the following list :

10, 5, 4, 18, 17, 1, 2. [8]

Or

8. (*a*) Sort the following nos. using insertion sort. Show all passes :

50, 10, 78, 40, 30, 02, 04, 15. [4]

(*b*) Sort the following elements in ascending order using bucket sort. Show all passes :

121, 235, 55, 973, 327, 179. [6]

(*c*) Write pseudo C algorithm for selection sort. [6]

9. (*a*) Explain sequential and linked memory organization. [6]

(*b*) Write pseudo C algorithm to find transpose of a sparse matrix using fast transpose algorithm. Analyze its time complexity. [10]

Or

10. (*a*) Explain row and column major representation of a matrix. [4]

(*b*) Write data structure to represent sparse matrix. Write C function to add two sparse matrices. [8]

(*c*) Represent the following polynomial using two-dimensional array : [4]

(*i*) $x^2 + xy + 2x^2y$

(*ii*) $3x^3 + 2y^2x + 5y^3x^3$.

11. (*a*) What are advantages of linked list over array ? [4]

(*b*) Define node structure for SLL and perform the following operation on a SLL without header node (write C functions) : [14]

(*i*) Delete first node

(*ii*) Delete last node

(*iii*) Delete a node with a specified data value which is between the two nodes

(*iv*) Find sum of elements in the list

(*v*) Print list reverse recursively.

Or

12. (*a*) Write pseudo C code to add two ordered polynomials in a single variable represented by SLL. [8]

(*b*) What is generalized linked list ? Write its applications. [4]

(*c*) Write a C function to reverse SLL. [6]

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

[4062]-213

S.E. (IT) (II Sem.) EXAMINATION, 2011

COMPUTER GRAPHICS

(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*) Give the algorithm for Bresenham circle drawing. Derive the necessary equations. [10]

(*b*) Explain the following devices :

(*i*) Scanners

(*ii*) Digitizers. [6]

Or

2. (*a*) Explain the term display file. Give *four* different ways to implement display file along with data structures. [8]

(*b*) Give the algorithm to draw a line using DDA. Use this algorithm to rasterize the line whose end points are (3, 2) and (10, 8). [8]

3. (*a*) Derive the general transformation matrix for mirror reflection of any polygon about an arbitrary line whose equation is given by $y = mx + b$, m is the slope of line and b in r intercept. [12]

(*b*) Use the above transformation matrix to reflect the polygon with vertices A(2, 5), B(7, 10) and C(10, 2) about the line $y = -10x + 5$. [4]

(*c*) Perform X-shear on the polygon whose vertices are A(0, 0), B(0, 4), C(4, 4), D(4, 0) by 2 units. [2]

Or

4. (*a*) Explain scanline method for polygon filling. [8]

(*b*) Perform a 45 degree rotation of a triangle with vertices A(10, 10), B(15, 15), C(20, 10) :

(*i*) about origin

(*ii*) about the point (5, 5). [8]

(*c*) Translate the polygon with coordinates A(0, 0), B(0, 4), C(4, 4), D(4, 0) by 2 units in X direction and 3 units in Y direction. [2]

5. (*a*) Obtain the general 3D transformation matrix for rotation about any arbitrary axis. [12]

(*b*) Write a short note on polygon meshes. [4]

Or

6. (*a*) Obtain general parallel projection onto a given view plane. The view plane passes through a point $V(x_0, y_0, z_0)$ and normal to the view plane is given by $N = n_1 i + n_2 j + n_3 k$. The direction of projection is given by vector $V = a_i + b_j + c_k$. Give your answer stepwise along with transformation matrix at each step. [12]

(*b*) Explain any *one* quadric surface with figure, its equation and parametric form. [4]

SECTION II

7. (*a*) Explain RGB, HSV color models. [8]

(*b*) What are the steps in design of animation sequence ? Describe each step in detail. [8]

Or

8. (*a*) Explain CIE chromaticity diagram. How is RGB to CMY conversion done ? Explain. [8]

(*b*) Write short notes on :

(*i*) Key frame systems

(*ii*) Morphing. [8]

9. (*a*) Describe diffuse illumination. [4]

(*b*) Explain Lambert's cosine law. [4]

(*c*) Explain with diagram :

(*i*) Ray tracing to find shadows

(*ii*) Ray tracing to find reflections. [8]

Or

10. (*a*) Compare Gauraud and Phong's methods of shading. [8]

(*b*) Write short notes on :

(*i*) Z buffer

(*ii*) Ray tracing to solve hidden surface problem. [8]

11. (*a*) Give the set of equations for generating Bezier curve. Give the algorithm for drawing a Bezier curve section using *four* points. [10]

(*b*) Explain how fractals are used to generate fractal surfaces. Give *two* examples of fractal surfaces. [8]

Or

12. (*a*) Explain Monte-Carlo method for rendering. [6]

(*b*) Write short notes on :

(*i*) Properties of Bezier curve

(*ii*) Antialising

(*iii*) Features of any Graphics Tool. [12]

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

[4062]-214

S.E. (IT) (II Sem.) EXAMINATION, 2011

PROCESSOR ARCHITECTURE AND INTERFACING

(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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) What is BIU in 80386 processor ? What are the functions of BIU ? [8]

(*b*) With a neat diagram explain the memory segmentation of 80386 processor. [10]

Or

2. (*a*) Explain the debug registers of 80386 processor with their formats. [10]

(*b*) List and explain the hardware interrupt pins of 80386 processor. [8]

3. (*a*) With examples explain the different addressing modes of 80386 processor. [10]

(*b*) What are assembler directives ? Explain any *three* assembler directives used in 80386 programming. [6]

Or

4. (*a*) Explain with diagram interface of 4 × 4 keyboard matrix with the 8255 Programmable Peripheral Interface. [10]

(*b*) What is segment override prefix ? With an example explain the implementation of segment override prefix. [6]

5. (*a*) List and explain the different Descriptor Table Registers used in protected mode of 80386 processor. [10]

(*b*) What is virtual memory of 80386 processor ? How is it created in 80386 processor using segmentation mechanism ? [6]

Or

6. (*a*) Explain the working of segment selector in protected mode operation of 80386 processor. [8]

(*b*) Explain the code segment descriptor format in 80386 processor. [8]

SECTION II

7. (*a*) State the differences in Virtual Mode of 80386 and 8086 processor. [10]

(*b*) Explain the difference between 3 operating modes of 80386. [8]

Or

8. (*a*) What is a Call Gate ? Explain how it is used in calling a function with a higher privilege level. [10]

(*b*) Explain how 80386 handles interrupts and exceptions in protected mode. [8]

9. Draw and explain the internal memory organization of 8051 Microcontroller. [16]

Or

10. (*a*) Draw an interfacing diagram of 8051 with 16 K × 8 program memory (EPROM) using 8 KB devices and 8 K × 8 data memory (RAM) using 8 KB devices. Explain. [12]

(*b*) Write ALP to configure port 0 to i/p and port 2 to o/p for 8051. [4]

11. (*a*) Explain the timer and counter operations in Mode 0 and Mode 2 of 8051. [8]

(*b*) List the features of PIC 16F8XX series of microcontrollers. [8]

Or

12. Explain the different operating modes of serial communication in 8051. [16]

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

[4062]-215

S.E. (IT) (Second Semester) EXAMINATION, 2011

DATA STRUCTURE AND FILES

(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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Write a note on command line arguments. [4]

(*b*) Compare between the following file read functions. [8]

fscanf, fread, fgets and fgetc.

(*c*) Compare sequential and index sequential files. [4]

Or

2. (*a*) Compare between the following file read functions : [8]

fprintf, fwrite, fputs and fputc.

