

Total No. of Questions—8]

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[4757]-1001

S.E. (Civil) (First Semester) EXAMINATION, 2015

ENGINEERING MATHEMATICS III

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data, if necessary.

1. (a) Solve any *two* of the following : [8]

(i)
$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 4 + 2^x + 3e^{-x} + \cos x$$

(ii)
$$x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = x + x^{-1}$$

(iii) Use the method of variation of parameters to solve the linear differential equation :

$$\frac{d^2y}{dx^2} + y = \operatorname{cosec} x .$$

P.T.O.

- (b) Solve the following system of linear equations by Gauss Elimination method : [4]

$$5x - 2y + 2z = 5, \quad 2x + y - z = 2, \quad x - y + z = 1.$$

Or

2. (a) Solve the system of simultaneous symmetric equations : [4]

$$\frac{dx}{2x} = \frac{dy}{-y} = \frac{dz}{4xy^2 - 2z}.$$

- (b) Apply Runge-Kutta method of 4th order to solve the differential equation :

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

to find y for $0 \leq x \leq 0.2$ with $h = 0.1$. [4]

- (c) Solve the following system of equations by Cholesky method : [4]

$$2x + 3y + z = 0$$

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

$$-x + y + 2z = 0.$$

3. (a) The first four moments about the value 4 are -1.5 , 17 , -30 and 108 . Calculate the moments about the mean. Also find coefficient of skewness and kurtosis. [4]

(b) Assume the mean height of soldiers to be 68.22 inches with a variance of 10.8 inches. How many soldiers in a regiment of 10,000 would you expect to be over 6 feet tall, where the data is normally distributed. (Given : $\phi(1.15) = 0.3749$) [4]

(c) Find the directional derivative of

$$\phi = xy^2 + yz^3$$

at the point $(2, -1, 1)$ in the direction of vector $i + 2j + 2k$. [4]

Or

4. (a) Attempt any one : [4]

(i) Prove that $\frac{\vec{r}}{r^3}$ is solenoidal.

(ii) Show that :

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

(b) Verify whether :

$$\vec{F} = (2xyz^2)i + (x^2z^2 + z \cos yz)j + (2x^2yz + y \cos yz)k$$

is irrotational. [4]

(c) Two lines of regression are :

$$5y - 8x + 17 = 0 \quad \text{and} \quad 2y - 5x + 14 = 0.$$

If $\sigma_y^2 = 16$, find : [4]

(i) σ_x^2

(ii) Coefficient of correlation.

5. (a) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ for

$$\bar{F} = (2xy + 3x^2)\bar{i} + (x^2 + 4yz)\bar{j} + (2y^2 + 6yz)\bar{k}$$

where C is the curve $x = t$, $y = t^2$, $z = t^3$ joining (0, 0, 0) and (1, 1, 1). [4]

(b) Use divergence theorem to evaluate $\iiint_S \bar{F} \cdot d\bar{s}$

for $\bar{F} = 4xz\bar{i} - y^2\bar{j} + yz\bar{k}$ over the surface of cube bounded by the planes $x = 0$, $x = 2$, $y = 0$, $y = 2$, $z = 0$, $z = 2$. [4]

(c) Using Stokes' theorem evaluate $\iint_S (\nabla \times \bar{F}) \cdot d\bar{s}$

for $\bar{F} = (x^3 - y^3)\bar{i} - xyz\bar{j} + y^3\bar{k}$ where S is the surface $x^2 + ay^2 + z^2 - 2x = 4$ above the plane $x = 0$. [5]

Or

6. (a) Using Green's theorem, evaluate $\oint \bar{F} \cdot d\bar{r}$ for the field :

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

over the region R enclosed by $y = x^2$ and then line $y = x$. [4]

- (b) Use divergence theorem to evaluate :

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

where S is the surface of the sphere $x^2 + y^2 + z^2 = 16$. [4]

- (c) Evaluate $\int_C \bar{F} \cdot d\bar{r}$ using Stokes' theorem for :

$$\bar{F} = 4y \bar{i} + 2z \bar{j} + 6y \bar{k}$$

where C is the intersection of :

$$x^2 + y^2 + z^2 = 2z, \quad x = z - 1. \quad [5]$$

7. (a) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y = a \sin \frac{\pi x}{l}$ from which it is released at time $t = 0$. Show that the displacement of any point at a distance x from one end at time t is given by : [7]

$$y(x, t) = a \sin \left(\frac{\pi x}{l} \right) \cos \left(\frac{\pi ct}{l} \right).$$

(b) Solve :

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

subject to :

[6]

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

(ii) $u_x(l, t) = 0$

(iii) $u(x, t)$ is bounded and

(iv) $u(x, 0) = \frac{u_0 x}{l}, 0 \leq x \leq l.$

Or

8. (a) Solve the equation :

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

subject to :

[7]

(i) $v = 0$ when $y \rightarrow \infty$ for all x

(ii) $v = 0$ when $x = 0$ for all y

(iii) $v = 0$ when $x = l$ for all y

(iv) $v = x(l - x)$ when $y = 0$ for $0 < x < l$.

(b) Solve the wave equation :

[6]

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

under the conditions :

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

(ii) $u(\pi, t) = 0$

(iii) $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$

(iv) $u(x, 0) = x, \quad 0 < x < \pi.$

Total No. of Questions—8]

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[4757]-1002

S.E. (Civil) (I Sem.) EXAMINATION, 2015
BUILDING TECHNOLOGY AND MATERIALS
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or
Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or
Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Discuss the need of Damp Proof course for roofs and
basement. [6]
- (b) Discuss the properties of a good brick used in construction. [6]

Or

2. (a) Write a short note on English bond with a neat labelled
diagram. [6]
- (b) Discuss the method underpinning. [6]

P.T.O.

3. (a) With a figure explain the Chequer board method of construction of floors. [6]
- (b) Draw a neat, labelled figured of semi-circular arch and name the various components. [6]

Or

4. (a) Explain the IS specifications for Cement concrete flooring tiles. [6]
- (b) Explain the following with sketches : [6]
- (i) Dormer window
 - (ii) Meeting style
 - (iii) Barrel bolt.
5. (a) Explain the following with sketches : [6]
- (i) Baluster
 - (ii) Scotia
 - (iii) Landing.
- (b) Explain the types of Lintels and discuss about any *two*. [7]

Or

6. (a) State the requirements of a good stair with respect to : [7]
- (i) Pitch
 - (ii) Head room
 - (iii) Location
 - (iv) Number of steps in a flight
 - (v) Rise and Tread
 - (vi) Width of stair.

- (b) Enlist types of stairs depending on the materials of construction. Explain any *one* in detail. [6]
7. (a) Define seasoning of timber. Explain defects in timber. [6]
(b) Enlist types of pointing and explain any *three* types of pointing with figures. [7]
- Or*
8. (a) Draw the figures showing different types of pointing. [7]
(b) Write a short note on Wall cladding. [6]

Total No. of Questions—8]

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[4757]-1003

S.E. (Civil) (First Semester) EXAMINATION, 2015

STRENGTH OF MATERIALS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Use of electronic pocket calculator is allowed.

(iv) Assume suitable data, if necessary.

(v) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

1. (a) A compound bar ABC 1.5 m long is made up of two parts 'AB' of aluminium and 'BC' of steel having cross-sectional area of steel half of the aluminum bar. The rod is fixed at 'A' and subjected to an axial pull of 200 kN at end 'C'. If the elongations of both materials is equal, find the lengths of each part assuming $E_{\text{steel}} = 200 \text{ GPa}$ and $E_{\text{aluminium}}$ as one third of steel. [6]

P.T.O.

- (b) A simply supported beam 8 m span carries u.d.l. of 3 kN/m over entire span. Find the maximum bending stress induced if the cross-section is as shown in Fig. 1. [6]

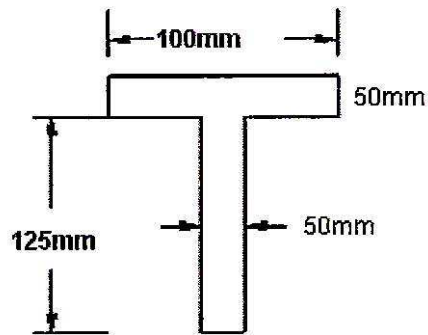


Fig. 1

Or

2. (a) A steel bar 2 m long is at 30°C. The temperature of the rod is increased by 150°C. Find : [6]
- (i) free expansion of the rod
 - (ii) temperature stress produced if expansion is prevented and nature of the stress
 - (iii) stress produced if 2.5 mm expansion is permitted. Assume supports are unyielding ? Take $E = 210 \text{ GPa}$, and $\alpha = 12 \times 10^{-6}/^\circ\text{C}$. Assume bar diameter = 16 mm.

- (b) An I section has the following dimensions. Web : 300 mm \times 10 mm, Flange 150 mm \times 20 mm. The maximum shear stress developed in the beam is 14.8 MPa. Find the shear force to which the beam is subjected. [6]
3. (a) Find maximum torque that can be safely applied to a shaft of 80 mm diameter. The permissible angle of twist is 1.5 degree in a length of 5 m and shear stress not to exceed 42 MPa. Take $G = 84$ MPa. [6]
- (b) A shaft of 95 mm diameter transmits 200 kW power at 100 rpm. If at a section bending moment is 15 kNm, then find the principal stress, maximum shear stress. [6]
- Or*
4. (a) A steel rod 28 mm in diameter is 3.5 m long. Find the maximum instantaneous stress induced and work done at maximum elongation when a load of 80 kN is suddenly applied. Take $E = 210$ GPa. [6]
- (b) A hollow shaft having an inside diameter 60% of its outer is to replace a solid shaft transmitting the same power at same speed. Calculate the percentage saving in material if material to be used is also the same. [6]

5. (a) An overhanging beam ABC with end 'A' hinged and simply supported at 'B' is loaded with udl of intensity 30 kN/m acting on 2 m length from 'A' and a point load of 10 kN acting at free end 'C'. Draw B.M.D. and S.F.D. Assume $l(AB) = 4$ m and $l(BC) = 1$ m. [7]
- (b) Draw shear force diagram, bending moment diagram and axial thrust diagram for the beam ABCD with end 'A' hinged and loaded as shown in Fig. 2. [6]

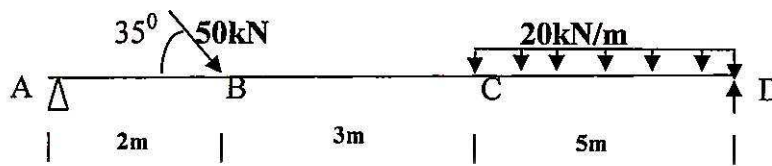


Fig. 2

Or

6. (a) Draw Shear force diagram and Bending Moment diagram for the beam as shown in Fig. 3. Indicate the numerical values at all important section. Find the position and value of maximum bending moment. [7]

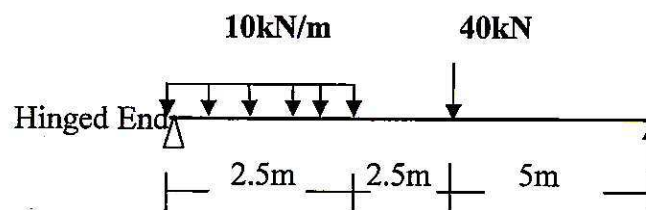


Fig. 3

- (b) The diagram shown in Fig. 4 is the shear force diagram for a beam which rests on two supports, one being at the left hand end. No couple is acting on beam. [6]

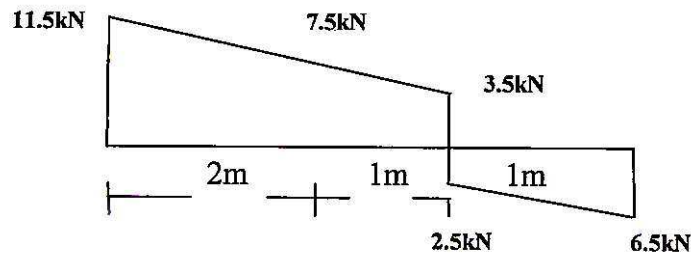


Fig. 4

7. (a) Compare the crippling loads given by the Euler's and Rankine's formula for a circular column of 40 mm diameter and 2000 m long. Take yield stress as 300 MPa. Rankine's constant $a = 1/7500$ and $E = 200$ GPa. [6]
- (b) State assumptions made in Euler's theory and its limitations. [7]

Or

8. (a) Explain core of the section and hence obtain a core section for a hollow circular column of external and internal diameter 'D' and 'd' respectively. [6]

- (b) A hollow rectangular section is having external size 500 mm \times 450 mm and internal size 400 mm \times 350 mm. It carries a vertical load of 100 kN at the outer edge of the column on X-axis. Calculate maximum and minimum intensities of stress in the section. Assume 500 mm side horizontal. [7]

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[4757]-1004

S.E. (Civil) (First Semester) EXAMINATION, 2015

SURVEYING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B.** :— (i) Neat diagrams must be drawn wherever necessary.
(ii) Figures to the right indicate full marks.
(iii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
(iv) Assume suitable data, if necessary.

1. (a) What are the types of error in plane tabling ? How are they minimized ? [6]
(b) The following reciprocal levels were taken with one level : [6]

Instrument at	Reading on		Remarks
	A	B	
A	1.884	2.896	Distance between A & B = 900 m R.L. of A = 300 m
B	0.537	1.894	

Determine :

- (i) The true difference in elevation between A & B.
(ii) The reduced level of B.
(iii) The error in the collimation adjustment of the level.

P.T.O.

Or

2. (a) State the uses and characteristics of contour lines. [4]
- (b) Find the distance to the visible horizon from the top of a light-house 60 m high. [2]
- (c) Determine the Fore bearing and back bearing of all the lines in a regular closed (pentagon) from the following direction : [6]
- (i) Traversing was done in clockwise direction.
- (ii) Local attraction was not suspected at any station.
- (iii) Fore bearing of line CD of the closed traverse ABCDEA was observed to be $35^{\circ} 30'$. Draw rough sketch of the traverse.
3. (a) What is meant by theodolite traversing ? State various methods of theodolite traversing. [6]
- (b) Tabulate the data required for setting out the circular curve by the deflection angle method using the following data : [6]
- (i) Chainage of intersection point = 1580 m
- (ii) Deflection angle = 35°
- (iii) Degree of curve = 5°
- (iv) Peg interval = 30 m.

Or

4. (a) State various obstacles in setting out curves. Explain the procedure of setting out simple curve when point of intersection is inaccessible. [6]
- (b) Two stations A and B are fixed on either side of a wood. The following traverse is run from A to B along the side of the wood : [6]

Line	Latitude	Departure
AC	+290.8 m	+327.5 m
CD	-229.2 m	+623.2 m
DB	-516.6 m	+267.8 m

Determine the length and bearing of AB and DA.

5. (a) Enlist the fundamental axes of a transit theodolite and describe how will you make the trunnion axis perpendicular to the vertical axis. [5]
- (b) A tacheometer with anallatic lense having the value of constant 100 was used and the following observations were made on staff held vertical : [8]

Instrument Station	H.I. in Meter	Vertical Angle	Staff At	Staff Reading in m
P	1.80	2°40'	M	1.25, 1.93, 2.56
		-4°40'	Q	1.45, 1.85, 2.30

R.L. of station M is 50 m. Calculate the R.L. of P & Q, distance PQ and gradient.

Or

6. (a) Explain the test and adjustment for making the line of collimation right angle to the horizontal axis. [5]
- (b) Draw the sketches of different stadio lines. [4]
- (c) Determine reduced level of horizontal line of sight from given data. Assume multiply constant 100 with anallatic lens : [4]

Instrument Station	Staff Station	Vertical Angle	Stadio Reading	Remark
A	B	8°20'	0.990, 1.555, 2.120	R.L. of B 100.00 m

7. (a) Explain distance and angle measurement with total station. [6]
- (b) Explain the method of transfer of centre line in long tunnels. [7]

Or

8. (a) What is total station ? State the classification based on range of total station. [7]
- (b) Define gradient. What is the importance of gradient while laying sewer pipe ? How is it decided ? [6]

Total No. of Questions—8]

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[4757]-1005

S.E. (Civil) (First Semester) EXAMINATION, 2015
GEOTECHNICAL ENGINEERING
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data if necessary.

(v) Neat diagrams must be drawn wherever necessary.

1. (a) Starting from first principles derive the following equations with usual nomenclature : [6]

$$\gamma = \frac{(G + eS_r)\gamma_w}{(1 + e)}.$$

(b) Explain with diagram a method for determining coefficient of permeability 'K' for clayey soils in the laboratory. [6]

P.T.O.

Or

2. (a) On a single graph paper, draw neat labelled graphs for : [6]
- (i) Uniformly graded soil
 - (ii) Well graded soil
 - (iii) Gap graded soil
 - (iv) Show on the same graph, zones of clay size, silt size, sand and gravel clearly.
- (b) State the applications of flownet and explain how seepage through a dam can be determined using flow net. (State the equation and terms involved in it). [6]
3. (a) Write a note on Vane Shear Test with neat sketch and the formulae involved. [6]
- (b) A load 1000 kN acts as a point load at the surface of a soil mass. Estimate the stress at a point 3 m below and 4 m away from the point of action of the load by Boussinesq's formula. Compare the value with the result from Westergaard's theory. [6]

Or

4. (a) Draw a curve showing the relation between dry density and moisture content for Standard Proctor test and indicate the salient features of the curve. [6]

- (b) Define total and effective stress.

Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 200 kN/m^2 and the pore water pressure is 80 kN/m^2 . The effective stress shear strength parameters for the soil are $c' = 16 \text{ kN/m}^2$ and $\Phi' = 39^\circ$. [6]

5. (a) Describe Rehmann's construction for determination of earth pressure with neat sketch. [7]

- (b) Derive the expression for the active state of pressure at any point for a submerged cohesionless backfill along with pressure diagrams. [6]

Or

6. (a) Explain how surcharge will affect earth pressure for cohesionless and cohesive soils in active state with pressure diagrams. [7]

- (b) A smooth vertical wall retains a level surface with $\gamma = 18$ kN/m³, $\phi = 30^\circ$, to a depth of 8 m. Draw the lateral pressure diagram and compute the total active pressure in dry condition and when water table rises to the GL. Assume $\gamma_{\text{sat}} = 22$ kN/m³. [6]
7. (a) Write short notes on causes and remedial measures of Landslides. [7]
- (b) Explain controlling techniques for subsurface contamination. [6]

Or

8. (a) What is slope stability and how are the different types of factor of safety determined ? [7]
- (b) Discuss sources and types of ground contamination. [6]

Total No. of Questions—8]

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Seat No.	
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[4757]-1006

S.E. (Civil Engineering) (Second Semester)

EXAMINATION, 2015

CONCRETE TECHNOLOGY

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—**
- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Your answers will be valued as a whole.
 - (v) Use of electronic pocket calculator is allowed.
 - (vi) Assume suitable data, if necessary.
 - (vii) Use of IS code 10262, 456 is not allowed.

1. (a) What are the minor compounds in Portland cement ? What is their role. [6]
- (b) Explain the physical properties of aggregates affecting workability of concrete. [6]

P.T.O.

Or

2. (a) What are the functions of types of admixtures ? [6]
(b) Define creep of the concrete. What are the factors affecting creep of concrete. [6]
3. (a) State the various types of non-destructive tests carried on hardened concrete. Explain “Impact echo test” for determination of concrete properties. [6]
(b) Describe the types of vibrators used for compaction of concrete. [6]

Or

4. (a) Write short notes on : [6]
(i) Cellular light weight concrete
(ii) Self-compacting concrete.
(b) Define Ferro cement. Explain the basic concepts in forming ferrocement composites used in the construction industry. [6]
5. Using Indian Standard recommended guidelines, design a concrete mix for a reinforced concrete structure to be subjected to the mild exposure conditions for the following requirements : [13]
(A) Stipulations for proportioning :
(a) Grade designation : M30

- (b) Standard deviation, $s = 5$
 - (c) Type of cement : OPC 43 grade conforming to IS8112
 - (d) Workability : 75 mm (slump)
 - (e) Degree of supervision : Good
 - (f) Type of aggregate : Angular coarse aggregate,
 - (g) Maximum cement content : 450 kg/m^3 .
- (B) Test data for materials :
- (a) Specific gravity of cement : 3.15
 - (b) Specific gravity of :
 - (i) Coarse aggregate— 2.74
 - (ii) Fine aggregate— 2.74
 - (c) Water absorption :
 - (i) Coarse aggregates— 0.5%
 - (ii) Fine aggregates— 1.00%
 - (d) Free surface moisture :
 - (i) Coarse aggregates— Nil (absorbed moisture also nil)
 - (ii) Fine aggregates— Nil

(e) Sieve analysis :

(i) Coarse aggregate :

IS Sieve Sizes (mm)	Analysis of Coarse Aggregate Fraction		Percentage of different Fractions			Remarks
	I	II	I (60%)	II (40%)	Combined (100%)	
20	100	100	60	40	100	Confirming of Table 2 of IS 383
10	0	71.2	0	28.5	28.5	
4.75		9.40		3.7	3.7	
2.36		0				

(ii) Fine aggregate : Conforming to grading zone I

(C) Design considerations :

Table 1 : From IS 10262; Maximum water content per cubic meter of concrete :

Sr. No.	Nominal Maximum Size of Aggregate (mm)	Maximum Water Content (kg)
(i)	10	208
(ii)	20	186
(iii)	40	165

Table 2 : From IS 10262; Volume of Coarse Aggregate per Unit Volume of Total Aggregate :

Sr. No. (1)	Nominal Maximum Size of Aggregate (mm) (2)	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(i)	10	0.50	0.48	0.46	0.44
(ii)	20	0.66	0.64	0.62	0.60
(iii)	40	0.75	0.73	0.71	0.69

Table 3 : From IS 456; Different exposure conditions for reinforced concrete :

Sr. No.	Exposure	Minimum cement content (kg/cubic m)	Maximum free water cement ratio	Minimum grade of concrete
(i)	Mild	300	0.55	M20
(ii)	Moderate	300	0.50	M25
(iii)	Severe	320	0.45	M30
(iv)	Very severe	340	0.45	M35
(v)	Extreme	360	0.40	M40

Or

6. (a) Write major factors affecting mix design. Explain water cement ratio. [4]
- (b) Write a short note on statistical quality control of concrete. [4]
- (c) Explain DOE method of mix design in brief. [5]
7. (a) State and explain factors affecting permeability of concrete. What measures should be taken to reduce permeability of concrete ? [8]
- (b) Explain in detail corrosion monitoring techniques of reinforcement and its preventive measures. [5]

Or

8. (a) Write detailed notes on : [8]
- (i) Sulphate attack on concrete
- (ii) Carbonation of concrete and its determination.
- (b) What are the symptoms of distress of concrete ? [5]

Total No. of Questions—8]

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[4757]-1007

S.E. (Civil) (Second Semester) EXAMINATION, 2015

ARCHITECTURAL PLANNING AND DESIGN OF BUILDINGS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Assume suitable data, if required.

(ii) Figures to the right indicate full marks.

(iii) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4
in answer-book.

(iv) Solve Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8
on Drawing Sheet only.

1. (a) Elaborate the term land use zoning and mention the requirements
of each of them. (Minimum 4 zones) [7]

(b) Explain the following principles of architectural planning with
suitable sketches : [6]

(i) Privacy

(ii) Roominess.

P.T.O.

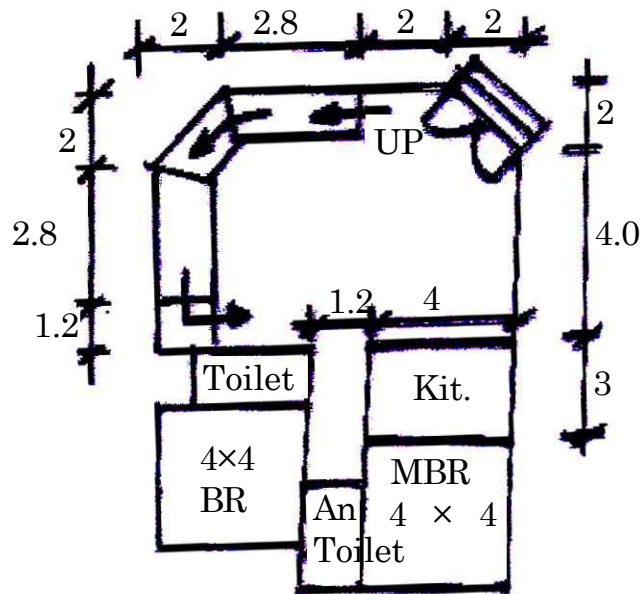
Or

2. (a) Enlist documents to be submitted for Seeking Commencement Certificate and Occupancy Certificate. [6]
- (b) Elaborate need for earthquake resistant structures in relation with—loss of human life; property and infrastructure. [7]
3. (a) What are Acoustical defects ? Explain any *two* in detail. [6]
- (b) Differentiate between building line and control line by drawing a suitable sketch. [6]

Or

4. (a) The internal dimensions of a factory building are $30 \times 20 \times 10$ (m^3). The number of air changes required per hour are 6, the indoor temperature is 36°C and outdoor temperature is 30°C . Find the area of openings required, if the distance between the inlet and outlet openings is 6 m. [6]
- (b) Explain with sketch the following terms : [6]
- (i) SP
- (ii) CV
- (iii) PP.

5. Draw a detailed floor plan to a scale of 1:50 of a residential building for the given line plan below. Use the following data : RCC framed structure, wall thk. 150 mm, Single storey building, Plinth height 450 mm. All dimensions in the sketch are in m. Indicate suitable locations and sizes of doors, windows in schedule of openings. Tread for the step is 280 mm. [13]



Or

6. Draw a detailed floor plan to a scale of 1:50 with the following data : [13]

(i) Living room 1 no. approx. area 15 m²

- (ii) Kitchen-cum-Dining 1 no. approx. area 15 m²
- (iii) Bed rooms 2 no. approx. area 12 m² each
- (iv) Floor to floor height 3.3 m
- (v) Load bearing structure
- (vi) Foundation and plinth in UCR masonry
- (vii) Varandah, passage, staircase, W.C. and Bath/attached toilet etc. of suitable sizes should be provided. Indicate the North.

7. Design a single storey hostel building and draw only line plan with the following data : [12]

- (i) Number of students 50
- (ii) Twenty rooms are two seated with 7.5 sq. m area per student and ten single seated with 9.5 sq. m area.
- (iii) Recreation room approx. area 35 m²
- (iv) Gymnasium approx. area 15 m²
- (v) Office space approx. area 12 m²
- (vi) Store room approx. area 10 m²
- (vii) Varandah, passage, staircase, W.C. and Bath etc. of suitable size should be provided.

Show North direction and mention scale.

Or

8. Draw a line plan of a Post-office using the following data :[12]

Entrance and moving space : 30 m² with seating arrangement

Public dealing counters : 6 in no. with 0.5 m width

Post-master's room : 15 m²

Working area for other staff : 30 m²

Post separation room : 30 m²

Safe custody area for cash : 10 m²

Cash transaction room : 12 m²

Speed post delivery section : 12 m²

Water room and Toilet (separate for male and female) : 7.5 m².

Total No. of Questions—8]

[Total No. of Printed Pages—3

Seat No.	
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[4757]-1008

**S.E. (Civil Engineering) (Second Semester) EXAMINATION, 2015
ENGINEERING GEOLOGY
(2012 PATTERN)**

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Write the answers to any *four* questions in a single answer-book.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data if necessary.

1. (a) Explain different forms of Minerals with suitable examples. [6]
- (b) Describe Civil Engineering significance of foliations of metamorphic rocks. [6]

Or

2. (a) What are extrusive and intrusive Igneous bodies ? Describe various Discordant Igneous intrusive bodies with neat diagrams. [6]
- (b) State and explain general principles of Stratigraphy. [6]

P.T.O.

3. (a) What is Fold ? Give nomenclature of the FOLD. Describe how fold passes into the Fault. [6]
- (b) What are Joints ? How do they occur in igneous and metamorphic rocks ? Describe types of Joints and their Civil Engineering significance. [6]

Or

4. (a) What is Rejuvenation ? Explain *two* features resulting due to rejuvenation. [6]
- (b) Write in detail mineral wealth of Gondwana. [6]
5. (a) What are the geological requirements for the foundation of Dam ? [6]
- (b) Describe geological work of groundwater in detail. [7]

Or

6. (a) What is Artesian condition ? Explain any *three* geological conditions leading to artesian well. [7]
- (b) Describe any *three* features developed due to marine erosion. [6]

7. (a) What difficulties you may face while tunnelling through : [7]
- (i) Axial portion of Syncline
 - (ii) Dyke crossing the alignment.
- (b) Define Remote sensing. Enlist elements of Remote Sensing.
Explain any *two* elements. [6]

Or

8. (a) What observations and precautions are necessary during Core
Drilling for Preliminary Geological Exploration ? [7]
- (b) What is Landslide ? What are the causes of it ? [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

Seat No.	
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[4757]-1009

S.E. (Civil) (Second Semester) EXAMINATION, 2015

STRUCTURAL ANALYSIS-I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

(ii) Neat sketches must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

(v) Use of electronic pocket calculator is allowed.

(vi) Use of cell phone is prohibited in the examination hall.

1. (a) A 4 m simply supported beam subjected to clockwise moment 20 kNm at mid span, determine maximum slope and deflection in term of EI. [6]

P.T.O.

- (b) Determine moment at B for the continuous beam loaded and supported as shown in the Fig. 1(b) by Clapeyron's theorem. [6]

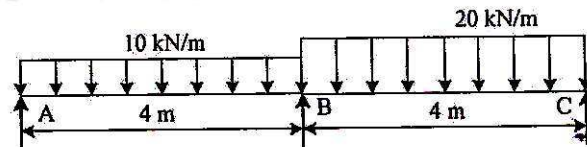


Fig. 1(b)

Or

2. (a) A propped cantilever of span 3 m loaded with uniformly distributed load 10 kN/m on entire span, determine the prop reaction. [6]
- (b) Determine the fixed end moments for the fixed beam loaded and supported as shown in Fig. 2(b). [6]

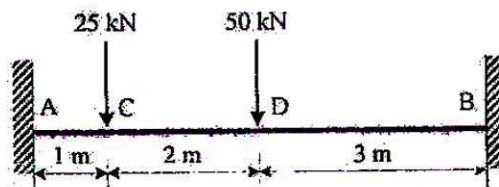


Fig. 2(b)

3. (a) Find the horizontal deflections of joint C of the truss shown in Fig. 3(a). The area of inclined member is 2000 mm^2 while the area of horizontal member is 1600 mm^2 . Take $E = 200 \text{ kN/mm}^2$. [6]

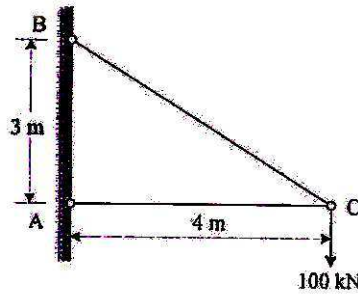


Fig. 3(a)

- (b) A simply supported beam is loaded and supported as shown in Fig. 3(b). Determine support reaction at A, Shear and moment at C by drawing Influence line diagram. [6]

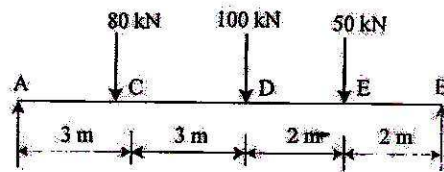


Fig. 3(b)

Or

4. (a) Find forces in members of the truss as shown in Fig. 4(a). Cross-sectional area and material of all members is same. [6]

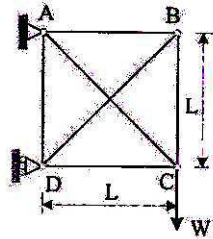


Fig. 4(a)

- (b) Draw the influence line diagram for the members U_2U_3 , L_2L_3 and U_2L_2 of a truss as shown in Fig. 4(b). [6]

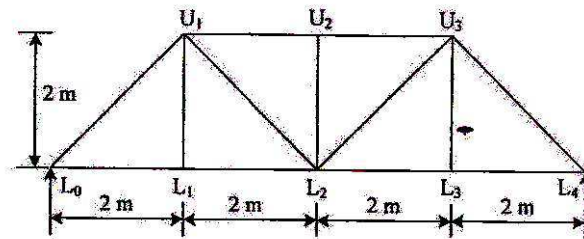


Fig. 4(b)

5. (a) A three hinge parabolic arch has a span of 24 m and a central rise of 4 m. It carries a concentrated load of 50 kN at 18 m from left support. Determine thrust and radial shear at a section 6 m from left support. [7]
- (b) Derive the expression for horizontal thrust when a uniformly distributed load w is acting on entire span of two hinged semicircular arch. [6]

Or

6. (a) A three hinged circular arch has a span of 40 m and a central rise of 8 m. It carries a uniformly distributed load 20 kN/m over the left-half of span. Find the reaction at the supports and shear at a section 10 m from left support. [7]
- (b) A two hinged parabolic arch of span 30 m and central rise 4 m is subjected to a point load of 30 kN at the center of the arch. Find the horizontal thrust and moment at 8 m from left hand support. [6]
7. (a) State and explain lower bound, upper bound and uniqueness theorem. [5]

- (b) A beam fixed at both ends is subjected to central point load W . The beam is of uniform plastic moment M_P . Determine the magnitude of collapse load. [8]

Or

8. (a) Find the shape factor for circular cross-section of diameter d . [5]
- (b) Determine collapse load in a propped cantilever of span L subjected to central concentrated load W . [8]

Total No. of Questions—8]

[Total No. of Printed Pages—4

Seat No.	
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[4757]-1010

S.E. (Civil) (II Sem.) EXAMINATION, 2015

FLUID MECHANICS—I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or
Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or
Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) Define :

(i) Mass density

(ii) Specific gravity

(iii) Surface tension

(iv) Capillarity

(v) Specific weight

(vi) Specific volume.

[6]

P.T.O.

