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[5352]-501

**S.E. (Civil) (I Sem.) EXAMINATION, 2018**  
**BUILDING TECHNOLOGY AND MATERIALS**  
**(2015 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) Assume suitable data, if necessary.
- (iv) Use of non-programmable scientific calculator is allowed.

- Q 1 a) Write a short note on : causes of failure of foundations. 5  
b) Explain in depth Reinforced Brick Masonry. 5  
OR
- Q 2 a) Write a short note on silica bricks, considering following points: ingredients, 6  
properties, applications.  
b) Write a short note on “slip formwork” 4
- Q 3 a) Write a short note on :functional requirements of flooring. 4  
b) Explain in depth i) folding doors ii) casement window. 6  
OR
- Q 4 a) Write a short note on pneumatic structures. 5  
b) Write a short note on “construction of an arch” 5
- Q 5 a) Write a short note on i) lifts andii) escalators . 8  
b) Explain in depth , “pointing”. 7  
OR
- Q 6 a) Design a dog legged staircase using following data: i) Floor to floor height- 3.2 m, 7  
ii) Riser- 160 mm, iii) Tread : 275 mm, iv) Landing width- 1.2 m (observed on  
either side of flight). Find the internal dimensions of staircase room. Draw the  
plan for the same.  
b) Write a short note on “wall cladding and white washing”; considering following 8  
points- meaning, purpose, material, process.

P.T.O.

- Q 7 a) Write a short note on :application of i) ceramic and ii) ecofriendly materials in construction industry. 8
- b) Explain in depth "Shoring". 7
- OR
- Q 8 a) Write a short note on : application of i) aluminum and ii) timber in construction industry. 8
- b) Write a short note on "causes and prevention of accidents" on construction site. 7

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[5352]-502

**S.E. (Civil) (First Semester) EXAMINATION, 2018**  
**STRENGTH OF MATERIAL**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :-** (i) Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6 and Q. Nos. 7 or 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 stepped bar is subjected to axial forces as shown in fig.1 Determine the total deformation of the bar. Take  $E_1 = E_2 = E_3 = 200\text{GPa}$

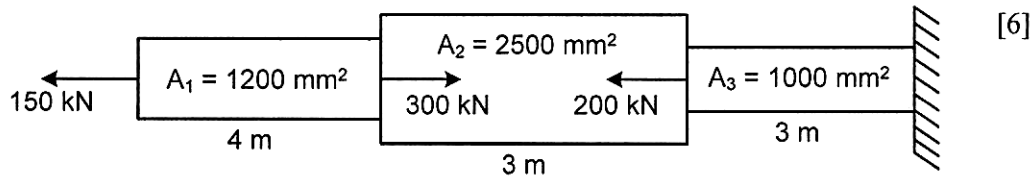


Fig.1

- b) A groove  $40\text{ mm} \times 40\text{ mm}$  is cut symmetrically at the bottom of a rectangular beam section as shown in fig.2. If the tensile stresses shall not exceed  $25\text{ N/mm}^2$ , Find the safe uniformly distributed load which the beam can carry on a simply supported beam of a span  $4\text{ m}$ . (All dimensions are in mm)

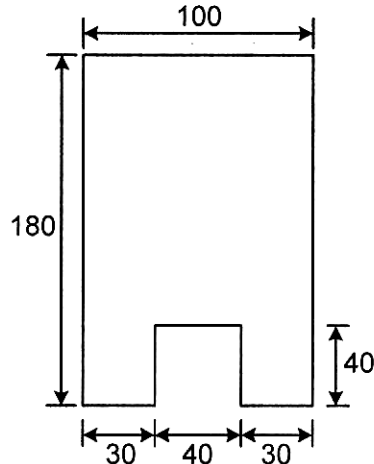


Fig.2

OR

2. a) A steel rod 20 mm diameter and 6 m long is connected to two grips one at each end a temperature of  $120^{\circ}\text{C}$ . Find the pull exerted when the temperature falls to  $40^{\circ}\text{C}$ .
- i) If the ends do not yield  
ii) If the ends yield by 1.10 mm. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $\alpha = 1.2 \times 10^{-6} / ^{\circ}\text{C}$ . [6]
- b) An I section has the following dimensions. Web: 300 mm  $\times$  10 mm, Flange: 150 mm  $\times$  20 mm. The beam is subjected to a shear force of 44 kN. Draw the shear stress distribution diagram over the depth of the section. [6]
3. a) If a solid steel shaft that will not twist through more than  $3^{\circ}$  in a 6 m length when subjected to a torque of 10kN.m, Find the minimum diameter of the shaft and maximum shear stress developed.  $G = 83 \text{ GPa}$ . [6]
- b) A shaft of 95 mm diameter transmits 300 kW power at 150 rpm. If at a section, bending moment is 20 kN.m. Find the principal stress and maximum shear stress. [6]

OR

4. a) Using the equation of strain energy, derive the stress intensity due to the following [6] types of axial loading.
- i) Gradually applied load  
ii) Suddenly Applied load
- b) A hollow steel shaft 4 m long transmits a torque of 25 kN.m. The total angle of [6] twist in this length is limited to  $2.5^{\circ}$  and the allowable shearing stress is 90 MPa. Find out the outside and inside diameter of the shaft if  $G=85 \text{ GPa}$ .
5. a) A simply supported beam of span 5 m, intensity of loading increases uniformly [6] from 8 kN/m at one end to 16 kN/m at the other end as shown in fig.3. Find the position and magnitude of the maximum bending moment. Also Draw Shear Force & Bending Moment Diagram.

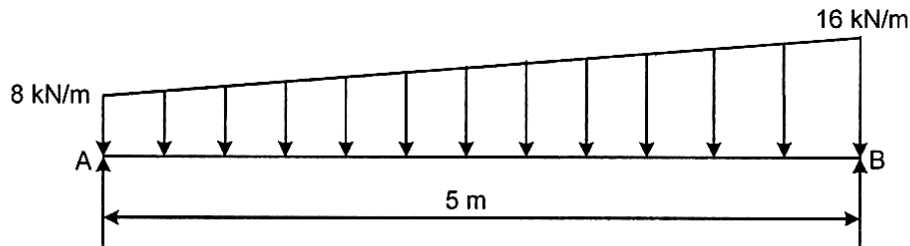


Fig.3

- b) Draw the loading diagram & bending moment diagram from the given shear force [7]  
diagram of a beam as shown in fig.4

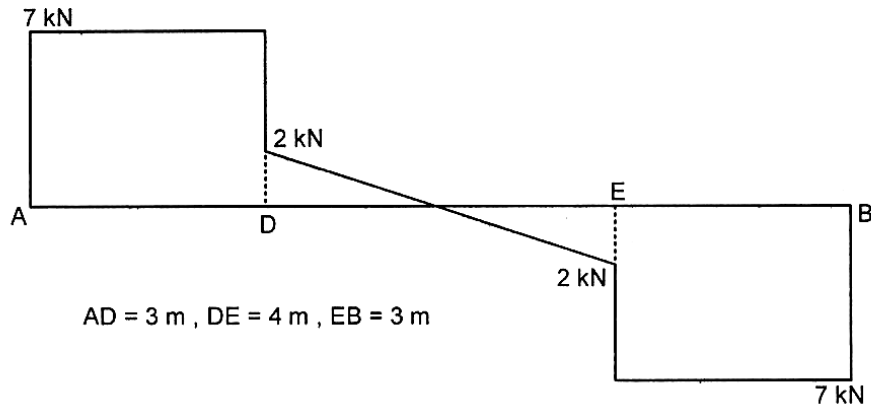


Fig.4

OR

6. a) Draw Shear Force Diagram & Bending Moment Diagram for the overhanging [6]  
beam carrying loads as shown in fig.5. also locate point of contra flexure.

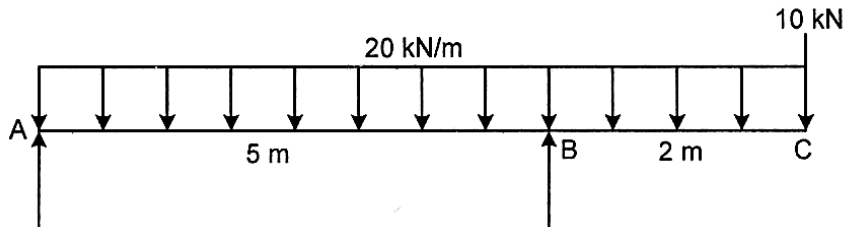


Fig.5

- b) Construct loading diagram for the following shear force diagram for a beam as [7]  
shown in fig.6.

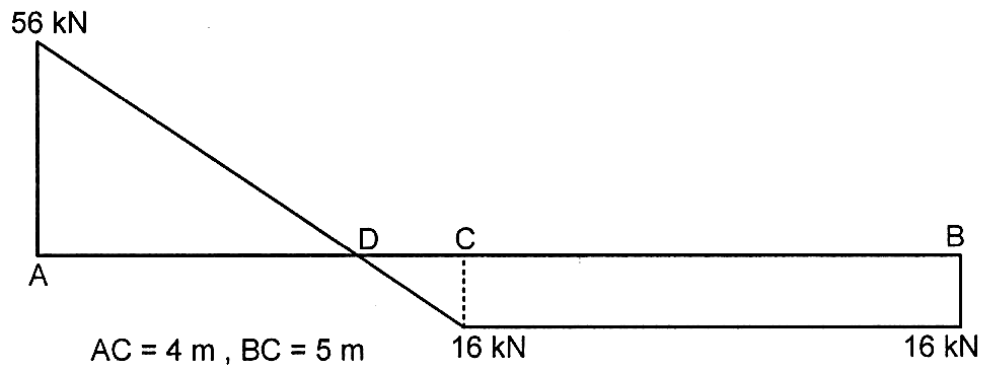


Fig.6

7. a) A hollow alloy tube 5 m long with external and internal diameters equal to 40 mm and 25 mm respectively was found to be 6.4 mm under a tensile load of 60 kN. Find the buckling load for the tube, when used as a column with both ends pinned. Also find the safe compressive load for the tube, with a factor of safety 4. [6]
- b) State the assumptions made in Euler's theory and its limitations. [7]

OR

8. a) Define core of section and hence obtain core of section for a rectangular column of breadth 480 mm  $\times$  depth 120 mm. [6]
- b) A short masonry pillar 600 mm  $\times$  600 mm in section. The pillar carries an eccentric load of 1000 kN acting at an eccentricity of 80 mm from the longitudinal axis as shown in fig.7 . Find the maximum and minimum stresses on the section. [7]

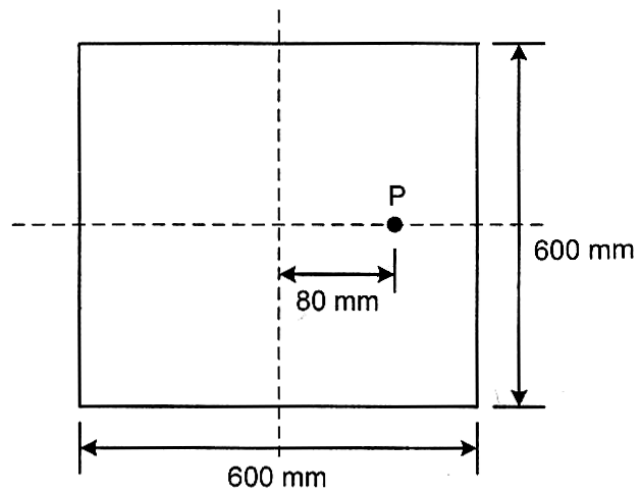


Fig.7

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[5352]-503

**S.E. (Civil) (I Sem.) EXAMINATION, 2018**  
**GEOTECHNICAL ENGINEERING**  
**(2015 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.

Q1) a) Describe briefly the procedure for conducting liquid limit test as per I.S. 2720. [6]  
How the result of this test are plotted. Draw the typical sketch of the plot.

b) What is flow net? Write down the characteristics and application of flow net. [6]

**OR**

Q2) a) Derive the relation between  $\gamma_d$ , G and e. [6]

b) Explain with neat sketch variable head permeability test. Derive the expression [6]  
for coefficient of permeability of soil for the variable head method.

Q3) a) Explain briefly the procedure of conducting unconfined compression test on [6]  
clayey soil sample. Draw Mohr's circle for the test.

b) A concentrated load of 25 kN acts on the surface of homogeneous soil mass of [6]  
large extent. Find the stress intensity at a depth of 8.0 meters by using  
Boussinesq's theory at a horizontal distance of 2.5m

**OR**

Q4) a) In case of Direct shear test ,the value of normal stress and corresponding shear [6]  
stress are given as;

$$\sigma = 75 \text{ KPa}, \tau = 61.3 \text{ KPa}$$

$$\sigma = 125 \text{ KPa}, \tau = 90.168 \text{ KPa}$$

$$\sigma = 175 \text{ KPa}, \tau = 119.036 \text{ KPa}$$

Determine cohesion and angle of internal friction of soil.

P.T.O.

- b) Differentiate between light compaction test and heavy compaction test. Draw typical compaction curve for both tests. [6]
- Q5) a) Explain Rankine's lateral stress distribution theory for active, passive and at rest state with the assumptions involved. [6]
- b) A wall with a smooth vertical back, 10m high, supports a purely cohesive soil with  $c = 9.81 \text{ kN/m}^2$  and  $\gamma = 17.66 \text{ kN/m}^3$ . Determine total Rankine's active pressure against the wall and the position of zero pressure [7]
- OR**
- Q6) a) Derive the relation for passive earth pressure using Rankine's theory for dry, cohesionless backfill. [7]
- b) Explain Rebhann's graphical method for determination of earth pressure on retaining wall [6]
- Q7) a) What is stability number ? Determine the critical height of excavation of a vertical cut in a cohesive soil, if  $c = 30 \text{ kN/m}^2$  and  $\gamma = 18 \text{ kN/m}^3$ . [6]
- b) Discuss sources and types of ground contamination [7]
- OR**
- Q8) a) State classification of slopes based on different criteria. Explain with neat sketch the different modes of slope failure. [7]
- b) Write down the effects of subsurface contamination [6]



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[5352]-504

S.E. (Civil) (I Sem.) EXAMINATION, 2018  
SURVEYING  
(2015 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 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 in the  
examination.  
(vi) Use of cell phone is prohibited in the examination hall.

Q.1. (a) Enlist temporary adjustment of plane table surveying and explain Intersection method of plane table surveying with neat sketch . (06)

(b) The following records refers to an operation involving reciprocal leveling

Instrument At	Staff reading on		Remarks
	A	B	
A	2.265	3.790	Distance AB = 1200.00 m.
B	1.015	2.715	RL of A = 550.500 m.

**Find:-**1) The true Reduced Level of B.

2) The combined correction for curvature and Refraction.

3) The collimation error.

4) Whether the line of collimation is Inclined upward or Downward.

(06)

OR

Q. 2. (a) The following fore and back bearings were observed in traversing with a compass in place where Local Attraction was suspected. Find the corrected FB and BB of lines using included angles. (06)

Line	AB	BC	CD	DE	EA
FB	158°30'	62°	342°	281°	210°30'
BB	339°	242°	163°	101°30'	30°

(b) Enlist the 3 Permanent adjustment of level and explain two peg method to make the line of collimation parallel to axis of the bubble tube. (06)

Q. 3. a) State and explain the fundamental axes of Theodolite. (04)

P.T.O.

b) The following observations were made on vertically held staff with a Tachometer fitted with an anallactic lens. Find the distance AB and RLs of A & B. (08)

Inst. Station	Height of Instrument	Staff Station	WCB	Vertical Angle	Hair Readings	Remarks
M	1.750	A	65° 30'	+ 9° 20'	2.350,3.150,3.950	R.L. of M =
		B	128° 15'	+ 4° 20'	1.750,2.250,2.750	173.250 m

OR

Q. 4. a) What is Total station, explain Area measurement function with total station. (06)

b) Find the area of the closed traverse with the help of following data, use Independent co-ordinate method: (06)

Side	Latitude	Departure
AB	+225.5	+120.5
BC	-245.0	+210.00
CD	-150.5	-110.5
DA	+170.0	-220.0

Q.5.a) Define Curve. Classify the different types of curves with sketches. (06)

(b) Two tangent intersects at chainage of 1750 m. The angle of intersection is 152°, calculate all data necessary for setting out curve of 246 m by the deflection angle method. The peg interval is considered as 25 m. Prepare a setting out table if the least count of vernier is 20". Apply check also. (07)

OR

Q. 6. a) Explain the method of setting out curve by offset from Long Chord. (06)

(b) Two tangent intersect at a chainage of 1000m, the deflection angle being 30° calculate all the necessary data for setting out circular curve of radius 200 m by the method of offset from chord produced taking peg interval of 20 m. (07)

Q. 7. a) Explain with sketch if needed: (4+3 =07)

- i) Significance of horizontal and vertical control in building construction
- ii) Explain how the setting of coordinates with global positioning System is done

b) Write a short note on BeiDou (SBPS) with any four points. (06)

OR

Q. 8. a) Describe the procedure of setting out Canal line with sketch. (06)

b) Explain three segment of SBPS (Space based Position System) and Explain Galileo System (07)

Total No. of Questions—8]

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[5352]-505

S.E. (Civil) (I Sem.) EXAMINATION, 2018

ENGINEERING MATHEMATICS—III

(2015 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) Draw neat diagrams wherever needed.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data, if necessary.

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

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

(i)  $(D^3 - D^2 + 4D - 4) y = e^x$

(ii)  $(D^2 - 2D + 2) y = e^x \tan x$

(by method of variation of parameters)

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

(b) Apply Gauss-Jordan method to solve the equations : [4]

$$x + y + z = 9$$

$$2x - 3y + 4z = 13$$

$$3x + 4y + 5z = 40.$$

P.T.O.

Or

2. (a) A light horizontal strut AB of length  $l$  is freely pinned at A & B and is under the action of equal and opposite compressive forces  $P$  at each of its ends and carries a load  $W$  at its centre. Show that the deflection at its centre is : [4]

$$\frac{W}{2P} \left[ \frac{1}{n} \tan \frac{nl}{2} - \frac{l}{2} \right] \text{ where } n^2 = \frac{P}{EI}.$$

- (b) Using fourth order Runge-Kutta method solve the equation : [4]

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

subject to the conditions  $x = 0, y = 1$  to find  $y$  at  $x = 0.1$  taking  $h = 0.1$ .

- (c) Solve the following system by Cholesky's method : [4]

$$9x_1 + 6x_2 + 12x_3 = 17.4$$

$$6x_1 + 13x_2 + 11x_3 = 23.6$$

$$12x_1 + 11x_2 + 26x_3 = 30.8.$$

3. (a) The equation of two lines of regression obtained in a correlation analysis are the following : [4]

$$2x + 3y - 8 = 0 \text{ and}$$

$$x + 2y - 5 = 0.$$

Obtain the value of the correlation co-efficient and the variance of  $y$  given that variance of  $x$  is 12.

(b) An aptitude test for selecting officers in a bank conducted on 1000 candidates. The average score is 42 and standard deviation of score is 24. Assuming normal distribution for the score find :

(i) The number of candidates whose scores exceed 60.

(ii) The number of candidates whose score lie between 30 and 60.

[Given Area = 0.2734 for  $z = 0.75$ , Area = 0.1915 for  $z = 0.5$ .]

(c) Find the directional derivative of  $\phi = 4e^{2x - y + z}$  at the point (1, 1, -1) in the direction towards (-3, 5, 6). [4]

*Or*

4. (a) In a certain distribution the first four moments about 4, are 1.5, 17, 30 and 108. Find the central moments and hence  $\beta_1$  and  $\beta_2$ . [4]

(b) Prove the following (any one) : [4]

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

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

(c) Show that the vector field : [4]

$$\bar{F} = (y^2 \cos x + z^2) \hat{i} + (2y \sin x) \hat{j} + 2xz \hat{k}$$

is conservative and find scalar field such that  $\bar{F} = \nabla \phi$ .

5. Attempt any two :

(a) Using Green's theorem evaluate : [6]

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

for the field

$$\bar{F} = 2x^2y\bar{i} + x^3\bar{j}$$

over the first quadrant of the circle  $x^2 + y^2 = a^2$ .

(b) Using Divergence theorem evaluate : [6]

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

where S is the upper half of sphere  $x^2 + y^2 + z^2 = 4$  above the plane  $z = 0$ .

(c) Evaluate : [7]

$$\iiint_S \nabla \times \bar{F} \cdot \hat{n} dS,$$

where

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

and S is the surface of the cone  $z = 4 - \sqrt{x^2 + y^2}$  above the XOY-plane.

Or

6. Attempt any two :

(a) Find the work done in moving a particle along  $x = 3 \cos \theta$ ,

$y = 3 \sin \theta$ ,  $z = 5\theta$ , from  $\theta = \frac{\pi}{4}$  to  $\theta = \frac{\pi}{2}$  under a field

of force given by : [6]

$$\bar{F} = -9\sin^2\theta\cos\theta\bar{i} + 3(2\sin\theta - 3\sin^3\theta)\bar{j} + 5\sin 2\theta\bar{k}.$$

(b) Evaluate : [6]

$$\iint_S (x \bar{i} + y \bar{j} + z \bar{k}) \cdot d\bar{S}$$

where S is the curved surface of the cylinder  $x^2 + y^2 = 4$  bounded by the planes  $z = 0$  and  $z = 2$ .

(c) Evaluate : [7]

$$\iint_S (\nabla \times \bar{F}) \cdot d\bar{S}$$

where

$$\bar{F} = x^3 \bar{i} - xyz \bar{j} + y^3 \bar{k}$$

and S is the surface  $x^2 + 9y^2 + 4z^2 - 2x = 36$  above the plane  $x = 0$ .

7. Solve any *two* of the following :

(a) If  $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$  represents the vibrations of a string of length  $l$  fixed at both ends find the solution with the following conditions : [7]

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

(ii)  $y(l, t) = 0$  for all  $t$ ,

(iii)  $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0$  for all  $x$  and

(iv)  $y(x, 0) = \frac{3a}{2l}x, \quad 0 \leq x \leq \frac{2l}{3}$   
 $= \frac{3a}{l}(l - x), \quad \frac{2l}{3} \leq x \leq l.$

(b) A rod of length  $l$  with insulated sides is initially at a uniform temperature  $x$ . Both the ends of the rod are kept at zero temperature. Find the temperature at any point and at any

time  $t$ , use  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ . [6]

(c) A rectangular plate is bounded by  $x = 0$ ,  $x = a$ ,  $y = 0$ ,  $y = b$ . Its surfaces are insulated and temperature along three edges  $x = 0$ ,  $x = a$ ,  $y = 0$  is maintained at  $0^\circ\text{C}$ , while the fourth edge  $y = b$  is maintained at constant temperature  $u_0$  until steady state is reached. Find steady state temperature  $u(x, y)$ . [6]

*Or*

8. Solve any *two* of the following :

(a) If  $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$  represents the vibrations of string of length  $l$  fixed at both ends, find the solution with boundary conditions : [7]

(i)  $y(0, t) = 0, \quad \forall t$

(ii)  $y(l, t) = 0, \quad \forall t$  and initial conditions

(iii)  $\left(\frac{\partial y}{\partial t}\right)_{t=0} = 0, \quad \forall x$

(iv)  $y(x, 0) = k(lx, x^2), \quad 0 \leq x \leq l.$



(b) The temperature at any point of a insulated metal rod of one meter length is governed by the differential equation  $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ . Find  $u(x, t)$  subject to the following conditions : [6]

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

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

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

and hence find the temperature in the middle of the rod at subsequent time.

(c) Solve  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ , which satisfies the conditions : [6]

$u(0, y) = u(l, y) = u(x, 0) = 0$  and

$u(x, a) = \sin \frac{m\pi}{l} x, \quad 0 \leq x \leq l.$

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[5352]-506

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

EXAMINATION, 2018

FLUID MECHANICS—I

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) 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) Explain in brief phenomenon of cavitation. [2]  
(b) Define Specific weight, dynamic viscosity and capillarity. [3]

*Or*

2. (a) Derive an expression for a pressure inside a liquid jet of radius R and surface tension  $\sigma$ . [3]  
(b) State and explain Newton's law of viscosity. [2]

P.T.O.

3. (a) Define 'Metacentre and Metacentric Height'. How are they important in case of floating body ? [3]
- (b) Discuss conditions of stability of a submerged body in short. [2]

*Or*

4. (a) Distinguish between simple manometer and differential manometer. [2]
- (b) Define gauge pressure, vacuum pressure and absolute pressure. [3]

5. (a) Distinguish between irrotational and rotational flow. [2]
- (b) Define path line and streak line, stream tube and give the example of each. [3]

*Or*

6. (a) What is velocity potential and stream function ? [2]
- (b) Define : [3]
- (1) Steady and unsteady flow
- (2) Uniform and non-uniform flow.

7. (a) What is an orifice ? What is meant by 'Large orifice' ? How does it differ from a small orifice ? [2]
- (b) Define coefficient of contraction, coefficient of discharge and coefficient of velocity. [3]

*Or*

8. (a) Explain how Bernoulli's theorem, applied to two points in flow, is modified to account for : [3]
- (i) Loss of head,
  - (ii) Installation of pump,
  - (iii) Non-uniform velocity variation in pipe.
- (b) What do you understand by dynamics of fluid flow ? How does it differ from kinematics of fluid flow ? [2]
9. (a) What is laminar sublayer ? How is its existence established ? [4]
- (b) Starting from first principles, derive Hagen-Poiseuille equation for steady laminar flow in pipes. [5]
- (c) A plate  $3\text{m} \times 1.5\text{m}$  is held horizontally in water moving at  $1.25\text{ m/s}$  parallel to its length. If the flow in the boundary layer is laminar at the leading edge of the plate : [6]
- (i) Find the distance from the leading edge where the boundary layer flow changes from laminar to turbulent,
  - (ii) Find the thickness of the boundary layer at this section
  - (iii) Find the frictional drag on this plate consisting both its sides. Assume negligible thickness of the plate. Take the dynamic viscosity of water as  $0.01\text{ P}$  and assume that the laminar boundary layer exists up to  $\text{Re} = 5 \times 10^5$ .

*Or*

10. (a) Define displacement thickness and derive an expression for the same. [5]
- (b) Explain different methods for controlling the boundary layer. [5]
- (c) An oil of mass density  $950 \text{ kg/m}^3$  and dynamic viscosity  $1.5$  poise is pumped through a  $100 \text{ mm}$  diameter and  $600 \text{ m}$  long pipe at a rate of  $0.01 \text{ m}^3/\text{s}$ .

Find :

- (i) Reynolds' number,
- (ii) Calculate the pressure required at the pump, if outlet, which is free to atmosphere is  $25\text{m}$  above pump level,
- (iii) What would be the power input if the overall efficiency of pump is to be  $75\%$  ? [5]
11. (a) A horizontal pipe of  $0.075 \text{ m}$  diameter delivers a discharge of  $0.01 \text{ m}^3/\text{sec}$ . This pipe has sudden expansion of  $0.10 \text{ m}$  diameter at a section. If the pressure at just upstream of sudden expansion is  $25 \text{ kN/m}^2$ , determine pressure at just downstream. Take specific weight of water as  $9.79 \text{ kN/m}^3$ . [5]
- (b) Define turbulent flow, Instantaneous velocity and temporal mean velocity. Write all the characteristics of turbulent flow. [5]
- (c) Write a short note on Prandtl's mixing length theory. [5]

*Or*

- 12.** (a) A 60 cm diameter pipe carries water. The velocity at 4 cm from the pipe wall is 3 m/s and the velocity gradient at the same point is  $11.25 \text{ s}^{-1}$ .

Determine :

- (i) the mean velocity of the flow,
  - (ii) friction factor,
  - (iii) average shear stress at the wall,
  - (iv) average height of roughness protrusions.
- (b) Enlist all the minor losses and write their expressions. [4]
- (c) Derive the expression for major loss of head in pipe. [5]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-507

**S.E. (Civil) (II Sem.) EXAMINATION, 2018**  
**ARCHITECTURAL PLANNING & DESIGN OF BUILDINGS**  
**(2015 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 and 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.

Q 1 A) Explain the following : Height zoning and Density zoning (6)

B) Explain any two aspects of Green Building planning with sketch. (7)

OR

Q2 A) Enlist the documents to be submitted for seeking Commencement Certificate and Occupancy Certificate. (7)

B) Differentiate between building line & control line by drawing a suitable sketch. (6)

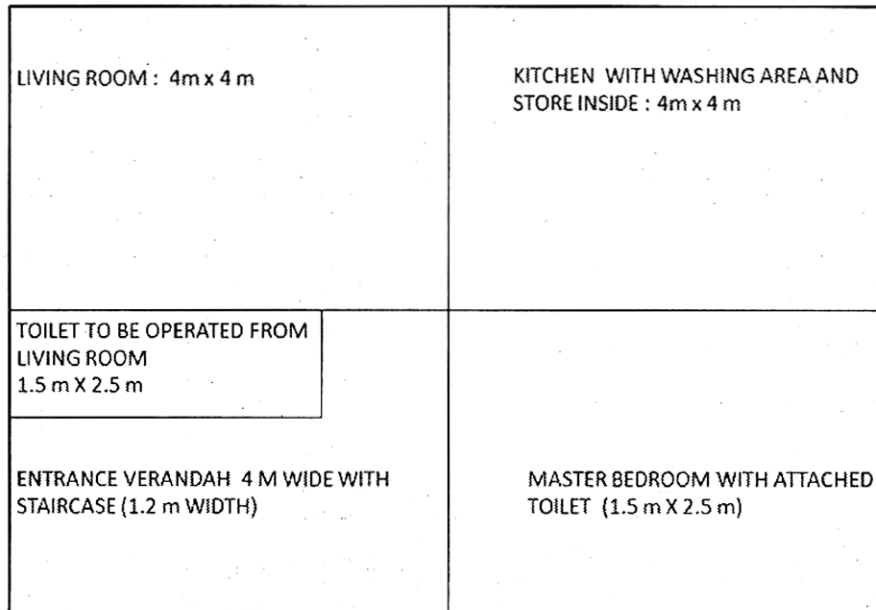
Q3 A) Explain the need for earthquake resistant structures in relation with - loss of human life; property and infrastructure. (6)

B) The internal dimensions of a factory building are 30 m x 20 m x 10 m. 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)

P.T.O.

OR

- Q4 A) Explain the following terms (any three): i) SP ii) CV iii) PP iv) FSI (6)
- B) What are Acoustic Defects? Explain the need of rectifying the same in relation with Radio Station. (6)
- Q 5 Draw a detailed Floor Plan to a scale of 1:50 or otherwise; of a residential building for the given line plan below. Use following data: RCC framed structure, Wall thickness, 150 mm for all, Single storey building, Plinth height 450 mm, All dimensions in the sketch are in m. Indicate suitable locations & sizes of doors, windows and staircase and write the schedule of openings. (13)



OR

- Q 6 Draw a detailed Floor Plan to a scale of 1:50 with following data: (13)
- i) Living room 1 no. approx. area 15 m<sup>2</sup> ii) Kitchen cum Dining 1 no. approx. area 15 m<sup>2</sup> iii) Bed rooms 2 no. approx. area 12 m<sup>2</sup> each  
iv) Floor to floor height 3.0 m v) R. C. C. structure vi) Plinth in UCR masonry  
vii) Varandah, Passage, Staircase, W.C. and Bath / attached toilet etc. of suitable sizes should be provided. Indicate North.



- Q 7 Design a single storey hostel building for girls and draw only the Line Plan with following data: (12)
- i) Number of girls to be accommodated : 75
  - ii) Thirty rooms are two seated with 7.5 sqm area per student and fifteen single seated with 9.5 sqm area.
  - iii) Recreation room approx. area 40 m<sup>2</sup>
  - iv) Gymnasium approx. area 15 m<sup>2</sup>
  - v) Office space approx. area 12 m<sup>2</sup>
  - vi) Store room approx. area 15 m<sup>2</sup>
  - vii) Varandah, Passage, Staircase, W.C. and Bath etc. of appropriate dimensions should be provided.
- Show North direction and mention scale.

OR

- Q8 Draw a line plan of a Post Office using following data : (12)
- A) Entrance and moving space : 30 m<sup>2</sup> with seating arrangement
  - B) Public dealing counters : cabins ,6 in no with area 2m x 2m each
  - C) Post master's room : 15 m<sup>2</sup>
  - D) Working area for other staff : 30 m<sup>2</sup>
  - E) Post separation room : 30 m<sup>2</sup>
  - F) Safe custody area for cash : 10 m<sup>2</sup>
  - G) Cash transaction room : 15 m<sup>2</sup>
  - H) Speed Post Delivery Section : 15 m<sup>2</sup>
  - I) Water room and Toilet (separate for male and female) : 7.5 m<sup>2</sup>

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-508

**S.E. (Civil Engg.) (II Sem.) EXAMINATION, 2018**

**CONCRETE TECHNOLOGY**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :—** (i) Answer question Nos. 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) 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 in detail importance of compaction of concrete. What are the different methods of compaction ? [6]

*Or*

2. (a) Write a short note on classification of Aggregates. [6]

(b) What are different methods to measure workability ? Explain flow table test in detail. [6]

P.T.O.

3. (a) Write short notes on : [6]  
(i) Shrinkage  
(ii) Swelling.
- (b) State and explain various operations involved during the concreting from mixing to finishing of concrete surface. [6]

*Or*

4. (a) Explain the compressive strength of concrete. How it is determined in laboratory ? [6]
- (b) Write short notes on : [6]  
(i) Fiber reinforced concrete  
(ii) Self compacting concrete.

5. (a) Briefly outline the IS code method of concrete mix design. Write the procedure of standard mixes. [7]
- (b) What do you mean by nominal mix, standard mix and design mix ? [6]

*Or*

6. (a) Explain the factors governing the selection of mix proportions. [7]
- (b) Explain DOE method of mix design in brief. [6]

7. (a) What is durability of concrete ? What is significance of durability ?  
What effect w/c ratio makes on durability ? [7]
- (b) What is evaluation of crack ? Why is it necessary ? [6]

*Or*

8. (a) Write a short note on “Retrofitting by FRP”. [5]
- (b) What is effect of permeability on concrete ? What measures  
should be taken to reduce permeability of concrete ? [8]

Total No. of Questions—8]

[Total No. of Printed Pages—5

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[5352]-509

S.E. CIVIL (II Sem.) EXAMINATION, 2018

STRUCTURAL ANALYSIS-I

(2015 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.

(v) Use of electronic pocket calculator is allowed.

1. (a) Derive equation to determine slope and deflection at free end of a cantilever beam subjected to a clockwise moment at free end. Use Macaulay's method. 'EI' is constant. [6]

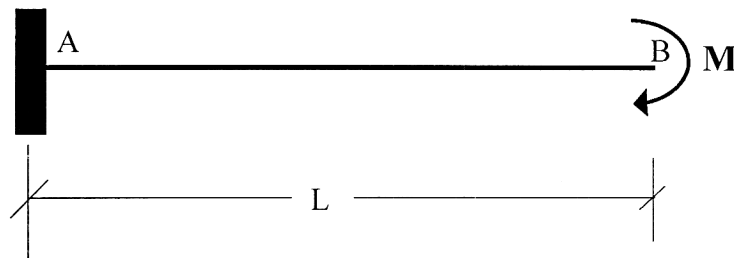
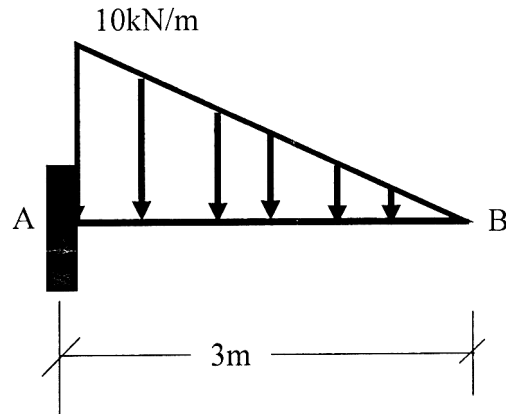


Fig. 1

- (b) For the beam shown below, determine magnitude and direction of a couple 'M' to be applied at free end of same beam so

P.T.O.

that deflection at free end becomes zero. [6]



**Fig. 2**

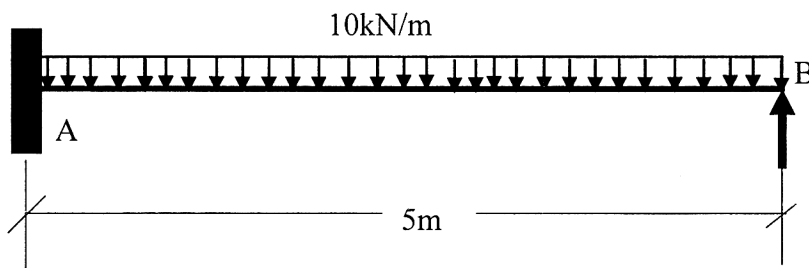
*Or*

2. (a) Write notes on : [6]

(i) Maxwell-Betti's Theorem

(ii) Advantages and disadvantages of fixed beam over simply supported beam.

