III ME, CV (5)

CBCS Scheme

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15MAT31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Expand $f(x) = x - x^2$ as a Fourier series in the interval $(-\pi, \pi)$. **(08 Marks)**

b. Obtain the half-range cosine series for the function $f(x) = x(l - x)$ in the interval $0 \le x \le l$. **(08 Marks)**

OR

2 a. Obtain the Fourier series of $f(x) = \frac{\pi - x}{2}$ in $0 < x < 2\pi$. Hence deduce that $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \ldots\ldots$. **(06 Marks)**

b. Find the half-range sine series for the function

$$f(x) = \begin{cases} \frac{1}{4} - x & \text{in } 0 < x < 1/2 \\ x - \frac{3}{4} & \text{in } 1/2 < x < 1 \end{cases}.$$ **(05 Marks)**

c. Compute the constant term and the coefficient of the 1st sine and cosine terms in the Fourier series of y as given in the following table:

x:	0	1	2	3	4	5
y:	4	8	15	7	6	2

(05 Marks)

Module-2

3 a. If $f(x) = \begin{cases} 1 - x^2; & |x| < 1 \\ 0; & |x| \ge 1 \end{cases}$. Find the Fourier transform of f(x) and hence find the value of $\int_0^\infty \frac{x\cos x - \sin x}{x^3} dx$. **(06 Marks)**

b. Find the Fourier sine and cosine transform of

$$f(x) = \begin{cases} x, & 0 < x < 2 \\ 0, & \text{elsewhere} \end{cases}.$$ **(05 Marks)**

c. Solve using Z-transform $y_{n+2} - 4y_n = 0$ given that $y_0 = 0$, $y_1 = 2$. **(05 Marks)**

OR

4 a. Obtain the inverse Fourier sine transform of $F_S(\alpha) = \frac{e^{-a\alpha}}{\alpha}$, $a > 0$. **(06 Marks)**

b. Find the Z-transform of $2n + \sin\left(\frac{n\pi}{4}\right) + 1$. **(05 Marks)**

c. If $U(z) = \frac{z}{z^2 + 7z + 10}$, find the inverse Z-transform. **(05 Marks)**

Module-3

5 a. Obtain the coefficient of correlation for the following data:

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

(06 Marks)

b. By the method of least square find the straight line that best fits the following data:

x :	1	2	3	4	5
y :	14	27	40	55	68

(05 Marks)

c. Use Newton-Raphson method to find a root of the equation $\tan x - x = 0$ near $x = 4.5$. Carry out two iterations. **(05 Marks)**

OR

6 a. Find the regression line of y on x for the following data:

x :	1	3	4	6	8	9	11	14
y :	1	2	4	4	5	7	8	9

Estimate the value of y when $x = 10$. **(06 Marks)**

b. Fit a second degree parabola to the following data:

x	0	1	2	3	4
y	1	1.8	1.3	2.5	6.3

(05 Marks)

c. Solve $xe^x - 2 = 0$ using Regula – Falsi method. **(05 Marks)**

Module-4

7 a. From the data given in the following table. Find the number of students who obtained less than 70 marks.

Marks :	0-19	20-39	40-59	60-79	80-99
Number of students :	41	62	65	50	17

(06 Marks)

b. Find the equation of the polynomial which passes through the points (4, -43), (7, 83), (9, 327) and (12, 1053). Using Newton's divided difference interpolation. **(05 Marks)**

c. Compute the value of $\int_{0.2}^{1.4} (\sin x - \log x + e^x)\,dx$ using Simpson's $\frac{3}{8}^{th}$ rule taking six parts.

(05 Marks)

OR

8 a. Using Newton's backward interpolation formula find the interpolating polynomial for the function given by the following table:

x :	10	11	12	13
f(x) :	22	24	28	34

Hence fine f(12.5). **(06 Marks)**

b. The following table gives the premium payable at ages in years completed. Interpolate the premium payable at age 35 completed. Using Lagrange's formula.

