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[5459]-101

S.E. (Civil) (I Semester) EXAMINATION, 2018 BUILDING TECHNOLOGY AND 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. Assume suitable data, if necessary. (iv)Explain the characteristics of bricks used in construction.[6] 1. (a)*(b)* List the advantages of using hollow concrete block masonry.[6] Or 2. (a)Write a note on "Foundation in Black Cotton Soil. [6] (b)Enlist "Various curing methods" and explain any one with sketch.[6] 3. Enlist different types of flooring. Explain any one in detail.[6] (a)(b)Draw a neat labelled figure (minimum 6 labels) of a semicircular arch and exlpain the concept of arch action. [6] OrWrite a note on "Grain storage structures." 4. (a)[6] *(b)* Explain Skylight window with a neat sketch. [6]

5. (a) List any 4 types of staircases. Explain quarter turn stairs with a neat figure. [7]

(b) Write a note on "Wall Cladding". [6]

Or

- 6. (a) Write short notes on : [6] (i) Escalators
 - (*ii*) Lifts.
 - (b) Write a note on "White Washing." [7]
- 7. (a) Explain the precautions to be taken on site by the workers to prevent accidents. [6]
 - (b) Write a note on different eco-friendly materials in construction. [7]

- 8. (a) Give the details of 'Applications of aluminum stainless steel and fiber reinforced polymers in construction'. [6]
 - (b) Explain the terms Strutting and Shoring with sketches. [7]

Total No. of Questions-8]

| Seat | |
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[5459]-102

S.E. (Civil) (First Semester) EXAMINATION, 2018

STRENGTH OF MATERIALS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :— (i) Neat diagrams must be must be drawn wherever necessary.
 - (*ii*) Figures to the right indicate full marks.
 - (*iii*) Use of electronic pocket calculator is allowed.
 - (iv) Assume suitable data, if necessary.
 - (v) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4,
 Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
- (a) Determine load 'P' and total elongation of the bar. Refer
 Figure 1.1. Assume E = 200 GPa. [6]



Fig. 1.1

(b) A beam of cross section 100 mm × 200 mm is simply supported at both ends. It carries two concentrated loads of 100 kN each acting at 2 m distance from each support. Span of the beam is 7 m. Determine the maximum bending stress induced in the beam.

Or

- 2. (a) A reinforced concrete column 500 mm × 500 mm in section is reinforced with 4 steel bars of 25 mm diameter one in each corner. The column is carrying a load of 1000 kN. Find the stresses in the concrete and steel bars. Take E for steel = 210 Gpa E for concrete = 14 GPa. [6]
 - (b) A timber beam of rectangular section is simply supported over a span of 5 m and carries a uniformly distributed load of 3 kN/m over the entire span. If the maximum shear stress is 7 MPa. If b = 2/3d, find value of b and d. [6]
- 3. (a) A solid aluminum shaft 100 mm diameter is to be replaced by a hollow steel shaft havrng 100 mm outer diameter. The two shafts have same angle of twist per unit torque over the total length if shear modulus for steel = 3 × shear modulus for aluminum. Find the inner diameter of the shaft. [6]
 - (b) Draw Mohr's circle for :
 - (1) pure shear
 - (2) pure biaxial tension
 - (3) pure uniaxial compression
 - (4) pure uniaxial tension.

[5459]-102

[6]

- 4. (a) A bar of 35 mm diameter stretches 3 mm under gradually applied load of 65 kN. If a weight of 2 kN is dropped on to a collar at the lower end of this bar through a height of 40 mm. Calculate maximum instantaneous stress and elongation of bar. Assume E = 200 GPa. [6]
 - (b) A bar of steel is 80 mm in diameter and 550 mm long. A tensile load of 100 kN is found to stretch the bar by 0.25 mm. The same bar when subjected to a torque of 1.4 kNm is found to twist through 3°. Find the values of four elastic constants.
- 5. (a) Draw SFD and BMD for a simply supported beam as shown in figure 5.1. [7]



Fig. 5.1

(b) Draw shearing force and bending moment diagram for the beam as shown in Fig. 5.2. Make maximum BMD. [6]



Fig. 5.2

6. (a) An overhang beam ABCDE is supported at A and D. DE = 1 m overhang BC = CD = 1 m, AB = 2 m. Position AB is subjected to UDL 16 kN/m. At C a point load of 20 kN is acting. At E a point load 8 kN is acting. Draw SFD and BMD. Locate point of contraflexure. Calculate maximum Bending moment. Refer figure 6.1. [7]



Fig. 6.1

(b) The diagram shown in figure, shear force diagram for a beam which rests on two supports. Draw loading and bending moment diagram.
 [6]



Fig. 6.2

(a) State four end condition of columns and draw neat sketches showing deflected shape and effective length. [6]

4

- (b) A 4 m length of a tube has a buckling load of 2 kN when used as a column hinged at both ends. Calculate buckling load for 4.5 m length of the same tube when used as column if :
 - (1) both ends are fixed
 - (2) one end fixed and other is hinged. [7]

- 8. (a) Explain core of the section and hence obtain a core section for hollow rectangular column of external and internal size $B \times D$ and $b \times d$ respectively. [7]
 - (b) A column support load of 400 kN is shown in figure. Find the stresses at the corner of the column at its base. (Refer in figure 8.1)



Fig. 8.1

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[5459]-103

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

GEOTECHNICAL ENGINEERING

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answers 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.
- (a) Define liquid limit, plasticity index and draw the plasticity chart for classification of fine grained soils. [6]
 - (b) Calculate the coefficient of permeability of a soil sample 6 cm in height and having 50 cm² cross-sectional area, if the quantity of water equal to 450 ml passed down in 10 minutes under an effective constant head of 40 cm. On oven drying, the test specimen weighs 495 g. Assuming G = 2.65, determine the seepage velocity of water during the test. [6]

- (a) What is quick sand condition ? When does it occur ? What is the critical hydraulic gradient of a sand deposit of specific gravity 2.65 and porosity 35%.
 - (b) State the methods for determination of field density. Explain the step by step procedure for any *one* of the methods with neat sketch.
- (a) How are MDD and OMC determined in standard proctor test ?
 Explain with neat sketch indicating the position of MDD and OMC and also state the significance of ZAV line. [6]
 - (b) Draw a neat sketch of laboratory shear vane. A vane 10.8 cm long, 7.2 cm in diameter, was pressed into soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 45 Nm. Find the shear strength of the clay on a horizontal plane.

- (a) What is pressure bulb ? Explain its significance and draw a neat sketch of pressure bulb for concentrated point loading.
 - (b) State and explain factors affecting shear strength for cohesive and cohesionless soils. [6]
- 5. (a) Derive the relation for determination of active earth pressure for cohesionless soil when backfill is loaded by uniform surcharge and also draw the pressure diagram. [7]
 - (b) State the assumptions in Coulomb's wedge theory and explain the theory with neat sketch. [6]

[5459]-103

- 6. (a) A smooth vertical wall retains a level backfill with $\gamma = 18$ kN/m³, $\phi = 33^{\circ}$, and c = 0 to a depth of 8 m. Draw the lateral earth pressure diagram and compute the active and passive thrust with its point of application. [7]
 - (b) Derive the relation lateral earth pressure in active state for cohesive soils along with pressure diagram and concept of H_c . [6]
- 7. (a) What are the causative factors of landslides ? Also discuss the types of landslides that can occur. [6]
 - (b) State the remediation techniques for subsurface contamination.
 Explain the bio-remediation technique for subsurface contamination
 [7]

- 8. (a) Write a short note on contaminant transport and detection of polluted zones. [6]
 - (b) Explain slope classification with neat sketches. [7] A cutting is to be made in clay for which the cohesion is 35 kN/m^2 and $\phi = 0^\circ$. The density of soil is 20 kN/m³. Find the maximum depth for a cutting of side slope 1.5 to 1 if the factor of safety is to be 1.5. Take the stability number for a 1.5 to 1 slope and $\phi = 0^\circ$ as 0.17.

Total No. of Questions-8]

| Seat | |
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[5459]-104

S.E. (Civil) (Second Semester) EXAMINATION, 2018

FLUID MECHANICS—I

(2015 **PATTERN**)

Time : 2 Hours

Maximum Marks : 50

- N.B. :- (i) Answer any four questions from Q. No. 1 or 2, 3 or 4, 5 or 6, 7 or 8.
 - (ii) Figures to the right indicate full marks.
 - (iii) Draw neat diagram wherever necessary.
 - (*iv*) Use of logarithmic table, slide rule and electronic pocket calculator is allowed.
 - (v) Assume suitable data if necessary, stating it clearly.
- (a) What is the difference between Mechanical Gauges and pressure transducers. Explain Practical applications of hydrostatic pressure. [4]
 - (b) Show by Buckingham π theorem, the resistance R to motion of spheres of diameter D, moving with uniform velocity V, through fluid of density ρ , viscosity μ , is given by : [5]

$$R = \rho \ V^2 D^2 \phi \ \frac{(\mu)}{\rho V D}$$

- 2. (a) Define surface tension and capillarity. What is the surface tension for Droplet and soap bubble. [4]
 - (b) A wooden cylinder of mass density 750 kg/m³ is required to float in a fluid of mass density 950 kg/m³. Find the ratio of diameter 'd' and length 'l' of the cylinder in order that the cylinder can just float with its longitudinal axis vertical. [5]
- 3. (a) Draw a neat sketch of venturimeter and derive the equation for discharge through venturimeter. [4]
 - (b) Determine the stream function if the velocity components of a two-dimensional incompressible fluid flow are given as : [5]

 $u = y^3 / 3 + 2x - x^2 y$ $v = xy^2 - 2y - x^3 / 3.$

- (a) What are the different methods of drawing flow net ? Explain electrical analogy method and its uses with the help of neat sketch in detail. [4]
 - (b) The horizontal venturimeter with inlet diameter 150 mm and throat diameter 75 mm is installed in a pipeline. The pipeline carries oil having relative density 0.85. The discharge through venturimeter is 0.075 m^3 /s. What is the deflection of mercury in the differential manometer ? Take the coefficient of discharge 0.97. [5]

- 5. (a) Derive the expression for maximum velocity and discharge for a laminar flow between parallel plates when both plates are fixed.
 [6]
 - (b) Determine the velocity of flow at a distance 75 mm from the axis of a pipe 200 mm in diameter, when Reynolds' number of flow is 1500. Oil of kinematic viscosity 2.4×10^{-6} m²/s and mass density 990 kg/m³ flows through the pipe. [6]
 - (c) Give a practical example of flow through porous media. Explain the importance of Darcy law for flow of groundwater. [4]

6. (a) Explain :

- 1. Laminar sublayer,
- 2. Hydrodynamically Smooth and Rough boundaries.
- (b) Why does the boundary layer separate from the body ? Explain any two methods for controlling the Boundary Layer separation.
 [6]
- (c) What are the principles of measurement of viscosity ? Explain any *one* method of measuring viscosity of fluid stating the principle of measurement.
 [6]
- 7. (a) What is major loss in flow through pipe and what causes the major loss ? Derive the equation for the major loss given by

$$h_f = \frac{f \,\mathrm{LV}^2}{2g\mathrm{D}}.$$
[8]

(b) What is scale of turbulence ? Explain Prandtl Mixing Length theory. [4]

3

[5459]-104

P.T.O.

[4]

(c) What is Equivalent sand grain roughness and its application in the study of friction factor of commercial pipe ? [4]

Or

- 8. (a) What is turbulent flow and its characteristics and explain wall turbulence and free turbulence. [4]
 - (b) Explain the concept of equivalent pipe and derive Dupit's equation for equivalent pipe. [4]
 - (c) Three pipes 350 m long, 350 mm diameter, 175 m long, 250 mm diameter and 250 m long, 300 mm diameter are connected in series in the same order. Pipe having 350 diameter is connected to reservoir. Water level in the reservoir is 20 m above the pipe axis which is horizontal. The respective friction factors for three pipes are 0.020, 0.022 and .0021.

Determine :

- (i) Flow rate
- (ii) Magnitude of loss in each pipe section and
- (*iii*) Diameter when the three pipes are replaced by a single pipe assuming f = .018 for all three pipes and to give the same discharge. Neglect minor losses. [8]

Total No. of Questions-8]

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[5459]-105

S.E. (Civil) (Sem. II) EXAMINATION, 2018 ARCHITECTURAL PLANNING AND 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, Q. No. 3 or Q. No. 4 in the answer-book.
 - (iv) Solve Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8 on Drawing Sheet only.

1. (A) What are the objectives of Development Plan ? How are these achieved ? [7]

- (B) Write short notes on : [6]
 - (*i*) Sun path
 - (*ii*) Wind diagram.

Or

2. (A) Write a short note on "TDR and its utility". [6]

- (B) Explain various Safety Aspects for Fire in detail. [7]
- **3.** (A) Distinguish between One Point and Two Point Perceptive (sketch for both considering single object is expected). [6]
 - (B) Write a note on RWH and its importance. [6]

- 4. (A) Explain the importance of marginal distances and rules for ventilation. [6]
 - (B) Write notes on artificial lighting and acoustical defects. [6]
- 5. A line plan for a residential building is shown in the following Fig. Draw detailed floor plan with 1 : 50 or suitable. [13]
 Use the following data :
 - (a) All external walls are of 230 mm thick.
 - (b) All partition walls are of 150 mm thick.
 - (c) RCC frame structure.
 - (d) Beam sizes = 0.23 m × 0.38 m.
 - (e) Column sizes = 0.23 m × 0.38 m.
 - (f) Floor to floor height = 3.2 m.
 - (g) Plinth height = 0.48 m.
 - (h) Toilet for M. Bed = 1.2×2.1 .
 - All dimensions are in meters.



[5459]-105

- 6. It is proposed to construct a bungalow for a Dean of Medical College The following are the requirements for accommodation : [13]
 - (i) A drawing hall -20 m^2
 - (*ii*) Living room -30 m^2
 - (*iii*) Kitchen cum dining room 20 m²
 - (*iv*) Guest bedroom 20 m^2
 - (v) Children's room -20 m^2
 - (vi) Master bedroom 20 m²

Provide adequate verandahs, passages, sanitary units, staircase etc. The structure may be planned as G + 1 RCC framed structure. Draw detailed "ground floor plan" and give schedule of openings and minimum three construction notes. [13]

- 7. It is proposed to construct a PWD Executive Engineer's office with the following data : [12]
 - (1) Entrance + Waiting : 15 m^2
 - (2) Administrative office : 18 m^2
 - (3) E.E. office (with attached toilet) : 18 m^2
 - (4) Technical Session : 15 m^2
 - (5) Record room : 12 m^2
 - (6) PA to Executive : 12 m^2
 - (7) Sanitary block (Ladies and Gents)—Suitable
 - (8) Passage : 1.5 m wide

Draw to a scale of 1 : 50 or suitable :

- (i) Line plan showing locations of doors, windows. (10 marks)
- (*ii*) Schedule of openings. (2 marks)

[5459]-105

- 8. It is proposed to construct a single-storeyed shopping complex with the following data : [12]
 - (1) Entrance : 60 m^2
 - (2) Big shops : 8 nos., 30 m^2 each.
 - (3) Small shops : 12 nos., 20 m^2 each.
 - (4) Telephone booths : 4 nos. of suitable size.
 - (5) Separate sanitary blocks for ladies and gents.
 - (6) Staircase for future expansion.
 - (7) All passages 2.5 m wide.
 - (8) RCC framed structure.
 - (9) Assume additional data if necessary.

Draw to a scale of 1 : 50 or suitable, line plan with north line.

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-106

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.
- 1. (A) Enlist and explain the different errors in Compass Surveying. [6]
 - (B) The following records refer to an operation involving reciprocal leveling : [6]

| Instrument | Staff reading on | | Remarks |
|------------|------------------|-------|----------------------------|
| At | Α | В | |
| А | 1.425 | 2.724 | Distance $AB = 1150.00$ m. |
| В | 1.429 | 2.504 | R.L. of Point A is 200 m |

Find the true difference in elevation between A and B. If instrument had a collimation error of 0.003/150 m, find the error due to refraction. [6]

- 2. (A) The whole circle bearing of a side AB of a equilateral anticlockwise triangle is 38° 45', then determine the Fore and Back bearings of all the sides of the triangle and tabulate your answer. [6]
 - (B) Explain the following with neat sketches : [6]
 - (1) Longitudinal Levelling
 - (2) Axis of Level Tube
 - (3) Contour Interval
- **3.** (A) Explain the following technical terms : [6]
 - (1) Face Left
 - (2) Swinging Right
 - (3) Departure
 - (B) The following observations were made on verticially held staff with a Tachometer fitted with an analytic lens. Find the level difference between P and Q.
 [6]

| Instrument | Staff | Vertical | Hair readings | Remarks |
|------------|---------|----------|------------------------|-----------------|
| Station | station | angle | (m) | |
| 0 | Р | - 5°00' | 0.850, 1.30, 1.50 | R.L. of point P |
| | Q | + 10°00' | $0.70, \ 0.95, \ 1.15$ | is 200 m |

4. (A) Explain the following technical terms : [6]

- (1) Plunging of Telescope
- (2) Optical Plumet
- (3) Multiplying constant
- (B) What is closing error ? The following are the length and bearings of the sides of a traverse ABCD. Compute the closing error and direction of closing error. [6]

| Line | Length (m) | Bearing |
|------|------------|---------------------|
| AB | 156.5 | 78° 40' |
| BC | 178.2 | 152° $32'$ |
| CD | 234.8 | 251° 18' |
| DA | 202.6 | 356° 15' |

5. (A) Define Curve. Explain various elements of curves. [7]

(B) Two straights AB and BC intersect at a chainage of 1326.78 m. The angle of Intersection is 150°. It is required to set out a simple circular curve of 400 m radius to connect the straights. Calculate all data necessary to set out the curve by the method of offsets from the chord produced with an interval of 20 M.

Or

6. (A) Classify different types of curves. Explain the method of setting out curve by Rankin's method (Two Theodolite method). [7]

[5459]-106

- (B) Two straights AB and BC intersect at a chainage of 1804.25 m. The angle of deflection is 40°. It is required to set out a simple circular curve of 300 m radius to connect the straights. Calculate all data necessary to set out the curve by the Rankin's method with a peg interval of 20 M.
- (A) Explain the significance of horizontal and vertical control in building construction. [7]
 - (B) Explain shortly the GALILEO as positioning system with any four points. [6]

- 8. (A) Describe the fieldwork in tunnel surveying with at least four points and a sketch. [7]
 - (B) Explain at least *four* salient features of GLONASS. [6]

Total No. of Questions—8]

Seat No.

[5459]-107

S.E. (Civil Engineering) (II Sem.) EXAMINATION, 2018 CONCRETE TECHNOLOGY (2015 PATTERN)

Time : 2 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 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.
 - (iv) Assume suitable data, if necessary.
 - (vii) Use of IS code 10262,456 is not allowed.

1. (a) Explain wet process of manufacturing of Portland cement.[6]

- (b) Write short notes on :
 - (i) Bleeding
 - (*ii*) Segregation.

Or

2. (a) What are the different functions of admixtures ? [6]

- (b) What are different methods to measure workability ? Explain compaction factor test in detail. [6]
- **3.** (a) Explain the factors affecting the strength of concrete. [6]
 - (b) Write a short note on :
 - (i) Underwater concreting
 - (ii) Ready mixed concrete.

[6]

[6]

- 4. (a) What is core test ? What are advantages and disadvantages of core test ? [6]
 - (b) Write a short notes on : [6]
 - (*i*) High density concrete
 - (*ii*) Self compacting concrete.
- 5. (a) What do you mean by concrete mix design ? What are the objectives in mix design ? [6]
 - (b) Write step by step procedure for concrete mix design by using IS 10262 methods. [7]

- 6. (a) Write major factors affecting mix design. Explain water-cement ratio. [4]
 - (b) What do you mean by : [4]
 - (*i*) Mean strength
 - (*ii*) Variance
 - (iii) Standard deviation
 - (iv) Coefficient of variation.
 - (c) Explain the DOE method of mix design in brief. [5]
- 7. (a) State and explain factors affecting permeability of concrete.
 What measures should be taken to reduce permeability of concrete ? [8]

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 $\mathbf{2}$

(b) Explain in detail corrosion monitoring techniques of reinforcement and its preventive measures. [5]

- 8. (a) Write a detailed note on : [8] (i) Attack by sea water
 - (ii) Chloride attack on concrete.
 - (b) Explain process of preparation of surface for repairs along with its importance. [5]

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-108

S.E. (Civil) (Second Semester) EXAMINATION, 2018 STRUCTURAL ANALYSIS—I

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- $N.B. := (i) \quad \text{Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6,} \\ Q. 7 or Q. 8.$
 - (ii) Neat sketches must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iii) Assume suitable data if necessary.
 - (iv) Use of electronic pocket calculator is allowed.
 - (v) Use of cell phone is prohibited during examination.
- (a) Using Macaulay's method, determine maximum deflection shown in figure below at 'B'. [6]



Fig. 1

(b) A cantilever beam subjected to uniformly distributed load
 10 kN/m on entire span of 3 m; determine maximum slope
 and deflection in term of EI. [6]

(a) Using Castigliano's first theorem, find vertical and horizontal deflection of 'A' as shown in figure below : [6]



(b) Analyse the continuous beam ABC as shown in figure below using three moment theorem. Also draw SFD and BMD assuming EI = constant.





3. (a) Determine the horizontal displacement of the joint C of the pin jointed frame as shown in figure below. The cross-section area of AB is 500 mm² and that of AC and BC is 750 mm². Assume E = 200 kN/mm². [6]



Fig. 4

 $\mathbf{2}$

[5459]-108

(b) Two loads 200 kN and 80 kN spaced at 0.8 m apart rolls on girder. Find maximum positive and maximum negative bending moment that can occur at section 'C' by placing the rolling load properly show in in figure below. [6]



4. (a) Draw Influence Line Diagram for the members U_1U_2 , L_1L_2 and U_1L_1 of a truss as shown in figure below. [6]



(b) Find the vertical deflection of the joint C of truss as shown in figure below. The area of the inclined tie is 2000 mm² and area of the horizontal member is 1600 mm². Take E 200 Gpa. [6]



Fig. 7

[5459]-108

5. (a) A three hinged parabolic arch having supports at different levels as shown in figure below. Determine horizontal thrust developed. Also find bending moment, normal thrust and radial shear force developed at section 15 m from left support. [7]





(b) Derive the expression for horizontal thrust when entire span of two hinged parabolic arch is loaded with udl of intensity 'w' kN/m.

Or

- 6. (a) A three hinged arch has span of 30 m and rise of 10 m. The arch carries a uniformly distributed load of 60 kN/m on the left half of its span. It also carries two concentrated loads of 160 kN and 100 kN at 5 m and 10 m from the right end. Determine the horizontal thrust at each support. [7]
 - (b) Two hinged parabolic arch of span 30 m and rise 6 m carries two point loads, each of 60 kN, acting at 7.5 m and 15 m from left end respectively.

Determine the horizontal thrust and bending moments below the point loads. [6] 7. (a) Determine the shape factor for asymmetric I-section. Where, [7] Top flange = 250 mm × 50 mm Web thickness = 50 mm Depth of Web = 200 mm Bottom flange = 400 mm × 50 mm.
(b) State the assumptions in plastic theory. [6]

Or

8. (a) Determine the plastic moment at collapse for the continuous beam ABCD loaded with ultimate load as shown in figure below with constant M_p. [7]



- Fig. 9
- (b) Explain Idealised and True stress-strain curve for mild steel in tension. [6]

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-109

S.E. (Civil Engineering) (Second Semester) EXAMINATION, 2018 ENGINEERING GEOLOGY

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :- (i) Solve/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.
- (a) Enlist important rock forming MINERAL families. Describe in detail 'FELSPAR' family. [6]
 - (b) What is 'DYNAMOTHERMAL' Metamorphism ? Describe two textural changes developed due to 'DYNAMOTHERMAL' Metamorphism. [6]

Or

- (a) Describe the process of formation of SEDIMENTARY rocks.
 [6]
 - (b) Write a note on OROGENIC and EPIROGENIC Mountains.

[6]

- (a) Describe any two features developed by 'REJUVENATION' of river.
 - (b) What are general principles of Stratigraphy ? Explain the importance of 'Faunal Succession'. [6]

- 4. (a) Why is 'Gondwana' formation important in the study of Stratigraphy ? [6]
 - (b) Which fundamental structures are studied in 'Structural Geology' ? Write engineering significance of JOINTS present in Compact Basalt.
 [6]
- 5. (a) Describe the LIMITATIONS of drilling method in Preliminary Geological Exploration. [7]
 - (b) Make a distinction between the foundation of dam on :[6](i) Anticline
 - (*ii*) Syncline.

- 6. (a) Describe favourable and unfavourable geological conditions for the STABILITY OF HILL SLOPES. Draw neat diagrams. [7]
 - (b) Explain feasibility of TUNNEL alignment across a 'FAULT PLANE'. [6]

- 7. (a) What are the requirements of good Building Stone ? Explain any three requirements. [7]
 - (b) What exploration is needed in the reservoir site of proposed DAM ? [6]

- 8. (a) What is ARTESIAN condition ? Describe geological conditions favorable for the formation of ARTESIAN wells. [7]
 - (b) Write a note on application of Remote Sensing in Engineering Geology.
 [6]

Total No. of Questions—8]

[Total No. of Printed Pages-5

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[5459]-110

S.E. (Civil) (First Semester) EXAMINATION, 2018 ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

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

- (*i*) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{4x}$
- $(ii) \quad (\mathbf{D}^2 + 4)y = \sec 2x$

(by method of variation of parameters)

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

(b) Solve the following system by Gauss elimination method : [4]

$$2x_1 + 4x_2 - 6x_3 = -4$$

$$x_1 + 5x_2 + 3x_3 = 10$$

$$x_1 + 3x_2 + 2x_3 = 5$$

2. (a) The differential equation satisfied by a beam, uniformly loaded with one end fixed and second subjected to a tensile force P is given by : [4]

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

Show that the elastic curve for the beam under conditions $y = 0, \frac{dy}{dx} = 0$ where x = 0 is given by :

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

where $EI = \frac{P}{n^2}$.

- (b) Given $\frac{dy}{dx} + \frac{y}{x} = \frac{1}{x^2}$; y(1) = 1, find y(1.1) by Euler's modified method taking h = 0.1. [4]
- (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) Calculate first three moments about the mean for the following tabulated data : [4]

| x | f |
|----|----|
| 61 | 5 |
| 64 | 18 |
| 67 | 42 |
| 70 | 27 |
| 73 | 8 |

| [5459] | -110 |
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(b) A manufacturer of cotter pins knows that 2% of his product is defective. If he sells cotter pins in boxes of 100 pins, then using Poisson distribution, find the probability that a box contains at least 4 defective pins.

(c) Find the directional derivative of
$$\phi = e^{2x} \cos yz$$
 at (0, 0, 0) in
the direction of tangent to the curve $x = a \sin \theta$,
 $y = a \cos \theta$, $z = a \theta$ at $\theta = \frac{\pi}{4}$. [4]

Or

4. (a) Prove the following identity (any one) : [4]
(i)
$$\nabla \cdot [r \nabla r^{-n}] = n(n-2)r^{-n-1}$$

(ii) $\nabla^2 (r^5 \log r) = (30 \log r + 11)r^3$

(b) If
$$\overline{F}_1 = (y+z)\overline{i} + (z+x)\overline{j} + (x+y)\overline{k}$$
 and $\overline{F}_2 = (x^2 - yz)\overline{i} + (y^2 - zx)\overline{j} + (\overline{z}^2 - xy)\overline{k}$, then show that $\overline{F}_1 \times \overline{F}_2$ is solenoidal. [4]

(c) Obtain regression lines for the following data : [4]

$$n = 5, \Sigma x_i = 30, \Sigma y_i = 40,$$

 $\Sigma x_i^2 = 220, \Sigma y_i^2 = 340, \Sigma x_i y_i = 214.$

- 5. (a) Find the work done by the force $\overline{F} = (2y+3)i + xz\hat{j} + (yz-x)\hat{k}$, when it moves from the point (0, 0, 0) to (2, 1, 1) along the curve $x = 2t^2$, y = t, $z = t^3$. [5]
 - (b) Evaluate $\iint_{S} \overline{F} \cdot \hat{n} dS$ where $\overline{F} = 4x\hat{i} 2y^{2}\hat{j} + z^{2}\hat{k}$ and S is the surface bounding the region x = 0, y = 0, z = 0 and x = a, y = a and z = a. [4]

[5459]-110
(c) Evaluate $\iint_{S} \nabla \times \overline{F} \cdot d\overline{S}$, where $\overline{F} = (x - z)i + (x^3 + yz)\hat{j} - 3xy^2\hat{k}$ and S is the surface of the cone $z = 2 - \sqrt{x^2 + y^2}$ above the xy plane. [4]

Or

6. (a) A vector field is given by : [5] $\overline{F} = (x^3 + e^{2y})i + 2x(e^{2y} + 3)\hat{j},$ Using Green's Lemma, evaluate : $\int_C \overline{F} \cdot d\overline{r}$

where C is the circle $x^2 + y^2 = a^2$.

- (b) Using Stokes' theorem, evaluate : [4] $\iint_{S} \nabla \times \overline{F}.dS, \text{ where } \overline{F} = y^{2}i + y\hat{j} - xz\hat{k}$ and S is the upper half of the sphere $x^{2} + y^{2} + z^{2} = a^{2}$ and $z \ge 0$.
- (c) Use divergence theorem to evaluate : [4] $\iint_{S} (y^2 z^2 i + z^2 x^2 \hat{j} + x^2 y^2 \hat{k}) . d\overline{S},$

where S is the upper part of the sphere $x^2 + y^2 + z^2 = 9$ above *xoy*-plane.

7. (a) A homogeneous rod of conducting material of length 200 cms has its ends kept at zero temperature and the temperature initially is :

$$u(x, 0) = x,$$
 $0 \le x \le 100$
= 200 - x, $100 \le x \le 200$

Find the temperature u(x, t) at any time t.

(b) A string is stretched and fastened to two points l apart. Motion is started by displaying the string in the form $u = 2\alpha \sin\left(\frac{\pi x}{I}\right)$ from which it is released at time t = 0. Find the displacement u(x, t) from one end. (Use wave equation $\frac{\partial^2 u}{\partial t^2} = C^2 \frac{\partial^2 u}{\partial x^2}$) [6]

Or

8. (a) Solve
$$\frac{\partial u}{\partial t} = k \frac{\partial^2 u}{\partial x^2}$$
 if :
(i) $u(0, t) = 0$
[7]

- (*ii*) u(l, t) = 0(*iii*) u(x, t) is bounded and

$$(iv) \quad u(x, 0) = \frac{u_0 x}{l}, \ 0 \le x \le l$$

(b) A rectangular plate with insulated surfaces is 10 cm wide and so long compared to its width that it may be considered infinite in length without introducing an appreciable error. If the temperature along short edge y = 0 is given by u(x, 0) =50 $\sin\left(\frac{\pi x}{10}\right)$, $0 \le x \le 10$, while the two long edges x = 0and x = 10 as well as the other short edge kept at 0°C. Find the steady state temperature u(x, y). [6] Total No. of Questions-8]

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[5459]-111

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 i.e. Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.
 - (ii) Figures to the right indicate full marks.
 - (iii) Assume suitable data, if necessary.
 - (iv) Neat diagrams must be drawn wherever necessary.
- 1. (a) Explain the following casting defects with neat sketches and state their remedies : [6]
 - (*i*) Blow holes,
 - (ii) Scabs,
 - (iii) Cold shuts.
 - (b) A cylinder of diameter 'D' and height 'H' having height to diameter ratio of three is reduced in height by 50% with the help of open die forging. A forging force of 700 kN is required at the end of the stroke to reduce the said height. If the work material flow stress is 350 MPa and coefficient of friction

is 0.28, find the true strain, shape factor and diameter 'D' of the cylinder. Also, comment on the required forging force if height to diameter ratio of the cylinder is changed to two keeping the diameter of the cylinder, coefficient of friction and work material flow stress values same as in the earlier case. [6]

Or

- (a) Explain with a neat sketch rotary swaging process. Is this process useful for forming parts of both symmetrical and unsymmetrical cross-sections ?
 - (b) A cube of side 'a' solidifies in time 't₁' seconds. If side of the cube is doubled ('2a'), then using Chvorinor's rule obtain the solidification time 't₂' of a resized cubical shape casing in terms of solidification time 't₁'. [6]
- 3. (a) State *four* applications of each of the following processes : Blow moulding, mechanical thermoforming and transfer moulding process. [6]
 - (b) With sketch compare leftward and rightward gas welding techniques. [6]

Or

- 4. (a) State any *four* welding defects with their causes and remedies. [6]
 - (b) With a neat sketch explain the sheet extrusion process. [6]
- 5. (a) With schematic sketches differentiate the compound and combination dies. [6]

(b) A cup of internal diameter 30 mm, height 45 mm is to be drawn from a 1.3 mm cold rolled steel with ultimate tensile strength of 320 MPa. The corner radius for cylindrical cup is 1.2 mm. Percentage reduction permitted in the first draw is 50% and in the second, third and fourth draw is 35%, 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 and drawing pressure for each draw. Consider value of die constant 'c' as 0.7 and value of punch and die clearance as 1.15 times thickness of sheet.