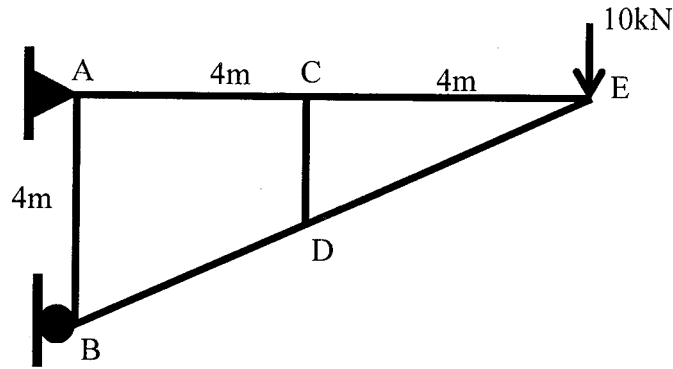
(b) Analyze the beam by Castiglino's second theorem and determine reaction of prop at 'B' if 10 mm sinking is allowed at 'B'. Take  $E_{prop} = 0.23 \times 10^5$  MPa and  $I_{prop} = 3 \times 10^8$  mm<sup>4</sup> [6]



**Fig. 3**

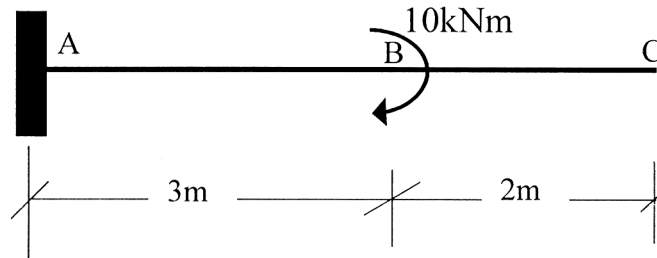
3. (a) A cantilever truss shown below is loaded by a vertical force of 10 kN at free end. Find modulus of elasticity of member material, if area of each member is 70 mm<sup>2</sup> and vertical deflection

is 5 mm at E. All members are made of same material. [6]



**Fig. 4**

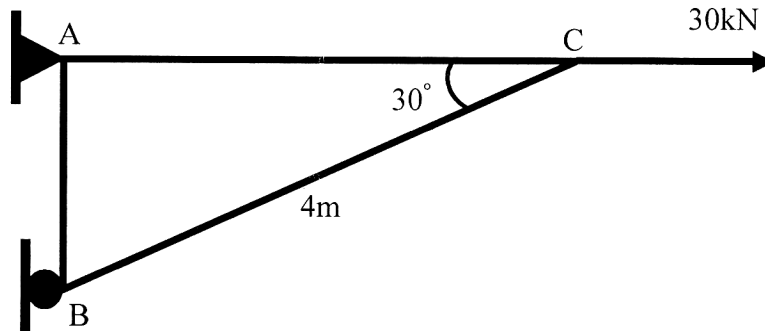
- (b) For a cantilever beam shown below, calculate reactions at fixed end and shear force and bending moment at C by influence line diagram method. [6]



**Fig. 5**

*Or*

4. (a) For the following bracket, members of same cross-sectional area and same material are used. If horizontal deflection at 'C' is 5 mm and modulus of elasticity is  $2.1 \times 10^5$  MPa, determine area of members. [6]



**Fig. 6**

- (b) For the cantilever beam shown below, calculate reactions at fixed end and shear force and bending moment at 'C' by influence line diagram method. Also draw influence line diagrams. [6]

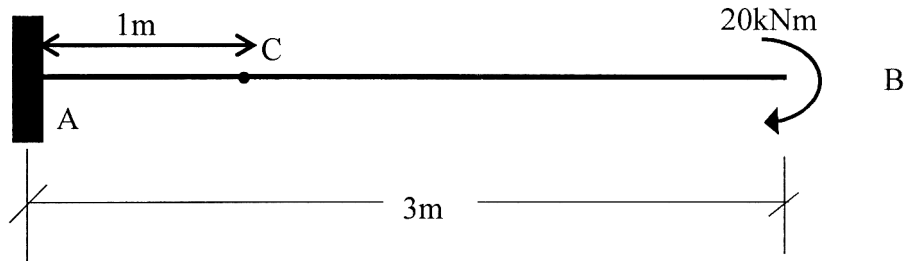


Fig. 7

5. A three hinged parabolic arch is loaded and supported as shown in figure below. Determine : [13]
- Support reactions
  - Maximum positive and negative moment.

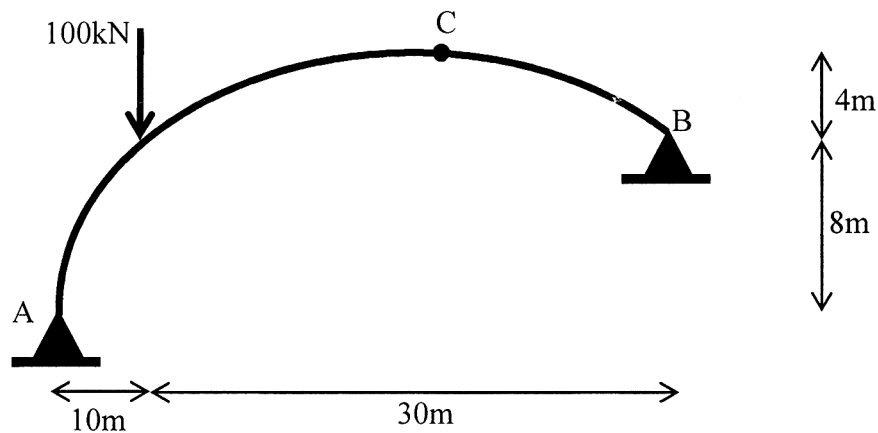


Fig. 8

Or

6. Determine horizontal thrust for a two hinged arch of span 'L' and central rise 'H' carries a point load 'W' at a distance 'a' from left hand support. Assume  $I + I_0 \sec \theta$ . [13]



7. (a) Explain : [9]

(i) Plastic Moment

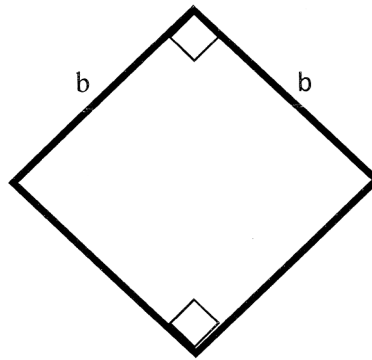
(ii) Plastic Collapse

(iii) Shape Factor.

(b) Write a note on Elastic-Plastic behavior beam. [4]

*Or*

8. For the cross-section shown below find shape factor. [13]



**Fig. 9**

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-510

S.E. (CIVIL ENGINEERING) (II Sem.) EXAMINATION, 2018

**ENGINEERING GEOLOGY**

(2015 COURSE)

Time : Two Hours

Maximum Marks : 50

- N.B. :—** (i) Write the Answers to any *four* questions in single answer-book only.
- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.

1. (a) Describe textures shown by the basaltic rocks. [6]  
(b) Write note on 'weathering' of the rocks. [6]

*Or*

2. (a) Explain 'Clastic' and 'Organic' rock deposits. Give examples of each. [6]  
(b) Write a note on 'Schistose' texture and 'Gneissose' texture. [6]
3. (a) Describe various types of 'Joints' found in the Deccan trap rocks. [6]  
(b) Write a note on 'Dharwar rocks' and their importance. [6]

*Or*

4. (a) What is an unconformity ? Describe any *two* types of Unconformities. [6]  
(b) Describe 'physiographic divisions of India'. [6]

P.T.O.

5. (a) What is 'rejuvenation' ? What are the geological reasons of rejuvenation ? [7]

(b) Write a note on GIS. [6]

*Or*

6. (a) Describe feasibility of a dam proposed folded strata. [7]

(b) What difficulties may have to be faced while excavating tunnel through axial plane of a fold ? [6]

7. (a) Describe how a fold passes in the fault. Draw neat sketches.[7]

(b) Write a note on 'types of aquifers'. [6]

*Or*

8. (a) discuss various methods of conservation of groundwater. [7]

(b) Enlist the requirements of 'Building Stones'. Describe any *two* amongst the list. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—6

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[5352]-511

S.E. (Mechanical/Auto/S/W) (I Sem.) EXAMINATION, 2018  
ENGINEERING MATHEMATICS—III  
(2015 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.  
(v) All questions are compulsory.

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

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

(ii)  $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$  (using method of variation of parameter)

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

(b) Using suitable Fourier transform, solve the following equation : [4]

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

P.T.O.

Or

2. (a) Solve any one : [4]

(i) Find Laplace transform of :

$$e^{-4t} \int_0^t \frac{\sin 3t}{t} dt.$$

(ii) Find Inverse Laplace transform of  $\frac{s}{s^2 + 6s + 25}$ .

(b) Using Laplace transform solve the D.E. : [4]

$$y'' + 4y' + 13y = \frac{1}{3} e^{-2t} \sin 3t, y(0) = 1, y'(0) = -2.$$

(c) A body of weight  $W = 1$  N is suspended from a spring stretches it 4 cm. If the weight is pulled down 8 cm below the equilibrium position and then released : [4]

(i) Set up a differential equation.

(ii) Find the position and velocity as function of time.

3. (a) The first four moments of a distribution about the value 5 are 2, 20, 40 and 50. From the given information obtain the first four central moments and coefficient of skewness and kurtosis. [4]

(b) In a certain factory turning out razor blades, there is a small chance of  $\frac{1}{500}$  for any blade to be defective. The blades are supplied in a packet of 10. Use Poisson distribution to calculate

the approximate number of packets containing : [4]

(i) no defective blades in a consignment

(ii) two defective blades

in a consignment of 10,000 packets.

(c) Find the directional derivative of the function  $\phi = e^{2x - y - z}$  at (1, 1, 1) in the direction of tangent to the curve : [4]

$x = e^{-t}$ ,  $y = 2 \sin t + 1$ ,  $z = t - \cos t$  at  $t = 0$ .

Or

4. (a) Find the regression line of  $y$  on  $x$  for the following data : [4]

$x$	$y$
10	18
14	12
18	24
22	6
26	30
30	36

(b) Prove the following (any one) : [4]

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

(ii) 
$$\nabla^2 (r^n \log r) = [n(n+1)\log r + 2n+1]r^{n-2}.$$

(c) Show that the vector field : [4]

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

is irrotational and hence find scalar function  $\phi$  such that

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

5. (a) Find the work done in moving a particle once round the ellipse  $\frac{x^2}{25} + \frac{y^2}{16} = 1$ ,  $z = 0$  under the field of force given

by : [5]

$$\bar{F} = (2x - y + z) \bar{i} + (x + y - z^2) \bar{j} + (3x - 2y + 4z) \bar{k}.$$

- (b) Use divergence theorem to evaluate : [4]

$$\iiint_S (x \bar{i} + y \bar{j} + z^2 \bar{k}) \cdot d\bar{S}$$

where S is the curved surface of the cylinder  $x^2 + y^2 = 4$ , bounded by the planes  $z = 0$  and  $z = 2$ .

- (c) Evaluate : [4]

$$\iint (\nabla \times \bar{F}) \cdot \hat{n} dS$$

where S is the plane surface of a lamina bounded by  $x = 0$ ,  $y = 0$ ,  $x = 1$ ,  $y = 1$ ,  $z = 2$  and .

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

*Or*

6. (a) Evaluate : [4]

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

where

$$\bar{F} = \sin y \bar{i} + x(1 + \cos y) \bar{j}$$

and C is the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ ,  $z = 0$ .

(b) Show that : [4]

$$\iiint_V \frac{dv}{r^2} = \iint_S \frac{\bar{r} \cdot \hat{n}}{r^2} ds.$$

(c) Evaluate : [5]

$$\iint_S \text{curl } \bar{F} \cdot \hat{n} ds$$

for the surface of the paraboloid

$$z = 9 - (x^2 + y^2)$$

where

$$\bar{F} = (x^2 + y - 4) \bar{i} + 3xy \bar{j} + (2xz + z^2) \bar{k}.$$

7. (a) If  $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$  represents the vibrations of a string of length  $l$  fixed at both ends, find the solution with boundary conditions : [7]

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

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

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

(iv)  $y(x, 0) = kx^2, \quad 0 \leq x \leq l.$

(b) Solve  $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$  if [6]

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



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

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

$$(iv) \quad u(x, 0) = \frac{2x}{l}, \quad 0 \leq x \leq l.$$

*Or*

8. (a) A rectangular plate with insulated surface is 4 cm wide and so long to its width that it may be consider infinite in length.

If the temperature of the short edge  $y = 0$  is given by : [6]

$$\begin{aligned} u &= 2x & 0 \leq x \leq 2 \\ &= 2(4 - x) & 2 \leq x \leq 4 \end{aligned}$$

two two long edges  $x = 0, x = 4$  as well as other short edge are kept at  $0^\circ\text{C}$  then find  $u(x, y)$ .

- (b) Use Fourier transform to solve the equation  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$

$0 < x < \infty, t > 0$ , subject to conditions : [7]

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

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

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

Total No. of Questions—8]

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[5352]-512

**S.E. (Mechanical/Auto Engineering) (I Sem.) EXAMINATION, 2018**  
**MANUFACTURING PROCESS-I**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :—** (i) All questions are compulsory. Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6 and Q. Nos. 7 or 8.

(ii) Figures to the right indicate full marks.

(iii) Assume suitable data, if necessary.

(iv) Neat diagrams must be drawn wherever necessary.

Q.1 (a) Explain with neat sketches the different types of cores used in foundry. [6]  
(b) An aluminium strip 240 mm wide 18 mm thick is rolled to a thickness of 14 mm in one pass. The roll radius is 240 mm and roll rotates at 125 rpm. Calculate the roll force and power required for this operation if the aluminium has true stress of  $78.44 \text{ N/mm}^2$  under unstrained condition and  $242.35 \text{ N/mm}^2$  in maximum strained condition. [6]

**OR**

Q.2 (a) With sketch differentiate the universal rolling mill with planetary rolling mill. [6]  
(b) A cubical shape of casting having side 'a' solidifies in time 't<sub>1</sub>' seconds. If side of the cube is increased by 30% of the earlier side then using Chvorinor's rule obtain the solidification time of a resized cubical shape casing 't<sub>2</sub>' in terms of solidification time 't<sub>1</sub>'. [6]

Q.3 (a) State four applications of each of the following processes: Transfer moulding, Injection moulding and Pressure thermoforming process. [6]  
b) With sketch compare forward and backward gas welding techniques. [6]

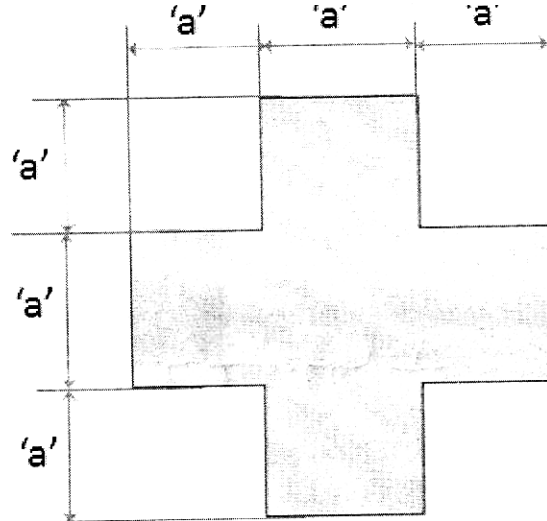
**OR**

Q.4 (a) State any six welding defects with their causes and remedies. [6]  
(b) With a neat sketch explain the pipe extrusion process. [6]

Q.5 (a) With schematic sketches differentiate the compound and progressive dies. [6]

P.T.O.

(b) Design a strip layout for manufacturing a mild steel component as shown in figure. The thickness of the component is 1.2 mm. Take ultimate shear stress value as  $220 \text{ N/mm}^2$ . Also find the percentage utilization, centre of pressure and press capacity. The dimension 'a' shown in the figure is 20 mm. [7]



**OR**

Q.6 (a) Explain with neat sketches any six press working operations. [6]

(b) A cup of internal diameter 50 mm, height 70 mm is to be drawn from a 1.2 mm cold rolled steel. The corner radius for cylindrical cup is 1.6 mm. Percentage reduction permitted in the first draw is 50% and in the second, third and fourth draw is 30%, 20% and 15% respectively. Consider trimming allowance of 3.2 mm for each 25 mm of cup diameter. Find size of the blank, number of draws required, punch and die dimensions for each draw. Also, draw sectional view of die block showing different dimensions for last draw. Consider value of punch and die clearance as 1.15 times thickness of sheet. [7]

Q.7 (a) Explain principle and working of thread cutting operation on lathe with neat sketch. [6]

(b) A workpiece of 76 mm diameter is to be turned down to a diameter of 68 mm. The length of the workpiece is 78 mm. The maximum allowable depth of cut is 0.8 mm. If the approach length is 20 mm and over travel is 10 mm then calculate the spindle revolution (RPM) and machining time for each pass if feed as 0.25 mm/rev and cutting speed as 200 m/min is kept constant for all the passes. Also, find the total machining time for all the passes. [7]

**OR**

Q.8 (a) Write a note on apron mechanism of a lathe. [6]

(b) Calculate the change gears for cutting two start right hand threads of 1.4 mm pitch on a lathe having 6 mm pitch of lead screw. Available gears are 20 to 120 teeth in steps of 5 teeth. Sketch the gear train and suggest what modification is required for cutting left hand threads? [7]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-513

S.E. (Mechanical/Automobile/Sandwich) (I Sem.) EXAMINATION, 2018

**THERMODYNAMICS**

**(2015 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) Answer for the four questions should be written in same answer-book attach supplement if required.

(iii) Neat diagrams should be drawn wherever necessary.

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

(v) Use of pocket calculator and different gas charts as applicable is allowed.

(vi) Assume suitable data, if necessary.

(vii) Figures to the right indicate full marks.

Q1) a) Explain the concept of i) Heat Engine, ii) Heat Pump and iii) Refrigerator with neat sketch and write down the expression for Efficiency or COP as applicable. [6]

b) A copper block of mass 1 kg at 500 K is immersed in lake at 300 K till it reaches thermal equilibrium with water. Find the total i) Total heat transferred to the lake, ii) Change in entropy of the lake, iii) Change in entropy of Copper ( $C_p$  of copper=0.386 kJ/kg K,  $C_p$  of water= 4.187 kJ/kg-K). [6]

**OR**

Q2) a) Explain the principle of increase of entropy and write down the formula for change in entropy for i) Reversible process, ii) Irreversible process and iii) Impossible process. [6]

b) During a Thermodynamics cycle heat transfer during various processes is: 120 kJ, -16 kJ, -48 kJ and 12 kJ. Find the net work done during the cycle. [6]

P.T.O.

- Q3) a) Show the following cycles with neat sketch, [6]
1. Carnot Cycle on T-s diagram.
  2. Otto Cycle on P-v diagram.
  3. Diesel Cycle on P-v diagram.
  4. Dual Cycle on P-v diagram.
  5. Brayton cycle on P-v diagram.
  6. Reversed Brayton cycle on P-v diagram.

- b) Find the enthalpy of 1 kg of steam at 12 bar when, [6]
- i) Saturated liquid condition,
  - ii) Steam is dry saturated,
  - iii) steam is 22 % dry,
  - iv) steam is 50 % dry
  - v) steam is superheated to 250 deg. C,
  - v) sub-cooled to 100 deg. C ( $C_p=2.25$  kJ/kg K)

**OR**

- Q4) a) Explain process of formation of steam on T-h diagram starting from -10 deg. C [6]  
(ice state) to 120 deg. C (Superheated condition) at atmospheric pressure.

- b) An engine is working on Otto cycle. The pressure and temperature at the [6]  
beginning of compression stroke are 1 bar and 300 K and the temperature at the  
end of compression stroke is 600 K. If the temperature at the end of constant  
volume heat addition process is 1800 K. Calculate the air standard efficiency,  
heat addition per kg of air and heat rejected per kg of air.

- Q 5) a) Give the function and location of any 3' of the following, [6]
- i) Super heater.
  - ii) Air pre heater
  - iii) Fusible plug
  - iv) Water level indicator.
  - v) Spring loaded safety valve.
- b) 5500 kg/hr steam is produced at a pressure of 76 bar in a boiler with a dryness [7]  
fraction of 0.98. The feed water temperature is 51 deg. C. The amount of coal  
burnt is 650 kg having C.V. of 3500 kg. Determine the following,  
i) Boiler efficiency ii) Equivalent evaporation per kg of fuel burnt.

**OR**

- Q 6) a) Explain the Boiler heat balance sheet with formulas used. [6]
- b) The boiler trial following observations are recorded mass of fuel is 1520 kg/hr. [7]  
The temperature of feed water is 30 deg. C. Dryness fraction of steam is 0.95.  
The pressure of steam is 8.5 bar, Coal burns per hour = 200 kg, CV of coal is  
27300 kJ/kg. The un burnt coal collected is 60 kg/hr with a CV of 2000 kJ/kg.  
The mass of flue gases is 17.73 kg/kg of coal burnt. The temperature of flue  
gases is 330 deg. C. The boiler room temperature is 27 deg. C. Specific heat of  
the flue gases 1 kJ/kg K. Draw Boiler heat balance sheet per kg of fuel burnt and  
calculate the efficiency of the boiler.

- Q 7) a) Define Human comfort condition and discuss the factors affecting human comfort. [6]
- b) Atmospheric air at 30 deg. C DBT and 18 deg. C WBT is cooled to 20 deg. C DBT without changing its moisture content. Find i) initial enthalpy and specific humidity of air, ii) Final relative humidity of air and WBT, iii) Sensible heat removed per kg of air. [7]

**OR**

- Q8) a) Draw following processes on sketch of Pscychrometric chart [6]
- i) Sensible cooling.
  - ii) Sensible heating.
  - iii) Heating and Humidification.
  - iv) Heating and Dehumidification,
  - v) Cooling and Humidification.
  - vi) Cooling and Dehumidification.
- b) Moist air enters a steam heating coil at 10 deg. C, 50 % RH which is heated sensibly and leaves the coil at 30 deg. C. The mass flow rate of the moist air is 50 kg/s. Find: 1. Sensible heat gained by air, ii) Mass flow rate of the steam in the coil if the steam enters the coil as saturated steam and the condensate leaves the coil at 85 deg. C at atmospheric pressure. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-514

**S.E. (Mechanical/Automobile Engg.) (I Sem.) EXAMINATION, 2018**  
**MATERIAL SCIENCE**  
**(2015 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) Use of calculator is allowed.

(v) Figures to the right indicate full marks.

(v) Assume suitable data, if necessary.

Q1. A) what is coordination number ? write the coordination number for [04]

bcc, fcc And HCP in sequence.

B) Define the following [04]

1. Lattice Angle      2. Cold working

C) With a neat diagram explain frankel and schottky defets . [05]

OR

Q.2 .

A) In plastic deformation of metals, property variation takes place, [06]

explain with a neat graph all property variations . Can it be recovered? If

yes only name the process.

P.T.O.

b) Show the following planes on a cubic structures [04]

1. (212)
2. (001)

c) Draw a self-explanatory diagram showing lattice angles and lattice parameters [03]

Q. 3

A) Write true or false and justify your answer (any four) [12]

1. Vickers Hardness number is independent of load.
2. For detecting the cracks in bronze metal part magnetic particle test can be used.
3. The fracture in creep is always intergranular in nature .
4. Stress relieving heat treatment can reduce the probability of corrosion.
5. The bottom of water storage tank gets corroded due to differential aeration corrosion.
6. Corrosion resistance is higher for an Alloys than pure metals.

OR

Q.4

A) Write short note on differential Aeration Corrosion . [03]

B) What is Pilling Bedworth Ratio and what is its importance in corrosion ? [03]

C) Explain fatigue fracture with neat labelled diagram and how it can be avoided. [06]

Q5.

A) Explain with neat diagram Chemical vapour deposition ? State its advantages, disadvantages & applications over other processes . [06]



B) What are the advantages of PVD over CVD process? [06]

methods used before surface coating . explain

OR

Q6) write a short note on ( any three) [12]

i) Powder Coating

ii) Plasma Nitriding

iii) Ion vapour deposition

Q.7)

A) With a neat diagram explain the process of cold compaction. [07]

B) Explain different powder manufacturing processes and explain [06]

any one in detail.

OR

Q8)

A) Define the following [04]

i) Green strength ii) Apparent density.

B) Write flow chart of production of Electrical contact material? [03]

B) List important advantages and disadvantages of Powder metallurgy [06]

over other processes.

Total No. of Questions—8]

[Total No. of Printed Pages—5

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[5352]-515

S.E. (Mech/Auto) (I Sem.) EXAMINATION, 2018  
STRENGTH OF MATERIALS  
(2015 PATTERN)

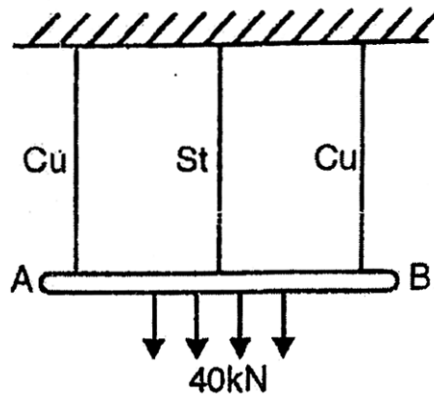
Time : Two Hours

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) All four questions should be solved in one answer-sheet.  
(iii) Figures to the right indicate full marks.  
(iv) Neat diagrams must be drawn wherever necessary.  
(v) Use Graph Paper for Graphical Solution.  
(vi) Use of Logarithmic Tables, Slide Rule, Mollier Charts, Electronic Calculator and Steam Tables is allowed.  
(vii) Assume suitable data, if necessary.

Que 01 a) Rigid body AB weighing of 40 kN hangs from three wires of equal lengths as shown in *Fig. No.- 01*. The middle wire is of steel and two outer wires are of copper. If cross sectional area of each wire is  $250 \text{ mm}^2$ . Calculate load sheared by each wire. Take  $E_{st}=210 \text{ GPa}$ ,  $E_{cu}=120 \text{ GPa}$ .

06 M



*Fig No.- 01*

b) A cantilever beam is fixed at D and is subjected to point loads and moments as shown in *Fig No. -02*. Draw SF and BM Diagram for the same.

06 M

P.T.O.

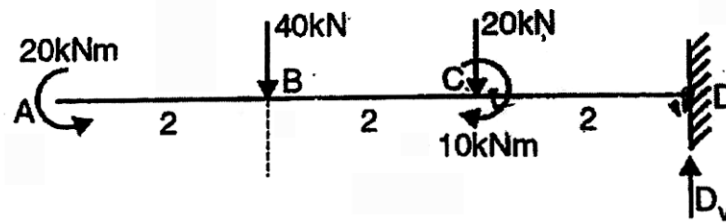


Fig No. -02

OR

Que 02 a) Three rods each of length 1 m and cross sectional area  $200 \text{ mm}^2$  are connected to a rigid plates at the ends as shown in Fig. No.- 03. If the temperature of the assembly is raised by  $25^\circ \text{C}$ , determine stress in each rod.

Take

$$E_{st} = 200 \text{ GPa}, \quad \alpha_{st} = 12 \times 10^{-6} \text{ per } ^\circ \text{C}$$

$$E_{cu} = 120 \text{ GPa}, \quad \alpha_{cu} = 18.5 \times 10^{-6} \text{ per } ^\circ \text{C}$$

06 M

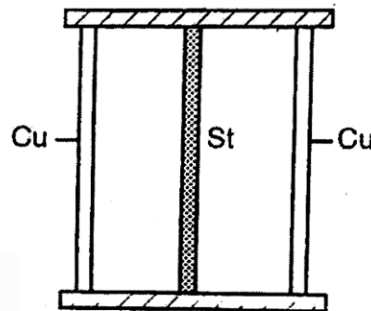


Fig. No.- 03

b) A beam 5 m long and simply supported at each end, has a uniformly distributed load of  $1000 \text{ N/m}$  extending from left end to the point 2 m away. There is also a clock wise couple of  $1500 \text{ N-m}$  applied at the center of beam. Draw the SF and BM diagram for the beam.

06 M

Que 03 a) A beam having a cross section in the form of channel as shown in Fig. No. 04 is subjected to bending moment acting about X-X axis. Calculate the thickness 't' of the channel in order that the bending stresses at the Top and Bottom layer of the beam C/S will be in the ratio 7 : 3.

06 M

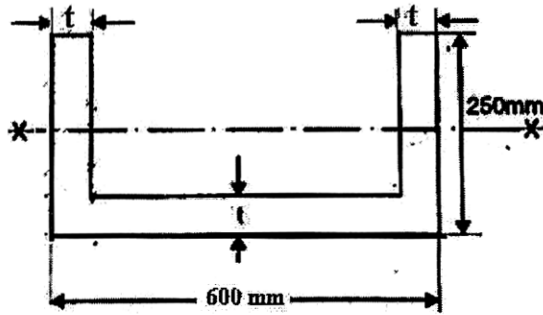
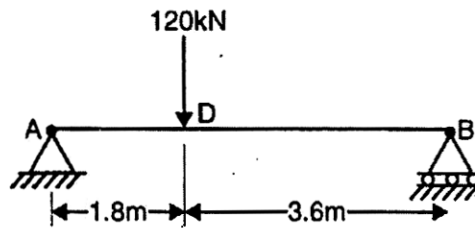


Fig. No. 04

- b) The horizontal beam as shown in Fig. No 05 is hinged at point 'A' and supported on roller at point 'B'. It carries a vertical load of 120 kN at point 'D'. Determine deflection at point 'D' by taking  $E = 200 \text{ GPa}$  and  $I = 160 \times 10^6 \text{ mm}^4$



06 M

Fig. No 05

OR

- Que 04a) A beam having 'T' shaped cross section with flange 200 mm X 50 mm and web 50 mm X 200 mm &  $I = 1.134 \times 10^8 \text{ mm}^4$ , is subjected to a vertical shear force of 100 kN. Calculate shear stress at

1. Bottom and Top Layer
2. Neutral axis
3. Junction layer of web and flange
4. Junction layer of flange and web

also draw shear stress distribution diagram showing stress at above stated layers

06 M

- b) A cantilever beam 'AB' is fixed at end 'A' on left and supports two concentrated loads of 10 kN and 5kN at point 'C' & point 'B' respectively.

06 M

Point 'C' and 'B' are at a distance of 1.3 m and 2.6 m respectively from point 'A'. Calculate deflection of point 'C' from its original position by taking  $E = 200 \text{ GPa}$  and  $I = 20.1 \times 10^6 \text{ mm}^4$

Que 05 a) A hollow circular shaft has an external diameter of 120 mm and an internal diameter of 100 mm. The maximum permissible shear stress is 100 MPa and twist is not to exceed  $3.6^\circ$  in length of 3 m. Maximum torque is 25 % more than the average torque. The shaft is rotating at 2 RPS. If shear modulus is 80 GPa, find safe power that can be transmitted. 07 M

b) An alloy tube of 25 mm internal diameter and 40 mm external diameter, when subjected to an axial tensile force of 60kN undergoes an extension of 3.84 mm over its 3 m length. What is its safe axial load resisting capacity (i. e. working load) as a column when one end is fixed and other is hinged? Take F. O. S. 4 06 M

OR

Que 06 a) A composite shaft consists of a steel rod 60 mm diameter surrounded by closely fitted tube of brass fixed to it. Find outside diameter of tube so that when torque is applied to the composite, it will be shared equally by the two materials. Take  $G$  for steel =  $8.4 \times 10^4 \text{ N/mm}^2$  and  $G$  for brass =  $4.2 \times 10^4 \text{ N/mm}^2$ . If the torque is 10,000 Nm find the maximum shearing stress in each material and the angle of twist in a length of 4 meters. 07 M

b) A cylindrical tube having internal diameter 70 mm and external diameter 80 mm is used on a column. The section is subjected to an axial load of 100 kN. Determine whether the tube is safe for the given application. Use Rankine formula with Rankine's constant  $a = (1/7500)$ ,  $E = 200 \text{ GPa}$ , Yield stress = 150 MPa, & Effective length of column = 4.5 m. 06 M

Que 07 An machine element is loaded as 75 MPa tensile stress in X-direction, 100 MPa tensile stress in Y-direction and 50 MPa shear stress in anticlockwise direction on

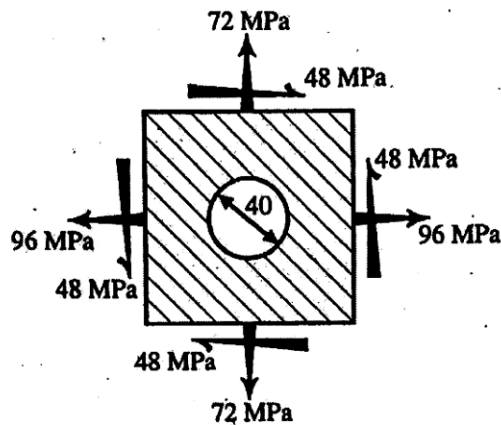
x-face. Determine following stresses using graphical method proposed by Mohr. Mohr's circle must be drawn by using suitable scale on graph paper only

- I. The principal stresses and their orientation
- II. The maximum shearing stresses and direction of the plane on which it occur

13 M

OR

- Que 08 a) A circle of 40 mm diameter is marked on steel plate before it is stressed as shown in *Fig. No. 06*. As a result of these stresses the circle deforms to an ellipse. Calculate the lengths of major and minor axis of an ellipse and their directions. Assume  $E = 200 \text{ GPa}$  and  $\mu = 0.25$



*Fig. No. 06*

07 M

- b) A member, solid circular in cross section is subjected to an axial pull of 13 kN and a shear force of 5 kN. Design cross section of member based on –
- I. Maximum principal stress theory
  - II. Maximum shear stress theory

Take

Elastic limit of axial tension = 250 MPa and

Poisson's Ratio  $\mu = 0.3$  and F. O. S. = 2.5

06 M

Total No. of Questions—8]

[Total No. of Printed Pages—4

Seat No.	
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[5352]-516

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

EXAMINATION, 2018

FLUID MECHANICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Neat diagram 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, Steam tables and p-h chart is allowed.

(iv) Assume suitable data, if necessary.

1. (a) Explain types of fluid using stress strain diagram. [6]

(b) Find the acceleration and vorticity components at a point (1,1,1) for the following flow field : [6]

$$u = 2x^2 + 3y, v = -2xy + 3y^2 + 3cy, w = -3/2z^2 + 2xz - 9y^2z$$

*Or*

2. (a) Define various types of flows with mathematical expressions. [6]

P.T.O.

- (b) A 400 mm diameter shaft is rotating at 200 RPM in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is  $0.7 \text{ N}\cdot\text{s}/\text{m}^2$ , determine : [6]
- (i) Torque required to overcome friction in bearing
- (ii) Power utilized in overcoming viscous resistance.
3. (a) Discuss various arrangements of Pitot tube used in pipes. [6]
- (b) A 0.2 m diameter pipe carries liquid in laminar region. A pitot tube placed in the flow at a radial distance of 15 mm from the axis of the pipe indicates velocity of 0.5 m/s. Calculate : [6]
- (i) the maximum velocity
- (ii) the mean velocity
- (iii) the discharge in the pipe.
- Or*
4. (a) Derive an expression of velocity and shear stress distribution for laminar flow through pipe. [6]
- (b) A 300 mm  $\times$  150 mm venturimeter is provided in a vertical pipeline carrying oil of specific gravity 0.9, flow being upward. The difference in elevation of the throat section and entrance section of the venturimeter is 300 mm. The differential U-tube mercury manometer shows a gauge deflection of 250 mm. Calculate : [6]
- (i) The discharge of oil, and



(ii) The pressure difference between the entrance section and the throat section.

Take  $C_d = 0.98$  and specific gravity of mercury as 13.6.

5. (a) A 3000 m long pipeline is used for transmission of power. 130 kW power is to be transmitted through the pipe in which water having a pressure of 40 bar at inlet is flowing. If the pressure drop over the length of pipe is  $800 \text{ kN/m}^2$  and  $f = 0.024$ , find : [6]

(i) Diameter of the pipe

(ii) Efficiency of transmission.

(b) Explain : [6]

(i) Reynolds Number

(ii) Weber Number

(iii) Euler Number.