Age completed :	25	30	40	60
Premium in Rs. :	50	55	70	95

(05 Marks)

c. Evaluate $\int_{4}^{5.2} \log_e x \; dx$ taking 6 equal strips by applying Waddles rule. **(05 Marks)**

Module-5

9 a. Verify Green's theorem for $\oint (xy + y^2)dx + x^2 dy$ where c is the closed curve of the region bounded by y = x and y = xz. **(06 Marks)**

b. Verify Stoke's theorem for $\vec{F} = (x^2 + y^2)i - 2xy\,j$ taken round the rectangle bounded by the lines x = ±a, y = 0 and y = b. **(05 Marks)**

c. A heavy cable hangs freely under gravity between two fixed points. Show that the shape of the cable is a catenary. **(05 Marks)**

OR

10 a. Use divergence theorem to evaluate $\iint_S \vec{F}\,\hat{n}\,ds$ over the entire surface of the region above XoY plane bounded by the cone $z^2 = x^2 + y^2$, the plane z = 4 where $\vec{F} = 4xz^1\hat{i} + xyz^2\hat{j} + 3z\hat{k}$. **(06 Marks)**

b. Find the extremal of the functional $\int_{x_1}^{x_2} [(y^1)^2 - y^2 + 2y \sec x]dx$. **(05 Marks)**

c. Prove that the shortest distance between two points in a plane is along the straight line joining them. **(05 Marks)**

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CBCS Scheme

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15CV/CT32

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Strength of Materials

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Name and define the four elastic constants. **(06 Marks)**

b. Determine the value of "P" and the total deformation of the stepped bar. Take $E = 2.1 \times 10^5$ N/mm^2. Refer fig.Q1(b). **(10 Marks)**

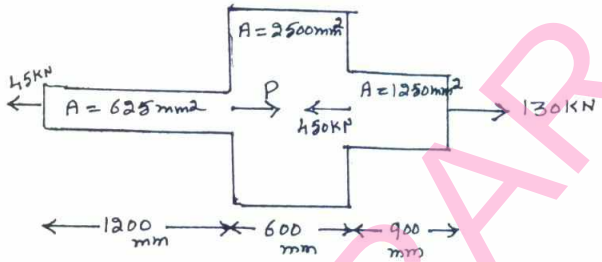


Fig.Q1(b)

OR

2 a. Derive the relationship between Young's modulus and bulk modulus. **(06 Marks)**

b. A steel bar is placed between two copper bars, each having same area and length as the steel bar. These are rigidly connected together at a temperature of 25^{0}C. When the temperature is raised to 325^{0}C, the length of the bar is increased by 1.5mm. Compute the original length and final stresses in each bar. Take $E_{steel} = 210$GPa and $E_{copper} = 100$GPa ; $\alpha_{steel} = 12 \times 10^{-6}/^0$C and $\alpha_{copper} = 17.5 \times 10^{-6}/^0$C. **(10 Marks)**

Module-2

3 a. Explain the procedure to construct Mohr's circle and to find principal stresses and their planes. **(04 Marks)**

b. The stresses acting at a point in a two dimensional stress system is as shown in fig.Q3(b). Determine : i) Principal stresses ii) Normal and tangential stress on the plane AB iii) Maximum shear stress. **(12 Marks)**

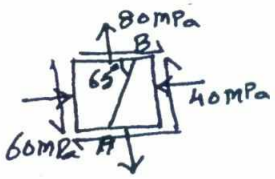


Fig.Q3(b)

OR

4 a. Derive an expression for hoop stress in thin cylinder. **(04 Marks)**

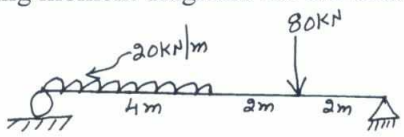
b. Find the thickness of the metal necessary for a steel cylindrical shell of internal dia 150mm to withstand an internal pressure of 50N/mm^2. The maximum hoop stress in the section not to exceed 150N/mm^2. If the thickness is found using the cylinder analysis, what is the percentage error? **(12 Marks)**