Or

- 6. (a) Explain with sketches *three* methods of reducing shear force in sheet metal works. [6]
 - (b) Find the centre of pressure and press capacity for manufacturing a mild steel component as shown in figure. The thickness of the component is 1.3 mm. Take ultimate shear stress value as 230 N/mm². The dimensions shown in figure are in mm and dimension 'a' is 60 mm. [7]



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- 7. (a) List the main steps required to cut an external taper using the taper turning attachment with a neat sketch. [6]
 - (b) The part shown below will be turned in two machining steps. In the first step a length of 100 mm (50+50) will be reduced from diameter 100 mm to diameter 80 mm and in the second step a length of 50 mm will be reduced from diameter 80 mm to diameter 60 mm. Calculate the required total machining time with the following cutting conditions, Cutting speed 'V' = 80 m/min, feed 'f' = 0.8 mm/rev and depth of cut 'd' = 2 mm/pass. [7]



Or

- 8. (a) Explain with a neat sketch external thread cutting operation to be carried on lathe. [6]
 - (b) Describe with neat sketches procedure to carry out eccentric turning operation and knurling operation on a lathe. [7]

Total No. of Questions-8]

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

EXAMINATION, 2018

THERMODYNAMICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- - (*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, Pscychrometric chart, Mollier Charts, scientific calculator is allowed.
 - (v) Assume suitable data, if necessary.
 - (vi) Figures to the right indicate full marks.
- (a) With the help of simple sketch write down the equation for the application of SFEE to the following engineering devices (any three): [6]
 - (1) Boiler
 - (2) Nozzle
 - (3) Turbine
 - (4) Pump
 - (5) Throttling device.

- (b) During a closed system under constant pressure process pressure is 105 kPa properties of the system change from volume 0.25 m³ to 0.45 m³ and temperature changes from 283 K to 513 K assuming 1 kg of mass and specific heat of 0.44 kJ/kgK. Determine : [6]
 - (1) Heat transfer
 - (2) Work transfer
 - (3) Change in internal energy.

- (a) State and explain increase of entropy principle and write down the change in entropy of universe for reversible process, irreversible process and impossible process. [6]
 - (b) In a system, executing a non-flow process, the work and heat per degree change of temperature are given by dW/dT = 200Joule/deg. C and dQ/dT = 160 Joule/deg. C. What will be the change of internal energy of the system when its temperature changes from T1 = 55 deg. C to T2 = 95 deg. C. [6]
- (a) Define and explain any six of the following terms with neat sketch showing piston and cylinder arrangement for air standard cycle : [6]
 - (*i*) Clearance volume.
 - (*ii*) Swept volume.
 - (*iii*) Total Volume
 - (*iv*) TDC
 - (v) BDC
 - (vi) Compression ratio
 - (vii) Cylinder bore.

- (b) 2 kg of steam is at 8 bar pressure and 0.8 dry.Determine :
 - (1) Total enthalpy of the steam,
 - (2) Total volume of the steam,
 - (3) Total entropy of the steam.

This steam is further heated at the same pressure till it becomes completely dry saturated. Estimate, a. total change in enthalpy (or heat added) to the steam during the process. [6]

Or

- (a) Define dryness fraction. Draw neat sketch of throttling calorimeter and derive the formula for dryness fraction measurement by throttling calorimeter. [6]
 - (b) 1 kg of air at 500 K is heated reversibly at constant pressure till 2000 K. Find the available and unavailable part of energy. Take Cp = 1.005 kJ/kgK, surrounding Temp. $(T_0) = 300$ K. [6]
- 5. (a) Draw the block diagram of boiler plant layout showing location of different accessories and distinctly show the water, air and flue gas circuit. [6]
 - (b) The boiler trial following observations are recorded mass of steam generated is 1520 kg/hr. 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 burnt per hour = 200 kg, CV of coal is 27300 kJ/kg. The unburnt 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 RT is 27 deg. C. Specific heat of the flue gases 1 kJ/kgK. Draw Boiler heat balance sheet per kg of fuel burnt and calculate the efficiency of the boiler.

- 6. (a) List down different boiler mountings for :
 - (i) Boiler Safety,
 - (*ii*) Steam Control,
 - (*iii*) Maintenance.
 - Also discuss their function in short. [6]
 - (b) Determine the Air-Fuel ratio for an oil fired steam generator for the following data recorded : [7]
 Chimney height = 40 m
 Chimney draught measured = 25 mm of water column
 Flue gases temperature coming out through chimney = 367 deg. C
 Ambient air temperature = 20 deg. C

Also calculate the velocity of flue gases through chimney neglecting flow losses.

[6]

- 7. (a) Define the following terms :
 - (i) DBT
 - (*ii*) Specific humidity
 - (iii) WBT
 - (iv) Relative humidity
 - (v) Degree of saturation
 - (vi) DPT.
 - (b) Moist air at 40 deg. C DBT and 20 deg. C WBT is sensibly cooled to 26 deg. C DBT. Plot the process on Psychrometric chart (attach the chart to answer sheet) and determine :
 - (1) Final WBT
 - (2) Total heat transferred in kW for air flow rate of 100 m^{3}/min
 - (3) Bypass factor of cooling coil if the coil surface temperature is 22 deg. C. [7]

- 8. (a) Draw neat labelled diagram for the following Psychrometric processes (any *three*) : [6]
 - (*i*) Sensible heating and write the equation for heat added.
 - (*ii*) Sensible cooling and write the equation for heat removed.
 - (*iii*) Humidification and write the equation for moisture added.
 - (*iv*) Dehumidification and write the equation for moisture removed.
 - (b) The moist air at 30 deg. C DBT and 75% RH enters the refrigeration coil at the rate of 120 m³/min. The coil DPT is 14 deg. C and Bypass factor of coil is 0.1. Plot the process on Psychrometric chart (attach the chart to answer sheet) Determine :
 - (1) Air temperature leaving the coil
 - (2) Capacity of cooling coil in kW and Tons of Refrigeration (TR). [7]



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[5459]-113

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

(2015 PATTERN)

Time : Two Hours

- N.B. :- (i) Solve Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
 - (ii) Figures to the right indicate full marks.
 - (iii) Draw the neat sketch wherever necessary.
- (a) What is atomic packing factor of unit cell ? Make its calculation for body centered cubic cell with neat sketch. [4]
 - (b) Differentiate between ceramic and polymers on the basis of the following factors : [4]
 - (i) Temperature resistance
 - (*ii*) Corrosion resistance
 - (*iii*) Thermal conductivity
 - (*iv*) Application.
 - (c) Define the following terms with its subtypes : [4]
 - (*i*) Line defects
 - (*ii*) Surface defects.

P.T.O.

Maximum Marks : 50

- (a) Differentiate between cold working and hot working as per changes in properties of material. [4]
 - (b) Discuss the mechanism of plastic ceformation on the basis of dislocation theory. [4]
 - (c) Define and explain the Lattice parameters of the unit cell. [4]
- **3.** (a) Identify the type of corrosion in the following cases (any *five*) : [5]
 - (i) Corrosion occurs at grain boundaries due to precipitation of some phase of grain boundary.
 - (ii) Stress corrosion of copper alloys like brasses in when the humidity is high.
 - (*iii*) Cornosion by the simultaneous effect of environment and cyclic fluctuation stresses.
 - (*iv*) Localized, accelerated attack in formation of cavities around which metal is relatively unaffected.
 - (v) When two dissimilar metals are in contact and exposed to an electrolyte ?
 - (vi) Stress corrosion occurs on steel, exposed to alkaline solutions at high temperatures and stresses.
 - (b) Identify and explain with neat sketch, the method of non-destructive testing for inspecting many component of same/different sizes at a time.

- (c) Draw stress-strain curve for steel. Show the following properties on it : [4]
 - (*i*) Resilience
 - (ii) Toughness
 - (iii) Proof stress
 - (iv) Necking point

4. (*a*) Identify the methods of NDT in the following cases (any *five*) : [5]



- (b) Calculate the following parameters for tensile test : [4]
 - (*i*) Ultimate tensile strength
 - (*ii*) Percentage elongation
 - (*iii*) Breaking strength
 - (*iv*) Percentage reduction

(**Given** : Specimen diameter = 11.8 mm, gauge length = 45 mm, Ultimate tensile strength = 7600 kg, breaking load = 5000 kg, final gauge length = 58.5 mm, diameter of fracture = 8.2 mm.)

- (c) Explain various methods of corrosion prevention. [4]
- **5.** (*a*) Explain 'Ion implantation method' of surface modification with neat sketch, working principle, advantages and disadvantages. [5]
 - (b) Differentiate between Physical vapor deposition and chemical vapor deposition on the basis of the following factors : [4]
 - (i) Deposition rate
 - (*ii*) Purity of the deposit
 - (iii) Surface finish
 - (*iv*) Versatility in composition of the deposit.
 - (c) Explain with neat sketch and working principle, the sequence of events that occur at a surface in a chemical vapor deposition process.
 [4]

- 6. (a) What is the significance of coating on the material properties ? Explain any two metallic and non-metallic coating methods. [5]
 - (b) Explain with neat sketch, advantages and disadvantages, IonVapor Deposition method. [4]
 - (c) State True and False for the following cases and justify your answer : [4]
 - (i) The chemical vapor deposition is more versatile than physical vapor deposition in composition of the deposit.
 - (ii) Ion implantation is commonly used in the manufacturing of semiconductor devices, tools and die materials.
- 7. (a) Define the term 'powder metallurgy' with basic steps and applications. [4]
 - (b) What do you mean by the term 'sintering' ? Explain with its steps.[4]
 - (c) Explain the role of powder metallurgy for manufacturing of 'cemented carbide' ? [4]

5

- 8. (a) Explain powder metallurgy with characteristics of metal powders, advantages and disadvantages. [4]
 - (b) What do you mean by conditioning of metal powders ? Explain with purpose and different processes. [4]
 - (c) What is a 'self lubricated bearing' ? Explain the role of powder metallurgy for manufacturing of 'self lubricated bearings' ? [4]

6

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[5459]-114

S.E. (Mechanical/Auto) (Sem. II) EXAMINATION, 2018

FLUID MECHANICS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- $N.B. := (i) \text{ Answer Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6,} \\ Q. 7 or Q. 8.$
 - (ii) Draw a neat diagram 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 the following :

[6]

- (1) Fluid as continuum.
- (2) Surface tension.
- (3) Vapour pressure.
- (b) A shaft 70.0 mm in diameter is being pushed at a speed of 400 mm/s through a bearing sleeve 70.2 mm in diameter and 250 mm long. The clearance which is assumed uniform is filled with oil of kinematic viscosity is 0.005 m²/s and specific gravity 0.9. Find the force exerted by the oil on the shaft. [6]

- 2. (a) Show that the pressure at a point in a fluid at rest is the same in all directions. [6]
 - (b) A circular plate of 4.0 m diameter is immersed in water of density 1000 kg/m³ in such a way that the plate's greatest and least depth below free surface are 6 m and 3 m respectively. Find the total pressure on the face of the plate and the position of center of pressure.
- **3.** (a) Explain the conditions of equilibrium of submerged bodies. [6]
 - (b) For the flow of an incompressible fluid the velocity component in the x-direction is $u = ax^2 + by$ and the velocity component if the z-direction is zero. Find the velocity component v in the y-direction such that v = 9 at y = 0. [6]

1.5 m (a)water

A Pitot tube is inserted in flow of water having density 1000 kg/m³ as shown in figure. Assuming the coefficient of Pitot tube as 0.98; determine the following at point 1 :

- (1) Flow velocity.
- (2) Stagnation pressure.

[4]

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4.

(b) Derive the equation :

$$\frac{dp}{\rho} + V dV + g dz = 0$$

where, p is the pressure, ρ is the density, V is the velocity of a fluid particle along a stream line, g is the acceleration due to gravity and z is difference in datum. [8]

- (a) What is coefficient of velocity coefficient of contraction and coefficient of discharge for an orifice ? [6]
 - (b) An orifice of 100 mm diameter discharges water under a constant head of 4.2 m. The diameter of jet at vena contracta is 8.2 cm. If the discharge through the orifice is 40 lps, determine the hydraulic coefficients of orifice. [7]

Or

- 6. (a) Explain the following with a neat sketch : [4]
 - (1) Hydrodynamically smooth and rough boundaries.
 - (2) Reynolds shear stress.
 - (b) For a viscous flow through circular pipe derive the expression : [9]

$$u = (\frac{-dp}{dx}) \frac{1}{4\mu} (R^2 - r^2)$$

where, u is velocity, p is the pressure, μ is the fluid viscosity, R is the outer radius of the pipe and r is the inner radius at which the velocity distribution is obtained.

7. (a) What are the factors affecting the growth of boundary layer ?
[4]

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(*b*)

The pressure drop, Δp along a straight pipe of diameter D has been experimentally studied. It is observed for laminar flow of a given fluid and pipe, Δp varies with distance between the two points 1 and 2 as shown in figure. Assume Δp as the function of D, length L, velocity V and fluid viscosity μ . Use dimensional analysis to deduce how pressure drop, Δp varies with pipe diameter D. [9]

Or

- 8. (a) Derive an expression for displacement, momentum and energy thickness with a neat sketch. [9]
 - (b) A solid sphere of 400 mm diameter is completely immersed in a flow of sea water. The velocity of flow is 1.2 m/s and specific gravity 1.025. Calculate the drag force on the sphere assuming $C_D = 0.6$. [4]

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[5459]-115

S.E. (Mech./Auto.) (Second Semester) EXAMINATION, 2018 THEORY OF MACHINES—I

(2015 PATTERN)

Time : 2 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 whenever necessary.
 - (iii) Figures to the right indicate full marks.
 - (*iv*) Use of calculator is allowed.
 - (v) Assume suitable data whenever necessary.
- 1. (a) Sketch and explain inversions of slider crank mechanism. [5]
 - (b) Derive equation for correct steering in a steering gear mechanism. [5]

Or

- 2. (a) Identify Friction circle in a Journal bearing with the help of a neat sketch. [5]
 - (b) A vertical engine running at 1200 rpm. With a stroke of 110 mm has a connecting rod 250 mm between centres and mass

of 1.25 kg. The mass centre connecting rod is 75 mm from big end centre and when suspended as a pendulum from the gudgeon pin axis makes 21 oscillations in 20 seconds. Calculate the radius of gyration of the connecting rod about an axis through its mass centre. [5]

- (a) Describe with neat sketch the construction and working of
 Epicyclic train type dynamometer. [4]
 - (b) A single plate clutch, effective on both sides, is required to transmit 25 kW at 3000 rpm. Determine the outer and inner radii of friction surface if the coefficient of friction is 0.25, the ratio of radii is 1.25 and the maximum pressure is not to exceed 0.1 N/mm². Also determine the axial thrust to be provided by springs. Assume the theory of uniform wear. [6]

Or

- 4. (a) Two shafts are connected by a Hook's joint. The driving shaft rotates uniformly at 500 rpm. If the total permissible variation of speed of the driven shaft not to exceed 6% of the mean speed, find the greatest possible angle between the center line of shafts. Also determine maximum and minimum speed of the driven shaft. [6]
 - (b) Write a loop closure equation for slider crank mechanism. [4]
- (a) Locate all the instantaneous centers of the mechanism as shown in fig. 1. The length of links are AB = 150 mm, BC = 300 mm, CD = 225 mm and CE = 500 mm. when the crank AB

rotates in the anticlockwise direction at a uniform speed of 240 rpm : [10]

Find :

- (i) Velocity of slider E
- (ii) Angular velocity of link BC and CE.





(b) Explain Space and Body Centrode. [5]

Or

- 6. (a) The crank of slider crank mechanism shown in Fig. 2 rotates clockwise at a constant speed of 300 rpm. The crank is 150 mm and connecting rod is 600 mm long. [10] Determine :
 - (*i*) Linear velocity and acceleration of the midpoint of the connecting rod.

 (*ii*) Angular velocity and angular acceleration of the connecting rod at a crank angle of 45° form IDC. Solve using relative velocity and acceleration method.



Fig. 2

- (b) Discuss Kennedy's theorem for locating ICR. [5]
- 7. The driving crank AB of the quick return mechanism as shown in Fig. 3, rotates at a uniform speed of 200 rpm. Find the velocity and acceleration of the point Q in the position shown, when the crank makes an angle of 60° with the vertical line AP. What is the acceleration of sliding of the block at B along the slotted lever PQ ?



Fig. 3

- 8. (a) The crank of a reciprocating engine is rotating in clockwise direction with a constant angular velocity of 60 rad/s, the lengths of crank and connecting rod are 100 mm and 350 mm respectively. Using Klien's construction, find : [12]
 - 1. Velocity and acceleration of piston
 - 2. Angular velocity and angular acceleration of connecting rod.
 - 3. Velocity and acceleration of midpoint of connecting rod, when the crank has turned through 30° from inner dead center.
 - (b) Discuss all four cases to determine direction of Coriolis component of acceleration when a block is sliding on rotating link. [3]

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-116

SE (Mechanical/Automobile) (II Semester) EXAMINATION, 2018 ENGINEERING METALLURGY

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Solve Question No. 1 or 2, Question No. 3 or 4, Question No. 5 or 6, Question No. 7 or 8.
 - (*ii*) Figures to the right indicate full marks.
 - (iii) Draw neat, well 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 : [4]
 - (1) Retained Austanite is a useful phase
 - (2) Martensite is a soft phase.
 - (c) Differentiate between Tool Steel and Plain Carbon Steel on the basis of composition, properties, uses, cost and examples. [5]

Or

(a) Is etching essential every time ? Explain with suitable example.
 [4]

- (b) What is Austenite to Pearlite transformation ? Explain with suitable figure. [4]
- (c) Explain how Microscopic and Macroscopic examinations are useful in investigating 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 Hardenability and explain the test with suitable figure. [4]
 - (c) What is Spark Test? Where is it applicable? [4]

- **4.** (a) Draw Iron Carbon diagram showing all details, like Temperature, Composition, Phases, Critical lines and reactions. [5]
 - (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. [5]
- (c) Write a short note on Quench Cracks in Hardening process. [4]

| 6. | <i>(a)</i> | What is the importance of TTT diagrams in Heat Treatmen |
|----|--------------|---|
| | | processes ? [4 |
| | (<i>b</i>) | Differentiate between Gray C.I. and Nodular C.I. [4 |
| | (c) | What is Sub Zero Treatment and why is it necessary ? [5 |
| | | |
| 7. | (<i>a</i>) | What is HAZ ? Explain with suitable figure. [5 |
| | (<i>b</i>) | State merits and demerits of Non-Ferrous metals over Ferrou |
| | | metals. |
| | (c) | Why are Aluminium and Copper metals known as corrosio |
| | | resistant ? [4 |
| | | resistant ? |

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]

| Seat | |
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| No. | |

[5459]-117

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

EXAMINATION, 2018

APPLIED THERMODYNAMICS

(2015 **PATTERN**)

Time : Two Hours

- *N.B.* :- (*i*) Solve four questions, Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.
 - (*ii*) Answer for the four questions should be written in same answer book attach supplement if required.
 - (*iii*) Neat and labeled diagrams should be drawn wherever necessary.
 - (*iv*) Use of pocket calculator and different gas charts as applicable is allowed.
 - (v) Assume suitable data, if necessary.
 - (vi) Figures to the right indicate full marks.
- (a) In a tabular format list down the name of various components, materials used and method used for manufacturing for IC Engines.
 - (b) Explain with neat sketch working of simple carburetor. [6]

P.T.O.

Maximum Marks : 50

- (a) With a neat and labeled sketch explain actual combustion curve for SI Engines on Pressure Vs. Crank angle diagram. [6]
 - (b) List down and explain in short different losses in real cycles vis-a-vis ideal reversible cycles. [6]
- 3. (a) Draw a neat and labeled diagram for Common Rail Diesel Injection system (CRDI) fuel supply system. [6]
 - (b) Explain Morse test for measuring Friction Power for multi-Cylinder IC Engines in detail. [6]

Or

- 4. (a) Explain the concept of knocking in CI Engines. [6]
 - (b) The following data was recorded from a test on a single cylinder four-stroke oil engine : [6]

Cylinder bore = 0.15 m, Engine stroke = 0.25 m, Indicated mean effective pressure = 7.355 bar, Engine speed = 400 rpm, Brake torque = 225 N-m, Fuel consumption = 3 kg/hr, CV = 44200 kJ/kg, Cooling water flow rate = 4 kg/min, Cooling water temperature rise = 42 deg. C., Cp water = 4.187 kJ/kg K. Calculate :

- (*i*) Mechanical Efficiency
- (*ii*) Brake thermal efficiency
- (*iii*) Specific fuel consumption.

- 5. (a) Explain the need of lubrication of Engine in Automobiles. List down the different Engine components lubricated in the Automobiles. [6]
 - (b) Draw neat, labeled and self-explanatory sketch of magneto ignition system.

- 6. (a) Discuss with neat sketch working of Exhaust gas re-circulation system for control of Nox. [6]
 - (b) What are the pollution norms adopted in Bharat Stage 6 and give the numbers in tabular format for acceptable emissions limits.
- 7. (a) Draw P-v diagram for ideal compressor with zero clearance volume and compressor with clearance volume and label all the processes and volumes. Write down the formula for volumetric efficiency for with and without clearance volume compressor. [6]
 - (b) A single stage single acting reciprocating compressor sucks air at 1 bar and 30 deg. C and delivers 0.6 kg of air per minute at 6 bar. The clearance volume is 3% of stroke volume. Taking the index for compression and expansion as 1.3, calculate :
 - (*i*) The volumetric efficiency of the compressor,
 - (ii) Indicated power
 - (iii) Power required if the mechanical efficiency is 85%. [7]

[5459]-117

- 8. (a) Explain with neat sketch working of Vane type rotary compressors. [6]
 - (b) A single stage reciprocating compressor takes 1 m^3 of air per minute at 1.013 bar at 15 deg. C and delivers it at 7 bar according to law PV^{1.35} = Constant, and the clearance is negligible. Calculate : [7]
 - (i) Mass of the air delivered per minute
 - (*ii*) Delivery temperature
 - (*iii*) Indicated Power.
 - Take Individual gas constant R = 287 J/kg K.

Total No. of Questions-8]

| Seat | |
|------|--|
| No. | |

[5459]-118

S.E. (Mechanical Sandwich/Auto) (I Sem.) EXAMINATION, 2018 STRENGTH OF MATERIALS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :- (i) Answer maximum four questions out of 8.
 - (*ii*) Solve Q. 1 or 2, Q. 3 or 4, Q. 5 or 6, Q. 7 or 8.
 - (*iii*) All the four questions should be solved in one answer book; attach extra supplements if required.
 - (iv) Draw diagrams wherever necessary.
 - (v) Use of scientific calculator is allowed.
 - (vi) Assume suitable data wherever necessary.
- (a) A domestic ceiling fan of mass 50 kg is attached to one end of hollow steel pipe (vertical) while other end is fixed in slab (celling) of a house. The length of the pipe is 200 mm and outside diameter is 20 mm. Determine the inside diameter of the pipe if the engineering strain is limited to 0.0001. Elastic modulus of steel is 200 GPa.

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





2. (a) A uniform weight W is to be attached to two rods whose lower ends are on the same level using a horizontal bar as shown in Fig below. Determine the ratio of the areas of the rods so that the bar attached to rods will remain horizontal.
[6]


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



3. (a) Determine the minimum height h of the beam as shown in figure below, if the flexural stress is not to exceed 20 MPa.



(b) A flat steel bar, 25.4 mm wide by 6.35 mm thick and 1 m long is bent by couples applied at the ends so that the midpoint deflection is 25.4 mm. Compute the stress in the bar and magnitude of the couples. Take E = 200 GPa.

4. (a) In a laboratory test of a beam loaded by end couples, the fibers at layer AB in Fig. shown below are found to increase 60 × 10⁻³ mm whereas those at CD decrease 100 × 10⁻³ mm in the 200-mm-gauge length. Using E = 70 GPa, determine the flexural stress in the top and bottom fibers. [6]



- (b) A cantilever beam of 1 m length is carrying UDL of 10 N/m over entire length. If the maximum deflection is limited to 1.2.5 mm, find the required flexural modulus EI of the beam.
 Also find the slope of beam. [6]
- 5. (a) Determine the maximum torque that can be applied to a hollow circular steel shaft of 100-mm outside diameter and an 80-mm inside diameter without exceeding a shearing stress of 60 MPa or a twist of 0.5 deg/m. Use G = 83 GPa. [6]

4

(b) A steel bar of rectangular cross-section 70 mm \times 110 mm and pinned at each end is subject to axial compression. If the proportional limit of the material is 185 MPa and E = 210 GPa, determine the minimum length for which Euler's equation may be used to determine the buckling load. [7]

Or

- 6. (a) A solid circular shaft is required to transmit 100 kW while turning at 26 rev/s. The allowable shearing stress is 100 MPa. Find the required shaft diameter. [6]
 - (b) A rectangular steel bar 70 mm × 90 mm in cross-section, pinned at each end and subjected to axial compression. The bar is 2.6 m long and E = 210 GPa. Determine the buckling load using Euler's formula and corresponding stress. [7]
- 7. Stressed element in a machine component is subjected to 150 MPa tensile stress in x direction, 50 MPa compressive stress in y direction and 100 MPa shear stress clockwise on x face. Compute the values and orientation of the principal stresses and maximum shear stress using graphical method proposed by Mohr. Mohr's circle must be drawn on GRAPH paper using appropriate scale.

(*Note*-Analytical solution and solution without GRAPH paper will not be evaluated.) [13]

8. Compute factors of safety, based upon the distortion energy theory, for stress elements at A and B of the member shown in the figure below. The bar is made of steel with yield strength of 280 MPa and is loaded by the forces F = 0.55 kN, P = 4.0 kN, and T = 25 N-m. [13]



Or

Total No. of Questions—8]

| Seat | |
|------|--|
| No. | |

[5459]-119

S.E. (Mech./Prod./Auto) EXAMINATION, 2018

(Common to Mech. & Mech. S/W)

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) Use of electronic pocket calculator is allowed.
 - (iv) Assume suitable data, if necessary.
- 1. (a) Solve any two of the following differential equations : [8]

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

(ii)
$$x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 3y = \sin\left(\sqrt{3} \log x\right) + x^3$$

(iii)
$$\frac{d^2y}{dx^2} + 4y = \tan 2x$$
, by using the method of variation of

parameters.

(b) Solve the integral equation : [4]

$$\int_{0}^{\infty} f(x) \sin \lambda x \ dx = 4e^{-6\lambda}, \lambda > 0.$$

- A 4 lb weight is suspended at one end of the spring suspended 2. (a)from ceiling. The weight is raised to $\left(\frac{5}{12}\right)$ feet above the equilibrium position and left free. Assuming the spring constant is 8 lb/ft, find the equation of motion, displacement function, amplitude and period. [4]
 - Solve any one of the following : *(b)* [4]
 - (i) Evaluate the integral $\int_{0}^{\infty} e^{-4t} t \cos t dt$, by using concept of

- Laplace transform. (*ii*) Obtain $L^{-1}\left[\frac{s+1}{(2s-1)(s+2)}\right]$.
- Solve the following differential equation by using the Laplace (c)transform method : [4]

$$\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = te^{-2t}$$

where $y(0) = 0$, $y'(0) = 2$.

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

| x | f |
|---|----|
| 0 | 1 |
| 1 | 8 |
| 2 | 28 |
| 3 | 56 |
| 4 | 70 |
| 5 | 56 |
| 6 | 28 |
| 7 | 8 |
| 8 | 1 |
| | |

[5459]-119

- (b) 200 students appeared in a certain examination obtained average marks 50% with standard deviation 5%. How many students do you expect to obtain more than 60% of marks, supposing that the marks are distributed normally. [4]
 (Given : At z = 2, A = 0.4772)
- (c) Find the directional derivative of $\phi = x^2 y^2 2z^2$ at the point P(2, -1, 3) in the directional PQ, where the point Q is Q(5, 6, 4). [4]

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

| x | У |
|----|----|
| 5 | 10 |
| 1 | 11 |
| 10 | 5 |
| 3 | 10 |
| 9 | 6 |

(b) Prove the following (any one) :

- (*i*) $\nabla \cdot \left(r \nabla \frac{1}{r^5} \right) = \frac{15}{r^6}$ (*ii*) $\nabla^2 \left[\frac{1}{r} \log r \right] = \frac{-1}{r^3}$
- (c) Show that the vector field :

$$\overline{\mathbf{F}} = (8xy + z^4)\overline{i} + (4x^2 - z)\overline{j} + (4xz^3 - y)\overline{k}$$

is irrotational. Also find the scalar ϕ such that $\overline{F} = \nabla \phi$.

[5459]-119

P.T.O.

[4]

[4]

Or

5. (a) Evaluate
$$\int_{C} \vec{F} \cdot d\vec{r}$$
 where $\vec{F} = e^{y}i + x(1 + e^{y})j$ and 'C' is the curve
of $\frac{x^{2}}{a^{2}} + \frac{y^{2}}{b^{2}} = 1, z = 0$. [5]

- (b) Evaluate $\iint_{S} [(z^2 x) dy dz xy dx dz + 3z dx dy]$ where S is closed surface of region bounded by x = 0, x = 3, z = 0, $z = 4 - y^2$ by using Gauss divergence theorem. [4]
- (c) By using Stokes' theorem evaluate $\iint_{S} \nabla \times \overline{F} \cdot \hat{n} \, dS$ where S is the curved surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane z = 2 where $\stackrel{\rightarrow}{F} = 3(x - y) i + 2xzj + xyk$. [4]

6. (a) Using Green's theorem evaluate $\int_{C} [\cos x \sin y - 4y) dx + \sin x \cos y dy]$ where C is the circle $x^2 + y^2 = 1$. [5]

(b) Using Gauss divergence theorem evaluate $\iint_{S} (lx + my + nz)dS$ where l, m, n are direction cosines of the outer normal to the surface $x^{2} + y^{2} + z^{2} = 4.$ [4]

(c) By using Stokes' theorem prove that : [4]

$$\int_{C} (\vec{a} \times \vec{r}) \cdot d\vec{r} = 2\vec{a} \cdot \iint_{S} d\vec{S}$$

- 7. (a) Solve the equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, under conditions : [7]
 - $(i) \qquad u(0, t) = 0$
 - $(ii) \quad u(\pi, t) = 0$
 - (*iii*) $\frac{\partial u}{\partial t} = 0$ when t = 0
 - (*iv*) $u(x, 0) = 2x, 0 < x < \pi$.

[5459]-119

(b) Solve
$$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$$
, under the condition : [6]
(i) $u(0, t) = 0$
(ii) $u(l, t) = 0$
(iii) $u(x, 0) = 100 \frac{x}{l}$ $0 < x < l$.