*Or*

6. (a) Torque  $T$  of propeller depends on density of liquid  $\rho$ , viscosity of liquid  $\mu$ , speed of shaft  $N$  rpm, linear velocity  $V$ , diameter of the propeller shaft  $D$ . Using Buckingham  $\pi$ -theorem, show that : [7]

$$T = \rho N^2 D^5 \phi \left[ \frac{ND}{\theta}, \frac{\rho ND^2}{\mu} \right]$$

(b) A siphon of dia 200 mm connects two reservoirs having a difference of elevation of 15 m. The total length of siphon is 400 m and the summit is 3 m above the water level in the upper reservoir. The length of siphon from upper reservoir to summit is 120 m. Take friction factor = 0.02,

Determine : [6]

(i) Discharge through the siphon, and

(ii) Pressure at the summit. Neglect minor losses.

7. (a) Write a short note on “Separation of Boundary Layer its Control.” [7]

(b) For the following velocity profiles in the boundary layer. Show that whether the boundary is attached, detached or on the verge of separation : [6]

(i)  $u/U = 2\eta - \eta^2 + 3\eta^3$

(ii)  $u/U = -2\eta + \eta^3 + 2\eta^4$

(iii)  $u/U = 2\eta^2 + 5\eta^3 + 2\eta^4$

where  $\eta = y/\delta$ .

*Or*

8. (a) Derive an expression for displacement, momentum and energy thicknesses. [9]

(b) A plate length 450 mm and width 150 mm has been placed longitudinally in a stream of crude oil (specific gravity 0.925 and kinematic viscosity of 0.9 stokes) which flows with velocity of 6 m/s. Calculate the friction drag on the plate. [4]

Total No. of Questions—8]

[Total No. of Printed Pages—6

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[5352]-517

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

EXAMINATION, 2018

THEORY OF MACHINES-I

(2015 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.

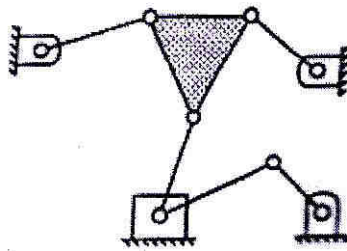
(iii) Figures to the right indicate full marks.

(iv) Use of calculator is allowed.

(v) Assume suitable data, if necessary.

1. (a) Explain different types of constrained motions with suitable examples. [6]

(b) Find degrees of freedom for the mechanism as shown in the following figure : [4]



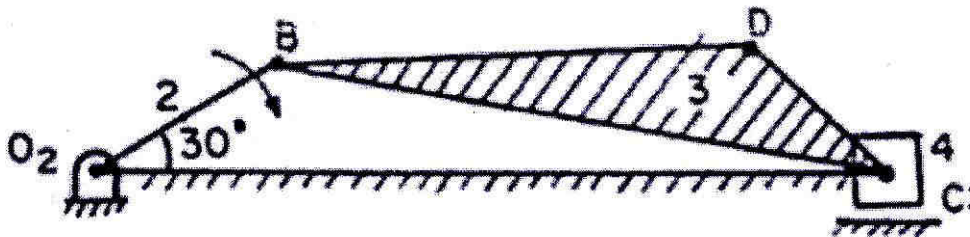
P.T.O.

*Or*

2. (a) With the help of neat schematic diagram derive frequency equation of Trifilar Suspension method. [5]
- (b) The connecting rod of an oil engine has a mass of 60 kg, the distance between the bearing centers is 1 meter. The diameter of the big end bearing is 120 mm and of the small end bearing is 75 mm. When suspended vertically with a knife-edge through the small end, it makes 100 oscillations in 190 seconds and with knife-edge through the big end it makes 100 oscillations in 165 seconds. Find the moment of inertia of the rod in  $\text{kg}\cdot\text{m}^2$  and the distance of C.G. from the small end centre. [5]
3. (a) Explain construction and working of Epicyclic train dynamometer with neat sketch. [4]
- (b) A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform wear and coefficient of friction as 0.3, find the maximum axial intensity of pressure between the discs for transmitting 25 kW at 1575 r.p.m. [6]

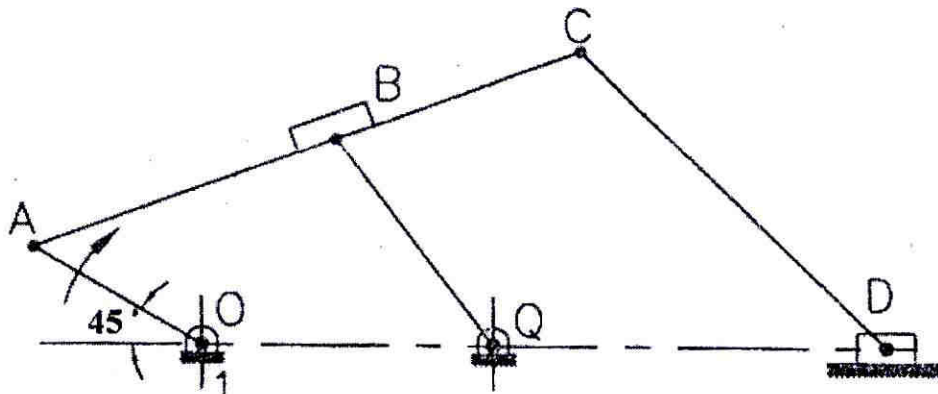
Or

4. (a) Derive an equation for finding angular velocity and angular acceleration of connecting rod analytical method. [5]
- (b) The driving shaft of a Hooke's joint runs at a uniform speed of 240 r.p.m. and the angle  $\alpha$  between the shafts is  $20^\circ$ . The driven shaft with attached masses has a mass of 55 kg at a radius of gyration of 150 mm. [5]
- (i) If a steady torque of 200 N-m resists rotation of the driven shaft, find the torque required at the driving shaft, when  $\theta = 45^\circ$ .
- (ii) At what value of ' $\alpha$ ' will the total fluctuation of speed of the driven shaft be limited to 24 r.p.m. ?
5. (a) Explain with neat sketch Velocity Image Principle. [3]
- (b) For the mechanism as shown in figure below, find the acceleration of point D on link DBC when link  $O_2B$  rotates at 30 r/s using relative velocity and acceleration method. Link lengths are  $O_2B = 200$  mm,  $BD = 460$  mm,  $DC = 175$  mm and  $BC = 600$  mm. [12]



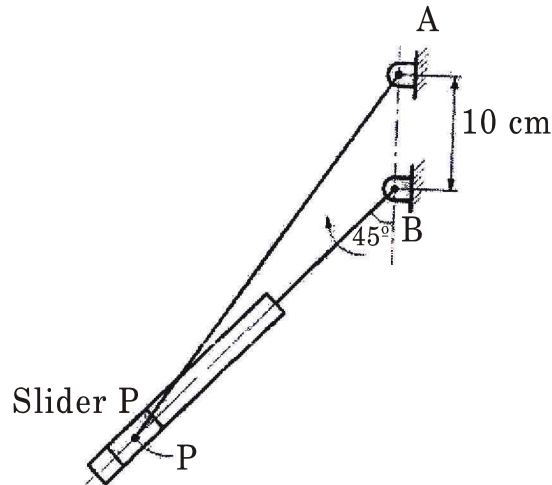
Or

6. (a) Explain with the help of neat sketch different type of ICR's. [3]
- (b) For the configuration shown in the following figure, enumerate and locate all the instantaneous centers of velocities and hence find the velocity of slider D, if the link OA rotates at 1000 rpm. Link lengths are  $OQ = 225$  mm,  $QB = 200$  mm,  $AB = 250$  mm,  $OA = 150$  mm,  $AC = 450$  mm,  $CD = 325$  mm. [12]



7. (a) Explain with neat sketch Acceleration Image Principle. [3]
- (b) The cylinder of rotary engine rotates at uniform speed of 900 rpm clockwise about the lower end B of fixed vertical crank AB 10 cm long. The connecting rod AP 40 cm long rotates about the upper end. The piston reciprocates in the cylinder. Determine the angular acceleration of connecting rod for a

cylinder which has turned through an angle  $45^\circ$  past the dead centre position as shown in figure, using relative velocity and acceleration method. [12]



*Or*

8. (a) The crank of reciprocating engine is 225 mm long, the connecting rod is 900 mm long and rpm is 150. Find the velocity and acceleration of the piston and angular velocity and angular acceleration of the connecting rod using Klein's construction when the angle which the crank makes with i.d.c. is  $30^\circ$ . [7]
- (b) The crank of reciprocating engine is 225 mm long, the connecting rod is 900 mm long. When the crank has turned through  $120^\circ$  from inner dead centre, it has an instantaneous speed of 240 rpm clockwise, decreasing at the rate of 100

rad/s<sup>2</sup> second square. Find the following using Klein's construction :

- (i) The velocity and acceleration of piston,
- (ii) The angular velocity and angular acceleration of the connecting rod
- (iii) The location of point X on the connecting rod which has minimum acceleration. [8]



Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-518

S.E. (Mech./Automo.) (Second Semester) EXAMINATION, 2018

ENGINEERING METALLURGY

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Solve Question Nos. 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) Draw neat, labelled sketch wherever necessary.

1. (a) Compare Steel and Cast Iron on the basis of composition, properties and application. [4]
- (b) State whether the following statements are True or False and justify your choice correctly :
  - (1) Retained Austenite is a useful phase.
  - (2) Martensite is a soft phase. [4]
- (c) Differentiate between Tool steel and Plain carbon steel, on the basis of composition, properties, uses, cost and examples. [5]

*Or*

2. (a) Is etching is essential every time ? Explain with suitable example. [4]
- (b) What is Austenite to Pearlite transformation ? Explain with suitable figure. [4]

P.T.O.

- (c) Explain how Microscopic and Macroscopic examinations are useful in investigations failure analysis in metals. [5]
3. (a) State whether the following statements are True or False and justify your choice correctly. [4]
- (1) Pack carburising is most suitable for large scale of production.
- (2) Tool steel requires preheating before austenitising.
- (b) Define Hardanability, and explain the test with suitable figure. [5]
- (c) What is Spark test ? Where is it applicable ? [4]
- Or*
4. (a) Draw Iron Carbon diagram showing all details, like Temperature, Composition, Phases, Critical lines and reactions. [6]
- (b) Differentiate between the following : [7]
- (1) Austempering and Martempering.
- (2) Annealing and Hardening.
- (On the basis of suitable figure, phases obtained, operating temperature. cooling medium and application.)
5. (a) Classify Cast Irons and explain why they are called as cast irons only ? [4]

(b) What is Malleabilising Heat Treatment ? Explain the test with suitable figure. [4]

(c) Write short note on Quench Cracks in Hardening process. [4]

*Or*

6. (a) What is the importance of TTT diagrams in Heat Treatment processes. [4]

(b) Differentiate between Gray C.I. and Nodular C.I. [4]

(c) What is Sub Zero Treatment and why is it necessary? [4]

7. (a) What is HAZ ? Explain with suitable figure. [5]

(b) State merits and demerits of Non-Ferrous metals over Ferrous metals. [3]

(c) Why Aluminium and Copper metals are known as corrosion resistant. [4]

*Or*

8. (a) What is IS, AISI, SAE and DIN ? Explain in detail. [6]

(b) What is Stellite 21 and Stellite 31 ? What are their advantages and disadvantages ? [6]

Total No. of Questions—8]

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[5352]-519

**S.E. (Mechanical/Automobile) (II Sem.) EXAMINATION, 2018**  
**APPLIED THERMODYNAMICS**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—**
- (i) Answer 4 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, if necessary.

- Q1. a) Explain the valve timing diagram of 4-stroke S. I. Engine with the help neat diagram. [6]  
b) Draw the schematic diagram of M.P.F.I. system. List down the sensors (minimum 4), [6]  
explain their location and function.

**OR**

- Q2. a) Explain the following losses for an actual S.I. Engine cycle: [6]  
(i) Time loss  
(ii) Exhaust blowdown loss  
Show above losses on P-V diagram.  
b) Explain the effect of various engine variables on flame speed in SI engines. [6]

- Q3. a) With neat sketch explain the construction and working of Compression Swirl type [6]  
Combustion Chamber in C.I. Engine.  
b) A single cylinder 4-stroke Engine gave the following results on full load. [6]  
Area of indicator card =  $300 \text{ mm}^2$ , Length of diagram = 40 mm,  
Spring constant= 1 bar/mm,  
Speed of engine= 400 rpm,  
Load on brake = 370 N,  
Spring balance reading= 50 N,  
Diameter of brake drum= 1.2 m,

P.T.O.

Fuel consumption= 2.8 kg/h, C.V. of fuel= 41800 kJ/kg,

Diameter of cylinder = 160 mm, stroke of piston= 200 mm.

Calculate: i) Indicated MEP ii) Indicated thermal efficiency iii) Brake power iv) Brake Thermal Efficiency.

**OR**

- Q4. a) Explain the various stages of combustion in CI engine. [6]  
b) Explain the Willian's line method of determining friction power and write its drawbacks. [6]

- Q5. a) Explain the variation of HC, CO and NOx emission with respect to air fuel ratio for S.I. engine. [6]  
b) Explain the working of magneto ignition system with neat sketch. [7]

**OR**

- Q6. a) How does Positive Crankcase Ventilation system reduce the pollution due to crankcase Blow-by? Explain with diagram. [6]  
b) What is engine governing? Explain any one method of engine governing with neat sketch. [7]

- Q7. a) Derive the expression for ideal intermediate pressure for two stage single acting reciprocating air compressor working under perfect intercooling condition. What is its effect on discharge temperature, pressure ratio and work required for each stage? [6]  
b) A two stage air compressor with perfect intercooling takes in air at 1 bar and 27<sup>0</sup>C. The law of compression in both the stages is  $pv^{1.3} = \text{constant}$ . The compressed air is delivered at 9 bar from the H.P. cylinder to an air receiver. Calculate, per kg of air, (a) minimum work of compression, (b) heat rejected in intercooler, (c) work required for single stage compression to the same delivery pressure. [7]

**OR**

- Q8. a) Explain Root's blower compressor with neat sketch. [6]  
b) A single stage reciprocating air compressor has a swept volume of 2000 cm<sup>3</sup>, runs at 800 rpm and takes in air 1.013 bar and 15<sup>0</sup>C. It operates on a pressure ratio of 8, with a clearance of 5% of the swept volume. Assume polytropic compression and expansion with  $n = 1.25$ . Calculate (a) Volumetric efficiency, (b) Indicated power, (c) Isothermal efficiency, (d) actual power needed to drive the compressor, if the mechanical efficiency is 85% [7]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-520

S.E. (Mechanical, Mech. Sandwich & Automobile)  
(II Sem.) EXAMINATION, 2018  
ELECTRICAL AND ELECTRONICS ENGINEERING  
(2015 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.

- Q.1** (a) Derive an expression for torque developed in three phase induction motor under running conditions. 6
- (b) The input power supplied to a 500 V, DC shunt motor is 8776 W. It is desired to reduce the speed of the motor by 30% by inserting a resistance in the armature circuit; keeping the shunt field and armature current unchanged. The resistances of the field and armature windings are 400  $\Omega$  and 0.25  $\Omega$  respectively. Calculate the value of the inserted resistance. 7

(OR)

- Q.2** (a) Derive an expression for armature torque developed in a DC motor. 6
- (b) A 6 pole, 50 Hz, 3-phase induction motor runs at 960 rpm when the torque on the shaft is 200 N-m. if the stator losses are 1500 W and friction and windage losses are 500 W, find (i) rotor copper loss and (ii) efficiency of the motor. 7
- Q.3** (a) Explain construction and working principle of Universal Motor. Mention it's any two applications. 6
- (b) Distinguish between a microprocessor and a microcontroller considering any six significant points. 6

P.T.O.

(OR)

- Q.4 (a)** Explain construction and working principle of AC and DC Servo motors with the help of suitable diagrams. **6**
- (b)** State *any six* significant features of ATmega 328P microcontroller. **6**
- Q.5 (a)** Explain the following functions used to handle GPIO in ATmega 328P based Arduino board with suitable examples:
- (i) pinMode( )
  - (ii) digitalWrite( )
  - (iii) digitalRead( )
- (b)** Draw interfacing circuit diagram of LCD module to Arduino board. Write the basic algorithm followed for this interfacing. **6**

(OR)

- Q.6 (a)** Explain the interfacing of LED with Arduino board with the help of diagram and write an algorithm to blink an LED. **6**
- (b)** Draw interfacing circuit diagram of 4 x 4 matrix keypad to Arduino board and write the algorithm for interfacing. **6**
- Q.7 (a)** Enlist *any six* significant features of ADC in ATmega 328P based Arduino board. **6**
- (b)** Draw interfacing circuit diagram of LVDT to Arduino board and explain the algorithm for interfacing. **7**

(OR)

- Q.8 (a)** Explain concept of PWM and draw interfacing circuit diagram of DC Motor to Arduino board in order to control speed of motor. **6**
- (b)** What is the function of LM35? Explain it's interfacing with Arduino board with the help of circuit diagram. **7**

Total No. of Questions—8]

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[5352]-521

**S.E. (Mechanical Sandwich) (I Sem.) EXAMINATION, 2018**  
**MATERIAL SCIENCE AND METALLURGY**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Answer *four* questions : Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6 and Q. Nos. 7 or 8.  
(ii) Neat diagrams must be drawn wherever necessary.  
(iii) Use of non-programmable electronic pocket calculator is allowed.  
(iv) Figures to the right indicate full marks.

1. a) Explain the packing of atoms to form the simple cubic, body centered cubic, face centered cubic and hexagonal close packed structures. [4]  
b) Explain with neat sketch edge dislocation and screw dislocation. [4]  
c) Explain with neat diagram principle of magnetic particle inspection. Why this method is used in both the longitudinal and transverse direction for testing the component? [4]
- OR
2. a) Draw typical engineering stress-strain curves for the following material;  
i) Aluminum ii) Cast iron  
iii) Mild steel iv) Natural rubber [4]  
b) What is creep in metals? Draw a typical creep curve and explain the various stages in creep. [4]  
c) Differentiate between slip and twinning? [4]
3. a) What is steel? How plain carbon steels are classified on the basis of C %? Compare these steels with reference to their composition and properties. [5]  
b) Explain four different types of stainless steel with reference to composition, properties and applications? [4]  
c) Compare between carburising and nitriding? [4]

P.T.O.



OR

4. a) What are different objectives of heat treatment of steels? Suggest suitable heat treatment according to objective. [5]  
b) What is conventional hardening heat treatment? Explain any two variants of hardening. [4]  
c) Explain four different types of Cast Iron with reference to microstructure and properties? [4]

5. a) Explain sintering mechanism in powder metallurgy. Explain with suitable example liquid phase sintering. [5]  
b) Explain advantages and limitations of powder metallurgy. [4]  
c) List four different types of brasses with their composition and application. [4]

OR

6. a) Explain two different types of babbitt material with reference to composition, microstructure and applications? [5]  
b) State composition, properties and applications of any two aluminium alloys. [4]  
c) Explain with neat flow diagram manufacturing of self lubricated bearings. [4]

7. a) What is polymer? Differentiate between thermoplastic and thermosetting polymers. [4]  
b) Compare ceramic material with metals and polymers. How ceramic powders are prepared. [4]  
c) What is composite? Briefly explain different types of composites. [4]

OR

8. a) What is elastomer? List the two molecular characteristics that are essential for elastomers. [4]  
b) Write short note on fibre reinforced composites. [4]  
c) Is it possible to grind up and reuse following polymer? Why or why not?  
i) phenol-formaldehyde ii) Polypropylene. [4]

Total No. of Questions—8]

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[5352]-522

S.E. (Mech/S/W) (I Sem.) EXAMINATION, 2018

FLUID MECHANICS AND MACHINERY

(2015 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) Differentiate between Kinematics and Dynamics of fluid flow. [5]

(b) An alloy containing gold and silver weighs 20.5 N in air and 18.8 N in water. Find % of gold and silver in this alloy.

$$S_{\text{gold}} = 19.5$$

$$S_{\text{silver}} = 10.5 \quad [8]$$

*Or*

2. (a) A circular plate of 2 m diameter has 50 cm hole. Plate is submerged in water with its upper edge 1 meter below the free surface of water. Centre of hole is 0.5 m below the centre of plate. Find the force acting on plate and centre of pressure. [6]

P.T.O.

(b) A flow field is represented by  $\phi = C(x^2 - y^2)$ . Verify validity of function. If valid, find the corresponding stream function. [7]

3. (a) A crude oil of sp. gravity 0.9 flows through a venturimeter fitted in a vertical pipe. The meter size is 20 cm  $\times$  8 cm. Discharge being 0.1 m<sup>3</sup>/sec. Length of venturimeter is 40 cm. If two pressure gauges are fitted at entry and exit of the meter, find difference in KPa between two gauges. If now gauges are replaced by mercuric manometer, what will be the head of mercuric in meters ? Take  $C_d = 0.98$ . [8]

(b) Using Buckingham  $\pi$  theorem, prove that : [5]

$$N_s = \frac{N\sqrt{P}}{H^{5/4}}$$

$$N = f(\rho, g, H, P, d).$$

*Or*

4. (a) Derive Weisbach-Darcy's equation and hence prove that : [8]

$$H_f = \frac{fLQ^2}{12.1d^2}.$$

(b) Prove that maximum efficiency of a curved vane with jet striking at the centre is given by : [5]

$$\eta_{\max} = \frac{8}{27}(1 + \cos \theta).$$

5. A francis turbine develops 300 kW BHP under 60 m head at 600 RPM. Assuming the following data :

$$D_2 = 2D_1, \frac{Vf_1}{\sqrt{2gH}} = 0.2, \eta_{Hyd} = 0.9, \eta_{OV} = 0.8, \text{ Vanes occupy } 5\% \text{ of runner space; } Vf_1 = Vf_2, \text{ inlet breadth ratio} = 0.1.$$

Find :

- (1) Inlet guide blade angle
- (2) Runner vane angle
- (3) Inlet and Outlet runner diameter
- (4) Inlet Wheel width. [12]

*Or*

6. (a) Why is draft tube not necessary for Pelton Wheel ?  
(b) Why is elbow draft tube used on Kaplan turbine ?  
(c) Which is turbine subjected to cavitation more ? Why ?  
(d) Why are outward flow reaction turbines not recommended ?  
(e) Which turbine has maximum part load efficiency ? Why ?  
(f) Write the formula for efficiency of draft tube and explain the parameters in it. [12]

7. The following data refers to a centrifugal pump :

Suction lift : 2 m, Delivery lift : 30 m

Head lost in suction and delivery pipes = 0.8 m and 0.3 m respectively. Diameter of suction and delivery pipe = 5 cm.

Determine :

- (a) Motor power if overall efficiency is 70% and manometric efficiency is 85%.
- (b) Negative head at suction side and positive head at delivery side. Actual head developed is 40 m. [12]

*Or*

8. A centrifugal pump running at 1500 RPM has following data :

$$D_1 = 10 \text{ cm}, D_2 = 30 \text{ cm}, B_1 = 5 \text{ cm},$$

$$B_2 = 2 \text{ cm}, Vf_1 = 3 \text{ m/s}, \beta_2 = 60^\circ.$$

Determine :

- (a) Discharge and  $Vf_2$
- (b) Inlet blade angle
- (c) K.E. of outlet water
- (d) Pump power
- (e) Pressure rise in impeller. [12]

Total No. of Questions—8]

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[5352]-523

S.E. (Mech. Engg./Sandwich) (Second Semester)

EXAMINATION, 2018

THERMAL ENGINEERING

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Solve Question Nos. 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) Draw neat, well labelled sketch wherever necessary.

(iv) Assume suitable data if necessary.

(v) Use of calculator is allowed.

1. (a) Explain the various methods to improve isothermal efficiency of reciprocating compressor. [6]
- (b) A three stage single acting reciprocating compressor has perfect intercooling. The pressure and temperature at the end of suction stroke in LP cylinder is 1.013 bar and 15°C respectively. If 8.4 m<sup>3</sup> of free air is delivered by compressor at 70 bar per minute and work done is minimum.

P.T.O.

Calculate :

- (i) Intermediate pressures
- (ii) Ratio of cylinder volumes
- (iii) Total indicated power.

Neglect clearance and assume  $n = 1.2$ . [7]

*Or*

2. (a) Give classification of refrigerants. [6]

(b) In a refrigeration plant working on Bell Coleman cycle air is drawn into compressor at a pressure of 1 bar and temperature of 9°C. After the compression to 8 bar, the air is cooled at constant pressure to temperature of 29°C . Then air is expanded to pressure of 1 bar. Compression and expansion follows the polytropic law. Given  $n = 1.35$ .

Take  $\gamma = 1.4$ ,  $C_p = 1.003$  kJ/Kg K.

Calculate : [7]

- (i) Refrigerating effect
- (ii) COP.

3. (a) Explain with neat sketch battery ignition system in IC engine. [6]

(b) Compare open and closed cycle gas turbine. [6]

*Or*

4. (a) Explain constant pressure turbo charging system. [6]

- (b) A simple closed cycle gas turbine plant receives air at 1 bar and 15°C and compresses it to 5 bar and then heats to 800°C in the heating chamber. The hot air expands in a turbine back to 1 bar. Calculate the power developed per kg of air supplied per second. Take  $C_p$  of air as 1 kJ/kgK. [6]
5. (a) Compare diesel knock and detonation. [6]
- (b) The output of an I.C. engine is measured by a rope brake dynamometer. The diameter of the brake pulley is 75 cm and rope diameter is 5 cm. The dead load on the tight side is 41 kg, and the spring balance reading is 5 kg. The engine consumes 4 kg/hr. of fuel at rated speed of 1000 rpm. The calorific value of fuel is 44000 kJ/kg. Calculate the brake specific fuel consumption and the brake thermal efficiency. [7]
- Or*
6. (a) Explain octane number. [6]
- (b) During a trial on a four cylinder petrol engine running at 3000rpm, the brake load was 267N when all the cylinders were working. When each cylinder was cut out in turn and the speed returned to 3000rpm, the brake readings were 178N, 187N, 182N, 182N. For the brake,  $b.p = (W \times rpm)/27300$ , where  $W$  is brake load in Newtons. Determine the brake power of the engine and estimate its indicated power and mechanical efficiency. [7]



7. (a) Explain the various sources of emission in SI engine. [6]  
(b) Explain the factors affecting the delay period. [6]

*Or*

8. (a) Give the classification of combustion chambers in CI engine. [6]  
(b) Write a note on emission norms. [6]

Total No. of Questions—8]

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[5352]-524

**S.E. (Mechanical Sandwich) (II Sem.) EXAMINATION, 2018**  
**METROLOGY AND QUALITY CONTROL**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) All questions are compulsory i.e. (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 calculator is allowed.  
(v) Assume suitable data, if necessary.

- Q1. a)** In a hole and shaft combination of 25 mm nominal size  $H_7$  hole limit are +0.021 mm, +0.000 mm and  $e_8$  shaft limits are - 0.40 mm, - 0.073mm. (i) State the type of fit with justification  
(ii) tolerance for both shaft and hole (iii) Maximum and minimum allowance obtained [6]  
**b)** Explain Johansson Mikrokator mechanical comparator with neat sketch [6]

**OR**

- Q2. a)** Determine the size of GO and NO GO gauge for the component having  $30H_7f_8$  fit. Being given with usual notations,  $i = 0.45\sqrt[3]{D} + 0.001D$ . The fundamental deviation for f shaft is  $-5.5D^{0.41}$ . 30 mm falls in the dia. Steps of 18 and 30. tolerance grade IT7=16i and IT8=25i [8]  
**b)** Mention the reasons for controlling the surface texture [4]

- Q3. a)** Explain two wire method to check the effective diameter of a thread with neat sketch and derive the relation to find out P value. [7]  
**b)** Briefly explain types of gear errors. [5]

**OR**

- Q4. a)** Explain Co-ordinate measuring machine with a sketch [6]  
**b)** Explain floating carriage micrometer [6]  
**Q5. a)** What is Quality circle and how is it beneficial? [6]  
**b)** Describe Profile projector listing its advantages. [7]

P.T.O.

**OR**

**Q6. a)** Briefly explain Pareto chart and for what purpose its analysis is done. [6]

b) What is concurrent engineering highlight the importance of concurrent engineering [7]

**Q7. a)** 15 samples of 150 items were inspected. Draw a P chart and comment on it. [7]

Sample no.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
No. of defects	22	15	13	24	14	35	07	11	16	37	18	10	20	21	17

b) Explain Just in time manufacturing philosophy. [6]

**OR**

**Q8. a)** In a double sampling plan  $N= 2000$ ,  $n_1=60$ ,  $c_1=0$ ,  $n_2 = 80$ ,  $c_2 = 2$ . Determine the probability that a lot containing 2% defective will be rejected. [8]

b) Explain Poka-yoke with an example. [5]

Total No. of Questions—8]

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[5352]-525

S.E. (Mechanical Engineering) (Sandwich) (II Sem.)

EXAMINATION, 2018

MANUFACTURING ENGINEERING

(2015 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) Assume suitable data, if necessary.  
(v) Use of electronic pocket calculator is allowed.

- 1 (a) Explain various types of pattern allowances. [6]  
(b) Explain centrifugal casting with neat sketch. [6]  
*Or*
- 2 (a) Explain Hot and cold working process. [6]  
(b) Define and explain extrusion and its types. [6]
- 3 (a) Explain with sketch principle and advantages of TIG welding. [6]  
(b) Explain the spot welding process. Differentiate between spot and seam welding process. [6]  
*Or*
- 4 (a) Draw and explain the Apron mechanism in lath machine. [6]  
(b) Define Tool life. Describe the factors affecting tool life. [6]

P.T.O.

- 5 (a) Explain the types of drill tools and tool holding devices. [7]  
(b) Explain Universal dividing head in milling machine. [6]

*Or*

- 6 (a) What is indexing and explain compound indexing method. [7]  
(b) Explain the factors for selecting the grinding wheel. [6]

- 7 (a) Explain with neat sketch of EDM and state its advantages and limitations. [7]  
(b) Explain with neat sketch of the EBM process. [6]

*Or*

- 8 (a) Explain with neat sketch, the working principle of USM and state its advantages and limitations. [7]  
(b) Explain with neat sketch ECM. [6]

Total No. of Questions—8]

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[5352]-526

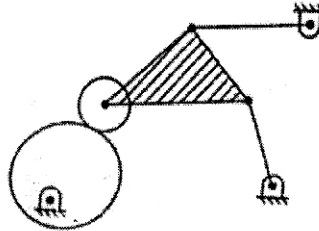
**S.E. (Mechanical-Sandwich) (II Sem.) EXAMINATION, 2018**  
**THEORY OF MACHINES**  
**(2015 PATTERN)**

**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 calculator is allowed.  
(v) Assume suitable data, if necessary.

- 1 a) What do you understand by inversion of a kinematic chain? Explain with the help of neat sketches any one inversion of a single slider crank chain, giving their practical applications. [06]
- b) Find degrees of freedom for the mechanism as shown in the following fig. [04]



**OR**

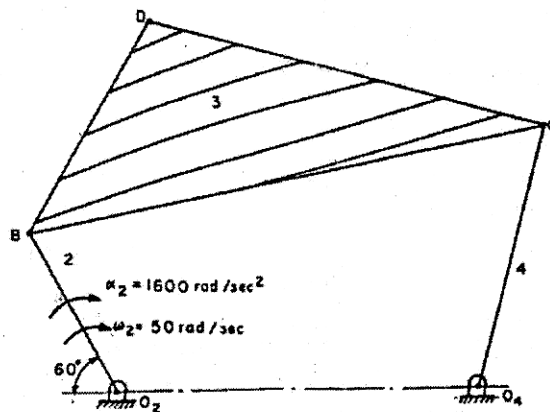
- 2 a) With the help of neat schematic diagram derive frequency equation of Trifilar suspension method. [05]
- b) The connecting rod of an engine weighing 12 Kg is 500 mm long. The obliquity ratio is 5 and the C.G. of connecting rod is at the distance of 120 mm from the crank pin centre. The periodic time of oscillation for the connecting rod when suspended from centre of small end is 1.33 sec. Determine dynamically equivalent two mass systems keeping one mass at small end. [05]

P.T.O.

- 3 a) Describe the construction and working of Tatham Dynamometer brake dynamometer. [04]
- b) A conical friction clutch is used to transmit 90 kW at 1500 r.p.m. The semicone angle is  $20^\circ$  and the coefficient of friction is 0.2. If the mean diameter of the bearing surface is 375 mm and the intensity of normal pressure is not to exceed  $0.25 \text{ N/mm}^2$ , find the dimensions of the conical bearing surface and the axial load required. [06]

OR

- 4 a) Derive an Equation for finding velocity and acceleration of slider using analytical method. [05]
- b) Two shafts with an included angle of  $160^\circ$  are connected by a Hooke's joint. The driving shaft runs at a uniform speed of 1500 r.p.m. The driven shaft carries a flywheel of mass 12 kg and 100 mm radius of gyration. Find the maximum angular acceleration of the driven shaft and the maximum torque required. [05]
- 5 a) State and prove the 'Aronhold Kennedy's Theorem' of three instantaneous centres. [03]
- b) For the mechanism as shown in fig, determine the angular acceleration of link 3 and 4. Also determine absolute acceleration of point D on link 3. [12]

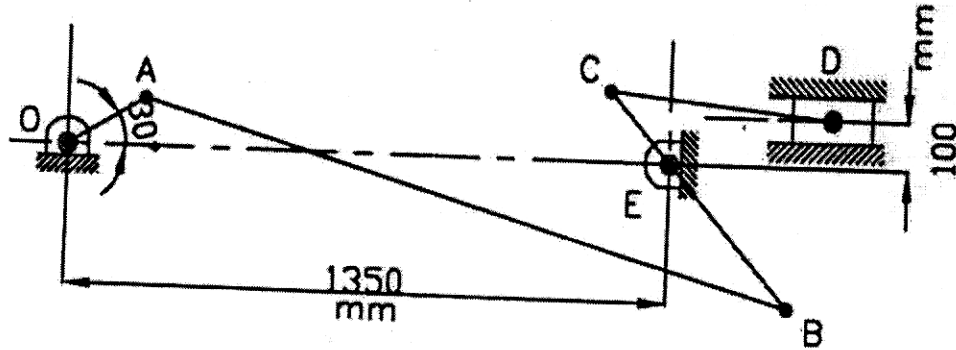


$$O_2B = 43.75, BC = 127.5, O_2O_4 = 87.5$$

$$O_4C = 62.5, BD = 56.25, CD = 100 \text{ mm}$$

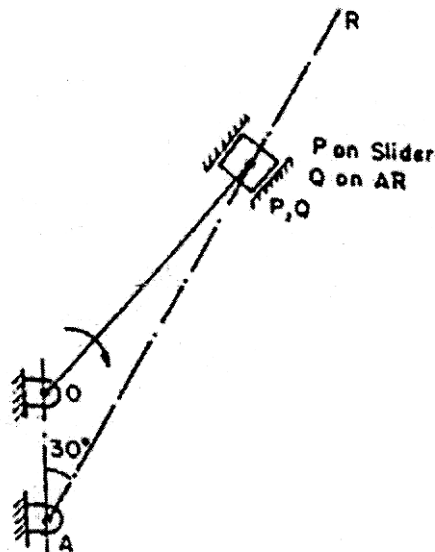
- 6 a) Explain Velocity Image Principle. [03]

- b) Fig shows a mechanism in which crank OA rotates uniformly at 120 rpm clockwise. Locate all the possible instantaneous centre of rotation. Find velocity of B, C and D, Angular velocity of the links AB, BC and CD. Link lengths are OA = 200 mm, AB = 1500 mm, BC = 600 mm, CD = 500 mm and BE = 400 mm. [12]



- 7 a) Explain Klein's construction for Velocity polygon of Single slider crank mechanism. [03]

- b) Fig shows rotary engine mechanism in which Link OA, 200 mm long is fixed. Link OP is connecting rod and is 520 mm long. The line of stroke is along AR and at the instant is inclined at 30° to the vertical. The body of engine consisting of cylinders rotates at a uniform speed of 400 rpm about fixed centre A. Determine Acceleration of piston inside the cylinder and angular acceleration of connecting rod. [12]





**OR**

- 8 a) The following data relate to a slider crank mechanism, crank radius = 150 mm, connecting rod length = 650 mm, crankshaft speed = 250 rpm. Determine the following at the instant when the crank and connecting rod are mutually perpendicular by using Klein's construction, (i) the velocity and acceleration of the midpoint of the connecting rod, (ii) the angular velocity and angular acceleration of connecting rod. [08]
- b) In an I C Engine mechanism, the crank is 200 mm long and connecting rod is 800 mm long. Find by using Klein's construction, the velocity and acceleration of piston and angular velocity, angular acceleration of connecting rod when the crank is turned through  $60^\circ$  from inner dead centre. The angular velocity of crank is 20 rad / sec and is increasing at the rate of 60 rad / sec<sup>2</sup>. [07]

Total No. of Questions—8]

[Total No. of Printed Pages—5

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[5352]-531

S.E. (Elect.&TC) (First Semester) EXAMINATION, 2018

SIGNALS AND SYSTEMS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Solve question No. 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) Assume suitable data if necessary.