(*b*) Write C implementation of all primitive operations on sequential file. [8]

3. (*a*) Consider the program

```
int fact (int n)
{
    Int x, y;
    If (n == 0)
        return (1);
    x = n-1;
    y = fact(x);
    return(n*y);
}
```

Suppose a calling program contains the following statement

Print (“%d”, fact(4));

Display the contents of the stack for the variables n, x and y as execution of the fact function proceeds. [8]

(*b*) Write a program to convert an infix expression to postfix. [6]

(*c*) Transform each of the following prefix expressions to infix. [4]

+-$ABC*D**EFG

++A-*$BCD/+EF*GHI

Or

4. (*a*) Write a program for implementation of stack as an ADT using sequential organisation. [8]

(*b*) Evaluate the following postfix expressions. Assume A = 1, B = 2, C = 3 [4]

AB + C - BA + C$-

ABC +*CBA-+*

(*c*) Give the data structures for implementation of stacks using both sequential and linked organisation. Give applications of stack. [6]

5. (*a*) Consider the following deque of characters where DEQUE is a circular array which is allocated six memory cells : LEFT = 2, RIGHT = 4, DEQUE : __, A, C, D,—,— Describe the deque while the following operations take place : [8]

(*i*) F is added to the right of the deque;

(*ii*) Two letters on the right are deleted;

(*iii*) K, L and M are added to the left of the deque;

(*iv*) One letter on the left is deleted;

(*v*) R is added to the left of the deque;

(*vi*) S is added to the right of the deque;

(*vii*) T is added to the right of the deque.

(*b*) Implement circular queue as an adt using linked list. [8]

Or

6. (*a*) Write a note on priority queues. [4]

(*b*) Differentiate between a queue and an array. List down the applications of queues. [6]

(*c*) Write the pseudo code for implementation of circular queue using arrays. [6]

SECTION II

7. (*a*) Define the following with respect to trees with examples : [8]

(*i*) Complete binary tree

(*ii*) Predecessor and Successor

(*iii*) Skewed binary tree

(*iv*) Height of tree

(*b*) Write non-recursive preorder and inorder traversal algorithms for inorder threaded binary tree. [8]

Or

8. (*a*) Write functions for non-recursive inorder and preorder traversals for binary trees. [8]

(*b*) Parenthesis are not given in an expression in prefix or postfix. Justify. Draw the expression tree and find the infix and postfix expressions for the following prefix expression.

*–AB + * CD/EF [8]

9. (*a*) Define a graph. For the given adjacency matrix draw the graph and its adjacency list : [8]

	A	B	C	D	E	F	G	H
A	0	1	1	0	0	0	0	0
B	1	0	0	0	1	0	0	0
C	1	0	0	1	0	1	0	0
D	0	0	1	0	0	0	0	1
E	0	1	0	0	0	0	1	0
F	0	0	1	0	0	0	1	1
G	0	0	0	1	0	1	0	0
H	0	0	0	1	0	1	0	0

Find all the nodes adjacent to node A, node F and node G.

(*b*) Write the algorithm to find the shortest path from every node to every other node in a graph using Dijkstra's algorithm. Find the same for any graph of your choice. [8]

Or

10. (*a*) For the given adjacency matrix, draw the graph : [10]

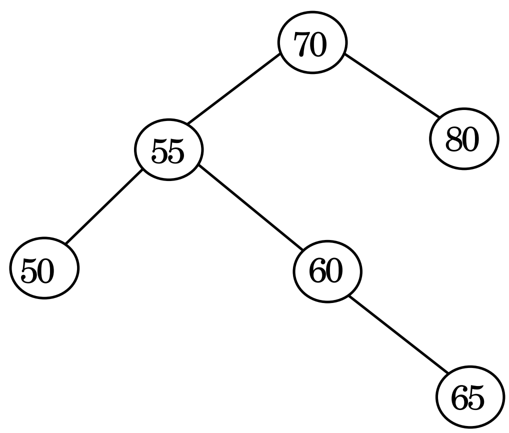
	A	B	C	D	E	F
A	0	3	4	0	2	1
B	0	0	2	0	0	3
C	0	0	0	2	6	1
D	2	6	1	0	1	2
E	0	0	0	0	0	3
F	0	0	0	0	0	0

Fig (a)

Write the pseudocode for Prim's algorithm and find the MST by showing all the steps.

(*b*) For the graph of fig. (a) write the pseudocode for Kruskal's algorithm and find the MST by showing all the steps. [6]

11. (*a*) Balance the AVL tree given in Fig. a. Show the balance factors in the result. [10]



Insert 49, 68, 44, 66, 77 to the resultant tree and show all the balance factors.

(*b*) Draw a Huffman's tree for the given data set and find the corresponding Huffman codes : [8]

Character	**Weight**	**Character**	**Weight**
A	10	H	3
B	3	I	6
C	4	J	8
D	15	K	7
E	2	L	5
F	4	M	12
G	2	N	5

Or

12. (*a*) Define a heap. With examples describe different types of heaps. Make a heap out of the following data read from the keyboard : 23, 7, 92, 6, 12, 14, 40, 44, 20, 21. [12]

Sort the heap in ascending order.

(*b*) Write a note on OBST. [6]

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

[4062]-216

S.E. (IT) (Second Semester) EXAMINATION, 2011

DATA COMMUNICATIONS

(2008 PATTERN)

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

***N.B.* :—** (*i*) Answer question No. **1** *or* **2**, **3** *or* **4**, **5** *or* **6** from Section I and question No. **7** *or* **8**, **9** *or* **10**, **11** *or* **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*) Draw ISO-OSI reference model. What are the responsibilities of : [8]

(*i*) Physical layer

(*ii*) Data Link layer

(*iii*) Network layer.

(*b*) Explain pulse code modulation. State the advantages of Delta modulation over Pulse code modulation [8]

P.T.O.

Or

2. (*a*) Explain various addresses in TCP/IP protocol suit. [8]

(*b*) Distinguish between : [8]

(*i*) Base band transmission and Broad band transmission

(*ii*) Time Domain and Frequency Domain.

3. (*a*) Define modulation and modulation index. Compare AM, FM and PM. [8]

(*b*) Explain BPSK and QAM. Draw constellation diagram of it. [8]

Or

4. (*a*) What do you mean by spread spectrum ? Explain FHSS. State the advantages and disadvantages. [8]

(*b*) Explain the concept of multiplexing. Explain TDM, FDM and WDM. [8]

5. (*a*) Explain Circuit Switched network with all three phases. State advantages and disadvantages. Discuss about the efficiency and delay in a circuit switched network. [10]

(*b*) Draw an electromagnetic spectrum for wireless communication. Explain Ground wave, Sky wave and Space wave propagation. [8]

Or

6. Write short notes on : [18]

(*a*) Co-axial cable and Fiber optic cable

(*b*) Dial up Modem

(*c*) Virtual Circuit Network.