Module-3

5 a. Derive the relationship between intensity of load, shear force and bending moment. **(06 Marks)**

b. Draw shear force and bending moment diagrams for the beam shown in fig.Q5(b). **(10 Marks)**

Fig.Q5(b)

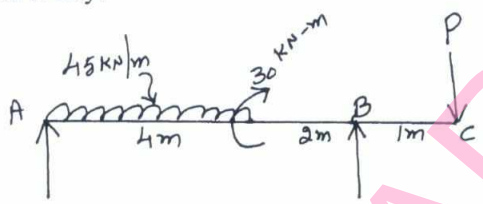


OR

6 a. Define i) Shear force ii) Bending moment and iii) Point of contra flexure. **(03 Marks)**

b. For the beam AC shown in fig.Q6(b), determine the magnitude of the load 'P' acting at C, such that the reaction at supports A and B are equal. Also draw SF and BM diagrams, locate the point of contra flexure if any. **(13 Marks)**

Fig.Q6(b)

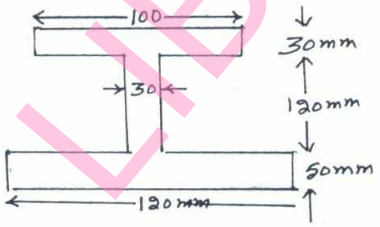


Module-4

7 a. What are the assumptions in bending theory? **(04 Marks)**

b. A beam simply supported at ends and having cross section as shown in fig.Q7(b) is loaded with a udℓ over a span of 8m. The allowable bending stress in tension is 30N/mm^2 and that in compression is 45N/mm^2. Determine the maximum value of udℓ, the beam can carry. **(12 Marks)**

Fig.Q7(b)



OR

8 a. Differentiate between short and long columns. **(04 Marks)**

b. What are the limitations of Euler's theory? **(04 Marks)**

c. A column 6m long has both of its ends fixed and has a timber section of 150mm × 200mm. Determine the crippling load on the column. Take E = 17.5 × 10^3 N/mm^2. **(08 Marks)**

Module-5

9 a. Derive the torsion equation with usual notations. **(08 Marks)**

b. A hollow shaft of external dia 120mm transmits 300KW power at 200rpm. Determine the maximum internal dia, if the maximum shear stress in the shaft is not to exceed 60N/mm^2. **(08 Marks)**

OR

10 a. Explain Maximum Principal Stress theory. **(04 Marks)**

b. A solid circular shaft is subjected to a bending moment of 9000N-m and a twisting moment of 12000 N-m. In a simple uniaxial tensile test of the same material, it gave the following particulars : Stress at yield point = 300N/mm^2 ; E = 200GN/mm^2.
Estimate the least dia required using i) Maximum principal stress theory ii) Maximum shear stress theory. Take FOS = 3 and μ = 0.25. **(12 Marks)**

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CBCS Scheme

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15CV33

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Fluid Mechanics

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. State Newton's law of viscosity and derive the expression. **(04 Marks)**

b. Derive an expression for pressure inside a liquid droplet. **(04 Marks)**

c. Petrol of specific gravity 0.8 flows up through a vertical pipe. A and B are the two points in the pipe, B being 0.3m higher than A. A and B are connected to a u-tube differential manometer containing mercury. If the pressure difference between A and B is 18kPa, find the mercury difference in manometer. **(08 Marks)**

OR

2 a. Distinguish between: i) Simple manometer and differential manometer; ii) Absolute pressure and gauge pressure; iii) Newtonian and non-Newtonian fluids. **(06 Marks)**

b. At a certain point in a fluid the shear stress is 0.216 Pa and the velocity gradient is 0.216/s. If specific gravity of fluid is 0.9, what is the kinematic viscosity? **(04 Marks)**

c. A cube of 0.3m sides and weight 30N slides down an inclined plane sloped at 30° to the horizontal. The plane is covered by an oil of $\mu = 2.3 \times 10^{-3}$ Pas with 0.03mm thickness. Determine the velocity with which the cube slides down. **(06 Marks)**