- (b) A circular plate 2.95 m diameter is immersed in water in such a way that its greatest and least depth below the free surface is 4.1 m and 1.6 m respectively. Determine the total pressure on one face of the plate and position of centre of pressure. [6]

Or

2. (a) State Buckingham's π theorem. Explain the procedure for solving problems by Buckingham's π theorem. [6]
- (b) A rectangular pontoon is 5 m long, 3 m wide and 1.20 m high. The depth of immersion of the pontoon is 0.85 m in sea water. If the centre of gravity is 0.65 m above the bottom of the pontoon, determine the meta-centric height. Take density of sea water = 1025 kg/m³. [6]

3. (a) Explain :
- (i) Steady flow and Unsteady flow
 - (ii) Uniform flow and Non-uniform flow
 - (iii) Laminar flow and Turbulent flow. [6]
- (b) Derive the Bernoulli's equation. Also mention the assumptions made for it. [6]

Or

4. (a) Explain rotation and vorticity. Derive the rotational components for three-dimensional flow. [6]

(b) A 20 cm × 10 cm venturimeter is inserted in a vertical pipe carrying oil of specific gravity 0.8, the flow of oil is in upward direction. The difference of levels between the throat and inlet section is 55 cm. The oil mercury differential manometer gives a reading of 33 cm of mercury. Find the discharge of oil in litres/s. Neglect losses. [6]

5. (a) Explain with neat sketches “Boundary layer separation and its control”. [7]
- (b) In case of laminar flow, through a circular pipe, show that ratio of maximum velocity to average velocity = 2.0. [6]

Or

6. (a) A fluid of viscosity 0.7 N.s/m² and specific gravity 1.3 is flowing through a circular pipe of diameter 100 mm. The maximum shear stress at the pipe wall is given as 196.2 N/m². Find :
- (i) The pressure gradient
- (ii) The average velocity
- (iii) Reynolds number of the flow. [7]
- (b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, where δ = boundary layer thickness. [6]

7. (a) Explain in brief :
- (i) Instantaneous velocity
 - (ii) Temporal mean velocity
 - (iii) Scale of turbulence. [6]
- (b) Derive the expression for “loss of head due to sudden enlargement” in case of flow through a pipe. [7]

Or

8. (a) Explain in brief with neat sketches :
- (i) Prandtl's mixing length theory
 - (ii) Velocity distribution in turbulent flow. [6]
- (b) The rate of flow of water through a horizontal pipe is $0.25 \text{ m}^3/\text{s}$. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2 . Determine :
- (i) Loss of head due to sudden enlargement
 - (ii) Pressure intensity in the large pipe
 - (iii) Power lost due to enlargement. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—8

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[4757]-1011

S.E. (Mech./Automobile) (First Semester)

EXAMINATION, 2015

ENGINEERING MATHEMATICS—III

(2012 COURSE)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of electronic pocket calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) Solve any *two* of the following : [8]

(i) $(D^2 + 9) y = x \cdot \sin 2x$

(ii) $(D^2 - 6D + 13) y = e^{3x} \cdot \sin 4x + 3^x$

(iii) $(D^2 + 4) y = \frac{1}{1 + \sin 2x},$

(using method of variation of parameters.)

P.T.O.

- (b) Using Fourier cosine integral of e^{-mx} ($m > 0$) show that : [4]

$$\int_0^{\infty} \frac{m \cos \lambda x \, d\lambda}{m^2 + \lambda^2} = \frac{\pi}{2} \cdot e^{-mx}, \quad (m > 0, x > 0).$$

Or

2. (a) A body of weight “W = 20 N” is hung from a spring. A pull of “40 N” will stretch the spring to 10 cm. The body is pulled down to 20 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position in time ‘ t ’ seconds. [4]

- (b) Solve any *one* of the following : [4]
- (i) Find the Laplace transform of

$$f(t) = \int_0^t \frac{\sin t}{t} dt.$$

- (ii) Find the inverse Laplace transform of

$$F(s) = \log \left(\frac{s + 4}{s + 8} \right).$$

- (c) Solve the following differential equation by using Laplace transform method : [4]

$$y''(t) + 9y(t) = 18t,$$

given that :

$$y(0) = 0, \quad y\left(\frac{\pi}{2}\right) = 1.$$

3. (a) Calculate the first four moments about the mean of the given distribution : [4]

x	f
2.0	4
2.5	36
3.0	60
3.5	90
4.0	70
4.5	40
5	10

- (b) Between 2 p.m. and 3 p.m. the average number of phone calls per minute coming into company are 3. Find the probability that during one particular minute there will be 2 or less calls. [4]

(c) Find the directional derivative of

$$\phi = xy^2 + yz^3$$

at $(1, -1, 1)$ in the direction of tangent to the curve

$$x = \sin t, y = \cos t, z = t \text{ at } t = \frac{\pi}{4}. \quad [4]$$

Or

4. (a) Find the coefficient of correlation for the following data : [4]

x	y
10	18
14	12
18	24
22	06
26	30
30	36

(b) Prove that (any one) : [4]

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

$$(ii) \quad \nabla^4 (r^2 \log r) = \frac{6}{r^2}.$$

(c) Show that : [4]

$$\bar{F} = (6xy + z^3) i + (3x^2 - z) j + (3xz^2 - y) k$$

is irrotational. Find the scalar ϕ such that :

$$\bar{F} = \nabla \phi.$$

5. (a) Evaluate :

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

for

$$\bar{F} = 3x^2\bar{i} + (2xz - y)\bar{j} + z\bar{k}$$

along the curve :

$$x = 2t^2, y = t, z = 4t^2 - t$$

from $t = 0$ to $t = 1$.

[4]

(b) Evaluate :

$$\iint_S \bar{F} \cdot d\bar{s}$$

where

$$\bar{F} = 4xz\bar{i} + xyz^2\bar{j} + 3z\bar{k}$$

and S is the surface of the cone :

$$z^2 = x^2 + y^2$$

bounded by $z = 4$.

[5]

(c) Apply Stokes' theorem to calculate :

$$\int_C 4ydx + 2zdy + 6ydz,$$

where C is the curve of intersection of

$$x^2 + y^2 + z^2 = 6z$$

and $z = x + 3$.

[4]

Or

6. (a) Evaluate :

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

for

$$\bar{F} = x^2\bar{i} + 2xy\bar{j} + z\bar{k}$$

and C is the straight line joining (1, 0, 2), (3, 1, 1). [4]

- (b) Show that : [4]

$$\iint_S \frac{\bar{r}}{r^3} \cdot \hat{n} ds = 0.$$

- (c) Evaluate using Stokes' theorem : [5]

$$\int_C (ydx + zdy + xdz)$$

C being intersection of

$$x^2 + y^2 + z^2 = a^2, \quad x + z = a.$$

7. (a) A string is stretched and fastened to two points l apart. Motion is started by displacing the string into the form

$$y = k(lx - x^2)$$

from which it is released at time $t = 0$. Find the displacement of any point on the string at a distance of x from one end at time t . Using differential equation : [7]

$$\frac{\partial^2 y}{\partial t^2} = C^2 \frac{\partial^2 y}{\partial x^2}.$$

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

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

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

(i) $u(0, t) = 0^\circ\text{C}$

(ii) $u(1, t) = 0^\circ\text{C}$

(iii) $u(x, 0) = 50^\circ\text{C}.$ [6]

Or

8. (a) Solve the partial differential equation :

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

subject to boundary conditions :

(i) $u(0, y) = 0$

(ii) $u(x, 0) = 0$

(iii) $u(a, y) = 0$

(iv) $u(x, b) = 40.$ [7]

(b) Use Fourier transform to solve the equation :

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

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. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[4757]-1012

S.E. (Mechanical/Automobile/Mechanical Sandwich)

(I Sem.) EXAMINATION, 2015

THERMODYNAMICS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve any *four* questions (Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8).

(ii) All the four questions should be solved in one answer book and attach extra supplement if required.

(iii) Draw neat and labelled diagrams whenever necessary.

(iv) Use of steam tables, Mollier charts, scientific calculator is allowed.

(v) Assume suitable data whenever necessary.

(vi) Figures to the right indicate full marks.

1. (a) State Kelvin-Planck and Clausius statement of the second law of thermodynamics and prove that the violation of Kelvin-Planck statement results into violation of Clausius statement. [6]

(b) In a certain heat exchanger, 50 kg of water is heated per minute from 50°C to 110°C by hot gases which enter the heat exchanger at 250°C. If the flow rate of gases is 100 kg/min, estimate the net change of entropy. Assume no loss of heat to surroundings. $C_p(\text{water}) = 4.186 \text{ kJ/kg-K}$, $C_p(\text{gas}) = 1 \text{ kJ/kg-K}$. [6]

P.T.O.

Or

2. (a) Derive expression for the following quantities for an ideal gas undergoing a constant temperature process : [6]
- (i) Non-Flow System—Work done, Change in internal energy, Heat transfer
- (ii) Flow System—Work done, Heat transfer, Entropy change.
- (b) A heat engine working on Carnot cycle absorbs heat from three thermal reservoirs at 1000 K, 800 K and 600 K. The engine does 10 kW of net work and rejects 400 kJ/min. of heat to a heat sink at 300 K. If the heat supplied by the reservoir at 1000 K is 60% of the heat supplied by the reservoir at 600 K, make calculations for the quantity of heat absorbed by each reservoir. [6]
3. (a) State the assumptions made for air standard cycle. Derive an expression for the air standard efficiency and mean effective pressure of an Otto cycle. [6]
- (b) Steam of mass 10 kg and pressure 1000 kPa, 0.85 dry, is heated at constant pressure till the volume is doubled. Determine :
- (i) Final quality of steam
- (ii) Heat added
- (iii) Change in Internal Energy. [6]

Or

4. (a) Sketch and explain the construction and working of a separating and throttling calorimeter used for determining the dryness fraction of steam in a boiler. [6]
- (b) A system at 450 K receives 225 kJ/s of heat energy from a source at 1500 K, and the temperature of both the system and source remains constant during the heat transfer process. Represent the process on temperature-entropy diagram and determine :
- (i) Net change in entropy
 - (ii) Available energy of heat source and system
 - (iii) Decrease in available energy.

Take atmospheric temperature equal to 300 K. [6]

5. (a) Describe briefly the advantages which you would expect to be gained from incorporating an economizer, air preheater, and a superheater in a steam generating plant. By line diagram, indicate the position of these accessories in a typical boiler plant. [6]
- (b) The following data relates to a trial on boiler using economizer, air preheater and superheater :

Condition of steam at exit of boiler = 20 bar, 0.96 dry

Temperature of steam at exit of superheater = 300°C

Steam evaporation rate/kg of fuel = 12 kg

Room temperature, $t_0 = 25^{\circ}\text{C}$

Temperature of feed water at exit of economizer, $t_1 = 50^{\circ}\text{C}$

Temperature of air at exit of air preheater, $t_a = 70^{\circ}\text{C}$

The temperature of flue gases at inlet to superheater, economizer, air preheater and exit of air preheater are respectively 650°C , 430°C , 300°C and 180°C respectively.

Assume that air supplied is 19 kg/kg of fuel of calorific value of 45,000 kJ/kg, find :

- (i) Equivalent evaporation with and without economizer, from and at 100°C .
- (ii) Thermal efficiency of the boiler with and without economizer.
- (iii) Thermal efficiency of superheater, economizer and air preheater. [7]

Or

6. (a) Define steam generator and write down the classification of boilers. [6]
- (b) In a certain boiler installation, a steel chimney of 30 m height produces a natural draught equivalent to 17.75 mm of water

column. The mean temperature of the boiler house is 298 K and that of hot gases leaving the chimney is 633 K. If the boiler uses 1350 kg of coal per hour, make calculations for :

- (i) Air supplied per kg of coal burnt on the grate,
- (ii) Draught in terms of column of hot flue gases,
- (iii) Density and mass flow rate of hot gas. [7]

7. (a) Define mass fraction and mole fraction with example and explain the method of writing the complete combustion equation of a C_8H_{18} with air. [6]

(b) A sample of coal supplied to a boiler has the following composition by mass :

Carbon = 87%, Hydrogen = 3%, Oxygen = 3%, Nitrogen = 1%, Sulphur = 1% and the remainder is ash. If 15% of excess air is supplied for combustion. Find :

- (i) The theoretical amount of air required for complete combustion of fuel
- (ii) The mass analysis of flue gas per kg of fuel. [7]

Or

8. (a) For what purpose a Bomb calorimeter is used ? Discuss its working with the help of a neat sketch. [6]

(b) The following data pertains to a test run made to determine the calorific value of a sample of coal :

Mass of coal burnt = 0.85 gm, Mass of fuel wire burnt and its calorific value is 0.028 gm and 6700 kJ/kg respectively, mass of water in calorimeter = 1800 gm, initial and final temperature of water = 16.5°C and 20.25°C, water equivalent of calorimeter = 350 gm, the coal contains 3% moisture by weight and R.T. = 20°C. Make calculations for the higher and lower calorific values of the coal sample. Consider latent heat of condensation of steam 2460 kJ/kg. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1013

S.E. (Mechanical & Automobile) (First Semester)

EXAMINATION, 2015

MANUFACTURING PROCESS—I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) All the *four* questions should be solved in one answer-book and attach extra supplements if required.

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of non-programable electronic pocket calculator is allowed.

(v) Assume suitable data, if necessary.

(vi) Solve Q. No. 1 *or* Q. No. 2, Q. No. 3 *or* Q. No. 4, Q. No. 5 *or* Q. No. 6, Q. No. 7 *or* Q. No. 8.

1. (a) Explain commonly used materials for pattern making with advantages and limitations. [6]

P.T.O.

- (b) A slab of size $300 \times 300 \times 50 \text{ mm}^3$ is requires to cast from a molten steel using a top riser of 170 mm diameter. If $(d/h) = 2$ for riser, calculate the freezing ratio. [6]

Or

2. (a) Explain friction and lubrication in metal forming. [6]
(b) Explain types of rolling mills. [6]
3. (a) Explain submerged arc welding process. State the advantages and limitations of the process. [6]
(b) Explain extrusion of film. [6]

Or

4. (a) Write short note on edge preparation in welding. [6]
(b) Compare between TIG and MIG welding process. [6]
5. (a) Calculate the amount of shear on the punch to cut a hole of 60 mm diameter in 2 mm thickness plate. The ultimate shearing strength of plate material is 400 MPa. If the punching force is to be reduced to half of the force using a punch without shear. Assume percentage penetration 68%. [7]
(b) Write a note on strip layout. [6]

Or

6. (a) Explain with sketch type of pilots used in sheet metal working. [6]
- (b) Find center of pressure for a MS part as shown in Fig. 6(b) with 1 mm thickness. Take ultimate shear strength of MS as 200 N/mm^2 . [7]

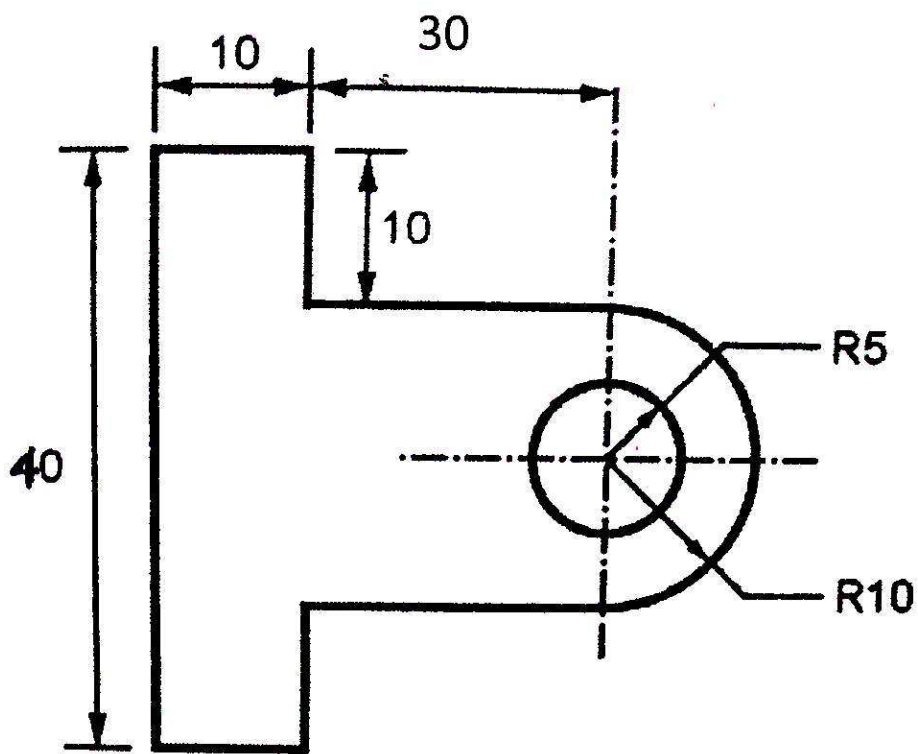


Fig. 6(b)

7. (a) With neat sketch explain back gear cone pulley type headstock. [7]
- (b) Explain Half nut mechanism. [6]

Or

8. (a) Why lathe centres and mandrels are required while machining on lathe ? Also draw neat sketch of any two types of lathe centers and mandrels. [7]
- (b) Calculate the angle by which compound rest will be swiveled when cutting a taper on a job with diameters 90 mm and 40 mm. Length of the job is 1.2 m. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1014

S.E. (Mechanical/Automobile)
(First Semester) EXAMINATION, 2015
FLUID MECHANICS
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Answer *four* questions out of 8.
(ii) 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.
(iii) *All* the four questions should be solved in one answer-book
and attach extra-supplements if required.
(iv) Draw diagrams wherever necessary.
(v) Use of scientific calculator is allowed.
(vi) Assume suitable data wherever necessary.

1. (a) State and prove Hydrostatic Law. [6]
(b) Discuss various types of flows. [6]

Or

2. (a) A body with gravity force of 500 N with a flat surface area
of 0.2 m^2 slides down a lubricated inclined plane making a
 30° angle with the horizontal. For viscosity of 0.1 kg.m/s
and body speed of 1 m/s . Determine the lubricant film
thickness. [6]
(b) Prove that streamlines and equipotential lines are orthogonal
to each other. [6]

P.T.O.

3. (a) Derive an expression for Euler's equation along stream-line. [6]
 (b) Write short notes on : [6]
 (i) Hydrodynamically smooth and rough boundaries.
 (ii) Velocity profile of Turbulent flow.

Or

4. (a) What is Pitot tube ? Derive expression for velocity. Draw with all labels Pitot static tube. [6]
 (b) Derive expression for velocity distribution for flow in fixed parallel plates. [6]
5. (a) Derive an expression for Darcy-Weisbach equation. [6]
 (b) Discharge Q of a centrifugal pump can be assumed to be dependent on density of liquid ρ , viscosity of liquid μ , pressure p , impeller diameter D , and speed N in RPM. Using Buckingham π -theorem, show that : [7]

$$Q = ND^3\phi\left[\frac{gH}{N^2D^2}, \frac{\nu}{ND^2}\right].$$

Or

6. (a) What are repeating variables ? What points are important while selecting repeating variables ? [6]
 (b) A siphon of dia. 200 mm connects two reservoirs having a difference of elevation of 20 m. The total length of siphon is 800 m and the summit is 5 m above the water level in the upper reservoir. If separation takes place at 30 kPa (absolute). Find maximum length of siphon from upper reservoir to summit. Take friction factor = 0.016, $P_{atm.} = 10.3$ m of water. [7]

7. (a) Derive an expression for displacement, momentum and energy thicknesses. [9]
- (b) A car of frontal area 1.4 m^2 travels in still air with speed 72 kmph . If drag coefficient is 0.350 , calculate power required to drive the car at this speed. Density of air is 1.2 kg/m^3 . [4]

Or

8. (a) Discuss boundary layer development over flat plate. [7]
- (b) Write a short note on “Flow around cylinder and aerofoil”. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1015

S.E. (Mechanical/Automobile) (First Semester)

EXAMINATION, 2015

MATERIAL SCIENCE

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Figures to the right indicate full marks.

(iii) Draw the neat sketch wherever necessary.

1. (a) What do you mean by the term 'Unit Cell' ? Define various lattice parameters. [4]
- (b) Differentiate between cold working and hot working according to temperature, variation in mechanical properties, grain formation and areas of application. [4]
- (c) What is composite material ? Explain with classification and types. [4]

Or

2. (a) What do you mean by the term 'Polymer' ? Explain with types, characteristics and applications. [4]

P.T.O.

- (b) What do you mean by the term 'ceramic' ? Explain with types, properties and application. [4]
- (c) Derive the expression for deformation of single crystal by slip ? State the condition for geometrical hardening and geometrical softening. [4]
3. (a) What is the concept of True stress and True strain ? Derive the relations between them also find out the condition for necking. [5]
- (b) What do you mean by the term 'Hardness of the material' ? Explain any *four* testing methods for checking the hardness of the material. [4]
- (c) What do you mean by 'non-destructive testing' ? Explain ultrasonic method of testing with working principle, advantages and drawbacks. [4]

Or

4. (a) Identify the methods of NDT in the following cases : [5]
- (i) Cavities, cracks or region of variable density for the metal/ non-metallic components manufactured by casting, welding and forging etc.
- (ii) To sort out dissimilar metals and detect differences in their composition, microstructure etc.
- (iii) Detecting internal defects such as cracks, porosity and laminations in metallic and non-metallic components during or after production.

- (iv) Various kinds of flaws in ferromagnetic components made from various welding, castings and forging etc.
- (v) Invisible cracks, porosity and other similar defects on the surface of components made up of metal, non-metal, plastic, glass etc.
- (b) Explain with working principle the material test for the component which shows a plastic deformation under constant stresses for a longer time at high temperatures. Draw the type of possible microstructure during this test. [4]
- (c) What is the purpose of 'Impact Test' ? Explain with types and the factors affecting the impact values of the component. [4]
5. (a) Define the term 'powder metallurgy' with steps of processing and classification of powder manufacturing processes. [5]
- (b) What do you mean by the term 'sintering' ? Explain the stages of sintering. [4]
- (c) Explain the role of powder metallurgy for manufacturing of 'cemented carbide' ? [4]

Or

6. (a) Explain powder metallurgy with characteristics of metal powders, advantages, disadvantages and areas of applications. [5]
- (b) What do you mean by conditioning of metal powders ? Explain with purpose and different processing stages. [4]

- (c) What is a 'self-lubricated bearing' ? Explain the role of powder metallurgy for manufacturing of 'self-lubricated bearings'. [4]
7. (a) Explain the following terms (any *two*) : [4]
- (i) Piezometric materials
 - (ii) Soft and hard ferrites
 - (iii) Super-conductors.
- (b) What do you mean by the term 'biomaterials' ? Explain with different types ? [4]
- (c) Explain the concept of 'shape memory alloy' with advantages, disadvantages and applications. [4]

Or

8. (a) Explain the following terms (any *two*) : [4]
- (i) Cryogenic applications of smart materials
 - (ii) Modern materials for high temperature applications
 - (iii) Dielectric materials.
- (b) Explain the concept of nano-science and technology. [4]
- (c) Explain 'Biosensors' with principle, advantages and applications. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—3

Seat No.	
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[4757]-1016

S.E. (Mechanical, Mechanical Sandwich, Automobile)

(Second Semester) EXAMINATION, 2015

ELECTRONICS AND ELECTRICAL ENGINEERING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

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

(iii) Assume suitable data if necessary and state the same clearly.

(iv) Neat diagrams must be drawn wherever necessary.

(v) Use of electronic pocket calculator is allowed.

1. (a) Explain TMOD register and specify its operating modes. [6]
(b) Explain different addressing modes supported by 8051 microcontroller. [6]

Or

2. (a) What is Program Status Word (PSW) ? State the function of each flag in it. [6]
(b) Discuss asynchronous and synchronous data transfer formats. [6]

P.T.O.

3. (a) Derive the expression for the torque developed in a three-phase induction motor under running conditions. Hence state the equation for maximum torque developed. [6]
- (b) A 200 V, 4 Pole, Lap wound DC shunt motor has 800 conductors on its armature. The resistance of armature winding is 0.5Ω and that of shunt field winding is 200Ω . The motor takes current of 21 A and flux per pole is 30 MWb. Find the speed and gross torque developed in armature. [7]

Or

4. (a) Explain V/f control method for controlling speed of three-phase induction motor. [6]
- (b) Draw and explain characteristics of DC shunt and series motors. [7]
5. (a) Discuss advantages of digital voltmeters over analog voltmeters. Also mention its limitations. [6]
- (b) Explain working of conventional standard signal generator with the help of neat diagram. [6]

Or

6. (a) Explain working of digital multimeter with the help of block diagram. [6]
- (b) Enlist applications of Cathode Ray Oscilloscope (CRO) for measurement of various electrical quantities. [6]

7. (a) Explain two wattmeter method used for measuring three-phase power in a star connected balanced load supplied by symmetrical a.c. with the help of neat connection diagram and phasor diagram. [6]
- (b) What is an AC bridge ? Enlist AC bridges. Derive the general equations for balance of an AC bridge. [7]

Or

8. (a) Two wattmeters are connected to measure total power in a three-phase circuit. One reads 4800 W while the other reads backwards. Over reversing the connections of the later, it reads 400 W. Find total power absorbed and power factor of circuit. [6]
- (b) What is Wien's bridge ? Derive the expression for unknown frequency in terms of bridge parameters. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

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[4757]-1017

S.E. (Automobile/Mechanical Engineering)

(Second Semester) EXAMINATION, 2015

APPLIED THERMODYNAMICS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Assume suitable data, if necessary.

(iii) Draw neat diagrams wherever necessary.

(iv) Figures to the right indicate full marks.

1. (a) Explain with the help of a P–V diagram the loss due to variation of specific heats in an Otto cycle. [6]

(b) With a neat sketch explain the working principle of simple carburetor. [6]

Or

2. (a) Draw ideal and actual valve timing diagram for four stroke S.I. engine. [6]

(b) Explain the different stages of combustion in S.I. engine. [6]

P.T.O.

3. (a) Explain the various factors that influence the delay period in C.I. engine. [6]

(b) In a test of a four-cylinder four-stroke petrol engine of 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a constant speed and with a fixed setting of the fuel supply of 0.082 kg/min. :

BP with all cylinders working = 15.24 kW

BP with cylinder No. 1 cut-off = 10.45 kW

BP with cylinder No. 2 cut-off = 10.38 kW

BP with cylinder No. 3 cut-off = 10.23 kW

BP with cylinder No. 4 cut-off = 10.45 kW

Estimate :

(1) Total indicated power of the engine

(2) Total friction power,

(3) Indicated thermal efficiency of the engine

If the calorific value of the fuel is 44 MJ/kg [7]

Or

4. (a) Explain with figures various types of combustion chambers used in CI engines. [6]

(b) During the trial of a single cylinder, four-stroke oil engine, the following results were obtained : [7]

Cylinder diameter = 20 cm

Stroke = 40 cm

Mean effective pressure = 6 bar

Torque = 407 Nm

Speed = 250 r.p.m.

Fuel consumption = 4 kg/h

Calorific value of fuel = 43 MJ/kg

Cooling water flow rate = 4.5 kg/min

Air used per kg of fuel = 30 kg of air/kg of fuel

Rise in cooling water temperature = 45°C

Temperature of exhaust gases = 420°C

Room temperature = 20°C

Mean specific heat of exhaust gas = 1 kJ/kgK

Specific heat of water = 4.18 kJ/kgK

Find IP, BP and draw heat balance sheet for the test.

5. (a) Explain with neat sketch pressurized dry sump lubrication system. [6]
- (b) Discuss the effect of A : F ratio on emission of : [6]
- (1) Unburnt HC
- (2) CO
- (3) NO_x.

Or

6. (a) Explain battery ignition system with neat diagram. [6]
- (b) Explain exhaust gas recirculation method used to control NO_x emissions. [6]
7. (a) What are the advantages of multi-staging in reciprocating air compressor ? [6]
- (b) During an experiment on reciprocating air compressor the following observations are being taken : [7]
- | | |
|---|--------------------------------|
| Barometer reading | = 75.6 cm Hg |
| Manometer reading across orifice | = 13 cm Hg |
| Atmospheric temperature | = 25°C |
| Diameter of orifice | = 15 mm |
| Coefficient of discharge across the orifice | = 0.65 |
| Take density of Hg | = 0.0135951 kg/cm ³ |
- Determine the volume of free air handled by compressor in m³/min.

Or

8. (a) Draw isothermal, polytropic and isentropic compression on P-V and T-s diagram and compare the three works. [6]
- (b) Determine the minimum number of stages required in an air compressor which admits air at 1 bar 27°C and delivers at 180 bar. The maximum discharge temperature at any stage is limited to 150°C. Consider the index for polytropic compression as 1.25 and perfect and optimum inter-cooling in between the stages. Neglect the effect of clearance. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[4757]-1018

S.E. (Mechanical/Automobile) (Second Semester)

EXAMINATION, 2015

STRENGTH OF MATERIALS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer *four* questions out of 8.

(ii) 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.

(iii) All the four questions should be solved in one answer-
book; attach extra supplements if required.

(iv) Draw diagrams wherever necessary.

(v) Use of scientific calculator is allowed.

(vi) Assume suitable data wherever necessary.

1. (a) A steel bar 25 mm diameter and length 250 mm is pulled by 0.001 mm by application of tensile load. Find the diameter of the bar if the linear strain is to be reduced by 10% without changing the load.

[6]

P.T.O.

- (b) Draw SFD and BMD for the beam loaded as shown in figure below. [6]

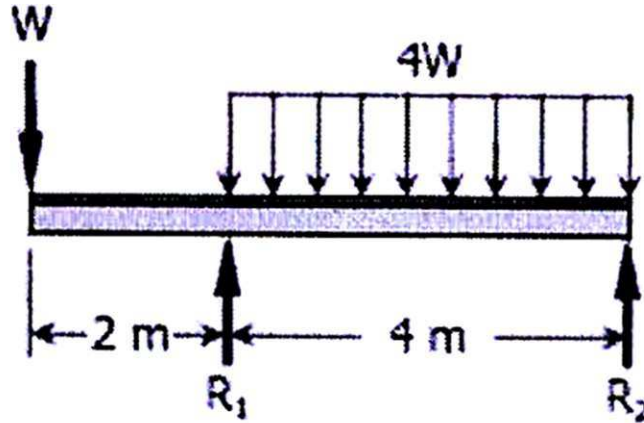


Fig. 1

Or

2. (a) A steel bar of 35 mm diameter and length 350 mm is pulled by 0.002 mm by application of tensile load. If the diameter of the bar is changed to 30 mm find the change in length for the same load. [6]
- (b) Draw SFD and BMD for the beam loaded as shown in figure below. [6]

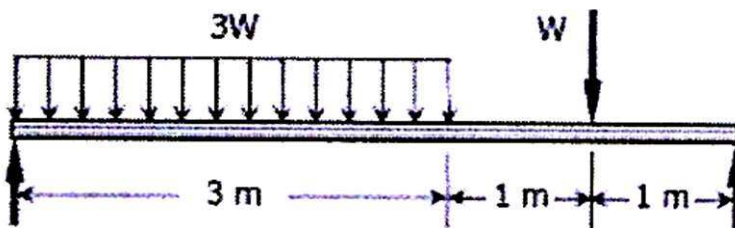


Fig. 2

3. (a) A rectangular steel bar, 15 mm wide by 30 mm high and 6 m long, is simply supported at its ends. If the density of steel is 7850 kg/m^3 , determine the maximum bending stress caused by the self-weight of the bar. [6]
- (b) Determine the deflection at the free end of a cantilever of length 4 m carrying a uniformly distributed load of 12 kN/m over a length of 3 m from fixed end. [6]
- Take $EI = 2 \times 10^{13} \text{ N/mm}^2$.

Or

4. (a) Determine the minimum height h of the beam shown in figure below if the flexural stress is not to exceed 20 MPa. [6]

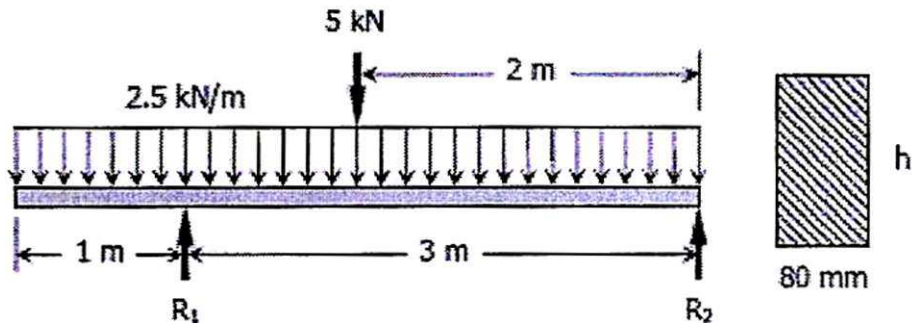


Fig. 3

- (b) For the problem described in question 3(b) determine the slope at the free end of the cantilever. [6]

5. (a) A hollow steel shaft 1 m long is required to transmit a torque of 10 kN-m. The total angle of twist in this length is not to exceed 1° and the allowable shearing stress is 100 MPa. Determine the inside and outside diameter of the shaft if $G = 100$ GPa. [6]
- (b) Determine the ratio of the buckling strengths of a solid steel column to that of a hollow column of same material and having same cross-sectional area. The internal diameter of hollow column is half of its external diameter. Both the columns are of the same length and are pinned at both ends. [7]

Or

6. (a) A steel bar of rectangular cross-section $33 \text{ mm} \times 66 \text{ mm}$ and pinned at each end is subject to axial compression. If the proportional limit of the material is 330 MPa and $E = 222$ GPa, determine the minimum length for which Euler's equation may be used to determine the buckling load. [6]

(b) A hollow shaft of diameter ratio $3/5$ is required to transmit 482 kW at 125 rpm. The shearing stress in the shaft must not to exceed 65 N/mm^2 and the twist in a length of 2 m not to exceed 1 degree. Calculate minimum external diameter of shaft which would satisfy these conditions.[7]
Take $G = 8 \times 10^4 \text{ N/mm}^2$.

7. A solid circular shaft is subjected to a bending moment of 8 kNm and a torque of 12 kNm. In a uniaxial test the shaft material gave the following results : Modulus of elasticity = 200 GN/m^2 , Stress at yield point = 300 N/mm^2 , Poisson's ratio = 0.3, Factor of safety = 3. Estimate the least diameter of the shaft using :

(i) Maximum principal stress theory

(ii) Maximum principal strain theory and

(iii) Shear strain energy theory. [13]

Or

8. A material is subjected to two mutually perpendicular direct stresses of 92 MPa tensile and 29 MPa compressive, together

with a shear stress of 22 MPa. The shear couple acting on planes carrying the 92 MPa stress is clockwise in effect.

Calculate :

- (i) magnitude and nature of the principal stresses;
- (ii) magnitude of the maximum shear stresses in the plane of the given stress system;
- (iii) direction of the planes on which these stresses act. [13]

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

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[4757]-1019

S.E. (Mech./Mech. Sand./Auto.) (Second Semester)

EXAMINATION, 2015

THEORY OF MACHINES—I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—**
- (i) Answer Q. No. 1 *or* Q. No. 2, Q. No. 3 *or* Q. No. 4, Q. No. 5 *or* Q. No. 6, Q. No. 7 *or* Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of calculator is allowed.
 - (v) Assume suitable data, if necessary.

1. (a) Define 'Inversion'. Explain with the help of neat sketches any *two* inversions of double slider crank chain. [5]
- (b) Write a note on 'Dynamically Equivalent System'. [5]

Or

2. (a) Compare 'Davis' and 'Ackermann' Steering Gear Mechanisms. [4]
- (b) With the help of neat schematic diagram, derive frequency equation of bifilar suspension system. [6]

P.T.O.