8. (a) Solve the equation : [6]

$$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0 \quad \text{which satisfies the conditions :}$$

$$u(0, y) = u(\pi, y) = 0 \quad \text{for all } y$$

$$u(x, 0) = k \qquad 0 < x < \pi, \quad \lim_{y \to \infty} u(x, y) = 0 \qquad 0 < x < \pi$$
(b) Use Fourier transform to solve the equation : [7]

$$\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}, \quad 0 < x < \infty, \quad t > 0 \quad \text{subject to conditions}$$
(i)
$$u(0, t) = 0, \quad t > 0$$
(ii)
$$u(x, 0) = \begin{cases} 2 \quad 0 < x < 1 \\ 0 \quad x > 1 \end{cases}$$

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

[5459]-119

Total No. of Questions—8]

| Seat | |
|------|--|
| No. | |

[5459]-120

S.E. (Mechanical, Mech. Sandwich & Automobile) (Second Semester) EXAMINATION, 2018 ELECTRICAL AND ELECTRONICS ENGINEERING (2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.
- 1. (a) Derive the general expression of torque in a three-phase induction motor. Hence obtain the condition for maximum torque. [6]
 - (b) A 250 V, 4 pole lap wound DC shunt motor takes no-load current of 4 A when running at 1200 r.p.m. The resistance of armature winding is 0.1 Ω and shunt field winding is 125 Ω. The brush drop is 2 V. If it takes current of 61 A on full-load, calculate its full-load speed. Assume that flux gets weakened by 5% on full-load condition due to armature reaction.

Or

(a) Draw the schematic arrangement of Three Point Starter in a DC shunt motor and explain its working by mentioning the role of each component in it. [6]

- (b) A 6-pole, 50 Hz, 3-phase induction motor running at full load with 4% slip develops a torque of 149.3 N-m at the shaft. The friction and windage losses are 200 W and the stator copper and iron losses amounts to 1620 W. Calculate (i) output power (ii) rotor copper loss and (iii) efficiency at full load.
- **3.** (a) Write any six important features of ATmega 328P microcontroller. [6]
 - (b) Elaborate the construction and operation of AC and DC Servo motor with the help of necessary diagrams. [6]

- (a) Describe the constructional details and operation of capacitor start capacitor run induction motor with the help of diagrams. [6]
 - (b) Draw bit pattern of status register of ATmega 328P and explain the significance of all bits. [6]
- 5. (a) Explain how many timers are present in ATmega 328P. In which mode these timers work ? [6]
 - (b) Explain the interfacing of LED with Arduino board and write an algorithm to blink an LED. [6]

Or

- **6.** (a) Write algorithm to interface keypad and Arduino. [6]
 - (b) Draw interfacing circuit diagram of Arduino board and LCD.Also write basic algorithm used for this interfacing. [6]

[5459]-120

- (a) List any six features of in-built ADC in ATmega 328P microcontroller. [6]
 - (b) Write algorithm and draw the diagram to interface LVDT with Arduino. [7]

- 8. (a) Explain serial communication with reference to Arduino. [6]
 - (b) Explain the format of ADCSRB and DIDRO registers mentioning the function of each bit. [7]

| Seat | |
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| No. | |

[5459]-121

S.E. (Mechanical Sandwich) (I Sem.) EXAMINATION, 2018 MATERIALS SCIENCE AND METALLURGY

(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.

| 1. | (<i>a</i>) | Define Atomic Packing factor. Find atomic packing factor for BCC structure. | or [4] |
|----|--------------|--|-----------|
| | (<i>b</i>) | Explain Dye Penetrate test with its applications. | [4] |
| | (c) | Define Hardness, Creep and Fatigue and true stress. [| [4] |
| | | Or | |
| 2. | (<i>a</i>) | What is deformation of single crystal by slip ? Derive expression of it. | on [4] |
| | (<i>b</i>) | List Points Defects and write effect of point defects. [| [4] |
| | (c) | Differentiate between engineering stress-strain curve, true stres strain curve. | s- [4] |
| 3. | (a) | Draw Isothermal TTT Diagram for eutectoid steel. [| [4] |
| | (<i>b</i>) | List types of cast iron with its applications. | [4] |
| | (<i>c</i>) | Define allotropy and list Critical temperature in Iron Carbo Diagram. | on [5] |
| | | P.T. | 0. |

- List any *four* applications of steel with carbon percentage. [4] 4. (a)
 - *(b)* What is need of surface hardening? Explain flame hardening. [4]
 - Explain effect of alloying elements on mechanical properties (c)of steel. [5]

5. Define sintering process and explain liquid phase sintering. [4] (a)

- *(b)* Explain season cracking of brasses. [4]
- Explain self-lubricating bearing, its composition and steps involved (c)in manufacturing. [4]

Or Co

- Describe steps involved in powder metallurgy. 6. (a)[4]
 - *(b)* Write composition and applications of Cartridge brass, Muntz Metal. [4]

List application of Powder Metallurgy. (c)[4]

- 7. Describe Addition and condensation polymerization with (a)[4] example.
 - *(b)* List application of ceramics with related mechanical property. [4]
 - (c)What is composite material and comment on need of composite? [5]

Or

- 8. (a)List mechanical properties of polymers with application. [4] (*b*) Explain Particle reinforced composites with example. [4]
 - Compare ceramic material with Metal with examples. (c)[5]

[5459]-121

| Seat | |
|------|--|
| No. | |

[5459]-122

S.E. (Mechanical Sandwich) (I Sem.) EXAMINATION, 2018 FLUID MECHANICS AND MACHINERY

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- - (ii) Neat diagrams must be drawn wherever necessary.
 - (*iii*) Use of logarithmic tables, slide rule and electronic pocket calculator is allowed.
 - (iv) Figures to the right indicate full marks.
 - (v) Assume suitable data, if necessary.
- 1. (a) A fluid of kinematic viscosity 2.6 stokes flows over a flat plate of surface area 1 m². At any distance 'y' meters from the plate, the velocity is given by $u = 5y - 2y^3$ m/s. If the shear force on the plate is 0.932N, determine the specific weight and sp.gr. [6]
 - (b) Given that $u = 2xy^2$ and $v = 2x^2y$. Examine whether these velocity components represent rotational or irrotational flow and then find the expression for velocity potential. [6]

- (a) Define Metacentre, Metacentric height and Buoyancy. Explain stability of submerged bodies. [6]
 - (b) A vertical pipe conveying oil of relative density 0.8, two pressure gauges has been installed at A and B where diameters are 160 mm and 80 mm respectively. Point A is 2 m above point B. The pressure guage readings have been shown that the pressure at B is greater that at A by 0.981 N/cm². Neglecting losses, find flow rate.
- **3.** (a) Explain the concept of pipes are connected in series, parallel and equivalent pipe. [5]
 - (b) A Pelton turbine running at 720 rpm uses 300 kg of water per sec. If the head available is 425 m. Velocity coefficient of nozzle is 0.97. The wheel bucket speed is 0.46 times of the jet speed and deflects the water through 165 degree, the relative velocity at outlet is 90% that of inlet. Determine hydraulic efficiency and overall efficiency. Also find the diameter of the runner and jet. [8]

- 4. (a) Show that the maximum efficiency for jet strikes the single curved vane is $8(1 + \cos \theta)/27$. [5]
 - (b) Two horizontal fixed parallel plates are 20 mm apart. Liquid of specific gravity 0.66 flows between plates. The velocity at 5 mm from the lower plate is 1.2 m/sec. Find mean velocity and viscosity of liquid by assuming laminar flow and head loss of 1.6 m per meter length.

5. (a) An inward flow reaction recorded the following data : Net head 68 m, Speed 750 rpm, Power output 330 W, Hydraulic efficiency 94%, Overall efficiency 85%, Flow ratio 0.15, Ratio of breadth to diameter is 0.1 at inlet, Inner diameter of the runner is 0.5 of outer diameter of the runner, 7% of circumferential area of the runner is occupied by the thickness of the vanes. Assume velocity of flow remains constant and flow is radial

Assume velocity of flow remains constant and flow is radial at exit determine discharge, outer diameter, inner diameter width at inlet and outlet, guide blade and vane blade angles. [10]

(b) Define draft tube and explain its function. [3]

Or

- 6. (a) Define runaway speed of turbine. Differentiate Francis turbine and Kaplan turbine. [5]
 - (b) The performance of an oil ring consuming a discharge Q of an oil depends on the internal diameter 'd' of the ring, the rotational speed N of the shaft, the density ρ , the viscosity μ , surface tension λ and specific weight of the oil w, show that :

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

Using dimensionless analysis.

[5459]-122

P.T.O.

[8]

7. Power input to centrifugal pump is 50 kW at the shaft while running at 1440 rpm. The impeller tip diameter is 30 cm and the blade width at the tip is 1.5 cm. The water flow rate is 110 lt/s. The vacuum gauge reading at the suction flange is 20 cm of mercury and at the delivery pressure gauge readings 370 kpa. The blade outlet angle is 65°. Calculate ideal head, manometric efficiency, mechanical efficiency, overall efficiency, specific speed, draw velocity, triangle, assume radial entry. [12]

Or

- 8. (a) Derive the expression for pressure rise across the impeller of a centrifugal pump. [8]
 - (b) Define suction head, static head, delivery head and manometric head. [4]

Total No. of Questions-8]

| Seat | |
|------|--|
| No. | |

[5459]-123

S.E. (Mechanical Sandwich) (II Semester) EXAMINATION, 2018 THERMAL ENGINEERING

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- N.B. := (i) Neat diagrams must be drawn wherever necessary.
 - (ii) Figures to the right side indicate full marks.
 - (*iii*) Use of calculator is allowed.
 - (iv) Assume suitable data, if necessary.
- (a) Derive an expression for volumetric efficiency of single-stage reciprocating air compressor. [6]
 - (b) A Refrigerator plant operates on reserved Brayton cycle and is required for a capacity of 10 TR. The cooler pressure is 4.2 bars and the refrigerator pressure is 1.4 bars. The air is cooled in the cooler to a temperature of 50°C and the temperature of air at inlet to compressor is -20°C. Calculate :
 - (i) COP
 - (*ii*) Net power per tone of refrigeration [6]

- (a) A single-stage reciprocating compressor takes 1 m³ of air per minute at 1.013 bar and 15°C and delivers at 7 bar. Assuming that law of compression is PV^{1.35} = C and clearance is negligible. Calculate : [6]
 - (i) Delivery temperature and
 - (*ii*) Indicated power.
 - (b) Define TOR and state the properties of good refrigerant [6]
- 3. (a) A gas turbine works between the fixed adiabatic temperatures limits 300 K and 900 K. The absolute pressure limits being 1 bar and 4 bar. The isentropic efficiency of compressor and turbine are 0.8 and 0.85 respectively. Determine : [6]
 - (i) Actual thermal efficiency
 - (ii) Actual network
 - (iii) Actual compressor work and
 - (iv) Actual tubrine work.
 - (b) Explain with neat sketch types of turbo charging. [6]

- 4. (a) Explain the following terms : [6]
 - (*i*) Thrust
 - (*ii*) Thrust power
 - (*iii*) Overall efficiency.
 - (b) Derive an expression for power required for supercharger. [6]

[5459]-123

 $\mathbf{2}$

- 5. (a) The brake specific fuel consumption of a petrol engine is 0.252 kg/KW-h with calorific value of fuel as 42500 kJ/kg. The mechanical efficiency is 85% and compression ratio is 7. Calculate : [6]
 - (*i*) Brake thermal efficiency
 - (ii) Indicated thermal efficiency
 - (*iii*) Air standard efficiency.
 - (b) Write a short note on Dry sump Lubrication system in IC engine. [3]
 - (c) Write a short note on Emission Norm". [4]

- 6. (a) Define the following terms : [6] (i) BSFC
 - (*ii*) Brake thermal efficiency
 - (*iii*) Volumetric efficiency.
 - (b) Write a short note on Engine liquid cooling system in IC engine. [3]
 - (c) Discuss various emissions on S.I. engines. [4]
- (a) Compare Diesel engine and Petrol engine emissions and describe with neat sketch catalytic converter system. [7]
 - (b) Explain stages of combustion in CI engine. [6]

Or

- 8. (a) What are various methods of treatments of exhaust gas ? Explain any one in brief. [6]
 - (b) Explain stages of combustion in SI engine. [7]

[5459]-123

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| No. | |

[5459]-124

S.E. (Mech. Sandwich) (Second Semester) EXAMINATION, 2018 METROLOGY AND QUALITY CONTROL

(2015 **PATTERN**)

Time : 2 Hours

Maximum Marks : 50

- **N.B.** :- (i) Neat diagrams must be drawn wherever necessary.
 - (ii) 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).
 - (iii) Assume suitable data, if necessary.
 - (iv) Use of calculator is allowed.
 - (v) Figures to the right indicate full marks.
- 1. (a) Write a note on working and applications of a Typical Micrometer. [6]
 - (b) Solve (any one): [6]
 - (i) Define the terms : Tolerance, Allowance and Deviation.
 - (*ii*) Find the shaft and hole dimensions with tolerance for a 90H8e9 pair given the following data with standard notations, 90 mm lies in diameter step of 80 to 100 mm. Upper deviation for *e* shaft is — $11D^{0.41}$, Tolerance unit, $i = 0.45 \sqrt[3]{D} + 0.001 \text{ D}$. Also, find the type of fit produced IT8=25*i* and IT9=40*i*.

- (a) Define 'Surface Texture'. Explain Root Mean Square (RMS) method of analyzing the surface trace of components. [6]
 - (b) Classify Comparators and write a note on LVDT comparator. [6]
- **3.** (a) Write a note on various types of screw thread errors. [6]
 - (b) State seven basic quality tools and explain any *one* from them in detail. [6]

- 4. (a) List and explain various categories of Cost of Quality with examples. [6]
 - (b) Explain with a sketch working of Profile Projector. State its applications. [6]
- 5. (a) What is TPM ? Explain eight pillars of TPM. [7]
 - (b) Write a note on any one : [6]
 - (i) Poka Yoke,
 - (*ii*) FMECA.

Or

6. (a) Write a note on QMS (ISO 9000,TS 16949). [8]
(b) Explain Quality Function Deployment. [5]

[5459]-124

 $\mathbf{2}$

- 7. (a) What are different types of Control charts? Mentioning their usage. Also, explain concept of 'Process Capability'. [7]
 - (b) Table below shows the number of defectives found in inspectionof 10 lots of 100 magnets each : [6]

| Lot No. | No. of defectives |
|---------|-------------------|
| 1 | 3 |
| 2 | 2 |
| 3 | 5 |
| 4 | 2 |
| 5 | 1 |
| 6 | 4 |
| 7 | 4 |
| 8 | 13 |
| 9 | 4 |
| 10 | 3 |

- (*i*) Determine the control limits for P chart and state whether the process is in control.
- (ii) If the point that goes outside the control limits is analyzed and eliminated, what will be the value of new control limit ?

- 8. (a) Write a note on Production Part Approval Process. [6]
 - (b) Attempt any one :
 - (*i*) Explain comparison of Single, Double and Multiple Sampling plan
 - (ii) Calculate sample size and AOQ for Single Sampling Plan using the following data : Probability of acceptance of 0.4%, defectives in a lot = 0.558, Lot size : 10000, acceptance number = 1, np' for sample = 1.5. Defectives found in the sample are not to be replaced. If defectives found in sample are to be replaced, then what will be AOQ ? [7]

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[5459]-125

S.E. (Mech. SW) (Second Semester) EXAMINATION, 2018 MANUFACTURING ENGINEERING

(2015 PATTERN)

Time : 2 Hours

Maximum Marks : 50

- N.B. := (i) Solve Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.
 - (ii) Figures to the right indicate full marks.
 - (iii) Neat diagrams must be drawn wherever necessary.
 - (iv) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
 - (v) Assume suitable data, if necessary.
- (a) Sketch and explain the construction and operation of hot chamber die casting machine. [6]
 - (b) Discuss the procedure for sand casting. Give the advantagesof permanent mould casting over sand casting. [6]

Or

2. (a) What do you understand by 'hot forming' and 'cold forming'? Discuss their relative merits and demerits. [6]

- (b) Suggest a suitable process for the following products/operations.Give proper justification : [6]
 - (*i*) Bolt Head
 - (ii) CI pipe of 1 m diameter
 - (iii) Machine tool bed
 - (*iv*) Connecting rod
 - (v) Reducing a steel sheet of 1.25 mm thick to 0.5 mm thick in passes
 - (vi) To cut sprue and risers of heavy ferrous castings.
- **3.** (a) Explain arc welding process in detail. Also discuss thermit welding. [6]
 - (b) Explain the Projection Welding process in brief. How 'Heat Balance' to be obtained in resistance welding ? Explain. [6]

- (a) State the desirable properties of cutting tool material. State commonly used tool materials. Discuss the factors affecting tool life.
 - (b) Answer the following : [6]
 - (i) Write the process to produce T-slots with proper sketch
 - (ii) What is 'Grade' and 'structure' refers to grind wheel
 - (iii) To produce 51 teeth on a gear blank, suggest a suitable machine tool, cutting tool and mechanism.

- Explain the Standard Marking System of a grinding 5. (a)wheels. [6]
 - What is indexing and explain compound indexing method? [7] (*b*)

- 6. Differentiate between : (a)
 - Up milling and Down milling operations. (i)
 - Gang drilling and Multi-spindle drilling Operations. (ii)
 - *(b)* Explain the types of drilling machines as well as the types of drills. [7]
- Explain the need of advanced manufacturing techniques for the 7. (a)fabrication of Microcomponents. Classify them based on energy [6] source used.
 - Explain the process of Abrasive Jet machining along with merits, *(b)* demerits and applications. [7]

Or

- 8. Discuss the principles of USM. State the various advantages, (a)disadvantages and applications of Ultrasonic machining. [6]
 - Differentiate between EDM and ECM process along with *(b)* sketches. [7]

[6]

Total No. of Questions-8]

Time : Two Hours

| Seat | |
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| No. | |

[5459]-126

Maximum Marks : 50

S.E. (Mech. Sand.) (II Sem.) EXAMINATION, 2018 THEORY OF MACHINES (2015 PATTERN)

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 wherever necessary.
- (a) Write only a classification of kinematic pairs giving example of each of them. [4]
 - (b) Draw a kinematic diagram of figure.1 (a-b). Also identifies the links and compute degree of freedom. [6]



Figure.1 (a) Shear Press

(b) Can Crusher

- 2. (a) A small flywheel of mass 85 kg is suspended in a vertical plane as a compound pendulum. The distance of centre of gravity from the knife edge support is 100 mm and the flywheel makes 100 oscillations in 145 seconds. Find the moment of inertia of the flywheel through the centre of gravity. [4]
 - (b) The connecting rod of a diesel engine weighs 556 N, the distance between the bearing centers is 90 cm and the diameter of the crank pin bearing 13 cm and that of the wrist pin bearing is 7.0 cm. When suspended vertically on a knife-edge through the crank pin bearing, it performs 61 oscillations in 100 s and with knife-edge through the wrist pin bearing, it makes 55 oscillations in the same time interval. Determine the moment of inertia about the axis through the centre of gravity (Note that the position of C.G. is unknown). [6]
- (a) A multi-disc clutch has three discs on the driving shaft the outside radius of the contact surfaces is 120 mm and inside radius 60 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 rpm. [4]
 - (b) Two shafts are connected by a Hooke's joint. The driving shaft revolves uniformly at 500 r.p.m. If the total permissible variation in speed of the driven shaft is not to exceed ±6% of the mean speed, find the greatest permissible angle between the centre lines of the shafts.

For an IC engine mechanism the crank radius is 90 mm and connecting rod length is 450 mm. The crank is rotating in anticlockwise direction with the angular velocity of 15 rad/s and angular acceleration of 100 rad/s². Find the acceleration of the piston and angular acceleration of the connecting rod, when the crank is at 60° from the inner

dead centre. Use complex algebra method.

Or

5. (a) The dimensions and configuration of the four bar mechanism, shown in Fig. 2, are as follows : [12]



Figure.2 Four Bar mechanism

 $P_1A = 300 \text{ mm}; P_2B = 360 \text{ mm}; AB = 360 \text{ mm}, \text{ and}$ $P_1P_2 = 600 \text{ mm}.$

The angle $AP_1P_2 = 60^{\circ}$. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s², both

4.

P.T.O.

[10]

clockwise. Determine the angular velocities and angular accelerations of P_2B , and AB and the velocity and acceleration of the joint B. Use relative velocity and acceleration method.

(b) Explain with the help of a neat sketch, the space centrode and body centrode. [3]

Or

6. Fig. 3 shows a Whitworth quick return motion mechanism. The various dimensions in the mechanism are as follows : [15]



Figure.3 Whitworth quick return motion mechanism

OQ = 100 mm; OA = 200 mm; QC = 150 mm; and CD = 500 mm. The crank OA makes an angle of 60° with the vertical and rotates at 120 r.p.m. in the clockwise direction. Locate all the instantaneous centres and find the velocity of ram D.

- 7. The kinematic diagram of one of the cylinders of a rotary engine is shown in Fig. 4. The crank OA which is vertical and fixed, is 50 mm long. The length of the connecting rod AB is 125 mm. The line of the stroke OB is inclined at 50° to the vertical. The cylinders are rotating at a uniform speed of 300 r.p.m., in a clockwise direction, about the fixed centre O. Draw velocity and acceleration polygon also determine :
 - (i) acceleration of the piston inside the cylinder, and
 - (*ii*) angular acceleration of the connecting rod. [15]



Figure.4 Cylinder of a rotary engine

- 8. (a) In an L.C. mechanism, the stroke length is 40 cm and the obliquity ratio is 4. The angular acceleration of the connecting rod is found to be 54 rad/s², when the crank makes an angle of 45° with the IDC, while rotating at a uniform speed. Determine :
 - (i) The crank speed of RPM
 - (*ii*) The acceleration of the piston
 - (*iii*) The velocity of acceleration of the mid-point of the connecting rod. Use Klien's construction method. [12]
 - (b) What is Coriolis acceleration ? [3]

Total No. of Questions—8]

| Seat | |
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S.E. (E&TC/Electronics) (I Sem.) EXAMINATION, 2018 SIGNALS AND SYSTEMS

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Attempt four questions as Q. No. 1 or Q. No. 2,
 Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6,
 Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (*iv*) Use of calculator is allowed.
 - (v) Assume suitable data, if necessary.
- 1. (a) Perform the following operations on the given signal x(t) which is defined as : [4]

$$x(t) = u(t + 4)$$

- (1) Sketch z(t) = x(-t 1)
- (2) Sketch y(t) = x(t) + z(t).
- (b) Write the expression for energy and power of the signal. Also determine whether the following signals is Energy or Power, and find energy or time averaged power of the signal : [4]

 $x(t) = 5\cos(10\pi t) + \sin(20\pi t); \quad -\infty \leq t \leq \infty.$

(c)Determine whether the following system is Static/Dynamic, Causal/Non-causal and Stable/Unstable and justify : [5] $h(t) = e^{-10t}u(t).$

Or

2. (a)Compute the convolution integral by graphical method and sketch [5]the output for the following signals :

$$\begin{aligned} x(t) &= u(t) \\ h(t) &= e^{-2t}u(t). \end{aligned}$$

(b) Check whether the following signal is even or odd and determine the even and odd part of the signal : [4]

$$x(t) = u(t).$$

- (c)Compute the convolution integral for the following signal : [4] $x(t) = u(t), \quad h(t) = \delta(t + 1) + \delta(t) + \delta(t - 1).$
- Find the trigonometric Fourier series for the periodic signal 3. (a)x(t) shown in the following figure : [6]



State any six properties of Fourier transform. *(b)* [6] $\mathbf{2}$ [5459]-131
4. (a) Find the Fourier transform of the following signals : [6]

- (1) $x(t) = \operatorname{sng}(t)$
- (2) $x(t) = \cos(\omega_0 t) u(t)$.
- (b) Write expression for Trigonometric Fourier series and Exponential Fourier series. [4]
- (c) Define amplitude and phase spectra of the signal. [2]
- 5. (a) Find the inverse Laplace transform of [6]

$$\mathbf{X}(s) = \frac{2}{\left(s+4\right)\left(s-1\right)}$$

If the Region of convergence is :

- (1) $-4 \leq \text{Re}(s) < 1$
- (2) $\operatorname{Re}(s) > 1$
- (3) $\operatorname{Re}(s) < -4.$
- (b) A signal x(t) has Laplace transform : [6]

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

Find the Laplace transform of the following signals :

(1)
$$y_1(t) = tx(t)$$

(2)
$$y_2(t) = e^{-t} x(t)$$
.

Or

6. (a) Find the Laplace transform of the following signal and sketch ROC : [6]

$$x(t) = e^{-3t}u(t) + e^{-5t}u(t).$$

3

[5459]-131

(b) Find the initial and final value of the following signal : [4]

$$X(s) = \frac{2s+3}{s^2+5s-7}$$

(c) State the relationship between Fourier transform and Laplace transform. [2]

7. (a) Find the following for the given signal
$$x(t)$$
: [6]

- (*i*) Autocorrelation
- (ii) Energy from Autocorrelation

$$x(t) = e^{-10t}u(t).$$

(b) Define Probability and state the properties of PDF. Also state the relationship between CDF and PDF. [7]

Or

8. (a) Suppose a certain random variable has CDF : [7] $F_x(x) = 0, \quad x \le 0$ $F_x(x) = kx^2, \quad 0 < x \le 10$ $F_x(x) = 100k, \quad x > 10$

Calculate K. Find the values of $P(X \le 5)$ and $P(5 < X \le 7)$.

(b) A coin is tossed three times. Write the sample space which gives all possible outcomes. A random variable X, which represents the number of heads obtained on any tripple toss. Also find the probabilities of X and plot the C.D.F. [6]

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S.E. (Electronics/E&TC) (I Sem.) EXAMINATION, 2018 ELECTRONIC DEVICES AND 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 logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
 - (iv) Assume suitable data, if necessary.
- (a) Draw and explain the V-I characteristics of N-channel JFET. [6]
 - (b) Explain the following non-ideal characteristics of MOSFET : [6]
 - (1) Finite output resistance
 - (2) Body effect
 - (3) Breakdown effects.

- 2. (a) For the circuit diagram shown in Fig. 1. Calculate I_D , V_{DS} , R_S . Assume : [6]
 - $I_{DSS} = 8 \text{ mA}$ $V_P = -4 \text{ V}$ $V_{GS} = -2 \text{ V}.$



Fig. 1

- (b) Write a short note on constant source Biasing circuit using MOSFET. [6]
- **3.** (a) Write a short note on MOSFET scaling. [6]
 - (b) Explain the MOSFET as switch In VLSI. [6]

4. (a) For the circuit diagram shown in Fig. 2, calculate AV, Ri, Ro. The MOSFET parameters are $V_T = 1.5$ V, $K_n = 0.8$ mA/V², $\lambda = 0.01$ V⁻¹. [6]

 $\mathbf{2}$





(b) Explain the MOSFET as current sink and source circuit in VLSI. [6]

5. (a) Draw and explain four basic types of Amplifier. [8]

- (b) An Amplifier has a midband gain of 100 and a bandwidth of 200 kHz : [5]
 - (*i*) If 5% negative feedback is introduced, find the new bandwidth and gain.
 - (*ii*) If the bandwidth is to be restricted to 1 MHz, find the feedback ratio. [5]

Or

- 6. (a) Draw and explain Hartley oscillator using FET. [7]
 - (b) In a Colpitt's oscillator using FET $C_1 = 100$ PF, $C_2 = 10,000$ PF. If the frequency of oscillator is vary between 950 kHz and 2000 kHz. Determine the range of inductor values. [6]

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- 7. (a) Explain the working of Buck type switching regulator with a neat diagram and necessary waveform. State its advantages. [8]
 - (b) Determine the range over which the output voltage can be varied in LM317 voltage regulator if values of $R_1 = 240 \Omega$ and R_2 is taken as 5 k Ω potentiometer. Assume $I_{adj} = 100$ µA. Draw the typical connection diagram. [5]

- 8. (a) Draw and explain block diagram of adjustable positive threeterminal voltage regulator. [8]
 - (b) Design an adjustable voltage regulator using LM317 for output voltage 1.25 V to 15 V and draw necessary connection diagram. (Assume $R_1 = 240 \Omega$, $I_{adjustable} = 100 \mu$ A). [5]

| Seat | |
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[5459]-133

S.E. (E&TC)/(Electronics) (First Semester) EXAMINATION, 2018 ELECTRONIC DEVICES AND CIRCUITS (2012 PATTERN)

Time : 2 Hours

Maximum Marks : 50

- $N.B. := (i) \quad \text{Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6,} \\ Q. 7 or Q. 8.$
 - (ii) Neat diagram must be drawn wherever required.
 - (*iii*) Figures to the right indicate full marks.
 - (iv) Use of scientific calculator is allowed.
 - (v) Assume suitable data, if necessary.
- 1. (a) What is thermal runaway ? Explain, how can thermal runaway be prevented. [6]
 - (b) Determine I_B , I_C and V_{CE} for the circuit shown in Fig.(1) : [6]



Fig. (1)

- (a) Differentiate among C.E, C.B. and C.C. BJT amplifier configurations. [6]
 - (b) For the circuit as shown in Fig. (2), determine voltage gain, input impedance and output impedance. Assume $h_{re} =$ $h_{oe} = 0$, $R_{B1} = 10 \text{ k}\Omega$, $R_{B2} = 2 \text{ k}\Omega$, $R_C = 1 \text{ k}\Omega$ and $R_E = 0.2 \text{ k}\Omega$, $V_{CC} = 15V$, $h_{fe} = 100$ and $h_{ie} = 1.1 \text{ k}\Omega : [6]$



Fig. 2

(a) Draw and explain frequency response of RC-Coupled CE amplifier. [6]

 $\mathbf{2}$

(b) Draw and explain Hartley oscillator. [6]

- (a) Compare the effect of negative feedback on input impedance, output impedance and bandwidth with voltage series and current series feedback. [6]
 - (b) Draw filter equivalent circuit to explain high frequency and low frequency response of RC-coupled CE amplifier. [6]
- 5. (a) For a transformer coupled class-A amplifier O/P voltage of 2.2 V (p - p) is obtained for an input of 100 mV (p - p)with a Load of 15 Ω . The transistor is biased with V_{CC} = 10V to allow 10 mA d.c. current. Then, determine Pin dc, Pout ac and efficiency. [7]
 - (b) Differentiate among Class-A, Class-B and Class-C amplifier based on any *two* points of differentiation. [6]

- 6. (a) Draw single power supply class-AB complimentary symmetry amplifier. Explain the use of diodes in the circuit. Also explain crossover distortion. [7]
 - (b) Explain harmonic distortions and total harmonic distortion and their importance in an amplifier. [6]
- 7. (a) Draw drain and transfer characteristics of E-MOSFET. Explain why E-MOSFET is called as enhancement type MOSFET. [5]
 - (b) What are the various non-ideal characteristics exhibited by E-MOSFETs ? Explain any two of them in detail.
 [8]

- (a) Explain the advantages of Bi-CMOS/Bi-MOS technology. Draw suitable diagram to explain Bi-CMOS/Bi-MOS. [7]
 - (b) For the given circuit, determine dc operating parameters. Given : V_{Th} = 1.5V, K = 0.8 mA/V². [6]



Total No. of Questions-8]

| Seat | |
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[5459]-134

S.E. (Electronics and Telecom. and Electronics) (I Sem.) 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, 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 calculator is allowed.
 - (v) Assume suitable data, if necessary.
- 1. (a) State and explain Norton's Theorem. [6]
 - (b) Explain construction and working of Isolation transformer. State its applications. [7]

Or

- (a) A single-phase transformer delivers 10 Amp, 220 V to a resistive load while the primary draws 6 Amp at 0.9 lagging p.f. from 450 V, 50 Hz supply. The turns ratio of transformer is 2. Calculate efficiency and regulation under this condition. [6]
 - (b) State and explain superposition theorem.

P.T.O.

[7]

- **3.** (a) Sketch and explain D.C. shunt motor characteristics. [6]
 - (b) Sketch and explain working of rotor resistance starter used for three-phase induction motor. [6]

- 4. (a) The rotor, of a 6 pole, 440 V, 50 Hz three-phase induction motor, has a power input of 60 kW. The frequency of rotor emf is 1.5 Hz. Calculate : [6]
 - (i) Rotor Cu loss
 - (ii) Gross mech. power developed
 - (*iii*) The rotor resistance per phase if the rotor current/ph is 58 Amp.
 - (b) A d.c. shunt motor operating on 220 V supply draws current of 22 Amp and runs at 800 rpm. Its armature resistance is 1 ohm and field resistance is 110 Ω . Calculate the additional resistance to be inserted in series with armature to reduce the speed to 520 rpm keeping load on motor constant. [6]
- 5. (a) Compare Brushless DC motor with conventional DC motor. [6]
 - (b) Explain with neat diagram working of Universal Motor. [6] Or
- 6. (a) Explain construction and working of Reluctance motor. [6]
 - (b) State applications of :

[6]

- (*i*) Universal motor
- (*ii*) Reluctance motor and
- (*iii*) Brushless DC motor.