SECTION II

7. (*a*) Explain the reason for moving from the Stop-and-Wait ARQ protocol to the Go-Back-N ARQ protocol. [8]

(*b*) Compare and contrast HDLC and PPP. [8]

Or

8. (*a*) Discuss the concept of redundancy in error detection and correction. [6]

(*b*) What is hamming distance ? What is the minimum Hamming Distance ? [4]

(*c*) Distinguish between forward error correction and error correction by retransmission. [6]

9. (*a*) Explain different controlled access methods with the help of diagrams. [10]

(*b*) What are the advantages of dividing an Ethernet LAN with a bridge ? [6]

Or

10. (*a*) Explain *three* categories of multiple access protocols. [10]

(*b*) Define the type of the following destination addresses. [6]

(*i*) 4A : 30 : 10 : 21 : 10 : 1A

(*ii*) 47 : 20 : 1B : 2E : 08 : EE

(*iii*) FF : FF : FF : FF : FF : FF

11. (*a*) What do you mean when we say that a bridge can filter traffic ? Why is filtering important ? [4]

(*b*) What is SONET ? Explain SONET devices with the help of diagram. [10]

(*c*) Discuss the working of VLAN. How does a VLAN reduce network traffic ? [4]

Or

12. (*a*) Discuss how an STS multiplexer is different from an add/drop multiplexer. [8]

(*b*) Explain SONET layers with respect to device-layer relationship. [10]

Total No. of Questions—**12**]

[Total No. of Printed Pages—**4**

[4062]-217

S.E. (IT) (Second Semester) EXAMINATION, 2011

MANAGEMENT AND FINANCE

(2003 PATTERN)

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

***N.B.* :—** (*i*) Answer any *one* question from each Unit.

(*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

UNIT I

1. (*a*) Define management. Explain in detail the functions of management. [12]

(*b*) Explain the importance of human relation skills to a manager. [4]

Or

2. (*a*) What are the different levels of management and their functions ? [8]

(*b*) Explain in brief the contribution of F.W. Taylor to the scientific management. [8]

UNIT II

3. (*a*) Define the law of demand and supply. Explain in brief the income and price elasticity of demand. [12]

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

(*i*) Utility

(*ii*) Value.

Or

4. (*a*) Distinguish between patents and copyrights. Explain the procedure for filing patents in India. [12]

(*b*) What do you understand by intellectual property rights ? [4]

UNIT III

5. Explain the following organizational structures with neat line diagrams : [18]

(*i*) Line organization

(*ii*) Line and staff organization

(*iii*) Functional organization

Or

6. (*a*) What is public corporation ? What are its characteristics ? [8]

(*b*) What are the various forms of ownership organizations ? State the factors to be considered before deciding the form of ownership to be started. [6]

(*c*) Explain in brief Memorandum of Association. [4]

SECTION II

UNIT-IV

7. Define training. What are the objectives of training and development function ? Describe the apprenticeship training along with its objectives. [16]

Or

8. (*a*) What is scientific selection of manpower ? Explain the process of manpower planning with a neat line diagram. [8]

(*b*) Explain with a neat diagram Maslow's need priority model. [8]

UNIT-V

9. (*a*) Working capital is known as 'revolving' or 'circulating capital'. Justify. [8]

(*b*) Define capital. What are the different types of capital ? State its importance in business enterprise. [10]

Or

10. (*a*) Explain the following types of markets in brief : [12]

(*i*) Money market

(*ii*) Capital market.

(*b*) Distinguish between budget and budgetary control. [6]

UNIT-VI

11. (*a*) Explain the term depreciation with suitable examples. Differentiate between depreciation and obsolescence. Explain the diminishing balance method of depreciation in brief. [12]

(*b*) Explain the significance of inventory turnover ratio. [4]

Or

12. (*a*) Explain the following in connection with the break-even chart with a neat sketch : [12]

(*i*) Break-even Point

(*ii*) Margin of safety

(*iii*) P/V ratio.

(*b*) What are the phases of capital budgeting ? [4]

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

[4062]-218

S.E. (Information Technology) (II Sem.) EXAMINATION, 2011

PROGRAMMING PARADIGM AND METHODOLOGY

(2003 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*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Explain the features of the following programming language paradigms in brief :

(*i*) imperative

(*ii*) object oriented

(*iii*) functional

(*iv*) logic

(*v*) concurrent. [10]

(*b*) Given a context free grammar (CFG) : S ® 0S0/1S1/0/1. Give a derivation tree for 0110110 and give the description of string which can be represented by the given CFG. [8]

Or

2. (*a*) What are the different benefits of higher level languages over low and assembly level language ? [8]

   (*b*) Explain with suitable example about logic programming paradigm of programming language. [6]

   (*c*) Differentiate between compiler and interpreter. [4]

3. (*a*) Give an example of an operation in programming language that is implemented as an in-line code sequence. [8]

   (*b*) What are the different bindings of data object ? Give the attributes of each of them. [8]

Or

4. (*a*) Differentiate between structure and union. [4]

   (*b*) Explain the difference among the type, variables of that type and constants of the type. [4]

   (*c*) Discuss the type conversion with respect to coercion, polymorphism and overloading. [8]

5. (*a*) Give the suitable code in 'C' to illustrate the call by value, call by reference and call by name. [8]

   (*b*) Define and discuss the following terms over the others :

   (*i*) Function

   (*ii*) Procedure

   (*iii*) Macro. [8]

Or

6. (*a*) Explain scope rules with suitable examples. [8]

(*b*) What do you mean by recursion in the program ? Give an example. [8]

SECTION II

7. (*a*) Write a LISP code for concatenating two lists and then display the list in reverse. [10]

(*b*) What is logic programming ? Explain it with respect to relation, rules, facts and queries. [8]

Or

8. (*a*) Explain different control structures used in PROLOG. [8]

(*b*) What is an association list ? Give suitable example in LISP. [6]

(*c*) Write a short note on garbage collection. [4]

9. (*a*) How do we achieve dynamic memory allocation using constructor and destructor in C++ ? [8]

(*b*) Define the following terms with respect to OOP :

(*i*) Object

(*ii*) Class

(*iii*) Subclass

(*iv*) Instance

(*v*) Method

(*vi*) Messages. [8]

Or

10. (*a*) What do you mean by information hiding and abstraction in C++ ? How do you differ from each other ? [8]

(*b*) What is the inheritance in C++ ? Explain different types of inheritances in C++. [8]

11. (*a*) Discuss the various components of the PASCAL program with suitable example. [10]

(*b*) What are the different data types supported by PASCAL ? Explain with suitable example. [6]

Or

12. (*a*) Write a program to reverse a string without using library functions in 'C'. [4]

(*b*) Explain the advantages of structured programming design. [4]

(*c*) Write different data types for :

(*i*) Pascal

(*ii*) C

(*iii*) LISP

(*iv*) PROLOG. [8]

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

[4062]-219

S.E. (IT) (Second Semester) EXAMINATION, 2011

MICROPROCESSOR SYSTEM

(2003 PATTERN)

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

N.B. **:—** (*i*) Answer question No. **1** *or* **2**, **3** *or* **4**, and **5** or **6** from Section I and question No. **7** *or* **8**, **9** *or* **10**, and **11** *or* **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*) What is the role of Bus Interface Unit (BIU) and queue inside BIU ? If CS = 1000H and IP = 0300H, what will be the effective address and physical address of the instruction ? Explain the advantages of segmentation. [10]

(*b*) Explain with suitable diagram how a byte or word is accessed at even or odd address. [8]

Or

2. (*a*) State direction and the function of the following pins of 8086 : [10]

(1) # INTA

(2) RESET

(3) # DEN

(4) # LOCK

(5) READY

where # indicates active low signal.

(*b*) Draw minimum mode configuration of 8086 showing clearly all signals and interconnections of the chips involved. [8]

3. (*a*) Draw programmer's model of 8086 and state functions of registers in it. [8]

(*b*) Identify the addressing modes of the following instructions and calculate physical address of the operand : [8]

(1) MOV AL, [BP]

(2) MOV CX, [BX]

(3) MOV AL, [BP + SI]

(4) MOV CS : [BX], AL

Given : CS = 2000H, DS = 3000H, SS = 4000H, ES = 5000H, BP = 0020h, BX = 0030h, SP = 0040h, SI = 0050h, DI = 0060h.