3. (a) Determine the dimensions of the contact surfaces of cone clutch, for the following specifications : [5]
- (i) Power transmission capacity = 20 kW
 - (ii) Speed = 1600 rpm
 - (iii) Cone angle = 30°
 - (iv) Maximum intensity of pressure = $0.8 \times 10^5 \text{ N/m}^2$
 - (v) Coefficient of friction = 0.3
 - (vi) Mean radius is twice the width of the friction surface.
- Assume uniform wear condition.
- (b) Explain Complex Algebra method of acceleration analysis for a binary link. [5]

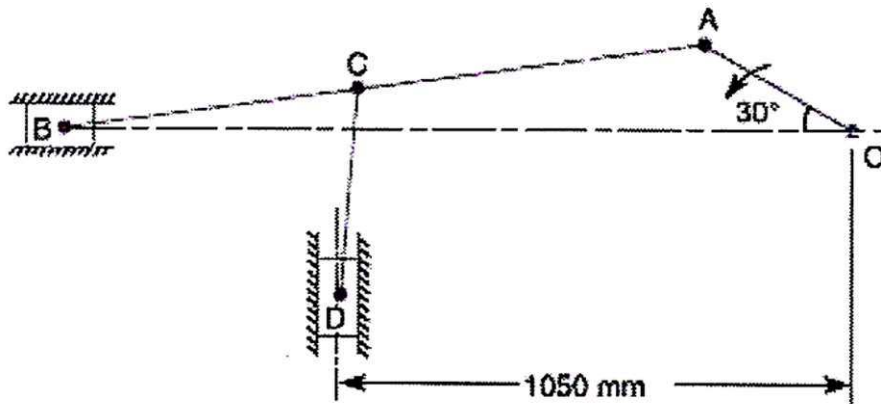
Or

4. (a) Describe with neat sketch the construction and working of epicyclic train type dynamometer. [5]
- (b) Derive an equation for velocity of piston in an I.C. engine mechanism, when crank rotates with uniform angular velocity using analytical method. [5]
5. (a) State and explain Kennedy's theorem. [4]

(b) In the mechanism shown in Fig. 1, the crank OA rotates at 20 rpm in anticlockwise direction and gives motion to the sliding blocks B and D. For the given configuration of mechanism, determine by relative velocity method and relative acceleration method :

[11]

- (i) Velocity of sliders B and D
- (ii) Angular velocity of link CD
- (iii) Acceleration of sliders B.



OA = 300 mm, AB = 1.2 m, BC = CD = 450 mm

Fig. 1 (for Q. No. 5 (b) and Q. No. 6(b))

Or

6. (a) With the help of neat sketch, explain the concept of 'Velocity Image Principle'.

[4]

- (b) In the mechanism shown in Fig. 1 the crank OA rotates at 20 rpm in anticlockwise direction and gives motion to the sliding blocks B and D. For the given configuration of mechanism, locate all instantaneous centers of rotation, then determine :
- (i) Velocity of sliders B and D
 - (ii) Angular velocities of links AB and CD. [11]

7. (a) What is Coriolis acceleration ? Find the direction of this acceleration in the case shown in Fig. 2. [4]

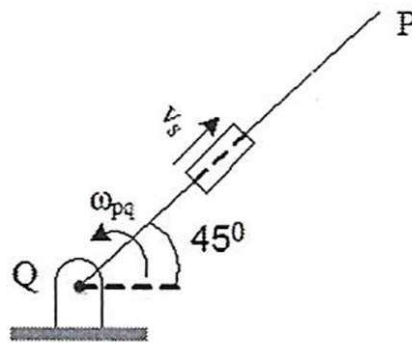


Fig. 2 (For Q. 7(a))

- (b) The crank of an engine is 180 mm long and obliquity ratio is 4. Determine the velocity and acceleration of the piston, when the crank is turned through 40° from I.D.C. position for the following two cases : [11]
- (i) The crank rotates at a uniform speed of 300 rpm
 - (ii) The crank rotates at a speed of 300 rpm and is increasing at the rate of 120 rad/s².

Or

8. (a) Explain the procedure to construct Kleins construction to determine the velocity and acceleration of a piston in an I.C. engine mechanism, when crank rotates at a uniform angular velocity. [4]
- (b) The driving crank AB of length 75 mm for the quick return mechanism, as shown in Fig. 3 revolves at a uniform speed of 200 rpm. Find acceleration of point Q, for the configuration shown, when the crank makes an angle of 60° with the vertical line of centers PA. [11]

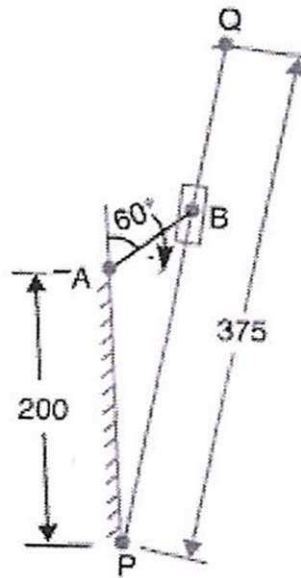


Fig. 3 (For Q. 8(b))

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1020

S.E. (Mechanical and Automobile) (Second Semester)

EXAMINATION, 2015

ENGINEERING METALLURGY

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer any *four* questions. Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Use of electronic pocket calculator is allowed.

(iv) Figures to the right indicate full marks.

1. (a) Define the following : [4]

(i) Phase

(ii) Ledeburite

(b) What is “isomorphous” system ? Explain with *one* example of the same. [4]

(c) Draw Fe-Fe₃C phase diagram and write the critical temperatures on it. [4]

P.T.O.

Or

2. (a) What is stainless steel ? For surgical applications which group of stainless steel is used ? Explain in detail. [4]
- (b) Draw a self-explanatory cooling curves for binary eutectic. [2]
- (c) With a neat diagram explain working of metallurgical microscope. [4]
- (d) What do you understand by AISI 1090 and Fe-230. [2]
3. (a) While selecting any material in corrosion, what are the different factors taken into consideration ? [6]
- (b) Write a short note on Nitriding. [4]
- (c) Explain strain hardening is one of best strengthening mechanism for pure metal. [3]

Or

4. (a) A large size gear needs to be hardened, suggest a suitable heat treatment for the same and justify your answer. [3]
- (b) What is Crevice corrosion ? How it can be reduced ? [3]
- (c) Explain in brief "Impressed current cathode protection". [3]

(d) Show the following heat treatment on TTT diagram : [4]

(i) Austempering

(ii) Conventional Hardening.

5. (a) In which cast iron, carbon is not present in the free form ?

Explain the treatment ? Which converts cementite into free carbon-graphite. Draw the microstructure after heat treatment. [6]

(b) What is mottled cast iron ? Why the formation of this cast iron is avoided ? [4]

(c) Discuss advantages of gray cast iron over white cast iron. [3]

Or

6. (a) Write True or False and justify your answer : [6]

(i) Chilled cast iron can be used for manufacturing wheels of road rollers.

(ii) Gray cast iron is used for manufacturing bearings.

(b) Draw a microstructure of ferritic “gray cast iron”. [2]

(c) What is Ni-Resist cast iron ? How does it differ from Nicrosilal ? [5]

7. (a) Give the composition of “Duralumin”. What are its properties ? [4]
(b) What is “Naval Brass” ? What are its applications ? [4]
(c) How “Invar” differs from “Elinvar” ? Compare their compositions and give *one* application of each. [4]

Or

8. (a) What properties are required for bearing materials ? Give composition of any *one* non-Ferrous alloy used as bearing. [4]
(b) Give typical composition, properties, applications of the following (any *two*) : [6]
(i) Cap Brass
(ii) Statuary Bronze
(iii) Muntz metal
(iv) Leaded brass
(c) What is Zinc equivalence in brass ? [2]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1023

S.E. (Mechanical Sandwich) (Second Semester)

EXAMINATION, 2015

METROLOGY AND QUALITY CONTROL

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—**
- (i) Neat diagrams must be drawn wherever necessary.
 - (ii) 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.
 - (iii) Assume suitable data, if necessary.
 - (iv) Use of calculator is allowed.
 - (v) Figures to the right indicate full marks.

1. (a) State different types of linear and angular measuring instruments, explain any *two* with example. [6]
- (b) State different types of comparators, explain sigma comparator in detail. [6]

P.T.O.

Or

2. (a) State and explain Taylor's Principle of Gauge Design with example. [6]
- (b) What is surface texture ? State different methods to analyze surface trace. [6]
3. (a) Explain method of measuring effective diameter by using two wires. [6]
- (b) Explain Pareto analysis and Fish bone diagram in detail. [6]

Or

4. (a) Explain CMM and UMM in detail. [6]
- (b) What are different quality costs ? Explain with examples. [6]
5. (a) What is TPM ? Explain eight pillars of TPM. [7]
- (b) Explain the concept of zero defects. [3]
- (c) Explain the concept of JIT. [3]

Or

6. (a) Write short notes on (any *two*) : [8]
- (i) Quality function deployment (QFD) in TQM
- (ii) Poka-yoke
- (iii) Kanban.
- (b) Explain ISO-9000 quality system standards. [5]

7. (a) Table given below shows the number of defectives found in inspection of 10 lots of 100 items each : [7]

Lot No.	No. of defective
1	5
2	2
3	2
4	3
5	4
6	1
7	13
8	4
9	3
10	4

- (i) Determine the control limits for P chart and state whether the process is in control.
- (ii) If the points that goes outside the control limits is analyzed and eliminated, what will be the value of new control limit ?
- (b) Differentiate between single, double and sequential sampling plan. [6]

Or

8. (a) Define AOQL and AOQ. For the following data, calculate the sample size and AOQ for single sampling plan. [7]
- (i) Probability of acceptance for 0.4% defectives in a lot is 0.558
 - (ii) Lot size $N = 15000$ units
 - (iii) $np' = 1.6$
 - (iv) Defective found in the sample are not to be replaced.
- (b) Explain control chart for variables with specification limits. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

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[4757]-1024

S.E. (Mechanical Sandwich)
(First Semester) EXAMINATION, 2015
FLUID MECHANICS AND MACHINERY
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B.** :— (i) All questions are compulsory.
(ii) Answers should be written in same answer-books.
(iii) Neat diagrams must be drawn wherever necessary.
(iv) Figures to the right indicate full marks.
(v) Your answers will be valued as a whole.
(vi) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
(vii) Assume suitable data, if necessary.

1. (a) Define path line, streak line and the streamline. For what type of flow these lines are identical ? [4]
- (b) A square plate 50 cm × 50 cm weighing 200 N is allowed to slide down an inclined plane which is laid at a slope of 1 vertical to 2.5 horizontal. What terminal velocity will be attained by the plate if 0.02 mm thickness of oil film lies interposed between the inclined plane and the plate ? The oil has a dynamic viscosity of 2.25×10^{-3} Ns/m². [8]

P.T.O.

Or

2. (a) Check whether the following functions satisfies continuity and is valid potential function : [6]

(i) $\phi = \frac{A}{2}(x^2 - y^2)$

(ii) $\phi = A(\cos x + \sin y)$

(iii) $\phi = A \log_e xy$

where, A is numerical constant.

- (b) A block of wood of specific gravity 0.7 floats in a water. Determine the meta-centric height of the block if its size is 2 m long \times 1 m wide \times 0.8 m deep. [6]

3. (a) Define Orifice-meter. Prove that the discharge through an orifice-meter is given by the relation : [5]

$$Q = C_d \frac{a_0 a_1}{\sqrt{a_1^2 - a_0^2}} \sqrt{2gh}$$

where :

a_1 = Area of pipe in which orifice-meter is fitted

a_0 = Area of orifice.

- (b) A Pelton wheel is to be designed for the following specifications : [8]

Shaft power = 11,772 kW, Head = 380 meters, Speed = 750 RPM, Overall efficiency = 86%, Jet diameter is not to exceed one-sixth of the wheel diameter. Determine :

(i) The wheel diameter

(ii) The number of jets required and

(iii) Diameter of the Jet.

Take $K_{v1} = 0.985$ and $K_{u1} = 0.45$.

Or

4. (a) A main pipe divides into two parallel pipes which again forms one pipe. The length and diameter for the first parallel pipe are 2000 m and 1.0 m respectively, while the length and diameter of 2nd parallel pipe are 2000 m and 0.8 m. Find the rate of flow in each parallel pipe, if total flow in the main is 3.0 m³/s. The co-efficient of friction for each parallel pipe is same and equal to 0.005. [9]

- (b) Obtain the expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. [4]

5. (a) Using Buckingham's π -theorem, show that the discharge Q consumed by an oil ring is given by : [10]

$$Q = Nd^3\phi \left[\frac{\sigma}{\rho N^2 d^3}, \frac{\mu}{\rho N d^2}, \frac{w}{\rho N^2 d} \right]$$

where :

d = internal diameter of the ring,

N = rotational speed,

ρ = density,

μ = viscosity,

σ = surface tension and w = sp. weight of oil.

- (b) What is a draft-tube ? What are its functions ? [3]

Or

6. (a) What is cavitation ? How can it be avoided in reaction turbine ? [3]
- (b) The hub diameter of a Kaplan Turbine working under a head of 12 m is 0.35 times the diameter of the runner. The turbine is running at 100 r.p.m. If the vane angle of the extreme edge of the runner at outlet is 15° and flow ratio 0.6, find : [10]
- (i) Diameter of the runner
 - (ii) Diameter of the boss and
 - (iii) Discharge through the runner.

The velocity of whirl at outlet is given as zero.

7. The outer diameter of an impeller of a centrifugal pump is 400 mm and outlet width is 50 mm. The pump is running at 800 rpm and is working against a total head of 15 m. The vanes angle at outlet is 40° and Manometric efficiency is 75% Calculate : [12]
- (i) Velocity of flow at outlet
 - (ii) Velocity of water leaving the vane
 - (iii) Angle made by the absolute velocity at outlet with the direction of motion at outlet, and
 - (iv) Discharge.

Or

8. A centrifugal pump with 1.2 m diameter runs at 200 r.p.m. and pumps 1800 liters/s, the average lift being 6 m. The angle which the vanes make at exit with the tangent to the impeller is 26° and the radial velocity of flow is 2.5 m/s. Determine the Manometric efficiency and the least speed to start pumping against a head of 6 m, the inner diameter of the impeller being 0.6 m. [12]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1025

**S.E. (Mechanical Sandwich) (First Semester) EXAMINATION, 2015
MATERIAL SCIENCE AND METALLURGY
(2012 PATTERN)**

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve any *four* questions Q. No. 1 *or* Q. No. 2, Q. No. 3
or Q. No. 4, Q. No. 5 *or* Q. No. 6, Q. No. 7 *or* Q. No. 8.

(ii) All the *four* questions should be solved in one answer-book
and attach extra supplements if required.

(iii) Draw neat and labelled diagrams wherever necessary.

(iv) Assume suitable data wherever necessary.

(v) Figures to the right indicate full marks.

1. (a) Explain with a schematic illustration, the relation between
tensile stress and resolved shear stress during loading of single
crystal. [4]

(b) What is fatigue ? How can fatigue strength be improved ? [4]

(c) What are the different methods to increase corrosion resistance
of a metallic material ? [5]

P.T.O.

Or

2. (a) Explain in brief “Radiography” technique for detecting defects in the components. [5]
- (b) Differentiate between Vickers and Brinell hardness test. [4]
- (c) What is Strain Hardening ? How does it improve the strength of materials ? [4]
3. (a) Explain the difference between Cast Irons and Steel. [4]
- (b) What is “Austempering” ? What are its advantages ? [4]
- (c) In which cast Iron “Rosettes of Temper Carbon” are observed ? Explain that treatment. [4]

Or

4. (a) What is the meaning of the following designation for cast iron and steel ? [4]
- (i) AISI
- (ii) EN
- (iii) SAE
- (iv) ISI.

- (b) Draw and label a microstructure of slowly cooled, eutectoid plain carbon steel. [4]
- (c) Explain “Flame Hardening” Heat treatment. [4]
5. (a) What is ‘Y’ alloy ? What are its properties and applications ? [4]
- (b) What is “Gun Metal” ? What are its properties and applications ? [4]
- (c) Explain “Cemented Carbides”. [5]

Or

6. (a) Explain in brief “Powder Conditioning”. [4]
- (b) What is Invar ? What are its properties and applications ? [4]
- (c) Differentiate between α -Titanium alloy and β -Titanium alloy. [5]
7. (a) What are “F.R.P” materials ? Give their *two* applications. [4]
- (b) What are “Refractory Ceramics” ? Give *two* examples of common ceramic refractory materials. [4]
- (c) How does “Condensation polymerization” differ from “addition polymerization” ? [4]

Or

8. (a) What are ceramic matrix composites ? Explain with *one* example. [4]
- (b) Explain in brief “sandwich panels”. [4]
- (c) How are “cerements” prepared ? Explain its properties and applications. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1027

S.E. (Mechanical S/W) (Second Semester) EXAMINATION, 2015

MANUFACTURING ENGINEERING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) *All the four* questions should be solved in one answer-book and attach extra supplements if required.

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

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

(v) Assume suitable data, if necessary.

(vi) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

1. (a) Explain moulding machines along with advantages and limitations. [6]

(b) Explain the types of adhesives and application. [6]

P.T.O.

Or

2. (a) Explain with sketch Swaging process. [6]
- (b) Explain types of flames. [6]
3. (a) Calculate index crank movement to divide 57 division by using compound indexing. The hole circles available are : [6]
- Plate I : 15, 16, 17, 18, 19, 20
- Plate II : 21, 23, 27, 29, 31, 33
- Plate III : 37, 39, 41, 43, 47, 49
- (b) Draw merchant force circle and only state relation between these forces. (Do not derive force relation) [6]

Or

4. (a) State various lathe attachments and explain *one* with neat sketch. [6]
- (b) Explain with neat sketch PAM, state commonly used gas or mixtures in PAM. [6]
5. (a) State types and explain with sketch pilots. [6]

(b) Describe the following die accessories with sketch : [7]

(i) Stock stop

(ii) Stripper.

Or

6. (a) Explain how material is cut in punch and die setup, also effect of clearance on this cutting. [7]

(b) Determine Force required for Banking a square plate having its side 60 mm and have a central hole of diameter 15 mm. The sheet metal thickness is 3 mm and shear strength of material is 380 N/mm². Show die and punch dimensions. Consider clearance of 10% of stock thickness. [6]

7. (a) Explain indexing method for jigs and fixture. [6]

(b) State various types of locating devices used in jig and fixtures and explain 'V' locator in detail with neat sketch. [7]

Or

8. (a) Explain turning fixture. [3]

- (b) Design and draw a drill jig to drill the four equispaced holes on the job shown in Fig. 8(b) [10]

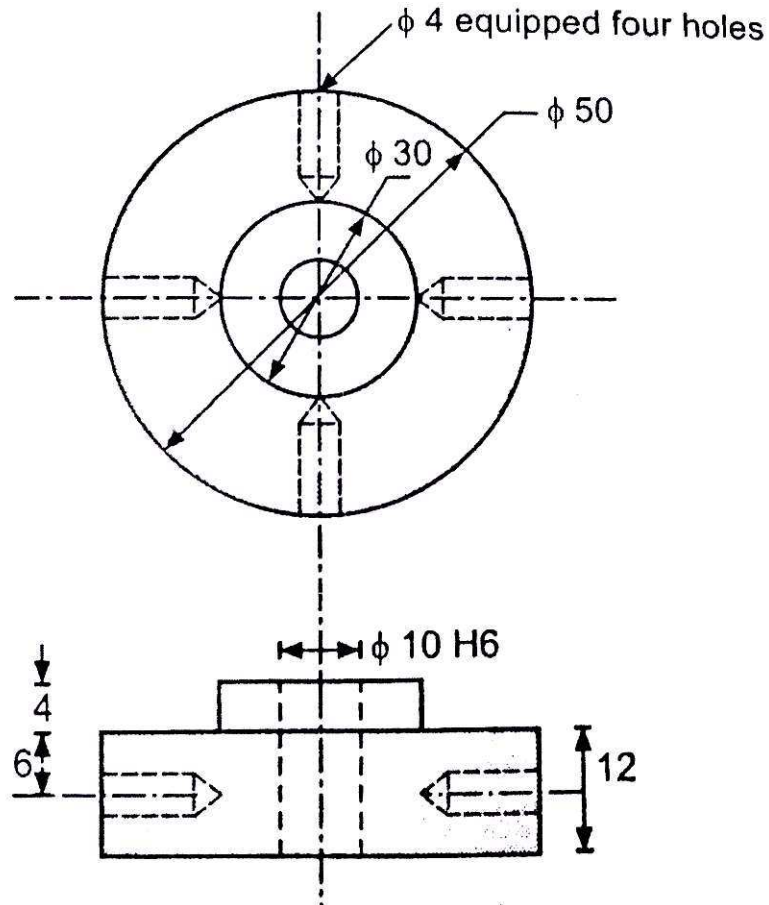


Fig. 8(b)

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

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[4757]-1030

S.E. (Mechanical Sandwich) (Second Semester)

EXAMINATION, 2015

THERMAL ENGINEERING

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve any *four* questions (Q. No. 1 *or* Q. No. 2, Q. No. 3 *or* Q. No. 4, Q. No. 5 *or* Q. No. 6, Q. No. 7 *or* Q. No. 8).

(ii) *All the four* questions should be solved in one answer-book and attach extra supplements if required.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Figures to the right indicate full marks.

(v) Use of steam tables, Mollier charts, scientific calculator is allowed.

(vi) Assume suitable data, if necessary.

1. (a) A single acting, single stage reciprocating air compressor of 250 mm bore and 350 mm stroke runs at 200 rpm. The suction and

P.T.O.

delivery pressures are at 1 bar and 6 bar respectively. Calculate the theoretical power required to run the compressor under each of the following conditions of compression : [6]

- (i) Isothermal
- (ii) Polytropic $n = 1.3$, and
- (iii) Isentropic, $\gamma = 1.4$

Neglecting the effect of clearance, show compression processes results on P-V diagram and write a comment on results.

(b) Write short notes on : [3+3]

- (i) Use of p-h chart
- (ii) Unit of refrigeration.

Or

2. (a) A refrigeration cycle uses Freon-12 as the working fluid. The temperature of the refrigerant in the evaporator is -10°C . The condensing temperature is 40°C . The cooling load is 150 W and the volumetric efficiency of the compressor is 80%. The speed of the compressor is 720 rpm. Show the processes on p-h chart and calculate : [6]

- (i) The mass flow rate of the refrigerant
- (ii) The displacement volume of the compressor.

Properties of Freon-12

Temperature (°C)	Saturation pressure (MPa)	Enthalpy (kJ/kg)		Specific volume (m ³ /kg) Saturated vapour
		Liquid	Vapour	
-10	0.22	26.8	183.0	0.08
40	0.96	74.5	203.1	0.02

(b) Why are multistage compressors preferred over single stage ?

Explain in detail with P-V diagram. [6]

3. (a) A room contains air at 25°C and 100 kPa at a relative humidity of 75%. Using psychrometry relations, determine : [6]

(i) the partial pressure of dry air

(ii) the specific humidity

(iii) the enthalpy per unit mass of the dry air

Given : $C_p = 1.005 \text{ kJ/kg. K}$ for air

(b) Explain battery ignition system with a neat sketch. [6]

Or

4. (a) Explain the following with psychrometric chart : [6]
- (a) Heating and Humidification
- (b) Cooling and Dehumidification.
- (b) A 4-cylinder, 4-stroke petrol engine develops 21 kW. A morse test was conducted at constant speed of 3000 rpm and B.P is measured, when each cylinder was cut-off are 14.8, 14.5, 14.6 and 14.75 kW respectively. Find I.P. of the engine when all cylinders are developing power. Also find mechanical efficiency and break mean effective pressure P_{bm}. Take bore = 7.5 cm and stroke = 9 cm. [6]
5. (a) Describe with neat sketch construction and working of catalytic converter system. [6]
- (b) Explain stages of combustion in C.I. Engine. [7]

Or

6. (a) Explain any *two* types of combustion chambers used in S.I. Engines. [6]
- (b) Write short notes on : [3+4]
- (i) Cetane number
- (ii) Emissions from S.I. and C.I. engines

7. (a) State the difference between jet propulsion and rocket propulsion. [6]
- (b) Derive optimum pressure ratio for maximum net work as function of the limiting temperature ratio and show that intermediate temperature must be equal to the geometric mean of temperature limits of the cycle. [5+2]

Or

8. (a) Explain the workings of a turbojet engine with the help of a sketch. What are its applications ? [6]
- (b) In a gas turbine plant air is compressed from 1 bar and 15°C through a pressure ratio of 4 : 1. It is then heated to 650°C in combustion chamber and expanded to 1 bar pressure in a turbine. Calculate the cycle efficiency and work ratio if a perfect heat exchanger is used. Take $\eta_c = 0.8$ and $\eta_t = 0.85$. Show the arrangement of the components of the plant and represent the processes on T-S diagram. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—7

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[4757]-1031

S.E. (Electrical/Instru.) (First Semester)

EXAMINATION, 2015

ENGINEERING MATHEMATICS—III

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—**
- (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of non-programable electronic pocket calculator and steam tables is allowed.
 - (v) Assume suitable data, if necessary.

1. (a) Solve any *two* : [8]

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

(ii) $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = \cos(\log x) + x \sin(\log x)$

(iii) $(D^2 + 4)y = \sec 2x$ by variation of parameters method.

P.T.O.

(b) Find Laplace-transform of $\frac{1 - \cos t}{t}$. [4]

Or

2. (a) The charge Q on the plate of condenser satisfies the equation : [4]

$$\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E}{L} \sin \frac{t}{\sqrt{LC}}$$

Prove that the charge at any time t is given by

$$Q = \frac{EC}{2} [\sin \omega t - \omega t \cos \omega t]$$

where $\omega = \frac{1}{\sqrt{LC}}$ and $Q = 0$ at $t = 0$.

(b) Solve (any one) : [4]

(i) $L[t \cup (t - 4) - t^3 \delta(t - 2)]$

(ii) $L^{-1} \left[\frac{1}{s^2 (s+1)^2} \right]$ by convolution theorem.

(c) Solve by Laplace-transform method : [4]

$$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 5y = e^{-t} \sin t$$

with $y(0) = 0$ and $y'(0) = 1$.

3. (a) Find inverse Fourier sine transform of : [4]

$$F_s(\lambda) = \frac{1}{\lambda} e^{-a\lambda}, \lambda > 0.$$

- (b) Find inverse z -transform of : [4]

$$F(z) = \frac{z^2}{(z-1)\left(z-\frac{1}{2}\right)^2}, |z| > \frac{1}{2}.$$

- (c) Find directional derivatives of

$$\phi = e^{2x-y-z}$$

at $(1, 1, 1)$ in the direction of tangent to curve

$$x = e^{-t}, y = 2\sin t + 1, z = t - \cos t$$

at $t = 0$. [4]

Or

4. (a) Prove the following (any one) : [4]

$$(i) \quad \nabla \cdot \left[r \nabla \left(\frac{1}{r^4} \right) \right] = \frac{8}{r^5}$$

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

- (b) Show that vector field [4]

$$\bar{F} = (6xy + z^3) \bar{i} + (3x^2 - z) \bar{j} + (3xz^2 - y) \bar{k}$$

is irrotational. Find scalar function ϕ such that :

$$\bar{F} = \nabla\phi.$$

(c) Solve the difference equation : [4]

$$f(k + 2) + 3 f(k + 1) + 2 f(k) = 0,$$

$$f(0) = 0, f(1) = 1.$$

5. (a) Evaluate :

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

where

$$\bar{F} = zi + xj + yk$$

and C is the arc of the curve $x = \cos t$, $y = \sin t$,
 $z = t$ from $t = 0$ to $t = 2\pi$. [4]

(b) Evaluate :

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

for vector field

$$\bar{F} = 4yi - 4xj + 3k$$

where s is a disc of radius 1 lying on the plane $z = 1$ and
C is its boundary. [4]

(c) Evaluate :

$$\iint_S (x^3 dydz + x^2y dzdx + x^2z dxdy)$$

where S is the closed surface consisting of the circular cylinder

$$x^2 + y^2 = a^2,$$

$$z = 0 \text{ and } z = b. \quad [5]$$

Or

6. (a) Using Green's theorem, evaluate

$$\int_C \left(\frac{1}{y} dx + \frac{1}{x} dy \right)$$

where C is the boundary of the region bounded by the parabola $y = \sqrt{x}$ and the lines $x = 1$, $x = 4$. [4]

(b) Evaluate :

$$\iint_S \bar{F} \cdot d\bar{s}$$

using Gauss divergence theorem where

$$\bar{F} = 2xyi + yz^2j + xzk$$

and s is the region bounded by

$$x = 0, y = 0, z = 0, y = 3, x + 2z = 6. \quad [5]$$

(c) Evaluate :

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

by Stokes' theorem, where

$$\bar{F} = y^2i + x^2j - (x + z)k$$

and C is the boundary of the triangle with vertices at (0, 0, 0), (1, 0, 0) and (1, 1, 0). [4]

7. (a) If $\phi + i\psi$ is complex potential for an electric field and

$$\phi = -2xy + \frac{x}{x^2 + y^2},$$

find function ψ . [4]

(b) Evaluate :

$$\oint_C \frac{z + 4}{(z + 1)^2 (z + 2)^2} dz$$

where 'C' is a circle $|z + 1| = \frac{1}{2}$. [5]

(c) Find the bilinear transformation which maps points 1, 0, i of z -plane onto the points ∞ , -2 , $-\frac{1}{2}(1 + i)$ of w -plane. [4]

Or

8. (a) Show that analytic function with constant amplitude is constant. [4]

(b) Evaluate :

$$\int_{2+4i}^{5-5i} (z+1) dz$$

along the line joining the points $2 + 4i$ and $5 - 5i$. [5]

(c) Find the image of Hyperbola :

$$x^2 - y^2 = 1$$

under the transformation $w = \frac{1}{z}$. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[4757]-1032

S.E. (Electrical) (I Sem.) EXAMINATION, 2015

POWER GENERATION TECHNOLOGIES

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) *All* questions are compulsory.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

1. (a) What is the function of draught system in thermal power plant ? With a neat diagram explain its working. [6]
- (b) Compare nuclear, diesel and gas turbine power plants. [6]

Or

2. (a) With the help of diagram explain the main parts and working of thermal power plant. [6]
- (b) Explain the nuclear reactor in nuclear power plant. [6]
3. (a) Differentiate between the working of Francis turbine and Kaplan turbine used in hydropower plants. [6]
- (b) Describe the types of wind turbine electrical generators. [7]

P.T.O.

Or

4. (a) In hydro-power plants, write short notes on : [6]
(i) Dams
(ii) Penstocks.
(b) Explain how the wind pattern affects power generation in wind energy systems. [7]
5. (a) What are solar energy collectors ? Write their types and compare them. [7]
(b) Explain stand-alone, hybrid stand-alone and grid connected renewable energy systems. [6]

Or

6. (a) Explain the impacts of temperature and insolation on I-V curves of PV cells. [6]
(b) Describe the fuel cells. How are they used for energy storage requirements ? [7]
7. (a) Explain a generic photo-voltaic cell. [3]
(b) Define the terms in solar energy system : [3]
(i) Solar constant
(ii) Cloudy index
(iii) Concentration ratio.
(c) Explain the process of municipal solid waste to energy conversion. [6]

Or

8. (a) Explain the methods of measurement of solar radiation. [6]
(b) Write a short note on 'Small-mini-micro hydro-plant'. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1033

S.E. (Electrical) (I Sem.) EXAMINATION, 2015

MATERIAL SCIENCE

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Figures to the right indicate full marks.

Physical Constants :

- (1) Angstrom Unit (AU) = 1×10^{-10} metres
- (2) Boltzmann's Constant (k) = 1.380×10^{-23} joule.degree⁻¹
- (3) Charge on Electron (e) = 1.601×10^{-19} coulomb
- (4) Mass of Electron (m) = 9.107×10^{-31} kg
- (5) Electron volt (eV) = 1.602×10^{-19} joules
- (6) Mass of Proton (m_p) = 1.627×10^{-27} kg
- (7) Velocity of light (c) = 2.998×10^8 m/sec
- (8) Dielectric Constant of free space (ϵ_0) = 8.854×10^{-12} F/m
- (9) Permeability of free space (μ_0) = $4\pi \times 10^{-7}$ H/m
- (10) Debye Unit = 3.33×10^{-30} coulomb.metre

1. (a) Define dielectric loss tangent and explain it with phasor diagram. [6]
- (b) Write down insulating materials used for insulators and switch gears. [6]

P.T.O.

Or

2. (a) Write down the materials used for various photoconductive cells. [6]
(b) Describe various crystal defects. [6]
3. (a) Describe magnetic strip technology. [7]
(b) Differentiate between characteristics of high and low resistive materials. [6]

Or

4. (a) In a material an application of magnetic field of 2.75×10^3 kA/m causes and magnetic flux density of 0.2485 Wb/m². Calculate its permeability, susceptibility and magnetization. [7]
(b) Write down properties and applications of :
(i) Silver and Silver alloys
(ii) Copper and Copper alloys. [6]
5. Write short notes on the following : [12]
(i) Carbon Nano-tubes (CNT)
(ii) Carbon clusters.

Or

6. Write short notes on the following : [12]
(i) Molecular Machines
(ii) Single Electron Transistor (SET).

7. (a) With neat sketch, explain how flux density is measured with the help of Gauss meter. [7]
- (b) Describe the method for measurement of dielectric strength of resins and polymers. [6]

Or

8. (a) Explain the step by step method of finding dielectric strength of transformer oil with a neat diagram as per IS 6798. [7]
- (b) Explain various tests carried out on high voltage cables. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1034

S.E. (Electrical) (I Sem.) EXAMINATION, 2015

ANALOG AND DIGITAL ELECTRONICS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or
Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or
Q. No. 8.

(ii) Figures to the right indicate full marks.

1. (a) Using Boolean algebra simplify : [6]
- (i) $ABC + A\bar{B}C + AB\bar{C}$
- (ii) $\bar{A}B\bar{C}D + \bar{A}BCD + ABD$.
- (b) Explain the operation of clocked SR flip-flop with truth table in detail. [6]

Or

2. (a) (i) Perform $(-4)_{10} - (-6)_{10}$ using the 2's complement form.
- (ii) Perform $(-4)_{10} - (-8)_{10}$ using 1's complement form. [6]
- (b) Draw the diagram, timing diagram and write the truth table for twisted ring counter. [6]

P.T.O.