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 $\mathbf{2}$

- 7. (a) Explain with a neat diagram working of DC servomotor. [7]
 - (b) Explain with neat diagram operation of single-phase shaded pole induction motor. [6]

[6]

Or

- 8. (a) What is stepper motor ? State different types of it. State applications of stepper motor. [7]
 - (b) State applications of :
 - (*i*) DC Servomotor
 - (*ii*) AC Servomotor
 - (iii) Shaded pole induction motor.

| Seat | |
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[5459]-135

S.E. (E & TC/Electronics) (I Sem.) EXAMINATION, 2018 NETWORK THEORY

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.
 - (*ii*) Figures to the right indicate full marks.
 - (iii) Assume suitable data, if necessary.
- 1. (a) Find current through branch AB using Thevenin's theorem. [6]



- (b) Explain the following terms with example : [6]
 - (i) Oriented graph
 - (ii) Tieset matrix
 - (*iii*) F-cutset matrix.

2. (a) State and explain maximum power transfer theorem. [6]

[6]

(b) The reduced incidence matrix is :

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

- (*i*) Obtain complete incidence matrix.
- (*ii*) No. of trees possible.
- 3. (a) Derive the expression for the voltage $V_c(t)$ across capacitor for the series RC circuit shown. [6]



- (b) Define the term quality factor. Prove for a series RLC resonant circuit $f_0 = \sqrt{f_1 f_2}$. [6]
- 4. (a) For the circuit shown below, find the current i(t) for all time t > 0. [6]



[5459]-135

- (b) A series resonant circuit has a bandwidth of 100 Hz and contains a 20 mH inductance and a 20 µf capacitance. Determine : [6] (i) f_0
 - (ii) Q₀ and
 - (iii) Impedance Z at resonance.
- 5. (a) What is symmetrical network ? Explain *two* characteristics of symmetrical network. [6]
 - (b) Design a constant K T type low pass filter with the following specifications : [7] Design resistance $R_0 = 560 \Omega$ and Cut-off frequency $f_c = 2$ KHz.
- 6. (a) Design symmetrical T attenuator with attenuation of 20 dB and design resistance of 600 Ω . [6]
 - (b) A symmetrical T network is composed of pure resistance has the following values of open and short circuit impedance : $Zoc = 800 \ \Omega$ Zsc = 600 Ω Determine characteristic impedance z_0 , z_1 and z_2 for the T network. [7]
- (a) Find z-parameters for the two port network shown below. State whether the network is symmetrical/asymmetrical. [7]



[5459]-135

- (b) Find the condition of symmetry and reciprocity of Y parameters. [6]
- 8. (a) Find h-parameters for the n/w shown in fig. [6]



(b) Explain the applications of Laplace Transforms to circuit analysis. [7]

| Seat | |
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| No. | |

[5459]-136

S.E. (Electronics/E & TC) (I Semester) EXAMINATION, 2018 DATA STRUCTURES AND ALGORITHMS

(2015 PATTERN)

Time : Two Hours

- N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right side indicate full marks.
 - (iv) Use of calculator is allowed.
 - (v) Assume suitable data, if necessary.
- 1. (a) Sort the following data using merge sort and selection sort : [6]

27, 10, 12, 25, 34, 16, 15, 31

(b) Write a C function with and without pointers to arrays for checking whether the given string is palindrome *or* not. [6]

Or

- **2.** (a) Explain the following :
 - (*i*) Call by value
 - (*ii*) Call by reference.

P.T.O.

[6]

Maximum Marks : 50

- (b) Write the following functions in 'C' : [6]
 - (*i*) STRCOPY() to copy a string to another string using array.

(ii) STRLENGTH() to find length of string using array.Note : Do not use standard library functions.

- 3. (a) Define Queue and explain any one application of queue. [6]
 (b) Identify the expressions and convert them into remaining two forms : [7]
 - (i) a*b/c*d-e/f
 - (ii) (a+b)/(c+d)

Or

- 4. (a) Differentiate singly linked list and doubly linked list. [6]
 - (b) Write a 'C' function to delete a number from singly linked list. [7]
- 5. (a) Define binary tree. Name and explain with suitable example the following terms : [6]
 - (i) Root node
 - (ii) Left sub tree and right sub tree
 - (*iii*) Depth of tree.
 - (b) Construct the binary search tree (BST) from the following elements : [6]

10, 60, 40, 28, 14, 50, 5

Or

6. (a) Construct the binary search tree from the following elements : [6]

5, 2, 8, 4, 1, 9, 7

Also show preorder, inorder and postorder traversal for the same.

[5459]-136

 $\mathbf{2}$

- (b) Define the following terms with example with respect to Binary Tree : [6]
 - (i) Strictly Binary Tree
 - (ii) Completely Binary Tree
 - (iii) Binary Search Tree
- 7. (a) Explain with suitable example the techniques to represent a Graph.

Note : Consider graph of minimum 6 vertices. [6]

(b) What do you mean by adjacency matrix and adjacency list ?
 Give the adjacency matrix and adjacency list as shown in figure (1).



Fig. 1

- 8. (a) Find out the minimum spanning tree of the following graph figure 2 using : [6]
 - (*i*) Prim's Algorithm
 - (ii) Kruskal's Algorithm.





(b) Find the shortest path from node 1 to all nodes in the graph shown in figure 3 using Dijkstra's algorithm. [7]



Fig. 3

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-137

S.E. (Elec. and Telcom. Engg/EC) (I Semester) EXAMINATION, 2018 DIGITAL ELECTRONICS

(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 and Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (*iii*) Use of logarithmic tables, electronic pocket calculator tables is allowed.
 - (iv) Assume suitable data, if necessary.
- 1. (a) By using K-map calculate the minimized expression for the following function and implement it using basic gates : [6] $F(ABCD) = \Sigma m(0, 2, 4, 8, 11, 15) + d(3, 10, 12, 13)$
 - (b) Explain universal shift registers with a diagram. [6]

Or

- (a) With truth table, K-map and logic diagram explain how SR
 F/F is converted to D F/F. [6]
 - (b) Implement the following expression using two 8 : 1 MUX. [6] $F(ABCD) = \Sigma m(2, 4, 6, 7, 9, 10, 11, 12, 15)$

- 3. (a) Design sequence detector for given sequence of110...... with suitable F/F using Moore circuit. [6]
 - (b) Explain with neat diagram, working of CMOS inverter. [3]

[3]

[3]

(c) Draw Tri-state TTL inverter.

Or

- 4. (a) Define the following terms : [6]
 - (i) Fan in
 - (*ii*) Fan out
 - (iii) Propagation delay
 - (iv) Power dissipation
 - (v) Figure of merit
 - (vi) Noise margin.
 - (b) Explain the following terms :
 - (*i*) State table
 - (*ii*) State assignment.
 - (c) Prepare state table for the following state diagram and eliminate redundancy if any : [3]



- **5.** (a) Explain PLA with the help of a neat diagram. [7]
 - (b) Compare PROM, PLA, PAL. [6]

- 6. (a) Design the following function using PLA : [7] $F_1(ABC) = \Sigma m(1, 2, 3)$ $F_2(A, B, C) = \Sigma m(5, 6, 7)$ (b) Sketch the circuit of one cell of dynamic RAM and explain
 - (b) Sketch the circuit of one cell of dynamic RAM and explain its working. [6]
- 7. (a) Sketch and explain the architecture of 8051 in detail. [6]
 (b) Explain ACALL instruction with an example. [4]
 - (c) Write assembly language program to perform 8-bit divisor. [3]

Or

- 8. (a) Explain the use of accumulator. [6]
 - (b) Explain the function of the following pins of 8051 : [4]
 (i) ALE
 - (ii) INTO
 - (c) Sketch the PSW register of 8051. [3]

[5459]-137

3

Total No. of Questions-8]

Seat No.

[5459]-138

S.E. (ELECTRONICS/E&TC) (II Sem.) EXAMINATION, 2018 INTEGRATED CIRCUITS

(2015 **PATTERN**)

| Time | : Т | wo Hours Maximum Marks : 50 |
|--------------|--------------|--|
| <i>N.B</i> . | | (i) Neat diagrams must be drawn wherever necessary. |
| | | (ii) Your answers will be valued as a whole. |
| | | (iii) Assume suitable data, if necessary. |
| | | |
| 1. | (<i>a</i>) | Draw block diagram of op-amp and explain in detail. [6] |
| | (<i>b</i>) | Draw neat circuit diagram of : |
| | | (i) Non-inverting amplifier [2] |
| | | (<i>ii</i>) Inverting summing amplifier. [4] |
| | | Or |
| 2. | (<i>a</i>) | Write notes on : [6] |
| | | (i) Level shifter |
| | | (<i>ii</i>) Current mirror circuits. |
| | (<i>b</i>) | Draw neat circuit diagram of : [6] |
| | | (i) Voltage follower |
| | | (<i>ii</i>) Single op-amp difference amplifier. |
| | | |
| 3. | (<i>a</i>) | Draw circuit diagram of inverting symmetrial Schmitt trigger |
| | | and plot hysteresis and explain in short. [6] |
| | (<i>b</i>) | Draw V to I converter with grounded load and explain with |

its output equation.

[6]

- 4. (a) Draw circuit diagram of precision full wave rectifier with showing input and output waveform. [6]
 - (b) Draw V to I converter with floating load and explain with its output equation. [6]
- 5. (a) Define the term Free running frequency, Lock range and Capture range in PLL. [6]
 - (b) Explain the operation of Wein bridge oscillator with neat circuit diagram. [7]

Or

6. (a) Explain PLL with its block diagram. [6]

- (b) Draw circuit diagram of phase shift oscillator and explain its operation. [7]
- 7. (a) Design wide band pass filter having $F_L = 1$ kHz and $F_h = 6$ kHz with pass band gain is 2. Draw circuit diagram with its component values. [7]
 - (b) Draw circuit diagram of first order LPF with its frequency response. [6]

Or

- 8. (a) Design a first order band reject filter for $F_h = 2$ kHz and $F_L = 6$ kHz with pass band gain is 3. Draw circuit diagram with its component values. [7]
 - (b) Draw circuit diagram of first order HPF with its frequency response. [6]

 $\mathbf{2}$

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-139

S.E. (Electronics/E&TC Engineering) (II Sem.) EXAMINATION, 2018 CONTROL SYSTEMS

(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.
- 1. (A) Determine the overall transfer function Y(s)/R(s) for the signal flow graph shown in Fig. 1. [6]



Fig. 1

(B) For the system with open loop transfer function :

$$G(s) = \frac{k_2}{s(s+k_1)}, H(s) = 1$$

with unity feedback, determine the values of k_1 and k_2 if the damping factor is 0.6 and peak time is 1 second. Also determine peak overshoot, natural frequency, rise time and settling time. [6]

Or

2. (A) Determine the overall transfer function Y(s)/R(s) for the block diagram shown in Fig. 2 using block diagram reduction rules.



- Fig. 2
- (B) Determine static error constant (k_p, k_v, k_a) and steady error for step input if the unity feedback system has open loop transfer function :

G(s) =
$$\frac{k}{s(s+2)(s+4)+10}$$
, $k = 20$.

Also find k if steady state error for step input is 0.8. [6] [5459]-139 2 **3.** (A) Investigate the stability of system with characteristic equation :

 $\mathbf{Q}(s) = s^4 + 9s^3 + 7s^2 + 4s + 3 = 0$ using Routh stability test. Also determine the number of poles

in the right half of *s*-plane.

(B) Draw Bode plot of the system with open loop transfer function :

$$\mathbf{G}(s) = \frac{20(s+5)}{s(s+10)}$$

and determine gain margin, phase margin. Also comment on stability. [8]

Or

4. (A) Determine resonant peak (M_r) and resonant frequency (W_r) for the unity feedback system with open loop transfer function : [4]

$$\mathbf{G}(s) = \frac{9}{s(s+4)}.$$

(B) Sketch the root locus of the system with : [8]

$$G(s) = \frac{k}{s(s+3)(s+5)}, H(s) = 1.$$

5. (A) Obtain controllable canonical and observable canonical state model of the system with transfer function : [6]

$$G(s) = \frac{s^2 + 7s + 9}{s^3 + 6s^2 + 4s + 3}.$$

[5459]-139

[4]

(B) For the system with state model :

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

investigate the state controllability and state observability.

[7]

Or

6. (A) Determine the transfer function of system with state model : [6]

$$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -4 & -7 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$
$$y = \begin{bmatrix} 1 & 2 & 1 \end{bmatrix} x$$

(B) Determine state transition matrix of the system with a state equation : [7]

$$\dot{x} = \begin{bmatrix} 0 & 1 \\ & & \\ 0 & -4 \end{bmatrix} x$$

Also determine solution of state equation if :

$$x(0) = \begin{bmatrix} 1 \\ 1 \end{bmatrix}.$$

[5459]-139

7. (A) Determine the pulse transfer function of system shown in Fig. 3 using first principle (starred Laplace and z-transform method). [7]





- (B) Obtain the ladder diagrams for the following Boolean expressions without minimizing them : [6]
 - (*i*) $Y = A\overline{B}\overline{C} + \overline{A}BC$
 - (*ii*) $Y = AB + \overline{A}\overline{B}\overline{C} + A\overline{B}D.$

Or

8. (A) Obtain the pulse transfer function of the system shown in Fig. 4 and determine its step response. [7]



Fig. 4

(B) Write controller equations, transfer functions and draw block diagrams of PI and PD controllers. [6]

| Seat | |
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| No. | |

[5459]-140

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

ANALOG COMMUNICATION

(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) 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.
- (a) Explain phase shift method of SSB generation. State its advantages and disadvantages. [6]
 - (b) Explain the need of modulation and the advantages of modulation. [4]
 - (c) Draw the spectrum for AMFC and AMSC. [2]

- **2.** (a) Explain Armstrong method of FM generation. [6]
 - (b) Draw the envelope detector and explain the distortions in the same. [6]
- **3.** (a) Define the following with neat characteristics : [6]
 - (*i*) Selectivity
 - (*ii*) Fidelity
 - (*iii*) Sensitivity.
 - (b) A receiver connected to antenna whose resistance is 50Ω has an equivalent noise resistance of 30Ω . Calculate receiver's noise figure in decibels and its equivalent noise temperature. Assume T = 290 K. [6]

Or

- 4. (a) Explain with waveform and block diagram AM superheterodyne receiver. [6]
 - (b) Derive Friss formula for noise factor of cascaded amplifier. [6]
- **5.** (a) Explain performance of FM in presense of noise. [7]
 - (b) Draw the circuit diagram of pre-emphasis and de-emphasis with characteristic in FM. [6]

Or

- 6. (a) Derive expression for signal to noise ratio in DSBSC system. [6]
 - (b) Explain the performance of FM in presence of noise. [7]

[5459]-140

 $\mathbf{2}$

- 7. (a) With the help of a block diagram explain transmitter and receiver of PCM. [6]
 - (b) State and explain different types of sampling and draw the spectrum of sampled output for sampling frequency less than, equal to and greater than maximum frequency of analog signal (for any one type of sampling).

- 8. (a) State and prove sampling theorem. [6]
 - (b) Draw and explain generation and regeneration of PWM and PPM. [7]

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-141

S.E. (Electronics/C & TC) (Second Semester) EXAMINATION, 2018 OBJECT ORIENTED PROGRAMMING

(2015 **PATTERN**)

Time : Two Hours

C++ ?

Maximum Marks : 50

- N.B. :- (i) Answer Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of Calculator is allowed.
 - (v) Assume suitable data, if necessary.
- (a) Differentiate between Procedure oriented programming and Object oriented programming. [6]
 - (b) What is the use of constructor ? State *four* types of constructor.Write a program in C++ for any *one* type. [6]

Or

- (a) Define inheritance. Explain different types of inheritance. [3]
 (b) How is memory allocated to a class and objects in
 - (c) Write a program in C++ to use Scope resolution operator. [6]

P.T.O.

[3]

- **3.** (a) Explain in brief the different data types in Java. [6]
 - (b) Write short notes on : [7]
 - (i) Control Statements in JAVA.
 - (*ii*) Command line Arguments.

- 4. (a) What is Recursion ? Write a program to print array elements using Recursion. [6]
 - (b) Explain appropriately the following : [7]
 - (*i*) The **this** keyword.
 - (ii) Finalize().
- 5. (a) Describe the various *four* forms of implementing interfaces in JAVA. [6]
 - (b) Write a program in Java to create a player class. Inherit the classes Cricket_player and Football_player from player class.
 [6]

Or

- 6. (a) Differentiate between Interface and a Class. [6]
 - (b) What is Package ? How do we add a class or an interface to a package in JAVA ? [6]

[5459]-141
- 7. (a) Explain Byte stream and Character stream. [6]
 - (b) What is a thread in JAVA ? Explain single threaded and multithreaded program. What is the difference between multiprocessing and multithreading ?

8. (a) Explain the terms : [6]
(i) Reading Console inputs.
(ii) Writing Console output.
(b) What is an applet in JAVA ? Explain a local applet and a remote applet. [7]

Total No. of Questions-8]

| Seat | |
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[5459]-142

S.E. (Electronics/E & TC) (Second Semester) EXAMINATION, 2018 COMPUTER ORGANISATION (2012/2015 COURSE)

Time : 2 Hours

Maximum Marks : 50

- **N.B.** :- (i) Neat diagrams must be drawn wherever necessary.
 - (ii) Figures to the right indicate full marks.
 - (*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
 - (iv) Assume suitable data, if necessary.
- 1. (a) Explain different functional units of computer organization. [6]
 - (b) Represent the following number in single precision and double precision IEEE format : [6]

 $(100.125)_{10}$.

Or

- (a) Compare RISC and CISC processor. [6]
 (b) Explain single bus structure and multi bus structure. [6]
 (a) Write down control sequence for the instruction Mov(R1), R2. [6]
 - (b) Write a short note on universal serial bus. [6]

Or

4. (a) What is the difference between subroutine and interrupt service routines ? [6]

(b) Differentiate memory-mapped I/O and I/O mapped I/O. [6]
5. (a) Explain the hierarchy of computer system. [6]
(b) Write a note on semiconductor RAM memories. [7]

Or

- 6. (a) Explain the concept of virtual memory. How virtual memory Address is translated to physical memory address ? [7]
 - (b) Explain cache mapping technique.
- 7. (a) Draw and explain functional block diagram of 8086 processor.
 - (b) List out addressing modes of 8086. [6]

[6]

[7]

- 8. (a) Draw flag structure of 8086 and explain operation of each flag. [7]
 - (b) Draw the pin diagram of 8086 microprocessor and explain the significance of the following pins : [6]
 - (*i*) MN/\overline{MX}
 - (*ii*) NMI
 - $(iii) \overline{\text{TEST}}$

Total No. of Questions-8]

| Seat | |
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[5459]-143

S.E. (E&TC/Elect.) (Second Semester) EXAMINATION, 2018 ENGINEERING MATHEMATICS—III (2015 PATTERN)

- Time : Two Hours
 Maximum Marks : 50

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

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

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

(*ii*) $\frac{d^2y}{dx^2} + y = \sec x \cdot \tan x$ (By variation of parameter)

(iii)
$$x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + 6y = x^{\varepsilon}$$

(b) Find the Fourier sine transform of a function $f(x) = e^{-|x|}$. [4]

Or

2. (a) An electric circuit consists of an inductance 'L', condenser of capacity 'C' and emf 'E₀. cos ωt ' so that the charge Q satisfies the differential equation $\frac{d^2Q}{dt^2} + \frac{Q}{LC} = \frac{E_0}{L} \cos \omega t$. If $\omega^2 = \frac{1}{LC}$ and at t = 0, $Q = Q_0$ and $i = i_0$, find the charge at any time 't.' [4]

- (b) Solve any one :
 - (i) Find z-transform of a function $f(k) = (k+1)2^k, k \ge 0$.

(*ii*) Find the inverse z-transform of $f(z) = \frac{z}{(z-2)(z-3)}|z| > 3$.

$$f(k+1) + \frac{1}{2}f(k) = \left(\frac{1}{2}\right)^k, \ k \ge 0, \ f(0) = 0.$$

3. (a) Find Lagrange's interpolating polynomial passing through set of points : [4]

| x | 0 | 1 | 2 | |
|---|---|---|----|--|
| у | 2 | 5 | 10 | |
| | | | | |

Use it to find y at x = 0.5; $\frac{dy}{dx}$ at x = 0.

(b) Compute y(0.1) by Runge-Kutta method of 4th order for the differential equation : [4]

$$\frac{dy}{dx} = xy + y^2, \ y(0) = 1 \text{ with } h = 0.1$$

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

Or

4.
$$(a)$$
 Show that (any *one*)

(i) $\nabla [\nabla . (\overline{r} / r^2)] = \frac{-2}{r^4} \overline{r}$ (ii) $\nabla [\overline{a} . \nabla \log r] = \frac{\overline{a}}{r^2} - \frac{2(\overline{a} . \overline{r})}{r^4} \overline{r}$

[5459]-143

[4]

(b) Show that the vector field $\overline{F} = (x^2 - yz)\overline{i} + (y^2 - zx)\overline{j} + (z^2 - xy)\overline{k}$ is irrotational. Find scalar potential ϕ such that $\overline{F} = \nabla \phi$. [4]

(c) Evaluate
$$\int_{1}^{2} \frac{dx}{x^{2}}$$
 using Simpson's $\frac{1}{3}$ rd rule taking $h = 0.25$. [4]

5. (a) Find work done in moving a particle once around the circle $x^2 + y^2 = 1, z = 1$ in the force field $\overline{F} = z\overline{i} + x\overline{j} + y\overline{k}$. [4]

(b) Using Stokes' theorem evaluate ∫_C(y dx + z dy + x dz) where C is the boundary of rectangle 0 ≤ x ≤ 2, 0 ≤ y ≤ π, z = 3.
(c) Use Gauss-Divergence theorem to evaluate ∬_S(y²z²i + x²z²j + x²z²z² + x²z² + x²z² + x²z² + x²z² + x²z² + x²z² + x² + x²z² + x² + x²z² + x² + x²

 $x^2y^2\overline{k}$). $d\overline{S}$ where S is the surface of hemisphere $x^2 + y^2 + z^2 = 9$ above *xy*-plane. [5]

Or

6. (a) Using Green's theorem evaluate $\int_{C} (x^{3} - 2y^{2}) dx + (3xy + 4x^{2}) dy$ along the closed curve formed by x = 0, x = 1, y = 0 and y = 2. [4]

(b) By using Stokes' theorem evaluate $\iint_{S} (\nabla \times \overline{F}) \cdot d\overline{S}$ where $\overline{F} = y\overline{i} + z\overline{j} + x\overline{k}$ over surface of paraboloid $z = 1 - x^2 - y^2$ for which $z \ge 0$. [4]

(c) By Gauss-Divergence theorem evaluate $\iint_{S} (x^{3}\overline{i} + y^{3}\overline{j} + z^{3}\overline{k}) \cdot d\overline{S}$ over the surface of the sphere $x^{2} + y^{2} + z^{2} = 1$. [5] 7. (a) If f(z) = u + iv is an analytic function show that both u and v are harmonic. [4]

[5]

[5]

(b) Evaluate :

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

where C is the contour |z| = 2.

(c) Find the bilinear transformation which maps the points 1, i, -1 from z-plane onto the points i, 0, -i of W-plane.
 [4]

Or

8. (a) Find harmonic conjugate of $u = x^3 - 3xy^2$ and corresponding analytic function in terms of z. [4]

(b) Evaluate
$$\int_{C} \frac{z^3-5}{(z+1)^2(z-2)} dz$$
 where C is the contour $|z| = 3$.

(c) Find image of straight line y = x under the transformation $w = \frac{z-1}{z+1}$. [4] Total No. of Questions-8]

[Total No. of Printed Pages-2

| Seat | |
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| No. | |

[5459]-151

S.E. (Electrical) (I Sem.) 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 in allowed.
- (iv) Assume suitable data, if necessary.
- 1. (a) Explain main components and working of Diesel Power plant.[6]
 - (b) With the help of diagram explain the main parts and working of thermal power plant. [6]

- 2. (a) Explain the construction and working of Nuclear Power Plant. [6]
 - (b) Compare Rankine cycle and Carnot cycle. [6]
- 3. (a) Explain in detail the impact of Tower Height in Wind turbinePlant. [7]
 - (b) In Hydroelectric Power plants writes short notes on : [6]
 - (i) Spillways
 - (*ii*) Penstock.

- 4. (a) Explain the difference between the working of Francis turbine and Kaplan turbine used in hydropower plants. [6]
 - (b) Describe the types of wind turbine electrical generators. [7]
- 5. (a) Explain photovoltaic cells. How are they used for energy storage requirements ? [7]
 - (b) Explain stand-alone, hybrid stand-alone and grid connected renewable energy systems. [6]

- 6. (a) Explain the process of municipal solid waste to energy conversion. [6]
 - (b) With the help of diagram explain the main concept of solar thermal power plant. [7]
- 7. (a) Explain how biomass energy is used to produce electricity ? [6]

(b) Explain the methods of measurement of solar radiation. [6]

Or

- 8. (a) Define and explain the terms in solar energy system : [6]
 (i) Solar constant
 - (*ii*) Concentration ratio.
 - (b) What is geothermal energy ? Explain with sketch how it can be harnessed to generate electricity ?[6]

| Seat | |
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| No. | |

[5459]-152

S.E. (Electrical) (I Semester) EXAMINATION, 2018

MATERIAL SCIENCE

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

Physical Constants :

- 1. Angstrom Unit(AU) = 1×10^{-10} metres
- 2. Boltzmann's Constant (k) = 1.380×10^{-23} joule.degree-1
- 3. Charge on Electron (e) = 1.601×10^{-19} coulomb
- 4. Mass of Electron (m) = 9.107×10^{-31} kg
- 5. Electron volt (eV) = 1.602×10^{-19} joules
- 6. Mass of Proton $(m_p) = 1.627 \times 10^{-27} \text{ kg}$
- 7. Velocity of light (c) = 2.998×10^8 m/sec
- 8. Dielectric Constant of free space (ϵ_0) = 8.854 × 10⁻¹² F/m
- 9. Permeability of free space $(\mu_0) = 4\pi \times 10^{-7}$ H/m
- 10. Debye Unit = 3.33×10^{-30} coulomb.metre
- (a) Write short note on fibre optics along with materials used and its applications. [6]

(b) What is the difference between dielectric material and insulating material ? Hence write the properties and applications of – Air and Pressboard.
 [6]

Or

- (a) Derive Clausius Mossotti relation as applied to dielectric materials in static field. State clearly the assumptions made. [6]
 - (b) Classify the solid insulating materials as per their ability to withstand temperatures. Explain properties and applications of any *two* solid insulating materials. [6]
- **3.** (a) Differentiate between : [6]
 - (i) Ferromagnetism and Antiferromagnetism
 - (ii) Soft Magnetic Materials and Hard Magnetic Materials.
 - (b) Describe properties and applications of any two materials of the following : [6]
 - (i) Copper
 - (*ii*) Constantan
 - (iii) Brass

Or

- 4. (a) Write short note on laser and magnetic strip technology. [6]
 - (b) The resistivity of copper at 300°K is $1.56 \times 10^{-8} \Omega m$. With 2 atomic percent nickel, the resistivity of alloy of copper - nickel becomes $4.06 \times 10^{-8} \Omega m$. With 3 atomic percent

silver, the resistivity of alloy of copper-silver becomes $1.98 \times 10^{-8} \Omega m$. What will be the resistivity of alloy of copper for 4 atomic percent of nickel and 3 atomic percent of silver at 300°K ? [6]

- 5. (a) Explain State Of Charge (SOC), Depth Of Discharge (DOD), energy density, power density in case of batteries. [8]
 - (b) Explain with neat diagram Single Electron Transistor. [5]

Or

- 6. (a) Explain with neat diagram, chemical reaction and applications of : [6]
 - (*i*) ZEBRA Battery
 - (ii) Nickel Cadmium Battery.
 - (b) Describe with neat diagrams : [7]
 - (i) Molecular Machines
 - (*ii*) Nano wires

7. (a) With neat sketch, explain how flux density is measured with the help of Gauss meter. [6]

(b) Enlist the apparatus along with the specifications to find the dielectric strength of transformer oil with a neat diagram. As per IS, what should be the gap spacing between the two electrodes ?

[5459]-152

- 8. (a) With neat circuit diagram and phasor diagram, explain measurement of dielectric loss angle (tan δ) by Schering Bridge as per IS 13585-1994. [6]
 - (b) Enlist the apparatus along with the specifications to find the dielectric strength of solid insulating material with a neat diagram.
 Which materials have you tested in your High Voltage laboratory ?
 What was the material used for the electrodes ? [7]

| Seat | |
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[5459] - 153

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

ANALOG AND DIGITAL ELECTRONICS

(2015 **PATTERN**)

 Time : Two Hours
 Maximum Marks : 50

 N.B. :- Attempt Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or 8.

1. (a) Perform the following arithmetic operations : [6]

- (1) Add 37 and 46 BCD numbers
- (2) Subtract using 2's Complement :

11011 - 10100

(b) (1) Convert the following number into desired base $(630.4)_8 \rightarrow (?)_{10}$

2. Convert $(2345)_{10}$ in BCD and Excess-3 code. [6]

Or

- 2. (a) With the help of a 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]
 - (b) Convert $A\overline{B}C + BCD + ACD + \overline{A}B$ into POS form using K-Map. [6]

- (a) Explain the difference between fixed and variable regulator.
 Draw suitable circuit diagram of IC-317 and derive formula for variable voltage available at the output in terms of circuit parameters.
 - (b) Write a short note on V to I converter with grounded type load. [6]

- **4.** (a) Design a low pass filter at a cut-off frequency of 1 kHz with passband gain of 2. Assume [C = 0.01 microfarad] [7]
 - (b) Draw neat diagram and explain IC 555 as Astable multivibrator. [6]
- **5.** (*a*) Explain direct coupled amplifier. Why direct coupling amplifier is not suitable for amplification of high frequencies signals ? [6]
 - (b) What is DC load line ? Derive equation for DC load line and show Q point on DC load line.[6]

Or

- 6. (a) Draw construction of FET and explain transfer characteristics and drain characteristics of FET. [6]
 - (b) Discuss relative merits and demerits of R-C coupled, transformer coupled and direct coupled multistage amplifiers. Draw their frequency response curve.
 [6]
- 7. (a) Compare the performance of half-wave rectifier and full wave uncontrolled rectifier. [6]

- (b) Draw the circuit diagram and state the expression of the following for the 1-phase full wave Center tap rectifier : [7]
 - (1) Average output voltage
 - (2) RMS output voltage
 - (3) Ripple factor.

- 8. (a) A three-phase bridge uncontrolled rectifier is connected to an R load. Draw neat diagram and explain with waveforms. [6]
 - (b) A voltage of 220 sin (100 πt) is applied to a half-wave rectifier with a load resistance 10 k-ohm. Calculate the maximum current, rms cuffent, average current, ac power input, dc power output and ripple factor. [7]

Total No. of Questions—8]

[Total No. of Printed Pages-3

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[5459]-154

S.E. Electrical (I Semester) EXAMINATION, 2018 ELECTRICAL MEASUREMENTS AND INSTRUMENTATION

(2015 PATTERN)

Time : Three HoursMaximum Marks : 50

N.B. :- (i) Attempt any four questions.

(ii) All questions carry equal marks.

 (a) With a suitable diagram explain construction and working of PMMC instrument. [6]

 (b) With suitable circuit diagram explain ammeter and voltmeter method for measurement of resistance. State *two* disadvantages of this method.