Module-2

3 a. Derive an expression for total pressure and center of pressure on a vertically immersed plane surface. **(08 Marks)**

b. In a 2D incompressible flow the velocity components are given by $u = x - 4y$ and $v = -y - 4x$. Show that velocity potential exists and determine it. Also find the corresponding stream function. **(08 Marks)**

OR

4 a. A vertical gate closes a circular tunnel of 5m diameter running full of water. The pressure at the bottom of the gate is 1MPa. Determine the hydrostatic pressure force and position of CP on the gate. **(08 Marks)**

b. Explain:
i) Steady and unsteady flows
ii) Streamline and path line
iii) Flownet
iv) Rotational and irrotational flow. **(08 Marks)**

Module-3

5 a. Derive the Bernoulli's equation of motion along the stream tube. **(08 Marks)**

b. A horizontal venturimeter 200mm × 100mm is used to measure the flow of water in a pipe. The pressure at inlet is 17.658N/cm^2 and vacuum pressure at throat is 30cm of mercury. Find the flow rate through the venturimeter if $C_d = 0.98$. **(08 Marks)**

OR

6 a. A cylindrical vessel open at the top is 1m long and 150mm in diameter. It contains water upto a height of 0.8m. The vessel is rotated at 300rpm. Find the depth of parabola formed at the free surface. Also find the maximum speed at which the vessel is to be rotated so that no water spills. **(08 Marks)**

b. A pipe line carrying oil of specific gravity 0.8 changes in diameter from 300mm diameter at position A to 500mm diameter at B which is 5m higher than A. If the pressure at A and B are respectively 20N/cm^2 and 15N/cm^2 and discharge is 150 lps, determine the loss of head and direction of flow. **(08 Marks)**

Module-4

7 a. Prove that the discharge over a triangular notch is $Q = \frac{8}{15} C_d \sqrt{2g} \tan\frac{\theta}{2} H^{5/2}$. **(08 Marks)**

b. Define C_v, C_c and C_d for an orifice. **(03 Marks)**

c. Explain types of nappe. **(05 Marks)**

OR

8 a. Water is flowing in a rectangular channel 1m wide and 0.75m deep. Find the discharge over a rectangular weir of 0.6m crest length. The head over the crest is 200mm, $C_d = 0.62$. Take velocity of approach into consideration and neglect end contraction. **(08 Marks)**

b. Differentiate between: i) Notch and weir; ii) Orifice and mouthpiece. **(04 Marks)**

c. A jet of water issuing from a 25cm diameter orifice under a constant head of 1.5m moves 0.915m vertically before it strikes ground at a distance of 2.288m measured horizontally from the vena-contracta. The discharge was found to be 102 lpm. Calculate C_d, C_v, C_c. **(04 Marks)**

Module-5

9 a. Derive Darcy's equation for head loss through a pipe. **(08 Marks)**

b. Water flowing through a rigid pipe of diameter 500mm with 1.5m/s is suddenly brought to rest. Find the instantaneous pressure rise if $K_{water} = 2GPa$. **(02 Marks)**

c. A compound pipe system consists of 1800m of 0.5m diameter, 1200m of 0.4m diameter and 600m of 0.3m diameter connected in series. Convert the system to,

i) An equivalent length of 0.4m diameter.

ii) An equivalent pipe of 3600m length. **(06 Marks)**

OR

10 a. Derive an expression for instantaneous rise in pressure in an elastic pipe due to sudden closure of a valve. **(08 Marks)**

b. Explain:

i) Hardy-cross method.

ii) Head loss due to sudden expansion. **(08 Marks)**

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CBCS Scheme

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15CV34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Basic Surveying

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define surveying. Enumerate the applications of surveying. **(08 Marks)**

b. A chain was tested before starting the survey and was found to be exactly 20m. At the end of the survey, it was tested again and was found to be 20.12m. Area of the plan of the field drawn to a scale of 1cm = 6m was 50.4cm^2. Find the true area of the field in Sq.m. **(08 Marks)**