3. (a) Draw the block diagram of OPAMP 741. For an ideal OPAMP give the values of the following parameter : [7]
- (i) CMRR
 - (ii) Slew rate
 - (iii) Bandwidth
 - (iv) PSRR
 - (v) Offset voltage
 - (vi) Output impedance.
- (b) Draw the diagram IC 555 configured in astable mode. Draw necessary waveforms. Give the formula for T_{on} and T_{off} . [6]

Or

4. (a) Explain the application of OPAMP as comparator. Show how the same circuit can be used as ZCD. [6]
- (b) Explain first order low pass filter with neat circuit diagram and frequency response. [7]
5. (a) Draw transformer coupled amplifier and write its advantages, disadvantages and applications. [6]
- (b) Explain DC load line analysis of CE configuration amplifier. [6]

Or

6. (a) Explain the drain characteristics of FET. [6]
- (b) Explain Push Pull amplifier. [6]

7. (a) What is the need of filter circuit ? Explain LC filters. [6]
(b) List the performance parameters of 1-phase bridge rectifier supplying RL load. [7]

Or

8. (a) With the help of circuit diagram and relevant waveforms, explain the operation of a 3-phase bridge rectifier with resistive load. [7]
(b) Draw the circuit diagram and state the expression of the following for a 1-phase half-wave rectifier : [6]
(i) Average output voltage
(ii) RMS output voltage
(iii) Form factor
(iv) Ripple factor.

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1035

**S.E. (Electrical) (First Semester) EXAMINATION, 2015
ELECTRICAL MEASUREMENT AND INSTRUMENTATION
(2012 PATTERN)**

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Assume suitable data if necessary.

(iv) *All* questions are compulsory.

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

(i) Accuracy

(ii) Repeatability

(iii) Reproducibility.

(b) Draw circuit diagram of Maxwell's Inductance capacitance bridge. Derive expression for unknown inductance with usual notations. [6]

Or

2. (a) Explain advantages and disadvantages of PMMC instrument. [6]

(b) Derive general equation for bridge at balance condition. [6]

P.T.O.

3. (a) Explain construction and working of Dynamometer type wattmeter. [6]
- (b) A 230 V, 1 ϕ Energy meter has a constant of 4A passing through it for 6 hours at unity power factor. If the meter disc makes 2208 revolutions during this period what is the meter constant in revolution per kWh. Calculate the power factor of the load if the number of revolution's made by the meter are 1472 when operating at 230 V, 5A for 4 hours. [6]

Or

4. (a) A wattmeter has current coil of 0.1 Ω resistance and pressure coil of 6500 Ω resistance. Calculate the percentage error due to resistance only with each of the two method of connection. When reading the input to an apparatus which takes :
- (i) 12 A at 250 V with unity power factor and
- (ii) 12 A at 250 V with 0.4 power factor. [6]
- (b) Explain electronic energy meter with neat block diagram. [6]
5. (a) Describe how the following measurements can be made with the use of CRO : [6]
- (i) Voltage measurement
- (ii) Current measurement
- (iii) Time period.
- (b) Describe capacitive pressure transducer with neat diagram. [7]

Or

6. (a) Waveform shown in figure is observed on a CRT screen. If the time/div switch is set to $10 \mu\text{S}$ and volt/div switch is set to 200 mV . Determine the frequency and peak to peak amplitude of the signal. [6]

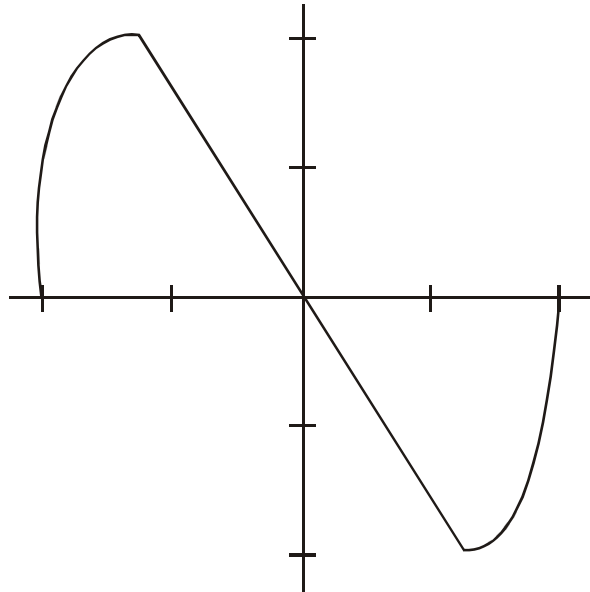


Fig.

- (b) Explain basic requirements of transducer. [7]
7. (a) State types of strain gauges. Explain semiconductor strain gauge. [6]
- (b) Explain inductive method of level measurement. [7]

Or

8. (a) Explain Ultrasonic method of level measurement. [6]
- (b) Explain construction and working of LVDT with neat diagram. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1036

S.E. (Electrical) (Second Semester) EXAMINATION, 2015

POWER SYSTEM—I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Figures to the right indicate full marks.

(iii) Assume suitable data if necessary and state the same clearly.

(iv) Neat diagrams must be drawn wherever necessary.

(v) Use of electronic pocket calculator is allowed.

1. (a) What is meant by tariff ? What are the objectives of tariff ? [6]
- (b) Discuss the necessity of excitation systems for alternators. Explain any *one* type of excitation system used for alternator in brief. [6]

Or

2. (a) An yearly load duration curve of a gas turbine power plant is straight line from 48,000 kW to 5000 kW. The load is taken by power plant which consists of two units of 20,000 kW each and one unit of 10,000 kW. Determine : [6]
- (1) Load factor
- (2) Capacity factor of plant.

P.T.O.

- (b) Name the different types of insulators used in power system ? Explain the applications of each type of insulators. [6]
3. (a) Derive the expression for sag for unequal supports ? What is the effect of ice and wind loading ? [8]
- (b) In a three-phase transmission line, three conductors are spaced at equal distance from each other i.e. 2.5 m. The diameter of each conductor is 1.3 cm. Find inductance per kilometer length of line. [5]

Or

4. (a) Derive the expression for internal and external flux linkages of conductor carrying current 'I' ampere and derive expression for inductance of single-phase line. [7]
- (b) Give the classification of underground cables. [6]
5. (a) Derive an expression for line to neutral capacitance of three-phase overhead transmission line with unsymmetrical spacing of conductors. Assume complete transposition. [8]
- (b) A single-phase transmission line has two parallel conductors 3.5 m apart from each other. The radius of each conductor is 1.5 cm. Calculate capacitance of line per kilometer. Assume $\epsilon_r = 1$. [4]

Or

6. (a) Derive the equation for capacitance per kilometer of a single phase overheads transmission line having distance 'D' between conductors and 'r' is radius of each conductors. [6]
- (b) Explain the methods of images in determining the effect of earth on capacitance calculation for overhead transmission lines. [6]
7. (a) Determine generalized circuit constants of short transmission line. State its characteristics. [6]
- (b) A medium single-phase transmission line 100 km long has the following constants : [7]
- R/km = 0.25 Ω
- Reactance 1 km = 0.8 Ω
- Susceptance 1 km = 14×10^{-6} (siemens)
- Receiving end voltage = 66,000 V
- Assume that total capacitance of line is located at receiving end alone. Determine :
- (1) Sending end current
 - (2) Sending end voltage
 - (3) Regulation
 - (4) Supply power factor.
- The line is delivering 15,000 kW at 0.8 p.f. (lagg).

Or

8. (a) Express the relationship for sending end voltage and current in terms of receiving end voltage and current for medium length transmission line with nominal 'T' method of representation. Draw neat circuit diagram and phasor diagram. [7]
- (b) A three-phase transmission line, 132 kV is connected to a 50 MW load at p.f. of 0.85 (lagg). The line constants of 80 km long line are $z = 96 \angle 78 \Omega$ and $Y = 0.001 \angle 90$ (S) Using nominal 'T' circuit representation Calculate A, B, C and D constants of transmission line. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1037

S.E. (Electrical) (Second Semester) EXAMINATION, 2015

ELECTRICAL MACHINES-I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer *four* questions.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) With neat circuit diagrams, explain open circuit and short circuit tests on a single phase transformer for finding the voltage regulation and efficiency. [6]

(b) With neat circuit diagram, explain the V-V connection of transformers. State its merits and demerits. [6]

P.T.O.

Or

2. (a) Compare the two winding transformer with autotransformer. [3]
- (b) Comment on various losses taking place in transformer. [3]
- (c) With neat circuit diagram, explain the Scott connection of transformers to convert 3 phase supply into 2 phase supply. [6]
3. (a) Derive torque equation and speed equation in case of D.C. motor. [6]
- (b) Explain the commutation process and its types in detail. [7]

Or

4. (a) Explain the role of commutator in D.C. motor along with the diagram. [7]
- (b) Explain any *two* methods of speed control of d.c. shunt motor. [6]
5. (a) Explain the production of rotating mmf by 3-phase balanced voltage fed to a symmetrical 3-phase winding. [6]
- (b) Explain power flow stages in case of three phase induction motor along with the diagram. [6]

Or

6. (a) A 14.71 kW, 4 pole, 50 Hz, 3-phase induction motor has friction and windage losses of 2% of the output power. The full load slip is 4%. Calculate rotor copper loss and output torque. [6]
- (b) Derive the condition for maximum starting torque in case of induction motor. [6]
7. (a) Draw the circuit diagram for conducting (i) No load test and (ii) Blocked rotor test on three phase induction motor. How are its equivalent circuit parameters computed using these tests ? [8]
- (b) Enlist various types of starters for three phase induction motor. With neat sketch, explain stator resistance starter along with its merits and demerits. [5]

Or

8. (a) Write step by step procedure to draw circle diagram from No Load test and blocked rotor test on three phase induction motor. [7]
- (b) Write a short note on soft starter for 3-ph induction motor. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[4757]-1038

S.E. (Electrical Engineering) (Second Semester) EXAMINATION, 2015

NETWORK ANALYSIS

(2012 PATTERN)

Time : Three Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of calculator is allowed.

(v) Assume suitable data if necessary.

1. (a) Simplify the circuit shown in Fig (1) and. Find V_1 : [6]

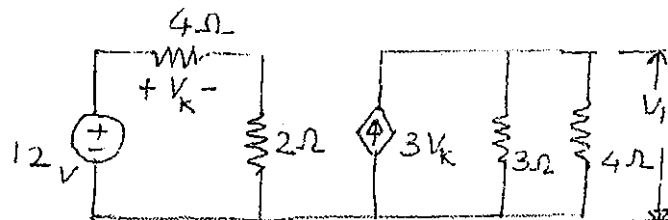


Fig (1)

P.T.O.

- (b) Draw the dotted diagram and Find equivalent reactance as shown in Fig. (2) : [7]

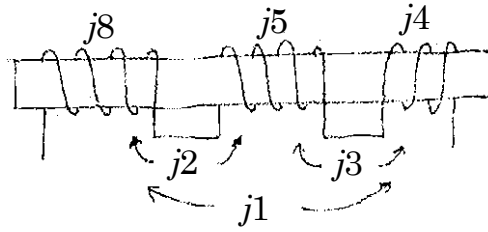


Fig. (2)

Or

2. (a) Find current through $5\ \Omega$ using Norton's theorem as shown in Fig. (3) : [7]

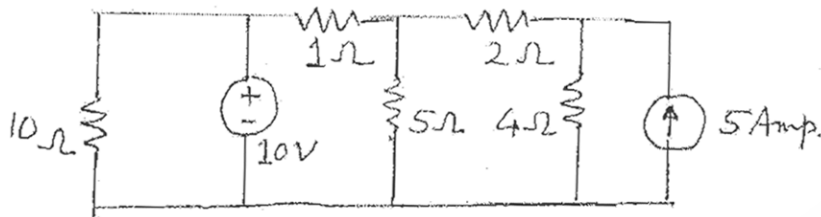


Fig (3)

- (b) Find current through $15\ \Omega$ by using Millman's theorem. [6]

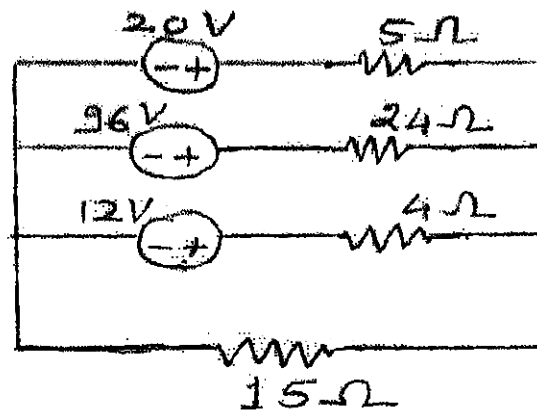


Fig. (4)

3. (a) For the circuit shown in Fig. (5), find $i(t)$ using classical theory. [7]

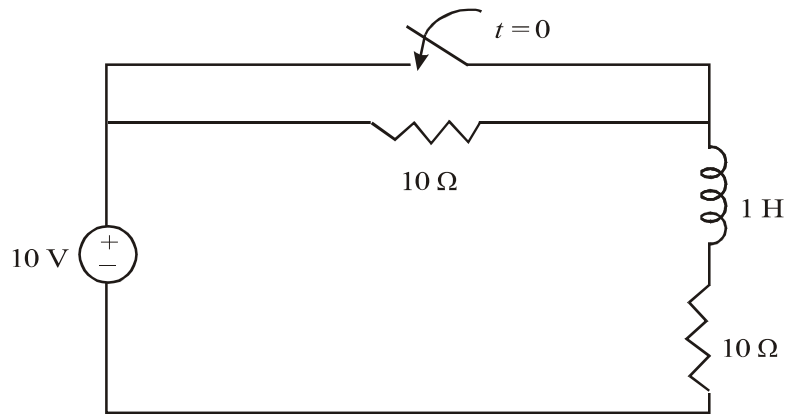


Fig. (5)

- (b) Find current $i(t)$ by using Laplace transform. The switch is closed at time $t = 0$. [6]

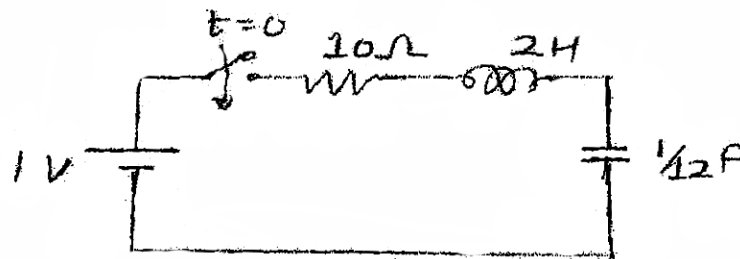


Fig. (6)

Or

4. (a) In the circuit shown in Fig. (7), the switch is moved to position 2 at time $t = 0$, find the expression of current for time $t > 0$ using Laplace transform : [7]

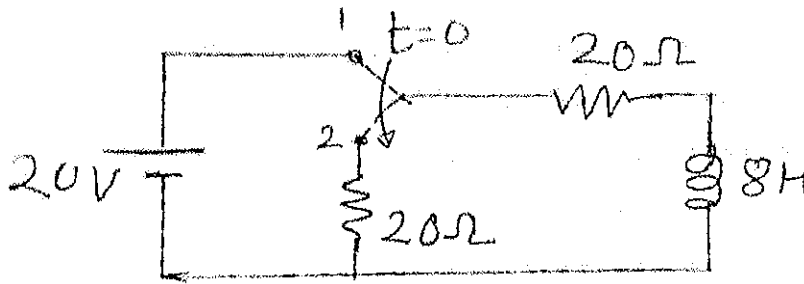


Fig. (7)

- (b) Find $i(t)$, by using convolution integral : [6]

$$F(s) = \frac{1}{s^2 + 9s + 18}$$

5. (a) For the circuit as shown in Fig. (8), find transmission parameters : [6]

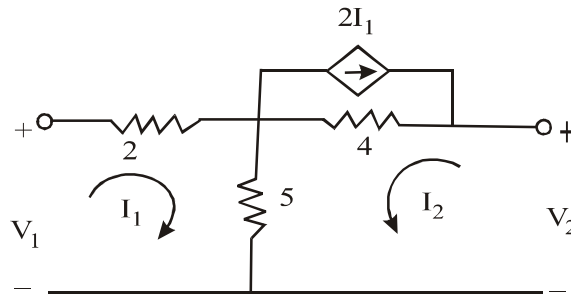


Fig. (8)

- (b) For the network shown in Fig. (9) find hybrid parameters : [6]

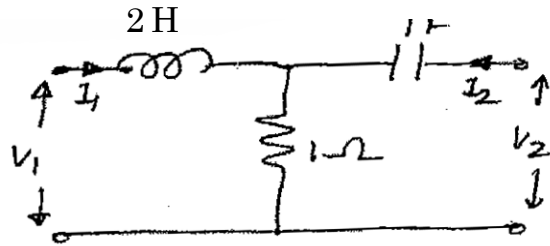


Fig. (9)

Or

6. (a) In the circuit shown in Fig. (10) find transmission parameters : [6]

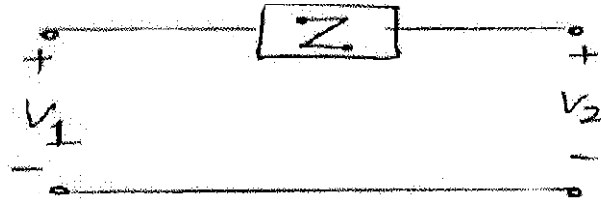


Fig. (10)

- (b) Develop the relationship between transmission parameter and hybrid parameters. [6]
7. (a) For the network shown in Fig. (11), find the voltage transfer function : [6]

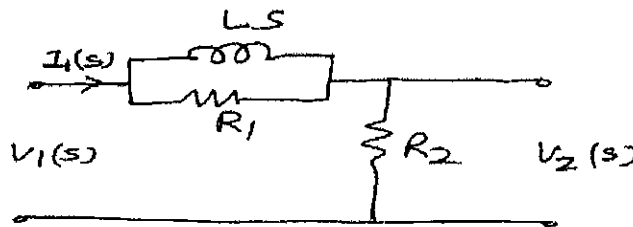


Fig. (11)

- (b) Develop the relation of anti-resonant frequency in parallel resonance circuit, also develop the relation of impedance offered by parallel resonant circuit. [6]

Or

8. (a) Find driving point impedance of given network : [6]

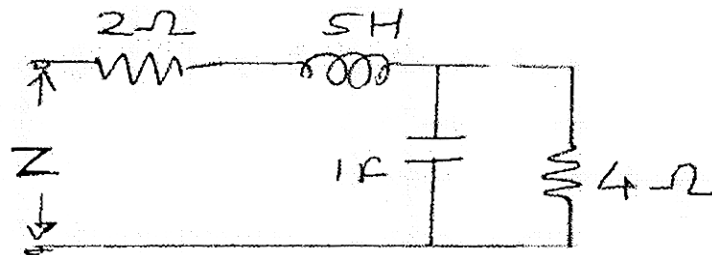


Fig. (12)

- (b) A high pass filter is constructed from two capacitors 1 micro farad each and 15 millihenry inductance, find design resistance and cut-off frequency. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1039

S.E. (Electrical) (Second Semester) EXAMINATION, 2015

NUMERICAL METHODS AND COMPUTER PROGRAMMING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6,
Q. 7 or Q. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) Give the syntax of 'for loop', 'while loop' and 'do-while loop' in C language. [6]

(b) State Descartes' Rule of sign and apply it to : [7]

$$x^4 + 2x^3 + 10x - 20 = 0.$$

P.T.O.

Or

2. (a) What are different data types in 'C' language ? Give their ranges. [6]
- (b) Explain Birge Vieta method to find the root of polynomial equations. [7]
3. (a) Explain Newton-Raphson method to find the root of equation with its pitfalls. [6]
- (b) Use Lagrange's interpolation to find polynomial equation to fit the following data points : [6]

(0, 2), (1, 3), (2, 12) and (5, 147)

Hence find $y(3)$.

Or

4. (a) Derive formula of Newton's Backward interpolation for equally spaced data points. [6]
- (b) Find the root of $x^2 - 49 = 0$ using bisection method at the end of sixth iteration in interval [5, 8]. [6]
5. (a) Explain Gauss-Jordan method to solve the system of linear simultaneous equations. [6]

- (b) Solve the following system of equations using Gauss Elimination method : [6]

$$\begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 4 \end{bmatrix}.$$

Or

6. (a) Explain Gauss-Jacobi method to solve the system of linear simultaneous equations. [6]
- (b) Solve the following system of equations using Gauss-Seidel method. Initial values $[0, 0, 0]^T$. Show 3 iterations : [6]

$$\begin{bmatrix} 8 & -4 & 0 \\ -4 & 8 & -4 \\ 0 & -4 & 8 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 0 \\ 4 \end{bmatrix}.$$

7. (a) Explain Modified Euler's method to solve ordinary differential equations. [6]
- (b) Solve : [7]

$$\int_1^2 \int_1^2 (x^2 + y^2) dx dy$$

using Trapezoidal rule. Take $h = k = \frac{1}{2}$.

Or

8. (a) Derive formula for Simpson's (3/8)th rule using Newton-Cote's formula for numerical integration. [6]

(b) Solve :

$$\frac{dy}{dx} = x + y$$

for $x = 0.2, 0.4$ by using Taylor series method.

Given $x_0 = 0, y_0 = 1, h = 0.2$. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1040

S.E. (Electrical) (Second Semester) EXAMINATION, 2015

**FUNDAMENTALS OF MICROPROCESSOR AND
MICROCONTROLLER**

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Explain the function of pins of 8085 : [4]

(i) HOLD

(ii) INTR

(b) Explain the stack and stack pointer in 8085 microprocessor. [4]

(c) Draw the timing diagram of I/O Read Machine Cycle. [4]

P.T.O.

Or

2. (a) State the condition of each flag after execution of instruction in 8085 microprocessor : [4]
- (i) XRI 05H
- (ii) MVJ A, 05H
- (b) Write down assembly language program for 8085 microprocessor to add two 8-bit numbers stored in memory location 4050 H and 4051 H. Store the result in 5000 H and 5001 H memory location. [4]
- (c) Write down any *four* features of Intel 8085. [4]
3. (a) List the operating modes of 8255. Draw control word format of I/O mode and BSR mode. [6]
- (b) Draw PSW and explain various Flags in 8051 microcontroller. [7]

Or

4. (a) Write an assembly language program to generate triangular waveform using DAC interfaced with 8051 microcontroller. [7]
- (b) Draw the format of TMOD and TCON registers. [6]

5. (a) List down the various addressing modes used in instruction set of 8051. Give *one* example of each. [6]
- (b) Explain steps to transfer data serially in 8051 and importance of TI flag. [6]

Or

6. (a) Explain the following instructions : [6]
- (i) SWAP A
- (ii) DJNZ R0, Label
- (iii) PUSH 00H
- (b) What will be the contents of the accumulator and register R0 after execution of the following code : [6]

MOV A, # 88 H

ADD A, # 06H

MOV R0, A

DA A

HERE : SJMP HERE

7. (a) Explain energy measurement using 8085 with suitable block diagram. [6]
- (b) Draw and explain stepper motor control using 8051. [7]

Or

8. (a) Explain power factor measurement using 8085 with block diagram. [6]
- (b) Explain with interfacing diagram, temperature measurement using 8051. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—7

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[4757]-1041

S.E. (Electronics/E & TC) (Second Semester)

EXAMINATION, 2015

ENGINEERING MATHEMATICS-III

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) Solve any two : [8]

$$(i) \frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^{-2x} \sin 2x$$

P.T.O.

(ii) $(D^2 - 4D + 4)y = e^{2x}x^{-2}$ (by variation of parameters)

(iii) $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = x + \frac{1}{x}$

(b) Solve : [4]

$$f(k) - 4f(k - 2) = \left(\frac{1}{2}\right)^k, k \geq 0$$

Or

2. (a) The charge Q on the plate of condenser satisfies the differential equation : [4]

$$\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E}{L} \sin \frac{t}{\sqrt{LC}}$$

Assuming $\frac{1}{LC} = \omega^2$ find the charge Q at any time ' t '.

(b) Find the Fourier sine integral representation for the function : [4]

$$f(x) = \begin{cases} \frac{\pi}{2} & ; 0 < x < \pi \\ 0 & ; x > \pi \end{cases}$$

(c) Attempt any one : [4]

(i) Find z -transform of $f(k) = ke^{-3k}; k \geq 0$

(ii) Find :

$$z^{-1} \left[\frac{z^2}{z^2 + 1} \right]$$

3. (a) Given :

$$\frac{dy}{dx} = 3x + \frac{y}{2}; \quad y(0) = 1 \quad h = 0.1$$

Evaluate $y(0.1)$ by using Runge-Kutta method of fourth order. [4]

(b) The distance travelled by a point p in XY – plane in a mechanism is given by y in the following table. Estimate distance travelled by p when $x = 4.5$.

x	y
1	14
2	30
3	62
4	116
5	198

[4]

- (c) Find the directional derivative of function $\phi = xy^2 + yz^3$ at $(1, -1, 1)$ along the direction normal to the surface $2x^2 + y^2 + 2z^2 = 9$ at $(1, 2, 1)$. [4]

Or

4. (a) Prove that (any one) : [4]

$$(i) \quad \bar{a} \cdot \nabla \left[\bar{b} \cdot \nabla \frac{1}{r} \right] = - \frac{(\bar{a} \cdot \bar{b})}{r^3} + \frac{3(\bar{b} \cdot \bar{r})(\bar{a} \cdot \bar{r})}{r^5}$$

$$(ii) \quad \nabla \cdot \left[r \nabla \frac{1}{r^5} \right] = \frac{15}{r^6}.$$

- (b) Use Trapezoidal Rule to estimate the value of :

$$\int_0^2 \frac{x}{\sqrt{2+x^2}} dx$$

by taking $h = 0.5$. [4]

- (c) Show that the vector field $f(r)\bar{r}$ is always irrotational and then determine $F(r)$ such that vector field $f(r)\bar{r}$ is solenoidal. [4]

5. (a) Evaluate :

$$\int_C \left[(2x^2y + y + z^2)i + 2(1 + yz^3)j + (2z + 3y^2z^2)k \right] \cdot d\bar{r}$$

along the curve $C : y^2 + z^2 = a^2 \quad x = 0$ [4]

(b) Find

$$\iint_S \bar{F} \cdot \hat{n} \, ds.$$

where s is the sphere $x^2 + y^2 + z^2 = 9$ and

$$\bar{F} = (4x + 3yz^2)\hat{i} - (x^2z^2 + y)\hat{j} + (y^3 + 2z)\hat{k} \quad [4]$$

(c) Evaluate :

$$\iint_S \nabla \times \bar{F} \cdot \hat{n} \, ds$$

for the surface of the paraboloid $z = 4 - x^2 - y^2$; ($z \geq 0$) and

$$\bar{F} = y^2\hat{i} + z\hat{j} + xy\hat{k}. \quad [5]$$

Or

6. (a) Find the total work done in moving a particle is a force field

$$\bar{F} = 3xy\hat{i} - 5z\hat{j} + 10x\hat{k} \quad \text{along the curve } x = t^2 + 1, \\ y = 2t^2, z = t^3 \text{ from } t = 1 \text{ and } t = 2. \quad [5]$$

(b) Using divergence theorem to evaluate the surface integral

$$\iint_S \bar{F} \cdot \hat{n} \, ds \quad \text{where } \bar{F} = \sin x\hat{i} + (2 - \cos x)\hat{j} \text{ and } S \text{ is the total}$$

surface area of the parallelepiped bounded by $x = 0$, $x = 3$,

$$y = 0, y = 2, z = 0 \text{ and } z = 1. \quad [4]$$

(c) Equations of electromagnetic wave theory are given by :

$$(i) \quad \nabla \cdot \bar{D} = \rho$$

$$(ii) \quad \nabla \cdot \bar{H} = 0$$

$$(iii) \quad \nabla \times \bar{D} = \frac{-1}{C} \frac{\partial \bar{H}}{\partial t} \text{ and}$$

$$(iv) \quad \nabla \times \bar{H} = \frac{1}{C} \left[\frac{\partial \bar{D}}{\partial t} + \rho \bar{v} \right]$$

Prove that :

$$\nabla^2 \bar{D} - \frac{1}{C} \frac{\partial^2 \bar{D}}{\partial t^2} = \nabla \rho + \frac{1}{C^2} \frac{\partial}{\partial t} (\rho \bar{v}) \quad [4]$$

7. (a) Find the analytic function $f(z) = u + iv$ if $2u + v = e^x (\cos y - \sin y)$. [5]

(b) Evaluate :

$$\int_C \frac{e^{2z}}{(z-1)(z-2)} dz,$$

where C is circle $|z| = 3$. [4]

(c) Find the bilinear transformation which maps the points $z = -1, 0, 1$ of z -plane into the points $w = 0, i, 3i$ of w -plane. [4]

Or

8. (a) Find the analytic function $f(z) = u + iv$

where

$$u = r^3 \cos 3\theta + r \sin \theta. \quad [4]$$

(b) Evaluate :

$$\int_C \frac{1 - 2z}{z(z - 1)(z - 2)} dz$$

where

$$C \text{ is } |z| = 1.5. \quad [4]$$

(c) Find the map of the straight line $y = 2x$ under the transformation : [5]

$$w = \frac{z - 1}{z + 1}$$

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

Seat No.	
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[4757]-1042

S.E. (E & TC/Electronics)
(First Semester) EXAMINATION, 2015
SIGNALS AND SYSTEMS
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Attempt *four* questions as Question Nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of calculator is allowed.

(v) Assume suitable data if necessary.

1. (a) Perform the following operations on the given signal $x(t)$ which is defined as : [4]

$$x(t) = \begin{cases} -t & , -4 \leq t \leq 0 \\ t & , 0 < t \leq 2 \\ 0 & , \text{elsewhere} \end{cases}$$

(i) Sketch the signal $x(t)$

(ii) Sketch $z(t) = x(-t - 1)$.

P.T.O.

(b) Determine whether the following signals are periodic or not, if periodic find the fundamental period of the signal : [4]

(i) $x(t) = \cos(2t) + \sin(2t)$

(ii) $x[n] = \cos\left(\frac{8\pi n}{15}\right)$.

(c) Determine the step response of the following systems whose impulse response is : [4]

$$h(t) = e^{-5t}u(t).$$

Or

2. (a) Compute the convolution integral by graphical method and sketch the output for [6]

$$x_1(t) = 1, \quad 0 \leq t \leq 2$$

0 otherwise

$$x_2(t) = e^{-2t}u(t).$$

(b) Find even and odd component of

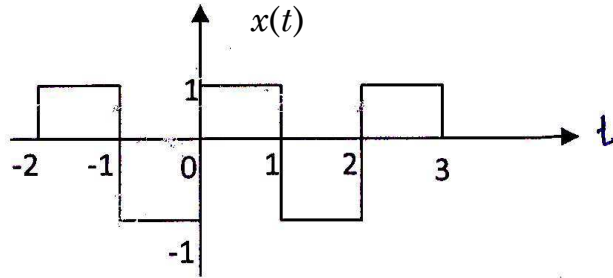
(i) $x(t) = u(t)$

(ii) $x(t) = \text{sgn}(t)$. [4]

(c) Determine the whether following signal is periodic or not, if periodic find the fundamental period of the signal [2]

$$x(t) = \cos^2(2\pi t).$$

3. (a) Find the trigonometric Fourier series for the periodic signal $x(t)$. Sketch the amplitude and phase spectra [6]



- (b) A signal $x(t)$ has Laplace transform

$$X(s) = \frac{s + 1}{s^2 + 4s + 5}$$

Find the Laplace transform of the following signals :

- (i) $y_1(t) = t x(t)$
(ii) $y_2(t) = e^{-t}x(t)$. [6]

Or

4. (a) Find the Fourier transform of $x(t) = \text{rect}\left(\frac{t}{\tau}\right)$ and sketch the magnitude and phase spectrum. [6]

- (b) Find the transfer function of the following : [6]

- (i) An ideal differentiator
(ii) An ideal integrator
(iii) An ideal delay of T second.

5. (a) Find the following for the give signal $x(t)$:

(i) Autocorrelation

(ii) Energy from Autocorrelation

(iii) Energy Spectral Density :

$$x(t) = Ae^{-at}u(t). \quad [6]$$

(b) Determine the cross correlation between two sequences which are given below : [4]

$$x_1(n) = \{1 \ 2 \ 3 \ 4\}$$

$$x_2(n) = \{3 \ 2 \ 1 \ 0\}$$

(c) State and describe any *three* properties of Energy Spectral Density (ESD). [3]

Or

6. (a) Prove that autocorrelation and energy spectral density form Fourier transform pair of each other and verify the same for $x(t) = e^{-2t}u(t)$. [9]

(b) State and explain any *four* properties of Power Spectral Density (PSD). [4]

7. (a) Explain Gaussian probability model with respect to its density and distribution function. [4]

(b) Two cards drawn from a 52 card deck successively without replacing the first : [4]

(i) Given the first one is heart, what is the probability that second is also a heart ?

(ii) What is the probability that both cards will be hearts ?

- (c) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X , which represents the number of heads obtained on any double toss. Draw the mapping of S on to real line. Also find the probabilities of X and plot the C.D.F. [5]

Or

8. (a) A random variable X is $f_x(X) = 5X^2$; $0 \leq x \leq 1$
 $= 0$; elsewhere

Find $E[X]$, $E[3X - 2]$, $E[X^2]$. [6]

- (b) A student arrives late for a class 40% of the time. Class meets five times each week. Find :
- (i) Probability of students being late for at three classes in a given week.
- (ii) Probability of students will not be late at all during a given week. [4]
- (c) State the properties of Probability Density Function (PDF). [3]

Seat No.	
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[4757]-1043

S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2015
ELECTRONIC DEVICES AND CIRCUITS
(2012 PATTERN)

Time : Two Hours**Maximum Marks : 50**

- N.B. :-** (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
(ii) Neat diagrams must be drawn wherever necessary.
(iii) Figures to the right indicate full marks.
(iv) Use of calculator is allowed.
(v) Assume suitable data if necessary.