Or

- (a) With usual notations derive the equation of final steady state deflection (θ) for PMMC instrument. [6]
 - (b) With suitable diagram explain fall of potential method for earth resistance measurement. [6]

- (a) A balanced star-connected load is supplied from 3-phase, 440 volt, 50 Hz supply system. The current in each phase 20 Ampere and laggs behind phase voltage by 40°. Calculate :
 - (*i*) Phase voltage
 - (*ii*) Load impedance
 - (iii) Load parameters
 - (iv) Readings of two watt meters connected in the load circuitto measure the power [7]
 - (b) With suitable block diagram explain working of electronic energymeter. [6]

- 4. (a) Explain any *three* errors in induction type energymeter in detail. Also state the method of compensation for these errors. [6]
 - (b) With suitable circuit diagram and phasor diagram explain one wattmeter method for measurement of reactive power in a 3-phase star connected (R + L) load. [7]
- (a) With suitable diagram explain any two types of inductive transducer. [7]
 - (b) With suitable diagrams explain measurement of phase angle of Lissajous patterns in case of CRO. [6]

- 6. (a) State the classification of pressure with respective ranges.
 Also state two methods for measurement of pressure in each category. [7]
 - (b) With suitable diagram explain construction of CRO. [6]
- 7. (a) With suitable diagram explain working of LVDT. [6]
 - (b) Explain pneumatic method of level measurement with suitable diagram. [6]

- 8. (a) State any *four* advantages and any *two* disadvantages of semiconductor strain gauges. [6]
 (b) With suitable diagram explain nucleonic method of level
 - measurement. [6]

Total No. of Questions-8]

| Seat | |
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[5459]-155

S.E. (Electrical) (II Semester) Examination, 2018 POWER SYSTEM-I

(2015 Pattern)

 Time : Two Hours
 Maximum Marks : 50

 N.B. :- (i)
 Answer Q. Nos. 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 side indicate full marks.
- (iv) Assume suitable data, if necessary.
- (a) A generating station supplies the following loads : 15,000 kW, 12,000 kW, 8,500 kW, 6,000 kW and 450 kW. The maximum demand is 22,000 kW. The annual load factor of the station is 48%. : [6]

Calculate :

- (i) Number of units supplied annually
- (ii) Diversity factor
- (iii) Demand factor.
- (b) Define string efficiency. Derive the expression for string efficiency of a suspension insulator consisting of four discs. [6]

- **2.** (a) Explain in brief, function and working of the following equipments used in substation : [6]
 - (i) Relays
 - (ii) PLCC equipment.
 - (b) Write short notes on the following types of tariffs : [6]
 - (i) Time of the day tariff
 - (*ii*) Interruptible tariff.

3. (a) Explain in brief with neat diagram the following effects : [6]
(i) Skin Effect
(ii) Proximity Effect.
Hence state what are the factors responsible for producing

these effects and how ?

(b) The weight of the overhead line conductor is 700 kg/km. The ultimate strength is 3000 kg. If safety factor is 2 and span length is 250 m. Find (i) Sag (ii) Height above which conductor should be supported if ground clearance required is 8 m. [7]

Or

(a) 3-phase bundled conductor line consist of 2 sub-conductors per phase, conductors are arranged in horizontal plane and are regularly transposed as shown in figure, radius of each conductor is 1.15 cm. Calculate inductance per phase per km. [7]



(b) Derive the expression for capacitance of single core cable. [6]

- 5. (a) Explain the concept of "Method of Images" in determining the effect on the capacitance of overhead transmission line.
 [6]
 - (b) 3-phase, 110 kV, 50 Hz overhead line conductors are placed in a horizontal plane. The conductor diameter is 1.5 cm if the line length is 120 km, assuming complete transposition of the line. Calculate :
 - (i) capacitance per phase
 - (*ii*) charging current. [6]

- 6. (a) Derive the expression for capacitance of double circuit lie when conductors are arranged in the form of regular hexagon with side 'd' meters. [6]
 - (b) A single-phase 10 km line is 6 m above the ground. The diameter of each conductor is 2 cm and is separated by 4 m horizontally. Find the following : [6]
 - (*i*) Capacitance between the conductors with the effect of ground.
 - (*ii*) Capacitance between the conductors neglecting the presence of ground.
 - (*iii*) Charging current when the line is charged at 33 kV, 50 Hz
- 7. (a) 150 km, 3-phase, 110 kV, 50 Hz transmission line transmits a load of 40 MW at 0.8 pf lagging at receiving end. Resistance/ ph/km = 0.15 Ω , reactance/ph/km = 0.6 Ω ; susceptance/ ph/km = 10⁻⁵ S. [7] Determine :
 - (i) A, B, C, D constants of the line
 - (ii) Sending end voltage (line-to-line).
 - (b) Justify the following statements : [6]
 - (*i*) In case of medium transmission lines, receiving end voltage is greater than sending end voltage under no load.
 - (*ii*) With increase in power factor, regulation of transmission line improves.

- 8. (a) Express the relationship for the sending end voltage and current in terms of receiving end voltage and current for a medium length transmission line with Nominal ' π ' method of representation. Draw the phasor diagram. [6]
 - (b) A 110 kV, 50Hz, 3-phase transmission line delivers a load of 50 MW at 0.85 p.f. lagging at the receiving end. If the generalized constants of the line are A = 0.95 ∠ 1.4°, B = 96 ∠ = 78°Ω and C = 0.0015 ∠90° S. Determine efficiency of transmission line.

Total No. of Questions—8]

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[5459]-156

S.E. (Electrical) (Second Semester) EXAMINATION, 2018 ELECTRICAL MACHINES—I

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6, Q. Nos. 7 or 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - *(iv)* Use of logarithmic tables, electronic pocket calculator is allowed.
 - (v) Assume suitable data, if necessary.
- (a) Open circuit test and short circuit test is carried out on a single phase, 230/500 volt, 25 kVA transformer. The observations are as below : [7]
 Open circuit test :
 (With HV winding open) 230 Volt, 5 Amp, 200 Watt Short circuit test :
 (With HV winding shorted) 6 Volt, 100 Amp, 180 Watt Find the parameters of equivalent circuit referred to LV side.
 - (b) With suitable phasor diagram explain wye/delta connection and delta/wye connection for 3-phase transformer. Clearly mark the angular displacement in respective phasor diagram. [6]

(a) A distribution transformer of 500 kVA has full load copper loss of 4.5 kW and iron loss is 3.5 kW. The loading of transformer for entire day is as follows : [7]

| No. of Hours | Loading of kW | Power Factor |
|--------------|---------------|---------------------|
| 6 | 400 | 0.8 |
| 10 | 300 | 0.75 |
| 4 | 100 | 0.8 |
| 4 | 0 | _ |

Determine all day efficiency of the distribution transformer. State and explain the conditions to be satisfied for satisfactory

[6]

3.

(b)

(a) Draw a neat diagram showing constructional details of a DC machine. Name all the parts. State the material used and function of respective part. [6]

parallel operation of two transformers.

(b) State the *two* methods of speed control of DC motor. Give comparison of these two methods (minimum 5 points of comparison expected).
 [6]

- 4. (a) A DC shunt motor takes a current of 4 Amp at no-load and runs at 720 rpm. The armature resistance is 0.2 ohm and shunt field resistance is 110 ohm. Calculate its speed at full load condition if full load current is 50 Amp. Assume that flux is reduced by 3% on full load condition due to armature reaction. [6]
 - (b) With suitable diagrams explain armature reaction in case of DC machine. [6]

- (a) A 3-phase induction motor has synchronous speed of 250 rpm and slip of 4% at full load. The rotor has resistance of 0.02 ohm per phase and standstill reactance of 0.15 ohm per phase. Calculate : [7]
 - (i) Ratio of maximum torque to full load torque.
 - (ii) The speed at which maximum torque is developed.
 - (b) With a neat diagram explain constructional details of slip-ring type 3-phase induction motor. State its *two* advantages. [6]

- 6. (a) The input to a 3-phase, 6 pole, 50 Hz induction motor is 47 kW at certain load. The total stator losses are 1 kW and mechanical losses are 1 kW. The motor runs at 970 rpm. Determine the HP output of motor. [7]
 - (b) With suitable phasor diagrams, explain how rotating magnetic field is produced when a 3-phase winding is fed by symmetrical 3-phase supply.
- (a) Explain why 3-phase induction motor needs a starter ? Draw a neat sketch of autotransformer starter and explain its working.
 - (b) Develop the approximate equivalent circuit for 3-phase induction motor in steps. Clearly mark all the parameters in the equivalent circuit. Briefly explain each step.

- 8. (a) With suitable circuit diagram explain no-load test carried out on 3-phase induction motor. What information is obtained from this test ? What assumptions are made while finding losses from this test ?
 - (b) Compare three-phase induction motor with 3-phase transformer on any six points.
 [6]

4

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-157

S.E. (Electrical Engg.) (Second Semester) EXAMINATION, 2018 NETWORK ANALYSIS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6, Q. Nos. 7 or 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (*iii*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
 - (iv) Assume suitable data, if necessary.
- 1. (a) Using mesh analysis, find the magnitude of dependent source. [7]



Fig. 1

(b) Find Norton's equivalent circuit for the network shown in Fig. 2 : [6]



Fig. 2

Or

- 2. (a) State and explain the concept of duality with suitable example. [6]
 - (b) Using superposition theorem, calculate current 'i' for the circuit shown in Fig. 3 : [7]



Fig. 3

3. (a) Using classical theory, find voltage across inductor at time t = 2, sec, after switch is opened : [6]





(b) For the circuit shown in Fig. 5 solve for i(t) using Laplace transform with switch 'k' closed at t = 0: [6]



Or

4. (a) R-L-C circuit is excited by D.C. voltage source. Find current i(t) using conventional method. The switch is closed at time t = 0. [6]



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(b) In the circuit shown in Fig. 7, the switch is moved to position 2 at time t = 0, find the expression of current for time t > 0, using Laplace transform : [6]



- 5. (a) Obtain 'Y' parameters in terms of transmission parameters. [6]
 - (b) Draw poles and zeros plot in the S plane of the driving point impedance function for the network shown in Fig. 8 : [7]



Fig. 8

6. (a) Find transmission parameter for the network shown in Fig. 9 : [7]



Fig. 9

- (b) Explain the necessary conditions for transfer function. [6]
- 7. (a) Derive an expression for characteristic impedance $(Z_{OT} and Z_{O\pi})$, attenuation constant (α) and phase constant (β) of constant k high pass filter from symmetrical network. [6]
 - (b) Design a prototype low pass filter (π and T section) if design impedance $R_0 = 500 \Omega$ and cut-off frequency $f_c = 2000$ Hz. [6]

Or

- 8. (a) Explain the following in relation with filters : [6]
 - (i) stop band
 - (*ii*) pass band
 - (*iii*) cut-off frequency.
 - (b) A prototype high pass filter has cut-off frequency of 10 kHz and design impedance of 600 Ω. Find value of L & C. Also find attenuation in dB and phase shift in degrees at frequency of 8 kHz.

5

Total No. of Questions-8]

[Total No. of Printed Pages-4

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[5459]-158

S.E. (Electrical) (II Semester) EXAMINATION, 2018 NUMERICAL METHODS AND COMPUTER PROGRAMMING (2015 PATTERN)

- Time : 2 Hours
 Maximum Marks : 50

 N.B. :- (i)
 Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No.

 4, Q. No. 5 or Q. No. 6 and Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
 - (v) Assume suitable data, if necessary.
- 1. (a) Give the syntax of 'for loop', 'while loop' and 'do-while-loop' used in C language. [6]
 - (b) The measured length of bridge and river are 9999 cm and
 9 cm respectively but the true values are 10,000 cm and 10 cm respectively. Compute and comment on :
 - (*i*) Absolute error
 - (ii) Percentage Relative error.

- 2. (a) Explain the following instructions used in C language. [6]
 - (1) printf
 - (2) scanf
 - (3) getch
 - (b) (i) Add the following floating point numbers : 243.31947E17 and 32.1698E14.

- (*ii*) Subtract the following floating point numbers : 37.9314E19 from 416.21943E18.
- (*iii*) Divide 317.23E33 by 32.17E18. [6]

3. (a) Solve the following equation $f(x) = e^{-x} - x = 0$ using Secant method. Show 4 iterations. Take $x_0 = 0$, $x_1 = 1$. [6]

(b) Find f(3) using Newton's Divided difference technique : [7]

| X | | Y |
|---|----|----|
| 0 | | 1 |
| 1 | | 4 |
| 2 | | 15 |
| 4 | | 85 |
| | Or | |

4. (a) The following is data from steam table, using Newton's forward interpolation, find pressure of steam for a temp of 142° : [6]

| Temp | Pressure |
|------|----------|
| 140 | 3.685 |
| 150 | 4.854 |
| 160 | 6.302 |
| 170 | 8.076 |
| 180 | 10.225 |

(b) Fit a straight line to the following data by method of least squares considering y as a dependent variable : [7]

| X | Y |
|----|----|
| 5 | 16 |
| 10 | 19 |
| 15 | 23 |
| 20 | 26 |
| 25 | 30 |

[5459]-158

2

- 5. (a) Solve $\frac{dy}{dx} = xy + y^2$, y(0) = 1 to get y at x = 0.1 using RK 4th order method. Take h = 0.1. [6]
 - (b) Compute the value of : [7]

$$\int_{1}^{2} \frac{dx}{x}$$

using Simpson's 1/3 rule and trapezoidal rule, taking h = 0.25. Or

6. (a) Using Simpson's rule integrate : [7]

$$\int_{0}^{1} \int_{0}^{1} \frac{1}{1+x+y} dx \, dy$$

Take h = k = 0.5.

(b) Apply modified Euler's method to find y(0.1). Given $\frac{dy}{dx} = xy$, y(0) = 1. Show 3 iterations. [6]

7. (a) Find
$$[A]^{-1}$$
 using Gauss-Jordan method : [6]

$$\mathbf{A} = \begin{bmatrix} -1 & 3 & 5 \\ -3 & 1 & 7 \\ 7 & -5 & -11 \end{bmatrix}$$

(b) Use Jacobi method to solve the following system of equations at the end of 5th iterations. Use initial values as x = 0, y = 0 and z = 0. [6]

$$8x - 3y + 2z = 20$$

$$4x + 11y - z = 33$$

$$6x + 3y + 12z = 35$$

$$Or$$

8. (a) Explain Gauss Elimination method for solution of linear simultaneous equations. [6]
[5459]-158 3 P.T.O.

(b) Find numerically the largest eigen value by power method.Show 5 iterations : [6]

$$\mathbf{A} = \begin{bmatrix} 1 & 6 & 1 \\ 1 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix} \quad \mathbf{X}_0 = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-159

S.E. (Electrical) (Second Semester) EXAMINATION, 2018 FUNDAMENTALS OF MICROCONTROLLER AND

ITS APPLICATIONS

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Attempt Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6, Q. Nos. 7 or 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 the architecture of 8051 Microcontroller. Explain memory mapping of 8051. [6]
 - (b) Draw and explain internal structure of PORT 1 of 8051 microcontroller. [6]

Or

- 2. (a) Explain in detail bit level instructions in 8051 microcontroller.[6]
 - (b) Explain in detail different timer modes of 8051 microcontroller.

[6]
- (a) Explain the interrupt structure of 8051 microcontroller. Explain how interrupts are prioritized. [6]
 - (b) Explain the Logical instructions present in 8051 microcontroller with a mnemonic code and its operation for each. [6]

- **4.** (a) Explain the different serial communication modes in 8051. [6]
 - (b) Write an assembly level program to generate a square wave of 2 kHz with timer 0 on port pin 1. [6]
- (a) Write an assembly language program to generate triangular waveform using DAC interfaced with 8051 microcontroller.

[7]

(b) Explain the mode 1 of 8255 PPI in output mode and list the functions of handshake signals.[6]

Or

- 6. (a) Explain in detail the following microcontroller development tools : [6]
 - (1) Assembler
 - (2) Compiler
 - (3) Cross Assembler and compiler.
 - (b) Draw and explain with schematic diagram hardware interfacing of 8255 with 8051 microcontroller. [7]

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- 7. (a) Draw a schematic diagram for speed control of stepper motor using 8051 microcontroller. [7]
 - (b) Write a program to rotate the DC motor for a given speed. [6]

- 8. (a) Write a program to rotate a motor 64° in the clockwise direction. The motor has a step angle of 2°. Use the normal 4 step sequence.
 - (b) Draw and explain with schematic diagram for Power Factor measurement using 8051 microcontroller. [7]

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-160

S.E. (Electrical Engineering & Instru.) (I Sem.) EXAMINATION, 2018 ENGINEERING MATHEMATICS—III

(2015 PATTERN)

Time : Two Hours

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

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

(ii) $(D + 1)^2 y = e^{-x}$ by variation of parameter method.

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

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

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

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

P.T.O.

ai ks.

Maximum Marks : 50

2. (a) An emf E sin pt is applied at t = 0 to a circuit containing a capacitance C and inductance L. Current I satisfies the equation $L\frac{dI}{dt} + \frac{1}{C}\int I dt = E \sin pt$ if $p^2 = \frac{1}{LC}$ and initially the current I and charge Q are zero then show that the current at time

$$t$$
 is $\frac{\mathrm{E}t}{2\mathrm{L}}\sin pt$ where $\mathrm{I} = -\frac{d\mathrm{Q}}{dt}$. [4]

(i) Evaluate :

$$\begin{bmatrix} \int_{0}^{\infty} \frac{\cos 6t - \cos 4t}{t} dt \end{bmatrix}$$
(*ii*) $L^{-1} \begin{bmatrix} \frac{1}{s^{4}(s+5)} \end{bmatrix}$ by convolution theorem.
Find Laplace transform of $\cosh t \, \delta(t - 4)$. [4]

3. (a) Find the Fourier transform of the function : [4] $f(x) = \begin{cases} 1 - x^2 & |x| \le 1 \\ 0 & \text{otherwise} \end{cases}$

(b) Attempt any one : [4]
(i) Find z-transform of
$$f(k) = \left(\frac{1}{4}\right)^{|k|} \forall k$$

(ii) Find inverse z-transform of $f(z) = \frac{z}{\left(z - \frac{1}{4}\right)\left(z - \frac{1}{5}\right)}$ for

$$\frac{1}{5} < \left| z \right| < \frac{1}{4}.$$

(c) In what direction, the directional derivative of $\phi = x^2 y z^3$ is maximum from the point (2, 1, -1) ? What is its magnitude ? [4]

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(c)

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

(i)
$$\nabla^4(r^2 \log r) = \frac{6}{r^2}$$

(ii) $\nabla \times \left(\frac{\overline{a} \times \overline{r}}{r^3}\right) = \frac{-\overline{a}}{r^3} + \frac{3(\overline{a} \cdot \overline{r})\overline{r}}{r^5}$

(b) Find a, b, c, so that $\overline{F} = (x + 2y + az)\overline{i} + (bx - 3y - z)\overline{j} + (4x + cy + 2z)\overline{k}$ is irrotational. [4]

(c) Obtain inverse z-transform of $F(z) = \frac{1}{(z-3)(z-4)} |z| > 3$ by inversion integral method. [4]

- (a) Evaluate $\int_{C} \overline{F} \cdot d\overline{r}$ for $\overline{F} = 3x^{2}\overline{i} + (2xz y)\overline{j} + z\overline{k}$ along the following curve $x = \alpha t^{2}, y = t, z = 4t^{2} t$ from t = 0, t = 1. [6]
- (b) Using Stokes' theorem evaluate : [7] $\int_{C} (x+y)dx + (2x-z)dy + (y+z)dz$

where C is the curve of intersection of $x^2 + y^2 + z^2 - 2ax - 2ay = 0$ and x + y = 2a.

(c) Evaluate $\iint_{S} (z^2 - x) dy dz - xy dz dx + 3z dx dy$ where S is the closed surface of region bounded by x = 0, x = 3, z = 0, $z = 4 - y^2.$ [6]

Or

3

6. Attempt any two :

(a) Using Green's theorem evaluate $\int_{C} \overline{F} \cdot d\overline{r}$ where $\overline{F} = x\overline{i} + y\overline{j}$ over the first quadrant of the circle $x^2 + y^2 = a^2$. [6]

P.T.O.

[4]

(b) Evaluate $\iint_{S} (\nabla \times \overline{F}) \cdot d\overline{S}$ where $\overline{F} = 3(x - y)\overline{i} + 2xz\overline{j} + xy\overline{k}$ over the surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane z = 2. [7]

(c) Find
$$\iint_{S} \overline{F} \cdot d\overline{S}$$
 where S is the sphere $x^{2} + y^{2} + z^{2} = 9$ and
 $\overline{F} = (4x + 3yz^{2})\overline{i} - (x^{2}z^{2} + y)\overline{j} + (y^{3} + 2z)\overline{k}.$ [6]

7. (a) If
$$u - v = x^3 + 3x^2y - 3xy^2 - y^3$$
, find an analytic function $f(z) = u + iv$. [4]

(b) Evaluate
$$\oint_C \frac{z+2}{z^2+1} dz$$
 where C is the circle $|z + i| = \frac{1}{2}$. [5]

(c) Find the bilinear transformation which maps the points -i, 0, (2 + i) of z-plane onto the points 0, -2i, 4 of the w-plane. [4]

Or

8. (a) Find an analytic function f(z) whose imaginary part is $r^n \sin n\theta$. [4]

[5]

(b) Evaluate :

$$\oint_{C} \frac{\sin^2 z}{\left(z - \frac{\pi}{6}\right)^3} dz$$

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

(c) Show that the map $w = \frac{2z+3}{z-4}$ transforms the circle $x^2 + y^2 - 4x = 0$ into the straight line 4u + 3 = 0. [4]

Total No. of Questions—8]

[Total No. of Printed Pages-2

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[5459]-161

S.E. (Instru. & Cont.) (I Sem.) EXAMINATION, 2018 SENSORS AND TRANSDUCERS-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.
- 1. (a) Enlist and define Dynamic characteristics of measuring system. [6]
 - (b) Explain working principle of Hall effect transducer with one application. [6]

Or

- (a) State true or false for the given statement "Fidelity is a static characteristic". Justify your answer by explaining fidelity in detail.
 - (b) How are Strain Gauges used for weight measurement ? What is the necessity for temperature compensation in it and how it is achieved ?
- (a) Define Torque. Enlist its transducers. Why is it necessary to measure torque ?
 [6]

- (b) Describe force measurement using Strain Gauge Load Cell ? [6] Or
- **4.** (a) What are Dynamometers ? Explain working of Gear type dynamometer. [6]
 - (b) Describe piezoelectric sensor for force measurement. State the expression for its output voltage. [6]
- 5. (a) Write a short note on Bourdon gauge with respect to construction, working, various types, materials used for construction. [7]
 - (b) Explain construction and working of high pressure measurement technique.[6]

- 6. (a) Discuss capacitive (Delta Cell) pressure transducers in detail with a neat sketch. [7]
 - (b) Explain construction and working of Low Pressure (Vacuum) measurement technique. [6]

7. (a) Write a short note on Radiation Pyrometers. [7]

- (b) Define : [6]
 - (*i*) Seebeck Effect
 - (*ii*) Peltier Effect
 - (*iii*) Thomson Effect.

Or

8. (a) Explain IC LM35 sensor available for temperature measurement. [7]

(b) What is self heating effect in RTDs ? How it can be minimized ? [6]

 $\mathbf{2}$

Total No. of Questions-8]

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[5459]-162

S.E. (Instrumentation and Control) (First Semester) EXAMINATION, 2018

BASIC INSTRUMENTATION

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- - (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) Define calibration and traceability. Draw traceability chart and explain. [6]
 - (b) Enlist the advantages and disadvantages of current and potential transformers over shunts and multipliers for extension of range of instruments. [6]

Or

- (a) With neat constructional diagram, explain the working of attraction type of moving iron instrument. [6]
 - (b) Derive the equation for loading effect of series connected instrument. [6]

- **3.** (a) How frequency can be measured by sweep method and Lissajous pattern method ? [6]
 - (b) A Wheatstone bridge as shown in below figure, uses a null detector having internal resistance of 50 Ω . Supply voltage to the bridge is 5 V. If the arms of bridge are : Ra = R1 = 560 Ω , Rb = 735 Ω and R2 = 1200 Ω . Calculate current through null detector. [6]



- 4. (a) Define Q and D factors. Explain the significance of these factors. [6]
 - (b) Enlist the advantages of DSO over Analog oscilloscope. [6]
- 5. (a) Draw block diagram of digital rpm meter and explain its operation. [6]
 - (b) Explain with neat diagram, how unknown capacitance is measured by digital capacitance meter ? [7]

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- 6. (a) Define pH. With suitable block diagram, explain how pH can be measured. [7]
 - (b) Draw block diagram of digital thermometer. Explain function of each block. [6]
- 7. (a) Draw the circuit which can convert positive half cycle of triangular wave into positive half cycle of sine wave and explain its working. [6]
 - (b) Explain the function of balanced detector and chopper in X-Y recorder. Enlist the applications of X-Y recorder. [7]

- 8. (a) Differentiate between traditional instruments and virtual instrument. [6]
 - (b) Classify recorders. Draw neat diagram of galvanometric type recorder and explain its operation. [7]

Total No. of Questions-8]

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[5459]-163

S.E. (Instru. and Control) (I Sem.) EXAMINATION, 2018 LINEAR INTEGRATED CIRCUITS (2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

- 2. (a) Discuss why we assume the following assumptions for op-amp derivations : [6]
 - (i) Large signal voltage gain = infinity
 - (ii) Input resistance = infinity
 - (b) State equation for input resistance with feedback, output resistancewith feedback, for a buffer amplifier. [6]
- 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]

- **4.** (*a*) Draw the circuit diagram and with the help of waveforms explain the working of precision full wave rectifier. [6]
 - (b) Write a 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 astable 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]

- 8. (a) Design second order high pass filter at a high cutoff frequency of 1 kHz. [6]
 - (b) Define a filter. Draw the circuit diagram and explain narrow band pass filter. [7]

Total No. of Questions-8]

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[5459]-164

S.E. (Instrumentation & Control) (First Semester) EXAMINATION, 2018 NETWORK THEORY (2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6, Q. Nos. 7 or 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) What is the current in the circuit shown in Fig. 1 ? Determine the voltage across each resistor. [6]





(b) Determine the mesh current i_1 in the circuit as shown in Fig. 2 : [6]



Fig. 2

2. (a) Determine the current in the 5 ohm resistor for the circuit shown in Fig. 3 : [6]





(b) Determine the Thevenin equivalent circuit across AB for the given circuit shown in Fig. 4 : [6]



3. (a) Find the Z parameter for the circuit shown in Fig. 5 : [6]



Fig. 5

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(b) Find the transmission or general circuit parameter for the circuit shown in Fig. 6 : [6]





Or

- 4. (a) For a given $Z_{11} = 3\Omega$, $Z_{12} = 1\Omega$, $Z_{21} = 2\Omega$, $Z_{22} = 1\Omega$, find the admittance matrix and the product Δ_v and Δ_x . [6]
 - (b) Two identical section of the network shown in Fig. 7 are connected in parallel. Obtain the Y parameter of the combination : [6]



Fig. 7

- 5. (a) The driving point impedance of LC network is given by : [8] $Z(s) = s^4 + 4s^2 + 3/(s^3 + 2s).$
 - (b) State properties of RC driving point function. [5]

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- 6. (a) Design a high pass filter having cut-off frequency of 1 kHz with a load resistance of 600 ohm. [8]
 - (b) Design a K-type band pass filter having design impedance of
 500 ohm and cut-off frequency 1 kHz and 10 kHz. [5]
- 7. (a) Find Foster realization of the given function : [8] $Z(s) = \frac{3(s^2 + 1)(s^2 + 16)}{s(s^2 + 9)}.$
 - (b) Design a L type attenuator to operate into a load resistance of 600 ohm with an attenuation of 20 db. [5]

8. (a) Find the two Foster realisation of driving point function is given by : [8]

$$\mathbf{Z}(s) = \frac{10s^4 + 12s^2 + 1}{2s^3 + 2s}.$$

(b) State and explain properties of Hurwitz Polynomials.

[5]

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[5459]-165

S.E. (Instru. & Cont.) (I Sem.) EXAMINATION, 2018

PHOTONICS AND INSTRUMENTATION

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6, Q. No. 7 or Q. No. 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Assume suitable data if necessary.
- (a) Draw electromagnetic spectrum of light and show different ranges in Hz. Give the application of each region. [8]
 - (b) State Maul's law and Brewster law. [4]

- 2. (a) Explain Light Emitting Diode with respect to the following points : [8]
 - (i) Electro luminescent process
 - (ii) Choice of LED materials.

- (b) Explain with neat sketch working construction of Incandescent lamp. [4]
- 3. (a) Define Optical Detector. Give the advantages of Thermal Detector over the Quantum Detectors. [6]
 - (b) List out the optical components. Explain any one in detail.[6]

- 4. (a) What is Quantum detector ? Explain any one types of Quantum detectors. [6]
 - (b) Write a short note on Photo transistor. [6]
- 5. (a) Explain the concept of Material absorption loss, Scattering loss, Bending loss. [7]
 - (b) Explain the following terms of Fiber cable : [6]
 - (i) Acceptance angle
 - (*ii*) Numerical aperture.

Or

- 6. (a) What is wave guiding principle ? Explain the term skew rays. [7]
 - (b) What are different modes used in fiber optics ? Explain with diagram.

| [54] | 159 | 1_1 | 65 |
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- 7. (a) What are the different types of telescopes ? Explain astronomical telescope with diagram. [7]
 - (b) Explain the basic principle of Holography. What are the applications of Holography ? [6]

- 8. (a) Explain with neat sketch OTDR. What are the applications of OTDR ? [7]
 - (b) Explain working principle of Camera with suitable diagram. [6]

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[5459]-166

S.E. (Instru. and Control) (II Sem.) EXAMINATION, 2018 TRANSDUCERS AND SIGNAL CONDITIONING

(2012/2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :- (i) All questions are compulsory.
 - (ii) Neat diagram must be drawn wherever necessary.
 - (*iii*) Figures to the right indicate full marks.
 - (*iv*) Use of Logarithmic tables, electronic pocket calculator and steam table is allowed.
 - (v) Your answer will be valued as a whole.
 - (vi) Assume suitable data if necessary.
- (a) Explain self heating effect in resistive sensors. How this effect is minimized. [7]
 - (b) If it is required to convert binary output into 0 to 5 volt with an resolution of 10 mV determine reference voltage and number of bits of DAC.

What do you mean by excitation ? What are excitations for

2.

(*a*)

| | [,] |
|---|--------|
| (b) Explain the concept of loading in electronic circuit | [5] |
| | |
| 3. (a) Explain capacitive level sensor signal conditioning wit | h neat |
| diagram. | [7] |
| (b) Explain working principle of inductive pickup with | n neat |
| diagram. | [5] |
| Or | |
| 4. (a) Explain Capacitance to frequency converter. | [7] |
| (b) Explain excitation techniques for Inductive sensor. | [5] |
| | |
| 5. (a) Draw and explain the signal conditioning circu | it for |
| phototransistor. | [6] |
| (b) Explain absolute Encoder signal conditioning scheme. | [7] |
| Or | |
| 6. (a) Explain optical pyrometer with a neat diagram. | [7] |
| (b) Explain reflection type optical proximity switch with | n neat |
| diagram. | [6] |
| [5459]-166 2 | |

- 7. (a) Temperature of a plating operation must be measured for control temperature within the range of 500°C to 600°C. Develop a measuring system with J type thermocouple that scales that temp. into 0 to 5 V. Assume ref. junction temperature is 0°C At T1 = 500°C Vth1" = 27.39 mV At T2 = 600°C Vth1 = 33.11 mV.
 - (b) Explain Hall effect sensor principle with a neat diagram. [5]

- 8. (a) Explain signal conditioning of ultrasonic displacement sensor with neat diagram. [7]
 - (b) Explain charge amplifier with neat diagram. [6]

Total No. of Questions—8]

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[5459]-167

S.E. (Instrumentation and Control) (II Semester) EXAMINATION, 2018 SENSORS AND TRANSDUCERS—II

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :- (i) Answer Q. No. 1 or 2, 3 or 4, 5 or 6, 7 or 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Assume suitable data, if necessary.
- (a) Explain the working principle of vortex shedding flowmeter with a neat diagram. [6]
 - (b) Explain radioactive type transducer for the measurement of level with a neat diagram.[6]

Or

- 2. (a) Explain the open channel flow measurement for the measurement of flow with a neat diagram. [6]
 - (b) Explain the working principle of fibre optic level detector with neat diagram. [6]
- **3.** (a) Define the following terms w.r.t. humidity :
 - (i) Absolute Humidity
 - (*ii*) Relative Humidity.