Or

4. (*a*) Compare :

(1) NEAR and FAR procedure

(2) DOS and BIOS. [8]

(*b*) What is the difference between .EXE file and .COM file ? How will you convert .EXE file to .COM file ? Explain. [8]

5. (*a*) Draw and explain the internal block diagram of 8259. [8]

(*b*) How is 8259 connected to 8086 ? Show interconnections between them. How does 8086 respond to INTR signal ? Write steps. [8]

Or

6. (*a*) Draw control word format of 8253 and give significance of bits in it. Explain any *two* operating modes of 8253 with waveforms. [8]

(*b*) State any 4 dedicated interrupts of 8086 with their types and specify condition which invokes these interrupts. [8]

SECTION II

7. (a) Draw and explain in short the block diagram of Programmable Peripheral Interface (PPI) 8255. Also comment on connection of this chip to the processor. Give different operating modes of 8255. [10]

   (b) Draw and explain block diagram of USART 8251. [8]

Or

8. (a) What is DMA and state its necessity ? What is the role of IC 8237 in DMA ? How is it interfaced with processor 8086 ? Explain various modes of operation of DMAC 8237. [10]

   (b) What is RS-232 interface ? Why is it necessary ? Write the basic features of USART 8251. [8]

9. (a) How does 80386 translate the logical address to physical address, when paging is enabled in protected mode ? Explain with the help of necessary formats of descriptors and diagrams. [10]

   (b) Compare IDT of 80386 with IVT of 8086. [6]

Or

10. (a) What do you mean by privilege levels ? What is the need ? Mention privileged and IOPL sensitive instructions of 80386. [10]

    (b) How does I/O permission bit-map help in accessing I/O devices ? [6]

11. (*a*) What is a task state segment (TSS) and its contents ? Explain the function and reaction of 80386 when the task switch occurs. [8]

(*b*) Draw and explain the TRAP GATE descriptor ? How is it different from Interrupt Gate Descriptor ? [8]

Or

12. (*a*) Draw and explain block diagram of Pentium processor. [8]

(*b*) What are the advantages of handling exceptions with task gates over using Trap or Interrupt Gates ? [8]

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

[4062]-221

S.E. (Biotech.) (First Semester) EXAMINATION, 2011

APPLIED CHEMISTRY

(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

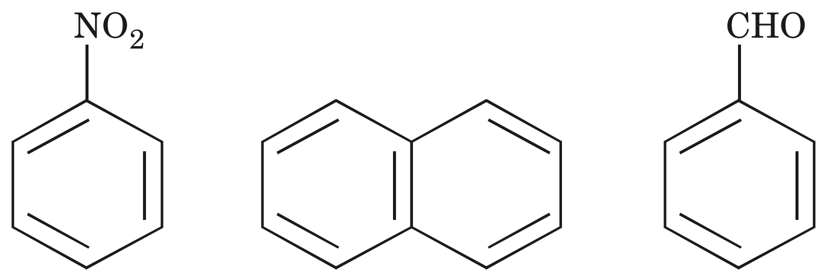
1. (*a*) What is Huckel's rule ? Discuss various criteria for aromaticity. [6]

(*b*) What are different types of organic reactions ? Explain them with suitable example. [6]

(*c*) What is inductive effect ? Explain +I and –I effect with suitable example. [4]

Or

2. (*a*) Draw all possible resonating structure for each of the following : [6]



(*b*) Write short notes on : [6]

(*i*) Hyperconjugative effect

(*ii*) Steric effect.

(*c*) Give reasons : [4]

(*i*) P-methoxy phenol is weaker acid than phenol

(*ii*) Pyrrole is a very weak base.

3. (*a*) What is Grignard's reagent ? Discuss its reaction involved in preparation of primary, secondary and tertiary alcohols from aldehyde and ketone. [6]

(*b*) Discuss the effect of the following factors on S_N2 reaction : [6]

(*i*) Nature of Nucleophile

(*ii*) Nature of Substrate

(*iii*) Nature of Leaving grp.

(*iv*) Nature of Solvent.

(*c*) Predict the product : [4]

(*i*)

(*ii*) $CH_3{-}\underset{\substack{|\\ CH_3}}{C}{=}CH_2 \xrightarrow{HCl} ?$

(*iii*) Acetanilide $\xrightarrow{\text{Sulphonation}}$?

(*iv*) $CH_3{-}CH_2{-}\overset{\substack{H\\ |}}{\underset{\substack{|\\ OH}}{C}}{-}CH_3 \xrightarrow[100^\circ C]{60\%\ H_2SO_4} ?$

Or

4. (*a*) Give the mechanism of E_1 and E_2 eliminations. [6]

Benzene $\xrightarrow[\text{mixture}]{\text{excess nitrating}}$?

(*b*) What is Claisen ester condensation ? Give its mechanism for formation of ethyl acetoacetate. [6]

(*c*) Give the mechanism of acylation of benzene. State the reagents for acylation. [4]

5. (*a*) What is conformational isomerism ? Discuss the conformational isomerism in *n*-butane. [6]

(*b*) Discuss conformation of cyclohexane with the help of energy profile diagram. [6]

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

(*i*) furan

(*ii*) thiophene.

Or

6. (*a*) Write a short note on optical isomerism. [6]

(*b*) Define and explain the following terms : [6]

(*i*) Geometrical isomerism in alkenes

(*ii*) R & S configuration

(*iii*) Asymmetric carbon.

(*c*) Predict the product : [6]

(*i*) Pyrrole + H_2 ?

(*ii*) Furan + Acetyl chloride ?

(*iii*) Quinoline ?

SECTION II

7. (*a*) What is Bragg's equation ? Describe the experimental methods for studying X-ray diffraction. [6]

(*b*) X-rays of wavelength equal to 0.134 nm give a first order diffraction from the surface of a crystal when the value of q is 10.5°, calculate the distance between the planes in the crystal parallel to the surface examined. [4]

(*c*) Explain concept of Parachor. Calculate the surface tension for ethyl alcohol at 20°C if parachor for hydrogen, carbon, oxygen are 17.1, 4.8 and 20.0 respectively. Density of ethyl alcohol is 0.740 g/cc. [6]

Or

8. (*a*) Derive the Poiseuille equation. [6]

(*b*) Describe any *one* method for measurement of vapour pressure. [6]

(*c*) The time required to flow through Ostwald's Viscometer is 1.82 minutes for water and for same volume of organic liquid having density 0.8 g/cc is 3.80 minutes. Find the viscosity of liquid relative to that of water.

(h_w = 1.002 centipoise) [4]

9. (*a*) What are the different types of molecular velocities ? Give the relationship between them. [6]

(*b*) Describe the pressure and volume corrections in van der Waals equation of state. [6]

(*c*) Calculate the root mean square speed of carbon dioxide molecules at 1000°C. [4]

Or

10. (*a*) Discuss the Andrew's experiment on liquefaction of carbon dioxide. [6]

(*b*) What do you mean by equipartition of energy ? [4]

(*c*) Calculate the mean free path of molecules in air using collision cross-section (ps^2) = 0.43 nm^2 at 25°C and :

(*i*) 10 atm

(*ii*) 1.0 atm

(*iii*) 1×10^{-6} atm. [6]

11. (*a*) Give the thermodynamic derivation for elevation in B.P. of solutions. [6]

(*b*) A solution contains 3.5 g of a non-volatile solute in 125 g of water, and it boils at 373.52 K. Calculate the molar mass of the solute (K_b for water = 0.52 K/m). [6]

(*c*) State and explain the Raoult's law. How will you distinguish between ideal and non-ideal solutions with the help of this law ? [6]

Or

12. (*a*) Define osmotic pressure and describe the Berkley and Hartley's method for the determination of osmotic pressure. [6]

(*b*) Derive a relationship between the relative lowering of V.P. and molar mass of the solute. [6]

(*c*) The vapour pressure of a 5% aqueous solution of a non-volatile organic substance at 373 K is 745 mm Hg. Calculate the molar mass of the substance. [6]

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

[4062]-223

S.E. (Biotechnology) (First Semester) EXAMINATION, 2011

MICROBIOLOGY

(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 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.