1. (a) List the sources of instability of collector current. Explain self-bias circuit in detail. [6]
(b) The transistor in the given circuit is connected as a common emitter amplifier. Calculate A_v , R_i , R_o . Refer Fig. 1. Assume $h_{ie} = 1.1 \text{ k}\Omega$, $h_{fe} = 50$, $h_{re} = 2.5 \times 10^{-4}$, $h_{oe} = 1/40 \text{ k}$. [6]

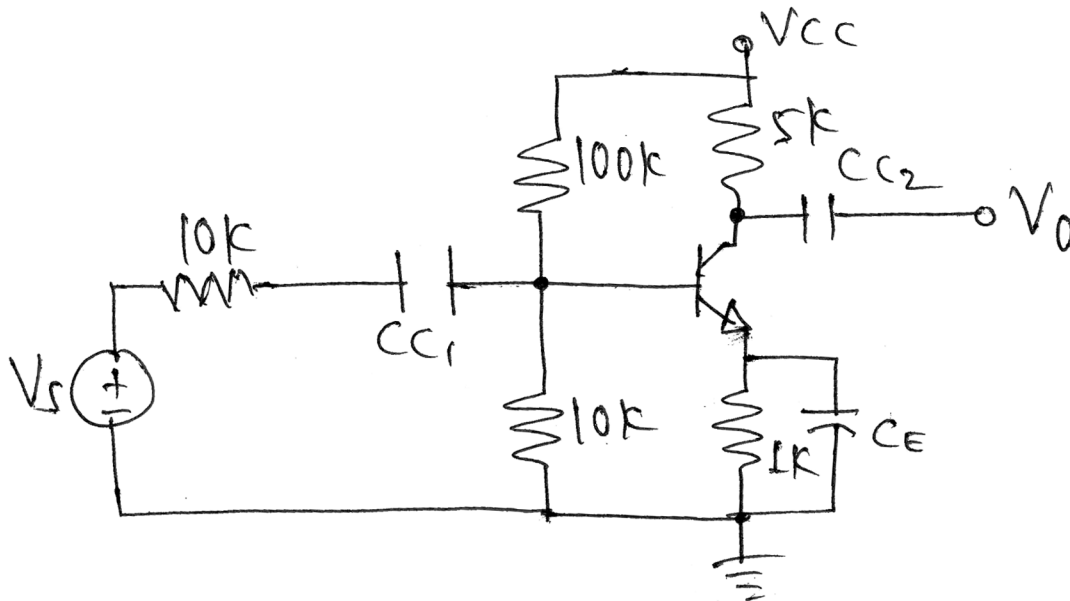


Fig. 1

Or

2. (a) Write a short note on thermal runaway. Explain thermal stability. [6]
(b) Describe the method to increase the input resistance using Darlington connection. [6]
3. (a) Draw and explain hybrid- π common emitter transistor model. [6]
(b) In Colpitts oscillators $L_2 = 5 \mu\text{H}$, $C_1 = C_2 = 0.001 \mu\text{F}$. What will be the frequency of oscillations. If value of inductor is doubled what will be frequency of oscillations ? What should be the value of inductor to get frequency double to that of original frequency ? [6]

Or

4. (a) For three stage RC coupled amplifier overall upper 3 dB frequency is 16 kHz and overall lower 3 dB frequency is 25 Hz. What are the values of F_L and F_H for each stage ? Assume all stages identical. Also calculate bandwidth of each stage. [6]
(b) Draw and explain various topologies of negative feedback. [6]
5. (a) What is cross over distortion ? Describe a method to minimize this distortion. [6]
(b) A class-A amplifier operates from $V_{CC} = 20 \text{ V}$, draws a no signal current of 5 Amp and feeds a load of 40Ω , through a step up transformer of $\frac{N_2}{N_1} = 3.16$. Find :
(i) Whether the amplifier is properly matched for maximum power transfer ?
(ii) Maximum a.c. signal power output.
(iii) Maximum d.c. power input.
(iv) Conversion efficiency at maximum signal input. [7]

Or

6. (a) Draw and explain complementary symmetry class-B power amplifier. [6]
- (b) A power amplifier supplies 3 watt to a load of $6\text{ k}\Omega$. The zero signal d.c. collector current is 55 mA and the collector current with signal is 60 mA. How much is the percentage second harmonic distortion ? [7]
7. (a) Explain the following non-ideal current voltage characteristics of MOSFET :
- (i) Body effect
 - (ii) Temperature effects
 - (iii) Breakdown effects. [6]
- (b) Calculate the drain current and drain to source voltage of a common source circuit with an N-channel EMOSFET shown in Fig. 2. Find the power dissipated in the transistor. Given $V_{TN} = 1\text{ V}$ and $K_n = 0.1\text{ mA/V}^2$. [7]

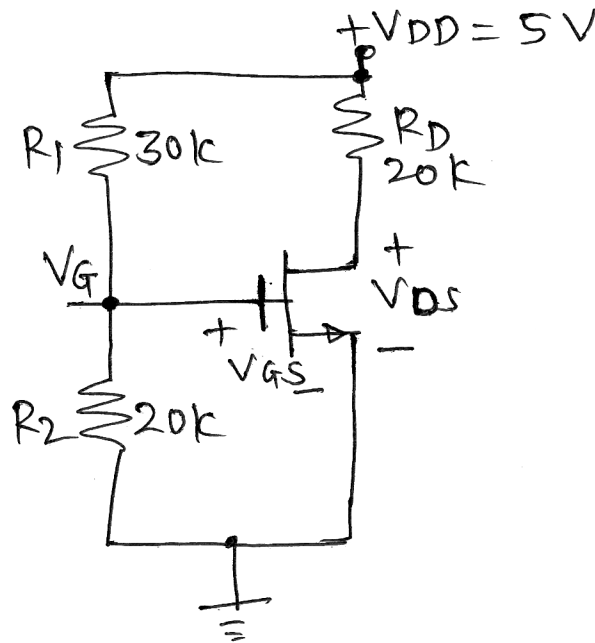


Fig. 2

Or

8. (a) Determine the small signal voltage gain for a CS amplifier shown in Fig. 3. Transistor parameters are $V_{TN} = 2\text{ V}$, $K_n = 0.5\text{ mA/V}^2$ and $\lambda = 0$. Assume the transistor is biased such that $I_{DQ} = 0.4\text{ mA}$. [7]

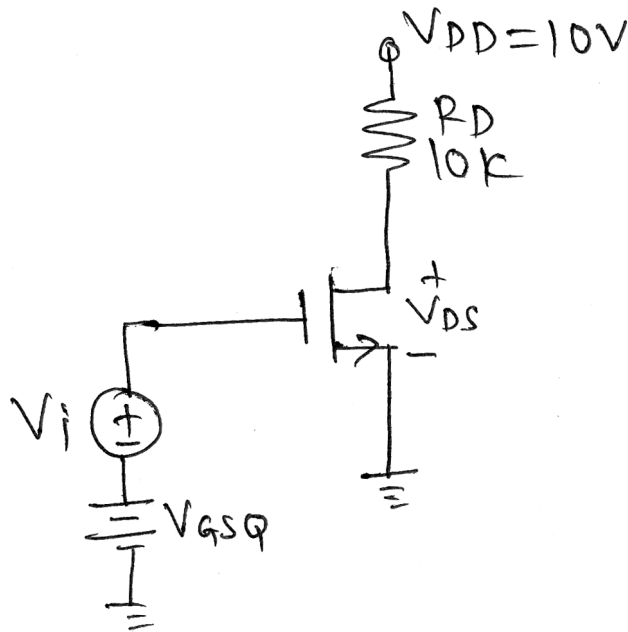


Fig. 3

- (b) Write a short note on Bi-CMOS technology. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

Seat No.	
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[4757]-1044

S.E. (Electronics & E & TC) (First Semester)

EXAMINATION, 2015

NETWORK THEORY

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data, if necessary.

1. (a) Obtain Thevenin and Norton equivalent circuits for the network shown in fig. 1. [6]

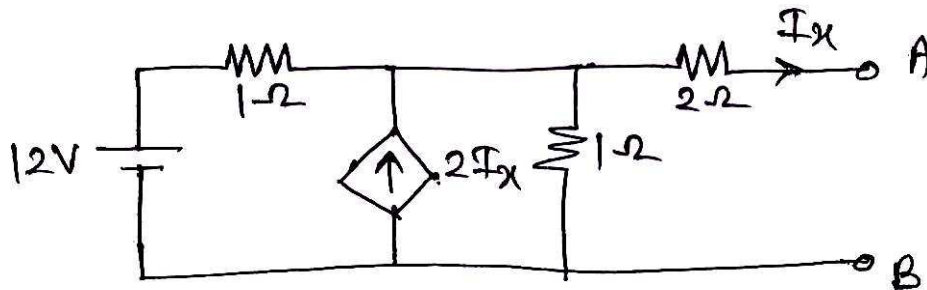


Fig. 1

P.T.O.

- (b) For the graph and tree given in Fig. 2. find complete incidence matrix, tieset matrix and F-cutset matrix : [6]

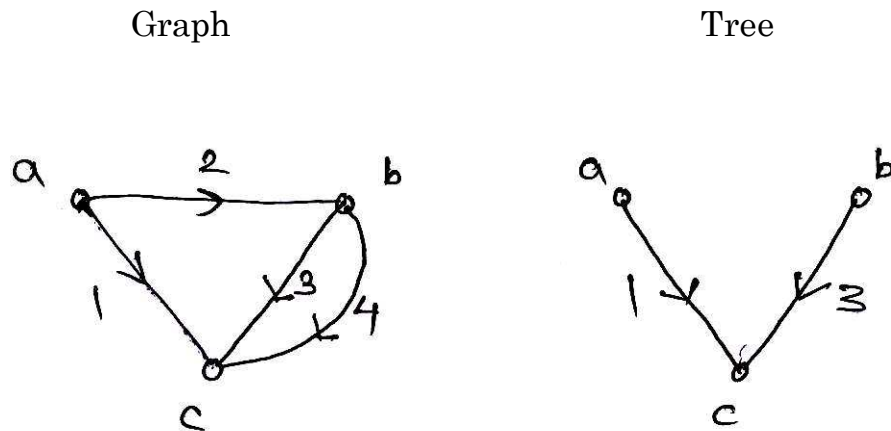


Fig. 2

Or

2. (a) For the network shown in Fig. 3, determine the current I_2 using superposition theorem. [6]

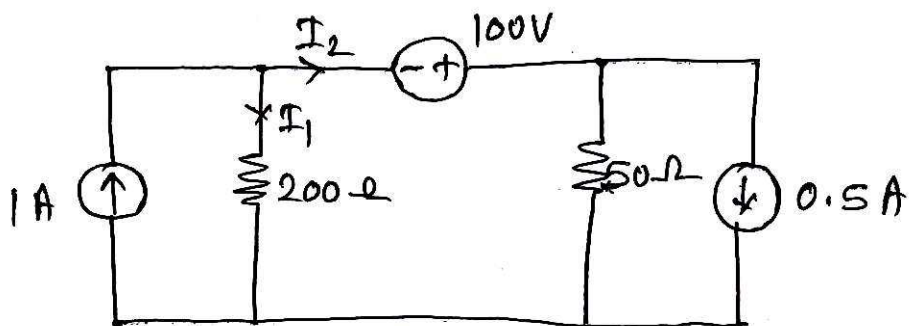


Fig. 3

- (b) For the given incidence matrix, draw oriented graph and determine number of possible trees. [6]

$$A = \begin{bmatrix} -1 & 1 & 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & -1 & 1 & 0 \\ 0 & 0 & -1 & 1 & 0 & 1 \end{bmatrix}$$

3. (a) Find the expression for $V_c(t)$ in the network shown in Fig. 4. [6]

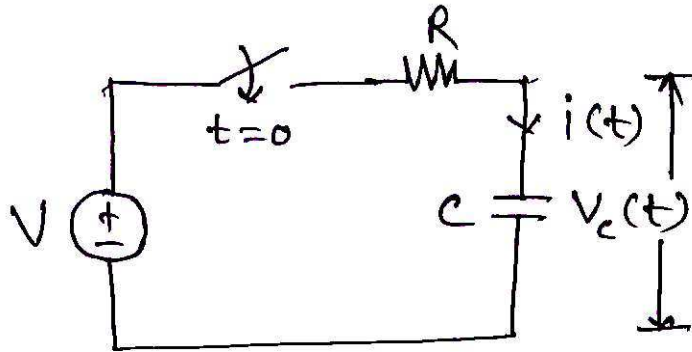


Fig. 4

- (b) A series resonant circuit consists of $R = 10 \Omega$, $L = 100 \text{ mH}$ and $C = 10 \text{ nF}$. Find resonant frequency ω_r , F_r , quality factor Q_r , at resonant frequency, bandwidth. Also find current flowing through circuit at resonance if the applied voltage is 100 V. [6]

Or

4. (a) For the network shown in Fig. 5, obtain the expression for $i_L(t)$. [6]

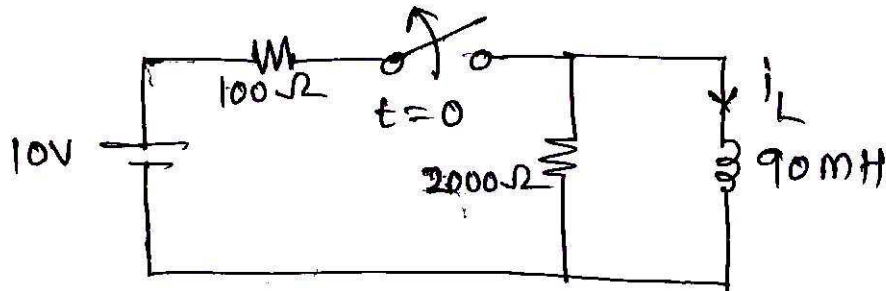


Fig. 5

- (b) A parallel resonant circuit has a coil of $100 \mu\text{H}$ with Q factor of 100 and is resonated at 1 MHz. Find : [6]
- (i) Capacitance
 - (ii) Resistance of coil
 - (iii) Bandwidth
 - (iv) Impedance at parallel resonance
5. (a) A Pi-section constant K filter consists of series arm inductance of 20 mH and two shunt arm capacitors of $0.1 \mu\text{F}$ each. Calculate cut-off frequency, attenuation at 1.5 kHz. Also find nominal impedance Z_π at $f = 0$ and $f = f_c$. [7]

- (b) For a T-section symmetrical network derive the expression for Z_{oc} , Z_{sc} and characteristic impedance Z_o . [6]

Or

6. (a) For the system with 500Ω resistance design T and Pi attenuators to have 100 dB attenuation. Also draw T and Pi attenuators showing the designed component values. [7]
- (b) Draw the T section and Pi section constant K Band pass filter circuits and write equations for components in series arm and shunt arm. [6]
7. (a) Explain different network functions for one port and two port networks. [7]
- (b) Determine Z parameters for the network shown in Fig. 6. [6]

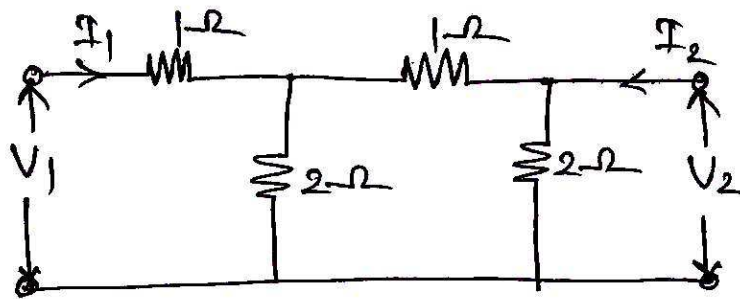


Fig. 6

Or

8. (a) Determine the impedance function $Z(s)$ for the network shown Fig. 7. Also draw its pole zero plot. [7]

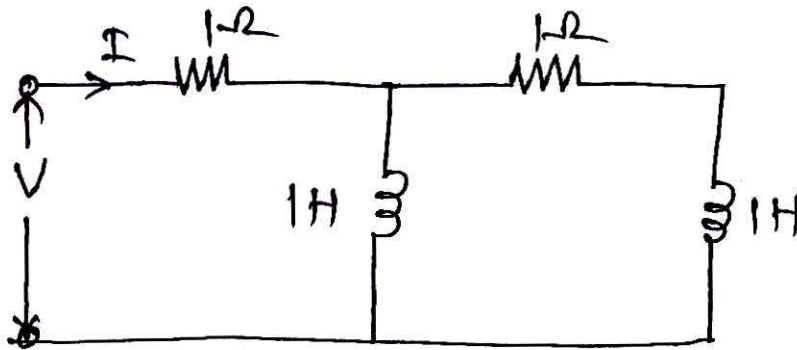


Fig. 7

- (b) Determine Y parameters of the network shown in Fig. 8. [6]

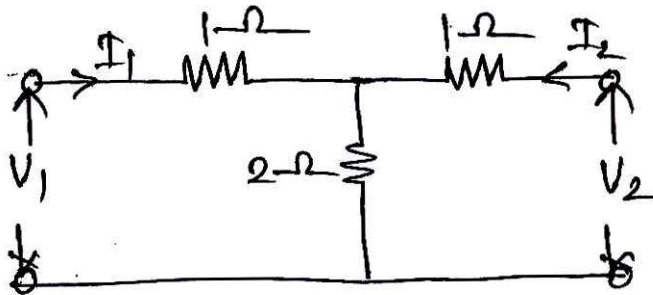


Fig. 8

Total No. of Questions—8]

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[4757]-1045

S.E. (E&TC/Electronics) (First Semester) EXAMINATION, 2015
DATA STRUCTURE AND ALGORITHM
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Assume suitable data if necessary.

1. (a) What do you mean by recursive function ? Explain with example. [6]

(b) Write a C function for insertion sort to sort integer numbers. [6]

Or

2. (a) Explain parameter passing by value and passing parameter by reference with suitable example. [6]

(b) What is pointer ? What are the advantages of using pointer ? Explain pointer declaration and its initialization with an example. [6]

3. (a) What is singly linked list ? Write C function for inserting a node at a given location into a Singly Linked List. [6]

P.T.O.

(b) Evaluate the following postfix expression using stack

$$623 + - 382 / + * 2 \wedge.$$

Note : \wedge stands for power and all operands are single digit. [7]

Or

4. (a) Write short notes on :

(i) Circular Linked list and

(ii) Doubly linked list. [6]

(b) What is priority queue ? Explain its implementation using any *one* method. [7]

5. (a) What is Binary Search Tree (BST) ? Write C functions for :

(i) Finding the smallest number in BST

(ii) Recursive inorder traversal of BST. [7]

(b) What is AVL Tree ? Define balance factor. Explain RR rotation with an example. [5]

Or

6. (a) What is Binary Search Tree (BST) ? Construct a BST for the following numbers :

27, 42, 43, 17, 39, 31, 10, 9, 19, 54, 33, 48.

Show all the steps. Write its preorder traversal. [8]

(b) Explain threaded binary tree with an example. What is its advantage ? [4]

7. (a) Write C function to implement Depth First Search traversal of a graph implemented using adjacency matrix. [6]
- (b) What do you mean by indegree and outdegree of a vertex in a graph ? Write a C function to find indegree and outdegree of vertex in a graph implemented using adjacency matrix. [7]

Or

8. (a) Define the term Graph. With the help of suitable example give adjacency matrix representation and adjacency list representation of a graph. [7]
- (b) What do you mean by spanning tree of a graph ? Find the minimal spanning tree of the following graph using Kruskal's algorithm. (Refer Fig. 1) [6]

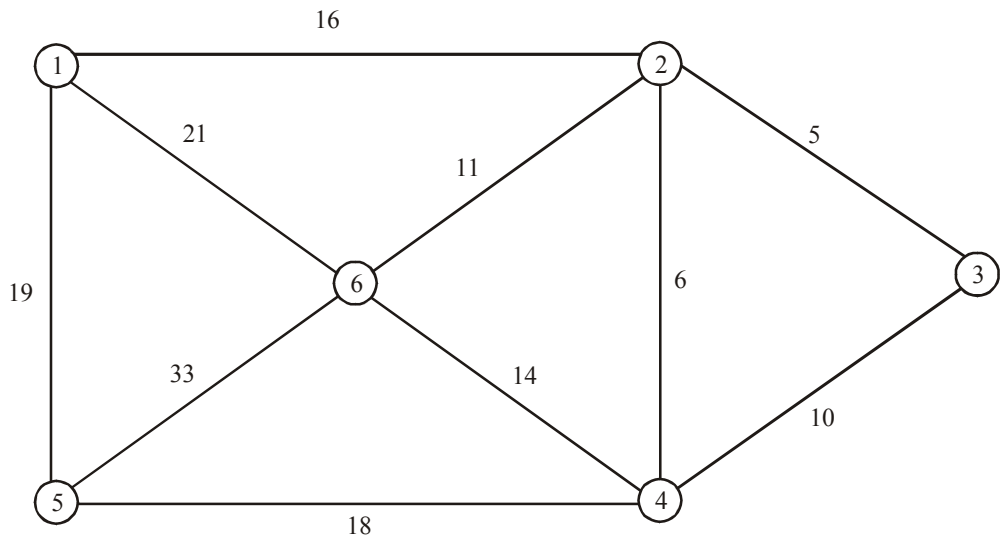


Fig. 1

Total No. of Questions—8]

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[4757]-1046

S.E. (E&TC/Electronics Engineering) (Second Semester)

EXAMINATION, 2015

INTEGRATED CIRCUITS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Use of calculator is allowed.

(iv) Assume suitable data if necessary.

1. (a) Draw the block diagram of op-amp and explain the function of each block in detail. [6]
- (b) Compare different types of op-amp technologies. [3]
- (c) Explain the effect of temperature on : [3]
 - (i) Input Bias Current
 - (ii) Input Offset Voltage
 - (iii) Input Resistance.

P.T.O.

Or

2. (a) Find the Q-point V_C and I_B for dual input balanced output differential amplifier when, $R_E = R_C = 65 \text{ k}\Omega$. [6]
Assume $I_E = I_C$, $\beta = 100$ for both transistors Q_1 and Q_2 ; $V_S = \pm 12 \text{ V}$.
- (b) What is the need of frequency compensation ? Explain any *one* method of frequency compensation. [6]
3. (a) Design a lossy integrator with square wave input of $2 V_{p-p}$ and 5 kHz frequency. Draw input and output waveforms. [6]
- (b) Explain with a neat circuit diagram working of symmetric Schmitt trigger using op-amp. Also derive the equation for the trigger points. [6]

Or

4. (a) Design an adder using op-amp to get output expression as : [6]
$$V_o = - (2V_1 + 3V_2 + 5V_3)$$
Where V_1 , V_2 and V_3 are inputs.
- (b) Draw and explain square wave generator using op-amp. [6]
5. (a) With a neat circuit diagram, explain voltage to frequency converter. [5]
- (b) Write a short note on Binary weighted Digital to Analog Converter (DAC). [5]

- (c) What output voltage would be produced by a D/A converter whose output range is 0 to 10 V and input binary number is : [3]
- (i) 10 (for a 2-bit DAC converter)
- (ii) 0110 (for a 4-bit DAC)
- (iii) 10111100 (for a 8-bit DAC).

Or

6. (a) Write a short note on Flash type Analog to Digital Converter. [5]
- (b) What are the different types of V to I converter. Explain any *one*. [5]
- (c) List various specifications of ADC. [3]
7. (a) With the help of neat block diagram explain operation of PLL. [5]
- (b) What is the need of current boosting circuit ? Explain with the help of any *one* circuit. [5]
- (c) Draw block diagram of frequency multiplier. Draw input-output waveforms. [3]

Or

8. (a) For PLL circuit shown in Fig. 1, calculate the following : [6]
- (i) Free running frequency
 - (ii) Lock range
 - (iii) Capture range.

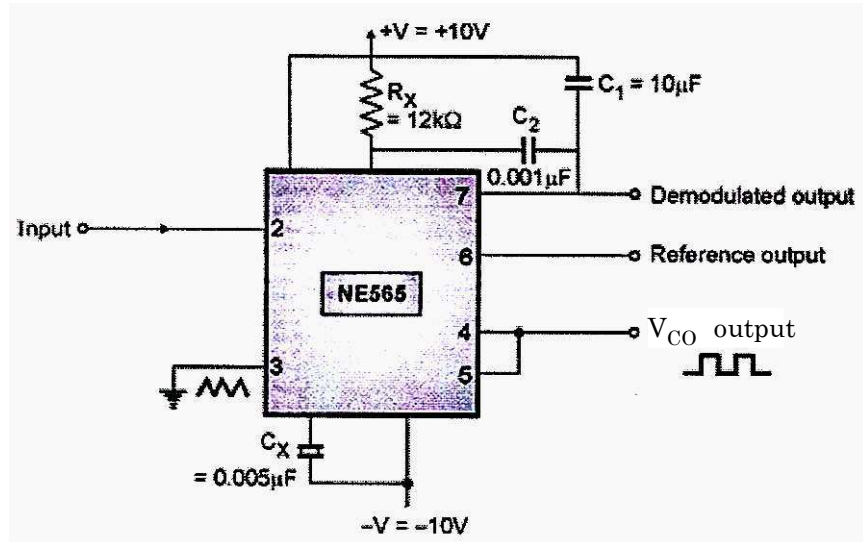


Fig. 1

- (b) Write a short note on practical voltage regulator using LM317. [5]
- (c) Explain the following terms : [2]
 - (i) Load Regulation
 - (ii) Line Regulation.

Total No. of Questions—8]

[Total No. of Printed Pages—4+1

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[4757]-1047

S.E. (E & TC Electronics) (Second Semester)

EXAMINATION, 2015

CONTROL SYSTEMS

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) Give the various terminology of electrical system and its analogous quantities based on force-current analogy. [6]

P.T.O.

(b) Write the differential equations of system shown in Fig. 1.

Also find $\frac{X_1(s)}{F(s)}$ [6]

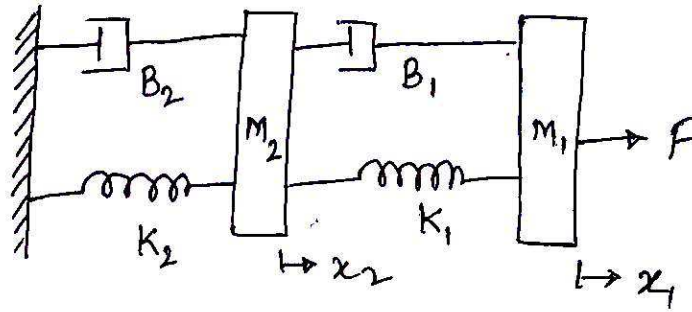


Fig. 1

Or

2. (a) Obtain transfer function of the system shown in Fig. 2 : [6]

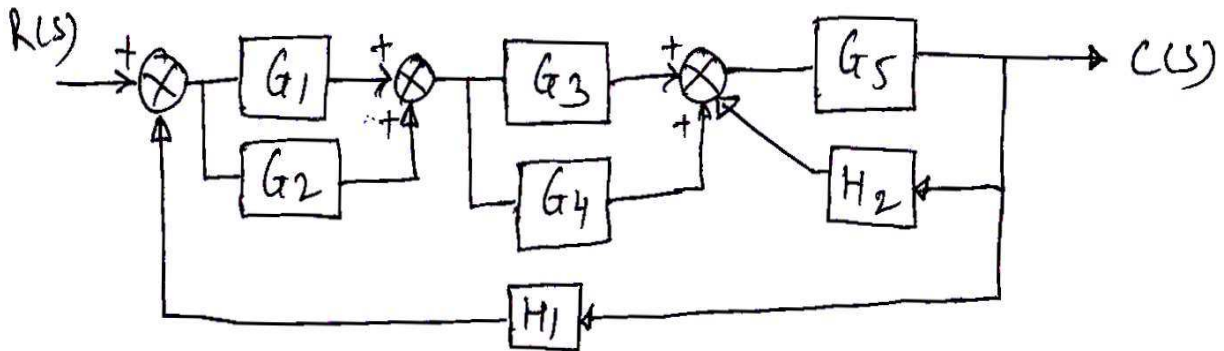


Fig. 2

(b) The open loop transfer function of unity feedback system is

$$G(s) = \frac{k_1}{s(\tau s + 1)} \text{ with } k, \tau > 0 \text{ with a given value of } k_1, \text{ the peak}$$

overshoot was found to be 80%. If the overshoot is decreased up to 20% by new gain k_2 , find k_2 in terms of k_1 . [6]

3. (a) Using Routh's criteria, comment on the stability if characteristic equation is : [4]

$$s^5 + 2s^4 + 3s^3 + 8s^2 + s + 1 = 0$$

(b) Draw the Bode plot and obtain gain margin, phase margin, gain crossover frequency and phase crossover frequency if : [8]

$$G(s) \cdot H(s) = \frac{50,000 (s + 10)}{s(s + 1) (s + 500)}$$

Or

4. (a) If

$$G(s) H(s) = \frac{k}{s(s + 1) (s + 10)}$$

sketch the complete Root locus and comment on the stability. [8]

(b) If

$$G(s) H(s) = \frac{1}{s(s + 1)}.$$

Find Resonance peak and Resonance frequency. [4]

5. (a) Obtain transfer function of state model if : [6]

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix}, B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}, C = [1 \quad 0 \quad 0], D = [0]$$

- (b) Find controllability and observability of the state model : [7]

$$A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}, B = \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}, C = [1 \quad 1 \quad 1], D = [0]$$

Or

6. (a) Obtain state transition matrix if : [6]

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -11 & -12 \end{bmatrix} x$$

using Laplace transformation.

- (b) With the help of general equation, explain concept of controllable canonical and observable canonical form of state space. [7]

7. (a) Enlist various terms in PID controller with sketch of output of P, PI, PD and PID controller for step input. [6]

- (b) Find pulse transfer function of Fig. 3. [7]

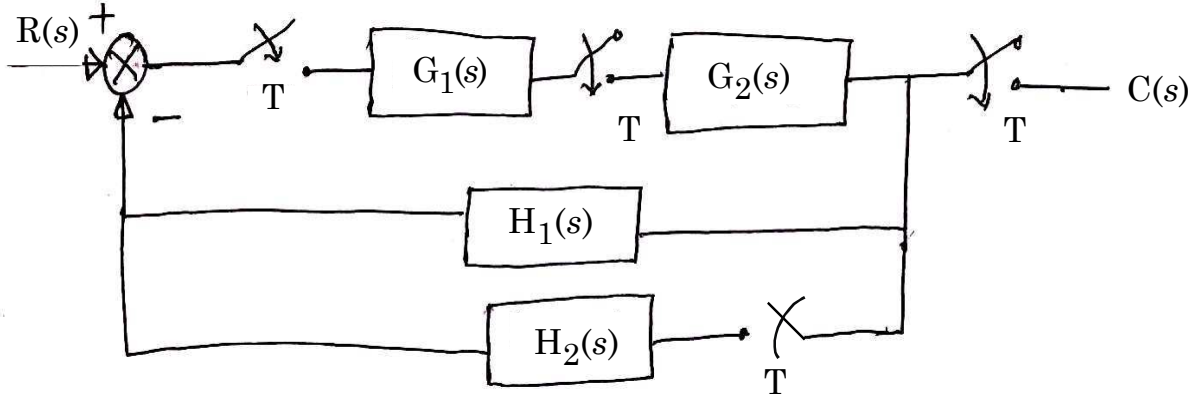


Fig. 3

Or

8. (a) Explain any *one* application of PLC with ladder diagram. [6]
 (b) Obtain unit step response of the system shown in Fig. 4. [7]

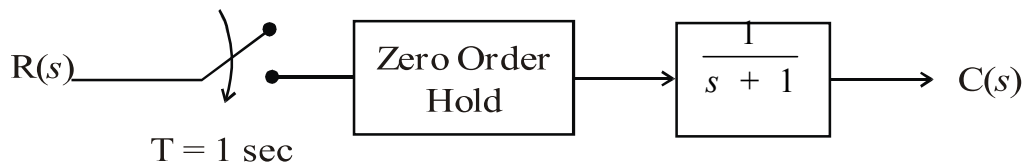


Fig. 4

Total No. of Questions—8]

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[4757]-1048

S.E. (E&TC) (Second Semester) EXAMINATION, 2015

ANALOG COMMUNICATION

(2008 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :-** (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right side indicate full marks.
- (iv) Assume suitable data, if necessary.

1. (a) State and compare different SSB generation methods. [6]
- (b) An angle modulated signal with carrier frequency $\omega_c = 2\pi \times 10^6$ is described by the equation : [6]

$$\Phi_{EM}(t) = 10 \cos (\omega_c t + 0.2 \sin 1000 \pi t)$$

- (i) Find the power of modulated signal
- (ii) Find the modulation index
- (iii) Find the frequency deviation
- (iv) Estimate the bandwidth.

P.T.O.

Or

2. (a) What is carrier communication ? Explain the types of the same. [6]
- (b) Explain with the help of neat block diagram, Armstrong method of FM generation. [6]
3. (a) Explain with waveforms and block diagram FM super-heterodyne receiver. [6]
- (b) Two resistors of $20\text{ k}\Omega$ and $50\text{ k}\Omega$ are at room temperature (290°K). For a bandwidth of 100 kHz , calculate the thermal noise voltage generated by :
- (i) Each resistor
- (ii) Two resistors in series
- (iii) Two resistors in parallel. [6]

Or

4. (a) What is tracking ? Explain different types of tracking in radio receiver. [6]
- (b) State various sources of noise with examples. Explain the following types of noise in detail (any *two*) : [6]
- (i) Thermal noise
- (ii) Low frequency noise
- (iii) Shot noise

5. (a) Derive the expression for signal to noise ratio in DSB-SC system. [7]
- (b) Explain pre-emphasis and de-emphasis in FM. [6]

Or

6. (a) Explain the performance of AM in presence of noise. [7]
- (b) Derive the expression for signal to noise ratio in SSB-SC systems. [6]
7. (a) Explain the types of sampling with waveforms. [6]
- (b) State and prove Sampling theorem with suitable waveforms and mathematical expression. [7]

Or

8. (a) With the help of neat diagram, explain PWM. [7]
- (b) Explain band limited and time limited signal. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1049

S.E. (Electronics/E&TC) (Second Semester)

EXAMINATION, 2015

COMPUTER ORGANIZATION

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data, if necessary.

1. (a) Explain different functional units of Computer Organization. [6]

(b) Give the IEEE standard for floating point numbers for : [6]

(i) single precision number

(ii) double precision number.

P.T.O.

Or

2. (a) Explain single bus structure and multi bus structure. [6]
(b) Represent (-13) multiple in booth's record format and bit pair recorded format. [6]
3. (a) Write down control sequence for the instruction move (R1), R2. [6]
(b) Explain the following standards : [6]
(i) PCI
(ii) SCSI
(iii) USB.

Or

4. (a) Compare horizontal microinstruction and vertical microinstruction. [6]
(b) Write a short note on interrupt driven Input/Output. [6]
5. (a) Explain cache memory. Why is it used ? [6]
(b) Write a note on semiconductor RAM memories. [7]

Or

6. (a) Write a note on a synchronous DRAM. [6]
(b) Explain the connection of the memory to the processor. [7]

7. (a) List out addressing modes of 8086. [6]
(b) Explain interrupt structure of 8086. [7]

Or

8. (a) Draw Flag Structure of 8086 and explain operation of each flag. [7]
(b) Explain Logical to physical addressing of 8086. [6]

Total No. of Questions—8]

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[4757]-1050

S.E. (Elex/E & TC) (First Semester) EXAMINATION, 2015

DIGITAL ELECTRONICS

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Assume suitable data, if necessary.

1. (a) Draw and explain the working of two input TTL NAND gates (with totem pole). [6]

(b) Implement the following function using single 8 : 1 MUX. [6]

$$F(A, B, C, D) = \sum m (1, 4, 6, 8, 10, 11, 13, 14)$$

Or

2. (a) Design and implement full adder using suitable decoder. [6]

(b) Draw and explain the working of 2 i/p CMOS NOR gate. [6]

P.T.O.

3. (a) Design mod 6 ripple up counter using T flip-flops. [6]
(b) Convert D to T and vice versa. [6]

Or

4. (a) Explain moore circuit with example. Also compare moore and mealy circuit. [6]
(b) Design a sequence detector to detect sequence 1101 using D FF and mealy machine. [6]

5. (a) Compare between PROM and PAL. [5]
(b) A combinational circuit is defined by a function $F_1 = \Sigma m(1, 3, 5)$
 $F_2 = \Sigma m(5, 6, 7)$.