1. (a) Perform the following operations and sketch the signals :  
[6]

(i)  $y(t) = x(t+1) - x(t) + u(t-2)$

(ii)  $y[n] = u[n+3] - 2u[n-1] + u[n-4]$

(b) Using impulse response properties, determine whether the  
following systems are : [6]

(i) Static/Dynamic

(ii) Causal/Non-causal.

P.T.O.

(iii) Stable/Unstable :

(1)  $h(t) = e^{-2|t|}$

(2)  $h(n) = 2\delta[n] - 3\delta[n-1]$ .

Or

2. (a) Find Even and Odd components of the following signals : [6]

(i)  $x(t) = 3t + t \cos t + t^2 \sin^2 4t$

(ii)  $x[n] = \{1, 1, -1, -1\}$ .

(b) Find convolution of the following, using graphical method : [6]

(i)  $x[n] = u[n]$

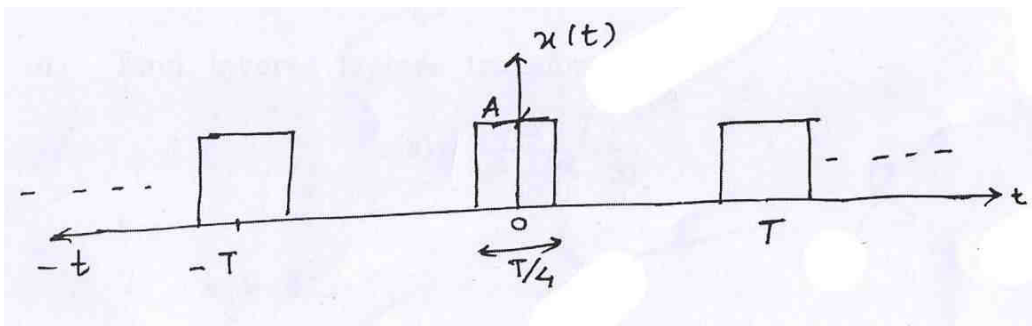
(ii)  $h[n] = a^n u[n] \quad 0 < a < 1$ .

3. (a) Find Fourier transform of the following signals using appropriate properties : [6]

(i)  $x(t) = \frac{d}{dt} \{e^{-at} \cdot u(t)\}$

(ii)  $x(t) = e^{-2t} u(t+2)$ .

(b) Find and sketch exponential Fourier series of the given signal : [6]



Or

4. (a) Find and sketch the trigonometric Fourier series of train of impulse defined as : [6]

$$x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kTs)$$

- (b) Find Fourier transform of the following signals : [6]

(i)  $u(t)$

(ii)  $\text{sgn}(t)$ .

5. (a) Find Laplace transform of the following :

(i)  $x(t) = \frac{d}{dt} t e^{-t} u(t)$  [3]

(ii)  $x(t) = e^{-3t} u(t) * \cos(t-2) u(t-2)$ . [4]

- (b) Find Initial and Final values of the signal  $x(t)$  having unilateral Laplace transform : [6]

(i)  $X(s) = \frac{7s+10}{s(s+2)}$

(ii)  $X(s) = \frac{5s+4}{s^3 + 3s^2 + 2s}$ .

Or

6. (a) Find inverse Laplace transform of : [7]

$$X(s) = \frac{3s+7}{(s^2 - 2s - 3)}$$

for :

(i)  $s > 3$

(ii)  $s < -1$

(iii)  $-1 < s < 3$ .

- (b) Find transfer function and impulse response of the causal system described by the differential equation : [6]

$$\frac{d^2}{dt^2} y(t) + 5 \frac{d}{dt} y(t) + \sigma y(t) = 2 \frac{d}{dt} x(t) - 3x(t).$$

7. (a) Find auto-correlation function of the signal given, using graphical method : [6]

$$x(n) = \left\{ \begin{array}{c} 2, 1, -2, 1, 3 \\ \qquad \qquad \qquad \uparrow \end{array} \right\}$$

- (b) The probability density function of a random variable X is given by : [7]

$$f_X(x) = e^{-x} u(x)$$

determine :

- (i) CDF
  - (ii)  $P(X \leq 1)$
  - (iii)  $P(1 < X \leq 2)$
  - (iv)  $P(X > 2)$ .
8. (a) The probability density function of a random variable 'X' is given by : [7]

$$f_X(x) = \begin{cases} \frac{1}{a} & |x| \leq a \\ 0 & \text{otherwise} \end{cases}$$

determine :

- (i) Mean  $E[X]$
  - (ii) Mean square value  $E[X^2]$
  - (iii) Standard deviation.
- (b) State and prove the relationship between auto-correlation and energy spectral density of Energy signal. [6]

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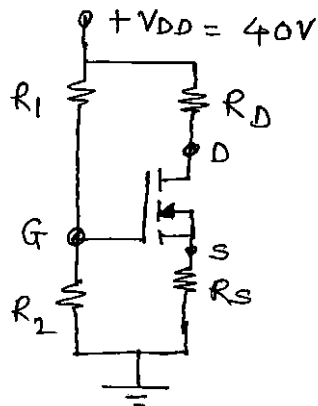
[5352]-532

**S.E. (E & TC/Electronics) (I Semester) EXAMINATION, 2018**  
**ELECTRONIC DEVICES AND CIRCUITS**  
**(2015 PATTERN)**

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

- N.B. :—** (i) Answer Q. 1 or 2, 3 or 4, 5 or 6, 7 or 8.  
(ii) Neat diagram must be drawn wherever necessary.  
(iii) Use of logarithm tables, slide rule, Mollier charts, electronic pocket calculator and steam table is allowed.  
(iv) Assume suitable data, if necessary.

1. (a) Explain the following terms with respect to JFET : [6]  
(i) Pinch off voltage ( $V_p$ )  
(ii) Cut-off voltage ( $V_{GS(off)}$ )  
(iii) Forward transconductor ( $g_m$ ).  
(b) For the circuit shown in figure 1. Calculate  $I_{DQ}$ ,  $V_{DSQ}$  and  $V_D$ . [6]



Assume :

$$R_1 = 22 \text{ M}\Omega, R_D = 3 \text{ k}\Omega$$

$$R_2 = 18 \text{ M}\Omega, V_{TN} = 3 \text{ V}, R_S = 0.82 \text{ k}\Omega$$

$$K_n = 0.12 \text{ mA/V}^2$$

$$V_{GS} = 10.48 \text{ V}$$

(Figure 1)

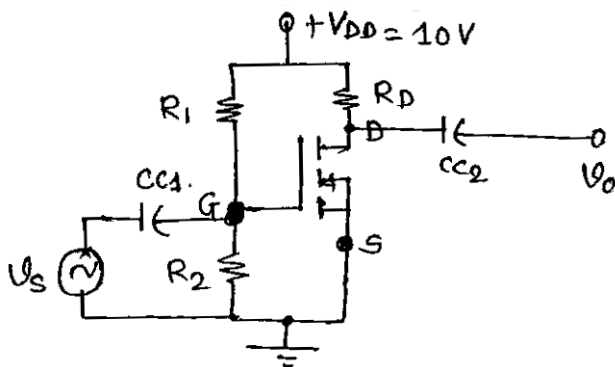
P.T.O.

Or

2. (a) Draw and explain the small signal mode of the JFET. [6]  
(b) Explain the following non-ideal voltage current characteristics of EMOSFET :  
(i) Finite output resistance  
(ii) Body effect  
(iii) Subthreshold conduction. [6]
3. (a) Draw the common source E-MOSFET amplifier and explain its modes of operation in detail. [7]  
(b) Draw and explain the working of MOSFET as current sink and source. [6]

Or

4. (a) For the circuit diagram shown in figure 2, calculate  $A_v$ ,  $R_i$  and  $R_o$ . [7]



Assume :

$$R_1 = 10 \text{ M}\Omega$$

$$R_2 = 3.6 \text{ M}\Omega$$

$$K_n = 0.5 \text{ mA/V}^2$$

$$\lambda = 0.01 \text{ V}^{-1}$$

$$V_{TN} = 1.5 \text{ V}$$

(Figure 2)

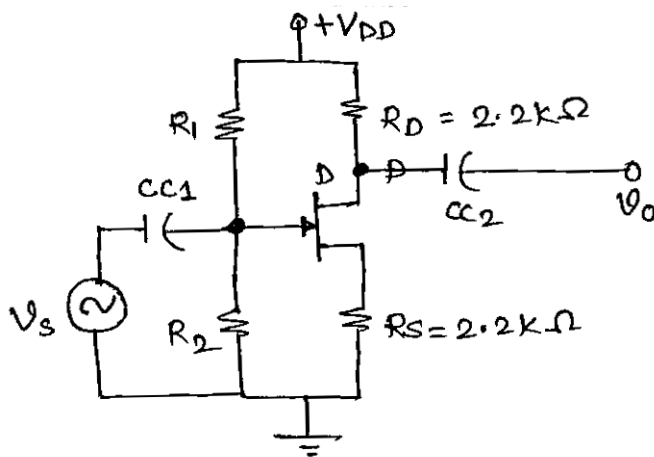
- (b) Write a short note on “MOSFET as Active resistor.” [6]



5. (a) What is the effect of negative feedback on the following parameters : [8]
- (1) Gain stability
  - (2) Bandwidth
  - (3) Input impedance
  - (4) Out impedance.
- (b) Draw and explain the Hartley oscillator. Give equation for frequency of oscillation. [5]

*Or*

6. (a) For the circuit diagram shown in figures, calculate the  $\beta$ ,  $R_{if}$ ,  $R_{of}$  and  $G_{mf}$ . [8]



Assume :

$$R_1 = 10 \text{ M}\Omega$$

$$R_2 = 1 \text{ M}\Omega$$

$$R_D = 2.2 \text{ k}\Omega$$

$$R_S = 2.2 \text{ k}\Omega$$

$$Y_{OS} = 20 \text{ }\mu\text{s}$$

$$g_m = 2.4 \text{ MA/V}$$

(Figure 3)

- (b) State Barkhausen criteria and draw RC phase shift oscillator. [5]
7. (a) Draw and explain the internal block diagram of negative three terminal adjustable Voltage regulators. [8]

(b) Write a short note on Boost SMPS. [4]

*Or*

8. (a) Draw the detailed block diagram of SMPS and explain its operation. [8]

(b) Design and adjustable voltage regulator using LM 317 for output voltage from 10 to 20 V and draw the typical connection diagram.

Assume :  $R_1 = 240 \Omega$  and  $I_{adj.} = 100 \mu A$ . [4]

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[5352]-533

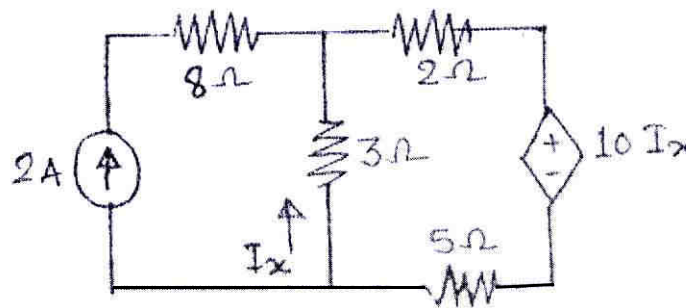
**S.E. (E & TC AND ELECTRONICS)**  
**(FIRST SEMESTER) EXAMINATION, 2018**  
**ELECTRICAL CIRCUITS AND MACHINES**  
**(2015 PATTERN)**

**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 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.

Q1. (a) Find current  $I_x$ .

[6]



(b) Explain open circuit test and short circuit test to be performed on transformer with neat circuit diagram. [6]

OR

Q2. (a) A 50 KVA, 2200/22 V, 50 Hz single phase transformer has an iron loss of 300 W. The resistances of low and high voltage windings are  $0.005 \Omega$  and  $0.5 \Omega$  respectively. If the p.f is 0.8 lagging, calculate maximum efficiency. [6]

(b) State and explain: Maximum Power Transfer Theorem. [6]

P.T.O.

- Q3. (a) Derive emf equation for DC generator. [6]  
(b) Explain the working principle of synchronous motor. [6]

OR

- Q4. (a) With the help of neat diagram explain the Torque slip characteristics of Induction motor. [6]

(b) A 4 pole, 250 V, DC series motor has a wave connected armature with 200 conductors. The flux per pole is 25 mWb when the motor is drawing 60 A from the supply. Armature resistance is  $0.15 \Omega$  while the series field winding resistance is  $0.2 \Omega$ . Calculate speed under this condition. [6]

- Q5. (a) Explain the construction and working principle of BLDC motor. Also draw its speed torque characteristics. [7]

(b) Explain in detail the principle of working, types and applications of the Reluctance motor. [6]

OR

- Q6. (a) Write a short note on Universal Motor. [7]

(b) Distinguish between Brushless DC motor and Conventional DC Motor. [6]

- Q7. (a) Write short notes on servomotors. [7]

(b) What are Stepper motors? How are they classified? Plot static and dynamic characteristics of stepper motor. [6]

OR

- Q8. (a) Describe the principal of operation of single phase split phase type induction motor along with its circuit and phasor diagram. [7]

(b) Write short note on Stepper Motors. [6]

Total No. of Questions—8]

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[5352]-534

S.E. (E & TC/Elect.) (I Sem.) EXAMINATION, 2018  
DATA STRUCTURES AND ALGORITHMS  
(2015 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.

- Q1) (a) Explain algorithm binary search with example. [6]  
(b) Sort the following numbers 38, 27, 43, 3, 9, 82, 10 using: [6]  
i) Bubble sort  
ii) Merge sort

OR

- Q2) (a) What is pseudo code? Write a pseudo code to find the factorial of  $n$  number. [6]  
(b) What is the difference between internal sorting and external sorting? Sort the [6]  
following numbers using selection sort.  
25, 17, 31, 13, 2

- Q3) (a) Convert the given infix expression to postfix expression using stack [7]  
(A \* B - (C - D)) / (E + F)  
(b) Compare array and linked list. [6]

OR

- Q4) (a) Draw and explain circular linked list. State the limitations of single linked list. [7]  
(b) Write limitations of arrays over linked list? Represent the following polynomial [6]  
using linked list:

$$23x^9 + 18x^7 + 41x^6 + 16x^4 + 3$$

- Q5) (a) Explain the different cases to delete an element from binary search tree. [6]  
(b) Write a recursive 'C' function for preorder and postorder traversal of a binary [6]  
Search tree.

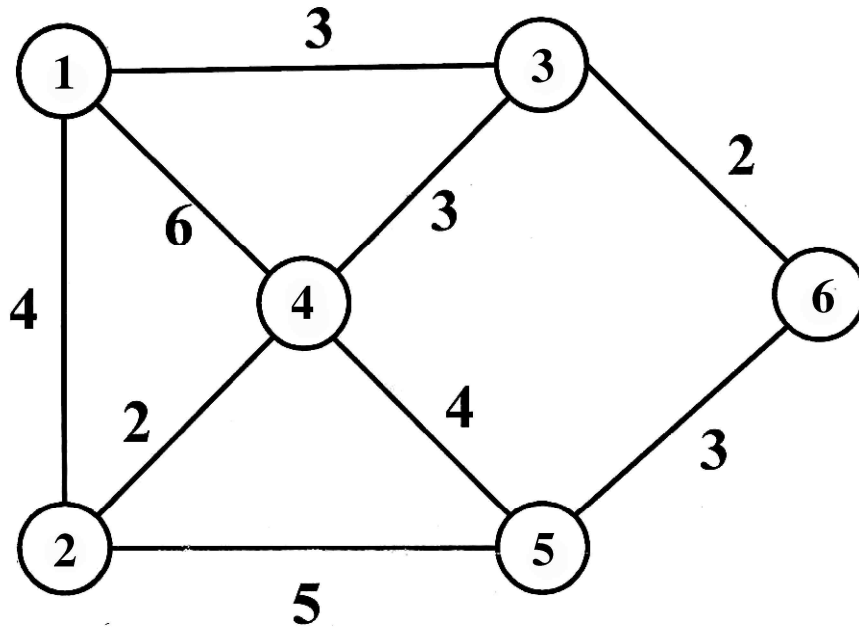
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OR

Q6) (a) Define traversal of binary tree? Explain three popular methods of binary tree traversal. [6]

(b) Explain with suitable example how will you represent a binary tree using Linked list. [6]

Q7) (a) Draw adjacency list and adjacency matrix for the following graph: [6]



(b) Explain with suitable example, BFS and DFS traversal of a graph. [7]

OR

Q8) (a) Explain Dijkstra's algorithm with example. [6]

(b) What is MST? Explain with suitable example Kruskal's Algorithm to find out MST. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-535

**S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2018**  
**DIGITAL ELECTRONICS**  
**(2015 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.

- Q 1 a Design a full adder using two half adders. 4 M  
b Minimize the following expression using k-map and  
implement using logic gates 4 M  
 $Y = \sum m(4,5,6,7,12,13,14,15)$   
c State the types of shift register and explain any one of them 4 M
- Q 2 a Design 3 bit synchronous counter using Delay flip flop(D-FF) 6 M  
B Design 4:1 MUX using 2:1 MUX 6 M
- Q 3 a Explain Mealy and Moore circuits with diagram? 6 M  
b Draw and explain operation of Tri-state TTL inverter? 6 M
- Q 4 a Explain the terms related to ASM chart. 6 M  
I. state box  
II. Decision box  
III. conditional box  
b Draw and explain the working of 2 input CMOS Inverter 6 M

P.T.O.

- Q 5 a Implement the following functions using PLA 6 M  

$$F1 = \sum m(0, 2, 4, 6)$$

$$F2 = \sum m(2, 3, 6, 7)$$
- b Explain the characteristics of DRAM. 4M
- c State various types of ROMS and their applications. 3M
- Q 6 a Draw the internal organization of asynchronous SRAM 6 M
- b Explain the general architecture of CPLD 4M
- c Explain the difference between PLA and PAL 3M
- Q 7 a Draw and explain block diagram of microcontroller 6 M
- b Explain stack operation and stack pointer register of 8051 4M
- c What are the different modes of timer of 8051? 3M
- Q 8 a Explain 8051 port structure with neat diagram 6 M
- b Explain the use of DPTR 4M
- c State salient features of 8051 microcontroller 3M



Total No. of Questions—8]

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[5352]-536

S.E. (Elect./E&TC) (II Sem.) EXAMINATION, 2018

INTEGRATED CIRCUITS

(2015 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) Assume suitable data, if necessary.

1. (a) Explain the following op-amp parameters : [6]

(i) Input offset voltage

(ii) CMRR

(iii) Slew Rate.

(b) Design a practical integrator for to operate at  $F = 4$  kHz  
and gain is equal to 2. [6]

*Or*

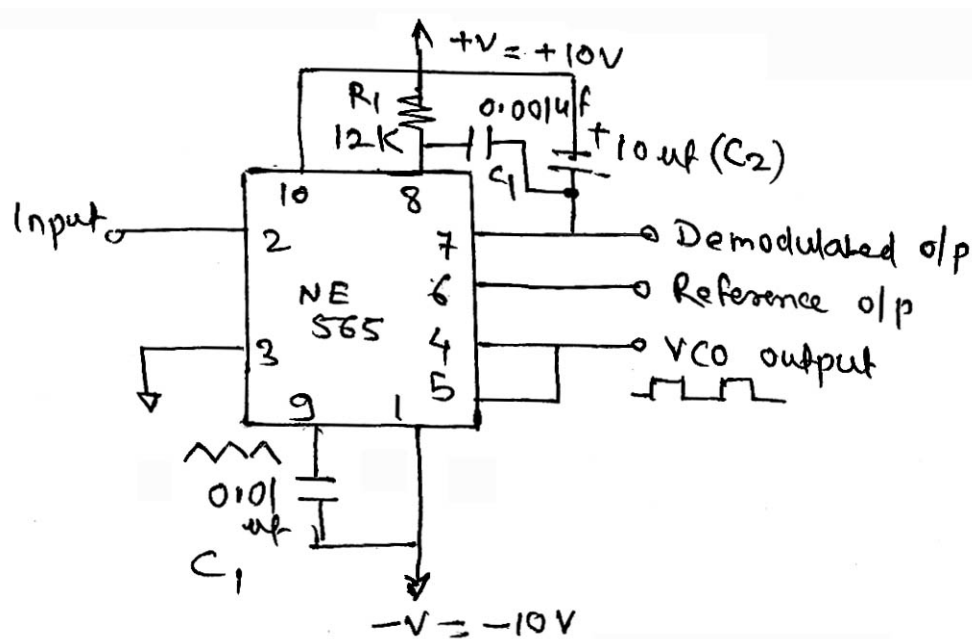
2. (a) Draw equivalent circuit of op-amp with its ideal transfer  
curve. [6]

P.T.O.

- (b) Draw the circuit diagram of practical differentiator and write equation for output voltage ( $V_o$ ). [6]
3. (a) Draw circuit diagram and its input and output waveform for peak detector. [6]
- (b) Draw circuit diagram for R-2R ladder DAC and write its output equation. [6]

Or

4. (a) Write short note on characteristic of comparator. [6]
- (b) Draw circuit diagram of Binary weighted DAC and write its output equation. [6]
5. (a) Calculate free running frequency  $F_{out}$ , the lock range  $F_t$  and the capture range  $F_c$  for the given circuit. [7]



- (b) Explain the working principle of oscillator with the help of its block diagram. [6]

*Or*

6. (a) Draw circuit diagram of frequency multiplier using PLL and explain its operation. [7]
- (b) Draw circuit diagram of phase shift oscillator and explain its operation. [6]
7. (a) Design a first order low pass filter with high cut-off frequency of 1 kHz and pass band gain is 3. Draw the circuit diagram with its component values. [7]
- (b) Draw circuit diagram of second order high pass filter. [6]

*Or*

8. (a) Design a first order high pass filter with low cut-off frequency of 6 kHz with pass band gain is 2. Draw the circuit diagram with its component values. [7]
- (b) Draw circuit diagram of second order low pass filter. [6]

Seat No.	
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[5352]-537

**S.E. (Electronics/E & TC) (II Sem.) EXAMINATION, 2018**  
**CONTROL SYSTEMS**  
**(2015 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) Determine the transfer function  $\frac{V_o(s)}{V_{in}(s)}$  for the system shown in Fig. 1 : [6]

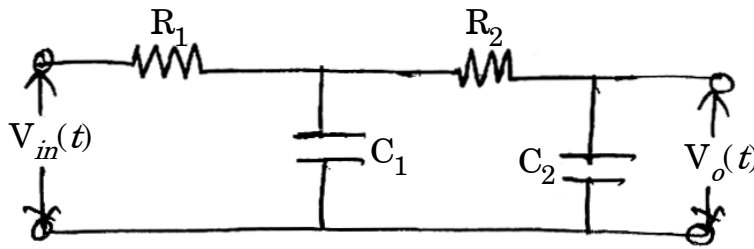


Fig. 1

- (b) For the unity feedback system with open loop transfer function  $G(s) = \frac{10(s+3)(s^2+4s+12)}{s(s+4)(s+6)(s^2+s+5)}$ , determine type and order of the system,  $k_p$ ,  $k_v$ ,  $k_a$  and steady state error for ramp input. [6]

P.T.O.

Or

2. (a) Determine the overall transfer function of the system shown in Fig. 2 using block diagram reduction rules : [6]

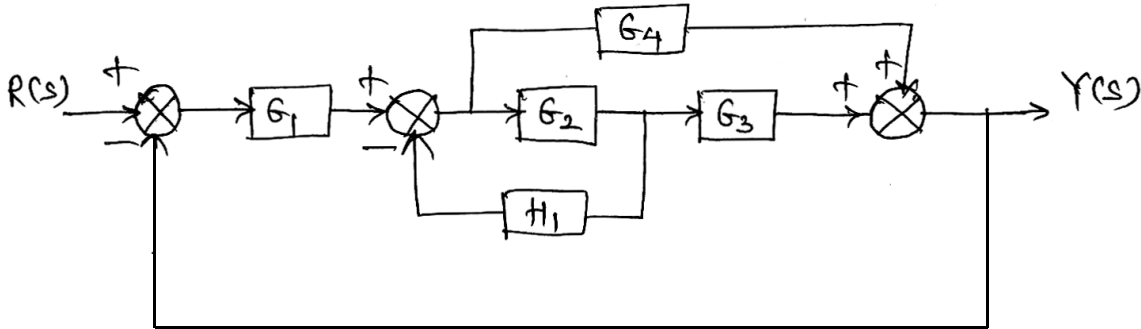


Fig. 2

- (b) For the system with closed loop transfer function  $G_{CL}(s) = \frac{k_1}{s^2 + k_2s + k_1}$  determine  $k_1$  and  $k_2$  if  $\xi = 0.5$  and setting time for 2% setting is 4 sec. Also find peak time, peak overshoot and rise time. [6]
3. (a) Investigate the stability of system with characteristic equation  $Q(s) = s^4 + 6s^3 + 15s^2 + 5s + 3 = 0$ . [4]
- (b) Draw Bode plot of the system with open loop transfer function  $G(s) = \frac{50}{s(s+5)(s+10)}$  and determine  $w_{gc}$ ,  $w_{pc}$ , gain margin and phase margin. [8]

Or

4. (a) For the system with closed loop transfer function  $G_{CL}(s) = \frac{400}{s^2 + 20s + 400}$ , determine resonant peak, resonant frequency, damping factor and natural frequency. [4]

- (b) Sketch root locus of the system with open loop transfer function : [8]

$$G(s) = \frac{k}{s(s+2)(s+3)}.$$

5. (a) Obtain the expression for state transition matrix using Laplace transform method and state any four properties of state transition matrix. [6]
- (b) Investigate for complete state controllability and observability of the system with state model : [7]

$$\dot{x} = \begin{bmatrix} 0 & 0 & -3 \\ 1 & 0 & -4 \\ 0 & 1 & -1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 2 \\ 0 \end{bmatrix} u$$
$$y = [0 \ 0 \ 1]x.$$

*Or*

6. (a) Obtain the controllable canonical and observable canonical state models for the system with transfer function : [6]

$$G(s) = \frac{s^2 + s + 9}{s^3 + 4s^2 + 11s + 3}.$$

- (b) Determine the transition matrix of the state equation : [7]

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ -8 & -6 \end{bmatrix} x$$

7. (a) Draw the ladder diagrams for Ex-OR, NOR and NAND gates. [6]
- (b) Draw and explain block diagram of digital control system. [7]

Or

8. (a) Explain Ziegler and Nichol PID tuning method. [6]  
(b) Determine pulse transfer function and step response of : [7]

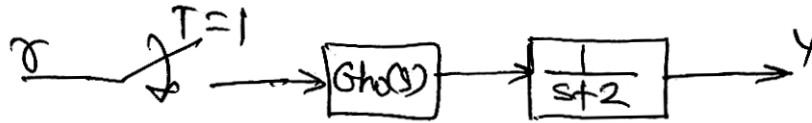


Fig. 3

Total No. of Questions—8]

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[5352]-538

S.E. (Electronics/E & TC) (II Semester) EXAMINATION, 2018

ANALOG COMMUNICATION

(2015 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 are the different types of amplitude modulation ? Explain any *one* in detail. [6]

(b) For receiver with IF and RF frequencies of 455 kHz and 900 kHz respectively. Determine : [6]

(i) The local oscillator frequency

(ii) Image frequency

(iii) Image frequency rejection ratio for Q of 80.

*Or*

2. (a) Draw and explain phase shift method of SSB-SC modulator. [6]

(b) AM transmitter has carrier of 550 Watt and modulated at depth of 65%, find the total power in transmitted wave and power saving in the following cases : [6]

(i) DSBSC

(ii) SSBSC.

P.T.O.



3. (a) Explain the performance characteristics of receiver with response curve : [6]
- (i) Sensitivity
  - (ii) Selectivity
  - (iii) Fidelity.
- (b) A carrier is frequency modulated with a sinusoidal signal of 2 kHz resulting in frequency deviation of 5 kHz :
- (i) Find bandwidth and modulation index of modulated wave.
  - (ii) If amplitude of modulating sinusoidal signal is increased by 3 and its frequency is halved. Find maximum frequency deviation and bandwidth of new modulated signal. [6]

*Or*

4. (a) What neat phasor diagram explain balanced slope detector in FM. [6]
- (b) FM wave is represented by the following equation,  
 $V = 10 \sin [5 \times 10^8 t + 4 \sin 1250 t]$ . Calculate :
- (i) Carrier and modulating frequency
  - (ii) Modulation index and maximum deviation
  - (iii) Power dissipated by FM wave in  $5\Omega$  resistor. [6]
5. (a) Derive the expression to calculate effective noise for series and parallel connection for resistors. [7]
- (b) Define the terms : [6]
- (i) Noise figure 1D Noise temperature
  - (ii) Noise bandwidth.

*Or*

6. (a) A mixer stage has a noise figure of 20 dB and this is preceded by amplifier that has a noise figure of 9 dB and an available power gain of 15 dB. Calculate the overall noise figure referred to input. [6]
- (b) Explain the performance of SSBSC in the presence of noise. [7]
7. (a) With suitable example, explain band limited and time limited signal. [6]
- (b) Discuss PWM generation and detection in detail. [7]

*Or*

8. (a) State sampling theorem and discuss its types. [6]
- (b) Differentiate between pulse analog modulation and pulse digital modulation. Discuss pulse code modulation. [7]

Total No. of Questions—8]

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[5352]-539

S.E. (E&TC/Elex) (Second Semester) EXAMINATION, 2018

OBJECT ORIENTED PROGRAMMING

(2015 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) Explain the basic concepts and features of OOP. [6]
- (b) Discuss the significance of Input/Output operators in C++ and their equivalence with 'C'. [3]
- (c) Discuss the usage of the operators that cannot be overloaded in C++. [3]

*Or*

2. (a) What is a constructor ? Discuss its types with suitable examples. [6]
- (b) Explain the concept of Inheritance in C++ with a suitable example. What are its types ? [6]

P.T.O.

3. (a) Explain in brief the different data types in Java. [6]  
(b) What are command line arguments ? Explain their significance with suitable example. [7]

*Or*

4. (a) Explain appropriately the following : [6]  
(i) The this keyword.  
(ii) finalize( ).  
(b) Discuss Access Control in Java and its significance. [3]  
(c) What is the significance of Static Members in Java ? Explain with example. [4]

5. (a) Describe different forms of inheritance in JAVA. Explain the syntax of single inheritance. [6]  
(b) What is an interface in JAVA, Write similarities and differences between an interface and a class ? [6]

*Or*

6. (a) What is Package ? How do we add a class or an interface to a package in JAVA. [6]  
(b) Describe the various four forms of implementing interfaces in JAVA. [6]

7. (a) What is a thread in JAVA ? Explain single threaded and multithreaded program. What is difference between multiprocessing and multithreading ? [7]

- (b) What is an exception in JAVA ? How do we define a try block and a catch block ? [6]

*Or*

8. (a) What is an applet in JAVA ? Explain a local applet and a remote applet ? [6]
- (b) Write a program in JAVA to create multiple threads and demonstrate how two threads communicate with each other ? [7]

Total No. of Questions—8]

[Total No. of Printed Pages—6

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[5352]-540

S.E. (E&TC/Elect.) (II Sem.) EXAMINATION, 2018

ENGINEERING MATHEMATICS—III

(2015 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) Solve any *two* of the following : [8]

(i)  $(D^2 + 5D + 6) y = e^x$

(ii)  $(D^2 + 4) y = \sec 2x$

(by method of variation of parameters)

(iii) 
$$\frac{dx}{x(2y^4 - z^4)} = \frac{dy}{y(z^4 - 2x^4)} = \frac{dz}{z(x^4 - y^4)}$$

P.T.O.

(b) Find the Fourier cosine transform of the function : [4]

$$f(x) = \begin{cases} x^2 & \text{if } 0 < x < a \\ 0 & \text{if } x > a \end{cases}$$

Or

2. (a) An uncharged condenser of capacity  $C$  charged by applying an e.m.f. of value  $E \sin \frac{t}{\sqrt{LC}}$  through the leads of inductance  $L$  and negligible resistance. The charge  $Q$  on the plate of condenser satisfies the differential equation : [4]

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

Prove that the charge at any time  $t$  is given by :

$$Q = \frac{EC}{2} \left[ \sin \frac{t}{\sqrt{LC}} - \frac{t}{\sqrt{LC}} \cos \frac{t}{\sqrt{LC}} \right].$$

(b) Find the inverse  $z$ -transform (any one) : [4]

(i)  $F(z) = \frac{2z^2 + 3z}{(z+2)(z-4)}, \quad |z| > 4$

(ii)  $F(z) = \frac{10z}{(z-1)(z-2)}$

(by inversion integral method)

(c) Solve the following difference equation : [4]

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

$$f(0) = 0, \quad f(1) = 2, \quad k \geq 0.$$

3. (a) Solve the differential equation  $\frac{dy}{dx} = 1 + xy$ ,  $y(0) = 2$  to get  $y(0.2)$  by using Runge-Kutta method of fourth order. ( $h = 0.2$ ) [4]
- (b) Find Lagrange's interpolation polynomial passing through set of points : [4]

$x$	$y$
0	2
1	3
2	12
5	147

- (c) Find directional derivative of  $\phi = 4xz^3 - 3x^2y^2z$  at  $(2, -1, 2)$  towards the point  $\bar{i} + \bar{j} - \bar{k}$ . [4]

*Or*

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

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

(ii) 
$$\nabla^4 e^r = e^r + \frac{4}{r} e^r.$$

- (b) Show that the vector field : [4]

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

is irrotational. Find scalar potential  $\phi$  such that  $\bar{F} = \nabla\phi$ .



(c) Compute the value of definite integral : [4]

$$\int_0^6 \frac{1}{1+x} dx$$

using Simpson's  $\left(\frac{3}{8}\right)$ th rule, dividing the interval into 6 parts.

5. (a) Evaluate : [4]

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

for the field  $\bar{F} = x^2 \bar{i} + xy \bar{j}$  over the region R enclosed by  $y = x^2$  and the line  $y = x$  using Green's theorem.

(b) Evaluate : [4]

$$\iint_S \bar{F} \cdot \hat{n} dS$$

for  $\bar{F} = 4xz \bar{i} - y^2 \bar{j} + yz \bar{k}$  and S, the surface of cube bounded by the planes  $x = 0, x = 2, y = 0, y = 2, z = 0, z = 2$  using Divergence theorem.

(c) Using Stokes' theorem calculate : [5]

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

where C is the curve of intersection of  $x^2 + y^2 + z^2 = 6z$  and  $z = x + 3$ .

Or

6. (a) Find the workdone by the force field given by : [4]

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

along the curve  $x^2 = 4y$ ,  $3x^3 = 8z$  from  $x = 0$  to  $x = 2$ .

- (b) Evaluate : [4]

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

for  $\bar{F} = 4xz \bar{i} - y^2 \bar{j} + yz \bar{k}$  and S, the surface of the cube bounded by the planes  $x = 0$ ,  $x = 3$ ,  $y = 0$ ,  $y = 3$ ,  $z = 0$ ,  $z = 3$  by using Divergence theorem.

- (c) Evaluate : [5]

$$\iint_S (\nabla \times \bar{F}) \cdot d\bar{S}$$

for  $\bar{F} = y \bar{i} + z \bar{j} + x \bar{k}$ , where S is the surface of the paraboloid  $z = 1 - x^2 - y^2$ ,  $z \geq 0$ .

7. (a) If  $f(z) = u + iv$  is analytic, show that  $u = c$ ,  $v = b$  are orthogonal. [4]

- (b) Evaluate : [4]

$$\oint_C \frac{z^2 + 1}{z - 3} dz$$

where

(i) 'C' is the circle  $|z - 3| = 2$

(ii) 'C' is the circle  $|z| = \frac{3}{2}$ .

- (c) Show that under the transformation  $\omega = z + \frac{1}{z}$  family of circles  $r = c$  are mapped on to family of ellipses. What happens if  $c = 1$  ? [5]

*Or*

8. (a) If  $f(z) = u + iv$  is analytic, show that  $u, v$  are Harmonic functions. [4]
- (b) Evaluate : [4]

$$\oint_C \frac{\sin 2z}{\left(z + \frac{\pi}{3}\right)^4} dz$$

where 'C' is the circle  $|z| = \frac{3}{2}$ .