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

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

SECTION I

1. Discuss in detail, the contributions made by Louis Pasteur and Antony van Leeuwenhoek to the development of microbiology. [18]

Or

2. Describe in detail the structure of Gram-positive and Gram-negative bacterial cell wall. [18]

3. Explain graphically the characteristic phases of bacterial growth during their growth in a batch culture. [16]

Or

4. Write short notes on the following : [8 each=16]

(*a*) Extremophiles

(*b*) Complex and differential media.

5. Answer the following : [8 each=16]

(*a*) What are the different methods of sterilisation ?

(*b*) Discuss the mode of action of Streptomycin and mechanism of streptomycin resistance.

Or

6. Write short notes on (any *four*) : [4 each=16]

(*a*) Disinfectants

(*b*) Chemo-autotrophs

(*c*) Flagella

(*d*) Pathogenic fungi

(*e*) Pasteurization.

SECTION II

7. Describe typical life cycle of a retrovirus with an example. [18]

Or

8. Explain the different stages of bacteriophage replication. Add a note on classification of viruses. [18]

9. "Microorganisms are ubiquitous in nature." Elaborate with examples. [16]

Or

10. Answer the following : [8 each=16]

(*a*) What are extrinsic and intrinsic factors with reference to food spoilage ? Explain each with an example.

(*b*) Describe the stages involved in sewage treatment.

11. Answer the following : [8 each=16]

(*a*) Define "Disease" and "Infection". Describe "Cholera" with respect its causative agent, pathogenesis and treatment.

(*b*) Discuss in detail, the different types of diseases. Give *one* example of each.

Or

12. Write short notes on (any *four*) : [4 each=16]

(*a*) Rabies

(*b*) Symbiotic associations

(*c*) Spread plate technique

(*d*) Vector borne diseases

(*e*) T_4 phage.

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

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S.E. (Biotechnology) (First Semester) EXAMINATION, 2011

BIOCHEMISTRY-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 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 should be drawn wherever necessary.

SECTION I

1. Derive the Henderson-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]

Or

2. Answer the following (6 marks each) : [18]

(1) Explain the Furanose and Pyranose rings.

(2) Discuss about carbonate-bicarbonate buffering system in blood.

(3) Draw a flow chart for glycosis with all enzymes, coenzymes and ATP molecules involved in it.

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. Describe in detail about the synthesis of glycogen with emphasis on the glycogenin and the catalytic activity of glycogen synthase. [16]

5. Write short notes on :

(1) Ion exchange chromatography [6]

(2) Peptide bond [5]

(3) Cysteine and cystine [5]

Or

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

(*a*) Digestion and absorption of protein

(*b*) Acid base properties of amino acids.

SECTION II

7. Describe in detail β-oxidation of fatty acids with special emphasis on reactions such as oxidation, hydration and thiolysis involved in this process. Draw the structures of intermediate products. [18]

Or

8. Explain in detail (9 marks each) : [18]

(1) Ketone bodies

(2) Synthesis of cholesterol esters.

9. Explain in detail synthesis of purine and pyrimidine bases by salvage pathway. [16]

Or

10. Write in detail about (8 marks each) : [16]

(1) Nucleosides and nucleotides

(2) Enzymatic hydrolysis of nucleic acids.

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

(1) Role and deficiencies of any *two* minerals.

(2) Balanced diet.

Or

12. Describe in detail about the classification and functions of vitamins. [16]

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

[4062]-225

S.E. (Biotechnology) (Second Semester) EXAMINATION, 2011

BIOCHEMISTRY—II

(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. What are the different structure levels of protein ? Explain in detail with suitable diagram about the secondary structure of protein. [18]

Or

2. Explain in detail about the structure and function of myoglobin and hemoglobin. [18]

3. Derive the Michaelis and Menten equation for a one-substrate enzyme-catalyzed reaction by considering the steady-state assumption. [16]

P.T.O.

Or

4. Write in detail about : [8 each]

(1) Regulatory enzyme

(2) Allosteric enzymes.

5. Describe in detail about competitive and non-competitive inhibition of enzyme with a suitable example of each. [16]

Or

6. Explain in detail about the role of lipoic acid and biotin in any *one* enzyme catalyzed reaction. [16]

SECTION II

7. Draw in detail the hormone cascade and give *one* function of each. [18]

Or

8. Write in detail about : [9 each]

(*a*) Role of heterotrimeric G protein

(*b*) Flow sheet for epidermal growth factor signaling.

9. Write short notes on : [8 each]

(1) Active and passive transport of molecules across membrane

(2) Muscle contraction.

Or

10. Explain in detail about P-450 drug metabolizing enzymes and metabolism of drugs. [16]

11. Explain in detail about : [8 each]

(*a*) Water and electrolyte balance

(*b*) Hypoglycemia.

Or

12. Answer the following : [8 each]

(1) Explain the application of biochemistry in monitoring liver disease.

(2) Write down in detail about protein energy malnutrition.

Total No. of Questions—**12**] [Total No. of Printed Pages—**8+4+2**

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S.E. (Biotechnology) (II Sem.) EXAMINATION, 2011

MATERIAL BALANCES AND STOICHIOMETRY

(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*) Assume suitable data, if necessary.

(*v*) Use of scientific calculator is allowed.

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

SECTION I

1. (*a*) A ternary mixture of *n*-butane, 1-butene and furfural is analyzed to find the content of each in it. The mixture is tripped off with the help of carbon dioxide without appreciable entrainment of furfural due to its very low vapor pressure. The stripped gases are passed through an absorber column in which CO_2 is absorbed in 25% (by mass) KOH solution. The mixture of hydrocarbons, saturated with water vapor is collected in a measuring burette.

The test data are as follows :

Sample mass = 6.5065 g

Volume of saturated gases collected at 296.4 K (23.25°C) and 102.5 kPa (769 torr) = 415.1 mL.

n-butane present in the hydrocarbons (dry) in the burette = 43.1 mol%.

Find the analysis of the liquid mixture (both on mole and mass basis).

Data : Vapor pressure of water over 25% KOH solution at 296.4 K = 2.175 kPa. [10]

(*b*) In the production of a drug having molecular weight of 192, the exit stream from the reactor flows at the rate of 10.3 L/min. The drug concentration is 41.2% (in water), and the specific gravity of the solution is 1.025. Calculate the concentration of the drug (in kg/L) in the exit stream, and the flow rate of the drug in kg mol/min. [8]

Or

2. (*a*) By titration it was found that a sample of water contains hardness equivalent to 500 mg/L (ppm) $CaCO_3$. Assuming that the water contains temporary hardness in 60% $Ca(HCO_3)_2$ form, and 40% $Mg(HCO_3)_2$ form. Find the concentrations of both in water. [6]

(*b*) Ambient air on a particular day in a city has the following condition :

Total pressure = 100 kPa (750 torr)

Dry bulb temperature = 308.15 K (35°C)

Dew point = 294.45 K (21.3°C)

Find the absolute humidity of the air.