Implement the circuit with PLA having 3 inputs, 3 product terms and two outputs. [8]

Or

6. (a) Explain in detail the architecture of CPLD. [6]
(b) What is meant by EPROM ? State its advantages and disadvantages. [7]

7. (a) Explain the following statements with examples : [6]
(i) Process
(ii) Case
(iii) If else

- (b) Write a VHDL code for 8 : 1 multiplexer using behavioural modeling. [7]

Or

8. (a) Explain in detail signal and variable with example in VHDL. [6]
- (b) Write a VHDL code for 4-bit ALU using case statement. [7]

Total No. of Questions—8]

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[4757]-1052

S.E. (Instrumentation & Control)
(First Semester) EXAMINATION, 2015
SENSORS AND TRANSDUCERS
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B.** :— (i) Neat diagrams must be drawn wherever necessary.
(ii) Figures to the right indicate full marks.
(iii) Assume suitable data if necessary.
(iv) *All* questions are compulsory.

1. (a) Explain the classification of transducers with suitable example. [4]
(b) Explain how the potentiometer can be used for measurement of rotary displacement. [4]
(c) Explain an application in which LVDT acts as secondary transducer. [4]

Or

2. (a) Explain the set up along with suitable transducer for very medium distance measurement. [4]

P.T.O.

- (b) Enlist various strain gauge compensation techniques ? Explain any *one* with neat sketch. [4]
- (c) Explain Magnetostrictive Torsion Transducer ? [4]
3. (a) What are different elastic pressure transducers ? Explain any *one* in detail. [4]
- (b) Draw the neat sketch of dead weight tester. [4]
- (c) Explain working of ring balance type DP instrument with neat sketch. [4]

Or

4. (a) What are different sources of errors and their remedies in filled system thermometers ? How they are overcome ? [6]
- (b) Explain working of bimetallic strip with neat sketch. State its applications. [6]
5. (a) What are Newtonian and non-Newtonian Fluids explain with suitable examples. [6]
- (b) Discuss what is the need for square root extractor in restriction type flow meters ? Draw the sketches of Eccentric, segmental and concentric type orifice plates. [7]

Or

6. (a) Derive Bernoulli's equation for incompressible flow. [8]
- (b) What is Laminar and Turbulent flow ? How is it decided ? [5]

7. (a) Write Nernst equation. Explain pH Temperature compensation in detail. [7]
- (b) Explain chain-balanced float type Density Measurement device with sketch. [6]

Or

8. (a) Explain Saybolt viscometer in detail. [6]
- (b) Explain capacitive type DP cell in detail. [7]

Total No. of Questions—8]

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[4757]-1053

S.E. (Instrumentation and Control Engineering)

(I Sem.) EXAMINATION, 2015

LINEAR INTEGRATED CIRCUITS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or
Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or
Q. No. 8.

(ii) Figures to the right indicate full marks.

1. (a) Define any *six* characteristics of Op-amp with ideal and Practical values. [6]
- (b) Explain the advantages of closed loop OP-AMP. Also explain unity gain amplifier with neat circuit diagram. [6]

Or

2. (a) Explain measurement of the Common Mode Rejection Ratio of Op-amp with neat circuit diagrams. [6]
- (b) Derive the output voltage equation for the voltage-shunt feedback amplifier with neat circuit diagram. [6]

P.T.O.

3. (a) Explain 3-input non-inverting voltage summer with equation and neat circuit diagram. [6]
- (b) What is oscillator ? State Barkhausen criteria and design Phase shift oscillator for $f_0 = 1$ kHz with neat circuit diagram. Assume suitable data. [6]

Or

4. (a) Explain with neat circuit diagrams and equations, limitations of basic Integrator and how it can be overcome by practical Integrator. [6]
- (b) Explain Window detector using IC LM 311 with neat circuit diagram and waveforms. [6]
5. (a) Design Astable Multivibrator for the duty cycle of 78% and frequency of 1.2 kHz. Assume suitable values. Also draw circuit diagram and waveforms. [8]
- (b) Draw and design low voltage regulator using IC 723 for 5 V. Assume suitable data. [5]

Or

6. (a) Explain Mono-stable multivibrator using IC 555 with neat circuit diagrams. [5]
- (b) Explain step-down switching regulator. Also state its advantages over linear regulators. [8]

7. (a) Explain second order Butterworth low-pass filter and also draw circuit diagram. [8]
- (b) What is order of filter ? Draw ideal and practical responses for all filters. [5]

Or

8. (a) Explain notch filter using Op-amp and draw circuit diagram and response. [6]
- (b) Design first order High-pass filter for the low cut-off frequency of 500 Hz. Assume suitable data. Draw neat circuit diagrams. [7]

Total No. of Questions—8]

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[4757]-1054

S.E. (Instrumentation and Control)
(First Semester) EXAMINATION, 2015
BASIC INSTRUMENTATION
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :-** (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
(ii) Figures to the right indicate full marks.
(iii) Neat diagrams must be drawn wherever necessary.
(iv) Use of calculator is allowed.
(v) Assume suitable data, if necessary.

1. (a) Explain the dynamic characteristics of instruments. [6]
(b) Draw the circuit diagram of basic DC potentiometer. If a DC potentiometer is calibrated having length of slidewire 400 cm, at 100 cm for 200 mV what will be the measurement range ? Also calculate the unknown emf if the null deflection is at 286.5 cm. [6]

Or

2. (a) Explain calibration, traceability and traceability chart. [6]
(b) Design multirange ammeter by universal shunt method that uses a basic PMMC meter having $R_m = 2.3 \text{ k}\Omega$ and $I_{fsd} = 500 \text{ }\mu\text{A}$. The desired range are 5 mA, 20 mA and 50 mA. [6]

P.T.O.

3. (a) With neat circuit diagram explain Hay's Bridge. [6]
(b) Write a note on Z-modulation. How is it used for unknown frequency measurement ? [6]

Or

4. (a) Explain the function of Aquadag, Vertical Deflecting Plates and Focus anode in CRO. [6]
(b) An AC bridge consists of the following arms : [6]
Arm ab – resistance of 800 Ω = parallel to capacitance
0.5 μF
Arm bc – resistance of 1200 Ω = in series with capacitance
0.5 μF
Arm cd – resistance of 300 Ω = in series with inductance
40 mH
If the frequency of supply is 100 Hz, calculate component value in arm da as a series combination of resistance and inductance.

5. (a) Explain with the help of block diagram, digital phase meter. [7]
(b) Draw block diagram of DMM. How resistances (low and high values) are measured in DMM ? [6]

Or

6. (a) Explain the digital tachometer. [7]
(b) What are the different blocks required for Digital Thermometer ? Explain with neat block diagram. [6]

7. (a) With appropriate circuit, explain how a triangular input wave will be converted into sine wave. [7]
- (b) Explain any *three* marking mechanisms in recorders. [6]

Or

8. (a) Write a short note on Virtual Instrumentation. [6]
- (b) What are the desirable characteristics of waveform generator ? Draw and explain block diagram of function generator. [7]

Total No. of Questions—8]

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[4757]-1055

**S.E. (Instru. & Control) (First Semester) EXAMINATION, 2015
PHOTONICS AND INSTRUMENTATION
(2012 PATTERN)**

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

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

(iv) Assume suitable data if necessary.

1. (a) Draw electromagnetic spectrum of light and show different ranges. [8]

(b) State Planck's equation and Snell's Law. [4]

Or

2. (a) Calculate the frequency for the wavelength of 50 mm. [4]

(b) Compare the following terms : [8]

(i) Reflection and Refraction

(ii) Diffraction and Interference.

P.T.O.

3. (a) For an Incandescent lamp the design parameters are : [4]
- (i) Design voltage = 5 V
 - (ii) Rated M.S.C.P. = 0.145
 - (iii) Operated at 4.5 V, then calculate :
 - (I) Rerated M.S.C.P.
 - (II) Reduction factor of lamp when M.H.S.C.P. = 0.725.
- (b) Explain the following terms related to Light Emitting Diode : [8]
- (i) Electroluminescent Process
 - (ii) Choice of LED Material
 - (iii) Applications of LED.

Or

4. (a) What is Quantum detector ? Explain any *one* type of Quantum detector. [8]
- (b) Explain with neat diagram Photomultiplier Tube. [4]
5. (a) What is Attenuation ? Explain different losses in fibre cable. [7]
- (b) Explain the following terms : [6]
- (i) Acceptance Angle
 - (ii) Numerical Aperture.

Or

6. (a) What is wave guiding principle ? Explain the term skew rays. [6]
- (b) What are the different modes used in fibre optics ? Explain with diagram. [7]
7. (a) Explain with suitable diagram working of Microscope. [7]
- (b) Explain OTDR with suitable diagram. [6]

Or

8. (a) Explain camera with suitable diagram. [7]
- (b) Explain Polarimeter with a neat diagram. [6]

Total No. of Questions—8]

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[4757]-1056

S.E. (Instrumentation & Control) (Second Semester)

EXAMINATION, 2015

DIGITAL TECHNIQUES

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.
(ii) Neat diagrams must be drawn wherever necessary.
(iii) Figures to the right indicate full marks.
(iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
(v) Assume suitable data if necessary.

1. (a) Convert the following : [6]
(i) $(77466)_8$ to hexadecimal number
(ii) $(BACF9.61C)_{16}$ to binary number
(iii) $(11001111011110110111)_2$ to hexadecimal number.
(b) Compare TTL and CMOS. [6]

Or

2. (a) Convert the following : [6]
(i) $(2ACS.D)_{16}$ to decimal number
(ii) $(22.64)_{10}$ to hexadecimal number
(iii) $(725.63)_8$ to binary number.
(b) Compare totem-pole and open collector. [6]

P.T.O.

3. (a) Design a code gray to binary. [6]
(b) Implement the following using 8 : 1 mux : [6]
 $F(A, B, C, D) = \Sigma m(0, 2, 6, 10, 11, 12, 13) + d(3, 8, 14).$

Or

4. (a) Convert JK to T flip-flop. [6]
(b) Implement $F(A, B, C) = \Sigma m(1, 3, 5, 6)$ using 4 : 1 mux. [6]

5. (a) Design PROM for 3 bit binary to Ex-3 code. [8]
(b) Write a short note on PROM. [5]

Or

6. (a) Compare ASIC and PLD approach. [8]
(b) Write a short note on PLA. [5]
7. (a) Explain digital clock with a neat diagram. [8]
(b) Write a short note on RAM. [5]

Or

8. (a) Write a short note on frequency counter. [8]
(b) Write a short note on ROM. [5]

Seat No.	
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[4757]-1057**S.E. (Instrumentation and Control) (Second Semester)****EXAMINATION, 2015****AUTOMATIC CONTROL SYSTEM****(2012 PATTERN)****Time : Two Hours****Maximum Marks : 50**

- N.B. :-** (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Use of non-programable calculator is allowed.
- (v) Assume suitable data, if necessary.

1. (a) Determine the overall transfer function of the system shown in Fig. 1 using block diagram reduction technique. [6]

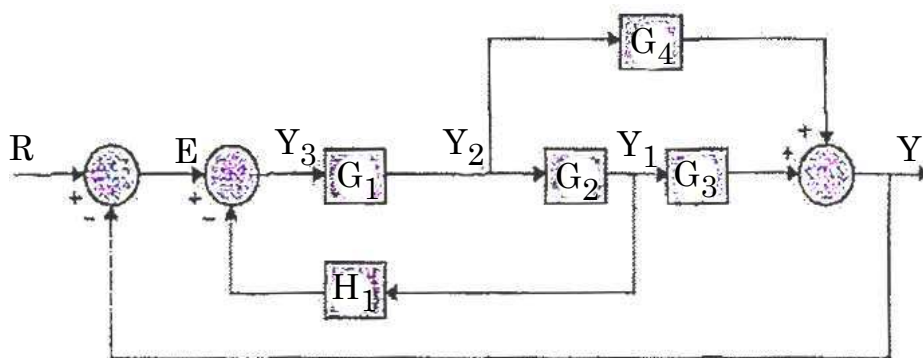


Fig. 1 : Block Diagram

- (b) Derive the transfer function of RLC electrical system. [6]

P.T.O.

Or

2. (a) Determine the overall transfer function of the system shown in Fig. 1 using Mason's gain formula. [6]
- (b) Derive the transfer function of mechanical (mass, spring and dashpot) system. [6]

3. (a) Prove that : [6]

$$e_{ss} = \lim_{s \rightarrow 0} \frac{sR(s)}{1 + G(s)H(s)}.$$

- (b) A system is excited with unit step input has a time response : [6]

$$c(t) = 1 + 0.5e^{-50t} - 1.5e^{-t}$$

- Find the transfer function of the system
- Determine ω_n and ζ
- Determine time constant of the system.

Or

4. (a) A unity feedback system has an open loop transfer function :

$$G(s) = \frac{K}{s(s + 10)}.$$

Determine the gain K so that the system will have a damping factor of 0.7. For this value of K determine T_s (for 2% tolerance band) and peak time of the system. [4]

- (b) Open loop transfer function of the system is :

$$G(s) = \frac{k}{s(s + 4)(s + 6)}.$$

Draw its root locus and comment on stability of the system. [8]

5. Magnitude plot of a frequency response is as shown in Fig. 2. Frequency axis is in rad/sec. Determine gain margin, phase margin and comment on stability. [13]

Or

6. Open loop transfer of a unity feedback system is :

$$G(s) = \frac{200(s + 1)}{s(s + 10)(s + 20)}$$

Draw its Bode plot and determine gain margin and phase margin and also comment on stability. [13]

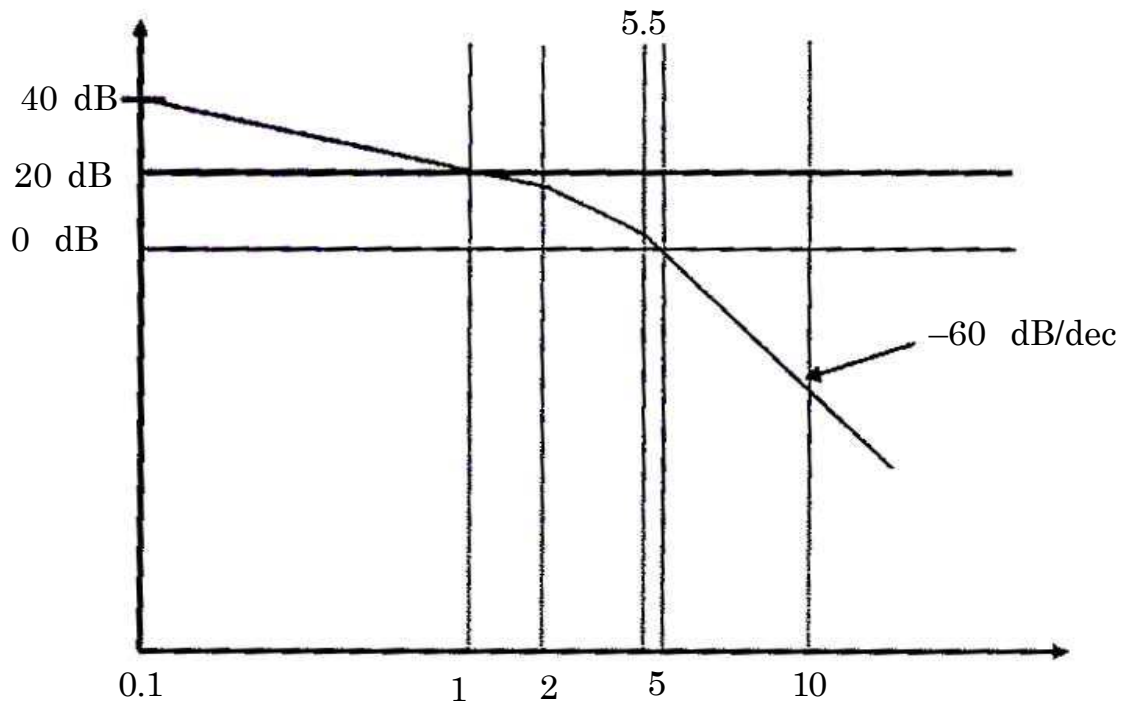


Fig. 2 : Magnitude plot of frequency response

7. (a) Sketch the approximate polar plot for the following system : [8]

$$G(s) = \frac{k}{s + p_1}$$

and

$$G(s) = \frac{k}{s(s + p_1)}.$$

- (b) Write a short note on mapping theorem. [5]

Or

8. (a) Sketch the approximate polar plot for the following systems : [8]

$$G(s) = \frac{k}{s}$$

and

$$G(s) = \frac{k}{s^2}.$$

- (b) Write a short note on mapping theorem. [5]

Total No. of Questions—8]

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[4757]-1058

S.E. (Instrumentation & Control) (Second Semester)

EXAMINATION, 2015

TRANSDUCER AND SIGNAL CONDITIONING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8

(ii) Neat diagrams must be drawn wherever necessary.

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

(iv) Use of electronic pocket calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) Explain signal level and bias changes in analog signal conditioning. [3]

(b) Explain lead compensation in signal conditioning. [3]

(c) Explain block diagram of RTD signal conditioning circuit used for temperature measurement application. [6]

P.T.O.

Or

2. (a) Discuss voltage divider and Bridge circuit for conversion of resistive sensors output in voltage signal. [6]
- (b) Explain signal conditioning circuits required for potentiometer sensor for level measurement. [6]
3. (a) Explain capacitance to voltage converter in detail. [6]
- (b) Explain inductive proximity sensor with its signal conditioning blocks and also explain importance of each block. [6]

Or

4. (a) With neat sketch explain capacitive proximity sensor. [6]
- (b) Explain excitation techniques used for inductive sensors. [6]
5. (a) In short explain signal conditioning circuits for photo diode and photo transistor. [7]
- (b) Explain pyrometers with neat sketches. [6]

Or

6. (a) Explain optical encoder and its signal conditioning circuit blocks. [7]
- (b) Explain optical proximity sensor circuits. [6]

7. (a) Explain signal conditioning circuit blocks used in ultrasonic level detector. [7]
- (b) Explain Hall effect sensor and its signal conditioning circuit. [6]

Or

8. (a) Discuss different excitation methods for electromagnetic flowmeter. [7]
- (b) Draw and explain block diagram of conductivity meter. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1059

S.E. (Instrumentation and Control) (Second Semester)

EXAMINATION, 2015

ELECTRONIC INSTRUMENTATION

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Use of calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) Explain RLC-Q meter with neat block diagram. [6]

(b) Draw and explain ramp generator circuit using timer IC 555. [6]

P.T.O.

Or

2. (a) Draw and explain block diagram of digital frequency meter. [6]
- (b) Draw and explain block diagram of Indirect frequency synthesis. [6]
3. (a) Explain details of 1 : 1 and 10 : 1 types of Passive probes. [6]
- (b) Draw and explain block diagram of 3-bit Flash type ADC. [6]

Or

4. (a) Explain any *two* Modes of DSO. [6]
- (b) Explain 4-bit R-2R type DAC using neat circuit diagram. [6]
5. (a) Explain the concept of Amplitude Modulation using neat waveforms. [7]
- (b) Describe FDM concept using neat block diagram. [6]

Or

6. (a) Explain the modulation concept using Frequency Shift Keying. [7]
- (b) Explain frequency modulation technique using neat waveforms. [6]

7. (a) Draw and explain working principle of fundamental suppression type distortion analyzer. [7]
- (b) Explain Super-heterodyne type spectrum analyzer with neat block diagram. [6]

Or

8. (a) Explain TRF spectrum analyzer with neat block diagram. [7]
- (b) Draw and explain block diagram of frequency selective wave analyzer. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1060

S.E. (Instrumentation and Control) (Second Semester)

EXAMINATION, 2015

INDUSTRIAL DRIVES

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) Explain with neat diagram construction of IGBT. [6]

(b) Explain in detail 1- ϕ full controlled bridge rectifier with resistive load. [6]

P.T.O.

Or

2. (a) Explain with neat diagram Jones Chopper. [6]
- (b) Explain with neat diagram working of 1- ϕ full bridge inverter. [6]
3. (a) Derive the EMF equation of DC generator. [6]
- (b) Derive the torque equation of 3- ϕ induction motors. [6]

Or

4. (a) What is the significance of back EMF ? [6]
- (b) Write a short note on speed control of induction motor. [6]
5. (a) Explain with neat diagram working principle of Alternators. [7]
- (b) Explain with neat diagram working principle of 1- ϕ induction motors. [6]

Or

6. (a) Write a short note on synchronous motors. [7]
- (b) Explain Torque-Speed characteristics of 1- ϕ induction motors. [6]

7. (a) Explain construction and working principle of stepper motor. [8]
- (b) Explain Torque-Speed characteristics of servomotors. [5]

Or

8. (a) What is the need of stepper motor in industrial automation ? Specify its *two* applications. [6]
- (b) Explain construction and working principle of Universal motors. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—7

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[4757]-1061

S.E. (Chemical/Printing Engineering) (First Semester)

EXAMINATION, 2015

ENGINEERING MATHEMATICS-III

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

- N.B. :-** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.
- (ii) Figures to the right side indicate full marks.
- (iii) Use of non-programmable calculator is allowed.
- (iv) Assume suitable data if necessary.

1. (a) Solve any *two* : [8]

(i) $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + 4y = \cos(\log x)$

(ii) $\frac{d^2y}{dx^2} + y = \sec x$ (by method of variation of parameters)

(iii) $\frac{dx}{3z - 4y} = \frac{dy}{4x - 2z} = \frac{dz}{2y - 3x}$

P.T.O.

(b) Solve the integral equation : [4]

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

Or

2. (a) A 1 kg weight suspended from a spring stretches it 4 cm. If the weight is pulled down 8 cm below the equilibrium position and then released, find the displacement of the body from its equilibrium position in time t seconds, the maximum velocity and period of oscillation. [4]

(b) Using Fourier integral representation, show that : [4]

$$\int_0^{\infty} \frac{1 - \cos \pi \lambda}{\lambda} \sin \lambda x d\lambda = \begin{cases} \frac{\pi}{2}, & 0 < x < \pi \\ 0, & x > \pi \end{cases}$$

(c) Find the Fourier cosine transform of : [4]

$$f(x) = \begin{cases} x, & 0 < x < \frac{1}{2} \\ 1 - x, & \frac{1}{2} < x < 1 \\ 0, & x > 1 \end{cases}$$

3. (a) Attempt any one : [4]

(i) Find Laplace transform of :

$$e^{-3t} \int_0^t t \sinh 2t dt.$$

(ii) Find inverse Laplace transform of :

$$\log \left(\frac{s^2 + b^2}{s^2 + a^2} \right).$$

(b) Solve by Laplace transform : [4]

$$\frac{d^2 y}{dt^2} + y = t, \text{ given } y(0) = 1, y'(0) = -2.$$

(c) Find directional derivative of $\phi = e^{2x-y-z}$ at (1, 1, 1) along the direction of tangent to curve : [4]

$$x = e^{-t}, y = 2 \sin t + 1, z = t - \cos t \text{ at } t = 0.$$

Or

4. (a) Attempt any one : [4]

(i) Prove that :

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

(ii) If ϕ and ψ satisfies Laplace equation then prove that $(\phi \nabla \psi - \psi \nabla \phi)$ is solenoidal.

(b) If vector field : [4]

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

is irrotational. Find a, b, c and scalar function ϕ such that $\bar{F} = \nabla\phi$

(c) Using Laplace transform evaluate : [4]

$$\int_0^{\infty} e^{-t} (1 + 2t + t^2) U(t - 1) dt.$$

5. (a) Evaluate :

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

where $\bar{F} = z\bar{i} + xz\bar{j} + (x - 2yz)\bar{k}$ along the curve $x = t$, $y = t^2$, $z = t^3$ from $t = 0$ to $t = 1$. [4]

(b) By using Gauss-Divergence theorem evaluate

$$\iint_S (\cos y \bar{i} + z^2 \sin x \bar{j} + z \bar{k}) \cdot d\bar{s} \text{ over the cylindrical region}$$

bounded by $x^2 + y^2 = 4, z = 0, z = 3$. [5]

(c) Evaluate :

$$\iiint_S (\nabla \cdot \bar{F}) \cdot d\bar{s}$$

where $\bar{F} = (x - z^2)\bar{i} + (y - 3x)\bar{j} + z^3 y \bar{k}$, s is the surface $x^2 + y^2 + z^2 - 4z = 1$ above the plane $z = 0$. [4]

Or

6. (a) Use Green's theorem to evaluate : [4]

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

where $\bar{F} = y^3\bar{i} - x^3\bar{j}$ and C is the circle $x^2 + y^2 = 4$.

- (b) Evaluate :

$$\iint_S [(3x)\bar{i} + x^3 \sin z \bar{j} + (y^2 \cos x)\bar{k}] \cdot d\bar{s}$$

over the surface of sphere $x^2 + y^2 + z^2 = 1$. [4]

- (c) Use Stokes' theorem to evaluate :

$$\oint_C (x + 2y)dx + (x - z)dy + (y - z)dz$$

where C is the boundary of triangle with vertices (1, 0, 0),

(0, 1, 0), (0, 0, 1). [5]

7. (a) If

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

represents the vibrations of string of length l fixed at both ends,
find the solution with boundary conditions : [7]

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

(ii) $u(l, t) = 0$ and initial conditions.

(iii) $\left(\frac{\partial u}{\partial t}\right)_{t=0} = 0$

(iv) $u(x, 0) = u_0 \sin\left(\frac{2\pi x}{l}\right), 0 \leq x \leq l$

(b) Solve :

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

(i) u is finite for all t ,

(ii) $u(0, t) = 0$

(iii) $u(l, t) = 0$

(iv) $u(x, 0) = \frac{2x}{l}, 0 \leq x \leq l$ [6]

Or

8. (a) An infinitely long uniform metal plate is enclosed between lines $y = 0$ and $y = 4$ for $x > 0$. The temperature is zero along the edges $y = 0, y = 4$ and at infinity. If the edge $x = 0$ is kept at a constant temperature 50°C , find the temperature distribution $u(x, y)$ [7]

(b) Use Fourier transform to solve :

$$\frac{\partial u}{\partial t} = 4 \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < \infty, \quad t > 0 \quad \text{subjected to}$$

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

$$(ii) \quad u(x, 0) = e^{-2x}, \quad x > 0$$

$$(iii) \quad u \text{ and } \frac{\partial u}{\partial x} \rightarrow 0 \text{ as } x \rightarrow \infty$$

[6]

Total No. of Questions—8]

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[4757]-1062

S.E. (Chemical) (First Semester) EXAMINATION, 2015
CHEMISTRY-I
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Question Nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8 from the following.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data if necessary.

1. (a) Draw and describe molecular orbital diagram and find the bond order for Nitrogen molecule. [4]
(b) Explain the structure and stability of free radicals. [4]
(c) Derive the integrated rate expression for second order kinetics involving two reactant with the same initial concentration. [4]

Or

2. (a) Name the various types of organic reaction. Explain substitution reaction with an example. [4]
(b) Derive the Arrhenius equation and show how it is calculated graphically. [4]
(c) Show that time required for a first order reaction to complete 99.9% reaction is approximately 10 times its half life period. [4]
3. (a) Explain the principle, technique and application of column chromatography. [4]
(b) State Lambert and Beer law. Derive the combined law equation. [4]
(c) Derive the thermodynamic equation relating T_b and H_{vap} . [5]

P.T.O.

Or

4. (a) Explain the instrumentation involved in UV-visible spectroscopy. [5]
(b) Derive the equation relating molar mass of solute with lowering of vapour pressure of its solution. [4]
(c) 2.43 gm sulphur in 100 gm naphthalene (MP = 80.1°C) has freezing point depression of 0.64°C. Latent heat of fusion of naphthalene is 19.4 J/mole. Find the molar mass and formula of sulphur in solution. (At. wt. of S = 32). [4]
5. (a) Explain, why phenol undergoes nitration faster than nitrobenzene. [4]
(b) Give the mechanism of Friedel-Craft's acylation and state the limitation. [4]
(c) Write a short note on Claisen rearrangement. [4]

Or

6. (a) Explain ethyl iodide gives ethylene by alcoholic KOH while it gives ethyl alcohol by action of aq. KOH. [4]
(b) Discuss the mechanism of E₁ and E₂ reaction of alkyl halides. [4]
(c) Write a short note on Beckmann's rearrangement. [4]
7. (a) Give the preparation of the following dyes : [5]
(i) Phenolphthalein
(ii) Methyl orange.
(b) Explain furan is more reactive than benzene in electrophilic substitution. [4]
(c) Describe the classification of dyes on the basis of chemical structure. [4]

Or

8. (a) Explain electrophilic substitution in five membered heterocycles. [5]
(b) Write a short note on diazotization and diazocoupling. [4]
(c) Give the steps involved in preparation of Alizarin. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1063

S.E. (Chem.) (First Semester) EXAMINATION, 2015

CHEMICAL ENGINEERING FLUID MECHANICS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) *All* questions are compulsory.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) What is rheology ? How fluids are classified according to their rheological behaviour ? [6]

(b) Determine the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9. [6]

Or

2. (a) Write a short note on types of flow. [6]

(b) Explain with neat sketch the working of an inclined tube manometer. [6]

P.T.O.

3. (a) Derive the expressions for laminar flow of fluids $f = 16/NRe$. [6]
(b) Water is flowing at a rate of $5\text{m}^3/\text{hr}$. through 40 mm pipe. Find Reynolds' number and friction factor. Take density and viscosity of water at 1 gm/cc and 1 centipoise. Also determine the nature of flow. [6]

Or

4. (a) Derive Hagen-Poiseuille equation and highlighting the assumption made. [6]
(b) Draw a neat sketch and explain the working of venturimeter. [6]
5. (a) Explain growth of boundary layer on a flat plate. [5]
(b) Define and derive expression for momentum thickness. [8]

Or

6. (a) With suitable example, describe in detail the method of dimensional analysis using Buckingham's π theorem. [8]
(b) Derive an expression of displacement thickness. [5]
7. (a) Explain different types of fluidization. [8]
(b) Explain phenomenon of cavitation in pumps. How can it be prevented ? [5]

Or

8. (a) Explain any *one* :

(i) Major and minor losses during transportation of fluid through pipes. [5]

(ii) Types of valves with its applications.

(b) Write short notes on : [8]

(i) Surface or friction drag

(ii) Deformation drag

(iii) Pressure drag

(iv) Form drag.

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1064

S.E. (Chemical) (First Semester) EXAMINATION, 2015

CHEMICAL ENGINEERING MATERIALS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data, if necessary.

1. (a) Define material and explain the classification of materials. [6]
- (b) Explain any *two* types of non-destructive testing methods for materials. [6]

Or

2. (a) Explain in brief Imperfections in crystal structures. [6]
- (b) Give the classification of engineering materials. [3]
- (c) Explain about ASTM methods. [3]

P.T.O.

3. (a) Write short notes on the following : [8]
- (i) Rolling
 - (ii) Bending
 - (iii) Central punching
 - (iv) Welding.
- (b) Define Nanotechnology. State the applications of Nanomaterials in chemical industry. [5]

Or

4. (a) Write short notes on : [7]
- (i) Carbon Nanotubes
 - (ii) Fullerites.
- (b) Write short notes on : [6]
- (i) Special steels
 - (ii) Aluminium alloys.

5. Write short notes on : [12]
- (a) Atomic force microscopy
 - (b) Scanning tunneling microscopy.

Or

6. Explain principle and working of Scanning Electron Microscope (SEM). [12]

7. Write short notes on (any *four*) : [13]

(i) Clays

(ii) Cement

(iii) Glass

(iv) Refractories

(v) Glass vitreous silica

(vi) Borosilicates.

Or

8. (a) Write a short note on Organic Protective coatings. [6]

(b) Discuss in detail applications of Ceramic materials. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[4757]-1065

S.E. (Chemical) (First Semester) EXAMINATION, 2015

PROCESS CALCULATIONS

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

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

(v) Assume suitable data, if necessary.

1. (a) The solubility of methyl bromide (CH_3Br) in methanol is 44 kg per 100 kg methanol. Express the composition of the saturated solution in weight % and mole %. (Atomic weight of Br = 79.91). [4]

P.T.O.

- (b) A waste acid from a nitrating process contains 23% HNO_3 , 57% H_2SO_4 and 20% water by weight. This acid is concentrated to a mixture containing 27% HNO_3 , 60% H_2SO_4 and 13% water by using sulphuric acid containing 93% H_2SO_4 and nitric acid containing 90% HNO_3 . Calculate the amount of waste acid and concentrated acids to get 100 kg of desired mixed acid. [8]

Or

2. (a) A gas mixture of CH_4 and C_2H_6 has an average molecular weight of 22.4. Find the partial pressure of CH_4 if the total pressure is atmospheric. [4]
- (b) A mixture of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ weighs 100 g. After removing the water of hydration by heating the dehydrated mass weighs 60 g. Calculate the weight ratio of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ to $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ in the original salt mixture. (Atomic weights : $\text{Cu} = 63$, $\text{S} = 32$, $\text{Fe} = 56$). [8]
3. (a) A gaseous reaction $\text{A} \rightarrow 2\text{B} + \text{C}$ takes place in an isothermal constant pressure reactor. Starting with a mixture of 60% A and 40% inerts (by volume) in a specified time the volume doubles. Calculate the conversion achieved. [6]

- (b) Liquid benzene at 303 K is continuously mixed with liquid toluene at 373 K in a molar proportion of 3 : 2 in an insulated tank. If the heat of mixing is assumed to be zero what is the temperature of the final mixture. Heat capacity data for benzene and toluene is as follows (assume $c = a + bT$) : [7]

Temp. K	Heat Capacity (c) kJ/kg K	
	Benzene	Toluene
283	1.591	1.524
338	2.018	—
358	—	2.236

Or

4. (a) Orthoxylene on oxidation gives phthalic anhydride. The reaction taking place is : $C_8H_{10} + 3O_2 \rightarrow C_8H_6O_3 + 3H_2O$. 20% excess air is used. The conversion is 50% and the yield of phthalic anhydride is 80% Calculate the requirement of orthoxylene and air for 100 kmol of phthalic anhydride. [6]

(b) Chlorinated diphenyl is heated from 313 K to 553 K at the rate of 4000 kg/h. Its heat capacity is given by $c = 0.7511 + 1.465 \times 10^{-3} T$ kJ/kg K. Also the mean heat capacity values at 313 K and 553 K are 1.1807 and 1.5198 kJ/kg K respectively. Calculate the heat to be supplied using both the data and find the percentage error when mean values of heat capacity are used. [7]

5. (a) Liquid paraffin wax is crystallized in a continuous jacketed crystallizer. For a particular run the data is as follows : Liquid paraffin fed = 675 kg/h, inlet temperature = 332 K, outlet temperature = 320 K, Mean heat capacity = 2.93 kJ/kg K, Latent heat of crystallization = 168.7 kJ/kg, Crystallization temperature = 320 K, Power input at shaft = 17 kW, Cooling water flow in the jacket = 1.92 lps, rise in jacket water temperature = 5.8 K. Assuming no radiation losses calculate the mass flowrate of crystals and the percentage crystallization. [8]

- (b) Define relative humidity and percentage humidity, and derive a relation between them. [5]

Or

6. (a) Carbon dioxide contains 0.053 kmol water vapour per kmol of dry CO₂. Temperature of the gas is 308 K and the pressure is 100 kPa. Calculate the relative saturation of the mixture, percentage saturation and the temperature upto which the mixture must be heated in order to achieve a relative saturation of 30%. Vapour pressure of water 308 K = 5.6 kPa and at 330 K = 16.475 kPa. [8]
- (b) Define wet bulb and dry bulb temperature, humid volume and humid heat. [5]
7. (a) Fuel gas has the following composition : CO = 27%, CO₂ = 4%, O₂ = 0.5% and N₂ = 68.5% by volume. Find the net theoretical oxygen required. Find the analysis of flue gas if the fuel gas is burned with 80% excess air than the net requirement. [7]
- (b) Explain in detail about proximate analysis of coal. [5]

Or

8. (a) The burning of a fuel oil which does not have nitrogen gives the following composition of the flue gas by volume : $\text{CO}_2 = 11.6\%$, $\text{O}_2 = 5\%$ and $\text{N}_2 = 83.4\%$ on dry basis. Compute the percentage excess air used and the carbon to hydrogen weight ratio in the fuel. [7]
- (b) Define adiabatic flame temperature and HCV and NCV. Is the actual adiabatic flame temperature different than that calculated theoretically ? [5]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1066

S.E. (Chemical) (Second Semester) EXAMINATION, 2015

CHEMISTRY—II

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer *four* questions.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Give evidence against the open chain structure of glucose. [4]
(b) What is a Zwitter ion ? Describe the isoelectric point. [4]
(c) Explain giving reason, why all transition metals exhibit variable oxidation states. [4]

Or

2. (a) Draw structures of Amylase, Amylopectin and Cellulose. [4]
(b) Explain the non-existence of low spin tetrahedral complex. [4]
(c) Draw and describe the diagram showing splitting of *d*-orbitals for transition metal ion in octahedral field. [4]

P.T.O.