Also explain any one sensor for humidity measurement. [6]

(b) Explain Searle's rotating cylinder for viscosity measurement witha neat sketch diagram. [6]

Or

- 4. (a) With neat sketch explain capacitive proximity sensor. [6]
 - (b) Explain Hydrostatic Head (Air bubbler) for density measurement with neat sketch. [6]
- 5. (a) Explain the following terms : [6]
 - (i) Filtering and impedance matching
 - (*ii*) Divider circuits
 - (iii) Concept of loading.
 - (b) What is the output voltage of a 10-bit DAC with 12 V reference if the input is (20 F)₁₆. What input is needed to get a 6.5 V output ? [7]

- 6. (a) List different blocks of signal conditioning system and explain any *two*. [6]
 - (b) Discuss the different causes that generate error in temperature measurement with RTD. How can these errors be avoided ?
- 7. (a) Explain signal conditioning of LVDT in respect to phase modulation, phase detection. [6]

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(b) Explain principle of working of capacitive level probe and explain any *two* methods to detect change in capacitance with a neat diagram.
 [7]

- 8. (a) Explain block diagram of RTD signal conditioning circuit used for temperature measurement application. [6]
 - (b) Explain the cold junction compensation of thermocouple with a neat diagram.
 [7]

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[5459]-168

S.E. (Instru. & Cont.) (Second Semester) EXAMINATION, 2018 AUTOMATIC CONTROL SYSTEM

(2015 PATTERN)

Time : 2 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.
- 1. (a) Find the transfer function of the following electrical system : [6]



Figure 1 : Electrical Systems

(b) Compare Force Voltage and Force Current Analogy with circuit diagram. [6]

(a) Find overall transfer function of system using block diagram reduction technique : [6]



Figure 2 : Block Diagram Representation of System.

(b) Compare the following : [6]

- 1. Feedback Vs. Feed forward control systems.
- 2. Open loop Control Systems *Vs.* Closed Loop Control systems.
- 3. Linear Vs. Non-linear Control Systems.
- **3.** (a) Find range of K so that system with the following characteristic equation is stable : [4]

$$s(s^2 + s + 1)(s + 4) + K = 0.$$

 $\mathbf{2}$

(b) A system is given by differential equation $\frac{d^2y(t)}{dt^2} + 4\frac{dy(t)}{dt} + 8y(t) = 8x(t), \text{ where } y(t) \text{ is ouput of system } x(t)$ is input. Find transfer function of system and determine all transient domain specification of system. [8]

[5459]-168

- 4. (a) A unity feedback system has open loop transfer function $G(s) = \frac{40(s+2)}{s(s+1)(s+4)}.$ Determine type of system, all static error coefficients. [4]
 - (b) The open loop transfer function of a control system is given as :

$$G(s)H(s) = \frac{K}{(s+1)(s+10)(s+30)}$$
.

Draw the root locus. Determine the value of K for which the system is critically damped and also the value of K for which the system becomes unstable. [8]

5. (a) A unity feedback control system has the transfer function : [4]

$$\mathbf{G}(s) = \frac{\mathbf{K}}{s(s+a)}$$

Find the value of K and a to satisfy the frequency domain specification of $M_r = 1.04$ and $\omega_r = 11.55$ rad/sec.

(b) Draw the Bode plot for a control system having transfer function : [9]

$$\mathbf{G}(s)\mathbf{H}(s) = \frac{250}{s(1+0.4s)(1+0.025s)}$$

Determine from the Bode plot the following :

3

- (a) Gain margin;
- (b) Phase margin;

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- (c) Gain cross-over frequency; and
- (d) Phase cross-over frequency.

- 6. (a) Explain the terms, Gain Crossover Frequency, Phase Crossover
 Frequency, Gain Margin and Phase Margin. [4]
 - (b) Determine the stability of the system using Nyquist criteria whose open-loop transfer function is : [9]

$$\mathbf{G}(s) = \frac{1}{s(s+1)(s+2s)}.$$

7. (a) Obtain transfer function of system whose state model is : [5]

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u \text{ and } y = \begin{bmatrix} 1 & 1 \end{bmatrix} x.$$

(b) Decompose the transfer function $\frac{Y(s)}{U(s)} = \frac{5(s^3 + 5s^2 + 6s)}{(s^3 + 6s^2 + 9s + 4)}$ by cascade decomposition. [8]

- 8. (a) Explain the terms State, State Vector, State Variable and State Space. [4]
 - (b) Decompose the transfer function given below by using parallel decomposition : [9]

$$\frac{\mathbf{Y}(s)}{\mathbf{U}(s)} = \frac{s^3 + 7s^2 + 12s + 8}{s^3 + 6s^2 + 11s + 6}.$$

Total No. of Questions-8]

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| No. | |

[5459]-169

S.E. (Instru. & Cont.) (Second Semester) EXAMINATION, 2018 ELECTRONIC INSTRUMENTATION

(2015 PATTERN)

Time : 2 Hours

Maximum Marks : 50

- - (ii) Figures to the right indicate full marks.
 - (iii) Neat diagrams must be drawn wherever necessary.
 - (iv) Use of calculator is allowed.
 - (v) Assume suitable data, if necessary.
- (a) Draw pulse waveform and explain its characteristics. [6]
 (b) What is meant by RMS ? Explain True RMS meter in detail. [6]

- **2.** (a) Explain frequency synthesis. [6]
 - (b) Explain digital LCRQ meter. [6]
- **3.** (a) Draw the circuit diagram of V to I converter for zero and span adjustment and explain its operation ? [6]
 - (b) Explain sample and hold circuit and draw its input and output waveform. [6]

- **4.** (a) Explain concept of sampling theorem. [6]
 - (b) Draw pin-out of IC CD 4051. Explain it and give application of this IC.
- **5.** (a) Write a note on TDM. [6]
 - (b) With neat block diagram, explain concept of Virtual Instrumentation. [7]

Or

- 6. (a) Explain concept of telemetry for process data. [6]
 - (b) Explain with any suitable example how to use virtual instrumentation system in electronics instrumentation ? [7]
- 7. (a) Draw the block diagram of fundamental suppression type of distortion analyzer and explain the measurement of THD. [7]
 - (b) With neat block diagram, explain swept AF type of spectrum analyzer. [6]

Or

8. (a) With neat block diagram, explain 'FFT Analyzer' ? [6]

Or

(b) With neat block diagram, explain 'Logic Analyzer' ? [7]

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Total No. of Questions—8]

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Maximum Marks : 50

S.E. (Instru. and Control)(II Semester) EXAMINATION, 2018 **DIGITAL TECHNIQUES** (2015 **PATTERN**)

Time : Two Hours

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.
- Figures to the right indicate full marks. (iii)
- Assume suitable data, if necessary. (iv)

Convert the following : 1. (a)[6] $(632)_8$ to decimal (i)(F4C)₁₆ to Decimal (ii) $(68)_{10}$ to Binary. (iii)*(b)* Write a short note on Tristate Buffer in TTL Logic Family.[6] Or 2. Convert the following : [6] (a) $(10110)_2$ to Hexadecimal (i) $(177)_{10}$ to Octal (ii)Find the 2s complements of 00101001. (iii)*(b)* Explain interfacing of TTL-CMOS with a neat sketch. [6] Design the following expression using NOR gate only : [6] 3. (a) $\mathbf{F} = (\mathbf{A} + \mathbf{B} + \mathbf{C}) (\mathbf{A} + \mathbf{B})\mathbf{D}$ Design the following function using DEMUX : (b)[6] F1(A, B, C) = $\Sigma m(0, 3, 7)$ $F2(A, B, C) = \Sigma m(1, 2, 5)$

| 4. | <i>(a)</i> | Convert JK flip-flop to SR flip-flop. | [6] |
|----|--------------|---|-------|
| | (<i>b</i>) | Design Hexadecimal to binary Decoder. | [6] |
| 5. | <i>(a)</i> | Classify memories based on the principle of operation. | List |
| | | various characteristics of memories. | [8] |
| | (<i>b</i>) | Design gray to binary convertor using PLA. | [5] |
| | | Or | |
| 6. | <i>(a)</i> | Explain Programmable Array Logic (PAL) with a neat sketch | h.[8] |
| | (<i>b</i>) | Design Divide by 93 counter using IC 7490. | [5] |
| | | | |
| 7. | <i>(a)</i> | Explain frequency counter with a neat sketch. | [8] |
| | (<i>b</i>) | Explain alarm Announciator with a neat sketch. | [5] |
| | | Or | |
| 8. | <i>(a)</i> | Explain with a neat sketch CPLD. | [8] |
| | (<i>b</i>) | Write a short note on FPGA. | [5] |
| | | | |

Total No. of Questions—8]

[Total No. of Printed Pages-3

| Seat | |
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| No. | |

[5459]-171

S.E. (Instrumentation & Control)

(Second Semester) EXAMINATION, 2018

INDUSTRIAL DRIVES

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Solve Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or 8.
 - (*ii*) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Assume suitable data, if necessary.
 - (v) Use of Logarithmic table, slide rule, electronics pocket calculator and steam table is allowed.
- (a) Draw symbol and VI characteristics of MOSFET. Explain MOSFET operation in detail. [6]
 - (b) Explain single phase full wave bridge controlled rectifier with neat circuit diagram and waveforms. [6]

- Draw symbol and static VI characteristics of IGBT. Give 2. (a)classification of IGBT. [6]
 - Explain the principle and working of PWM chopper. (*b*) [6]
- Explain Fleming's left hand rule and based on Fleming's left 3. (a)hand rule how DC motor operates ? [7]
 - *(b)* Explain principle and working of capacitor start capacitor run [6] motor. Or

- Give classification of stepper motor. Differentiate between variable 4. (a)reluctance and permanent magnet stepper motor. [7]
 - Explain shaded pole motor and give its application. (*b*) [6]
- 5. List two methods of speed and direction control of DC motor. (a)Explain any one in detail. [6]
 - With neat diagram, explain chopper drive for DC motor. [6] (*b*)

- **6**. Explain stepper motor drive in detail. [6] (a)
 - (*b*) Write a short note on half stepping and full stepping of stepper [6] motor.

| [5459] | -171 |
|--------|------|
|--------|------|
| 7. | <i>(a)</i> | Explain speed control method for AC motor. | [6] |
|----|--------------|--|--------|
| | (<i>b</i>) | Explain the working of VFD with a neat diagram and | enlist |
| | | its benefits. | [7] |
| | | | |

| 8. | (a) | Explain | two | contro | ol r | nodes | of | synchronous | motor | with |
|----|--------------|----------|-------|--------|------|-------|------|-------------|-------|------|
| | | diagrams | | | | | | | | [7] |
| | (<i>b</i>) | Write a | short | note | on | Solid | Stat | te Relay. | | [6] |

Total No. of Questions—8]

| Seat | |
|------|--|
| No. | |

[5459]-181

S.E. (Computer) (First Semester) EXAMINATION, 2018 DISCRETE MATHEMATICS

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or 8.
 - (ii) Assume suitable data wherever necessary.
 - (*iii*) Figures to the right indicate full marks.
 - (iv) Draw neat and labelled diagram wherever necessary.
- 1. (a) By using mathematical induction show that : [4] $1 + 2 + 3 + \dots + n = n(n + 1)/2$ for all natural number values of n.
 - (b) Use : [2]
 - p : I will study discrete structure
 - q : I will go to a movie
 - r : I am in a good mood.

Write the English sentence that corresponds to each of the following :

- (i) $\sim r \rightarrow q$
- (ii) ~~ q ~~ h ~~ p
- (*iii*) $q \rightarrow \sim p$
- $(iv) \sim p \rightarrow \sim r.$

(c) Let R = {(1, 4), (2, 1), (2, 5), (2, 4), (4, 3), (5, 3), (3, 2)}
on the set A = {1, 2, 3, 4, 5}. Use Warshall's algorithm to find transitive closure of R. [6]

Or

2. (a) 100 sportsmen were asked whether they play cricket, football or hockey. Out of these 45 play cricket, 21 play football, 38 play hockey, 18 play cricket and hockey, 9 play cricket and football, 4 play football and hockey and 23 play none of these. Find the number of sportsmen who play : [6]
(i) exactly one of the games

(ii) exactly two of the games.

- (b) A = $\{1, 2, 3, 4\}$, B = $\{1, 4, 6, 8, 9\}$; aRb iff b = a^2 . Find the domain, range of R. Also find its relation matrix and draw its diagraph. [6]
- (a) From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are are there on the committee. In how may ways can it be done ?
 - (b) How many 4-letter words with or without meaning, can be formed out of the letters of the word 'LOGARITHMS', if repetition of letters is not allowed ?

[5459]-181

(c) Determine whether the two graphs are isomorphic or not.Explain. [6]



Or

4. (a) Use Dijkstra's algorithm to find the shortest path between A and Z in figure : [6]



(b) If a committee has eight members : [6]

- (i) How many ways can the committee members be seated in a row ?
- (*ii*) How many ways can the committee select a president, vice-president and secretary ?

[5459]-181

5. (a) Find maximum flow in the transport network using labeling procedure. Determine the corresponding min cut : [7]



- (b) Define the following terms : [6]
 - (i) Level and height of a tree
 - (*ii*) Cut points
 - (*iii*) Eccentricity of a vertex.

Or

6. (a) Find minimum spanning tree for the graph shown below using Kruskal's algorithm. [7]



(b) Suppose data items A, B, C, D, E, F, G occur in the following frequencies respectively 10, 30, 5, 15, 20, 15, 5. Construct a Huffman code for the data. What is the minimum weighted path length ?

[5459]-181

- 7. (a) Let $Z_n = \{0, 1, 2, \dots, n 1\}$. In Z_{12} what is the order of 3, 6 and 8. [3]
 - (b) Let $(\mathbf{Q}, *)$ is an Algebraic system. * is a binary operation defined as $a * b = a + b - ab \forall a, b \in \mathbf{Q}$. Determine whether $(\mathbf{Q}, *)$ is a group. [4]

[6]

[6]

- (c) Define :
 - (i) Rings
 - (ii) Integral domain
 - (*iii*) Field.

Or

8. (a) Let $Z_n = \{0, 1, 2, \dots, n-1\}$. Let * be a binary operation such that a * b = remainder of (a + b) divided by n. Construct a table for n = 4. Is $(Z_4, *)$ a monoid, semigroup, group and abelian group. [7]

(b) Define :

- (i) Group code
- (ii) Galois theory
- (iii) Cyclic group.

| Seat | |
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| No. | |

[5459]-182

S.E. (Computer Engineering) (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 drawn wherever necessary.
 - (iii) Assume suitable data, if necessary.

 (a) How will you implement full-adder using half-adder ? Explain the circuit diagram. [6]

- (b) How lockout condition in counter is avoided ? [2]
- (c) Draw and explain Ring counter using JK flip-flop (Timing Diagram is expected). [4]

Or

2. (a) Design full Subtractor using multiplexer IC 74151. [4]

- (b) Compare synchronous and asynchronous counter. [2]
- (c) Simplify the following function using Qunie-McCluskey minimization technique :

$$Y(A, B, C, D) = \Sigma m (0, 1, 2, 3, 5, 7, 8, 9, 11, 14).$$
 [6]

Design an ASM chart for 2-bit UP counter using mode control 3. (a)[6] line. When M = I UP counting When M = 0 remain in same state. *(b)* Implement the following function using PAL : F1(A, B, C, D) = Σm (1, 3, 4, 6, 9, 12, 14) $F2(A, B, C, D) = \Sigma m (1, 2, 3, 7, 12, 15).$ [4](c)Define PLD. Mention different types of PLD. [2]Or Write VHDL code full adder using behavioural style of 4. (a)modeling. [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) Draw three input standard TTL NAND gate and explain its operation. [5]
 - (b) Explain the interfacing of TTL and CMOS : [8]
 - (*i*) CMOS driving TTL
 - (*ii*) TTL driving CMOS.

Or

- 6. (a) Draw and explain wired AND gate in detail. [5]
 - (b) Explain the characteristics of digital IC. [4]
 - (c) Explain with a neat diagram CMOS NOR gate. [4]

[5459]-182

 $\mathbf{2}$

- 7. (a) Explain addressing modes of 8051 with example (any *three*) : [6]
 - (b) List any *eight* applications of microcontroller 8051. [4]
 - (c) Explain the following pins of 8051 : [3]
 - (i) RXD
 - (ii) $\overline{\text{PSEN}}$
 - (*iii*) $\overline{\text{EA}}$.

- 8. (a) State the registers used in Timer/counter operation. Explain TMOD register. [5]
 - (b) Explain the following instructions with respective to microcontroller 8051 and give example of each : [8]
 - (i) MUL
 - (*ii*) L JUMP
 - (iii) SWAP
 - (*iv*) PUSH.

| Seat | |
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| No. | |

[5459]-183

S.E. (Computer Engineering) (I Sem.) EXAMINATION, 2018 DATA STRUCTURES AND 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) Neat diagrams must be drawn wherever necessary.
 - (iii) Assume suitable data, if necessary.

1. (a) Explain static and dynamic data structures with examples. [4]

- (b) What is recurrence relation ? Explain with example. [2]
- (c) Explain the algorithmic strategy of divide and conquer. Explain its application in binary search. [6]

Or

- (a) Write pseudo C/C++ code for reversing a string and state its time complexity. [4]
 - (b) Explain the need for fast transpose of sparse matrix. Comment on its time complexity. [2]
 - (c) Explain two-dimensional arrays with row and column major implementation. Explain address calculation in both cases with example.
 [6]

3. (a) Represent the following using GLL: [3]

(p, q(r, s(u, v), w) (x, y))

- (b) Explain the algorithm for evaluation of a postfix expression with an example. [3]
- (c) Write pseudo C/C++ code to delete a node from a doubly linked list.

Or

- 4. (a) What is backtracking ? Explain the use of stack in backtracking. [4]
 - (b) Compare sequential and linked organisation of data. [2]
 - (c) Write pseudo C/C++ code to perform addition of two polynomials using arrays.

5. (a) Define the following with example : [6]

- (1) Multi-queue
- (2) Dequeue
- (3) Circular queue.
- (b) Explain circular queue using linked list. Write pseudo C code for enqueue operation. [7]

Or

- 6. (a) Write pseudo C/C++ code to perform insert and delete operation on linear queue. [6]
 - (b) Explain priority queue. Write ADT for priority queue and state its applications. [7]

[5459]-183

 $\mathbf{2}$

- 7. (a) What is heap ? Explain heap sort with suitable example. State its complexity. [6]
 - (b) Sort the following numbers using quick sort : [7]
 25, 82, 17, 23, 38, 7, 64, 86, 21
 State its time complexity and space complexity.

- 8. (a) Write pseudo C/C++ code to perform shell sort. State its time complexity. [6]
 - (b) Explain linear search with example. State its time complexity and compare it with binary search. [7]

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-184

S.E. (Computer) (I Semester) 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 side indicate full marks.
 - (*iii*) Use of calculator is allowed.
 - (iv) Assume suitable data if necessary.
- 1. (a) List the elements of Bus Design. Explain any two elements of Bus Design. [6]
 - (b) Using Booth's algorithm multiplies the following : [6]
 Multiplicand = + 22
 Multiplier = -5 [6]

Or

- 2. (a) Draw and explain data flow of floating point addition. [6]
 (b) Explain Direct cache mapping technique with its advantages and disadvantages. [6]
- **3.** (a) What are data transfer modes of DMA ? Explain any *two* in detail. [6]

- (b) Discuss the following I/O mechanisms for transferring data with a neat flowchart : [6]
 - (*i*) Programmed I/O
 - (ii) Interrupt driven I/O

- **4.** (a) What is Machine Instruction ? Explain types of Machine Instructions. [6]
 - (b) Explain the following addressing modes along with suitable example : [6]
 - (i) Direct addressing
 - (ii) Indirect addressing
 - (iii) Displacement addressing mode
- 5. (a) Draw and explain the functional block diagram of 8086. [7]
 - (b) Explain the use of the following registers of 8086 CPU : [6]
 - (i) General purpose registers
 - (ii) Segment Register
 - (iii) Pointer and Index register
 - (iv) Flag Register

- 6. (a) Draw and explain instruction cycle state diagram. [7]
 - (b) Compare superscalar and superpipelined approaches in superscalar processor. [6]

[5459]-184

- (a) Explain the following instruction execution phases with suitable example : [7]
 - (*i*) Fetch the instruction
 - (*ii*) Fetch the operand
 - (*iii*) Execute the instruction
 - (b) Draw and explain Microprogrammed Control Unit. [6]

- 8. (a) Explain in detail the following microinstruction sequencing techniques : [6]
 - (i) Single Address Fields
 - (ii) Variable Address Fields
 - (b) Name the different design methods for hardwired control units.Explain in detail with any one design method. [7]

Total No. of Questions—8]

Seat No.

[5459]-185

S.E. (COMPUTER ENGINEERING) (I Semester) EXAMINATION, 2018 OPERATING SYSTEM AND ADMINISTRATION

(2012 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

1. (a) Explain the structure of the unix with neat diagram. [6]

- (b) Write short notes on the following : [6]
 - (*i*) Context of the process
 - (*ii*) State transitions.

Or

| 2. | (<i>a</i>) | Explain different types of the Kernel. [6] |
|----|--------------|---|
| | (<i>b</i>) | What is the building block primitive ? Explain the types of |

- building block primitives. [6]
- **3.** (a) Explain the following : [6]
 - (*i*) Access control list
 - (ii) File Attributes.

(b) What is bootstrapping ? Explain the different phases of the bootstrapping.[6]

Or

- (a) Explain the PERL loop control statements. [6]
 (b) Explain the file system. What are the different types of the files ? [6]
- 5. (a) Differentiate between program and process. Explain with neat diagram contents of a UNIX process image. [7]
 - (b) Explain access control in UNIX operating system. [6]

Or

- 6. (a) State and explain different signals in UNIX. [6]
 (b) Explain different identifiers like userid, effective userid, saved
 - userid, real userid. [7]
- (a) What are the different levels of the RAID model ? Explain with the help of diagram. [7]
 - (b) Explain the Disk formatting process in detail. [6]

Or

- 8. (a) What is the extended file system ? Explain the different extended file system. [7]
 - (b) Explain the elements of the LVM with the help of diagram. [6]

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[5459]-185
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 $\mathbf{2}$

| Seat | |
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| No. | |

[5459]-186

S.E. (Computer) (I Sem.) EXAMINATION, 2018 OBJECT ORIENTED PROGRAMMING

(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 diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Assume suitable data, if necessary.
- (a) What is dynamic memory allocation ? Explain its use in C++ with a suitable example. [6]
 - (b) What are primitive data types and User defined data types ? [3]
 - (c) What are inline functions ? What are their advantages ? [3]

Or

- 2. (a) Explain the use of explicit and mutable keywords with suitable examples (hint : explicit is used with constructor and mutable is used with data member declaration). [6]
 - (b) Differentiate between compile time polymorphism and run time polymorphism.[6]

- 3. (a) Write a template function that returns the average of all the elements of an array. The arguments to the function should be the array name and the size of the array (type int). In main(), Exercise the function with arrays of type int, long, double and char. [5]
 - (b) How function overloading and function templates are related to each other ? State valid example to justify your answer. [4]
 - (c) What are friend functions and static functions ? [4]

- 4. (a) 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]
 - (b) Explain various arithmetic pointer operations. [4]
 - (c) What is generic programming ? How is it implemented in
 C++ ?
- 5. (a) Write a program that returns the size in bytes of a program entered on the command line : [6]

\$ filesize program.txt

(b) Write a program to create a file, read and write the record into it. Every record contains Employee Name, Id, and Salary. Store and retrieve at least 3 employee data. [7]

[5459]-186

- **6.** (a) Explain the following file handling functions : [10]
 - I. open()
 - II. get()
 - III. getline()
 - IV. seekg()
 - V. tellg()
 - (b) What is a Stream ? Explain types of Streams available in C++. [3]
- 7. (a) State functions of vector STL. Write a program to explain the same. [6]
 - (b) Elaborate advantages and disadvantages of the following Basic Sequence Containers : [6]
 - (a) Vector
 - (b) List.

- 8. (a) Write a program to implement Map using STL. [6]
 - (b) What is the STL ? Why should a C++ programmer be interested in the STL ? What is the design philosophy of the STL ? What are the major components of the STL ? [6]

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-187

S.E. (Computer Engineering) (I/II Semester) EXAMINATION, 2018 **MICROPROCESSOR ARCHITECTURE** (2015/2012 PATTERN)

| Time | e: 2 | Hours Maximum Marks : 5 | 50 |
|--------------|--------------|---|-----|
| <i>N.B</i> . | : (| <i>i</i>) Attempt <i>all</i> questions. | |
| | (<i>i</i> | i) Figures to the right side indicate full marks. | |
| 1. | (<i>a</i>) | Explain segmentation structure of 8086. | 6] |
| | (<i>b</i>) | Explain architecture of 8086. [Or | [6] |
| 2. | (<i>a</i>) | Explain register structure of 80386 with neat diagram. [| 6] |
| | (<i>b</i>) | What is GDT descriptor and LDT descriptor. [| [6] |
| 3. | (<i>a</i>) | Differentiate between shift and rotate instruction. [| 3] |
| | (<i>b</i>) | Explain with example addressing modes of 80386. | 6] |
| | (<i>c</i>) | Explain the following instruction with example : [(1) NOP | 3] |
| | | (2) POPA | |
| | | $\begin{array}{c} (2) & \text{FORM} \\ (3) & \text{XLAT} \end{array}$ | |
| | | Or | |
| 4. | (<i>a</i>) | Explain non-pipelined read cycle with timing diagram. [| [6] |
| | (<i>b</i>) | What are the advantages of pipelined architecture ? [| 3] |
| | (<i>c</i>) | Define macro and explain how macro is call in ALP. [| 3] |
| 5. | (<i>a</i>) | Explain any multicore architecture with neat diagram. [| 5] |
| | (<i>b</i>) | List the advantages of cache memory. | 4] |
| | (<i>c</i>) | What is front side bus and back side bus. | [4] |

| 6. | <i>(a)</i> | Give the features of parallel programming with diagram. | [5] |
|----|--------------|---|------|
| | (<i>b</i>) | Explain software developer viewpoint about multic | core |
| | | architecture. | [4] |
| | (<i>c</i>) | Explain multiprocessing concept in detail. | [4] |
| 7. | (a) | Give the features of SSE. | [4] |
| | (<i>b</i>) | Explain the execution model of SIMD with neat diagram. | [5] |
| | (c) | Explain functional block diagram of microarchitecture code na | ame |
| | | Nehalem. | [4] |
| | | Or | |
| 8. | (<i>a</i>) | Define chip multiprocessing. | [4] |
| | (<i>b</i>) | Draw and explain 64-bit architecture block diagram. | [5] |
| | (c) | Explain different data types of 64-bit architecture. | [4] |
| | | | |

Total No. of Questions-8]

Time : Two Hours

| Seat | |
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| No. | |

[5459]-188

S.E. (Computer Engg.) (II Sem.) EXAMINATION, 2018 MICROPROCESSOR AND INTERFACING TECHNIQUES (2012/2015 PATTERN)

N.B. :- (i) Answer total 4 questions 1 or 2, 3 or 4, 5 or 6, 7 or 8.

- (*ii*) Neat diagram must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
- 1. (a) Draw and explain architecture of i7 processor. [6]
 - (b) Differentiate between .COM and .EXE programs. [3]
 - (c) Explain the following addressing modes with example : [3]
 - (i) Based scaled indexed addressing mode
 - (ii) Direct addressing mode
 - (iii) Register indirect addressing mode.

Or

- (a) Write initialization instruction for 8259 interrupt controller to meet the following specification. Assume port addresses 40H and 41H. [4]
 - (*i*) Interrupt type 64

P.T.O.

Maximum Marks : 50

- (ii) Level triggered, single, ICW₄ needed
- (*iii*) Mask interrupts IR_2 and IR_5
- (b) Write a short note on TSR and PSP. [4]
- (c) Draw and explain write timing diagram of 8086 minimum mode.[4]
- **3.** (a) Draw and explain block diagram of 8255 PPI. [3]
 - (b) Enlist difference between synchronous and asynchronous communication. [3]
 - (c) With proper format explain the following control word of 8279:
 - (i) Display write inhibit/blanking
 - (ii) Keyboard/Display mode set
 - (iii) Write display RAM.

- 4. (a) Draw and explain showing how a DMA controller is interfaced with microprocessor system. [4]
 - (b) Calculate count value to generate square wave of 1 ms with input frequency of 750 kHz using 8253. Design appropriate control word for counter 1. [4]

 $\mathbf{2}$

(c) Define the following terms :

- (*i*) Resolution
- (*ii*) Accuracy
- (iii) Monotonicity
- (*iv*) Conversion time.
- 5. (a) Draw and explain control and status word of 8087. [6]
 - (b) Draw the schematic of 8086 microprocessor operating in maximum mode with all required support chips. Explain working in detail.

Or

- 6. (a) Explain the following instructions of 8087 with example : [3]
 - (i) FSQRT
 - (ii) FLDPI
 - (iii) FPTAN.
 - (b) Explain any four data types of 8087 with proper format. [4]
 - (c) Draw 8086 based minimum mode system interfaced with 4×4 matrix keyboard using 8255 PP1 using port A. Assume the following addresses : Port A—61H, Port B—63H, Port C = 65, CWR = 67H.

[4]

- 7. (a) Write feature of i5 processor. [4]
 - (b) Write a short note on serial ATA Controller and Quick Path Interconnect. [4]
 - (c) Draw and explain block diagram of ICH10 configuration. [5]

- 8. (a) Draw and explain block diagram of Intel i5 processor. [7]
 - (b) Explain the features of 82801 ITR I/O controller hub. [4]

[2]

(c) Draw basic blocks of X58 chipset.

Time : Two Hours

| Seat | |
|------|--|
| No. | |

[5459]-189

Maximum Marks : 50

S.E. (Computer Engineering) (II Sem.) EXAMINATION, 2018 COMPUTER ORGANIZATION

(2012/2015 PATTERN)

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) Differentiate between microprocessor and microcontroller. [6]
 - (b) Multiply the following numbers using Booth's algorithm : [6]
 Multiplicand = +13, Multiplier = 6 (show steps in detail).

Or

- (a) Explain IEEE 488 format for single precision and double precision floating point numbers with example. [6]
 - (b) Explain IAS computer with suitable example. [6]
- 3. (a) Explain the working of multistage pipeline with an example. [6]
 - (b) Divide the following number using restoring division algorithm : [7]
 Dividend 1100 and Divisor 11.

- Explain the communication between processor and coprocessor. [6] Explain the DDR3 memory organization. Compare memory mapped I/O and I/O mapped I/O with merits
- Explain cache mapping techniques with example. *(b)* [6]

[7]

[6]

Or

- 6. Differentiate between UMA and NUMA. [6] (a)
 - *(b)* List out the page replacement algorithm. Explain any one algorithm in detail. [6]
- Explain in detail about IBM Cell Broadband Engine (CBE). [7] 7. (a)
 - Write a short note on the following with an example : [6] (*b*)
 - (i)IA-64 model

and demerits.

AMD Multi-core Opteron. (ii)

Or

- What do you mean by 64-bit architectures ? What are the 8. (a)features of it ? [7]
 - Differentiate between desktop and mobile version of i7 (*b*) [6] processor.

4.

5.