Data : vapor pressure of water at 294.45 K = 2.5326 kPa = 19 torr. [6]

(*c*) An industrial strength drain cleaner contains 5.00 kg of water and 5.00 kg of NaOH. What are the mass (weight) fraction and mole fraction of each component in the drain cleaner container ? [6]

3. (*a*) A storage tank of a demineralised (DM) water has a holding capacity of 1500 m^3 upto an overflow point. The inflow of DM water to the tank is 25 L/s having silica (as SiO_2) content of 0.005 mg/L. The supply of DM water to the high pressure boilers from the tank amount to 25 dm^3/s. With time the DM water quality deteriorates and the silica content in the feed DM water increases to 0.02 mg/L. Assume that the inflow into and the outflow from the tank remains constant at 25 L/s. Calculate the time for the silica content in the storage tank to increase to 0.01 mg/L. [10]

(*b*) Fish caught by human beings can be turned into fish meal, and the fish meal can be used as feed to produce meat for human beings or used directly as food. The direct use of fish meal significantly increases the efficiency of the food chain. However, fish protein concentrate, primarily for aesthetic reasons, is used mainly as a supplementary protein food. As such, it competes with soy and other oilseed proteins.

In the processing of the fish, after the oil is extracted, the fish cake is dried in rotary drum dryers, finely ground, and packed. The resulting product contains 65% protein. In a given batch of fish cake that contains 80% water (the remainder is dry cake), 100 kg of water is removed, and it is found that the fish cake is then 40% water. Calculate the weight of the cake originally put into the dryer. [6]

Or

4. (*a*) Dilute sulfuric acid has to be added to dry charged batteries at service stations to activate a battery. You are asked to prepare a batch of new 18.63% acid as follows. A tank of old weak battery acid (H_2SO_4) solution contains 12.43% H_2SO_4 (the remainder is pure water). If 200 kg of 77.7% H_2SO_4 is added to the tank, and the final solution is to be 18.63% H_2SO_4, how many kilograms of battery acid have been made ? [10]

(*b*) A pressure swing adsorption (PSA) unit produces nitrogen for inerting purpose. It is fed with compressed air at 7 bar g and 313 K (40°C) at the rate of 170 Nm^3/h. Unit consists of carbon molecular sieves which absorbs nitrogen under pressure. Nitrogen is produced from the unit at the rate of 50 NM^3/h having 99.5% purity (by volume). Calculate the average composition of the reject stream. [6]

5. (*a*) Antimony is obtained by heating pulverized stibnite (Sb_2S_3) with scrap iron and drawing off the molten antimony from the bottom of the reaction vessel.

$$Sb_2S_3 + 3Fe \text{ ® } 2Sb + 3FeS.$$

Suppose that 0.600 kg of stibnite and 0.25 kg of iron turnings are heated together to give 0.200 kg of Sb metal. Determine :

(*i*) the limiting reactant

(*ii*) the percentage of excess reactant

(*iii*) the degree of completion (fraction) (*iv*) the percent conversion

(*v*) the yield.

(Molecular weight of Sb_2S_3 = 339.7, Fe = 55.85, Sb = 121.8, FeS = 87.91) [10]

(*b*) Corrosion of pipes in boilers by oxygen can be alleviated through the use of sodium sulphite. Sodium sulphite removes oxygen from boiler feed water by the following reaction :

$$2Na_2SO_3 + O_2 \circledR 2Na_2SO_4.$$

How many pounds of sodium sulfite are theoretically required (for complete reaction) to remove the oxygen from 8,330,000 1b of water (10^6 gal) containing 10.0 parts per million (ppm) of dissolved oxygen at the same time maintain a 35% excess sodium sulfite ? [6]

Or

6. Immobilized glucose isomerase is used as a catalyst in producing fructose from glucose in a fixed bed reactor (water is the solvent). For the system shown in Figure, what percent conversion of glucose results on one pass through the reactor when the ratio of the exit stream to the recycle stream in mass units is equal to 8.33 ?

The reaction is :

$$\underset{\text{Glucose}}{C_{12}H_{22}O_{11}} \quad ® \quad \underset{\text{Fructose}}{C_{12}H_{22}O_{11}}$$

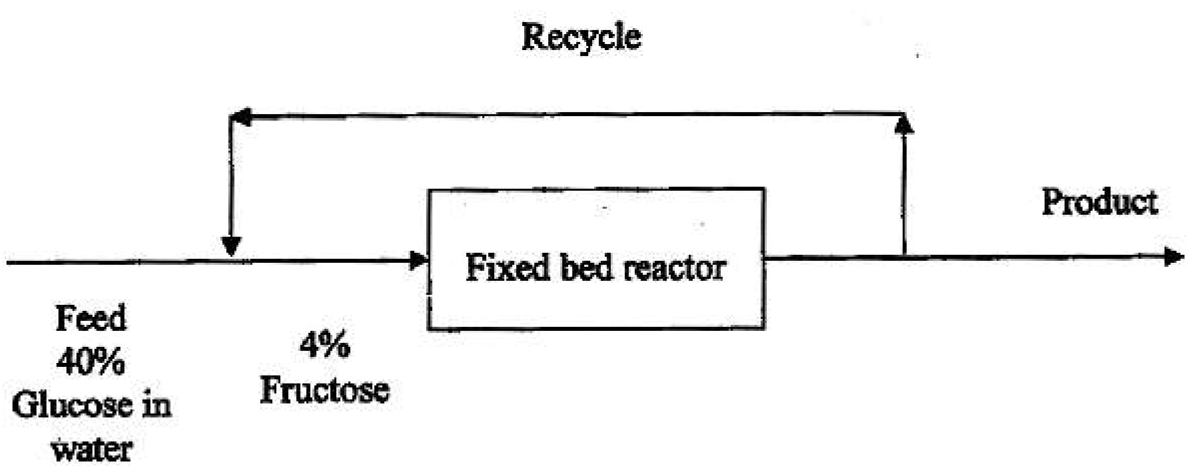


Figure — Fixed Bed Reactor [16]

SECTION II

7. A sulphur burner in a sulphite pump mill burns 200 kg of pure sulphur per hour. The gases leave the burner at 1144 K and are cooled before being sent to an absorption tower. As a primary cooler, a waste heat boiler is employed for producing saturated steam at 1.5 MPa.a. The temperature of the feed water to the boiler is 15 K lower than that of saturated steam at 1.5 MPa and the temperature of the gas mixture leaving the boiler is 463 K. Assume 10% excess air, complete combustion, no heat loss to the surroundings and no SO_3 formation. Calculate the amount of steam produced.