- (c) Find the bilinear transformation which maps the points  $z = -1, 0, 1$  onto the points  $\omega = 0, i, 3i$  respectively. [5]

Total No. of Questions—8]

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[5352]-541

S.E. (Electrical Engg./Instru. & Control) EXAMINATION, 2018

ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Use of electronic pocket calculator is allowed.

(iii) Net diagrams must be drawn wherever necessary.

(iv) Assume suitable data, if necessary.

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

(1)  $\frac{d^3 y}{dx^3} + 4 \frac{dy}{dx} = \sin 2x$

(2)  $(D^2 + 9)y = \frac{1}{1 + \sin 3x}$  by variation of parameters method

(3)  $(4x + 1)^2 \frac{d^2 y}{dx^2} + 2(4x + 1) \frac{dy}{dx} + y = 2x + 1$

(b) Solve by Laplace Transform method [4]

$$\frac{d^2 y}{dt^2} + 9y(t) = 18t$$

with  $y(0) = 0, y(\pi/2) = 0$ .

P.T.O.

Or

2. (a) An inductor of 0.5 henry is connected in series with resistor of 6 ohms. A capacitor of 0.02 farad and generator having alternative voltage given by  $24 \sin 10t$  ( $t > 0$ ) with a switch K.

Forming a differential equation find the current and charge at any time  $t$  if charge is zero when switch is closed at  $t = 0$ . [4]

- (b) Solve any one : [4]

(1)  $L\left[t \int_0^t e^{-4t} \sin 3t dt\right]$

(2)  $L^{-1}\left[\frac{2s+1}{(s^2+s+1)^2}\right]$

- (c) Find Laplace transform of  $(1 + 2t - 3t^2 + 4t^3) \cup (t - 2)$ . [4]

3. (a) Find Fourier sine transform of  $f(x) = \begin{cases} x & 0 \leq x \leq 1 \\ 2-x & 1 \leq x \leq 2 \\ 0 & x > 2 \end{cases}$  [4]

- (b) Attempt any one : [4]

- (i) Find  $z$ -transform of  $f(k) = (k + 1)(k + 2)2^k$   $k \geq 0$ .

- (ii) Show that

$$z^{-1} \left\{ \frac{1}{\left(z - \frac{1}{2}\right)\left(z - \frac{1}{3}\right)} \right\} = \{x_k\} \text{ for } |z| > \frac{1}{2}$$

$$\text{where } x_k = 6 \left[ \left(\frac{1}{2}\right)^{k-1} - \left(\frac{1}{3}\right)^{k-1} \right], \quad k \geq 1.$$

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

Or

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

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

$$(ii) \quad \nabla 4e^r = e^r + \frac{4}{r} e^r$$

(b) Show that  $\bar{F} = (6xy + z^3)\bar{i} + (3x^2 - z)\bar{j} + (3xz^2 - y)\bar{k}$  is irrotational and find  $\phi$  such that  $\bar{F} = \nabla\phi$ . [4]

(c) Solve  $y_k - \frac{5}{6}y_{k-1} + \frac{1}{6}y_{k-2} = \left(\frac{1}{2}\right)^k \quad k \geq 0$ . [4]

5. Attempt any two :

(a) Evaluate  $\int_c \bar{F} \cdot d\bar{r}$  for  $\bar{F} = (2x + y)\bar{i} + (3y - x)\bar{j}$  and  $c$  is the straight line joining  $(0, 0)$  and  $(3, 2)$ . [6]

(b) Apply Stokes' theorem to evaluate

$$\int_c 4y dx + 2z dy + 6y dz$$

where  $c$  is the curve of intersection of  $x^2 + y^2 + z^2 = 6z$  and  $z = x + 3$ . [7]

(c) Evaluate  $\iint_s \bar{r} \cdot \hat{n} d\bar{s}$  over the surface of a sphere of radius 1 with centre at the origin. [6]

Or

6. Attempt any two :

(a) Using Green's theorem evaluate  $\int_c \bar{F} \cdot d\bar{r}$  where

$$\bar{F} = (2x - \cos y)\bar{i} + x(4 + \sin y)\bar{j}$$

where  $c$  is the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1, z = 0$ . [6]

- (b) Evaluate  $\iint_s (\nabla \times \bar{F}) \cdot d\bar{s}$  for  $\bar{F} = y\bar{i} + z\bar{j} + x\bar{k}$  where  $s$  is the surface of paraboloid  $z = 1 - x^2 - y^2$  above the XOY plane. [7]
- (c) Use Gauss divergence theorem to evaluate  $\iiint_s \bar{F} \cdot d\bar{s}$  over the cylindrical region bounded by  $x^2 + y^2 = 4$ ,  $z = 0$ ,  $z = \alpha$ , where  $\bar{F} = x\bar{i} + y\bar{j} + z^2\bar{k}$ . [6]

7. (a) If  $V = \sinh x \cos y$  find  $u$  such that  $u + iv$  is analytic function. [4]
- (b) Evaluate  $\oint_c \frac{1+z}{z(z-2)} dz$  where  $c$  is the circle  $|z| = 1$ . [4]
- (c) Find the bilinear transformation which maps points  $1, i, -1$  of  $z$ -plane onto  $i, o, -i$  of  $w$ -plane. [5]

*Or*

8. (a) Find 'a' such that the function  $f(z) = r^2 \cos 2\theta + ir^2 \sin(a\theta)$  is an analytic function. [4]
- (b) Evaluate  $\oint_c \frac{15z+9}{z(z+3)} dz$  where  $c$  is the circle  $|z - 1| = 3$ . [4]
- (c) Show that under the transformation  $w = \frac{i-z}{i+z}$ ,  $x$ -axis in  $z$ -plane is mapped onto the circle  $|w| = 1$ . [5]

Total No. of Questions—8]

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[5352]-542

**S.E. (Electrical) (First Semester) EXAMINATION, 2018**

**POWER GENERATION TECHNOLOGIES**

**(2015 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 Rankine cycle with PV and TS Diagram. [6]

(b) Explain coal handling system in thermal power plant with neat flow chart. [6]

*Or*

2. (a) Explain the working of Air-preheater and economiser in thermal power plant and show its location in layout. [6]

(b) With the help of diagram explain the diesel power plant. [6]

3. (a) Explain hydrograph and flow duration curve with example. [6]

(b) Derive the relation for the power in wind and describe the Environmental Impacts of Wind Turbines. [7]

P.T.O.



*Or*

4. (a) Explain the following terms with sketches : [6]  
(i) Water hammer effect  
(ii) Surge tank.  
(b) Explain working of vertical type wind turbine with diagram. [7]

5. (a) Explain the process of municipal solid waste to energy conversion with diagram. [7]  
(b) Explain the Shading impacts on I-V curves of PV cells. [6]

*Or*

6. (a) Explain the process Biomass energy conversion. [6]  
(b) With the help of diagram explain the concept of solar thermal power plant. [7]

7. (a) Define the terms in solar energy system : [6]  
(i) Solar constant  
(ii) Cloudy index  
(iii) Concentration ratio.  
(b) Explain grid connected renewable systems and their requirements. [6]

*Or*

8. (a) Explain the working of PV cell and Simplest Equivalent Circuit for a Photovoltaic Cell. [6]  
(b) Describe the fuel cells. How are they used for energy storage requirements ? [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-543

S.E. (Electrical Engineering) (First Semester)

EXAMINATION, 2018

ANALOG AND DIGITAL ELECTRONICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Solve question Nos. 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 diagram must be drawn wherever necessary.

(iv) Use of calculator is allowed.

(v) Assume suitable data if necessary.

1. (a) Explain binary number in detail give the difference between  
binary number system and BCD. [6]

(b) Show the 8-bit subtraction of the following decimal numbers  
in 2's complement form : [6]

(i) +22, +17

(ii) +17, +22

P.T.O.

*Or*

2. (a) Simplify the following expression using K-map : [6]  
 $f(A, B, C, D) = \Sigma m(1, 2, 3, 5, 7, 8, 9, 11, 14)$
- (b) With the help of neat circuit diagram, explain the operation of ring counter. If the initial data loaded is  $(0001)_2$  then draw timing diagram for the same. [6]

3. (a) Design and explain the operation of MOD 10 asynchronous counter with timing diagram. [7]
- (b) Explain the working of JK flip-flop with truth table. [6]

*Or*

4. (a) Explain the difference between fixed and variable regulator. Explain with suitable circuit diagram, how IC-317 can act as variable voltage regulator. Also derive formula for variable voltage available at the output of IC LM 317 in terms of circuit parameters. [7]
- (b) Draw neat diagram and explain IC 555 as Astable multivibrator. [6]
5. (a) Explain with neat connection diagram first order low pass filter. Also explain its frequency response. [6]
- (b) Draw neat diagram and explain direct coupled amplifier. Give its applications. [6]

*Or*

6. (a) Draw and explain transfer characteristics and drain characteristics of FET. [6]
- (b) Explain Push pull amplifier with waveforms, applications. [6]
7. (a) Discuss relative merits and demerits of R-C coupled, Transformer coupled and direct coupled multistage amplifiers. Draw their frequency response curve. [6]
- (b) With the help of circuit diagram and relevant waveforms explain the operation of single-phase full wave bridge rectifier with resistive load. [7]

*Or*

8. (a) A 220V, 50Hz AC voltage is applied to the primary of 4 : 1 step down transformer, which is used in bridge rectifier, having a load resistance of 1 K ohm. Assuming the diode to be an ideal, determine the following : DC output voltage, DC output current and DC power delivered to the load. A single-phase half wave uncontrolled rectifier is connected to an RL load. [6]
- (b) Draw diagram and derive an expression for the  $I_{dc}$ ,  $V_{dc}$ . [7]

Total No. of Questions—8]

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[5352]-544

S.E. (Electrical) (I Sem.) EXAMINATION, 2018  
MATERIAL SCIENCE  
(2015 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.

**Physical Constants:**

1. Angstrom Unit(AU) =  $1 \times 10^{-10}$  metres
2. Boltzmann's Constant (k) =  $1.380 \times 10^{-23}$  joule.degree<sup>-1</sup>
3. Charge on Electron (e) =  $1.601 \times 10^{-19}$  coulomb
4. Mass of Electron (m) =  $9.107 \times 10^{-31}$  kg
5. Electron volt (eV) =  $1.602 \times 10^{-19}$  joules
6. Mass of Proton (m<sub>p</sub>) =  $1.627 \times 10^{-27}$  kg
7. Velocity of light (c) =  $2.998 \times 10^8$  m/sec
8. Dielectric Constant of free space ( $\epsilon_0$ ) =  $8.854 \times 10^{-12}$  F/m
9. Permeability of free space ( $\mu_0$ ) =  $4\pi \times 10^{-7}$  H/m
10. Debye Unit =  $3.33 \times 10^{-30}$  coulomb.metre

**Q.1 a)** Prove that the energy stored per unit volume in a polarized atom of polarizability  $\alpha$ , is  $1/2 PE$  and  $1/2(\alpha E^2)$ , where P is polarization and E is electric field intensity. (6)

**b)** State the properties & applications of - (6)  
i) Paper ii) SF<sub>6</sub>

OR

**Q.2 a)** Write short note on fibre optics with its principle of working. State clearly materials used for fibre optics. (6)

**b)** Explain various factors which affect breakdown in liquid insulating materials. (6)

**Q.3 a)** In a certain transformer, the hysteresis loss is 200W when the maximum flux density is 0.87 tesla and frequency is 40 Hz. What would be the hysteresis loss, if the maximum flux density is increased to 1.2 tesla and frequency is reduced to 30 Hz? Assume the hysteresis loss is proportional to  $B_m^{1.7}$ . (6)

P.T.O.

b) Write materials, their properties and applications for thermal bimetal and thermocouple. (6)

**OR**

**Q.4 a)** What are Ferrites? Give properties and applications of ferrites. (6)

b) Describe properties and applications of Eureka and Bronze. (6)

**Q.5 a)** Discuss in brief the concepts of energy bands in insulators, semiconductors and conductors. (5)

b) Explain with neat diagram - Single Electron Transistor (SET) and nano wires. (8)

**OR**

**Q.6 a)** Write note on molecular machines. (5)

b) Explain with neat diagram, chemical reaction and applications of - (8)  
i) ZEBRA battery ii) Lithium Ion battery

**Q.7 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 the method of finding dielectric strength of air using sphere gap voltmeter with a neat diagram as per IS 2584. (6)

**OR**

**Q.8 a)** Explain the method of finding dielectric strength of solid insulating material with a neat diagram as per IS 6798. (6)

b) With neat circuit diagram & phasor diagram, explain measurement of dielectric loss angle ( $\tan \delta$ ) by Schering Bridge as per IS 13585-1994. (7)

Total No. of Questions—8]

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[5352]-545

**S.E. (Electrical) (First Semester) EXAMINATION, 2018**  
**ELECTRICAL MEASUREMENTS AND INSTRUMENTATION**  
**(2015 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 table, slide rule, Mollier chart, electronic pocket calculator and steam table is allowed.

(iv) Assume suitable data, if necessary.

1. (a) Draw a neat schematic diagram of attraction type moving iron instrument and explain deflecting, controlling, and damping system used in it. [6]
- (b) With a circuit diagram derive the equation for an unknown self inductance by Anderson's bridge. [6]

*Or*

2. (a) Design a multi range d.c. milli-ammeter using a basic movement with an internal resistance  $R_m = 50 \Omega$  and a full scale deflection current  $I_m = 1 \text{ mA}$ . The ranges required are 0–10 mA; 0–50 mA; 0–100 mA; and 0–500 mA. [6]
- (b) Draw circuit diagram of Kelvin's double bridge. Derive expression for unknown resistance with usual notations. [6]

P.T.O.

3. (a) Draw the possible method of connecting the pressure coil of a wattmeter and compare the errors. Explain the use of “compensation winding” in a wattmeter. [6]
- (b) A 230 V single phase energy meter has constant load of 5 A passing through it for 8 hours at a power factor of 0.9. If the meter LED makes 26500 impulses during this period, find the meter constant in imp/kwh. calculate the power factor of the load if the no. of impulses are 11230 when operating at 230 V and 6 A for 5 hours. [7]

*Or*

4. (a) While performing a load test on a 3 phase wound rotor induction motor by two wattmeter method, the readings obtained on two wattmeters were + 14.2 kW and -6.1 kW and line voltage was 440 V. [6]

Calculate :

- (i) True power drawn by the motor
- (ii) Power factor
- (iii) Line current.
- (b) With a neat schematic diagram, explain construction of two element energy meter. [7]
5. (a) Explain the following terms associated with CRO : [6]
- (i) Volts/division
- (ii) Invert
- (iii) dual ch
- (iv) x-position
- (v) xy-mode
- (vi) y-position.



- (b) Explain capacitive transducers for pressure measurement with a neat diagram. [6]

*Or*

6. (a) Draw and explain block diagram of Digital Storage Oscilloscope. [6]

- (b) Explain McLeod gauge for measurement of pressure. [6]

7. (a) Explain level measurement by mechanical method. [6]

- (b) Define strain. What are the types of strain gauge ? Explain wire strain gauge. [7]

*Or*

8. (a) Explain Electrical method for measurement of level. [6]

- (b) What are the advantages and disadvantages of a Linear Variable Differential Transformer (LVDT). Explain how the magnitude and direction of displacement of core of an LVDT detected ? [7]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-546

**S.E. (Electrical) (II Sem.) EXAMINATION, 2018**  
**POWER SYSTEM—I**  
**(2015 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.

Q1 a) Explain in brief, what are base load and peak load plants hence explain advantages of interconnected grid system [6]

b) Explain various methods of improving string efficiency [6]

**OR**

Q2 a) With neat diagram, explain construction and advantages of following types of insulators [6]

- i) Pin Insulator  
ii) String Insulator

b) The maximum demand of consumer is 20 A at 230 V and his total energy consumption is 8760 kWh. If the energy is charged at 3 Rs per unit for 400 Hrs of maximum demand per annum plus 6.5 Rs per unit for additional units, calculate annual bill [6]

Q3 a) Derive an expression for loop inductance of a 1 phase overhead lines [6]

b) Diameter of conductor of transmission line is 1.3 cm. Maximum permissible sag with a horizontal wind pressure per meter length of 1.6 kg and with ice loading per meter of 1.1 kg is 5.4 m. Calculate permissible span between two supports at the same level. [7]  
Braking stress of conductor =  $4300 \text{ kg/cm}^2$   
Weight of conductor per meter length = 1.2 kg  
Factor of safety = 2.5

P.T.O.

**OR**

Q4 a) Derive the expression for flux linkages [7]  
i) Due to a single current carrying conductor  
ii) In parallel current carrying conductors

b) A single core, 5 km long cable having core diameter of 0.9 cm [6]  
and insulation of relative permittivity of 4.2 and 1.1 cm  
thickness, is connected to 33 kV, 50 Hz supply. Find  
capacitance of cable also find maximum and minimum stress in  
insulation

Q5 a) What do you understand by electric potential? Derive an expression [6]  
for electric potential at  
i) Charged single conductor  
ii) Conductor in a group of charged conductors

b) A 3 phase 50 Hz, 66 kV overhead line conductors A, B and C are [6]  
placed in horizontal plane. Distance between conductors A and B is  
2.3 m, B and C is 2.2 m. Diameter of each conductor is 1.3 cm. If  
the line length is 125 km calculate  
(i) Capacitance per phase  
(ii) Charging current per phase  
Assume complete transposition of the line

**OR**

Q6 a) Derive the expression for capacitance of 3 phase double circuit line [6]  
when conductors are arranged in the form of regular hexagon of  
side 'd' meters

b) A single phase transmission line has two parallel conductors 2 m [6]  
apart, the diameter of each conductor is 0.7 cm and conductors are  
placed 8 m above the ground. Calculate line to neutral capacitance  
for line length of 100 km  
i) Neglecting effect of ground  
ii) Considering effect of ground

Q7 a) Obtain the relationship between sending end voltage and current in [7]  
terms of receiving end voltage and current for a medium  
transmission line using nominal 'T' method. Draw neat phasor  
diagram.

- b) A 3 phase, 50 Hz, 16 km long overhead line supplies 1000 kW at 11 kV, 0.8 pf lagging. The line resistance is  $0.03 \Omega$  per phase per km and line inductance is 0.7 mH per phase per km. Calculate sending end voltage and regulation of line [6]

**OR**

- Q8 a) With neat circuit diagram, derive expression for ABCD constants of medium transmission line ' $\pi$ ' model. hence state properties of medium transmission line [6]

- b) A 3 phase, 50 Hz, transmission line delivers 50 MVA at 0.8 pf lagging and at 110 kV. Generalized circuit constants of line are as follows [7]  
 $A = D = 0.98 \angle 3^\circ$ ,  $B = 110 \angle 75^\circ \Omega$ ,  $C = 0.0005 \angle 80^\circ S$ .  
Calculate sending end voltage and sending end current and sending end power factor

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-547

S.E. (ELECTRICAL) (II Sem.) EXAMINATION, 2018

**ELECTRICAL MACHINES-I**

(2015 COURSE)

**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 side rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
  - (iv) Assume suitable data, if necessary.
  - (v) 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) With suitable circuit diagram explain OC, SC test on single-phase transformer. Explain how equivalent circuit parameters are obtained from these tests. [6]
- (b) Explain VV connection of 3-phase transformer with suitable diagram. State its advantages. [6]

*Or*

2. (a) What is necessity of parallel operation ? State the conditions to be satisfied for parallel operation of transformers. [6]
- (b) Develop equivalent circuit of transformer referred to primary side with usual notations. [6]

P.T.O.

3. (a) Derive the torque equation of DC motor with usual notations. State the meaning of each notation used. [6]
- (b) A 220 volt DC shunt motor takes 4 Amp at no load and runs at 720 rpm. Its armature resistance is 0.2 ohm and shunt field resistance is 110 ohm. Calculate the speed at full load if full load current is 50 Amp. The flux reduces by 5% on full load due to armature reaction. [6]

*Or*

4. (a) With suitable diagrams explain armature reaction in DC machine. [6]
- (b) Draw a neat sketch of 3-point starter used for DC shunt motor. Explain its construction and working. [6]
5. (a) Draw torque-slip characteristics of 3-phase induction motor and explain it in detail. Clearly mark all important torque points on it. [6]
- (b) A 12 pole 3-phase induction motor has rotor resistance per phase of 1 ohm and standstill reactance of 3 ohm per phase. The standstill emf between sliprings is 100 volt. Calculate the rotor current per phase and rotor power factor when :
- (i) Sliprings are short circuited.
- (ii) When resistance of 3 ohm per phase is added in the rotor circuit. [6]

*Or*

6. (a) Draw power flow diagram of 3-phase induction motor. Write respective mathematical expressions for each stage. State which losses are constant and which losses are variable with reasoning. [6]

- (b) Derive the condition for maximum torque under running condition for 3-phase induction motor with usual notations. [7]
7. (a) With suitable diagram explain the working of rotor resistance starter used for 3-phase induction motor. [7]
- (b) Develop approximate equivalent circuit for 3-phase induction motor in steps. Write the assumptions made. [6]
- Or*
8. (a) With a suitable diagram explain DOL starter used for 3-phase induction motor. [7]
- (b) Plot circle diagram of 3-phase induction motor. Indicate the following quantities in it :
- (i) No load current
  - (ii) Full load power factor angle
  - (iii) Constant losses
  - (iv) Stator copper loss
  - (v) Torque line
  - (vi) Output line. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—6

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[5352]-548

S.E. (Electrical Engineering) (II Sem.) EXAMINATION, 2018

NETWORK ANALYSIS

(2015 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) Find  $I_x$  and  $I_y$  shown in Fig. 1 using Mesh analysis. [6]

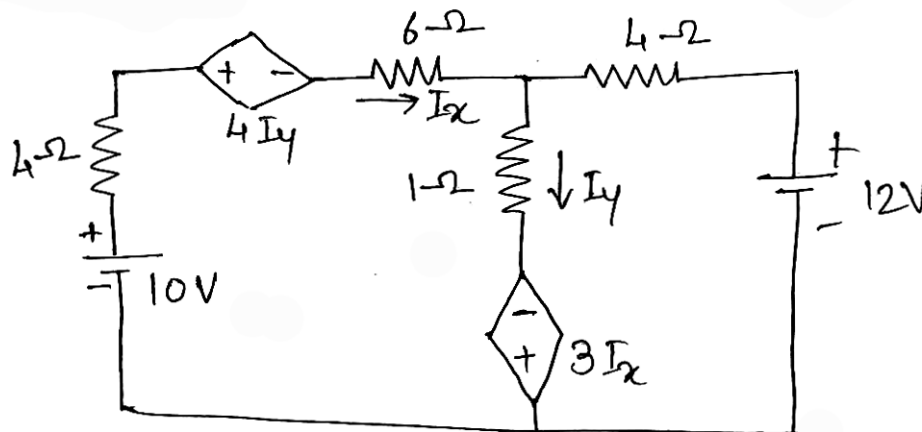


Fig. 1

P.T.O.



- (b) Find the Thevenin's equivalent of the circuit shown in Fig. 2. [7]

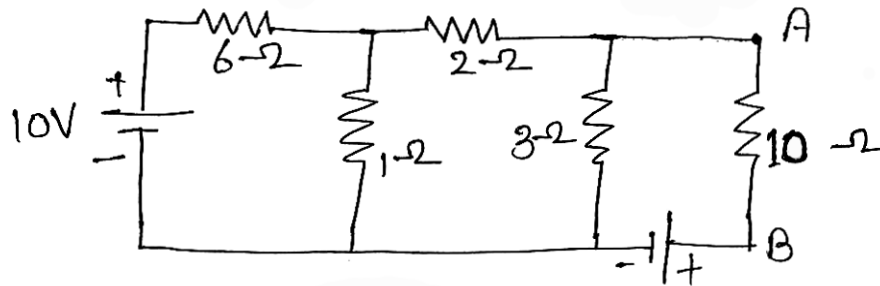


Fig. 2

Or

2. (a) Find the Mesh transformation matrix for the circuit shown in Fig. 3. [7]

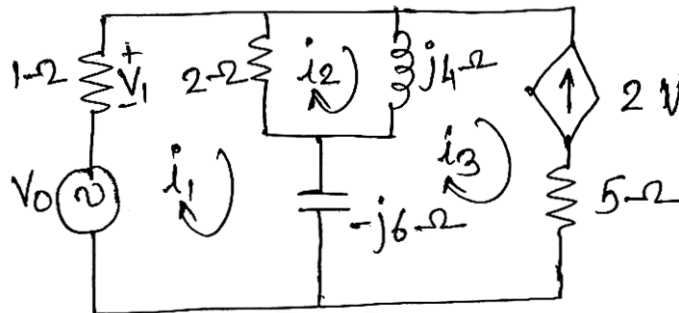


Fig. 3

- (b) State and explain maximum power transfer theorem applied to a.c. circuit. [6]
3. (a) In Fig. 4 steady state condition is reached with 100 V d.c. source. At  $t = 0$ , switch  $k$  is suddenly opened. Find the expression

of current through the inductor after  $t = \frac{1}{2}$  sec. [6]

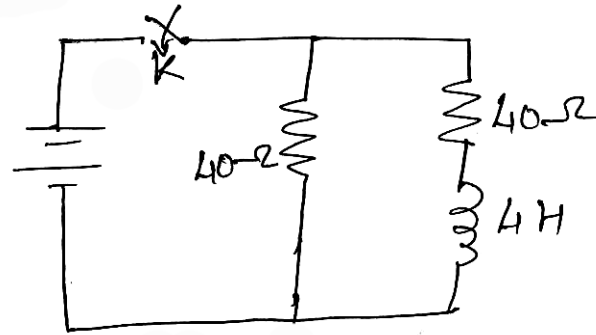


Fig. 4

- (b) For the circuit shown in Fig. 5, obtain the current through the capacitor 'C' at  $t = 0^+$  following switching at  $t = 0$ . Assume the capacitor to be initially discharged. [6]

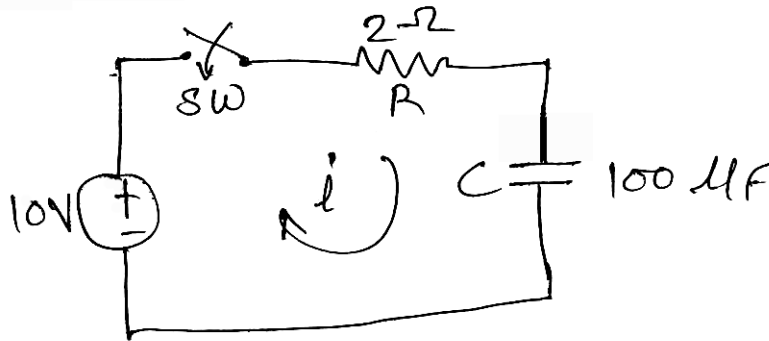


Fig. 5

Or

4. (a) The  $10 \mu\text{F}$  capacitors in RC circuit of Fig. 6 has initial charge of  $100 \mu\text{c}$  with polarities as shown in figure. At  $t = 0$ , the

switch being closed, a d.c. voltage of 100 V is applied. Find the expression for the current. [6]

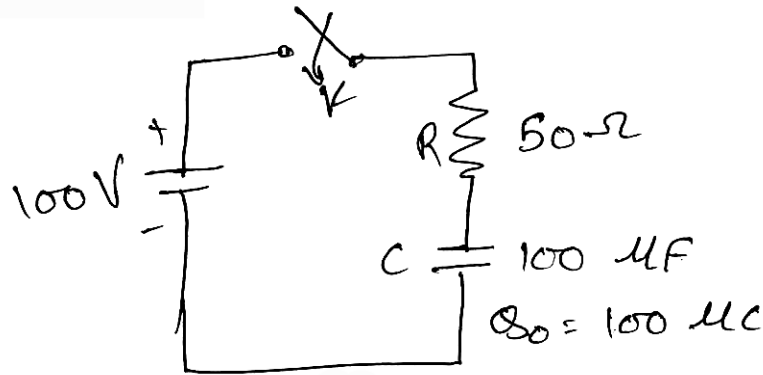


Fig. 6

(b) In the circuit shown in Fig. 7, the switch 's' is kept in position '1' for long period to establish the steady state conditions. The switch is then moved to position '2' at  $t = 0$ . Find out the expression for the current after switching the switch to position '2'. [6]

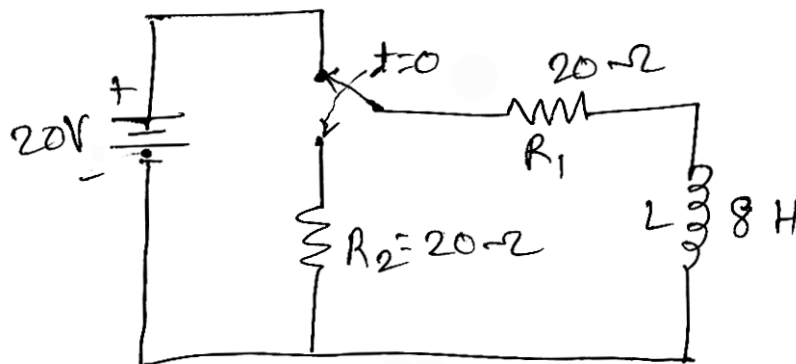


Fig. 7

5. (a) Find 'Y' parameter for the circuit shown in Fig. 8. [7]

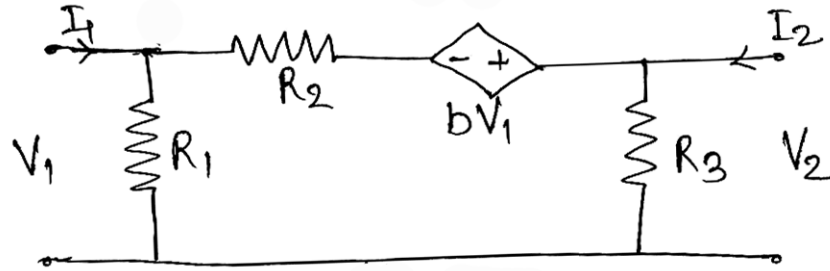


Fig. 8

- (b) Write a short note on restriction on pole and zero location in transfer function. [6]

Or

6. (a) Develop relation between 'Z' parameter and transmission parameter. [6]
- (b) Find the driving point admittance  $Y_{11}(s)$  for the network shown in Fig. 9 and plot pole-zero diagram. [7]

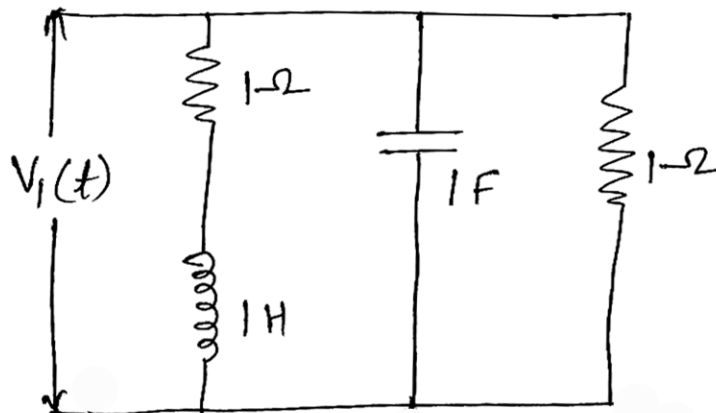


Fig. 9

7. (a) Derive the expression for characteristic impedance ( $Z_0$ ) attenuation constant ( $\alpha$ ) and phase constant ( $\beta$ ) of prototype constant-K type low pass filter from symmetrical network. [6]
- (b) Design a 'T' and ' $\pi$ ' section constant-K high pass filter having cut-off frequency of 12 KHz and nominal impedance  $R_0 = 500 \Omega$ . Also find : [6]
- (i) Its characteristic impedance and phase constant at 24 kHz and
- (ii) attenuation at 4 kHz.

*Or*

8. (a) Explain the following terms in relation with filters : [6]
- (i) Cut-off frequency
- (ii) Pass band
- (iii) Stop band.
- (b) Design constant-K low pass filter to have a cut-off frequency of 796 Hz when terminated in a  $600 \Omega$  resistance in both the T and  $\pi$  configurations. [6]

Total No. of Questions—8]

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[5352]-549

**S.E. (Electrical) EXAMINATION, 2018**  
**NUMERICAL METHODS AND COMPUTER PROGRAMMING**  
**(2015 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) List different types of operators used in 'C'. Give 2-3 examples  
of each type. [6]  
(b) State the rules for identifying significant digits in a number  
and determine the same for : [6]  
(i) 124.06  
(ii) 0.02406

*Or*

2. (a) Explain the following terms with suitable example : [6]  
(i) Truncation error  
(ii) Round off error  
(iii) Chopping error  
(iv) Relative error.

P.T.O.

(b) Using Birge Vieta method find the root of the equation  $x^4 - 2x^3 - 4x + 4 = 0$  with initial approximation 0.5. Perform two iterations. [6]

3. (a) Using N-R method find the real root of the equation  $x^3 - \sin x + 1$  with  $x_0 = -2$ . Perform 4 iterations. [6]

(b) The following table gives the population of a town during last 6 census. Using Newton's backward interpolation formula determine the population in the area 1954 : [7]

Year	Population in Thousands
1911	12
1921	15
1931	20
1941	27
1951	39
1961	52

*Or*

4. (a) Explain with neat figure Regula Falsi method for solution of transcendental equation. [6]

- (b) Find equation of a straight line to be fit into the following data using least square approximation : [7]

$x$	$y$
0	10
2	12
4	18
6	22
8	20
12	30
20	30

5. (a) Explain modified Euler's method for solution of ordinary differential equation. Draw suitable diagram. [6]
- (b) Evaluate  $\int_1^{1.8} \frac{e^x + e^{-x}}{2} dx$  using Simpson's  $\left(\frac{1}{3}\right)^{\text{rd}}$  rule taking  $h = 0.2$ . [7]

*Or*

6. (a) Using 4th order RK method solve  $\frac{dy}{dx} = \sqrt{x^2 + y}$  at  $x = 0.2$  with  $x(0) = 0.8$  and  $h = 0.2$ . [7]
- (b) Derive Trapezoidal rule for numerical integration as a special case of Newton's Cote formula. [6]
7. (a) Using Jacobi iterative method, obtain solution of the following system. Perform 5 iterations : [6]
- $$27x + 6y - z = 85$$
- $$6x + 15y + 2z = 72$$
- $$x + y + 54z = 110$$
- take
- $$X^{(0)} = Y^{(0)} = Z^{(0)} = 0.$$



- (b) Explain Gauss Seidal iterative method of solution of system of linear simultaneous equation. [6]

*Or*

8. (a) Solve the following system of equation using Gauss elimination method : [6]

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

- (b) Explain Gauss Jordan method to solve the system to linear simultaneous equation. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-550

S.E. (ELECTRICAL) (II Sem.) EXAMINATION, 2018

FUNDAMENTALS OF MICROCONTROLLER AND ITS APPLICATIONS

(2015 Pattern)

Time : Two Hours

Maximum Marks : 50

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

1. (a) Explain clearly the differences between Microcontroller and Microprocessor. [6]

(b) Explain the addressing modes of 8051 with example. [6]

*Or*

2. (a) Compare different family members of MCS-51 family. [6]

(b) Explain the following instructions with example. [6]

(i) SJMP

(ii) DJNZ

(iii) MUL AB.

3. (a) Write an assembly language program to multiply 2 numbers stored at memory location C000 H and C001 H. Store the answer in D000H and D001 H. [6]

(b) Write a note on the different interrupts available in 8051. [7]

P.T.O.

*Or*

4. (a) Write an assembly language program to find smallest number from an array of 5 numbers stored at memory location 6000 H and store the answer in 1000 H. [6]  
(b) Write the steps taken by CPU to transfer data serially.[7]
5. (a) Explain the function of the following Microcontroller tools :  
(i) Assembler  
(ii) Simulator  
(iii) Emulator. [6]  
(b) Write down the steps to program ADC 0809. Also draw the interfacing diagram with 8051 Microcontroller. [6]

*Or*

6. (a) Explain the control word format of 8255 PPI. Write the control word to program all ports as output ports. [6]  
(b) Interface DAC 0808 with 8051 Microcontroller. Write program to generate sawtooth waveform. [6]
7. (a) With the help of block diagram, show how temperature can be measured using 8051. [6]  
(b) Draw circuit diagram and write program for relay interfacing using 8051. [7]

*Or*

8. (a) With the help of block diagram, show how power factor can be measured using 8051. [6]  
(b) Draw an interfacing diagram and write program for speed control of a stepper motor. [7]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-551

S.E. Ins : & Con. (I-Sem.) EXAMINATION, 2018

206261 : SENSORS & TRANSDUCERS-I

(2015 COURSE)

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) Assume suitable data, if necessary.