(a)

(*b*)

(a)

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-190

S.E. (Computer Engineering) (II Semester) 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.
- (a) Write Bresenham's line drawing algorithm to draw dotted line. Also explain any *two* advantages of Bresenham's line drawing algorithm over other line drawing algorithm. [6]
 - (b) Write and explain with example Sutherland-Hodgeman line clipping algorithm. [6]

Or

| 2. | (a) | Write | and | explain | Cohen | Sutherland | line | clipping |
|----|-----|----------|-----|---------|-------|------------|------|----------|
| | | algorith | ım. | | | | | [4] |

- (b) Define the following terms : [4]
 - (1) Frame Buffer
 - (2) Aspect Ratio
 - (3) Convex Polygon
 - (4) Concave Polygon.
- (c) Write and explain any one inside test algorithm. [4]

3. Write transformation matrices for : [6] (a)(i)2-D Rotation clockwise direction 2-D Rotation about arbitrary point (ii)2-D reflection wrt X-axis (iii) (iv)3-D rotation about Y-axis 3-D Scaling (v)3-D translation. (vi)(*b*) Explain the following terms with example : [6] (i)Parallel Projection Homogenous coordinates (ii)Segment table. (iii)

Or

- 4. (a) What is inverse transformation ? Explain with an example. [4]
 - (b) Explain the CIE chromaticity diagram. [4]
 - (c) Explain 3-D clipping with an example. [4]
- 5. (a) Write short notes on the following back face removal algorithm : [4]
 - (i) Painter's algorithm
 - (*ii*) Z-buffer.
 - (b) Explain point source illumination and diffused illumination. [5]

(c) Enlist and explain in detail any two shading algorithms. [4]
 [5459]-190 2

| 6. | <i>(a)</i> | Explain Phong Specular reflection model in detail. | [4] |
|----|-------------------|--|------|
| | (<i>b</i>) | Explain BSP tree with its advantages. | [3] |
| | (<i>c</i>) | Write a short note on Phong and Gauraud model. | [6] |
| | | | |
| 7. | <i>(a)</i> | What is fractal ? Explain Hilbert curve in detail. | [4] |
| | (<i>b</i>) | Write a short note on blending function of Bezier curve. | [4] |
| | (c) | What is openGL ? Write any three 3D transformation Funct | tion |
| | | of openGL. | [5] |
| | | | |
| | | Or | |
| 0 | $(\cdot \cdot)$ | Description of NIVIDIA and later in a sector of the | • |

| 8. | (a) | Draw block diagram of NVIDIA workstation and explain it | in |
|----|--------------|---|-----|
| | | brief. | [5] |
| | (<i>b</i>) | Explain Kotch curve and its application in detail. | [4] |
| | (c) | Write a short note on Interpolation and approximation. | [4] |

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-192

S.E. (CE) (Second Semester) EXAMINATION, 2018

ADVANCED DATA STRUCTURES

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer to the questions Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.
 - (ii) Assume suitable data, if necessary.
 - (iii) Draw neat labelled diagram wherever necessary.
 - (iv) Figures to the right indicate full marks.
- (a) Let characters a, b, c, d, e, f have probabilities 0.07, 0.09, 0.12, 0.22, 0.23, 0.27 respectively. Find an optimal Huffman code and draw Huffman tree. What is the average code length ? [6]
 - (b) Write an aigorithm for Preorder traversal of binary tree and give suitable example. [6]

Or

(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 the 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]

- 3. (a) Explain about a skip list with an example. Give applications of skip list. [6]
 - (b) What is hash function ? Enlist characteristics of a good hash function. Explain modulo Division and folding method. [6]

Or

- 4. (a) Construct the AVL tree for the following data by inserting each of the following data item one at a time : [6] 10, 20, 15, 12, 25, 30, 14, 22, 35, 40
 - (b) Explain the following :
 - (i) Static and dynamic tree tables with suitable example. [3]
 - (ii) Dynamic programming with principle of optimality. [3]

[5459]-192

(a) Write an algorithm to arrange numbers in ascending order using heapsort. Arrange the following numbers in ascending order using heapsort : [7]

$$48, 0, -1, 82, 10, 2, 100$$

(b) Construct B+ tree of order 3 for the following data : [7]
1, 42, 28, 21, 31, 10, 17, 7, 31, 25, 20, 18

Or

- 6. (a) Build the min-heap for the following data : [8]
 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.
 - (b) Write short notes on : [6]
 - (i) Red-black tree
 - (*ii*) K-dimensional tree.
- (a) Explain any *three* operations carried out on sequential file.
 Write pseudo code for each these three operations. [6]
 - (b) Explain Linked organization of a file. [6]

Or

- 8. (a) Define sequential file organization. State advantages and disadvantages of sequential file organization. Write pseudo code for insertion of records in sequential file. [6]
 - (b) Explain any two types of indices. [6]

[5459]-192

3

Total No. of Questions—8]

[Total No. of Printed Pages-2

Seat No.

Time : 2 Hours

[5459]-193

Maximum Marks : 50

S.E. (Comp. Engg.) (II Sem.) EXAMINATION, 2018 MICROPROCESSOR

(2015 PATTERN)

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

- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.
- (a) With the help of neat diagram explain how logical address is converted into physical address ? Assume paging mechanism is disabled.
 - (b) Explain any three control transfer instructions of 80386. [6] Or
- (a) Explain how linear address is converted into physical address by 80386 memory management. [6]
 - (b) What is the use of the following instructions in 80386 ? Mention which flags gets effected with each instruction : [6]
 ADC, DIV, CMP
- 3. (a) With the help of suitable diagram, explain how call gate descriptor is used to change the privilege levels in protected mode ? [6]
 - (b) Explain the procedure of handling interrupts in protected mode.[6]

| 4. | <i>(a)</i> | What is the role of TSS in multitasking ? Explain I/O permission |
|----|--------------|--|
| | | bitmap in TSS. [6] |
| | (<i>b</i>) | Draw the format of interrupt gate and trap gate descriptor. |
| | | What is the difference between them ? [6] |
| 5. | (<i>a</i>) | What is the role of DR0 to DR3 registers in debugging ? |
| | | Explain task switch breakpoint. [4] |
| | (<i>b</i>) | What are content of CR0 register after RESET in 80386 ? |
| | | Explain all related bits. [3] |
| | (c) | Explain linear address formation in virtual mode of 80386.[6] |
| | | Or |
| 6. | <i>(a)</i> | Explain any <i>four</i> debugging features of 80386. [4] |
| | (<i>b</i>) | List any three differences between Virtual 86 mode and 8086.[3] |
| | (<i>c</i>) | With the help of neat diagram explain format of DR6 register.[6] |
| 7. | <i>(a)</i> | Compare Pipelined and Non-pipelined bus cycle. [2] |
| | (<i>b</i>) | Explain the following signals of 80386 : [6] |
| | | M/IO#, W/R#, READY# |
| | (c) | Explain the following instructions of 80387 : [5] |
| | | FLD, FSQRT, FLDZ, FBSTP |
| | | Or |
| 8. | <i>(a)</i> | Explain any two instructions used in 80387 to pop data from |
| | | its stack registers. [2] |
| | (<i>b</i>) | With the help of neat diagram, explain the pipelined read bus |
| | | cycle. [6] |
| | (c) | When WAIT state is required in 80386 read bus cycle ? Explain |
| | | with neat diagram. [5] |
| | | |
Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-194

S.E. (Computer Engg.) (Second Semester) EXAMINATION, 2018 PRINCIPLES OF PROGRAMMING LANGUAGES

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) All questions are compulsory.

- (ii) Figures to the right indicate full marks.
- (a) Explain the use of paint(), update() and repaint() methods for applet programming. What is the difference in paint() and repaint() methods ? [7]
 - (b) What are predefined I/O classes ? Show with example how BufferedReader class is used in Java to receive character and a string inputs. [6]

Or

- (a) What is Character Streams and Byte Streams ? State any two examples of each predefined Character and Byte Stream classes for I/O in Java. [7]
 - (b) What is an exception in Java ? What do you mean by handling an exception ? Give example to show the use of try(), Catch() methods.

- 3. (a) What is an Interface ? What is the difference in class and an Interface ? What is use of declaring variables in an interface in Java ? [7]
 - (b) State the difference in compile time and runtime polymorphism.Show how this is implemented in Java for overriding of methods.

4. (a) What is a Constructor ? Show with example the use and overloading of default, parameterized and copy constructor.

[7]

- (b) What is use of a package in Java ? How CLASSPATH helps to store and retrieve the classes ? How is access protection provided for packages ?
 [6]
- 5. (a) What do you mean by reliability of software ? What are qualities of programming expected for reliability ? [6]
 - (b) What is the purpose of checking type compatibility ? Explain various types of compatibility checks. [6]

Or

- 6. (a) What do you mean by Semantics ? Explain the axiomatic semantics with example. [6]
 - (b) Explain by example the use of the following data aggregates to construct compound data types : [6]
 - (1) Powerset
 - (2) Finite Mapping.

- 7. (a) What is advantage of modularity in software design ? How Encapsulation and packaging helps to provide modularity for large programs ?
 [6]
 - (b) What are objects and classes in Java ? State three majorOO programming principles used in Java. [6]

- 8. (a) State and explain four main programming paradigms. Which of these paradigms is used in Ada for programming ? [6]
 - (b) Write a program in Java which reads a matrix of size 3 by 3 and performs the addition of elements in each row and each column. The program prints the each row and column additions.
 [6]

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-195

S.E. (Comp/IT) (II 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) Use of electronic pocket calculator is allowed.
 - (v) Assume suitable data, if necessary.
- 1. (a) Solve any two differential equations : [8]

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

(*ii*)
$$(2x+1)^2 \frac{d^2y}{dx^2} + 2(2x+1)\frac{dy}{dx} + 4y = 4\sin\left[2\log\left(2x+1\right)\right]$$

(*iii*) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$, by using the method of variation

of parameters.

(b) Solve the integral equation : [4]

$$\int_{0}^{\infty} f(x) \sin \lambda x \, dx = e^{-\lambda}, \quad \lambda > 0.$$
P.T.O.

- 2. (a) An electrical circuit consisting of an inductance L, condenser of capacity C is connected in series with applied alternating emf [sin t] at t = 0. Find the current i and charge q at any time t by assuming $w^2 = \frac{1}{LC}$ and $w \neq n$. [4]
 - (b) Solve any one of the following : [4]
 - (i) Obtain $z[K^2]$, $K \ge 0$.

(*ii*) Obtain
$$z^{-1}\left[\frac{6z}{(z+2)(z-4)}\right]$$
, $|z| > 4$, $K \ge 0$.

(c) Solve the difference equation : [4] $x_{K+2} - 3x_{K+1} + 2x_{K} = 0$ where $x_0 = 0, x_1 = 1$ for $K \ge 0$.

- **3.** (a) The first four moments of a distribution about the value 4 are -1.5, 17, -30 and 108. Obtain the first four central moments, β_1 and β_2 . [4]
 - (b) Fit a straight line of the form Y = aX + b to the following data by least squares method : [4]

| X | Y |
|----|----|
| -2 | 17 |
| 1 | 14 |
| 3 | 12 |
| 6 | 9 |
| 8 | 7 |
| 9 | 6 |

 (c) A series of five one day matches is to be played between India and Sri Lanka. Assuming that the probability of India's win in each match as 0.6 and results of all the five matches independent of each other, find the probability that India wins the series.

Or

- 4. (a) The height of a student in a school follows a normal distribution with mean 190 cm and variance 80 cm². Among the 1,000 students from the school, how many are expected to have height above 200 cm ?
 [Given : Z = 1.118, A = 0.3686] [4]
 - (b) In a factory manufacturing 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 at least one defective blade in a consignment of 10,000 packets. [4]
 - (c) For a bivariate data, the regression equation of Y on X is 4x + y = μ and the regression equation of X on Y is 9x + y = λ. Find the values of μ and λ. Also, find the correlation coefficient between X and Y, if the means of X and Y are 2 and -3 respectively. [4]

[5459]-195

5. (a) Find the directional derivative of \$\phi\$ = x²yz + 4xz² at the point (1, -2, 1) in the direction of the vector 2i - j - 2k. [4]
(b) Show that :

F = (y + z)i + (z + x)j + (x + y)k

is irrotational. Hence find the scalar potential ϕ such that $\overline{F} = \nabla \phi.$ [4]

(c) Find the work done in moving a particle in the force field :

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

along the straight line from (0, 0, 0) to (2, 1, 3). [5]

Or

6. (a) Show that (any one) : [4] (i) $\nabla \cdot (\phi \nabla \psi - \psi \nabla \phi) = \phi \nabla^2 \psi - \psi \nabla^2 \phi$

(i)
$$\nabla \cdot (\phi \nabla \psi - \psi \nabla \phi) = \phi \nabla^2 \psi - (ii)$$

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

(b) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2$ at (2, -1, 2) along a line equally inclined with coordinate axes. [4]

$$\int_{C} \overline{F} \cdot d\overline{r} \text{ for } \overline{F} = (2y+3)\overline{i} + xz\overline{j} + (yz-x)\overline{k}$$

along the $x = 2t^2$, y = t, $z = t^3$ from t = 0 to t = 1. [5]

7. (a) Determine the analytic function f(z) = u + iv if $u = 3x^2y - y^3$. [4]

(b) Find the bilinear transformation which maps the points z = 1, i, -1 into the points w = i, 0, -i. [4]
(c) Evaluate :

$$\int\limits_{\mathrm{C}} \; rac{4-3z}{z(z-1)\left(z-2
ight)} \, dz,$$

where C is the circle $|z| = \frac{3}{2}$. [5]

Or

- 8. (a) Determine the analytic function f(z) = u + iv if u = 2x - 2xy. [4]
 - (b) Find the image of the circle |z 1| = 1 in the complex plane under the mapping $w = \frac{1}{z}$. [4]
 - (c) Evaluate :

$$\int_{\mathcal{C}} \frac{3z+4}{z(2z+1)} \, dz,$$

where C is the circle |z| = 1. [5]

| Seat | |
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| No. | |

[5459]-201

S.E. (Information Technology) (I Sem.) EXAMINATION, 2018 DISCRETE STRUCTURES

(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) Draw the neat sketch wherever necessary.
- 1. (a) Suppose license plate contains 2 English letters followed by 4 digits :
 - (*i*) How many different license plates can be manufactured if repetition of letters and digits are allowed ?
 - (ii) How many plates are possible if only the letters are repeated ?[6]
 - (b) 100 of them 120 engineering students in a college take part in at least one of the activity group discussion, debate and quiz. 65 participate in group discussion, 45 participate in debate, 42 participate in quiz, 20 participate in debate and quiz. Find the number of students, who participate in :
 - (*i*) All the three activities.
 - (*ii*) Exactly one of the activities. [6]

2. (a) Out of 5 males and 6 females, a committee of 5 is to form.Find the number of ways in which it can be formed so that among the person chosen in the committee there are :

- (i) Exactly 3 male and 2 female.
- (*ii*) At least 2 male and one female. [6]
- (b) It is known that the university 60% of the professor plays tennis, 50% of them plays football. 70% cricket, 20% plays tennis and football, 30% plays tennis & cricket and 40% plays football & cricket. If someone claimed that 20% of the professor plays tennis, football & cricket would you believe that claim ? Why ?
- 3. (a) Find the transitive closure of the relation R on A = {1, 2, 3, 4} defined by : [6]
 R = {(1, 2), (1, 3), (1, 4), (2, 1), (2, 3), (3, 2), (3, 4), (4, 2), (4, 3)}.
 - (b) Determine, if the following graphs (G1, G2) are having the Hamiltonian circuit or path ? Justify your answer. [6]



4. (*a*) Let

A = $\{1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 18, 24\}$

be ordered by the relation X divides Y (Y divided by X). Show that the relation is a partial ordering and draw Hasse diagram. [6]

(b) Find the shortest path between a - z for the given graph using Dijkstra's algorithm. [6]



5. (a) For the following set of weight construct optimal binary prefix code.

3

$$A = 5, B = 6, C = 6, D = 11, E = 20$$
 [7]

(b) Using Prim's algorithm to find minimum spanning tree. Takea as staring vertex. [6]



6. (a) Construct the labelled tree of the following algebraic expression :

$$(((X + Y) * Z)/3) + (19 + (X * X))$$
[7]

(b) Find the fundamental cutsets of the following graph with respect to given spanning graph : [6]



7. (a) Define the following :

(i) Groupoid

- (ii) Monoid
- (*iii*) Abelian Group. [6]

(b) 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]

Or

8. (a) Show that (G, +8) is an abelian group where :

$$G = \{0, 1, 2, 3, 4, 5, 6, 7\}.$$
 [6]

(b) Show that (F, +, *) is a field where F is set of all rational numbers and + and * are ordinary addition and multiplication operators ?

Total No. of Questions—8]

[Total No. of Printed Pages-2

| Seat | |
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| No. | |

[5459]-202

S.E. (I.T.) (First Semester) EXAMINATION, 2018 COMPUTER ORGANIZATION AND ARCHITECTURE (2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

N.B. :- (i) Answer four questions in all.

- (ii) Neat diagrams must be drawn wherever necessary.
- (*iii*) Figures to the right indicate full marks.
- (iv) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or
 6, Q. Nos. 7 or 8.
- 1. (a) Multiply -7 and -3 using Booth's algorithm. [6]
 - (b) Describe non-restoring division algorithm. [6]

Or

- **2.** (a) What is an instruction cycle ? Explain with state diagram. [6]
 - (b) Write a short note on register organization. [6]
- 3. (a) Draw and explain Hardwired Control Unit. [6]
 (b) Write control sequence by execution of the instruction ADD (R₁), R₂ for single bus architecture. [6]

Or

4. (a) A direct mapped cache has the following parameters : [6] Cache size = 1 K words, Block size = 128 words and main memory size = 64 K words. Specify the number of bits in TAG, BLOCK and WORDS in main memory address.

- (b) Explain K-way set associate mapping techniques with its merits and demerits. [6]
- 5. (a) Describe MIPS architecture with diagram. [7]
 (b) Explain events of fetch cycle of MIPS pipeline. [6]

- 6. (a) Explain types of hazards in pipeline architecture. [6]
 (b) Explain five stage pipelines with data paths and control path for MIPS architecture. [7]
- 7. (a) Explain closely coupled and loosely coupled microprocessor system. [7]
 - (b) Write a short note on Multi-core architecture. [6]

Or

- 8. (a) Write short notes on : [6] (i) NUMA

 - (ii) UMA
 - (*iii*) CC-NUMA.
 - (b) Explain Flynn's taxonomy for multiple processor organization.

[7]

| Seat | |
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| No. | |

[5459]-203

S.E. (IT) (I Sem.) EXAMINATION, 2018 DIGITAL ELECTRONICS AND LOGIC DESIGN (2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer question nos. 1 or 2, 3 or 4, 5 or 6 and 7 or 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Assume suitable data, if necessary.

1. (a) Compare TTL and CMOS logic families. [6]

(b) Minimize the given Boolean expression using Quine-McCuskey method : [6]

F(A, B, C, D) =
$$\Sigma m (0, 1, 3, 7, 8, 9, 11, 15).$$

Or

- 2. (a) Convert the following numbers in Binary form : [6]
 - $(i) \quad (125.12)_{10} = (?)_2$
 - (ii) $(337.025)_8 = (?)_2$
 - (iii) (5DB.FA)₁₆ = (?)₂
 - (b) Implement given function using 8 : 1 MUX and logic gates. [6] $F(A, B, C, D) = \Sigma m (0, 1, 3, 4, 8, 9, 15).$
- **3.** (a) Design and implement T flip-flop using SR flip-flop. [6]
 - (b) Draw state diagram to detect sequence 101 using Moore Modeling and Mealy modeling style. [6]

- 4. (a) Give comparison of Combinational circuit with Sequential circuit. Draw and explain one-bit memory cell using NAND gates. [6]
 - (b) Design sequence generator to generate sequence 1010 using shift register. [6]
- 5. (a) Design and implement given functions F1 and F2 using suitable PAL : [7]

F1(A, B, C) =
$$\Sigma m$$
 (0, 1, 3, 6, 7);
F2(A, B, C) = Σm (1, 2, 4, 6)

(b) Write the comparison of FPGA and CPLD. [6]

Or

- 6. (a) Draw and explain various components used in ASM chart. [6]
 - (b) Implement Full adder circuit using suitable PLA. [7]
- 7. (a) Explain data objects used in VHDL with appropriate examples. [6]
 - (b) Write VHDL code (Entity and Architecture) for Full adder using Behavioural modeling style. [7]

Or

- 8. (a) Explain difference between Sequential statements and Concurrent statements used in VHDL with suitable examples. [6]
 - (b) Write VHDL code for half-adder using structural modeling style. [7]

| Seat | |
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| No. | |

[5459]-204

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

FUNDAMENTALS OF DATA STRUCTURES

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

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

1. (a) Explain dynamic memory allocation functions in C. [4]

- (b) Explain the following with example : [6]
 - (1) Pointer to array
 - (2) Pointer to pointer
 - (3) Array to pointer.
- (c) List and explain the fundamental types in C. [2]

Or

(a) Explain memory allocation, declaration, access and initialization of structure variable with suitable example. [4]

- (b) What is stream ? State the type of stream used in C File handling. [4]
- (c) Explain the ways of parameter passing in C functions. [4]
- **3.** (a) What is Complexity of Algorithm ? Explain the importance of algorithm analysis. [4]
 - (b) Write Pseudo C code of binary search algorithm. [6]
 - (c) Define the following : [2]
 - (1) Data Object
 - (2) Data Structure.

- 4. (a) Write C program to implement Quick Sort and show all passes to sort the following list using quick sort : [6]
 55 85 0 25 40 35 20
 - (b) Explain different asymptotic notations. [6]
- 5. (a) Explain the features of sequential organization in comparison with linked organization. [6]
 - (b) Write Pseudo C code for Sparse matrix simple transpose. [7]

Or

- 6. (a) What do you mean by ordered list ? Explain Sparse matrix as an example of ordered list. [7]
 - (b) Explain representation of polynomial using array and structure with an example.

- 7. (a) Explain the following :
 - (1) Doubly linked list
 - (2) Self-referential structure.
 - (b) Write Pseudo C code for inserting and deleting node of a circular linked list. [7]

[6]

Or

8. (a) Explain GLL and represent the following polynomials using GLL : [7]

 $13 x^{4} + 5x^{3} - 12xy + 9xy^{3} - 20x^{2}y^{4}$

(b) Write C code to evaluate a polynomial term. [6]

| Seat | |
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| No. | |

[5459]-205

S.E. (Information Technology) (I Sem.) EXAMINATION, 2018 PROBLEM SOLVING AND OBJECT ORIENTED PROGRAMMING (2015 PATTERN)

Time : Two HoursMaximum 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 wherever necessary.
 - (*iii*) Figures to the right indicate full marks.
 - (iv) Assume suitable data, if necessary.
- 1. (a) What is cohesion and coupling ? Why are cohesion and coupling important to programmers ? [6]
 - (b) What are operators ? Explain different types of operators. Write precedence of it. [6]

Or

- 2. (a) What are the *three* types of decision logic structure ? Explain with flowchart. [6]
 - (b) Create the algorithm and the flowchart to find the average age of all the students in a class using While/While End. Write pseudo code for same.
 [6]

- **3.** (a) Explain features of object oriented programming in detail. [6]
 - (b) What is friend function ? Give syntax for same. What are properties of friend function ? [6]

- 4. (a) Explain need of operator overloading. Write C++ program to demonstrate any unary operator overloading. [6]
 - (b) How memory management is carried out in C++ ? Write syntax for the same.
- 5. (a) Explain need of function overloading. Write C++ program to demonstrate function overloading. [6]
 - (b) What is inheritance ? What are different types of inheritance ? [7]

Or

- **6.** (a) Explain virtual function and pure virtual function. [6]
 - (b) Explain template in C++. Write a generic function to sort the integer and float array using function template. [7]
- 7. (a) Write a note on Standard Template Library. [6]
 - (b) Which Classes are used in file stream operations ? Explain in detail. [7]

Or

8. (a) Explain Namespaces. What are rules for namespaces ? [6]
(b) How to manage console I/O operations ? Explain with example. [7]

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[5459]-205
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 $\mathbf{2}$

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-206

S.E. (Information Technology) (II Semester) EXAMINATION, 2018 COMPUTER GRAPHICS

(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) Differentiate between Raster scan and Random scan. [6]
 - (b) Interpret Bresenham's algorithm to find which are pixels are turned on for the line segment (1, 2) to (7, 6).

Or

- 2. (a) What are different types of polygon ? How can we test whether the given point is inside the polygon ? [6]
 - (b) Find the transformation of a square ABCD whose center is at (2, 2) is reduced to half of its size with center still remaining at (2, 2). The square ABCD's coordinates are (0, 0), (4, 0), (4, 4), (0, 4). Find the new coordinates.

- **3.** (a) Explain 3D transformation rotation about arbitrary axis. [6]
 - (b) In 2D clipping how are line grouped into visible, invisible and partially visible categories ?

- 4. (a) Explain the ways of projecting 3D object onto 2d Screen in detail. [6]
 - (b) Let ABCD be the rectangle window with A(10, 20), B(100, 20), C(100, 90), D(10, 90). Find the region codes for endpoints and use Cohen Sutherland algorithm to clip the lines P1-P2 with P1(5, 30) and P2(70, 110) and Q1-Q2 with Q1(50, 70) and Q2(80, 30).
- 5. (a) Explain block diagram of i860. [6]
 - (b) Write a note on openGL. [7]

Or

- 6. (a) Explain pseudo C Algorithm for Gourand Shading. [6]
 (b) Explain in detail Graphics memory pipeline. [7]
- 7. (a) What is interpolation ? Explain the process of curvesApproximation. [6]

(b) Explain features of any graphics tool you have used. [7] [5459]-206 2

- 8. (a) Explain algorithm for fractal lines with the example of generation of coastlines. [7]
 - (b) Write short notes on : [6]
 - (i) Fractals and topological dimensions
 - (*ii*) Koch curve.

3

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-207

SE (Inform. Tech.) (Second Semester) EXAMINATION, 2018 PROCESSOR ARCHITECTURE AND INTERFACING

(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) Assume suitable data, if necessary.
- 1. (a) What are addressing modes of 80386 ? Explain any three with example. [6]
 - (b) Explain functionality of BUSY #,W/R#, ADS #, and NA# pins of 80386.

Or

- 2. (a) Which are the different segments registers available in 80386?
 Explain their significance when 80386 is in Real mode and protected mode ? [6]
 - (b) Explain Control Registers CR0 to CR3 of 80386. [6]

- 3. (a) Which are the different ways 80386 can perform Task Switching operation ? Explain Task Switching operation with diagram. [6]
 - (b) Draw architecture diagram of 8051 and explain. [7]

- (a) Explain various registers used in Paging when 80386 is operating in protected mode. [7]
 - (b) Explain the significance of the following instructions of 8051 : [6]
 MOV R0, #20H
 MOVX @DPTR, A
 DJNZ R1, label
- (a) Write 8051 ALP (assembly language program) (with comments) to generate square wave of 2 kHz using internal Timer. Explain the calculations and significance of SFRs used for the same. (Assume Crystal Frequency : 11.092 MHz). [7]
 - (b) Write ALP (assembly language program) (with comments) to send FFH and 00 H data serially using 8051 serial communication mode.

Or

6. (a) Explain vectored interrupts available in 8051 with diagram, their vectored addresses and their priority. How to change the priority of interrupts, explain with the help of Interrupt priority (IP) register.

- (b) Write ALP to configure I/O ports of 8051 for the following configurations using bit/byte addressable instructions : [6]
 - P2.0 to P2.3 to read the data from keyboard and P2.4 to P2.7 to write data to display
 - 2. To generate square wave at P3.0
 - 3. Alternate pins of Port P1 in lnput and Output mode.
- 7. (a) How 8051 is interfaced with LCD ? Explain with diagram and interfacing signals. [6]
 - (b) How temperature sensor is interfaced with 8051 ? Explain with diagram and interfacing signals. [6]

- 8. (a) Draw interfacing diagram of 8051 with ADC. Explain with diagram and interfacing signals. [6]
 - (b) Which are different operating modes of 8255 ? Explain in detail. [6]

Total No. of Questions—8]

[Total No. of Printed Pages-3

Seat No.

[5459]-208

S.E. (I.T.) (II Semester) EXAMINATION, 2018 DATA STRUCTURES AND FILES (2015 PATTERN)

Time : 2 Hours

Maximum Marks : 50

- (ii) Neat diagrams must be drawn wherever necessary.
- (iii) Figures to the right indicate full marks.
- (iv) Assume suitable data, if necessary.

 (a) Convert the following expression from infix to Postfix and Prefix. Make use of appropriate data structure which can be used for conversion. [6]

a. 2 * 3 / (2 – 1) + 5 * 3

(b) Traverse a given tree in Preorder, Inorder and Postorder.[6]



Or

2. (a) Evaluate given expressions : [6] (i) 2 3 * 2 1 - / 5 3 * + (ii) + * 2 / 3 - 2 1 * 5 3

- (b) Explain any *three* applications of stack with appropriate example.[6]
- **3.** (*a*) What is Topological sorting ? Explain it with suitable example.[6]
 - (b) What is hashing ? What are characteristics of good hash function ? Where is hashing applicable ? [6]
 Or
- 4. (a) Apply Kruskal's algorithm to find out Minimum Spanning Tree of given graph. [6]



- (b) Apply max heap sorting technique to sort given data set :[6] 1, 12, 9, 5, 6, 10
- 5. (a) What are the benefits of AVL Tree over BST ? Explain with suitable example. [4]
 - (b) Compare AVL tree and RB tree with different parameters.[6]
 - (c) Write a short note on Splay Trees. [4]

[6]

Or

- 6. (a) What is TBT ? What is advancement in TBT over BT ? Draw any suitable in-ordered TBT and traverse it in Pre-order traversal.
 - (b) Write short notes on :
 - (*i*) B Tree
 - (ii) B+ Tree.

- 7. (a) What primary operations can be performed on files ? Explain all of them w.r.t. file handling. [6]
 - (b) Explain file opening function in C++ with different file opening modes. [6]

- 8. (a) Explain prototype of the following function in C++ with example : [8]
 - (i) seekg
 - (b) seekp
 - (c) tellg
 - (*d*) tellp
 - (b) Differentiate Sequential, Index Sequential and Direct Access file. [4]

Total No. of Questions—3]

[Total No. of Printed Pages-3

| Seat | |
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| No. | |

[5459]-209

S.E. (IT) (Second Semester) EXAMINATION, 2018 FOUNDATIONS OF COMMUNICATION AND COMPUTER NETWORK (2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6, Q. Nos. 7 or 8.
 - (*ii*) Figures to the right indicate full marks.
 - (iii) Assume suitable data, if necessary.
- 1. (a) Draw ISO/OSI model and explain functions of the following layers : [6]
 - (1) Physical
 - (2) Data link
 - (3) Network layer.
 - (b) What is an AM wave ? Derive a mathematical expression for AM wave.

Or

- **2.** (a) Explain different addressing schemes in TCP/IP model. [6]
 - (b) Calculate bandwidth required for FM in which the modulating frequency is 1 kHz and maximum possible deviation is 15 kHz. Assume highest needed sidebands 5. Also calculate bandwidth using Carson's rule ?

- (a) What is meant by Constellation Diagrams ? Draw the Constellation Diagrams for the ASK, PSK, FSK, QPSK and 4-QAM.
 - (b) What is CRC ? Generate the CRC code for message 1101010101. Given generator Polynomial $g(x) = x^4 + x^2 + 1$. [6]

- 4. (a) What is meant by Delta Modulation ? Explain distortions in Delta Modulation. [7]
 - (b) What is meant by Parity check ? Explain two-dimensional Parity check method in detail. [6]
- 5. (a) Compare FDM, TDM and WDM. [6]
 - (b) Draw and explain FHSS modulation techniques. [6]

Or

- 6. (a) Explain in brief ALOHA, slotted ALOHA mentioning efficiency, advantages in each case. [6]
 - (b) Discuss CSMA/CA random access technique. How is collision avoidance achieved in the same ? [6]
- (a) What is meant by switching ? Explain circuit switching in detail with help of three phases, efficiency and delay. [6]
 - (b) Write short notes on : [7]
 - (i) IEEE 802.4 (Token Bus)
 - (ii) IEEE 802.5 (Token Ring).

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 $\mathbf{2}$

- Explain the following physical layer implementation in standard 8. (a)[6] Ethernet :
 - *(i)* 10Base5
 - (ii) 10BaseT
 - (iii) 10BaseF

with respect to media, maximum length and line encoding.

What is purpose of bridges ? Explain types of bridges. Explain (*b*) Frame filtering. Why are bridges called self-learning devices ? c

[7]

| Seat | |
|------|--|
| No. | |

[5459]-211

S.E. (Chemical) (I Semester) EXAMINATION, 2018

CHEMISTRY-I

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :- (i) Answer four questions in all.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (*iii*) Figures to the right indicate full marks.
 - (iv) Assume suitable data, if necessary.
- (a) Derive the integrated rate equation for second order kinetics if initial concentration of reactants are same. Explain the characteristics of second order reaction. [6]
 - (b) Draw and describe molecular orbital diagram and find the bond order for Nitrogen molecule. [6]

Or

- **2.** (a) Draw the resonating structure of : [6]
 - (*i*) Benzaldehyde
 - (*ii*) Nitrobenzene
 - (*iii*) Aniline.
- (b) (i) Define and explain Stark-Einstein law of photochemical reaction. [3]
 - (ii) Show that time required for first order reaction to complete
 99.9% reaction is approximately 10 times its half-life
 period. [3]
- 3. (a) Explain the principle, technique and application of column chromatography. [6]
 - (b) Derive the equation for elevation in boiling point and show it is colligative properties. [4]
 - (c) Explain Berkeley and Hartley method for measurement of osmotic pressure. [3]

| 4. | (a) | Define | and | explain | Henry | and | Raoult's | law. | [6] |
|----|-----|--------|-----|---------|-------|-----|----------|------|-----|
|----|-----|--------|-----|---------|-------|-----|----------|------|-----|

- (b) Explain any two detectors used in gas chromatography. [4]
- (c) Explain the applications of IR spectroscopy. [3]

[6]

5. (a) Predict the product :



 $\mathbf{2}$



$$(iii) \quad C_2H_5 - OH \quad \xleftarrow{75\% \text{ H}_2\text{SO}_4}{140^{\circ}\text{C}} ?$$

(b) Write short notes on :

(*i*)

Favorski rearrangement

(*ii*) Reformatsky reaction.