	SO_2	O_2	N_2
a	24.7706	26.0257	29.5909
$b \times 10^3$	62.9481	11.7551	–5.141
$c \times 10^6$	–44.2585	–2.3426	13.1829
$d \times 10^9$	11.122	–0.5623	–4.968

Latent heat of vaporization at 1.5 MPa = 1945.2 kJ/kg

Sensible heat = 4.1868 kJ/kg K. [16]

Or

8. (*a*) If the standard heat of formation for H_2O (*l*) is –285.835 kJ/g mol and the heat of evaporation is +44.012 kJ/g mol at 25°C and 1 atm, what is the standard heat of formation of H_2O (*g*) ? [6]

(*b*) Coal gasification consists of the chemical transformation of solid coal into gas. The heating values of coal differ, but the higher the heating value, the higher the value of the gas produced (which is essentially methane, carbon monoxide, hydrogen etc.). The following coal has a reported heating value of 29,770 kJ/kg as received. Assuming that this is the gross heating value, calculate the net heating value :

Component	**Percent**
C	71.0
H_2	5.6
N_2	1.6
Net S	2.7
Ash	6.1
O_2	13.0
Total	100.0

[6]

(*c*) Calculate heat of reaction for the following reaction of 4 g mol of NH_3 :

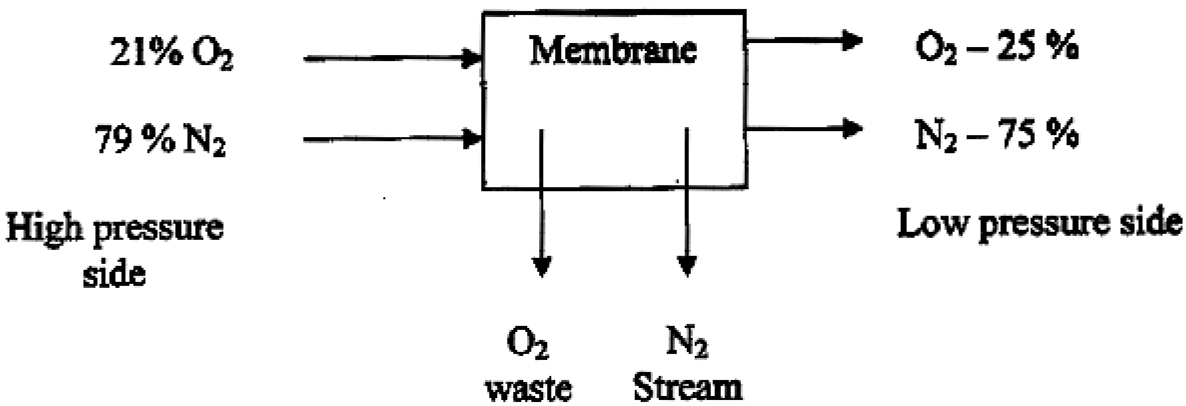
$4NH_3$ (*g*) + $5O_2$ (*g*) ® $4NO$ (*g*) + $6H_2O$ (*g*)

	NH_3 (*g*)	**O_2 (*g*)**	**NO (*g*)**	**H_2O (*g*)**
Heat of formation at 25 °C and 1 atm (kJ/g mol)	–46.191	0	–90.374	–241.826

[4]

9. (*a*) A multiple contact countercurrent extractor is employed to extract oil from halibut livers with the help of ethyl ether. The fresh livers are charged to the extractor at the rate of 1000 kg/h and contain 25.7% oil (by mass). Pure ether enters the bottom of the extractor. The overflow from the extractor contains 70% oil (by mass). The underflow rate is 0.23 kg solution/kg oil free solids and is known to contain 12.8% oil (by mass). Based on these operating conditions, make the complete material balance and find the flow rate of ether to the extractor. Also, compute the percentage recovery of oil. [8]

(*b*) Membrane represents a relatively new technology for the separation of gases. One use that has attracted attention is the separation of nitrogen and oxygen from air. The following figure illustrates a nanoporous membrane that is made by coating a very thin layer of polymer on a porous graphite-supporting layer. What is the composition of the waste stream if the stream amounts to 80% of the input ? [8]



Or

10. A saturated solution of $MgSO_4$ at 353 K (80°C) is cooled to 303 K (30°C) in a crystallizer. During cooling, mass equivalent to 4% solution is lost by evaporation of water. Calculate the quantity of the original saturated solution to be fed to the crystallizer per 1000 kg crystals of $MgSO_4.7H_2O$. Solubilities of $MgSO_4$ at 303 K (30°C) and 353 K (80°C) are 40.8 and 64.2 kg per 100 kg water respectively. [16]

11. (*a*) Fuels for motor vehicles other than gasoline are being eyed because they generate lower levels of pollutants than does gasoline. Compressed propane has been suggested as a source of economic power for vehicles. Suppose that in a test 20 kg of C_3H_8 is burned with 400 kg of air to produce 44 kg of CO_2 and 12 kg of CO. What was the percent excess air ? [8]

(*b*) The Orsat analysis of the flue gas from an oil fired furnace is CO_2—8%, CO—3%, O_2—4% and N_2—85%. An analysis indicates that the oil contains 78% by weight of C; the remainder being combustible hydrogen and moisture. Air enters at 30°C and 1.013 bar. Assuming air to be dry. [10]

Or

12. A coal sample has the following proximate and ultimate analyses. The GCV (as analyzed on dry ash free) = 23392 kJ/kg. Calculate :

(*i*) the net hydrogen in the coal

(*ii*) GCV based on Dulong's formula

(*iii*) NCV (actual of the coal)

(*iv*) the carbon content of coal using Calderwood equation and

(*v*) the moisture free and ash free analysis of coal.

Analysis of coal :

Air dried coal — Proximate analysis (Mass %) : Moisture — 7%, Volatile Matter — 26%, Fixed Carbon — 46% and Ash — 21%.

Air dried coal — Ultimate analysis (Mass %) : Carbon — 54%, Hydrogen — 3%, Sulphur — 0.4%, Nitrogen — 2.2%, Ash — 21% and Oxygen — 19.4%.

As received analysis — Ultimate analysis : Carbon — 50.22%, Hydrogen — 2.79%, Sulphur — 0.37%, Nitrogen — 2.05%, Ash — 19.53%, Oxygen — 18.04%, Moisture — 7.00%. [18]

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

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S.E. (Biotechnology) (II Sem.) EXAMINATION, 2011

CELL BIOLOGY AND TISSUE CULTURE

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

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

SECTION I

1. Explain, how eukaryotic cells are different from prokaryotic cells with respect to their structure. Describe any *three* eukaryotic cell organelles in detail. [18]

Or

2. Golgi complexes and lysosomes, explain how they are related to each other. Add a note on Exocytosis. [18]

3. Describe the structure of eukaryotic cell membrane. Explain "Selective permeability" of the same. [16]

Or

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

(*a*) Enlist the different mechanisms of transport of molecules across the cell membrane. Describe any *one* in detail.

(*b*) Describe the mechanism of molecule transport across the nuclear membrane.

5. Write notes on (**8** marks each) : [16]

(*a*) What is extracellular matrix ? Discuss their types and cells involved in production of the same.

(*b*) What is signal transduction ? Explain the role of cell surface receptors in the same.

Or

6. Write short notes on (any *four*) (**4** marks each) : [16]

(*a*) G protein-coupled receptor

(*b*) Microtubules

(*c*) JAK/STATs

(*d*) Endocytosis

(*e*) Morphogen.

SECTION II

7. What is apoptosis ? Explain how it is different from necrosis. [18]

Or

8. Give an overview of cell cycle and cell cycle check points. Add a note on relation of cell cycle with cancer. [18]

9. Describe the process of Haematopoesis. Add a note on chemical and physical properties of blood. [16]

Or

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

(*a*) Enlist different types of epithelial tissues. Explain any *one* in detail.

(*b*) What are stem cells ? Describe various stem cells niches in human body.

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

(*a*) What are the methods of animal tissue culture ? Explain any *one* in brief.

(*b*) Explain plant tissue culture can be used commercially for production of secondary metabolites.

Or

12. Write short notes on (any *four*) (**4** marks each) : [16]

(*a*) Totipotency

(*b*) Protoplast fusion

(*c*) Cryopreservation of animal cells

(*d*) Transgenic plants

(*e*) Suspension cell cultures.

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

[4062]-228

S.E. (Biotechnology) (Second Semester) EXAMINATION, 2011

THERMODYNAMICS

(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 should be drawn wherever necessary.