1. (a) Draw a block diagram of measurement system with basic and auxiliary functional elements ? Give functions of each element in short. [6]

(b) Define and explain in brief the following static characteristics : [6]

(i) Accuracy

(ii) Static error

(iii) Hysteresis

*Or*

2. Describe LVDT in detail with respect to its construction, working principle output obtained ? What is residual voltage ? What are its causes. [12]

3. (a) Explain the working principle of optical pulse tachometer. Give formula for calculation of speed in rpm. [6]

P.T.O.

- (b) Enlist various types of acceleration transducers. Discuss in detail Seismic type accelerometer. [6]

*Or*

4. (a) What are dynamometers ? Explain Absorption type dynamometer in detail. [6]
- (b) Draw and explain construction, working of angular type of encoder. [6]
5. (a) Discuss diaphragm as force summing devices in detail. How are the strain gauges mounted on it ? Why ? [7]
- (b) Justify with suitable diagram and explanation whether the following statement is true or false : [6]  
“LVDT is a secondary transducer for pressure measurement.

*Or*

6. (a) Explain characteristics of manometer fluids used in measurement of pressure balance, Explain construction and working of Ring manometer ? [7]
- (b) Define and give unit of : [6]
- (i) Absolute pressure
- (ii) Gauge pressure
- (iii) Vacuum pressure
7. (a) Write a short note on thermocouples on the basis of their : [7]
- (i) Working principle

- (ii) Types
  - (iii) Characteristics
  - (iv) Cold junction compensation.
- (b) Explain in detail RTD with respect to its : [6]
- (i) Principle
  - (ii) Two OR three wire construction
  - (iii) Sensitivity.

*Or*

8. (a) Compare RTD with Thermistor on the basis of principle of working, characteristics and applications. (Any 7 points). [7]
- (b) Explain construction of bimetallic thermometer with a neat diagram. What are the materials used for its constructions ? [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-552

S.E. (Instrumentation and Control) (First Semester)

EXAMINATION, 2018

BASIC INSTRUMENTATION

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Solve question Nos. 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 side 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) Compare PMMC and moving iron type basic meter.

(Give main 3 points of comparison) [6]

(b) Explain the accuracy, precision and hysteresis. [6]

*Or*

2. (a) Draw basic DC Potentiometer and explain the measurement  
of unknown emf. [6]

(b) Write a note on traceability and traceability chart. [6]

P.T.O.

3. (a) Draw appropriate waveforms for ALT and CHOP modes in dual trace CRO and explain its operation. [6]
- (b) Give the procedure for the measurement of unknown resistance with the help of Wheatstone bridge ? [6]

*Or*

4. (a) Draw the diagram of 10 : 1 attenuator probe. Explain how it works at low and high frequencies ? [6]
- (b) An AC Bridge consists of the following components : [6]
- arm AB :  $R = 400 \Omega$ ,
- arm BC :  $R = 150 \Omega$  in series with  $C = 0.2 \mu\text{F}$ ,
- arm CD : unknown and
- arm DA :  $R = 100 \Omega$  in series with  $L = 100 \text{ mH}$ .
- If the source frequency is 1000 Hz, calculate the constants of arm CD by considering it as a series combination.

5. (a) Explain with the help of block diagram, digital thermometer. [7]
- (b) Draw and explain dc voltage attenuator used in DMM. Why is it needed ? [6]

*Or*

6. (a) Explain the digital instrument for measurement of speed of rotating shaft of DC motor. [7]
- (b) With a neat block diagram, explain electronic KWh meter. [6]



7. (a) It is desired to plot the relation between input-output characteristics of a platinum RTD. Which type of recorder you will use ? Draw block schematic and explain. [7]
- (b) Write a short note on Virtual Instrumentation. [6]

*Or*

8. (a) Draw block schematic of a general function generator. Explain the generation of sine, square and triangular waveforms. [7]
- (b) What is the need of a recorder ? How are they classified ? Which are the different writing mechanisms ? Explain electrostatic writing. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-553

S.E. (Instrumentation and Control) (Sem. I)

EXAMINATION, 2018

LINEAR INTEGRATED CIRCUITS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Figures to the right indicate full marks.

(iii) Use of calculator is allowed.

(iv) Assume suitable data, if necessary.

1. (a) Draw the block diagram of operational amplifier and explain function of each block. [6]
- (b) Explain different types of noise generated in operational amplifiers. [6]

*Or*

2. (a) Discuss why one assume following assumptions for op-amp derivations :
  - (i) Large signal voltage gain = infinity
  - (ii) Input resistance = infinity. [6]
- (b) State equation for input resistance with feedback, output resistance with feedback, for a buffer amplifier. [6]

P.T.O.

3. (a) With the help of circuit diagrams explain the difference between ideal and practical differentiator. [6]
- (b) Draw the circuit diagram of voltage to current converter with grounded load. Derive expression for output voltage. [6]

*Or*

4. (a) Distinguish basic and practical integrator using operational amplifier (do not draw circuit diagram). Use points such as effect of additional capacitor, gain, input resistance. [6]
- (b) Write short note on Schmitt trigger. [6]
5. (a) Define load regulation and line regulation. By using IC 723 design linear voltage regulator for regulated voltage of 5 volts. [7]
- (b) Design a stable multivibrator for 50% duty cycle by using IC 555. [6]

*Or*

6. (a) Enlist four important properties/characteristics of voltage regulator IC 7805. [8]
- (b) Sketch and explain block diagram of a switching regulator. [5]
7. (a) Differentiate active filters and passive filters. [6]
- (b) What is order of a filter? Design second order low pass filter at a high cutoff frequency of 1 kHz. [7]

*Or*

8. (a) Consider an active low pass first order filter using op-amp. Assume that input frequency is  $f$  Hertz. Higher Cut-off frequency is  $f_H$  Hertz. Pass band gain of the filter ( $A_F$ ) =  $1 + (R_f/R_1)$ .

Further assume higher cut off frequency  $f_H = 1/(2\pi RC)$ . If  $\left| \frac{v_o}{v_{in}} \right|$  is gain of the filter as function of frequency, prove that (derive equation) :

$$\left| \frac{v_o}{v_{in}} \right| = \frac{AF}{\sqrt{1 + \left( \frac{f}{f_H} \right)^2}}$$

Where  $v_o$ ,  $n$ ,  $AF$  are output, input voltage and pass band gain of active filter circuit. [5]

- (b) Draw circuit diagram for Q. 8(a). [3]
- (c) Assume equation given in Q. 8(a). Assume input frequency as 100 Hz, 200 Hz, 700 Hz, 1 kHz and 3 kHz. Calculate the gain magnitude if  $f_H = 1$  kHz and  $A_F = 2$ . [5]

$f(\text{Hz})$	Gain magnitude
Given frequencies	?
	?

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[5352]-554

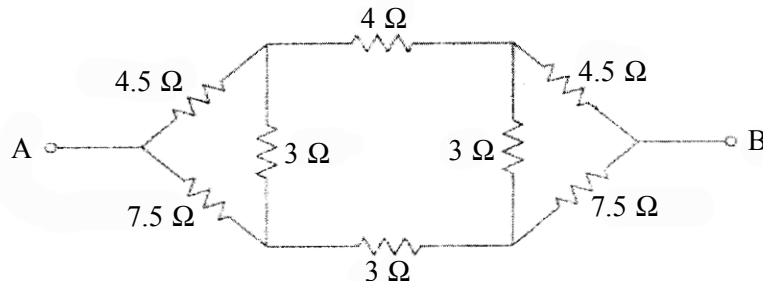
**S.E. (Instrumentation & Control) (I Sem.) EXAMINATION, 2018**  
**NETWORK THEORY**  
**(2015 PATTERN)**

**Time : Two Hours**

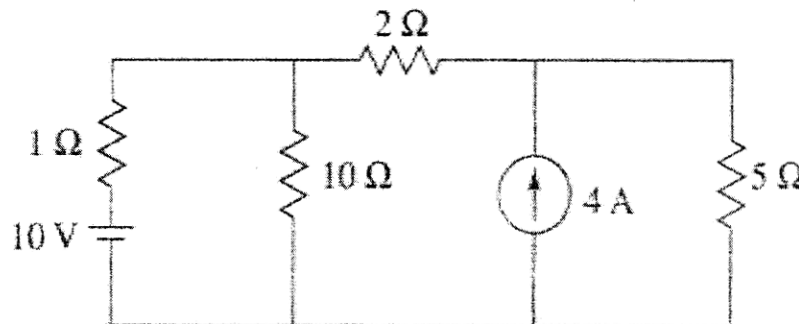
**Maximum Marks : 50**

- 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.

Q1) a) Find an equivalent resistance between A and B 06



b) Determine the current in the 10 Ω resistor. Use Superposition Theorem. 06

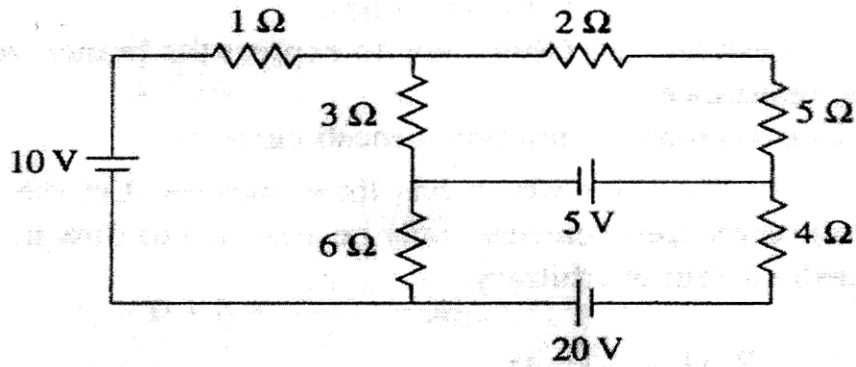


P.T.O.

OR

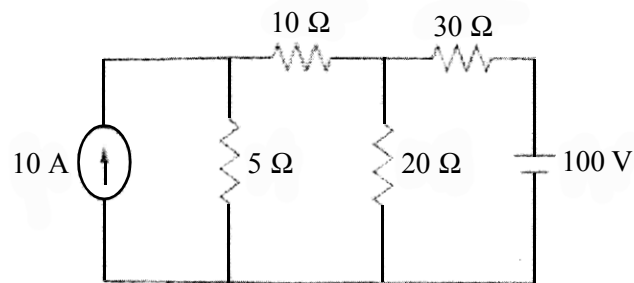
Q2) a) What is Mesh analysis? Find the current through the 5 Ω resistor.

06



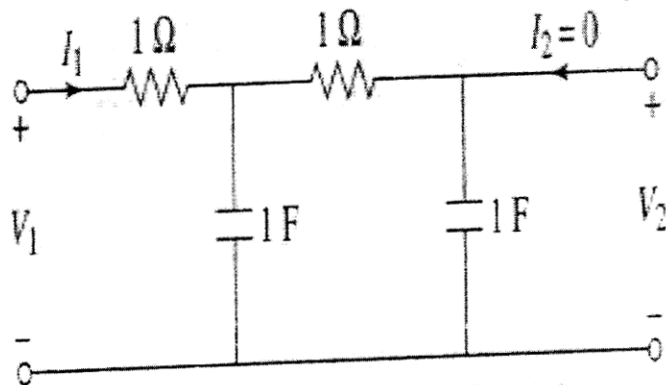
b) State Thevenin's theorem. Find the current through the 10 Ω resistor.

06



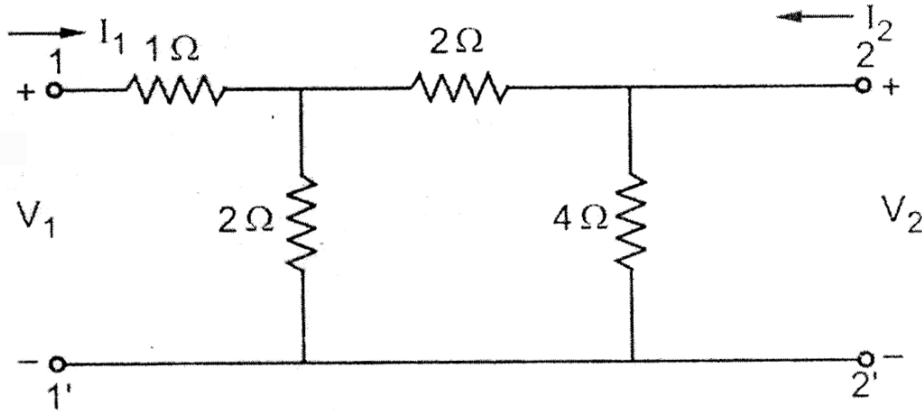
Q3) a) For the network shown below, determine the voltage transfer function  $\frac{v_2}{v_1}$ .

06



b) Derive h parameter in terms of all other parameters.

06



OR

Q4) a) Check the stability by Routh's criteria.

06

(i)  $s^4 + 7s^3 + 6s^2 + 21s + 8$

(ii)  $s^4 + s^3 + 2s^2 + 3s + 2$

(iii)  $s^5 + 2s^4 + 4s^3 + 6s^2 + 2s + 5$

b) Currents  $I_1$  and  $I_2$  entering at port 1 and port 2 respectively of a two-port network are given by the following equations:

06

$$I_1 = 0.5V_1 - 0.2V_2$$

$$I_2 = -0.2V_1 + V_2$$

Find Y,Z and ABCD parameters for the network.

Q.5 a) Check positive realness of the following.

08

(i)  $\frac{s+3}{s+1}$

(ii)  $\frac{s^2 + s + 6}{s^2 + s + 1}$

b) State properties of RC driving point function.

05

OR

Q.6 a) Design a low pass filter (both T &  $\pi$ ) having cutoff frequency 2KHz and load resistance 500 $\Omega$ .

08

b) State Properties of Positive real Function.

05

Q.7 a) Find Foster form of

08

$$z(s) = \frac{s(s+4)(s+8)}{(s+1)(s+6)}$$

b) Derive expression for symmetrical T attenuator.

05

Q.8 a) Find Causer form of

08

$$z(s) = \frac{s^2 + 4s + 3}{s^2 + 2s}$$

b) State & Explain Properties of HURWITZ POLYNOMIALS.

05



Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-555

S.E. (Instru. & Con.) (Second Semester) EXAMINATION, 2018

SENSORS AND TRANSDUCERS—II

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to right indicate full marks.

(iv) Assume suitable data, if necessary.

1. (a) Explain the working principle of electromagnetic flowmeter with a neat diagram. State its advantages and disadvantages. [6]
- (b) Explain capacitive transducer for the measurement of level with a neat diagram. [6]

*Or*

2. (a) Explain the difference between variable head type and variable area type flowmeter. Briefly explain the working principle of variable area type flowmeter with a neat diagram. [6]
- (b) Explain the working principle of ultrasonic level sensor with a neat diagram. [6]

P.T.O.

3. (a) Define dynamic viscosity and kinematic viscosity and specify their units. List down four methods for viscosity measurement.

[6]

(b) Explain inductive proximity sensor in detail.

[6]

*Or*

4. (a) Explain hydrometer for density measurement with neat diagram.

[6]

(b) Define Absolute Humidity and Relative Humidity. Explain any *one* sensor for humidity measurement.

[6]

5. (a) Explain the following terms :

[6]

(i) Signal level and bias change

(ii) Linearization

(iii) Filtering

(b) What is the output voltage of a 10-bit DAC with a 12V reference if the input is  $(20F)_{16}$ . What input is needed to get a 6.5 V output ?

[7]

*Or*

6. (a) Explain the general guidelines for designing low pass filter.

[6]

(b) The input to a 10-bit ADC with a 12 V reference is 4V. What is the hex output ? If the output was found to be  $(1B4)_{16}$ , what is the voltage input ?

[7]

7. (a) Design a signal conditioning circuit for RTD of the following data : [7]

Temperature range : 30°C to 300°C,

RTD output resistance : 112 to 220Ω

Output voltage range : 0 mV to 300 mV

- (b) Design the signal conditioning circuit for capacitive level sensors. [6]

*Or*

8. (a) Design a signal conditioning circuit for thermocouple for the following data : [7]

Temperature : 50°C to 200°C,

Thermocouple output : 2.6 to 10.78 mV

Output voltage range : 0 mV to 5 V

The reference junction temperature is maintained at 0°C.

- (b) Explain the cold junction compensation of thermocouple with a neat diagram. [6]

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[5352]-556

**S.E. (Instrumentation and Control)**  
**(II Sem.) EXAMINATION, 2018**  
**AUTOMATIC CONTROL SYSTEM**  
**(2015 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-programmable calculator is allowed.  
 (v) Assume suitable data, if necessary.

Q.1 a) Compare following; [06]

- a. Open Loop Control Systems Vs Closed Loop Control systems.
- b. Linear Control Systems Vs Nonlinear Control Systems.
- c. Stable Control Systems Vs Unstable control Systems

b) Find the transfer function  $\frac{x_5}{x_1}$  for the system whose signal flow graph is as shown in figure 1 [06]

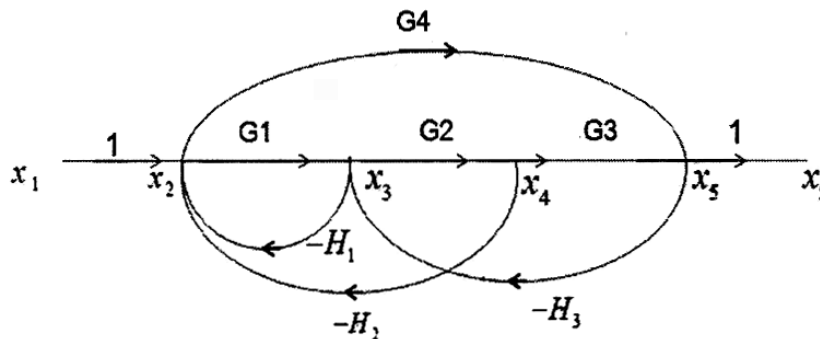


Figure.1 Signal flow Graph.

**OR**

Q.2 a) With neat sketch explain basic components of feedback control system. Explain one example of feedback control system. [06]

P.T.O.

- b) Draw analogous electrical system for given system using force- voltage analogy. [06]

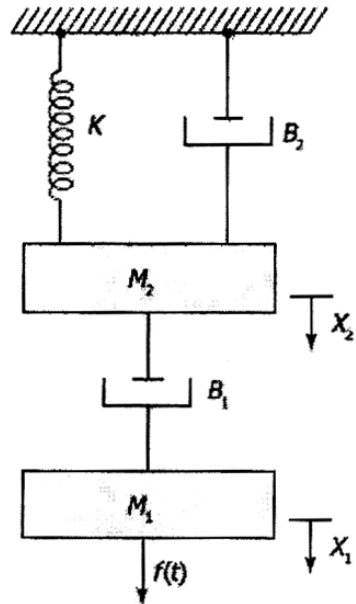


Figure. 2 Mechanical systems.

- Q.3 a) Measurement conducted on a servo mechanism show the system response [06]  
 $C(t) = 1 + 0.2e^{-0.6t} - 1.2e^{-10t}$  when subjected to unit step input,

- (a) Obtain the expression for closed loop transfer function.  
 (b) Determine the undamped natural frequency and the damping ratio of system.

- b) The characteristic equation of a feedback control system is given by [06]

$$s^4 + 20s^3 + 15s^2 + 2s + k = 0$$

- (a) Determine the range of values of k for the stable system.  
 (b) Determine marginal gain and marginal frequency.

OR

- Q.4 a) The closed loop poles of a system are shown in figure.3 Find settling time for 2% [04]  
 tolerance band.

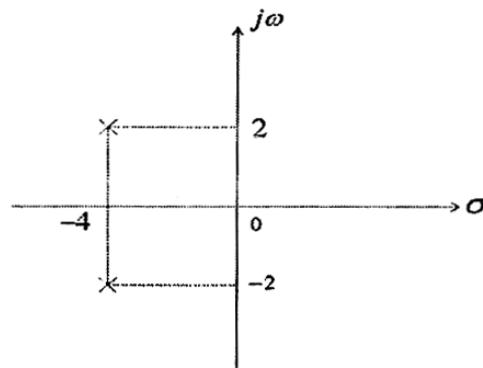


Figure 3 closed loop pole location

- b) Sketch the root locus of system whose open loop transfer function is [08]

$$G(s)H(s) = \frac{K}{s(s^2 + 2s + 2)}$$

Determine the value of K for

which the system is critically damped and also the value of K for which the system becomes unstable.

- Q.5 a) A second order system has overshoot of 50% and period of oscillation 0.2 Sec in step response determine i) Resonant Peak ii) Resonant Frequency. [04]  
 b) Sketch Polar plot for a system [09]

$$G(s)H(s) = \frac{10}{s(s+1)(s+2)}$$

Determine various stability margins.

OR

- Q.6 a) Define Following [04]  
 Resonant Peak, Resonant Frequency, Bandwidth, Crossover frequency.  
 b) A unity feedback control system has open loop transfer function [09]

$$G(s)H(s) = \frac{80}{s(s+2)(s+20)}$$

; Draw bode plot of system.

Determine gain Margin, Phase Margin, Comment on Stability.

- Q.7 a) Consider following system described by [05]

$$\dot{x} = \begin{bmatrix} -5 & -1 \\ 3 & -1 \end{bmatrix} x + \begin{bmatrix} 2 \\ 5 \end{bmatrix} u \quad \text{and} \quad y = [1 \quad 2] x$$

Obtain the transfer function of System.

- b) Obtain a state model for system in various companion form; [08]

$$\frac{Y(s)}{U(s)} = \frac{1}{s^3 + 6s^2 + 10s + 5}$$

OR

- Q.8 a) Explain different advantages of State Space Approach over Transfer Function Approach [04]

- b) A feedback control system has a closed loop T.F  $\frac{C(s)}{R(s)} = \frac{10(s+4)}{s(s+1)(s+3)}$  [09]

Construct three different state models for this system.

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-557

**S.E. (Instrumentation and Control) (II Sem.) EXAMINATION, 2018**  
**ELECTRONIC INSTRUMENTATION**  
**(2015 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) Assume suitable data, if necessary.

- Q1 a) Explain true R.M.S. meter with neat schematic diagram (6)  
b) Explain the following measurement errors associated with counter (6)  
i. Gating error  
ii. Time base error  
iii. Trigger level error

OR

- Q2 a) Explain the Principle of Q meter with practical Q meter circuit (6)  
b) Explain the working of Ramp wave generator (6)

OR

- Q3 a) Explain V to I converter using op-amp with zero adjustment (6)  
b) Explain sample & hold circuit (4)  
c) An 8 bit DAC has reference voltage  $V_{ref} = 5V$ . What is the output voltage when binary input is  $B_{in} = 10110001$ ? (2)

P.T.O.

OR

- Q4 a) What is VCO? Explain LM566 (6)
- b) What is sampling theorem. (2)
- c) Explain the following terms associated with ADC  
1) Resolution 2) Accuracy (4)
- Q5 a) What is Telemetry? (2)
- b) Explain PCM? (5)
- c) Differentiate between A.M. & F.M.? (6)

OR

- Q6 a) Explain any one application of LabVIEW in process instrumentation (6)

b) What is modulation index in case of amplitude modulation. In case of AM, if peak amplitude of modulating signal is 4v & that of carrier signal is 8v, calculate the value modulation index (7)

- Q7 a) Write short note on Logic Analyser. (6)
- b) Write short note on Wave Analysers. Draw & Explain the block diagram of Frequency Selective Analyser. (7)

OR

- Q8 a) Describe Distortion Analyser in detail (7)
- b) Explain the working of FFT analyser with the help of block diagram. (6)



Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-558

S.E. (INSTRUMENTATION AND CONTROL) (II Sem.) EXAMINATION, 2018

**DIGITAL TECHNIQUES**

(2015 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) Assume suitable data, if necessary.

1. (A) Write a short note on gray code. [6]  
(B) Explain with help of neat diagram TTL totem pole output NAND gate. [6]

*Or*

2. (A) Minimize the following function using Quine-McClusky method : [8]  
 $F(w, x, y, z) = \sum m(1, 4, 6, 7, 8, 9, 10, 11, 15)$ .  
(B) State and explain the De Morgan's Theorem. [4]

3. (A) Explain the circuit of full subtractor with the help of neat diagram. [6]  
(B) Convert the JK flip-flop to D flip-flop. [6]

*Or*

4. (A) Explain the circuit of BCD adder with help of neat diagram.[6]

P.T.O.

- (B) Explain the working of clocked SR flip-flop with help of neat diagram. Also write excitation table of SR flip-flop. [6]
5. (A) What is the MOD number of counter ? Explain the working of MOD-8 asynchronous counter using JK flip-flop. Draw its output waveforms also. [7]
- (B) Design MOD-16 up counter using IC 74193. [6]
- Or*
6. (A) Compare Counter IC 7493 and IC 7490. [6]
- (B) Explain with the help of diagram working of Johnson Counter implementation using D flip-flop. Draw the output waveform.[7]
7. (A) Write a short note on FPGA. [6]
- (B) What are the PLDs ? What are the types of PLDs ? Why PLDs are preferred for implementing the circuits ? Explain any *one* in detail. [7]
- Or*
8. (A) Explain the digital clock. [7]
- (B) With the help of block diagram explain the basic architecture of CPLD. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-559

**S.E. (Instrumentation and Control) (II Sem.) EXAMINATION, 2018**  
**INDUSTRIAL DRIVES**  
**(2015 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) Neat diagrams must be drawn whenever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.
- (v) Use of logarithmic table, slide rule, electronics pocket calculator and Steam table is allowed.

1. (a) Draw symbol and V-I characteristics of SCR. Explain V-I characteristics of SCR in detail. [6]
- (b) Explain single phase full wave midpoint controlled rectifier with neat circuit diagram and waveforms. [6]

*OR*

2. (a) Explain two transistor model of SCR and derive equation for Anode Current. [6]
- (b) Give classification of chopper and explain Jones chopper with neat diagram. [6]
3. (a) Explain various characteristics of DC series motor with appropriate diagram. [6]
- (b) Why single phase induction motor is not self starting ? [2]

P.T.O.

- (c) Explain construction and working of split phase induction motor. [5]

*OR*

4. (a) Draw and explain printed circuit DC motor. Give its advantages and disadvantages. [7]  
(b) Write short note on Universal Motor. Give its applications. [6]
5. (a) What is H bridge drive ? Explain it with neat diagram for controlling motor. [6]  
(b) Explain half stepping and full stepping of stepper motor. [6]

*OR*

6. (a) Explain speed controlling method of Brushless DC motor. [6]  
(b) Explain L293 with its pin configuration and functional block diagram. [6]
7. (a) List various types of SSR and explain any one in detail. [6]  
(b) Explain closed loop control of synchronous motor. [7]

*OR*

8. (a) Explain closed loop control of induction motor with neat diagram. [7]  
(b) Write short note on Variable Frequency Drive. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—6

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[5352]-561

S.E. (Computer) (First Semester) EXAMINATION, 2018

DISCRETE MATHEMATICS

(2015 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) Prove : [4]

$$1^3 + 2^3 + 3^3 + \dots + n^3 = \left[ \frac{n(n+1)}{2} \right]^2.$$

(b) Prove that the set of rational numbers is countably infinite. [4]

(c) Let  $A = \{1, 2, 3\}$  and  $f_1$  and  $f_2$  are functions from  $A$  to  $B$  given by : [4]

$$f_1 = \{(1, 2), (2, 3), (3, 1)\} \text{ and}$$

$$f_2 = \{(1, 2), (2, 1), (3, 3)\}$$

Compute  $f_1 \circ f_2$  and  $f_2 \circ f_1$

P.T.O.

Or

2. (a) Compute the transitive closure of given digraph using Warshall's algorithm : [4]

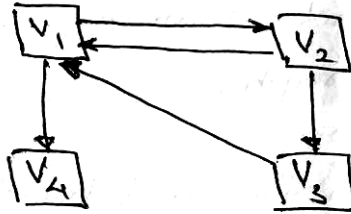


Fig. 2(a) Graph  $G(V, E)$

- (b) Show that the relation  $R$  is "Less than" from  $A$  to  $B$  where : [4]

$$A = \{1, 2, 8\} \text{ and}$$

$$B = \{1, 2, 3, 5\}$$

Find :

- (i)  $R$  in Roster form
  - (ii) Domain and Range of  $R$ .
- (c) Explain with example, notation used and mathematical expression to describe the following terms : [4]
- (i) Membership
  - (ii) Subset
  - (iii) Equality between sets
  - (iv) Union of sets.

3. (a) Write an algorithm for generating permutation of  $\{1, 2, \dots, n\}$ . Apply it for  $n = 3$  case. [4]
- (b) Solve the following :
- (i) How many different car number plates are possible with 2 letters followed by 3 digits. [4]
- (ii) How many of these number plates begin with 'MH'.
- (c) Consider a graph  $G(V, E)$  where  $V = \{v_1, v_2, v_3\}$  &  $\deg(v_2) = 4$ : [4]
- (i) Does such simple graph exist? If not, why?
- (ii) Does such a multigraph exist? If yes, give example.

*Or*

4. (a) Explain the following in brief : [4]
- (i) Subgraphs and spanning subgraph
- (ii) Isomorphic graph
- (iii) Bipartite graph
- (iv) Adjacency matrix and incidence matrix of undirected graph.
- (b) Apply Dijkstra's Algorithm to find the shortest path from vertex  $v_1$  to  $v_5$  in the graph shown below in Fig. 4.(b). [4]

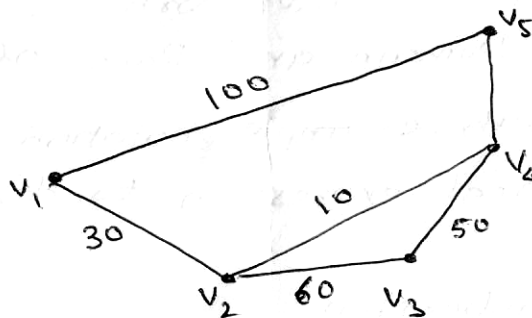


Fig. 4(b). Weighted Graph

(c) In how many ways can a cricket team of eleven players be chosen out of a batch of 14 players. How many of them will : [4]

(i) Include a particular player.

(ii) Exclude a particular player.

5. (a) Determine the maximum flow in the transport network shown in Fig. 5. (a) using Labelling procedure. Determine the corresponding min. cut. [7]

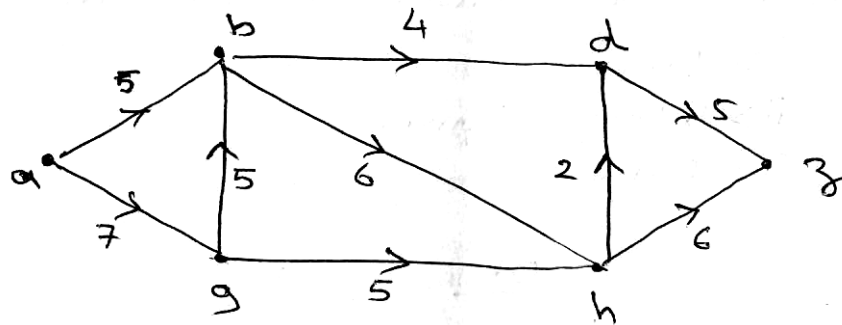


Fig. 5.(a) Graph Transport network.

(b) Explain the following terms : [6]

(i) Spanning trees

(ii) Properties of trees

(iii) M-ary tree.



Or

6. (a) Give the stepwise construction of minimum spanning tree using Prim's Algorithm for the following graph shown in Fig. 6(a) Obtain the total cost of minimum spanning tree. [7]

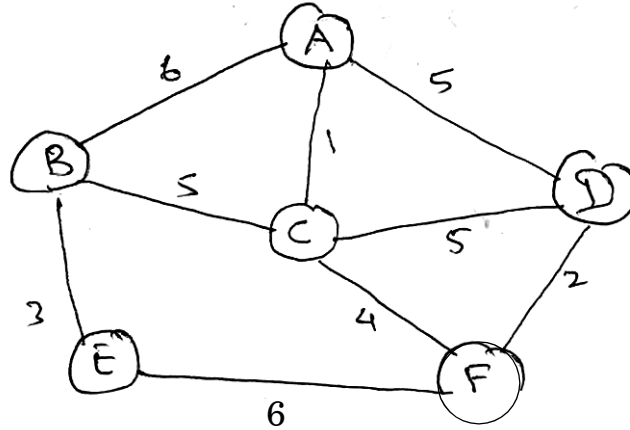


Fig. 6.(a) Graph G.

- (b) Explain the following : [6]
- (i) Game tree
  - (ii) Kruskal's Algorithm.
7. (a) Let  $R = \{0, 60, 120, 180, 240, 300\}$  and  $*$  = binary operation so that for  $a$  and  $b$  in  $R$ ,  $a * b$  is overall angular rotation corresponding to successive rotation by  $a$  and by  $b$ . Show  $(R, *)$  is a group. [7]
- (b) Explain the following terms with examples : [6]
- (i) Ring
  - (ii) Integral Domain
  - (iii) Field.

*Or*

8. (a) Show that  $(\mathbb{I}, \oplus, \odot)$  is a commutative ring with identity where  $\oplus$  and  $\odot$  are defined as : [7]

$$a \oplus b = a + b - 1 \text{ and}$$

$$a \odot b = a + b$$

- (b) Explain the following terms : [6]

(i) Monoids

(ii) Sub-group

(iii) Group codes.

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-562

S.E. (Com. Engg.)(I-Sem.) EXAMINATION, 2018

DIGITAL ELECTRONICS AND LOGIC DESIGN

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Neat diagram must be draw wherever necessary.

(iii) Assume suitable data, if necessary.

1. (a) Design two bit comparator using gates (consider A1 MSB and A0 LSB) [4]
- (b) Minimize the following logic function using K-map and realize using logic gates : [4]  
$$F(A,B,C,D) = \sum M(1, 5, 7, 13, 15) + d (0, 6, 12, 14).$$
- (c) Design 3-bit synchronous counter using T flip-flop. [4]

*Or*

2. (a) Design a sequence generator for the sequence 1010 using shift register. [6]
- (b) Simplify the following function using Quine-McCluskey minimization technique : [6]  
$$Y(A, B, C, D) = \sum m (0, 1, 2, 3, 5, 7, 8, 9, 11, 14).$$

P.T.O.

3. (a) State and explain basic components of ASM chart. Draw ASM chart for MOD 3 UP counter. [6]

(b) Implement 3 bit binary to gray code converter using PLA.[6]

*Or*

4. (a) Write VHDL code for full adder using data flow modeling style.[4]

(b) Explain entity declaration for 4 : 1 multiplexer having enable line. [2]

(c) Design BCD to Excess-3 code converter using PLA. [6]

5. (a) Explain with neat diagram CMOS inverter. [4]

(b) State the following characteristics of digital IC logic family TTL and CMOS : [4]

(i) FAN out

(ii) Noise Margin

(c) Explain TTL open collector logic. [5]

*Or*

6. (a) Give the classification of logic family. [4]

(b) Draw three input standard TTL NAND gate and explain its operation. [5]

(c) Explain wired logic in CMOS. [4]

7. (a) Give the significance of the following pins of microcontroller 8051 : [7]

(i) ALE

- (ii)  $\overline{\text{INT1}}$
- (iii) TXD
- (vi)  $\overline{\text{PSEN}}$
- (v)  $\overline{\text{EA}}$
- (vi) WR
- (vii) RXD.

(b) Explain addressing modes of 8051 with example (any 3).[6]

*Or*

8. (a) Which pins of 8051 are used for interrupt. Draw and explain IF register. [5]
- (b) Compare microprocessor and microcontroller. [2]
- (c) Explain the following instructions with respect to microcontroller 8051 and give example of each : [6]
- (i) DIV
  - (ii) L JUMP
  - (iii) PUSH.

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-563

S.E. (Computer Engineering) (I Sem.) EXAMINATION, 2018

DATA STRUCTURE & ALGORITHMS

(2015 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) Draw neat diagrams wherever necessary.

(iii) Assume suitable data, if necessary.

1. (a) Define and explain the following terms : [3]

(i) Data

(ii) Data structure

(iii) Algorithm.

(b) Give pseudo C/C++ code to reverse the string. [3]

(c) Explain the divide and conquer strategy with suitable example.  
Comment on its time complexity. [6]

*Or*

2. (a) Define and explain the following terms : [4]

(i) Sequential organization

(ii) Linear data structure

(iii) Ordered list

(iv) Sparse matrix.

P.T.O.