3. (a) (i) 25 ml of standard solution of 0.05 M KCl solution takes 37.5 ml of AgNO_3 from burette, during standardization of the AgNO_3 , by Mohr's method.
- (ii) 100 ml of chloride water sample requires 11.7 ml of the AgNO_3 solution. Calculate the quantity of chloride ions per litre in the given water sample. [4]
- (b) Explain strong acid-strong base titration with titration curve. [4]
- (c) Give mechanism of metal co-ordination compound catalysed reactions in Wacker process. [4]

Or

4. (a) What is a complexometric titration ? Explain any *one*. [4]
- (b) Derive the Langmuir adsorption isotherm. [4]
- (c) Explain "Adsorption theory" of catalysis. [4]
5. (a) What do you understand by the term conformations ? Draw all conformations of ethane. [5]
- (b) Explain geometrical isomerism with a suitable example. [4]
- (c) Assign R and S configuration in 2, 3-dichloropentane. [4]

Or

6. (a) Discuss the conformations of cyclohexane with the help of energy profile diagram. [5]
- (b) Explain Bayer's strain theory for cycloalkanes. [4]
- (c) Define the terms enantiomers and diastereomers giving examples. [4]
7. (a) Give the mechanism and kinetics involved in nitration of various organic compounds. [5]
- (b) Give the details of process for manufacture of Dodecylbenzene sulphonate. [4]
- (c) Give the various reagents used for Halogenation. [4]

Or

8. (a) Write a note on design of reactors. [5]
- (b) Explain continuous nitration process. [4]
- (c) Give the mechanism of sulphonation. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1067

S.E. (Chemical Engineering) (Second Semester)

EXAMINATION, 2015

CHEMICAL ENGINEERING THERMODYNAMICS—I

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

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

(iv) Use of calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) Explain PV diagram for a pure substance showing all the regions. [6]

(b) Calculate the molar volume and compressibility factor for methanol vapor at 500 K and 10 bar by using Redlich-Kwong equation. Constants for Redlich-Kwong equation :

$$a = 21.7181 \text{ Nm}^4\text{K}^{1/2}/\text{mol}^2, b = 4.5617 \text{ m}^3/\text{mol}. \quad [6]$$

P.T.O.

Or

2. (a) Explain the phase rule and discuss the degree of the freedom for any system. [4]
- (b) Derive the expression for work done and heat transferred for a polytropic process. [8]
3. (a) Derive the expression to show temperature dependence of standard heat of reaction. [6]
- (b) Derive the following relation for the efficiency of Carnot engine : [7]

$$\eta = (T_h - T_l)/T_h.$$

Or

4. (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 600 K. 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, O₂, N₂ and CO₂. [7]
- (b) Explain the concept of entropy and prove that entropy is a state function. [6]

5. (a) The equation of state of a certain substance is given by the expression :

$$V = RT/P - C/T^3 \text{ and } C_p = A + BT,$$

where A, B and C are constants. Derive expression for changes in internal energy, enthalpy and entropy for :

(i) An isothermal process

(ii) An isobaric process. [8]

- (b) Explain the terms coefficient of volume expansion and isothermal compressibility. [5]

Or

6. (a) Derive the following fundamental residual property relation for 1 mol of substance for closed thermodynamic system :

$$d(G^R/RT) = V^R dP/(RT) - H^R dT/(RT^2)$$

where, G^R -residual Gibbs free energy; V^R -residual volume; H^R -residual enthalpy; T-temperature; P-pressure and R-Universal gas constant. [8]

- (b) Derive the Clausius-Clapeyron equation for vapor-liquid two phase system. [5]

7. (a) Differentiate between a refrigerator and a heat pump. [4]

- (b) The work output from a Carnot engine operating between two thermal reservoirs at 500 K and 900 K respectively is utilised by a Carnot refrigeration machine for absorbing

heat at the rate of 4 kJ/s from a cold room at 270 K and discarding heat to the surrounding at 300 K. Determine the quantity of heat absorbed by the engine at 600 K. If the COP of the refrigerator and the efficiency of the engine are two third of the ideal values, what is the quantity of heat absorbed by the engine at 500 K. [8]

Or

8. (a) Why is liquefaction of gass needed ? [3]
- (b) A Carnot engine is coupled to a Carnot refrigerator so that all the work produced by the engine is produced by the engine is used by the refrigerator in extraction of heat from a heat reservoir at 0°C at the rate of 35 kW. The source of energy for the Carnot engine is a heat reservoir at 250°C. If both devices discard heat to the surroundings at 25°C, how much heat does the engine absorb from its heat-source reservoir ? If the actual coefficient of performance of the refrigerator is $\text{COP}_{\text{actual}} = 0.6 \text{ COP}_{\text{Carnot}}$ and if the thermal efficiency of the engine is $\eta_{\text{actual}} = 0.6 \eta_{\text{Carnot}}$, how much heat does the engine absorb from its heat source reservoir ? [9]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1068

S.E. (Chemical) (Second Semester) EXAMINATION, 2015

HEAT TRANSFER

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Assume suitable data, if necessary.

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

1. (a) Explain different modes of Heat Transfer with their fundamental Laws. [6]
- (b) Explain Rayleigh's method of dimensional analysis. [6]

Or

2. (a) State and explain : [6]
 - (i) Fourier law of heat conduction
 - (ii) Newton's law of cooling
 - (iii) Stefan-Boltzmann's law of radiation.
- (b) Thermal conductivity of a material at any temperature is given by equation, $K = 0.925 + 0.000486 T$ (W/mK). If the plane wall of thickness 25 cm is constructed using this material and the two sides are maintained at 1200°C and 450°C respectively. Calculate the heat flow rate per unit area. [6]

P.T.O.

3. (a) Explain the Radiation shield. [3]
- (b) Define : [3]
- (i) Emissive power
- (ii) Radiosity
- (iii) Irradiation.
- (c) Two large parallel plates with emissivities 0.2 and 0.6 are maintained at 1000 K and 500 K respectively. A third plate with emissivity 0.08 is introduced as a radiation shield in between two plates. Calculate reduction in heat loss rate per unit area and temperature of the shield ? [6]

Or

4. (a) Explain any *two* : [6]
- (i) Radiation shape factor
- (ii) Kirchoff's identity
- (iii) Concept of Black Body.
- (b) Derive the following relationship for forced convection heat transfer process by dimensional analysis : [6]

$$\text{Nu} = C [\text{Re}^a \cdot \text{Pr}^b]$$

where,

Nu = Nusselt number

Re = Reynolds' number

Pr = Prandtl number

a , b and c are numerical constants.

5. (a) A shell and tube heat exchanger is to be provided with tubes of 31 mm outer diameter and 27 mm inner diameter, 4 m long. It is required for heating water from 295 K to 318 K with the help of condensing steam at 393 K on the outside of tubes. Determine the number of tubes required if water flow rate is 10 kg/sec. Heat transfer coefficient on steam side and water side are $6000 \text{ W/m}^2 \text{ K}$ and $850 \text{ W m}^2 \text{ K}$ respectively. Neglect all other resistances. [8]
- (b) What is Heat Exchangers ? Enlist the types of Heat Exchangers. [5]

Or

6. (a) Describe Fouling factor in heat exchanger. [4]
- (b) Explain individual and overall heat transfer coefficient. [4]
- (c) Derive Log Mean Temperature Difference (LMTD) for concurrent double pipe heat exchanger. [5]

7. (a) Differentiate between the single effect and multiple effect evaporators. [6]
- (b) An aqueous sodium chloride solution (10 wt %) is fed into a single effect evaporator at a rate of 10000 kg/hr. It is concentrated to a 20 wt % sodium chloride solution. The rate of consumption of steam in the evaporator is 8000 kg/hr. Calculate capacity (kg/hr) and economy of the evaporator. [7]

Or

8. (a) What is an evaporation ? Explain Calendria type evaporator with neat sketch. [8]
- (b) Define Boiling point elevation and explain Duhring's plot. [5]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[4757]-1069

S.E. (Chem.) Second Sem.) EXAMINATION, 2015

PRINCIPLES OF DESIGN

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

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

(iv) Assume suitable data, if necessary.

1. (a) A metal rod of 16 mm diameter is fractured at a tensile force of 90 kN. Another hollow circular rod of 25 mm inside diameter of same metal has to withstand a tensile force of 40 kN. Adopting a factor of safety 3, determine the required wall thickness. [6]

(b) Draw stress strain diagram for cast iron and explain in detail. [6]

P.T.O.

Or

2. (a) What is meant by 'stress concentration' ? How do you take it into consideration in case of a component subjected to dynamic loading ? [6]
- (b) A square pin is required to resist a pull of 40 kN and a shear force of 15 kN. Determine suitable section according to strain energy theory. The material of the pin has elastic limit 350 MPa and $\mu = 0.3$. Take F.O.S. = 2.5. [6]
3. (a) Design a muff coupling used to connect two shafts transmitting 95 kW at 400 rpm. The material of the shaft and key is plain carbon steel for which allowable shear and crushing stresses are 40 MPa and 80 MPa respectively. The material for the muff is cast iron which has permissible shear stress 15 MPa. Also check safety of the design in shear and crushing. Assume that $T_{\max} = 1.25 T_{\text{avg}}$. [8]
- (b) A line shaft is given to transmit it 100 kW at 300 rpm by means of a motor placed vertically below it. The pulley is overhang from the shaft at 400 mm from the bearing as shown in Fig. 1. The pulley is 1 m in diameter and has belt tensions

in the ratio 2 : 1. Find the diameter of the shaft if maximum allowable shear stress is 40 MPa. [6]

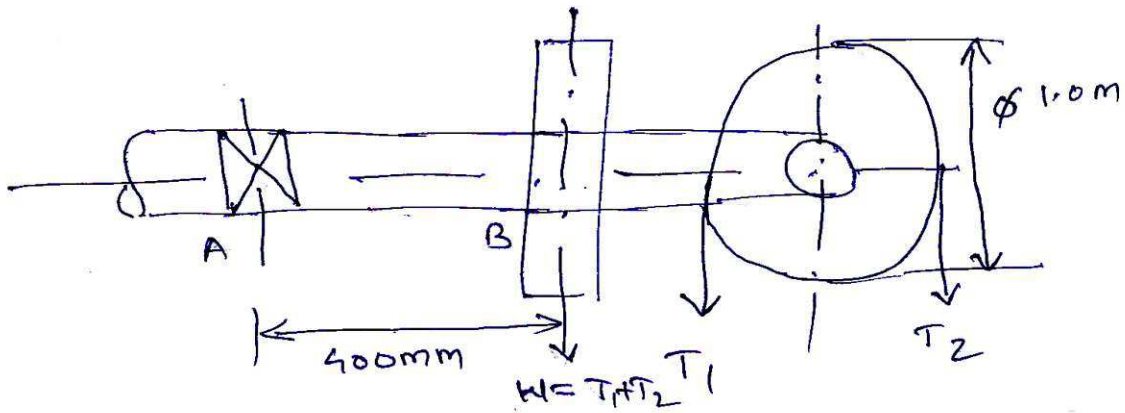


Fig. 1

Or

4. (a) Draw S.F. and B.M.D. for the simply supported beam shown in Fig. 2. Find maximum B.M. values along with their positions on the beam. Find point of contraflexure if any. [8]

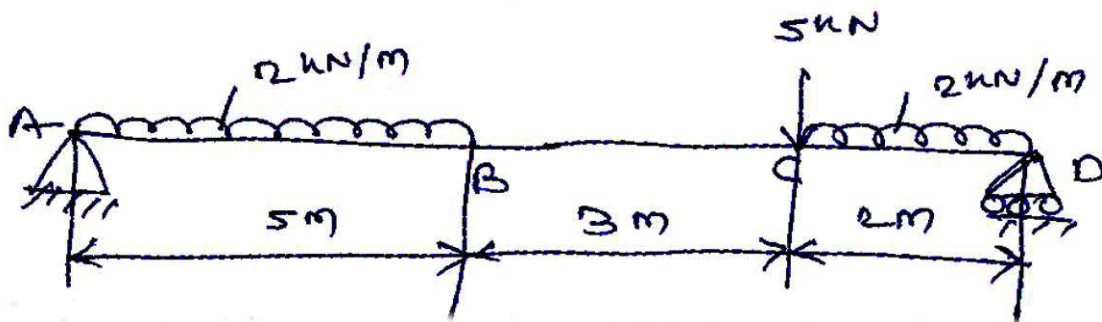


Fig. 2

(b) An automobile transmission shaft is required to transfer 45 kW at 500 rpm. The outside diameter must not exceed 50 mm and the maximum shear stress is not to exceed 84 MPa. Compare the weights of solid and hollow shafts which would just meet these requirements. Also find percentage saving in material if any. [6]

5. (a) What are various types of welding joints used in pressure vessels ? Discuss with neat sketches. [6]

(b) A leather belt weighing 2 kg/m is used to drive a cast iron pulley 800 mm in diameter at 300 r.p.m. if the angle of contact of the belt is spread over $\frac{5}{1.2}$ of the circumference and maximum tension in belt is 4000 N, find power capacity of the belt :

(i) considering the centrifugal tension and

(ii) without considering centrifugal tension.

The coefficient of friction of leather on cast iron is 0.35. [6]

Or

6. (a) A 100 mm long journal bearing supports a load of 3 kN on a 60 mm diameter shaft. The bearing has diametral clearance of 0.1 mm and the viscosity of the oil is 0.02 kg/m-s at the operating temperature. If the bearing can dissipate heat of 100 J/s, determine the maximum safe speed. Assume, $k = 0.002$. [6]
- (b) With neat sketches explain types of flanged joints used in pressure vessels. [6]
7. (a) A cylindrical shell of a vessel has an inside diameter 2 m and is subjected to an internal pressure 5 kg/cm². Calculate the required thickness and corresponding deflection. Allowable tensile stress of the material is 1020 kg/cm². [6]
- (b) Which joint in a vessel is stronger, circumferential or longitudinal ? How can the weak joint be reinforced ? What are the advantages of such reinforcement ? [6]

Or

8. (a) Calculate the thickness of a flanged torispherical head for a vessel having internal diameter 6000 mm. Design pressure of the vessel is 3.4 kg/cm². Inside crown radius is 6000 mm. Inside knuckle radius is 380 mm. Permissible stress of the material is 1190 kg/cm², welded joint efficiency is 100%. [6]

(b) A vessel is designed for an internal pressure 100 kg/cm^2 . A spiral wound metal fibre stainless steel gasket with inside diameter 36 cm and width 2.0 cm is used. Gasket factor is 3.0 while gasket seating stress is 675 kg/cm^2 .

Permissible stress for bolt material at atmospheric and operating condition is 1300 kg/cm^2 . Check whether the gasket width is sufficient to keep it away from crushing out ? [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1070

S.E. (Chemical) (Second Semester) EXAMINATION, 2015

MECHANICAL OPERATIONS

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Explain Cyclone Separator with neat diagram. [6]

(b) What is screen efficiency and screen effectiveness ? [6]

Or

2. (a) A material is crushed in a Blake Jaw Crusher such that the average size of particles is reduced from 50 mm to 10 mm with the consumption of energy of 13.0 kW(kg/s). What would be the

P.T.O.

consumption of energy needed to crush the same material of average particle size 75 mm to an average size of 25 mm :

(i) Assuming Rittinger's law applies

(ii) Assuming Kick's law applies.

Which of these results would be regarded as being more realistic and why ? [8]

(b) Explain the importance of screening in Chemical Industry. [4]

3. (a) Describe with a neat sketch the construction of Belt Conveyor. [6]

(b) Describe with a neat sketch the construction of Screw Conveyor. [6]

Or

4. (a) Describe with neat sketch construction of screw conveyor. List advantages and disadvantages. [6]

(b) Write short notes on : [6]

(i) Sigma Mixer

(ii) Ribbon Blender.

5. (a) Describe with a neat sketch the working of plate and frame filter press. [8]

(b) Explain the operating cycle of centrifuge filter. [5]

Or

6. (a) A rotary filter operating at 2 rpm, filters 1000 lit/min. operating under the same vacuum neglecting the resistance of the filtercloth, at what speed must the filter be operated to give a filtration rate of 2000 lit/min. [9]
- (b) Write a note on Bag Filters. [4]
7. (a) Calculate the settling velocity of glass spheres having a diameter of 1.554×10^{-4} m in water at 293.2 K. The slurry contains 60 wt% solid. The density of the glass spheres is 2467 kg/m^3 , density of water 998 kg/m^3 and viscosity of water is 1.005×10^{-3} Pa.s [9]
- (b) Write a note on Particulate fluidization. [4]

Or

8. (a) Write an explanatory note on Kynch Theory of Sedimentation. [9]
- (b) Distinguish between free settling and hindered settling. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1071

S.E. (Computer Engineering/Information Technology)

(Second Semester) EXAMINATION, 2015

ENGINEERING MATHEMATICS-III

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Attempt *four* questions : Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
(ii) Neat diagrams must be drawn wherever necessary.
(iii) Figures to the right indicate full marks.
(iv) Use of electronic non-programmable calculator is allowed.
(v) Assume suitable data if necessary.

1. (a) Solve (any *two*) : [8]
(i) $(D^2 + 9)y = x^3 - \cos 3x$
(ii) $(D^2 + 2D + 1)y = e^{-x} \log x$
(iii) $(2x + 1)^2 \frac{d^2y}{dx^2} - 6(2x + 1) \frac{dy}{dx} + 16y = 8(2x + 1)^2$.
(b) Find Fourier sine transform of $f(x) = e^{-x} \cos x$, $x > 0$. [4]

Or

2. (a) A resistance of 50 ohms, an inductor of 2 henries and a 0.005 farad capacitor are connected in series with e.m.f. of 40 volts and an open switch. Find the instantaneous charge and current after the switch is closed at $t = 0$, assuming that at that time charge on capacitor is 4 coulomb. [4]

P.T.O.

(b) Solve (any one) : [4]

(i) Find z -transform of $f(k) = \frac{\sin ak}{k}$, $k > 0$.

(ii) Find inverse z -transform of $\frac{3z^2 + 2z}{z^2 + 3z + 2}$, $1 < |z| < 2$.

(c) Solve difference equation : [4]

$$f(k + 2) - 3f(k + 1) + 2f(k) = 0, f(0) = 0, f(1) = 1.$$

3. (a) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. Obtain the first four central moments, mean, standard deviation and coefficient of skewness and kurtosis. [4]

(b) A manufacturer of electronic goods has 4% of his product defective. He sells the articles in packets of 300 and guarantees 90% good quality. Determine the probability that a particular packet will violate the guarantee. [4]

(c) Find the directional derivative of $xy^2 + yz^3$ at $(2, -1, 1)$ along the line $2(x - 2) = (y + 1) = (z - 1)$. [4]

Or

4. (a) In an intelligence test administered to 1000 students the average score was 42 and standard deviation 24. Find the number of students with score lying between 30 and 54.

(Given : For $z = 0.5$, area = 0.1915). [4]

(b) Prove (any one) : [4]

(i) $\nabla^2 \left(\frac{\bar{a} \cdot \bar{b}}{r} \right) = 0$

(ii) $\nabla \times \left(\frac{\bar{a} \times \bar{r}}{r} \right) = \frac{\bar{a}}{r} + \frac{(\bar{a} \cdot \bar{r})\bar{r}}{r^3}$.

- (c) Show that $\vec{F} = r^2\vec{r}$ is conservative. Obtain the scalar potential associated with it. [4]

5. (a) Evaluate : [4]

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

where $\vec{F} = (2x + y^2)\vec{i} + (3y - 4x)\vec{j}$ and

C is the parabolic arc $y = x^2$ joining (0, 0) and (1, 1).

- (b) Using Stokes theorem, evaluate : [5]

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

where C is the curve given by

$$x^2 + y^2 + z^2 - 2ax - 2ay = 0, \quad x + y = 2a.$$

- (c) Use divergence theorem to evaluate :

$$\iiint_S (x\vec{i} - 2y^2\vec{j} + z^2\vec{k}) \cdot d\vec{s}$$

where S is the surface bounded by the region $x^2 + y^2 = 1$ and $z = 0$ and $z = 1$. [4]

Or

6. (a) Apply Green's theorem to evaluate :

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

where C is the boundary of the area enclosed by the x-axis and the upper-half of the circle $x^2 + y^2 = 16$. [4]

- (b) Using Stokes theorem, evaluate

$$\iiint_S (\nabla \times \vec{F}) \cdot d\vec{s}$$

where $\vec{F} = 3y\vec{i} - xz\vec{j} + yz^2\vec{k}$ and 's' is the surface of the paraboloid $2z = x^2 + y^2$ bounded by $z = 2$. [5]

(c) Show that : [4]

$$\iiint_V \frac{2}{r} dv = \iint_S \frac{\vec{r} \cdot \hat{n}}{r} ds.$$

7. (a) Find the imaginary part of the analytic function whose real part is $x^3 - 3xy^2 + 3x^2 - 3y^2$. [4]

(b) Evaluate :

$$\oint_C \frac{z^2 + 1}{z^2 - 1} dz$$

where C is the circle : [4]

$$|z - 1| = 1.$$

(c) Find the bilinear transformation, which maps the points $z = -1, 0, 1$ on to the points $w = 0, i, 3i$ respectively. [5]

Or

8. (a) Show that analytic function $f(z)$ with constant amplitude is constant. [4]

(b) Evaluate the following integral using residue theorem :

$$\oint_C \frac{4 - 3z}{z(z - 1)(z - 2)} dz$$

where C is the circle :

$$|z| = \frac{3}{2}. [4]$$

(c) Find the image of the straight line $y = 3x$ under the transformation

$$w = \frac{z - 1}{z + 1}. [5]$$

Total No. of Questions—8]

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[4757]-1072

S.E. (Computer) (First Semester) EXAMINATION, 2015

DATA STRUCTURES AND PROBLEM SOLVING

(2012 COURSE)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

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

(iv) Assume suitable data, if necessary.

1. (a) Write a pseudo 'C' code to implement quick sort. Derive time complexity of quick sort in best and worst case. [6]

(b) Derive the code for the following message using Huffman encoding 'A B R A K A D A B R A'. [6]

Or

2. (a) Sort the following data using merge sort : [3]
[10, 5, 15, 3, 20, 1, 30, 9].

(b) Write recursive function to calculate a^b . [3]

P.T.O.

- (c) Create a binary tree from the following inorder and postorder traversals. Also write preorder traversal of the constructed tree : [3]

Postorder	Inorder
I	D
D	I
H	C
G	G
C	H
F	B
B	F
E	A
A	E

- (d) What is binary tree ? How is it different from a basic tree ? Explain with figures. [3]

3. (a) Write algorithm for Breadth First Traversal of the graph. Also write its complexity. [6]

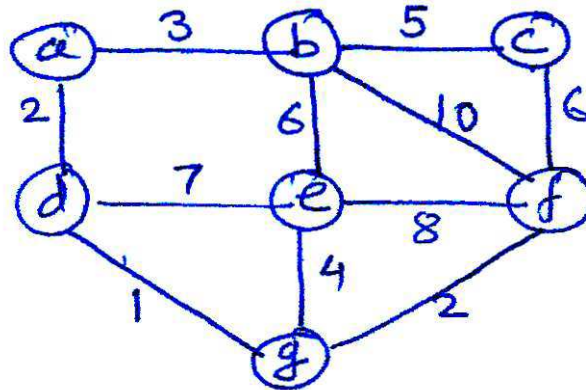
- (b) Construct the AVL tree for the following data :

20, 1, 2, 25, 15, 70, 30, 75, 10, 35.

Show clearly rotation used. [6]

Or

4. (a) Find the shortest path from a to f , in the following graph using Dijkstra's Algorithm. [6]



- (b) Write 'C' code for the following function w.r.t. AVL tree :
- (i) Rotate Left
 - (ii) Rotate Right. [3]
- (c) For the hash table size of 10 using hash function $F(\text{key}) = \text{key} \% 10$ insert the following keys :
- 65, 75, 25, 29, 85, 39, 36.
- Use linear probing with chaining. [3]
5. (a) Sort the following data in descending order using heap sort
85, 15, 25, 95, 145, 55, 165, 75.
Show all steps. [5]
- (b) Construct B+ tree of order 3 for the following data : [4]
10, 2, 30, 5, 90, 100, 50, 75, 35, 25.
- (c) Write 'C' program to read 10 integers from keyboard and store them in the file "My File". [4]

Or

6. (a) Create Min Heap for the following data using repeated insertion method 5, 7, 2, 3, 9, 1, 10. [4]
- (b) What is B tree ? Explain the procedure to delete node from B tree. [3]
- (c) Explain random access file and sequential file. [3]
- (d) Explain the following operation on sequential file :
- (i) Creation
 - (ii) Read
 - (iii) Insert. [3]
7. (a) Find the largest number among the following using parallel computation : [6]
- 10, 3, 2, 8, 30.
- (b) Write a parallel algorithm for odd even merge sort. [4]
- (c) Explain in detail parallel computation model. [3]

Or

8. (a) Explain the list ranking problem. Explain with example how will you solve it using pointer jumping techniques. [6]
- (b) Compute prefix sum (8, 2, -1, 5) using binary tree techniques. [4]
- (c) Write notes on : [3]
- (i) CRCW
 - (ii) EREW
 - (iii) CREW.

Total No. of Questions—8]

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[4757]-1073

S.E. (Computer Engg.) (First Semester) EXAMINATION, 2015

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4 and Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

(ii) Figures to the right indicate full marks.

(iii) Assume suitable data, if necessary.

1. (a) Minimize the following function using K-map and realize using logic gates : [4]

$$F(A, B, C, D) = \sum m (1, 5, 7, 13, 15)$$

$$+ d(0, 6, 12, 14)$$

(b) Convert the following : [2]

$$(46)_{10} = (?)_8$$

(c) List the differences between CMOS and TTL. [6]

P.T.O.

Or

2. (a) Convert the following numbers into binary numbers ? [4]
- (i) $(37)_8$
- (ii) $(25.5)_{10}$
- (b) Explain standard TTL characteristics in detail. [6]
- (c) Represent the following signed number in 2's complement method : [2]
- (i) +25
- (ii) -25
3. (a) Design a 3-bit excess 3 to 3-bit BCD code converter using logic gate. [6]
- (b) Design mod-5 synchronous counter using J-K flip-flop. [4]
- (c) Draw the excitation table of J-K flip-flop. [2]

Or

4. (a) Design a 4-bit binary to Gray code converter circuit using logic gates. [4]
- (b) Design a Mod 20 counter using decade counter IC7490. [6]
- (c) Perform the following : [2]
- $(11011)_2 + (0101)_2 = (?)_2$

5. (a) State and explain basic component of ASM chart ? Also explain the salient features of ASM chart. [7]
- (b) Write VHDL code 4 : 1 multiplexer using behavioural and data flow modelling style. [6]

Or

6. (a) Design a sequence generator circuit to generate the sequence 1-2-3-7-1 using Multiplexer controller based ASM approach. Consideration : [7]
- (i) If control input $C = 0$, the sequence generator circuit in the same state.
- (ii) If control input $C = 1$, the sequence generator circuit goes into next state.
- (b) Explain the following statements used in VHDL with suitable examples : [6]
- (i) CASE
- (ii) With select-when
- (iii) Loop statement.

7. (a) Comparison between PROM, PLA and PAL. [7]
- (b) Draw and explain the basic architecture of FPGA. [6]

Or

8. (a) A combinational circuits is defined by the function : 7

$$F_1(A, B, C) = \sum m (0, 1, 3, 7)$$

$$F_2(A, B, C) = \sum m (1, 2, 5, 6)$$

Implement this circuit with PLA.

(b) A combinational circuits is defined by the function : 6

$$F_1 (A, B, C) = \sum m (0, 1, 5, 6, 7)$$

Implement this circuit with PAL.

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1074

S.E. (Computer Engg.) (First Semester) EXAMINATION, 2015

OPERATING SYSTEM AND ADMINISTRATION

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :-** (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
(ii) Neat diagrams must be drawn wherever necessary.
(iii) Figures to the right indicate full marks.
(iv) Assume suitable data, if necessary.

1. (a) Draw and explain high level architecture of unix systems. [6]
(b) Write a short note on interrupts and exceptions. [4]
(c) Explain batch processing and multiprogramming. [2]

Or

2. (a) Explain 4 state process diagram. [6]
(b) What do you mean by user and hardware perspective of operating system ? [4]
(c) List any two functions of an OS. [2]

P.T.O.

3. (a) Explain organization of the file hierarchy tree. [6]
(b) Explain types of files in unix. [3]
(c) Explain input, output and error redirection. [3]

Or

4. (a) Explain the entire process of booting (system turn on to login prompt). [6]
(b) Differentiate between grub and LILO. [4]
(c) Define a shell. [2]
5. (a) Which *two* signals can never be ignored ? [2]
(b) Explain signal and kill function with parameters. [4]
(c) What are real effective and save ids. [3]
(d) Differentiate between nice and renice (with examples). [4]

Or

6. (a) Differentiate between user mode and kernel mode instructions. [4]
(b) How does a user level process change to kernel mode ? Explain. [2]
(c) Explain how kill function can be used to send signal to a group of processes also give the syntax of kill function. [4]
(d) What is the shadow password file ? Where does user password reside in unix. [3]

7. (a) Write a short note on RAID and its levels. [6]
(b) Explain the process of mounting and unmounting a pendrive. [4]
(c) Explain the fields in /etc/group file. [3]

Or

8. (a) What is meant by disk partitioning and disk formatting. [4]
(b) What is the native file of Linux and Unix. Differentiate between Unix and Linux. [4]
(c) What are the startup files ? What are its tasks ? [3]
(d) How to set the password for user account in linux/unix. [2]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1075

S.E. (Computer Engineering) (First Semester) EXAMINATION, 2015

MICROPROCESSOR ARCHITECTURE

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer any *four* questions, Q. No. 1 *or* Q. No. 2, Q. No. 3 *or* Q. No. 4, Q. No. 5 *or* Q. No. 6, Q. No. 7 *or* Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

1. (a) Explain and draw bit pattern for flag register of 80386 DX with significance of each bit. [6]
- (b) List the features of 80386 DX microprocessor. [3]
- (c) Explain in brief instruction queue to 8086 microprocessor. [3]

Or

2. (a) Explain architecture of 8086 microprocessor with the help of neat block diagram. [6]

P.T.O.

- (b) Explain the purpose of pointers and index registers. [3]
- (c) How many segment registers are used by 8086 ? Mention the use. [3]
3. (a) Differentiate between CALL and JMP. [3]
- (b) Explain control inputs BS16# with the help of timing diagram for 16-bit data transfer. [5]
- (c) Differentiate between direct index addressing mode and base index addressing mode. [4]
- Or*
4. (a) Explain protected mode & V86 mode. [4]
- (b) Explain the idle and wait state machine cycle with the help of timing diagram. [5]
- (c) Explain the following instruction with an example : [3]
- (i) ENTER
- (ii) LEAVE
- (iii) BOUND
5. (a) What are the advantages of multicore designing ? [3]
- (b) What are the advantages of cache memory ? [4]
- (c) Explain the execution model of SIMD with neat diagram. [6]

Or

6. (a) What are the advantages of Hyperthreading technology ? [4]
(b) What are the *three* common configuration that support multiprocessing ? Explain. [6]
(c) Define chip multiprocessing. [3]
7. (a) Give the features of SSE. [6]
(b) Enlist data types of 64-bit architecture. [3]
(c) Explain Hyperthreading with advantages and disadvantages. [4]

Or

8. (a) Draw and explain the block diagram of 64-bit architecture. [6]
(b) Explain virtualization technology. [4]
(c) Explain briefly the compatibility mode and 64-bit mode of IA 64 architecture. [3]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1076

S.E. (Computer) (Second Semester) EXAMINATION, 2015
OBJECT ORIENTED AND MULTICORE PROGRAMMING
(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B.** :— (i) Neat diagrams must be drawn wherever necessary.
(ii) Figures to the right side indicate full marks.
(iii) Use of calculator is allowed.
(iv) Assume suitable data if necessary.

1. (a) Explain the following terms with respect to object oriented programming : [8]
(1) Dynamic look-up
(2) Delegation
(3) Implicit and Explicit Function
(4) Merits and demerits of friend function.
- (b) What are different formatting activities supported by Stream manipulators ? Support with suitable examples. [4]

Or

2. (a) What is abstraction ? Why is it important ? Describe abstract base class. Illustrate an example to explain it. [8]

P.T.O.