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

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

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

SECTION I

1. (*a*) A domestic refrigerator transfers energy in the form of heat from the cold space to the ambient atmosphere at higher temperature. Does it violate the Clausius statement of the second law of thermodynamics ? Explain in detail. [6]

(*b*) A system consisting of some fluid is stirred in a tank. The rate of work done on the system by the stirrer is 2.25 hp.

P.T.O.

The heat generated due to stirring is dissipated to the surroundings. If this heat is 3400 kJ/hour, determine the change in internal energy of the system. [6]

(*c*) Suppose a hot body is available at 200ºC while the ambient temperature is 25ºC. Calculate the maximum efficiency of a heat engine which operates between these two bodies. Determine the power delivered by engine if it absorbs energy as heat at a rate of 10 kJ/s from hot body. [6]

Or

2. (*a*) State and explain the Gibbs' phase rule for non-reacting systems. Determine the number of degrees of freedom for a system containing liquid solution of alcohol in water in equilibrium with its vapour. [4]

(*b*) State and explain the first law of themodynamics along with its mathematical statement. How will you calculate work done in a reversible adiabatic process ? [6]

(*c*) A steel casting of mass 10 kg at 800ºC is quenched in 100 kg water at 30ºC in an insulated container. The heat capacities of steel and water are 0.461 kJ/kg K and 4.23 kJ/kg K respectively. Calculate the change in entropy of steel and water. [8]

3. (*a*) Explain in brief the following terms : [8]

(*i*) Sensible heat effects

(*ii*) Standard heat of combustion

(*iii*) Standard heat of formation

(*iv*) Hess's law

(*b*) Pure CO is mixed with 100% excess air and completely burnt at constant pressure. The reactants are originally at 400 K. Determine the heat added or removed if the products leave at 600 K. The standard heat of reaction at 298 K is 283.028 kJ/mol of CO burned. The mean specific heats applicable in the temperature range of this problem are 29.10, 29.70, 29.10 and 41.45 J/mol K respectively for CO, O_2, N_2 and CO_2 respectively. [8]

Or

4. (*a*) Calculate the standard enthalpy change for the reaction at 298 K from the heat of formation of the chemical species. [8]

$$C_4H_{10}(g) + 13/2\,O_2(g) \text{ ® } 4CO_2(g) + 5H_2O(g)$$

The standard heats of formation (in kJ) of compounds involved in the reaction are :

Compound	$\mathbf{\Delta H^o_{r298}}$
$C_4H_{10}(g)$	–74.943
$CO_2(g)$	–393.978
$H_2O(g)$	–241.997

(*b*) The standard heat of combustion of benzene at 298 K is –3269.5 kJ/mol when burnt completely to CO_2 and liquid water. The standard heat of combustion of hydrogen to liquid water is –286.04 kJ/mol and that of carbon to CO_2 is –393.78 kJ/mol. Calculate the standard heat of formation of liquid benzene. [8]

5. (*a*) What are fundamental property relations ? Elaborate. [8]

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

(*i*) Partial molar properties

(*ii*) Chemical potential

Or

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

(*i*) Fugacity coefficient

(*ii*) Ideal solution

(*iii*) Excess Gibbs free energy

(*b*) Will it be possible to prepare 0.1 m^3 of alcohol water solution by mixing 0.03 m^3 alcohol with 0.70 m^3 pure water. If not possible, what volumes should have been mixed in order to prepare a mixture of the same strength and of the required volume ? The partial molar volume of ethanol and water are 53.6×10^{-6} m^3/mol and 18×10^{-6} m^3/mol respectively at the desired composition. The density of ethanol and water are 789 kg/m^3 and 997 kg/m^3 respectively. [10]

SECTION II

7. (*a*) What does Duhem's theorem state ? Explain with examples. [5]

(*b*) What is Raoult's law and why is it important with respect to vapour liquid equilibrium ? [5]

(*c*) Determine the composition of the liquid which is in equilibrium with an equimolar vapour mixture of toluene and benzene at 95ºC. At 95ºC, the saturation pressures of benzene (1) and toluene (2) are :

P_1^s = 1176.21 torr

P_2^s = 477.03 torr [8]

Or

8. (*a*) With the help of a neat diagram, explain the boiling point and dew point curves. [10]

(*b*) Write notes on : [8]

(*i*) Criteria for equilibrium

(*ii*) Modified Raoult's law

9. (*a*) What is the equilibrium constant with respect to reacting systems ? Derive an expression to show the effect of temperature on equilibrium constant. [8]

(*b*) Acetic acid is esterified in the liquid phase reaction with ethanol at 373.15 K and atmospheric pressure to produce ethyl acetate and water according to the reaction :

$$CH_3COOH(l) + C_2H_5OH(l) ® CH_3COOC_2H_5(l) + H_2O(l)$$

If initially there is one mole each of acetic acid and ethanol, estimate the mole fraction of ethyl acetate in the reaction mixture at equilibrium. [8]

Data :

K at 298 K = 6.5266

$\Delta H^o_{298} = -3640$ J

$$K = \frac{x_{EtAc} . x_{H_2O}}{x_{AcH.} \, x_{EtOH}}$$

K = (Product of mole fraction of the products)/(Product of mole fraction of the reactants).

Or

10. (*a*) Derive the phase rule for reacting systems. Determine the number of degrees of freedom for the following system :

A system consisting of the gases CO, CO_2, H_2, H_2O and CH_4 in chemical equilibrium. [8]

(*b*) The standard heat of formation and standard free energy of formation of NH_3 at 298 K are –46,100 J/mol and –16,500

J/mol respectively. Calculate the equilibrium constant for the reaction at 500 K :

$$N_2(g) + 3H_2(g) \text{ ® } 2NH_3(g)$$

Assume that the standard heat of reaction is constant in the temperature renage 298 K to 500 K. [8]

11. (*a*) Explain the role of ATP in bioenergetics. [8]

(*b*) Explain the application of thermodynamics to the enzyme catalysed reactions. [8]

Or

12. Describe in detail the different types of bio-chemical reactions giving suitable examples for each type. [16]

Total No. of Questions—**11**] [Total No. of Printed Pages—**3**

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S.E. (Biotechnology) (II Sem.) EXAMINATION, 2011

GENETICS AND MOLECULAR BIOLOGY

(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. Describe in detail the phenomenon of DNA packaging with the help of the following terms : [16]

(*i*) Chromosome

(*ii*) Chromatin

(*iii*) Chromatid

(*iv*) Euchromatin and Heterochromatin.

Or

2. What do you mean by 'Model System' ? Explain any *one* model system with the detailed applications. [16]

3. Write short notes on (Any *two*, **8** marks each) : [16]

(*i*) Thermal Denaturation

(*ii*) Hyperchromicity

(*iii*) Nucleic acid in chloroplast

(*iv*) Z DNA structure.

4. Discuss the mechanism of DNA replication in prokaryotes. [18]

Or

5. Write short notes on (**9** marks each) : [18]

(*i*) Rolling circle model of DNA replication.

(*ii*) Types of mutations with examples.

SECTION II

6. What is translation ? Explain in detail roles of *m*RNA, *t*RNA and *r*RNA in translation. [16]

Or

7. Write short notes on (**8** marks each) : [16]

(*i*) Reverse Transcriptase

(*ii*) Ribozyme.

8. What is meant by gene ? Explain in detail structure and regulation of gene. [16]

Or

9. Who discovered the concept of 'operon' ? Write in detail lac operon. [16]

10. Explain in detail protein synthesis in prokaryotes and eukaryotes. [18]

Or

11. Write in detail : [18]

(*i*) Chaperons

(*ii*) Heat shock proteins

(*iii*) Thalassemia.