Or

- 6. (a) Give mechanism of Friedel-Crafts alkylation and give its merits. [6]
 - (b) What are the effects of the following factors on $S_N 1$ and $S_N 2$ reactions ? [6]
 - (i) Nature of solvent
 - (ii) Nature of leaving group
 - (iii) Nature of nucleophile.

7. (a) Give the preparation of the following dyes : [7]

- (*i*) Phenolphthalein
- (*ii*) Methyl orange.

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[6]

- (b) Explain any two methods of synthesis :
 - (*i*) Pyrrole
 - (*ii*) Pyridine.

- 8. (a) Explain classification of dyes on the basis of application. [7]
 - (b) Write a short note on diazotisation and coupling in azo dyes. [6]

[6]

Total No. of Questions-8]

Seat No.

[5459]-212

S.E. (Chemical) (I 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) Assume suitable data, if necessary.
 - (iv) Use of calculator is allowed.
- (a) Draw shear stress shear rate diagram and explain rheological behaviour of different fluid. [6]
 - (b) A pipe continues an oil of specific gravity 0.9 a differential manometer contained at the two points A & B shows a differences in mercury level as 15 cm. Find the difference of pressure at 2 point.

Or

- 2. (a) The density of substance is 2900 kg/m³, calculate its :
 - (1) Relative density
 - (2) Specific volume
 - (3) Specific weight [6]

(b) State and prove
$$P = \frac{[px + py + pz]}{3}$$
. [6]

3. (*a*) Draw a neat sketch and explain the working of venturimeter derive an equation to calculate flow rate by using Venturimeter. [6]

(b) Derive Hagen-Poiseuille Equation, highlighting the assumptions made.[6]

Or

- 4. (a) A 30 cm diameter pipe conveying water, branches into two pipe of diameter 20 cm and 15 cm respectively if the average velocity in 30 cm diameter is 2.5 m/s find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm diameter pipe is 2 m/s. [6]
 - (b) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m calculate the difference of pressure at two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds.
- 5. (a) With suitable example, describe in detail the Reyleigh's Method of dimensional analysis. [7]
 - (b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$, where u is the velocity at a distance y from the plate and u = U at $Y = \delta$, where $\delta =$ Boundary layer thickness. Also calculate the value of $\delta * / \theta$. [6]

Or

- 6. (a) Find the expression for the drag force on smooth sphere of diameter 'D', moving with uniform velocity 'v' in a fluid of density 'ρ' and dynamic viscosity 'μ'. [6]
 - (b) Explain the concept of boundary layer ? [7]

- 7. Explain Buckingham's π -theorem in detail. [6] (a)
 - *(b)* Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by : [7]

$$\frac{u}{v} = 2\left(\frac{y}{\delta}\right) - \left(\frac{y}{\delta}\right)^2$$

[7]

- Define the following :
 - (1) Reynolds' Number
 - (2)Froude's Number
 - (3)Euler's Number
 - Weber's Number (4)
 - Mach's Number (5)
 - Hydraulic Similarities. (6)
 - *(b)* Explain operating characteristic of centrifugal pump? Define [6] pump.

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8.

(a)

3

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-213

S.E. (Chemical) (I Semester) EXAMINATION, 2018 ENGINEERING MATERIALS

(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 table is allowed.
 - (iii) Assume suitable data, if necessary.
- **1.** (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 GPa. [8]

Or

- (a) Draw and explain stress-strain curve for Mild Steel materials. [6]
 (b) Define factor of safety and give its applications. [4]
 - (c) Define the term Hardness. [2]
- 3. (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]

P.T.O.

| 4. | (<i>a</i>) | Write a short note on Brinell hardness test. | [6] |
|----|--------------|--|------|
| | (<i>b</i>) | Write short notes on the following : | [6] |
| | | (i) Carbon nanotubes | |
| | | (<i>ii</i>) Bucky balls. | |
| 5. | Expl | ain principle, construction with diagram and working of Scann | ing |
| | prob | e microscopes. [| [13] |
| | | Or | |
| 6. | Expl | ain principle, construction with diagram and working atomic fo | orce |
| | micr | oscopy. | [13] |
| | | | |
| 7. | (<i>a</i>) | Write a short note on Glass and its types. | [6] |
| | (<i>b</i>) | Explain the term Refractories materials. | [7] |
| | | Or | |
| 8. | Writ | e short notes on (any <i>two</i>) : [| [13] |
| | <i>(a)</i> | Vitrification process | |
| | (<i>b</i>) | Cement material | |
| | (c) | Clays | |

(d) Borosilicate.

Total No. of Questions—8]

| Seat | |
|------|--|
| No. | |

[5459]-214

S.E. (Chemical Engineering) (I Semester) EXAMINATION, 2018 PROCESS CALCULATIONS

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Attempt Q. No. 1 or 2, Q. No. 3 or 4, Q. No. 5 or 6, Q. No. 7 or 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) (i) Convert a volumetric flow rate of 5 m³/s to 1/s. [2]
 - (ii) A solution of caustic soda contains 20% NaOH by weight. The density of the solution is 1.196 kg/l. Find the Normality, Molarity and Molality of the solution. [4]
 - (b) 10000 kg/hr of solution containing 20% methanol is continuously fed to a distillation column. Distillate (Product) is found to contain 98% methanol and waste solution from column carries 1% methanol. All percentage are by weight. [6] Calculate :
 - (i) The mass flow rate of distillate and bottom product and(ii) The percentage loss of methyl alcohol.

| 2. | (a) | (<i>i</i>) | Explain | the | following | : | [3] |
|----|-----|--------------|---------|-----|-----------|---|-----|
|----|-----|--------------|---------|-----|-----------|---|-----|

- (1) Partial pressure
- (2) Vapour pressure
- (3) Average molecular weight.
- (*ii*) State the following laws : [3]
 - (1) Raoult's Law
 - (2) Dalton's Law
 - (3) Amagat's Law.
- (b) A mixture of phenol and water forms two separate liquid phases, one rich in phenol and other rich in water, composition of layers is 70% and 9% (By weight) phenol respectively. If 500 kg of phenol and 700 kg of water are mixed and layer allowed to separate, what will be the weight of two layers ? [6]
- 3. (a) The feed containing 60 mole % A, 30 mole % B and 10 mole % inerts enters a reactor. The product steam leaving the reactor is found to contain 2 mole % A. Reaction takes place as :

$$2A + B \rightarrow C.$$

Find the percentage of Original 'A' getting converted to C.

(b) Calculate the enthalpy change between reactants and products if both are at 298.15 K (25°C) if 60 mole CO₂ is produced according to the following reaction : [6]

 $2C_4H_{10}(s) \ \ \text{+} \ \ 13O_2(g) \ \ \rightarrow \ \ 8CO_2(g) \ \ \text{+} \ \ 10H_2O(l)$

Data :

| Components | ΔH_F^0 KJ / mol at 298.15 K(25°C) |
|--------------------------|---|
| C_4H_{10} | -125.79 |
| CO_2 | -393.51 |
| $10 \text{ H}_2\text{O}$ | -285.83 |

4. (a) Explain :

- (*i*) Conversion
- (*ii*) Yield
- (*iii*) Selectivity
- (iv) Limiting Reactant
- (v) Excess Reactant
- (vi) Stoichiometric ratio.
- (b) When the liquid benzene is completely burned to carbon dioxide and liquid water, the standard heat of combustion is -3267.6kJ/mol. The standard heat of combustion of hydrogen to liquid water is -285.83 kJ/mol. And that of carbon to CO₂ gas is -393.51 kJ/mol. Calculate the standard heat of formation of liquid benzene. [6]
- 5. (a) 10,000 kg of an aqueous solution containing 29.6% (by weight) anhydrous sodium sulfate at 413 K is charged to the crystallizer. During the cooling operation, 5% of the initial water is lost by evaporation and $Na_2SO_4.10H_2O$ is crystallized out. The mother liquor is found to contain 18.3% (by weight) anyhydrous sodium sulfate. Calculate the yield of crystals. [8]

P.T.O.

[6]

- (b) Define :
 - (*i*) Dry bulb temperature
 - (*ii*) Wet bulb temperature
 - (iii) % relative humidity
 - (*iv*) Dew point
 - (v) Humid heat.

- 6. (a) Carbon dioxide contains 0.053 kmol of water vapour per kmol of dry CO₂ gas at temperature of 308 K and pressure of 100 kpa. Calculate : [6]
 - (i) Relative saturation of the mixture
 - (ii) Percentage saturation of the mixture
 - (*iii*) The temperature at which the mixture must be heated in order to achieve the relative saturation of 30%.Data :
 - (1) Vapour pressure of water at 308 K = 5.60 kpa.
 - (2) Vapour pressure of water at 330 K = 16.74 kpa.
 - (b) The dry bulb temperature and dew point of ambient air were found to be 303 K and 289 K respectively. At 100 kpa calculate :
 - (i) The absolute molal humidity
 - (*ii*) The absolute humidity
 - (iii) The % RH
 - (*iv*) % saturation
 - (v) The humid heat
 - (vi) Humid volume.

Data :

- (1) Vapour pressure of water at 289 K = 1.818 kpa.
- (2) Vapour pressure of water at 303 K = 4.243 kpa.

- 7. (a) Write a short note on Orsat analysis. [4]
 - (b) The ultimate analysis of a coal sample is given as carbon :
 61.5%, hydrogen : 3.5%, sulphur : 0.4%, ash : 14.2%, nitrogen : 1.8% and rest is oxygen. [9]
 Calculate :
 - (i) Theoretical oxygen requirement per unit weight of coal kg/kg.
 - (*ii*) Theoretical dry air requirement per unit weight of coal kg/kg.
 - (iii) The Orsat analysis of flue gases when the coal is burned with 90% excess dry air.

- 8. (a) Write a short note on Proximate analysis and Ultimate analysis of coal. [5]
 - (b) Crude oil is found to contained 87.1% carbon, 12.5% Hydrogen and 0.4% sulfur (by weight). [4] Its gross calorific value at 298.15 K is measured to be 45070 kJ/kg oil. Calculate its net calorific value at 298.15 K. Data :

Latent heat of water vapor at 298.15 K = 2442.5 kJ/kg.

(c) The gross heating value of gaseous n-Propanol is 2067.44 kJ/mole at 298 K. Calculate its net heating value in kJ/mole at 298 K. (Given : Latent heat of water vapor at 298 K = 2442.5 kJ/kg).

Total No. of Questions-8]

[Total No. of Printed Pages-3]

Seat No.

[5459]-215

Maximum Marks : 60

S.E. (Chemical) (II Semester) EXAMINATION, 2018 CHEMISTRY—II

(2015 PATTERN)

Time : Two Hours

N.B. :---

(*i*) Neat diagrams must be drawn wherver 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) How does glucose react with : [6]
 - (i) HNO₃
 - (ii) Acetic anhydride
 - (iii) Phenyl hydrazine
 - (b) How does CFT explain the colour of coordination complexes. [6]

Or

- (a) Explain structures of the following on the basis of valence bond theory :
 - (*i*) $[Fe(CN)_6]^{3-}$
 - (ii) [Ni(Co)₄].
 - (b) What are enzymes ? Give the classification of enzymes. [6]

P.T.O.

3. (a) Explain Volhard's method for finding the Cl^- Qty. [5]

- (b) Calculate Molarity and Normality of solution containing 0.5 gmNaOH dissolved in 500 ml solution. [4]
- (c) State importance of catalyst in industrial chemical process. [4]

Or

| 4. | (a) | What is an adsorption isotherm ? Explain the Freund | lich |
|----|--------------|---|------|
| | | isotherm. | [5] |
| | (<i>b</i>) | Give the important properties of zeolites. | [4] |
| | (<i>c</i>) | What is a redox titration ? Explain direct titration with | any |
| | | one example. | [4] |
| | | | |

| 5. | (a) | Explain | geometrical | isomerism | with | an | example. | [6 | 5] |
|----|-----|---------|-------------|-----------|------|----|----------|----|----|
|----|-----|---------|-------------|-----------|------|----|----------|----|----|

- (b) Define the terms : [6]
 - (i) Enantiomer
 - (*ii*) Diastereomer
 - (iii) Racemisation

Or

6. (a) Discuss conformation of butane. [6]

(b) Show with the help of potential energy diagram staggered conformations more favoured over eclipsed conformation of ethane.

| [5459] |]-215 |
|--------|-------|
|--------|-------|

- 7. (a) Describe the synthesis of aspirin and paracetamol. [5]
 - (b) Discuss the types of insecticide formulation. [4]
 - (c) Explain the use of the following compounds as fertilizers : [4]
 - (i) Urea
 - (ii) Ammonia.

| 8. | (a) | Explain with example each term : | [5] |
|----|--------------|---|-----|
| | | (i) Antipyretics | |
| | | (ii) Antibiotics. | |
| | (<i>b</i>) | Write a note on "Potassium fertilizer". | [4] |
| | (c) | Explain the role of plant hormone. | [4] |

Total No. of Questions-8]

| Seat | |
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| No. | |

[5459]-216

SE (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 in permitted.
- 1. (a) Consider a hollow sphere with boundary surface at $r = r_1$ and $r = r_2$ are maintained at temperatures T_1 and T_2 respectively. The thremal conductivity of the cylinder material varies with temperature and is given by $K = K_0 (1 + \alpha T + \beta T^2)$. Derive an expression for the total heat flow rate Q through the sphere. [6]
 - (b) Explain thermal boundary layer. [6]

Or

2. (a) It is necessary to insulate a flat surface so that the rate of heat loss per unit area of this surface does not exceed P.T.O.

450 W/m². The temperature difference across the insulating layer is 400 K. Evaluate the thickness of insulation if : [6]

- (i) The insulation is made up of asbestos cement having a thermal conductivity of 0.11 W/(m.K) and
- (*ii*) The insulation is made up of fire clay having conductivity of 0.84 W/(mK).
- (b) Air at a temperature of 523 K flows over a flat plate 0.3 m wide and 1 m long at a velocity of 8 m/s. If the plate is to be maintained at 351 K, calculate the rate of heat to be removed continuously from the plate. [6] Data : Properties of the air at the mean temperature are : Kinematic Viscosity = $3.90 \times 10^{-4} \text{ m}^2/\text{s}$ Thermal Conductivity = $36.4 \times 10^{-3} \text{ W/(m.K)}$ N_{Pr} = 0.69
- **3.** (a) Explain boiling curve.
 - (b) Calculate the net radiant interchange per square meter for very large planes at temperatures of 903 K and 613 K respectively.
 Assume that the emissivity of the hot and cold planes are 0.95 and 0.85 respectively. [6]

[6]

Or

4. (a) Differentiate between Drop-wise Condensation and Film-wise condensation. [6]

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[5459]-216
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- (b) Two concentric tubes A and B with diameter 30 cm and 25 cm respectively are maintained at temperatures of 813 K and 473 K. The emissivity of tube A is 0.87 and that of B is 0.26 Determine the net heat transfer by radiation between the surface of tubes expressed in watts for each square meter of B.
- 5. (a) Hot oil at a rate of 1.2 kg/s (Cp = 2083 J/(Kg K) flows through a double pipe heat exchanger. It enters at 633 K and leave at 573 K. Cold fluid enters at 303 K and leaves at 400 K. If the overall heat transfer coefficient is 500 W/(m².K). Claculate the heat transfer area for : [8]
 - (i) Parallel Flow and
 - (ii) Counter-Current Flow.
 - (b) Explain Heat transfer in Agitated Vessel. [5]

6. 1-2 shell and tube heat exchanger is to be used to cool introbenzene from 400 K to 317 K with the help of benzene, entering at 300 K and leaving at 333 K. Benzene is flowing at a rate of 20000 kg/h through tubes and the tube side coefficient is 1050 W/m²K. Nitrobenzene is flowing through the shell at a rate of 7250 kg/h the shell inside diameter is 450 mm and fitted with 170 tubes of 19 mm o.d and 15 i.d. and 5 m long. The tubes are arranged

on a 25 mm square pitch. Baffle spacing is 150 mm. fouling factor to be provided is $9 \times 10^{-4} \text{m}^2$.K/W. Check the suitability of this exchanger. [13]

Data :

For nitrobenzene :

Cp = 2.387 kJ/(kg.K), μ = 7.0 × 10⁻⁴ kg(m.s), k = 0.151 W/(m.K). Viscosity correction factor = 1.0 and LMTD Correction factor = 0.90.

- 7. (a) Calculate the boiling point elevation and the driving force for the heat transfer use the following data : Solution boils at temperature of 380 K and the boiling point of water at a pressure in the vapour space is 373 K. Temperature of condensing steam is 399 K.
 - (b) Differentiate between the forward feed and backward feed arrangement for multiple effect evaporator. [6]

Or

8. A solution containing 10% solids is to be concentrated to a level of 50% solids. Steam is available at a pressure of 0.20 MPa (saturation temperature of 393 K). Feed rate to the evaporator is 30000 kg/h the evaporator is working at reduced pressure usch that boiling point is 323 K. The overall heat transfer coefficient is 2.9 kW/(m^2 K). Estimate the steam economy and heat transfer surface for : [13]

(a) Feed introduced at 300 K

(b) Feed introduced at 315 K.

Data :

Specific heat of feed = 3.98 kJ/(kg.K)

Latent heat of condensation of steam at 0.20 Mpa = 2202 kJ/kg Latent heat of vaporisation of water at 323 K (i.e. at pressure in the vapour space = 2383 kJ/kg).

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-217

S.E. (Chemical Engineering) (II Sem.) EXAMINATION, 2018 PRINCIPLES OF DESIGN

(2015 PATTERN)

Time : Two Hours

- Maximum Marks : 50
- **N.B.** :- (i) Figures to the right indicate full marks.
 - (ii) Draw neat figures wherever necessary.
 - (iii) Use of scientific calculators is allowed.
 - (iv) Assume suitable data wherever necessary.
 - (v) Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6 and Q. 7 or Q. 8.
- **1.** Define the following :
 - (1) Poisson's Ratio
 - (2) Modulus of elasticity
 - (3) Creep
 - (4) Fatigue
 - (5) Young's modulus
 - (6) Endurance limit.

[12]

- 2. Write short notes on the following : [12]
 - (1) Principal stresses and planes
 - (2) Torsional shear stress
 - (3) Theories of failure.
- 3. (a) Select a suitable diameter for a solid circular shaft to transmit 150 kW at 180 r.p.m. if the allowable shear stress is 80 MPa and angle of twist is 1° in a length of 3 m. Take $G = 0.82 \times 10^5 \text{ MPa}.$ [5]
 - (b) A shaft 80 mm diameter transmits power at maximum shear stress 60 MPa. Find the length of a 20 mm wide square key to mount on a pulley on the shaft so that normal and shear stress in the key does not exceed 80 MPa and 40 MPa respectively.

Find shear strength of the shaft with keyway using Moore expression and compare it with shear strength of the shaft. [8]

Or

- 4. (a) Explain different types of joints used in the industry. [4]
 - (b) A leather belt weighing 2 kg/m is used to drive a cast iron pulley 800 mm in diameter at 300 r.p.m. If the angle of contact of the belt is spread over 5/12 of the circumference and

maximum tension in belt is 4000 N, find power capacity of the belt :

- (i) Considering the centrifugal tension and
- (ii) Without considering centrifugal tension.

Take coefficient of friction of leather on cast iron as 0.35. [6]

- (c) Define velocity ratio and slip in belt drive : [3]
- **5.** (a) Write short notes on :

[6]

- (1) Pressure vessel code
- (2) Material of construction for low pressure vessels.
- (b) Find the thickness for a tube of internal diameter 100 mm subjected to an internal pressure which is 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 N/mm². Take E = 205 kN/mm² and $\mu = 0.29$. Neglect longitudinal strain. [7]

Or

- 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 × 10³ mm³. Calculate the pressure exerted by the fluid on the shell, taking modulus of elasticity for the material of the shell as 200 KN/mm² and Poisson's ratio as 0.3.
 [5]
 - (b) Differentiate between thick and thin walled pressure vessels. [5]
 - (c) Define pressure vessel. [3]

| 7. | <i>(a)</i> | The | following is the high pressure vesse | 1 s | shell data : [8] |
|----|--------------|------|--------------------------------------|-----|--------------------------------|
| | | (1) | Internal diameter of the shell, pi | : | 300 mm |
| | | (2) | Internal design pressure | : | 150 N/mm^2 |
| | | (3) | External pressure, Po | : | 0.1 N/mm^2 |
| | | (4) | Material of construction | : | High tensile steel |
| | | | | | (Cr, Mo, V) |
| | | (5) | Permissible internal stress | | |
| | | | (based on UTS) | : | 500 N/mm^2 |
| | | (6) | Permissible stress (based on YS), f | : | 700 N/mm^2 |
| | | (7) | Modulus of elasticity | : | $2 \times 10^5 \text{ N/mm}^2$ |
| | | Dete | rmine vessel shell thickness. | | |
| | (7) | | | | 1 641 |

- (b) Explain shrink fit construction in high pressure vessel. [4] Or
- 8. (a) Discuss stresses in thick walled (high pressure) vessels in detail with suitable equations used to design it. [5]
 - (b) Explain mutishell construction in high pressure vessel. [5]
 - (c) Mention pressure range of high pressure vessel and low pressure vessel. [2]

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-218

S.E. (Chemical) (Second Semester) EXAMINATION, 2018 CHEMICAL ENGINEERING THERMODYNAMICS-I

(2015 PATTERN)

Time : Two Hours

Maximum Marks : 50

- N.B. :- (i) Answer Q. Nos. 1 or 2, Q. Nos. 3 or 4, Q. Nos. 5 or 6, Q. Nos. 7 or 8.
 - (ii) Neat diagrams must be drawn wherever necessary.
 - (iii) Figures to the right indicate full marks.
 - (iv) Use of Calculator is allowed.
 - (v) Assume suitable data, if necessary.

SECTION I

- 1. (a) A spherical balloon of 0.5 m diameter contains a gas at 1 bar and 300 K. The gas is heated and the balloon is allowed to expand. The pressure inside the balloon varies linearly with the diameter. What would be the work done by the gas when pressure inside reaches 5 bar ? [6]
 - (b) Explain : [6]
 - (i) State and path function
 - (ii) Phase Rule.

P.T.O.

1 kg of liquid water initially at 273 K, it is heated to 2. (a)373 K (100°C) by contact with a heat reservoir at 373 K (100°C). What is the entropy change of the water of the heat reservoir ? What is total entropy ? [6]

- *(b)* State and prove the Clausius inequality. [6]
- An ideal gas is undergoing a series of three operations : the 3. (a)gas is heated at constant volume from 400 K and 2 bar to pressure of 4 bar. It is expanded in a reversible adiabatic process to a pressure of 2 bar. It is cooled at a constant pressure of 2 bar to 400 K. Calculate Q, W, ΔE and ΔH for each step.

$$C_p = (7/2)^* R$$
 and $C_v = (5/2)^* R$ [9]

Explain PT diagram. *(b)* [3]

Or

| 4. (<i>a</i>) |) Derive the expression for effect of temperature on | standard |
|------------------------|--|----------|
| | heat of reaction. | [8] |
| (b) |) Define : | [4] |
| | (i) The Heat of Reaction | |
| | (ii) The Standard Heat of Reaction | |
| | (iii) The Standard Heat of Formation | |
| | (iv) The Standard Heat of Combustion. | |
| [5459]-21 | 18 2 | |

5. (a) Show that :

$$\mathbf{C}_p - \mathbf{C}_v = \frac{\beta^2 \mathbf{V} \mathbf{T}}{\mathbf{K}}$$

(b) Derive Clausius Clapeyron equation. [5]

Or

6. Derive Maxwell equations.

[13]

- 7. (a) A heat pump is used to heat a house in the winter and to cool it in the summer. During the winter, the outside air serves as a low-temperature heat source; during the summer, it acts as a high-temperature heat sink. The heat transfer rate through the walls and roof of the house is 0.75 kW for each kelvin of temperature difference between the inside and outside of the house, summer and winter. The heat-pump motor is rated, at 1.5 kW. Determine the minimum outside temperature for which the house can be maintained at 293 K (20°C) during the winter and the maximum outside temperature for which the house can be maintained at 298 K (25°C) during the summer.
 - (b) Why is liquefaction of gas needed ? [3]

3

[5459]-218

P.T.O.

[8]

- 8. (a) A refrigeration machine operates at a condenser temperature of 290 K needs 1 kW of power per ton of refrigeration. Determine the following : [7]
 - (i) The coefficient of performance.
 - (ii) The heat rejected to the condenser.
 - (iii) Lowest temperature the system can maintain.
 - (b) Explain Absorption Refrigeration Cycle. [6]

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-219

S.E. (Chemical Engineering) (II Semester) EXAMINATION, 2018 MECHANICAL OPERATION

(2015 **PATTERN**)

Time : Two Hours

Maximum Marks : 50

- **N.B.** :- (i) Attempt Question Nos. 1 or 2, 3 or 4, 5 or 6, 7 or 8. (ii) Figures to the right indicate full marks.
 - (W) Tigaros to the right matcate fair marries.
 - (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 importance of screening in chemical industry. [6]
 - (b) Derive the equation to find area of thickener. [7]

Or

- (a) Explain different factors affecting size of product in ball mill.
 [8]
 - (b) Differentiate between fluidised bed and spouted bed. [5]
- **3.** (a) Explain Cyclone separator with neat diagram also enlist its applications. [6]
 - (b) Describe the types of mixers for paste and plastic mass. [6] P.T.O.

| 4. | <i>(a)</i> | Explain Forth Floatation with a neat diagram. | [4] |
|----|--------------|---|------|
| | <i>(b)</i> | (i) Why are Baffles provided in mixing tank ? | [2] |
| | | (<i>ii</i>) Define Mixing and Agitation and state purpose of Agitat | ion |
| | | in Chemical Process Industries. | [6] |
| | | | |
| 5. | <i>(a)</i> | Enlist the factors affecting the rate of filtration. | [5] |
| | (<i>b</i>) | What is filtration ? Which are two main types ? Explain fact | ors |
| | | to be consider while selecting Filtering Equipment. | [8] |
| | | | |
| | | Or | |
| 6. | <i>(a)</i> | Explain with a neat diagram Plate and Frame filter press. | [8] |
| | (<i>b</i>) | Compare pressure filter and Vacuum Filter. | [5] |
| | | | |
| 7. | <i>(a)</i> | Explain advantages and disadvantages of pneumatic convey | ring |
| | | system. | [6] |
| | | | |

(b) Explain advantages and disadvantages of Belt conveyor and enlist its applications. [6]

Or

- 8. (a) Explain with neat sketch Construction and Screw Conveyors and write its advantages and disadvantages. [8]
 - (b) Write a short note on flight conveyor. [4]

[5459]-219

 $\mathbf{2}$

Total No. of Questions—8]

| Seat | |
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| No. | |

[5459]-220

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, electronic pocket calculator 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*) $(D^2 + 3D + 2)y = \cos(e^x)$
 - (*ii*) $(D^2 2D + 1)y = x e^x \sin x$
 - (*iii*) $x^2 \frac{d^2 y}{dx^2} 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x)$.
 - (b) Find the Fourier cosine transformation for the function : [4]

$$f(x) = x^2, \quad 0 < x < a$$

= 0, $x > a$

P.T.O.

2. (a) A body of weight 9.8 N is suspended from a spring having constant 4 N/m. Prove that the motion is one of resonance if a force $16\sin 2t$ is applied and damping force is negligible and weight is at rest initially in equilibrium position. [4]

(b) Show that Fourier transform of $f(x) = e^{-x^2/2}$ is $e^{-\lambda^2/2}$. [4]

(c) Find
$$f(x)$$
, if $F_s(\lambda) = \frac{1}{\lambda} e^{-a\lambda}$. [4]

[4]

[4]

(*i*) Find Laplace Transform of
$$e^{-at} \int_{0}^{t} \frac{\sin bt}{t} dt$$
.

(*ii*) Find Inverse Laplace Transform of
$$\log\left(\frac{s^2+b^2}{(s-a)^2}\right)$$
.

$$\mathbf{F}(t) = \begin{cases} e^{-4(t-3)} \sin 3(t-3), & t > 3\\ 0, & t < 3 \end{cases}.$$

(c) Find constant m and n such that the surface :

$$mx^2 - 2nyz = (m + 4)x,$$

will be orthogonal to the surface $4x^2y + z^3 = 4$ at a point (1, -1, 2). [4]

(a) Attempt any one : 4.

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

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

(b)Verify whether the following vector field : [4]

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

is irrigational, if so, find corresponding potential ϕ such that $\overline{\mathbf{F}} = \nabla \phi$.

(c)Solve by Laplace Transform method : [4]

$$\frac{d^2y}{dt^2} + y = t,$$

given y(0) = 1, y'(0) = -2.

5. Evaluate : (a)

$$\int_{C} \overline{F} \cdot \overline{dr} \quad \text{for} \quad \overline{F} = x^{2} \,\overline{i} + 2xy \,\overline{j} + z \,\overline{k}$$

3

where C is the straight line joining (1, 0, 2) and (3, 1, 1).

P.T.O.

[5]

(b) Evaluate :

$$\iint_{\mathbf{S}} \overline{r}.\hat{n}ds$$

where S is the closed surface of a sphere of radius 1 with centre at origin.

(c) Apply Stokes theorem to evaluate : [4]

$$\iint_{\mathbf{S}} (\nabla \times \overline{\mathbf{F}}).\hat{n}ds$$

where $\overline{F} = 3(x - y) \overline{i} + 2xz \overline{j} + xy \overline{k}$ and S is the curved surface of the paraboloid, $x^2 + y^2 = 2z$ bounded by the plane z = 2.

6. (a) Find the work done in moving a particle once round the circle $x^2 + y^2 = a^2, z = 0$ under the field of force : [5]

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

(b) Evaluate :

 $\iint_{\mathbf{S}} (\nabla \times \overline{\mathbf{F}}). d\overline{s}$

where $\overline{\mathbf{F}} = (x^2 - yz)\overline{i} - (x - y)\overline{j} + 3(xy)^2\overline{k}$ and S is the curved surface of the cone $z = 2 - \sqrt{x^2 + y^2}$ above the XOY plane.

$$(c)$$
 Show that :

$$\iint_{\mathrm{S}} r\left(\nabla\frac{1}{r^3}\right) \cdot d\overline{s} = \iiint_{\mathrm{V}} \frac{3}{r^4} dv.$$

[5459]-220

[4]

[4]

7. (a) Find the solution of the equation :

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

under the conditions :

(*i*)
$$V(0, t) = 0; \forall t$$

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

$$(iii) \quad \left(\frac{\partial \mathbf{V}}{\partial t}\right)_{t=0} = \mathbf{0}$$

(*iv*)
$$V(x, 0) = (\pi - x)$$
 in $0 \le x \le \pi$.

 (b) A homogeneous rod of conducting material of length 100 cm, has its ends are kept at zero temperature and the initial temperature is :

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

Find the temperature u(x, t) at any time. [6]

Or

8. (a) An infinitely long uniform metal plate is enclosed between the lines y = 0 and y = L for x > 0. The temperature is zero along edges y = 0; y = L and at x = ∞. If the edge x = 0 is kept at a constant temperature u₀. Find the temperature distribution u(x, y).
(b) Use Fourier transform to solve :

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

under the conditions :

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

(ii) u(x, t) is bounded

(*iii*)
$$u(x, 0) = \begin{cases} 1; & 0 \le x \le 1 \\ 0; & x > 1 \end{cases}$$
 [6]