- (b) What do you mean by type conversion ? Explain the same with example. [4]
3. (a) What is the importance of Process control block ? Explain its structure. [4]
- (b) Explain challenges in multicore software development. [4]
- (c) What is overloading template ? Explain it with an example. [4]

Or

4. (a) Explain data-race and deadlocks in multicore programming. [8]
- (b) Explain the exception handling mechanism in C++. [4]
5. (a) Explain the different attributes of the pthread_attr_t object which can be modified by the creator of the thread. [9]
- (b) Explain the significance of hardware thread and software thread. [4]

Or

6. (a) Explain thread priorities and the different thread scheduling policies. [9]
- (b) Compare process context and thread context. [4]

7. (a) Explain Interprocess Communication (IPC) and explain any *two* ways of implementing IPC. [8]
- (b) Write a note on “Critical Section”. [5]

Or

8. (a) Explain the use of semaphores and mutex to prevent race conditions and deadlocks. [8]
- (b) Explain messages queues as the IPC mechanism. [5]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1077

S.E. (Computer Engineering) (Second Semester) EXAMINATION, 2015

MICROPROCESSOR AND INTERFACING TECHNIQUES

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Answer total *four* questions. Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

1. (a) What are different components of MS-DOS ? Explain DOS loading with the help of neat diagram. [8]

(b) Compare 8086, 80386 and i7 processor on the basis of architectural features. [4]

Or

2. (a) Draw and explain block diagram of 8259APIC. [8]

(b) Write the initialization instructions of 8259A PIC, to meet the following specifications : [4]

(i) Interrupt type 32

P.T.O.

- (ii) Edge Triggered, single and ICW4 needed, interval of 8
- (iii) Mask IR1 & IR3 interrupts.

3. (a) Draw and explain I/O of BSR mode of 8255 with appropriate control word formats. [4]
- (b) Draw and discuss internal block diagram of 8251 USART. [6]
- (c) Define Resolution and Offset error terms of ADC. [2]

Or

4. (a) Design a control word format for square wave generator with 1ms period, the input frequency for 8253 is 1 MHz. [4]
- (b) Draw and explain the following 8279 commands : [4]
- (i) Keyboard/Display mode set command
 - (ii) Read FIFO/Sensor RAM command.
- (c) Explain with neat diagram sequence of DMA operation. [4]
5. (a) Draw and discuss the interface between 8086 and 8087. [7]
- (b) With proper timing diagram explain Read cycle in minimum mode of 8086 microprocessor. [6]

Or

6. (a) With the help of neat diagram explain minimum mode configuration of 8086. [6]

- (b) Draw and explain format of control and status word of 8087 NDP. [4]
- (c) Explain the following 8087 instructions with *one* example each : [3]
- (i) FSQRT
- (ii) FLDZ
- (iii) FADD
7. (a) Explain the features of 82801 IJR I/O Controller Hub. [5]
- (b) Draw and explain block diagram of X58 Chipset. [8]
- Or*
8. (a) Draw and explain block diagram of i5 motherboard. [8]
- (b) Write a short note on Intel's QPI Technology. [3]
- (c) Explain ICH10 PCI Interface. [2]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1078

S.E. (Computer) (Second Semester) EXAMINATION, 2015

COMPUTER GRAPHICS AND GAMING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—**
- (i) Neat diagrams must be drawn wherever necessary.
 - (ii) Assume suitable data, if necessary.
 - (iii) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

1. (a) Describe Frame buffer display in computer graphics. [4]
(b) Explain display file and its structure. [4]
(c) Explain Bresenham's Line drawing algorithm. [4]

Or

2. (a) Write short notes on : Persistence, Resolution, Aspect ratio. [4]
(b) Write the properties of video display devices. [4]
(c) Using DDA algorithm find out which pixels would be turned on for the line with end points(1, 1) to (5, 3). [4]

P.T.O.

3. (a) Write Cohen-Sutherland line clipping algorithm. [4]
(b) Explain concept of viewing parameters with an example. [4]
(c) What is meant by coherence and how it can increase the efficiency of scan line polygon filling. [4]

Or

4. (a) Write the transformation matrix for translation and scaling. [2]
(b) Write algorithm to fill the polygon area using flood fill method. [4]
(c) Explain the concept of 2D rotation about an arbitrary point with matrix representation. [6]
5. (a) Compare RGB and HSV color model. [3]
(b) Explain the procedure to generate B-spline curve. [4]
(c) What is surface shading algorithm ? Explain phong shading. [6]

Or

6. (a) What are the advantages of Warnock's algorithm ? [3]
(b) Explain the concept of reflection, shadows and ray tracing. [4]
(c) Explain Hilbert's curve with an example. [6]

7. (a) What are the applications of morphing ? [3]
(b) Write a short note on 3D maxstudio or Maya. [4]
(c) Describe the various operations carried out on the segment. [6]

Or

8. (a) Explain image transformations with example. [3]
(b) Write advantages and disadvantages of segments. [4]
(c) Draw block diagram of i860. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1079

S.E. (Computer) (Second Semester) EXAMINATION, 2015

COMPUTER ORGANIZATION

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7
or Q. 8.

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

1. (a) Differentiate between microprocessor and micro-
controller. [6]

(b) What is the need of coprocessor ? How is it interface with
CPU ? [6]

P.T.O.

Or

2. (a) What are the factors to be considered for processor level parallelism ? [6]
- (b) Differentiate between RISC and CISC. [6]
3. (a) Explain the design of multiplier control unit using Delay Element method. [6]
- (b) What is microprogrammed control unit design ? Draw and explain basic structure of micro-programmed control unit. [7]

Or

4. (a) Write a short note on sequential ALU. [7]
- (b) Write and explain control sequence for ADD [R3], R1. [6]
5. (a) Compare memory mapped I/O and IO mapped I/O. [4]
- (b) What are different types of bus interfaces ? Explain in detail USB bus organization. [8]

Or

6. (a) Write a short note on Intel Nehalem memory organization. [6]
- (b) What is need of DMA ? How it works ? [6]

7. Write short notes on (any *two*) : [13]

- (i) AMD Multicore Opteron
- (ii) IBM Cell Broadband Engine
- (iii) Power PC.

Or

8. (a) What do you mean by 64 bit architectures ? What are features of it ? [6]

(b) What are the features of IA-64 model ? [7]

Total No. of Questions—8]

[Total No. of Printed Pages—7

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[4757]-1080

S.E. (Computer) (First Semester) EXAMINATION, 2015

DISCRETE STRUCTURE

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Neat diagrams must be drawn wherever necessary.

(ii) Figures to the right indicate full marks.

(iii) Assume suitable data, if necessary.

1. (a) In the first year computer science class of 80 students, 50 knew COBOL, 55 'C' and 46 PASCAL. It was also known that 37 knew 'C' and COBOL, 28 'C' and PASCAL, and 25 PASCAL and COBOL. 7 students however knew none of the language. [4]

(i) How many knew all the three languages ?

(ii) How many knew exactly two languages ?

(iii) How many knew exactly one language ?

P.T.O.

(b) Let n be a positive integer S_n , be the set of all divisors of n .
Let D denote the relation of 'division'. Draw the diagrams of
lattices for : [4]

(i) $n = 24$

(ii) $n = 30$

(iii) $n = 6$.

(c) Negate each of the statement : [4]

(i) $\forall x, |x| = x$

(ii) $\exists x, x^2 = x$

(iii) If there is a riot, then someone is killed.

(iv) It is day light and all the people are arisen.

Or

2. (a) Find the transitive closure of the relation R on : [4]

$A = \{1, 2, 3, 4\}$ defined by

$R = \{(1, 2), (1, 3), (1, 4), (2, 1), (2, 3), (3, 4), (3, 2), (4, 2),$
 $(4, 3)\}$

(b) Prove by mathematical induction that for : $n \geq 1$: [4]

$$1.1! + 2.2! + 3.3! + \dots + n.n! = (n + 1)! - 1$$

(c) Let $f(x) = x + 2$, $g(x) = x - 2$ [4]

$h(x) = 3x$ for $x \in \mathbb{R}$ where \mathbb{R} is the set of real number,

find :

(i) $g \circ f$

(ii) $f \circ g$

(iii) $f \circ f$

(iv) $h \circ g$

(v) $g \circ g$

(vi) $f \circ h$

(vii) $h \circ f$

(viii) $f \circ h \circ g$

3. (a) Show that in a connected planar graph with 6 vertices and 12 edges, each of the regions is bounded by 3 edges : [5]

(b) Show that $(G/N, *)$ is a group. [4]

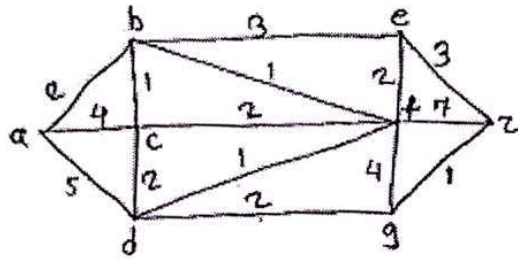
(c) Explain the terms : [4]

(i) Homomorphism of Group

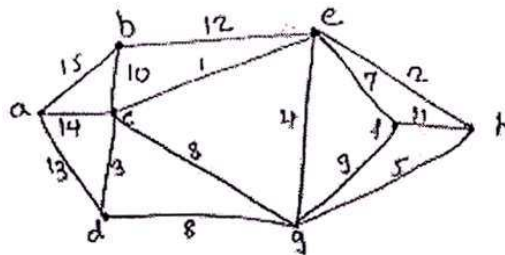
(ii) Automorphism of Group.

Or

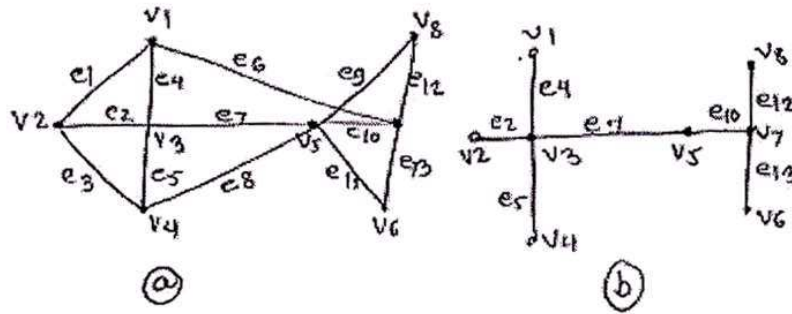
4. (a) Find the shortest path between $a-z$ for the given graph : using Dijkstra's algorithm. [6]



- (b) Show that $R = \{a + b; b \mid\}$ for the operation $+$, $*$ is an integral domain but not a field. [5]
- (c) Explain the term Eulerian path and Eulerian circuit with example. [2]
5. (a) Obtain the minimum spanning tree using Kruskal algorithm for the following graph. Obtain the total cost of minimum spanning tree. [7]



- (b) Find the fundamental system of cut-set for the graph G shown below with respect to the spanning tree T. [5]



Or

6. (a) A secondary storage media contains information in files with different formats. The frequency of different types of files is as follows. Exe (20), bin(75), bat(20), jpeg(85), dat(51), doc(32), sys(26), c(19), cpp(25), bmp(30), avi(24), prj (29), 1st(35), zip(37). Construct the Huffman code of this. [6]
- (b) Explain : [6]
- (i) Eccentricity of a vertex
 - (ii) Cut points
 - (iii) Level and height of a tree.

7. (a) Suppose license plate contains 3 English letters followed by 4 digits : [7]
- (i) How many different license plates can be manufactured if repetition of letters and digits are allowed ?
- (ii) How many plates are possible if only the letters are repeated ?
- (iii) How many plates are possible if only the digits are repeated ?
- (b) Out of 4 officers and 10 clerks, a committee of 2 officers and 3 clerks is to be formed. In how many ways committee can be done if : [6]
- (i) Any officer and any clerk can be included.
- (ii) A particular clerk must be in committee.
- (iii) A particular officer cannot be in committee.

Or

8. (a) A student is to answer 10 out of 13 questions in an exam : [6]
- (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.

(b) 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 : [7]

(i) B wins

(ii) C wins

(iii) B or C wins.

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1082

S.E. (IT) (First Semester) EXAMINATION, 2015

COMPUTER ORGANISATION

(2012 COURSE)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,

Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) With suitable diagram explain in brief Von Neumann Architecture. [6]

(b) Explain in brief functions of the following pins of 8086 : [6]

(i) ALE

(ii) \overline{RD}

(iii) MN/\overline{MX} .

P.T.O.

Or

2. (a) Draw flow chart and explain Booth's Algorithm for two's complement multiplication. [6]
- (b) Draw neat diagram of internal architecture of 8086 and explain any *one* block. [6]
3. (a) What are interrupts ? Explain interrupts of 8086. [6]
- (b) Explain with suitable diagram multiple bus organization of CPU. [7]

Or

4. (a) What is segmentation ? List segment registers of 8086 and explain its use in brief. [6]
- (b) Explain with suitable diagram hardwired control method for design of control unit. [7]
5. (a) Explain direct mapping technique used in Cache memory. [6]
- (b) What is TLB ? Explain its use with suitable diagram. [6]

Or

6. (a) List the different types of internal memory explain any *two* in brief. [6]
- (b) Write a short note on optical memories. [6]

7. (a) Draw block diagram of 8255 PPI and explain it. [7]
(b) What is DMA ? Explain with neat diagram. [6]

Or

8. (a) Compare serial V/s parallel I/O. Explain features of serial I/O USART 8251. [7]
(b) List various bus standards interfaces. Explain any *one* in detail with suitable diagram. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1083

S.E. (I.T.) (First Semester) EXAMINATION, 2015

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4
and Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Represent the following decimal numbers in single precision
floating point format : [6]

(i) 255.5

(ii) 110.65

(b) What do you mean by open collector output ? Explain
with suitable circuit diagram. What is the advantage of this
output ? [6]

P.T.O.

Or

2. (a) Perform 2's complement arithmetics of : [6]
- (i) $(7)_{10} - (11)_{10}$
 - (ii) $(-7)_{10} - (11)_{10}$
 - (iii) $(-7)_{10} + (11)_{10}$

(b) Draw suitable circuit diagram and explain the drawback of WIRED_OR TTL GATE ? [6]

3. (a) What is race around condition ? Explain with the help of timing diagram. How is it removed in basic flip-flop circuit ? [6]
- (b) Design a sequence generator using shift register and decoder circuit to generate the sequence1101011..... . [7]

Or

4. (a) How will you convert the basic SR-flip-flop (SR-FF) into JK-flip-flop ? [6]
- (b) Design a MOD-11 counter using IC7490. Show states with the help of timing diagram. [7]

5. (a) Draw the basic structure FPGA. Explain its feature in brief. [6]
- (b) Implement the following function using programmable logic device : [6]
- (i) $F1 = \sum m (0, 3, 4, 7)$
 - (ii) $F2 = \sum m (1, 2, 5, 7)$

Or

6. (a) Draw the basic structure of CPLD. Explain its features in brief. [6]
- (b) Design a BCD to Excess-3 code convertor using suitable programmable logic device. [6]
7. (a) State and explain different data types supported by VHDL. [6]
- (b) Write features of VHDL. Explain entity architecture declaration for 2 bit NOR and AND gate. [7]

Or

8. (a) State and discuss different types of operators used in VHDL. Give precedence of these operators. [6]
- (b) Describe different modelling styles of VHDL with suitable example. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1084

S.E. (I.T.) (First Semester) EXAMINATION, 2015

FUNDAMENTALS OF DATA STRUCTURES

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,

Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data if necessary.

1. (a) Explain various bitwise operators in C. Give example of each operator. [4]

(b) Illustrate the difference between Union and Structure with suitable example. [4]

(c) Write a C program to swap two numbers using call by reference. [4]

P.T.O.

Or

2. (a) What is pointer variable ? Explain declaration, initialization and accessing a pointer variable with an example. [4]
- (b) Explain arrays with example. [4]
- (c) Explain if and switch-case decision control statement. [4]
3. (a) Define the following terms with example : [6]
- (i) Data object
- (ii) Data structure
- (iii) Data type
- (b) Sort the following and show the status of every pass using selection sort 34, 9, 78, 65, 12, -5. [6]

Or

4. (a) Compare linear and non-linear, static and dynamic, primitive and non-primitive data structure. [6]
- (b) Sort the following data to ascending order using quick sort. Show all passes with pivot : 17, 8, -9, 2, 0, -5, 7, 20, 11, 15. [6]

5. (a) Define polynomial. Represent the following polynomial using array : [7]

(i) $x^3 + x^2 + x + 16$

(ii) $x^5y^4 + x^3y^3 + x^2 + y^2 + 10$

(b) Explain simple and fast transpose of a sparse matrix with example. [6]

Or

6. (a) Explain sequential memory organization with example. [6]

(b) Explain the two-dimensional array in detail with column and row major representation and address calculation in both the cases. [7]

7. (a) What are the advantages of linked list over array ? Describe different types of linked list. [7]

(b) Write a C function to perform the following operation on SLL : [6]

(i) Insert element at any position

(ii) Reverse the list without using any DS.

Or

8. (a) Write C function to delete any node in case of DLL. [6]

(b) Explain the concept of GLL and represent the following
GLL : [7]

(i) $((a, b), (c, d), e)$

(ii) $(a, (b, c), d)$

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[4757]-1085

S.E. (Information Technology) (First Semester) EXAMINATION, 2015

PROBLEM SOLVING & OBJECT ORIENTED

PROGRAMMING CONCEPTS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.

SECTION I

1. (a) What are the various types of modules ? Explain the term coupling and cohesion related to module. [6]
- (b) What is the difference between an expression and equation ?
Write an equation to calculate the following : [4]
- (i) The average of five numbers.

P.T.O.

(ii) The sale price of an item given an original price and a percentage discount.

(iii) The amount when the principal, interest and period of time is given.

(c) Evaluate for $A = 5$, $B = 3$ and $C = 2$: [2]

(i) $F = A * C \setminus (A + C)$

(ii) $F = (C * (B + 3 * A) + 5 * A) / C$

Or

2. (a) Design an algorithm to calculate the salary of an employee using the following problem solving strategies : [8]

(i) Sequential logic

(ii) Decision logic

(iii) Loop logic

(iv) Selection logic

To calculate the salary consider designation, no. of days worked, wages per day, basic salary, allowances and deductions. Calculate salary according to designation of employee.

(b) Define Algorithm. What are the various types of algorithm ? Explain them with suitable example. [4]

3. (a) 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. [6]

(b) Explain how the polymorphism is achieved in C++ with suitable examples. [6]

Or

4. (a) Define constructor and destructor. Explain various types of constructors with syntax. [6]

(b) Explain the algorithm to count the number of times a particular word occurs in a text. [6]

5. (a) Explain with a suitable example how code reusability is achieved in C++. [6]

(b) What are the various rules for overloading the operators ? [4]

(c) Define Friend Class. Explain the concept of forward declaration of a class. [3]

Or

6. (a) Define inheritance. Explain various types of inheritance with suitable example. [10]
- (b) What is an operator function ? Describe the syntax of an operator function. [3]
7. (a) What is generic programming ? How is it implemented in C++ ? [3]
- (b) Define exception. Explain various types of exception with example. [10]

Or

8. (a) Describe briefly the features of I/O system supported by C++. [4]
- (b) Explain how the exception is handled in C++. [4]
- (c) What is STL ? Explain various components of STL. [5]

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[4757]-1086

S.E. (I.T.) (Second Semester) EXAMINATION, 2015

DATA STRUCTURES AND FILES

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Answer *four* questions.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Change the following infix to postfix using stack. Clearly indicate the content of stack : [6]

(i) $(A + B) * C - D * F + C.$

(ii) $(A - 2) * (B + C - D * E) * F.$

(b) Explain the implementation of circular queue using sequential organization. [6]

P.T.O.

Or

- 2.** (a) Implement Stack as an ADT using linked Organization. [6]
- (b) Specify which of the following application would be suitable for a first-in-first-out queue and justify your answer : [4]
- (i) A program is to keep track of patients as they check into a clinic, assigning them to doctors on a first come, first served basis.
- (ii) An inventory of parts is to be processed by part number.
- (iii) A dictionary of words used by spelling checker is to be created.
- (iv) Customers are to take numbers at a bakery and be served in order when their number come-up.
- (c) Define Multiqueues. [2]
- 3.** (a) Write a function for creating Binary Search Tree. [4]

- (b) 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	1	0	0
B	1	0	0	0	1	0	0	0
C	1	0	0	1	0	0	0	0
D	0	0	1	0	0	0	0	1
E	0	1	0	0	0	0	0	1
F	1	0	0	0	0	0	1	0
G	0	0	0	0	0	1	0	1
H	0	0	0	1	1	0	1	0

Find all the nodes adjacent to node A, node F and node G.

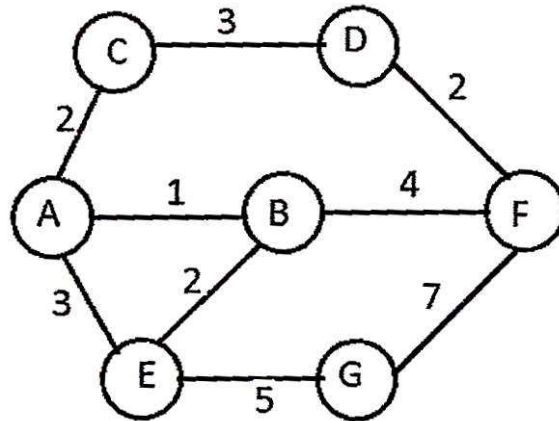
Or

4. (a) Construct a binary tree from the given traversals : [4]

Pre-order : * + a - b c / - d e - + f g h

In-order : a + b - c * d - e / f + g - h

- (b) With example define the following terms wrt graphs : [4]
- (i) Degree of node
 - (ii) Isolated node
 - (iii) Path
 - (iv) Cycle.
- (c) For the given graph show stepwise representation of MST using Kruskal's algorithm. [4]



5. (a) Create a Huffman's tree for the given data set and find the corresponding Huffman's codes : [6]

Data	Weight
A	10
B	3
C	4
D	15
E	2
F	4
G	2
H	3

- (b) Create hash table and resolve collision using linear probing with replacement : [4]

Table Size = 10 Hash Function = $\text{key} \% 10$

9, 45, 13, 59, 12, 75, 88, 11, 105, 46

- (c) Consider hash table in Q5b. After the hash table is 70% full apply rehashing and resolve collision for the same data. [4]

Or

6. (a) Construct an AVL search tree by inserting the following elements in the order of their occurrence. Show the balance factor and type of rotation at each stage : [6]

55, 66, 77, 15, 11, 33, 22, 35, 25, 44, 88, 99

- (b) Write C++ program to implement priority queue using a Heap Data Structure. [8]

7. (a) Distinguish between logical and physical deletion of records and illustrate it with example. [6]

- (b) With the prototype explain the inbuilt functions in 'C' language for reading and writing character and record in a file. [6]

Or

8. (a) Explain different file opening mode with example in C++. [6]
- (b) Explain the concept of : [6]
- (i) Primary Indexes
 - (ii) Clustering Indexes
 - (iii) Secondary Indexes.

Total No. of Questions—8]

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[4757]-1087

S.E. (I.T.) (Second Semester) EXAMINATION, 2015

FOUNDATION OF COMPUTER NETWORKS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
(ii) Figures to the right indicate full marks.
(iii) Assume suitable data, if necessary.
(iv) Neat diagrams must be drawn wherever necessary.

1. (a) Distinguish between baseband transmission and broadband transmission. [4]
(b) Explain pulse code modulation. [4]
(c) List the line coding schemes in digital transmission. Explain Polar NRZ scheme. [4]

Or

2. (a) Explain various transmission impairments in detail. [6]
(b) Draw and explain FDM and TDM. [6]
3. (a) Explain ISO-OSI model in detail. [8]
(b) Write a short note on Virtual circuit networks. [5]

P.T.O.

Or

4. (a) Explain with suitable example guided transmission media and unguided transmission media. [8]
(b) Write a short note on TCP/IP protocol stack. [5]
5. (a) Discuss the concept of redundancy in error detection and correction. [8]
(b) Explain linear code block. [5]

Or

6. (a) Explain Go-back-N automatic repeat request protocol. [5]
(b) What is Checksum ? Describe in detail internet checksum method with suitable example. [8]
7. (a) Discuss CSMA/CD random access technique. How is collision avoidance achieved in the same ? [7]
(b) Explain TDMA and FDMA. [5]

Or

8. (a) Compare and contrast FDMA and CDMA in detail. [8]
(b) Explain PPP in detail. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1088

S.E. (Information Technology) (Second Semester) EXAMINATION, 2015

PROCESSOR ARCHITECTURE AND INTERFACING

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Draw the figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Differentiate between procedure and macro. [6]

(b) Explain difference between 80386 pipelined and non-pipelined bus cycle with neat diagram. [6]

Or

2. (a) Explain the following assembler directives :

(i) Public and Extrn

(ii) .Org

(iii) : Model [6]

P.T.O.

- (b) State and explain the significance of any *three* interrupt related signals of the 80386. [6]
3. (a) Draw and explain the logical address to physical address translation with paging in 80386 processor. [6]
- (b) What is virtual mode ? How to switch from protected mode to virtual 86 mode. [6]

Or

4. (a) Write down the steps to switch from Real Mode (RM) to Protected Mode (PM). [6]
- (b) Explain the difference between 3 operating models of 80386. [6]
5. (a) Identify and justify addressing mode of the following 8051 instructions : [6]
- (i) MOV @ RO, A
- (ii) MOV B, 50H
- (iii) DIV AB.
- (b) List SFR's used in 8051. Draw and explain SCON and TCON. [7]

Or

6. (a) Explain the following instructions in 8051 : [6]
- (i) MUL AB
 - (ii) SWAP A
 - (iii) MOV DPTR, #3000H
- (b) List the features of 8051 microcontroller. Draw and explain architecture of 8051. [7]
7. (a) How many interrupts are there in 8051 ? List them according to their priority. Explain the IP register structure. [7]
- (b) Explain any *two* operating modes of timer used in 8051. [7]

Or

8. (a) List and classify 8051 interrupts. [7]
- (b) Draw and explain formats of SBUF and IE. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[4757]-1089

S.E. (Information Technology) (Second Semester)

EXAMINATION, 2015

COMPUTER GRAPHICS

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :— (i) Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.

(ii) Figures to the right indicate full marks.

(iii) Neat diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

1. (a) List the methods for character generation. Explain any *one* character generation method briefly. [6]

(b) Describe the 2-D transformation matrix for rotation about arbitrary point. [6]

Or

2. (a) Write C code for Bresenham's line drawing algorithm. [6]

P.T.O.

- (b) Find out the final co-ordinates of a figure bounded by the co-ordinates (1, 1), (3, 4), (5, 7) and (10, 3) when scaled by two units in X direction and three unit in Y direction. [6]
3. (a) Explain Cohen-Sutherland Line Clipping method with suitable example. [6]
- (b) Explain 3D transformation-Rotation about arbitrary axis. [6]

Or

4. (a) Explain with example Window to Viewport transformation. [6]
- (b) Explain parallel and perspective projection with diagram. [6]
5. (a) Explain the difference between RGB and CMY(K) color model. [6]
- (b) What is colour mixing ? Explain in detail. [7]

Or

6. (a) What is half-toning and shading ? Explain any *one* type of shading. [6]
- (b) Explain HSV color model and also compare it with RGB color model. [7]

7. (a) Explain Hilbert curve in detail. [6]
(b) Explain Bezier curve generation using midpoint subdivision. [7]

Or

8. (a) Explain the technique of smoothing of curves using B-Spline. [6]
(b) Explain algorithm for fractal lines. [7]

Total No. of Questions—8]

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[4757]-1090

S.E. (Information Technology) (I Semester) EXAMINATION, 2015

DISCRETE STRUCTURE

(2012 Pattern)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) Prove the statement is true using mathematical induction : [6]

$$n^3 + 2n \text{ is divisible by } 3 \text{ for all } n \geq 1$$

(b) Find the transaction closure by using Warshall's algorithm for the given relation as : [6]

$$R = \{(1, 1), (1, 4), (2, 1), (2, 2), (3, 3), (4, 4)\}.$$

P.T.O.

Or

2. (a) Solve the following recurrence relation : [6]

$$a_n - 7a_{n-1} + 10a_{n-2} = 0, a_0 = 0, a_1 = 3$$

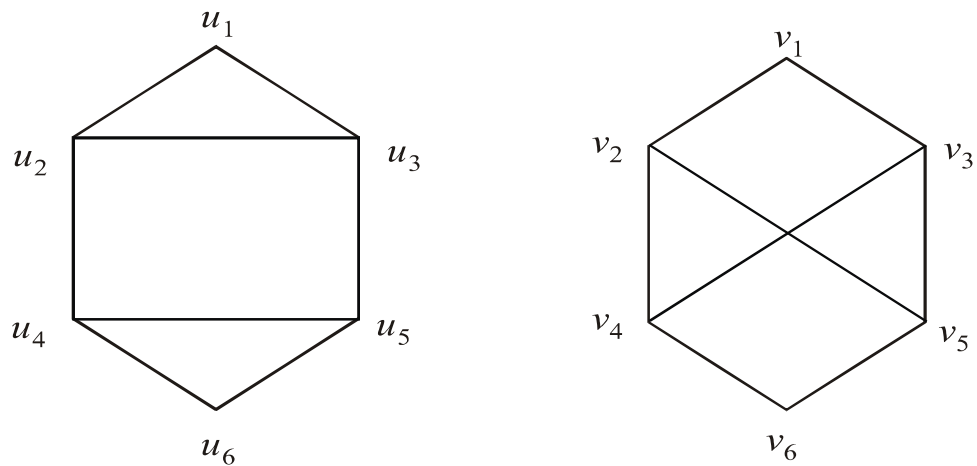
- (b) A survey of 70 high school students revealed that 35 like folk music, 15 like classical music, and 5 like both. How many of the students surveyed do not like either folk or classical music ? [6]

3. (a) Determine whether the following sets together with binary operation represent a group. If so, determine if it is abelian or not, specify the identity & inverse. [6]

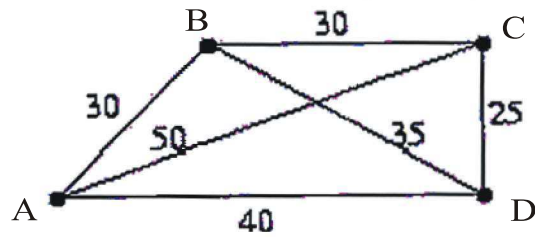
(i) Set of odd integers, binary operation : multiplication

(ii) Set of all rational numbers binary operation : addition.

- (b) (i) Determine graph G and H shown in figure are isomorphic or not ? Justify your answer. [6]

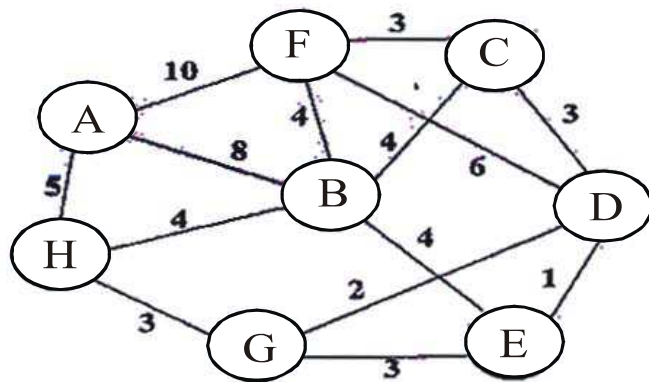


(ii) Find the Hamiltonian circuit using nearest neighbor method

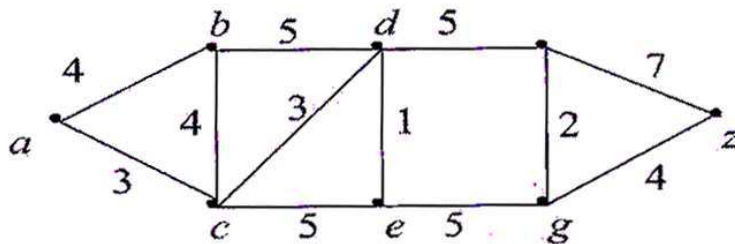


Or

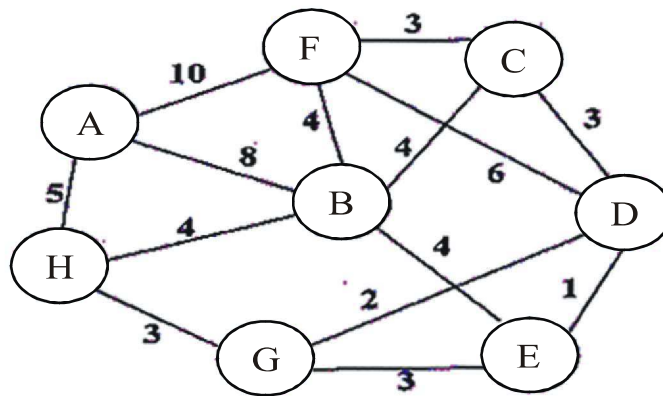
4. (a) Find minimum spanning tree and its minimum weight using Prim's algorithm. [6]



- (b) Find the shortest path using Dijkstra's algorithm for the given graphs. [6]

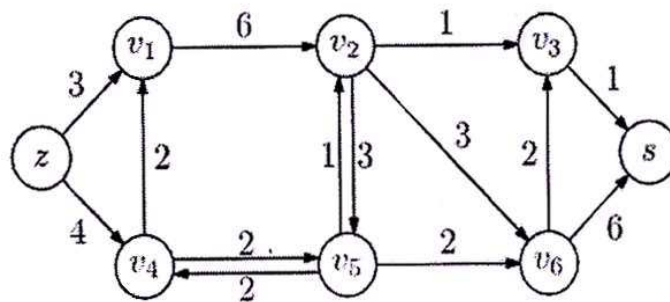


5. (a) Construct an optimal binary tree for the set of weights as $\{15, 22, 9, 11, 10, 13, 8\}$. Find the weight of an optimal tree. Also assign the prefix codes and write the code words. [6]
- (b) Find the minimum spanning tree and weight of it for the given graph using Kruskal's algorithm. [7]



Or

6. (a) Find the maximum flow for the following transport network. [6]



(b) Construct a binary tree with the inorder traversal as 3, 5, 6, 7, 10, 12, 13, 15, 16, 18, 20, 23 and preorder traversal as 15, 5, 3, 12, 10, 6, 7, 13, 16, 20, 18, 23 [7]

7. (a) A die is rolled and a coin is tossed, find the probability that the die shows an odd number and the coin shows a head. [4]

(b) In how many ways can 6 men and 5 women be seated in a line so that no two women sit together ? [3]

(c) What is the number of ways of choosing 4 cards from a pack of 52 playing cards ? In how many of these : [6]

(i) Four cards are of the same suit

(ii) Four cards belong to four different suits

(iii) Cards are of same color.

Or

8. (a) A basket contains 30 apples, 20 pears and 10 peaches. What is the probability that the first piece of fruit taken from the basket will be a peach ? [4]

- (b) In how many ways can three prizes be distributed among four winners so that no one gets more than one prize ? [3]
- (c) An 8 member team is to be formed from a group of 10 men and 15 women. In how many ways can the team be chosen if: [6]
- (i) The team must contain 4 men and 4 women
 - (ii) There must be more men than women
 - (iii) There must be at least two men.