- (b) Explain polynomial representation using an array with suitable example. [2]
- (c) Explain the Asymptotic notation Big O, Omega and Theta with suitable example. [6]
3. (a) Write a pseudo C/C++ code to insert node into a singly linked list. [3]
- (b) Explain Generalised linked list with suitable example. [3]
- (c) Explain evaluation of postfix expression using stack with suitable example. [6]

*Or*

4. (a) Give pseudo C/C++ code to implement the following operations on linked stack : [4]
- (i) Create
- (ii) Push data.
- (b) Explain the stepwise conversion using stack for the given infix expression to the postfix expression : [2]
- $$A * B + C * D.$$
- (c) Write pseudo C/C++ code for polynomial addition using singly linked list. [6]
5. (a) Define the following terms with example : [6]
- (i) Linear queue
- (ii) Circular queue
- (iii) Priority queue.

- (b) Write pseudo C/C++ code to implement priority queue operations. [7]

*Or*

6. (a) Explain linear queue and circular queue with suitable example. Give the advantages of circular queue over linear queue. [6]
- (b) Write pseudo C/C++ code to implement linked queue. [7]
7. (a) Sort the following numbers using insertion sort :  
55, 85, 45, 11, 34, 05, 89, 99, 67.  
Discuss its time complexity and space complexity. [6]
- (b) Explain sequential search and binary search with appropriate example. Comment on their data organization, time complexity and space complexity. [7]

*Or*

8. (a) Explain Merge sort using the following example :  
18, 13, 12, 22, 15, 24, 10, 16, 19, 14, 30.  
Discuss its time and space complexity. [6]
- (b) Write a pseudo C/C++ code to sort the data using bucket sort in ascending order. [7]



Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-564

**S.E. (Computer) (I Sem.) EXAMINATION, 2018**  
**COMPUTER ORGANIZATION AND ARCHITECTURE**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

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

- Q.1 a) List the elements of bus design. Explain any two elements of Bus Design [6]  
b) Perform division of following 4 bit numbers using restoring Division algorithm [6]  
Dividend= 1010 Divisor=0011.
- OR**
- Q.2 a) Represent 1259.125 in single precision and double precision formats. [6]  
b) Explain associative mapping technique with neat diagram. [6]
- Q.3 a) What are Data transfer modes of DMA? Explain any two in detail. [6]  
b) Discuss following I/O mechanisms for transferring data with a neat flowchart. [6]  
i. Programmed I/O  
ii. Interrupt driven I/O
- OR**
- Q.4 a) List the features of thunderbolt interface. Draw and explain thunderbolt configuration. [6]  
b) Explain following addressing modes along with suitable example. [6]  
I. Direct addressing  
II. Indirect addressing  
III. Displacement addressing mode
- Q.5 a) Draw and Explain the functional block Diagram of 8086. [7]  
b) Explain Instruction pipelining in detail. [6]

P.T.O.

OR

- Q.6 a) Draw and Explain Instruction cycle state diagram. [7]  
b) Compare Superscalar and super pipelined approaches in superscalar processor [6]
- Q.7 a) Explain following instruction execution phases with suitable example [7]  
i. Fetch the instruction  
ii. Fetch the operand  
iii. Execute the instruction  
b) Draw and Explain Micro programmed Control Unit [6]
- OR
- Q. 8 a) Explain in detail following micro instruction sequencing techniques [6]  
i. Single Address Fields  
ii. Variable address Fields  
b) Draw and Explain Single Bus organization of CPU [7]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-565

**S.E. (Computer) (I Sem.) EXAMINATION, 2018**

**OBJECT ORIENTED PROGRAMMING**

**(2015 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.

**SECTION I**

- Q1) a) Define Constructor, Destructor. Write a program to explain use of new, delete, constructor and destructor. [6]  
b) What is the difference between Inheritance and Containment? Write a program in C++ to defend your answer. [6]

**OR**

- Q2) a) What is Operator overloading? Using friend function show how to overload increment (++) operator. Assume suitable class data members and member functions. [6]  
b) List and explain various features of object oriented programming. [4]  
c) Define class as ADT. [2]
- Q3) a) How smart pointers avoids the problem of memory leak [4]  
b) How function overloading and function templates are related to each other. State valid example to justify your answer. [4]

- c) Create a user defined exception to check whether your employee exist in your data structure (use any data structure to store the employees) and throw exception if name is not in the employees list. Use the catch block to print an appropriate message on the screen [5]

**OR**

- Q4) a) Explain pointer to a variable and pointer to a function. Use suitable example. [4]  
b) What are friend functions and static functions? [6]  
c) What is the need of Exception handling? [3]

P.T.O.

- Q5) a) What is a Stream? Explain types of Streams available in C++. [6]  
b) Write a program to create a file, read and write the record into it. [7]  
Every record contains Employee Name, Id, and Salary. Store and retrieve at least 3 employee data.

**OR**

- Q6) a) Explain following file handling functions [10]  
I. open() II get() III. getline() IV. seekg() V. tellg()  
b) What are cin and cout ? Explain iostream. [3]
- Q7) a) What is the purpose of Iterator? Elaborate forward, bidirectional and random-access [6]  
iterators with suitable examples  
b) What is a stack? How it is implemented using STL [6]

**OR**

- Q8) a) Elaborate advantages and disadvantages of following Basic Sequence Containers [6]  
a) Vector b) list  
b) What is the STL? Why should a C++ programmer be interested in the STL? What is [6]  
the design philosophy of the STL? What are the major components of the STL?

Total No. of Questions—8]

[Total No. of Printed Pages—5

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[5352]-566

S.E. (COMP/IT) (II Semester) EXAMINATION, 2018

ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

(ii) Figures to the right indicate full marks.

(iii) Your answers will be valued as a whole.

(iv) Use of electronic pocket calculator is allowed.

(v) Assume suitable data, if necessary.

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

(i)  $(D^2 + 4)y = e^x + x^2$

(ii)  $(D^2 + 6D + 9)y = x^{-4}e^{-3x}$

(iii)  $x^2 \frac{d^2 y}{dx^2} + 3x \frac{dy}{dz} + y = \frac{1}{x} \sin (\log x).$

(b) Solve the integral equation : [4]

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

P.T.O.

2. (a) An uncharged condenser of capacity  $C$  charged by applying an emf of value  $E \sin \frac{t}{\sqrt{LC}}$  through leads of inductance  $L$  and of negligible resistance. The charge  $Q$  on the plate of condenser satisfies the diff. equation  $\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E}{L} \sin \frac{t}{\sqrt{LC}}$ .

Find the charge at any time  $t$ . [4]

- (b) Solve any *one* of the following : [4]

(i) Find  $z \left\{ \cos \left( \frac{k\pi}{2} + \frac{\pi}{4} \right) \right\}$ ,  $k \geq 0$ .

- (ii) Using inversion integral method, find :

$$z^{-1} \left\{ \frac{z}{(z-1)(z-2)} \right\}$$

- (c) Solve the following difference equation  $y_{k+2} - 5y_{k+1} + 6y_k = u_k$  with  $y_0 = 0$ ,  $y_1 = 1$  and  $u_k = 1$  for  $k \geq 0$ . [4]

3. (a) The first four moments of a distribution about the value 5 are  $-4$ ,  $22$ ,  $-117$  and  $560$  respectively. Find the moments about the mean. Also calculate  $\beta_1$  and  $\beta_2$ . [4]

- (b) Fit a straight line of the form  $y = ax + b$  to the following data by the least square method : [4]

$x$	0	6	8	10	14	16	18	20
$y$	3	12	15	18	24	27	30	33

- (c) There is a small probability of  $\frac{1}{1000}$  for any computer produced to be defective. Determine in a sample of 2000 computers, the probability that there are : [4]
- (i) no defectives, and
- (ii) 2 defectives.

*Or*

4. (a) The lifetime of an article has a normal distribution with mean 400 hours and standard deviation 50 hours. Assuming normal distribution, find the expected number of articles out of 2000 whose lifetime lies between 335 hours to 465 hours. (Given :  $Z = 1.3$ ,  $A = 0.4032$ ). [4]
- (b) On an average 20% of the workers in an industry suffer with a certain diseases. If 12 workers are chosen from the industry, find the probability that : [4]
- (i) Exactly 2 workers suffer from the diseases,
- (ii) At least one worker suffers from the disease.
- (c) Obtain the line of regression of  $y$  on  $x$  for the following data. Also, estimate the value of  $y$  for  $x = 10$ . [4]

$x$	2	4	5	6	8	11
$y$	18	12	10	8	7	5

5. (a) Find the directional derivative of the function  $\phi = x^2yz^3$  at  $(2, 1, -1)$  towards the point  $(1, -1, 1)$ . [4]
- (b) Show that  $\vec{F} = (y \cos z)\vec{i} + (x \cos z)\vec{j} - xy \sin z\vec{k}$  is irrotational. Find scalar of  $\phi$  such that  $\vec{F} = \nabla\phi$ . [4]
- (c) Evaluate  $\int_C \vec{F} \cdot d\vec{r}$  for  $\vec{F} = 3x^2\vec{i} + (2xz - y)\vec{j} + z\vec{k}$  along the curve  $x = t^2, y = t, z = t^3$  from  $t = 0, t = 1$ . [5]

Or

6. (a) Show that (any one) : [4]
- (i)  $\nabla \times (\vec{r}r^3) = 0$
- (ii)  $\nabla^2 (r^2 \log r) = 5 + 6 \log r$ .
- (b) Find the directional derivative of the function  $\phi = x^2y + xyz + z^3$  at  $(1, 2, -1)$  along the direction  $8\vec{i} + 8\vec{j}$ . [4]
- (c) Find the work done in moving a particle along the circle  $x^2 + y^2 = 4$  under the field of force  $\vec{F} = x\vec{i} + y^2\vec{j}$ . [5]
7. (a) Find an analytic function  $f(z) = u + iv$  where  $v = 4x^3y - 4xy^3$ . [4]
- (b) Find a Bilinear Transformation  $w = f(z)$  which transforms the points  $z = \infty, i, 0$  on  $z$ -plane to the points  $w = 0, i, \infty$  on  $w$ -plane respectively. [4]
- (c) Use Residue theorem, to evaluate the integral

$$\oint_C \left[ \frac{4z-1}{z^2 - z - 6} \right] dz$$

where  $c$  is a closed curve  $|z| = 4$ . [5]



*Or*

8. (a) Find an analytic function  $f(z) = u(r, \theta) + iv(r, \theta)$  where  $v = r^n \sin(n\theta)$ . [4]

(b) Find the mapping of  $y^2 = 2y - x^2$  on  $z$ -plane through the transformation  $w = \frac{2}{z}$  on  $w$ -plane. [4]

(c) Evaluate the integral

$$\oint_C \left[ \frac{\sin \pi z^2 + 6z}{(z-1)(z+2)} \right] dz$$

where  $C$  is a closed curve  $|z| = 3$ . [5]

Total No. of Questions—8]

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[5352]-567

S.E. (Computer Engineering) (II Sem.) EXAMINATION, 2018

COMPUTER GRAPHICS

(2015 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.

- Q1 a) Explain display file structure with any 2 primitive operations [4]  
b) Explain polygon fill with seed fill algorithm [4]  
c) Scan convert a line with end points (10,5) & (16,10) using DDA line drawing algorithm [4]  
OR
- Q2 a) what is polygon filling? Explain in detail scan line polygon filling algorithm? [6]  
b) Write and explain Bresenham's circle drawing algorithm with related mathematics. [6]
- Q3 a) Explain briefly rotation about an arbitrary axis in 3D. [6]  
b) Write short note on.  
i. Morphing ii. Design of animation sequence iii. CIE chromaticity diagram [6]  
OR
- Q4 a) Explain following terms with examples [6]  
i] Properties of light ii] Keyframes iii] HSV color model  
b) Explain perspective projection and its types in brief. [3]  
c) Rotate origin centered square with 2 unit length of each side, in clockwise direction with rotation angle of  $90^\circ$ . [3]
- Q5 a) Enlist and explain in detail any 2 shading algorithms. [7]  
b) How Warnock and painter algorithm are useful in hidden surface removal? Explain with their advantages. [6]  
OR
- Q6 a) Write short note on phong and Gouraud model. [7]  
b) Write short note ( any two ) [6]  
i] Z-buffer ii] Back face detection and removal algorithm iii] BSP tree

P.T.O.

- Q7 a) What is fractal? Explain Koch(Triadic) curve in detail [4]  
b) Write short note on blending function of Bezier curve [4]  
c) What is OpenGL? Write four features of the same? Write any two 3D transformation Function of OpenGL [5]

OR

- Q8 a) Draw block diagram of NVIDIA workstation and explain it in brief. [5]  
b) Explain Hilbert curve and its application in detail. [4]  
c) Write short note on B-spline curve [4]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-568

**S.E. (Computer Engineering) (II Sem.) EXAMINATION, 2018  
ADVANCED DATA STRUCTURES  
(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :—** (i) Answer to the 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) Assume suitable data, if necessary.

(iii) Draw neat labelled diagram wherever necessary.

(iv) Figures to the right indicate full marks.

**Q.1**

a. Write an algorithm to delete node from BST.

[6]

b. Write an algorithm for Preorder traversal of binary tree and give suitable example.

[6]

**OR**

**Q.2**

a. Draw any directed graph with minimum 6 nodes and represent graph using adjacency matrix, adjacency list, adjacency multilist and inverse adjacency list.

[6]

b. Consider the graph represented by following adjacency matrix –

	1	2	3	4	5	6
1	0	3	1	6	0	0
2	3	0	5	0	3	0
3	1	5	0	5	6	4
4	6	0	5	0	0	2
5	0	3	6	0	0	6
6	0	0	2	2	6	0

And find minimum spanning tree of this graph using Prim's algorithm

[6]

**Q.3**

a. Construct hash table of size 10 using linear probing without replacement strategy for collision resolution. The hash function is  $h(x) = x \% 10$ . Consider slot per bucket is 1.

31, 3, 4, 21, 61, 6, 71, 8, 9, 25

[6]

b. Explain about a skip list with an example. Give applications of skip list

[6]

P.T.O.

**OR**

**Q. 4**

**a.** Construct the AVL tree for the following data by inserting each of the following data item one at a time

10, 20, 15, 12, 25, 30, 14, 22, 35, 40 [6]

**b** Explain following-

**i.** Static and dynamic tree tables with suitable example. [3]

**ii.** Dynamic programming with principle of optimality. [3]

**Q.5**

**a.** Write an algorithm to arrange numbers in ascending order using heapsort. Arrange the following numbers in ascending order using heapsort :

48, 0, -1, 82, 10, 2, 100 [7]

**b.** Construct B+ tree of order 3 for the following data:

1,42,28,21,31,10,17,7,31,25,20,18 [7]

**OR**

**Q. 6**

**a.** Build the min-heap for the following data:

25, 12,27,30,5,10,17,29,40,35

After creation of min-heap perform one delete operation on it and show the final min-heap

[8]

**b.** Write short note on:

[6]

**i.** Red-black tree

**ii.** K-dimensional tree

**Q. 7**

**a.** Explain Linked organization of a file

[6]

**b.** Define sequential file organization. Explain advantages of indexing over sequential file. [6]

**OR**

**Q. 8**

**a.** Define sequential file organization. Write pseudo code for insertion of records in sequential file [6]

**b.** Explain any two types of indices. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-569

**S.E. (Computer) (II Sem.) EXAMINATION, 2018**

**MICROPROCESSOR**

**(2015 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 diagram must be drawn whenever necessary.  
(iii) Figures to the right indicate full marks.  
(iv) Assume suitable data, if necessary.

1. (a) Explain immediate and register addressing mode with an example. [2]  
(b) Draw and explain the flag register of 80386. [4]  
(c) Draw and explain segment descriptor. [6]
- Or*
2. (a) What is the use of Interrupt Flag ? [2]  
(b) Explain paging mechanism. [4]  
(c) Draw and explain the 80386 address translation mechanism considering PG bit in CR0 in set. [6]
3. (a) What is CPL and RPL ? [2]  
(b) Explain Interrupt no. 0 and 4. [4]  
(c) Explain the role of Task Register in multitasking and the instructions used to modify and read TR. [6]

P.T.O.

*Or*

4. (a) List five aspects of protection in the 80386. [2]  
(b) Write a short note on 'I/O permission Bit Map'. [3]  
(c) Draw and explain TSS. [7]
5. (a) Write short note on Virtual 8086 Mode. [3]  
(b) Explain software initializations required for protected mode. [4]  
(c) Draw and explain structure of the TLB. [6]

*Or*

6. (a) What are the contents of various registers of processor 80386 after reset ? [3]  
(b) Explain entering and leaving V86 mode. [4]  
(c) Draw and explain debug registers of the 80386. [6]
7. (a) Explain the following signals : [3]  
(i) W/R##  
(ii) D/C#  
(iii) M/IO#  
(b) Explain any *four* 80387 constant instructions. [4]  
(c) Draw read cycle with non-pipelined address timing. [6]

*Or*

8. (a) Explain the following signals : [3]  
(i) INTR#  
(ii) NMI#  
(iii) RESET#  
(b) Draw and explain 80387 register stack. [4]  
(c) Explain any *six* 80387 data transfer instructions. [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-570

S.E. (COMPUTER ENGG.) (II-Sem.) EXAMINATION, 2018

PRINCIPLES OF PROGRAMMING LANGUAGES

(2015 COURSE)

Time : Two Hours

Maximum Marks : 50

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

(ii) Figures to the right indicate full marks.

1. (a) What is an Applet ? Write a generic Skeleton of Java Applet and explain the use of each block. [7]

(b) State with example the use of the following built in exceptions in Java :

(1) IndexOutOfBoundsException( )

(2) NullPointerException( )

(3) ArrayIndexOutOfBoundsException( ) [6]

*Or*

2. (a) What is the use of CharacterArrayReader() and CharacterArrayWriter() methods in Java ? Write a program which reads string of 10 characters from the user. Program extracts and prints the substring from the given string using above methods. [7]

(b) What is difference in character and byte streams in Java ? Give any *two* input and any *two* output classes for character streams. [6]

P.T.O.



3. (a) What is inheritance ? What are advantages of using inheritance ? Show by example the simple inheritance in Java. [7]
- (b) Explain the following Java concepts and state the difference with examples : [6]
- (1) Interface and Abstract class
  - (2) Static and Dynamic Dispatch.

*Or*

4. (a) What is use of Constructors ? What are types of constructors in Java ? Give example of each type. [7]
- (b) Explain the concepts and state the difference in the following with examples : [6]
- (1) Method Overloading and Overriding
  - (2) Applet and Console Program.

5. (a) What are steps of software development process SDLC (Waterfall Model) ? Why the use of this model is necessary in software development ? [6]
- (b) Explain how data is handled in programming languages. Give the type structure of ADA Language. [6]

*Or*

6. (a) What do you mean by Syntax ? State and draw the EBNF definition for Syntax Rules. [6]
- (b) Explain with example the use of the following data aggregates to construct compound data types : [6]
- (1) Sequencing
  - (2) Cartesian Product.

7. (a) What is generic programming ? How C++ offers generic programming constructs ? Give example. [6]
- (b) Explain why Java is Secured, Portable, and Dynamic ? Which of the concepts in Java ensures these ? [6]
8. (a) What is the advantage of grouping Units ? Explain the constructs in C++ based on grouping of Units. [6]
- (b) Write a program in Java using switch-case statement to perform addition, subtraction, Multiplication and Division of given two numbers and print the result. Does the program generate any exception ? [6]

Total No. of Questions—8]

[Total No. of Printed Pages—5

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[5352]-571

**S.E. (Information Technology) (First Semester)**

**EXAMINATION, 2018**

**DISCRETE STRUCTURES**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

**N.B. :—** (i) Solve question Nos. Q. 1 *or* Q. 2, Q. 3 *or* Q. 4,  
Q. 5 *or* Q. 6, Q. 7 *or* Q. 8.

(ii) Neat diagram must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Assume suitable data if necessary.

1. (a) Find the smallest number of people you need to choose at random so that the probability that at least two of them were both born on April 1 exceeds  $\frac{1}{2}$ .

Assume number of days in year as 366 days. [6]

- (b) Show that each of these conditional statements is a tautology by using truth tables : [6]

(i)  $(p \wedge q) \rightarrow p$

(ii)  $p \rightarrow (p \vee q)$ .

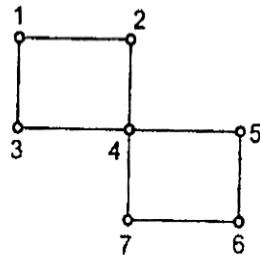
P.T.O.

*Or*

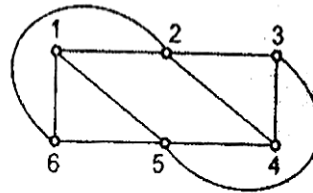
2. (a) A club has 25 members : [6]
- (i) How many ways are there to choose four members of the club to serve on an executive committee ?
- (ii) How many ways are there to choose a president, vice president, secretary, and treasurer of the club, where no person can hold more than one office ?
- (b) There are 2504 computer science students at a school. Of these, 1876 have taken a course in Java, 999 have taken a course in Linux, and 345 have taken a course in C. Further, 876 have taken courses in both Java and Linux, 231 have taken courses in both Linux and C, and 290 have taken courses in both Java and C. If 189 of these students have taken courses in Linux, Java, and C, how many of these 2504 students have not taken a course in any of these three programming languages ? [6]
3. (a) Draw the graph and its equivalent Hasse diagram for divisibility on the set : [6]
- {1, 2, 3, 6, 12, 24, 36, 48}.
- (b) State the theorems for presence of Euler path and circuit in a graph. Justify whether the graphs contain the following properties. If yes, write the path and circuit : [6]
- (i) Euler path
- (ii) Euler circuit

(iii) Hamiltonian path

(iv) Hamiltonian circuit.



$G_1$

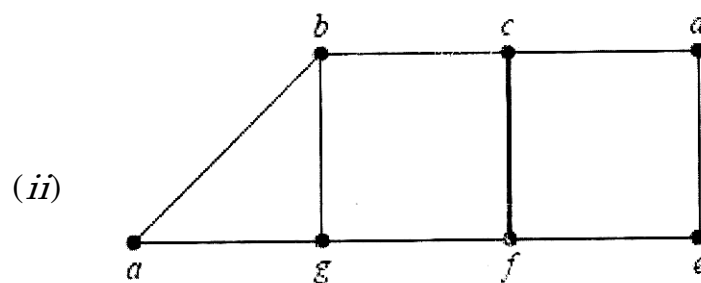
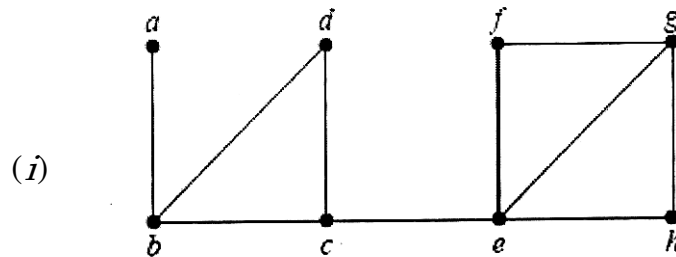


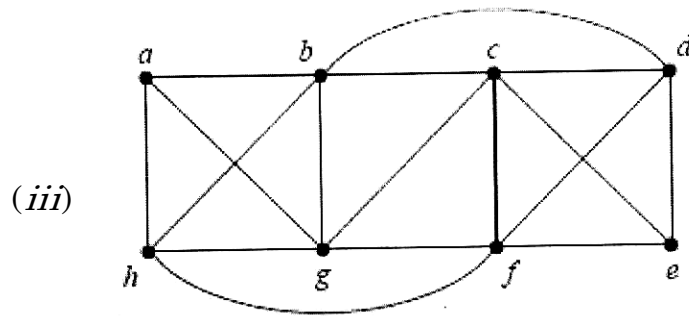
$G_2$

4. (a) Use Warshall's algorithm to find transitive closure of the following relation on the set  $\{1, 2, 3, 4\}$ , [6]

$$R = \{(1, 2), (1, 3), (1, 4), (2, 3), (2, 4), (3, 4)\}$$

- (b) Find minimum cut set and value of vertex connectivity of the following graphs. [6]





5. (a) Suppose 1000 people enter a chess tournament. Use a rooted tree model of the tournament to determine how many games must be played to determine a champion, if a player is eliminated after one loss and games are played until only one entrant has not lost. (Assume there are no ties.) [7]
- (b) How many edges does a full binary tree with 1000 internal vertices have ? [6]

*Or*

6. (a) Represent the expressions  $(x + xy) + (x/y)$  and  $x + ((xy + x)/y)$  using binary trees. Write these expressions in :
- (i) prefix notation
- (ii) postfix notation
- (iii) infix notation. [7]
- (b) Use Huffman coding to encode these symbols with given frequencies : [6]
- $a : 0.20, b : 0.10, c : 0.15, d : 0.25, e : 0.30.$
- What is the average number of bits required to encode a character ?

7. (a) What is abelian group ? Show that  $(\mathbb{Z}_6, +)$  is an Abelian Group ? [7]

(b) Find the hamming distance between code words of :

$$C = \{(0000), (0101), (1011), (0111)\}$$

Rewrite the message by adding even parity check bit and odd parity check bit. [6]

*Or*

8. (a) Let  $R = \{0^\circ, 60^\circ, 120^\circ, 180^\circ, 240^\circ, 300^\circ\}$  and  $*$  = binary operation, so that for  $a$  and  $b$  in  $R$ ,  $a * b$  is overall angular rotation corresponding to successive rotations by  $a$  and then by  $b$ . Show that  $(R, *)$  is a Group. [7]

(b) Let  $G = \{\text{even}, \text{odd}\}$  and binary operation  $\oplus$  be defined as : [6]

$\oplus$	even	odd
even	even	odd
odd	odd	even

Show that  $(G, \oplus)$  is a group.

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-572

**S.E. (I.T.) (I-Sem.) EXAMINATION, 2018**  
**COMPUTER ORGANIZATION AND ARCHITECTURE**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Neat diagram must be drawn wherever necessary.  
(ii) Figures to the right indicate full marks.  
(iii) Assume suitable data, if necessary.

1. (a) State and explain marketing metrics—MIPS, MFLOPS and Amdahl's law. [6]  
(b) Draw and explain processor organisation. [6]

*Or*

2. (a) Find CPU time, for program having  $10 \times 10^6$  instructions which is executed on processor having CPI 1.0, clock rate of 4 GHz. [6]  
(b) Give classification of instruction based on function. [6]
3. (a) Explain MESI protocol with diagram. [6]  
(b) A cache has 256 blocks of 16 words each, memory is 64k words. Find sizes, if cache used : [7]  
(i) Direct mapping  
(ii) Fully Associative mapping.

P.T.O.



*Or*

4. (a) Draw and explain hardwired control unit. [6]  
(b) Write control sequence for the execution of the following  
instructon : [7]  
ADD (R<sub>3</sub>) + R<sub>1</sub> where R<sub>1</sub> ← R<sub>1</sub> + (R<sub>3</sub>).

5. (a) What is instruction pipelining ? How it improves performance  
of computer ? [6]  
(b) Explain dynamic branch prediction and delayed branch prediction  
for MIPS pipeline with suitable diagram and example. [6]

*Or*

6. (a) Draw and explain 5 stage MIPS pipeline. [6]  
(b) Describe in brief any *one* pipeline hazard and its solution.[6]
7. (a) Draw and explain multicore architecture. [7]  
(b) What is cluster computing ? Explain its benefits. [6]

*Or*

8. (a) Explain multithreading. Describe its various types with suitable  
diagrams. [7]  
(b) Write short notes on : [6]  
(i) Core Duo  
(ii) Core-i7.

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-573

**S.E. (IT) (I Sem.) EXAMINATION, 2018**

**DIGITAL ELECTRONICS AND LOGIC DESIGN**

**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Answer Q. Nos. 1 or 2, 3 or 4, 5 or 6 and 7 or 8.  
(ii) Neat diagram must be drawn wherever necessary.  
(iii) Assume suitable data, if necessary.

1. (a) Do the following [6]  
(i)  $(27.50)_2 - (68.75)_2$  Using 2's complement method.  
(ii) Convert the decimal number 25 into Binary format, Excess -3 format and BCD format  
(b) Design Full subtractor circuit using decoder IC 74138 [6]
- OR**
- 2 (a) Define following terms related to logic families [6]  
(i) Power dissipation  
(ii) Fan-in  
(iii) Fan-out  
(iv) Noise margin  
(v) Propagation delay  
(vi) Figure of Merit  
(b) Draw and explain 4 bit BCD adder using IC 7483. [6]
- 3 (a) Compare Asynchronous counter with Synchronous counter. Design MOD 11 up [6]  
counter using IC 74191.  
(b) Draw and explain 4 bit Ring counter. Write the Truth Table for same showing all possible states if initial state is 1100. [6]

P.T.O.

**OR**

- 4 (a) Design and draw MOD 56 counter using IC 7490 and explain its operation. [6]  
(b) Draw and explain 4 bit SISO and SIPO shift register. Give applications of each. [6]
- 5 (a) Draw ASM chart for 2bit binary up counter with mode control input M such that [7]  
For M = 1 Counter counts Up  
For M = 0 Counter holds present state.  
Design the circuit using multiplexer controller method.  
(b) Design 4:1 multiplexer using suitable PAL [6]

**OR**

- 6 (a) Design 3 bit Binary to Gray code converter using suitable PLA [7]  
(b) Draw and explain Internal Architecture of CPLD in detail. [6]
- 7 (a) What is VHDL? Explain components of VHDL in detail with example of 2 input [6]  
AND gate.  
(b) Write VHDL code (Entity and Architecture) for 4:1 Multiplexer using Dataflow [7]  
modeling method

**OR**

- 8 (a) Compare sequential and concurrent statements in VHDL with suitable example [6]  
(b) Write VHDL code (Entity and Architecture) in Behavior modeling style for 2 bit [7]  
synchronous up/down counter. Consider  
Mode = 0 Up counting  
Mode = 1 Down counting

Total No. of Questions—8]

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[5352]-574

**S.E. (I.T.) (I Sem.) EXAMINATION, 2018**  
**FUNDAMENTALS OF DATA STRUCTURE**  
**(2015 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) Explain working of different logical operators in C with examples. [3]  
(b) Explain use of “break” and “continue” keywords in C with suitable examples. [3]  
(c) Explain the different modes of opening text and binary files in C using fopen() function. [6]

**OR**

2. (a) What is output of following code: [2]  

```
int aarray[]={45,67,89};  
int *p=array;  
printf(“%d”, *(p++));  
printf(“%d”, *p);
```

  
(b) What is purpose of structure in C? Is it possible to define structure into the structure? Explain with suitable examples. [4]  
(c) What are different methods for passing parameters to function? Write how array can be efficiently passed to a function with example. [6]
3. (a) Explain the following terms i)malloc() ii)calloc() iii)realloc() iv) free() [6]  
(b) What is the importance of pivot elements in the quick sort method? [2]  
(c) Write pseudo C code for bubble sort? Show its working pass by pass for following data : 10, 4, 55, 21, 6 [4]

P.T.O.

**OR**

4. (a) Explain the following terms [3]
- i) Big Oh notation
  - ii) Omega Notation
  - iii) Theta Notation

- (b) What is Persistent and Ephemeral data structure? [3]
- (c) Write pseudo code for non-recursive binary search function and comment on its time complexity in best, average and worst cases. [6]

5. (a) Write address calculation for elements of one dimensional array. [2]
- (b) Explain sequential memory organization with example. [4]
- (c) Write an algorithm to add two sorted polynomial in a single variable. Analyze its time complexity. [7]

**OR**

6. (a) Explain the two dimensional arrays in details with column and row major implementation and address calculation in both the cases. [6]
- (b) What is sparse matrix? Explain how it is represented. Write C pseudo code for addition of two sparse matrices. What is its time complexity? [7]

7. (a) Explain concept of generalized linked list with example? [4]
- (b) Write advantages of circular linked list over linear linked list. [2]
- (c) What is Doubly Linked List? Write C code to delete a node from DLL at following positions: [7]

- i) At the beginning
- ii) In the middle
- iii) At the end

**OR**

8. (a) Compare linked list with arrays with reference to the following aspects: [6]
- i) Accessing any element randomly
  - ii) Insertion and deletion of an element
  - iii) Utilization of memory
- (b) What is Singly Linked List (SLL)? Write C pseudo code for performing following operations on SLL: [7]
- i) Insert element at any position
  - ii) Reverse the list without using additional data structure

Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-575

**S.E. (Information Technology) (First Semester) EXAMINATION, 2018**  
**PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :-** (i) Solve Question Nos. Q. 1 *or* Q. 2, Q. 3 *or* Q. 4,  
Q. 5 *or* Q. 6, Q. 7 *or* Q. 8.
- (ii) Neat diagram must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.

1. (a) What are types of problems ? What are difficulties with problem solving ? [6]
- (b) What are operators ? Explain different types of operators. Draw table for hierarchy of operator. [6]

*Or*

2. (a) Explain Local and global variable parameters. [6]
- (b) Create the algorithm and the flowchart to find the percentage (%) of all the students in a class using repeat until loop. [6]

P.T.O.

3. (a) Explain features of object oriented programming in detail. [6]  
(b) Explain friend function and friend class. Give syntax for same. [6]

*Or*

4. (a) Explain need of operator overloading. Write C++ program to demonstrate any binary operator overloading. [6]  
(b) How is memory management carried out in C++ ? Write syntax for the same. [6]
5. (a) Explain Abstract Base Class in detail. [6]  
(b) Explain multiple inheritance with C++ program. [7]

*Or*

6. (a) What are virtual function and virtual destructor ? [6]  
(b) How is concept of inheritance useful in object oriented programming language ? Explain types of inheritance. [7]
7. (a) Which Classes are used file stream operations ? Explain in detail. [6]  
(b) Explain Exception Handling mechanism in C++ ? Explain how to catch multiple Exceptions in Program. [7]

*Or*

8. (a) Explain Namespaces. What are rules for namespaces ? [6]  
(b) How to manage console I/O operations ? [7]



Total No. of Questions—8]

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[5352]-576

S.E. (Information Technology) (Sem. II)

EXAMINATION, 2018

COMPUTER GRAPHICS

(2015 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 are the steps of Bresenham's circle drawing algorithm ?  
Explain with example. [6]

(b) What is the concept of display file and display file interpreter. [6]

*Or*

2. (a) Discuss any *two* polygon filling methods. [6]

(b) Interpret Digital Differential Analyser (DDA) algorithm to find which pixels are turned on for the line segment between (2, 3) and (8, 6). [6]

3. (a) Explain Cohen-Sutherland line clipping algorithm with diagram. [6]

(b) Explain reflection about XY, YZ and XZ plane. [6]

P.T.O.

*Or*

4. (a) Explain different types of parallel and perspective projections. [6]  
(b) Explain window and viewport in detail with example. [6]
5. (a) Write a short note on animation sequence. [7]  
(b) Write a note on OpenGL. [6]

*Or*

6. (a) Explain block diagram of i860. [7]  
(b) What is shading ? Explain different types. [6]
7. (a) Write a note on fractal lines and surfaces. [7]  
(b) What is interpolation ? Explain any interpolation algorithm. [6]

*Or*

8. (a) Explain Bezier curve generation using midpoint subdivision. [7]  
(b) Explain techniques of smoothing curves using B Splines. [6]

Total No. of Questions—8]

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[5352]-577

**S.E. (Information Technology) (II Sem.) EXAMINATION, 2018  
PROCESSOR ARCHITECTURE AND INTERFACING  
(2015 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.

- Q.1) a) Explain any 3 addressing modes of 80386 with example [06]  
b) Explain following pins of 80386 [07]  
BE0-BE3 #, ADS #, NA# and Ready
- OR**
- Q.2) a) Which are the different registers and descriptors used for logical to linear address conversion when 80386 is in Protected mode? Explain their significance and format [07]  
b) Explain Control Registers CR0 to CR3 of 80386 [06]
- Q.3) a) How 80386 performs Task Switching operation Explain with diagram [06]  
b) Explain features of 8051 [06]
- OR**
- Q.4) a) Explain various registers used in Paging when 80386 is operating in Protected mode [06]  
b) Explain the significance of following instructions of 8051 [06]  
MOV R0, #50H  
MOV R0, 50H  
DJNZ R1, label
- Q.5) a) Write 8051 ALP (assembly language program) (with comments) to generate square wave of 2Khz using internal Timer. Explain the calculations and significance of SFRs used for the same. (Assume Crystal Frequency : 11.092MHz) [07]  
b) Explain SCON of 8051 with format and any 2 operating modes of 8051 for Serial Communication? [06]
- OR**
- Q.6) a) What are vectored interrupts? Explain vectored interrupts available in 8051 with diagram and their priority. How to change the priority of vectors explain with the help of Interrupt Priority (IP) register [07]  
b) Write ALP to configure I/O ports of 8051 for following configurations using bit/byte addressable instructions [06]  
1. Alternate pins of Port P1 in Input and Output mode  
2. P2.0 to P2.3 to read the data from keyboard and P2.4 to P2.7 to write data to display  
3. To generate square wave at P3.0

P.T.O.

- Q.7) a) Draw interfacing diagram of 8051 with LCD and explain significance of interfacing signals. [06]  
b) Draw interfacing diagram of 8051 with temperature sensor and explain [06]
- OR**
- Q.8) a) Draw interfacing diagram of 8051 with ADC and explain significance of interfacing signals. [06]  
b) Explain operating modes of 8255 in detail. [06]

Total No. of Questions—8]

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[5352]-578

S.E. (I.T.) (Second Semester) EXAMINATION, 2018

DATA STRUCTURES AND FILES

(2015 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) Write a C++ function to convert infix expression to postfix expression. [6]

(b) Construct a binary tree from the given traversal : [6]

(i) Preorder : \* + a - b c / - d e - + f g h

Inorder : a + b - c \* d - e / f + g - h

(ii) Inorder : H, D, I, B, E, A, J, F, K, C, G

Postorder : H, I, D, E, B, J, K, F, G, C, A

*Or*

2. (a) Imagine that the content of queue Q1 & Queue Q2 are as shown. What would be the content of Q3 after the following code is executed ? Show pictorial representation of both Q1

P.T.O.

& Q2 with value of front & rear The queue contents are shown front (left) to rear (right). [6]

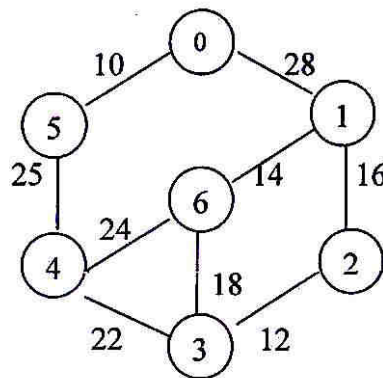
Q1 : 42 30 41 30 19 20 25 14 10 11 12 15

Q2 : 3 5 7 4 13

1. Q3 = createQueue( )
2. count = 0
3. loop (not empty Q1 and not empty Q2)
  - 3.1. count = count + 1
  - 3.2. dequeue(Q1, x)
  - 3.3. dequeue(Q2, y)
  - 3.4. if (y equal count)
    - 3.4.1 enqueue(Q3, x)
  - 3.5. end if
4. end loop.

(b) Explain binary search tree in detail. [6]

3. (a) Write the pseudo code for Kruskal's algorithm and find minimum spanning tree for the following graph : [6]



- (b) Create a Huffman's tree for the given data set and find the corresponding Huffman's code : [6]

Data	Frequency
A	10
B	3
C	4
D	15
E	2
F	4
G	2
H	3

*Or*

4. (a) Show stepwise construction of maxheap for the data : [8]  
40, 50, 10, 60, 20, 30, 70
- (b) What is symbol table ? Give symbol table ADT. [4]
5. (a) Explain topological sorting using example. [4]
- (b) Construct an AVL for the following data : MAR, MAY, NOV, AUG, APR, JAN, DEC, JUN, FEB, JUL, OCT, SEP. Show the balance factor of each node and type of rotation. [10]

*Or*

6. (a) Explain red and black tree in detail. [6]
- (b) Explain the steps to build a B-tree of order 5 for the following data : [8]  
78, 21, 14, 11, 97, 85, 74, 63, 45, 42, 57, 20, 16, 19, 32, 30, 31

7. (a) Write C++ program for reading the character from keyboard and write in text file. [4]

(b) Explain various operations on Sequential Files in detail. [8]

*Or*

8. (a) What is file ? Explain different file opening mode. [6]

(b) Explain with example : [6]

(i) seekg( )

(ii) tellg( )

(iii) rewind( ).



Total No. of Questions—8]

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[5352]-579

S.E. (I.T.) (II Sem.) EXAMINATION, 2018

**FOUNDATIONS OF COMMUNICATION AND COMPUTER NETWORK  
(2015 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.

1. (a) Draw and explain TCP/IP protocol suite. [6]  
(b) A modulating signal  $10 \sin (2\pi \times 10^3 t)$  is used to modulate a carrier signal  $20 \sin (2\pi \times 10^4 t)$ . Find the modulation index, percentage modulation, frequencies of the sideband components and their amplitudes. What is the bandwidth of the modulated signal ? [6]

*Or*

2. (a) With the help of diagram explain AM. Write mathematical expression of AM modulated signal. [6]  
(b) What is bandwidth required for FM in which the Modulating frequency is 2 kHz and maximum possible deviation is 10 kHz. Assume highest needed sidebands 8. Also calculate using Carson's rule. [6]

P.T.O.

3. (a) Explain pulse code modulation and Delta modulation with suitable diagram. [6]
- (b) Explain the following shift keying techniques with suitable examples : [7]
- (i) ASK
- (ii) FSK
- (iii) PSK

*Or*

4. (a) Explain in detail Go-Back-N and Selective Repeat ARQ system.[6]
- (b) What are different Error detection techniques ? Explain any *one* with suitable example. [7]
5. (a) Write a short note on CSMA/CD. How is it useful for collision avoidance ? [6]
- (b) What is TDM ? Draw and explain TDM Multiplexing and Demultiplexing Process. [6]

*Or*

6. (a) Explain TDMA and CDMA with neat diagram. [6]
- (b) What is spread spectrum ? Explain FHSS with its advantages and disadvantages. [6]
7. (a) Enlist different connecting devices in network and explain any *two* in detail. [6]
- (b) Explain Circuit switched network with three phases. [7]

*Or*

8. (a) Explain types of bridges with suitable diagram. [6]
- (b) Compare and contrast circuit switched network with packet switched network. [7]

Total No. of Questions—8]

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[5352]-581

S.E. (Chemical) (I Sem.) EXAMINATION, 2018

CHEMISTRY—I

(2015 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 logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(vi) 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 carbonium ion. [4]
- (c) Derive the integrated rate expression for first order kinetics. [4]

*Or*

2. (a) Explain the stability of allyl free radical. [4]

P.T.O.

- (b) What is steady state approximation ? How is it used to calculate the rate of complex reaction ? [4]
- (c) Quantum efficiency of a photo-chemical reaction between  $H_2$  and  $Cl_2$  is  $10^5$ , with wavelength of 4800 Å. Calculate the no. of moles of HCl formed from 1 Joule of the energy. [4]
3. (a) Explain the important components of gas chromatography. [4]
- (b) State and derive Lambert and Beer's law. [4]
- (c) Derive equation for molar mass of a solute by depression in freezing point. [4]

*Or*

4. (a) Explain the principle, technique and applications of thin layer chromatography. [4]
- (b) Derive the thermodynamic equation relating  $T_b$  and  $H_{rap}$ . [4]
- (c) 1.51 gm NaCl in 500 gm of water ( $K_b = 0.51$  K/molar) elevated boiling point of water by  $0.05^\circ C$ . Calculate the apparent molar mass, Van't Hoff factor and degree of dissociation of NaCl. [4]
5. (a) Give the mechanism of Friedel-Craft alkylation. [4]
- (b) What are the effect of solvent, nature of nucleophile and nature of leaving group on  $S_N1$  reactions ? [4]
- (c) Write a short note on Beckmann's rearrangement. [4]

*Or*

6. (a) Give the mechanism of nitration of benzene. [4]  
(b) Discuss the mechanism of E<sub>2</sub> reactions. [4]  
(c) Write a short note on Saytzeff rule. [4]
7. (a) Give *two* methods each for the synthesis of furan and pyrrole. [5]  
(b) Describe synthesis of the following : [5]  
(i) Alizarin  
(ii) Phenolphthalein.  
(c) Write a brief note on colour and constitution theory of a dye. [4]

*Or*

8. (a) Explain the electrophilic substitution reactions in five membered heterocyclic ring compounds. [5]  
(b) Describe the Skraup synthesis of Quinoline. [5]  
(c) Give a brief account on classification of dyes on the basis of application. [4]

Total No. of Questions—8]

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[5352]-582

S.E. (Chemical) (I Semester) EXAMINATION, 2018

FLUID MECHANICS

(2015 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) Draw shear stress-shear rate diagram and explain rheological behaviour of different fluids. [6]

(b) The right limb of a single U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp. gr. 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. [6]

*Or*

2. (a) State and prove the Pascal's law. [6]

P.T.O.

- (b) Calculate the density, specific weight and weight of one litre of petrol of specific gravity = 0.7. [6]
3. (a) Develop the general form of the continuity equation in Cartesian coordinates for three-dimensional flow. Hence, deduce the equation for steady incompressible fluid flow. [6]
- (b) What is Hagen Poiseuille's formula ? Derive an expression for Hagen Poiseuille's formula. [7]

*Or*

4. (a) An oil of sp. gr. 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm. The oil mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take  $C_d = 0.98$ . [6]
- (b) Derive Darcy Weisbach equation to find head loss due to friction. [7]
5. (a) What do you mean by : [6]
- (1) Dimensionally homogenous equation and
- (2) Dimensionally non-homogenous equation
- Give *two* examples of each. List out uses of dimensional analysis.
- (b) Discuss the classification of the fluidization and describe the particulate and aggregative fluidization. [6]

*Or*

6. (a) The pressure drop ' $\Delta P$ ' in a pipeline of diameter ' $D$ ' and length ' $L$ ' depends upon density ' $S$ ' and viscosity ' $\mu$ ' of flowing fluid, mean velocity ' $v$ ' are average height of roughness projection ' $K$ '. Obtain an expression for ' $\Delta P$ ' and show that :

$$hf = \frac{\Delta P}{r} = \frac{fL}{\Delta} \cdot \frac{v^2}{2g}$$

where  $hf$  is loss of head due to friction =  $\frac{\Delta P}{r}$ ,  $r$  is the specific weight of fluid and ' $f$ ' the frictional resistance coefficient. [6]

- (b) Explain the development of boundary layer over a flat plate held parallel to the direction of flow. State the factors affecting growth of boundary layer. [6]
7. (a) Define and explain : [6]
- (i) Geometric similarity
  - (ii) Kinetic similarity
  - (iii) Dynamic similarity.
- (b) Write short notes on : [7]
- (i) Types of valves with its applications
  - (ii) Cavitation
  - (iii) NPSH.

*Or*

8. (a) What are repeating variables ? What points are important while selecting repeating variables ? [6]
- (b) Define a centrifugal pump. Explain the working of a centrifugal pump with sketches. [7]



Total No. of Questions—8]

[Total No. of Printed Pages—2

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[5352]-583

S.E. (Chemical) (I Sem.) EXAMINATION, 2018

ENGINEERING MATERIALS

(2015 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.

- Q1) a) Define the following terms: 6
- i. Shear Stress
  - ii. Resilience
  - iii. Malleability
- b) Draw and explain stress-strain curve for Mild Steel materials. 6

OR

- Q2) a) Write the classification of Engineering Materials. 4
- b) A steel rod of 30 mm diameter, 280 mm long is subjected to axial forces alternating between maximum compression of 15 kN and a maximum tension of 5 kN. Find the difference between the greatest and least length of the rod.  $E = 210 \text{ GPa}$ . 8

P.T.O.

Q3) a) What are the different types of Hardness testing methods? Explain any one method in detail. 6

b) Draw Iron-Iron carbide equilibrium diagram. 6

OR

Q4) Write short notes on the following: 12

i) Carbon nanotubes

ii) Applications of Nanomaterials in chemical industry

Q5) Explain principle and working of Transmission Electron Microscope (TEM) 13

OR

Q6) Write short notes on: (Any Two) 13

i. X- ray diffraction

ii. Atomic force microscopy

iii. Scanning Tunneling microscopy

Q7) a) Define ceramic materials. Write applications of ceramic materials. 7

b) Explain the term Refractories materials with applications 6

OR

Q8) a) Write a short note on Organic Protective Coatings? 6

b) Write a short note on Glass and its types. 7

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-584

**S.E. (Chemical) (First Semester) EXAMINATION, 2018**  
**PROCESS CALCULATIONS**  
**(2015 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.

- Q 1 (a)** The flow rate of water through a pipe is reported as 15 cubic feet per minute. [4]  
Taking density of water as 1 g/cc, calculate the mass flow rate in kg/s
- b)** After crystallization operation, the solution of  $\text{CaCl}_2$  in water contains 60 g of  $\text{CaCl}_2$  per 100 g of water. Calculate the amount of this solution necessary to dissolve 200 kg of  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$  crystals at a temperature of 298 K. [8]  
The solubility of  $\text{CaCl}_2$  at 298 K is 819.2 g of  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$  per 1000 g of water.
- Q 2 (a)** An aqueous of Acetic Acid of 30% concentration (by mass) has density 1040 kg/m<sup>3</sup>. Find Molality, Normality and Molarity of the solution. [4]
- (b)** A gas mixture consisting of 65 %  $\text{N}_2$  and 35 %  $\text{SO}_3$  by volume is admitted to an absorption column at a rate of 4500 kg/h. It is contacted with a stream of 50 %  $\text{H}_2\text{SO}_4$  flowing counter current to the gas stream at a rate of 5000 kg/h. The gases leave at 101.3 kPa. Water lost with the exit gases exerts a partial pressure of 25 kPa. If the concentrated acid leaving the bottom of the column contained 75 %  $\text{H}_2\text{SO}_4$ , what percent of the entering  $\text{SO}_3$  is absorbed and converted to acid? [8]

P.T.O.

- Q 3 a)** Hydrogen gas is burned in an adiabatic reactor with two times the theoretical quantity of air, both air and hydrogen being at 298 K initially. What will be the temperature of the reaction product? The standard heat of formation of gaseous water is  $-241.826$  kJ/mol. The heat capacities (kJ/mol K) of the gases are as follow: **[7]**

$$\text{Water Vapor } C_p = 30.475 + 9.652 \times 10^{-3} T + 1.189 \times 10^{-6} T^2$$

$$\text{Nitrogen : } C_p = 27.034 + 5.815 \times 10^{-3} T - 0.2889 \times 10^{-6} T^2$$

$$\text{Oxygen } C_p = 25.611 + 13.260 \times 10^{-3} T - 4.2077 \times 10^{-6} T^2$$

- b)** Formaldehyde is produced by dehydrogenation of methanol **[6]**  

$$CH_3OH \longrightarrow HCHO + H_2$$

The per pass conversion is 67 %. The product leaving the reactor is fed to separation unit battery where formaldehyde is separated from methanol and hydrogen. The separated methanol is recycled to reactor. If the production rate of formaldehyde is 1000 kg/h. Calculate: (i) combined feed ratio (ii) flow rate of methanol required to the process as fresh feed.

- Q 4 a)** Ethylene oxide is produced by oxidation of ethylene. 100 kmol of ethylene are fed to a reactor and the product is found to contain 80 kmol ethylene oxide and 10 kmol  $CO_2$ . Calculate the percentage conversion of ethylene and percentage yield of ethylene oxide. **[7]**

- b)** Pure methane is heated from  $30^\circ C$  to  $250^\circ C$  at atmospheric pressure. Calculate heat added per kg of methane : **[6]**

$$C_p = 19.249 + (52.113 \times 10^{-3})T + (11.973 \times 10^{-6}T^2) \text{ kJ/kmol K.}$$

- Q 5 a)** Carbon dioxide contains 0.053 kmol water vapour per kmol of dry  $CO_2$ . 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 Relative humidity, percentage humidity and Humid volume. Derive the relation between them. **[5]**

- Q 6** A liquid mixture containing 30 mole % benzene (B), 25 % toluene (T) and 45 % xylene (X) is fed at the rate of 1000 kmol/h to a distillation unit consisting of two columns. The bottom product from the first column is to contain 99 mole % X and no B, and 98 % of the X in the feed is to be recovered in this stream. The overhead from the first column is fed to the second column. The overhead from the second column contains 99 mole % B and no X. The benzene recovered in this stream represents 96 % of the B in the feed to this column. Calculate the molar flow rates (kmol/h) and component mole fraction in each product stream from both columns. **[13]**
- Q 7** a) Explain in detail about proximate analysis of coal **[5]**
- b) The orsat analysis of the flue gases from a boiler house chimney gives CO<sub>2</sub>: 11.4%, O<sub>2</sub>: 4.2 % and N<sub>2</sub> 84.4% (mole %). Assuming that complete combustion has taken place. Calculate the % excess air, and also find the C/H ratio in the fuel. **[7]**
- Q 8** a) Explain the following: **[6]**
1. Classification of fuels
  2. Calorific values of fuels
  3. Adiabatic Flame Temperature
- b) The gross heating value of gaseous n-butane is 2877.40 kJ/mol at 298 K. Calculate its net heating value in kJ/mol and kJ/kg **[6]**

Total No. of Questions—8]

[Total No. of Printed Pages—4+2

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[5352]-585

S.E. (Chemical) (I Sem.) EXAMINATION, 2018

ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B.* :— (i) Neat diagrams must be drawn wherever necessary.  
(ii) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.  
(iii) Assume suitable data, if necessary.  
(iv) 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) Solve any two : [8]

(i)  $(D^3 + D) y = \sin (x + 3)$

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

(iii)  $\frac{d^2 y}{dx^2} + y = \sec x$  (by method of variation of parameters)

(b) Find the Fourier cosine transform of : [4]

$$f(x) = \begin{cases} x, & 0 \leq x \leq 1 \\ 2 - x, & 1 \leq x \leq 2. \\ 0, & x > 2 \end{cases}$$

P.T.O.

*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 and period of oscillation. [4]

- (b) Find the Fourier cosine integral representation of : [4]

$$f(x) = e^{-mx} (m \geq 0, x > 0).$$

- (c) Solve the integral equation : [4]

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

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

- (i) Find the Laplace transform of :

$$f(t) = e^{-t} \cos 2t \sin t$$

- (ii) Find the inverse Laplace transform of :

$$F(s) = \frac{s^2}{(s^2 + a^2)^2}.$$

- (b) Find the Laplace transform of : [4]

$$f(t) = \begin{cases} t, & 0 < t < 1 \\ 0; & 1 < t < 2 \end{cases}; f(t+2) = f(t).$$

- (c) Find the directional derivative of the function  $\phi = e^{2x-y-z}$  at (1, 1, 1) in the direction of the tangent to the curve  $x = e^{-t}$ ,  $y = 2 \sin t + 1$ , and  $z = t - \cos t$  at  $t = 0$ . [4]

Or

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

(i) Prove that :

$$\nabla^4 e^r = \left(1 + \frac{4}{r}\right) e^r.$$

(ii) Prove that :

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

(b) Show that  $\bar{F} = \frac{1}{r} \left[ r^2 \vec{a} + (\bar{a} \cdot \bar{r}) \vec{r} \right]$  is irrotational and find  $\phi$  such that  $\vec{F} = \nabla\phi$ , where  $\vec{a}$  is constant vector. [4]

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

$$\frac{d^2 y}{dt^2} + 9y = 9 \cdot U(t - 3); y(0) = 0, y'(0) = 0$$

where  $U(t - 3)$  is a unit step function.

5. (a) Find the work done in moving particle along the curve joining points  $(0, 0, 0)$  and  $(1, 1, 1)$  under force field : [4]

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

(b) Evaluate  $\iint_S \bar{F} \cdot d\bar{S}$  where S is surface of sphere  $x^2 + y^2 + z^2 = 9$  and  $\bar{F} = x^3\bar{i} + y^3\bar{j} + z^3\bar{k}$ . [4]

(c) Evaluate  $\iint_S (\nabla \times \bar{F}) \cdot d\bar{S}$ , where  $\bar{F} = (x^3 - y^3)\bar{i} - (xyz)\bar{j} + y^2\bar{k}$  and S is surface  $x^2 + 4y^2 + z^2 - 2x = 4$  above plane  $x = 0$ . [4]



Or

6. (a) If  $\vec{F} = (zx + y^2)\vec{i} + (3y - 4x)\vec{j}$  then evaluate  $\int_C \vec{F} \cdot d\vec{r}$  along parabolic arc  $y = x^2$  joining points (0, 0) and (1, 1). [4]
- (b) Evaluate  $\iint_S (\nabla \times \vec{F}) \cdot d\vec{S}$ , where  $\vec{F} = (x - y)\vec{i} + (x^2 + yz)\vec{j} - 3xy^2\vec{k}$  and S is surface of paraboloid  $z = 4 - x^2 - y^2$  above XOY plane. [4]
- (c) Evaluate  $\iint_S (4xz\vec{i} - y^2\vec{j} + yz\vec{k}) \cdot d\vec{S}$  over a cube bounded by planes  $x = 0$ ,  $x = 2$ ,  $y = 0$ ,  $y = 2$  and  $z = 0$ ,  $z = 2$ . [5]

7. Solve any two :

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

$$u = a \sin \frac{2\pi x}{l} \text{ from which it is released at time } t = 0. \text{ Use}$$

wave equation  $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$  to find displacement  $u(x, t)$  from one end. [7]

- (b) Solve  $\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$  if : [7]

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

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

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

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

(c) Solve  $\frac{\partial^2 v}{\partial x^2} + \frac{\partial^2 v}{\partial y^2} = 0$  with conditions : [6]

(i)  $v = 0$  when  $y \rightarrow \infty, \forall x$

(ii)  $v = 0$  when  $x = 0, \forall y$

(iii)  $v = 0$  when  $x = 1, \forall y$

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

Or

8. Solve any two : [7]

(a) Solve :

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

with conditions :

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

(ii)  $y(3, t) = 0$

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

(iv)  $y(x, 0) = \begin{cases} x, & 0 \leq x \leq 2 \\ 2(3 - x), & 2 \leq x \leq 3 \end{cases}$

(b) Solve : [6]

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

if :

(i)  $u$  is finite  $\forall t$ ,

(ii)  $u = 0$  when  $x = 0, \pi, \forall t$

(iii)  $u = \pi x - x^2$  when  $t = 0$  and  $0 \leq x \leq \pi$ .

(c) The initial temperature along the length of an infinite bar

is  $u(x, 0) = \begin{cases} 2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ . If the temperature  $u(x, t)$  satisfies

the equation  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ ,  $-\infty < x < \infty$ ,  $t > 0$ . By using Fourier

transform, find the temperature at any point of the bar at

any time  $t$ . [6]

Total No. of Questions—8]

[Total No. of Printed Pages—3

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[5352]-586

S.E. (Chemical) (Sem. II) EXAMINATION, 2018

CHEMISTRY-II

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

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

(iii) Assume suitable data, if necessary.

1. (a) How does Glucose react with :

(i) Acetylation

(ii)  $\text{NaBH}_4$

(iii) Bromine water. [6]

(b) Define the following terms with example :

(i) Coordination no.

(ii) Ligand

(iii) Complex ions. [6]

*Or*

2. (a) What are enzymes ? How do they function ? [6]

(b) Explain giving reasons why :

(i) Most of the transition metals are paramagnetic.

(ii) All transition metals exhibit variable valency. [6]

P.T.O.

3. (a) Give the assumption of Langmuir adsorption theory and explain the isotherm. [6]
- (b) Explain direct titration with EDTA. [4]
- (c) What is buffer solution ? Give the formulae for pH of an acidic and basic buffer. [3]

*Or*

4. (a) Give the mechanism of metal co-ordination compound catalysed reactions by Wacker's process. [6]
- (b) A given solution of  $\text{Fe}^{++}$  is diluted to volume 250 ml. 25 ml of this solution in titration against 0.05 N  $\text{KMnO}_4$ . Takes 18.4 ml upto end point. Calculate the  $\text{Fe}^{++}$  ion quantity in the given solution (At. wt. of iron = 55.8) [4]
- (c) What is a complexometric titration ? Give the theory involved in them. [3]
5. (a) Explain the conformation of butane by Newman projection formula. [6]
- (b) Which are the conditions and characteristic of geometrical isomers to occur by giving suitable e.g. [6]

*Or*

6. (a) Explain Baeyer's strain theory for cycloalkanes. [6]
- (b) Discuss the E-Z system of naming geometrical isomers with suitable e.g. [6]
7. (a) Discuss the synthesis of Aspirin, Paracetamol. [6]
- (b) Explain the term Growth regulators. [4]
- (c) Give the chemical reaction in preparation of :
- (i) Triple superphosphate
- (ii) Diammonium superphosphate. [3]

*Or*

8. (a) Briefly mention the applications of insecticide. [4]
- (b) Mention the uses of  $\alpha$ -Naphthyl acetic acid. [3]
- (c) What is meant by the following terms : [6]
- (i) Antipyretic
  - (ii) Antibiotic
  - (iii) Anaesthetic
  - (iv) Tranquilizers
  - (v) Sedatives
  - (vi) Antihistamines.

Total No. of Questions—8]

[Total No. of Printed Pages—4

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[5352]-587

S.E. (Chemical) (Second Semester) EXAMINATION, 2018

HEAT TRANSFER

(2015 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) Derive a relation for the critical radius of insulation for a circular cross-section having radius  $R$  and length  $L$ . [6]

(b) Explain : [6]

(i) Natural Convection

(ii) Forced Convection.

*Or*

2. (a) One end of a very long aluminium rod of 3 mm in diameter is connected to a wall at 413 K, while the other end protrudes/projects into a room whose air temperature is 288 K. Calculate the total heat dissipated by the rod. [6]

Data :

$k$  for aluminium = 150 W/(m.K)

$h$  between the rod surface and environment = 300 W/(m<sup>2</sup>K).

P.T.O.

(b) Explain : [6]

(i) Wilson Plot

(ii) Fouling Factor.

3. (a) Define : [6]

(i) Pool Boiling

(ii) Local Boiling

(iii) Saturated Pool Boiling.

(b) Estimate the total heat loss by convection and radiation from an unlagged steam pipe, 50 mm o.d., at 415 K to air at 290 K.

Data :  $e = 0.90$

The film coefficient ( $h_c$ ) to calculate heat loss by natural convection is given by :

$$h_c = 1.18 (\Delta T/D_o)^{0.25} \text{W}/(m^2\text{K}) \quad [6]$$

*Or*

4. (a) Explain : [6]

(i) Film-wise condensation

(ii) Effect of Non-condensable Gases.

(b) Explain : [6]

(i) Radiation Shields

(ii) Radiation Shape Factor.



5. (a) Explain design procedure for Double pipe Heat Exchanger. [10]  
(b) Explain Baffles in Shell and Tube Heat Exchanger. [3]

*Or*

6. Water at 303 K enters a 25 mm I.D. tube at a rate of 1200 l/h. Steam condenses on the outside surface of tube (28 mm O.D.) at temperature of 393 K and its film heat transfer coefficient may be taken as 6000 W/(m<sup>2</sup>K).

Determine the length of the tube required to heat water at 343 K.

Data : Thermal Conductivity of tube wall material = 348.9 W/(m.K.)

Properties of water at mean temperature of 323 K are :

$k = 0.628$  W/(m.K.),  $\rho = 980$  kg/m<sup>3</sup> and  $\mu = 6 \times 10^{-4}$  kg/(m.s),  
 $C_p = 4.187$  kJ/(kg.K). [13]

7. (a) A triple effect evaporator is concentrating a solution that has no appreciable boiling point elevation. The temperature of steam to the first effect is 381.3 K and the boiling point of the solution in the last effect is 324.7 K. The overall heat transfer coefficient in the first, second and third effect are 2800, 2200 and 1100 W/(m<sup>2</sup>K) respectively. At what temperature will the solution boil in the first and second effect ? [8]
- (b) Explain Material and energy balance over single effect evaporator. [5]

*Or*

8. (a) An evaporator is operating at atmospheric pressure. It is desired to concentrate a feed from 5% solute to 20% solute (by weight) at a rate of 5000 kg/h. Dry saturated steam at a pressure corresponding to the saturation temperature of 399 K used. The feed is at 298 K and the boiling point rise 5 K. The overall heat transfer coefficient is 2350 W/(m<sup>2</sup>K). Calculate the steam economy of the evaporator and the area of heat transfer to be provided.

Data : Treating the solution as a pure water and neglecting BPR, the latent heat of Condensation of steam at 399 K is 2185 kJ/kg.

Latent heat of vaporisation of/evaporation of water at 101.325 kPa and 373 K = 2257 kJ/kg.

Specific heat of feed is 4.187 kJ/(kg K). [9]

- (b) Define : [4]

(i) Capacity of Evaporators

(ii) Economy of Evaporators.

Total No. of Questions—8]

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[5352]-588

**S.E. (Chemical Engineering) (II Sem.) EXAMINATION, 2018**  
**PRINCIPLES OF DESIGN**  
**(2015 PATTERN)**

**Time : Two Hours**

**Maximum Marks : 50**

- N.B. :—** (i) Attempt Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,  
Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.  
(ii) Figures to the right indicate full marks.  
(iii) Draw neat figures wherever necessary.  
(iv) Use of scientific calculators is allowed.  
(v) Assume suitable data wherever necessary.

- Q.1) a) Differentiate between Process design and process equipment design (mechanical design) [05]  
b) What are design codes? Explain. Also discuss various codes and standards used in chemical process and equipment design. [05]  
c) Define fatigue and creep [02]

OR

- Q.2) a) Explain shear force diagram [04]  
b) Explain bending moment diagram [04]  
c) What are various theories of failure. Enlist and explain any two of them [04]
- Q.3) a) A steel shaft having 25 mm diameter transmits 30 kW at 600 r.p.m through a gear. The tensile strength of the material of the shaft are 650 MPa. Taking factor of safety 3, design a suitable key for the gear ,assuming that the key and shaft are made from same material. [07]  
b) A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 r.p.m. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diameter clearance of the bearing is 0.15 mm and absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s, find the power wasted in friction. [06]

P.T.O.

OR

- Q.4) a) What are various types of joints. Give its classification and explain three main joints with neat diagram [05]
- b) A flat belt drive transmits power between the driver pulley having 400 mm diameter and the driven pulley having 200 mm diameter. If the belt slip reduces the velocity ratio by 20 %, find the percentage slip at each drive (assumed to be equal at both the pulleys). [05]
- c) Write short note on lubrication of bearings [03]
- Q.5) a) What is circumferential or hoop stress? Explain with neat diagram [03]
- b) What is longitudinal stress ? Explain with neat diagram [03]
- c) Find the thickness for a tube of internal diameter 100 mm subjected to an internal pressure which is  $\frac{5}{8}$  of the value of the maximum permissible circumferential stress. Also find the increase in internal diameter of such a tube when the internal pressure is  $90 \text{ N/mm}^2$ . Take  $E = 205 \text{ kN/mm}^2$  and  $\mu = 0.29$ . Neglect longitudinal strain. [07]

OR

- Q.6) a) A seamless spherical shell, 900 mm in diameter and 10 mm thick being filled with fluid under pressure until its volume increases by  $150 \times 10^3 \text{ mm}^3$ . Calculate the pressure exerted by the fluid on the shell, taking modulus of elasticity for the material of the shell as  $200 \text{ KN/mm}^2$  and Poisson's ratio as 0.3 [05]
- b) Give classification of pressure vessels and explain [05]
- c) Define pressure vessel and give its examples in process plants [03]
- Q.7) a) What is thick walled pressure vessel? Define and explain [04]
- b) Differentiate between thick walled and thin walled pressure vessels [04]
- c) What are various vessel closures used in high pressure vessels. Explain delta ring closures [04]

OR

- Q.8) a) Enlist and explain various materials of construction used for high pressure vessels [06]
- b) What are various types of constructions used for making high pressure vessels ? Enlist and explain [06]

Total No. of Questions—8]

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[5352]-589

**S.E. (Chemical) (II Sem.) EXAMINATION, 2018**  
**CHEMICAL ENGINEERING THERMODYNAMICS—I**  
**(2015 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 calculator is allowed.  
(v) Assume suitable data, if necessary.

**SECTION I**

1. (a) Nitrogen gas is confined in a cylinder and its pressure is maintained by a weight placed on the piston. The mass of piston and the weight together is 50 kg. The acceleration due to gravity is  $9.81 \text{ m/s}^2$  and the atmospheric pressure is 1.101325 bar. Assume frictionless piston, find : [8]
- (i) The force exerted by the atmosphere, the piston, and the weight on the gas if the piston is 100 mm.  
(ii) The pressure of gas.  
(iii) The work done by the gas, if the gas is allowed to expand pushing up piston and the weight by 400 mm.
- (b) Explain intensive and extensive properties. [4]

P.T.O.

*Or*

2. (a) 1 kg of liquid water initially at 273.15 K (0°C), it is first heated to 323.15 K (50°C) by contact with a heat reservoir at 323.15 K (50°C) and then to 373.15 K (100°C) by contact with a reservoir at 373.15 K (100°C). What is total entropy ? [6]
- (b) State the prove the Clausius inequality. [6]
3. (a) 1 kg of air is heated reversibly at constant pressure from initial state of 300 K and 1 bar until its volume triples. Calculate W, Q,  $\Delta U$  and  $\Delta H$  for the process. Assume that air obeys the relation  $PV/T = 83.14 \text{ bar cm}^3/\text{mol. K}$  and  $C_p = 29 \text{ J/mol.K}$ . [9]
- (b) Explain PV diagram. [3]

*Or*

4. (a) How is the standard heat of reaction evaluated using (a) the standard heat of formation and (b) the standard heat of combustion of the various components. [10]
- (b) Explain Adiabatic flame temperature. [2]

## SECTION II

5. (a) Develop equations for evaluating the change in internal energy and change in enthalpy for process involving ideal gas. [7]
- (b) Explain residual properties. [6]

*Or*

6. (a) The equation of state of a certain substance is given by the expression  $V = (RT/P) - (C/T^3)$ , and the specific heat is given by the relation  $C_p = A + BT$  where A, B and C are constants. Derive expression for changes in internal energy, enthalpy and entropy for : [10]
- (i) an isothermal process
- (ii) an isobaric process.
- (b) What are the fundamental differential equations for the energy properties ? [3]
7. (a) A refrigeration system requires 1.5 kW of power for a refrigeration rate of 4 kW. [6]
- (i) What is the coefficient of performance ?
- (ii) How much heat is rejected in the condenser ?
- (iii) If heat rejection is at 313.15 K (40°C), what is the lowest temperature the system can possibly maintain ?
- (b) Explain liquefaction of processes. [7]

*Or*

8. (a) What are the desirable properties of refrigerant ? [4]

(b) A heat pump is used to maintain the temperature inside a building at 295 K by pumping heat from the outside air at 275 K. The unit has an overall efficiency of 25%. The pump is driven electrically and the electric power is generated by the combustion of certain fuel gas. The heat of combustion of the fuel is 890.09 kJ/mol. It is estimated that only 33% of the heat of combustion of the fuel is converted into electricity. Determine the amount of fuel burned for delivering 1000 MJ of heat to the building. [9]



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[5352]-590

S.E. (Chem. Engg.) (Second Semester) EXAMINATION, 2018

MECHANICAL OPERATIONS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

*N.B.* :— (i) Solve Question Nos. 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.

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

1. (a) Explain Black Jaw crusher with neat diagram. [6]

(b) Explain different types of Thickeners with neat diagram. [7]

*Or*

2. (a) Calculate the operating speed of the ball mill from the following data : [6]

(i) Diameter of ball mill = 500 mm

(ii) Diameter of Ball = 50 mm

Operating speed of ball mill is 35% of critical speed.

P.T.O.

(b) Explain sedimentation. State the assumptions of Kynch theory of sedimentation. [7]

3. (a) Explain Magnetic separation method with neat diagram. [4]

(b) Explain different types of impellers with neat diagrams. [8]

*Or*

4. (a) Explain different types of Fluidisation. [6]

(b) Write short note on Muller mixer and Sigma mixer. [6]

5. (a) Explain Rotary Vacuum filter with neat sketch. [7]

(b) A plate and frame press, filtering a slurry, gave a total 8 m<sup>3</sup> of filtrate in 1800 seconds and 11 m<sup>3</sup> in 3600 seconds, when filtration was stopped. Estimate the washing time in seconds if 3 m<sup>3</sup> of wash water was used. The resistance of cloth can be neglected and a constant pressure is used throughout. [6]

*Or*

6. (a) Describe with neat sketch the working of plate and frame filter press. [8]

(b) State factors to be considered while selecting filtration equipment. [5]

7. (a) Explain Belt conveyor with neat diagram. Enlist its advantages and disadvantages. [6]

(b) Write advantages and disadvantages of Screw conveyor. [6]

*Or*

8. (a) Write a note on chain and flight conveyor. [4]

(b) Explain screw conveyor and pneumatic conveyor with neat diagram. [8]