OR

2 a. Define Ranging. Explain indirect or reciprocal ranging with sketch. **(08 Marks)**

b. Two stations P and Q on the main survey line were taken on the opposite sides of a pond. On the right of PQ a line PR, 210m long was laid down and another line PS, 260m long was laid down on the left of PQ. The points RQ and QS are 85m and 75m respectively. Compute the length of PQ. **(08 Marks)**

Module-2

3 a. Differentiate between Prismatic compass and surveyors compass. **(06 Marks)**

b. The following bearings were observed while traversing with a compass

Line	FB	BB
AB	45°45′	226°10′
BC	96°55′	277°05′
CD	29°45′	209°10′
DE	324°48′	144°48′

Mention which stations were affected by local attraction and determine the corrected bearing. **(10 Marks)**

OR

4 a. Enumerate the applications of Theodolite **(06 Marks)**

b. Explain the repetition method of measuring the horizontal angle using Transit Theodolite and errors eliminated by that method. **(10 Marks)**

Module-3

5 a. What is meant by balancing of Traverse? Explain the Bowditch method of adjusting the traverse. **(08 Marks)**

b. In a closed traverse ABCDE, the length and bearings of EA has been omitted. Compute the length and bearing of the line EA. **(08 Marks)**

Line	Length (m)	Bearing
AB	204	87°30′
BC	226	20°20′
CD	187	280°0′
DE	192	210°3′
EA	?	?

OR

6 a. Derive the distance and elevation formulae for stadia tachometry, when the staff is held vertical and the line of sight being inclined upwards and downwards. **(06 Marks)**

b. To determine the gradient between two points A and B a tachometer was set up at another station 'C' and the following observations were made, keeping the staff vertical.

Staff at	Vertical angle	Staff reading (m)
A	+4°20′00″	1.300, 1.610, 1.920
B	+0°10′40″	1.100, 1.410, 1.720

If the horizontal angle ACB is 35°20′, determine the average gradient between A and B, K = 100, C = 0.0. **(10 Marks)**

Module-4

7 a. Enumerate the errors in Levelling. **(06 Marks)**

b. The following staff readings were observed successively with level, the instrument having been moved forward after the second, fourth and eighth readings:
0.875, 1.235, 2.310, 1.385, 2.930, 3.125, 4.125, 0.120, 1.875, 2.030, 3.765.
The first reading was taken on a BM of elevation 132.135m. Enter the readings in a level book format and reduce the levels. Apply the usual checks. **(10 Marks)**

OR

8 a. Define sensitiveness of bubble tube. Describe the field procedure to determine the sensitiveness of bubble tube. **(06 Marks)**

b. Find the elevation of the top of the chimney from the following data :

Inst Station	Reading on BM (m)	Angle of elevation	Remarks
A	0.865	18°36′	RL of BM = 421.380m
B	1.225	10°12′	Distance AB = 50m

Stations A, B and top of chimney are in the same vertical plane. Station 'A' is nearer to the chimney. **(10 Marks)**

Module-5

9 a. A series of offsets were taken from a chain line to a curved boundary line at intervals of 15m in the following order.

0, 2.65, 3.80, 3.75, 4.65, 3.60, 4.95, 5.85m.

Compute the area between the chain line, curved boundary and the end offsets by Trapezoidal and Simpson's rule. **(08 Marks)**

b. A railway embankment is 10m wide with side slopes of 1:1.5 (V: H). Assuming the ground to be level in a direction transverse to the centerline, calculate the volume contained in a length of 120m, the centre heights at 20m intervals being in 'm' 2.2, 3.7, 3.8, 4.0, 3.8, 2.8, and 2.5. Compute the volume by Trapezoidal and prismoidal rule. **(08 Marks)**

OR

10 a. Enumerate the characteristics of contours with sketches. **(08 Marks)**

b. Calculate the area of a closed traverse ABCDA by independent co-ordinates method.

Line	Lat	Dep
AB	+108	+4
BC	+15	+249
CD	-123	+4
DA	0	-257

(08 Marks)

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CBCS Scheme

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15CT/CV35

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Geology

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. What is Engineering Geology? Name the modules of Engineering Geology you have studied. Explain the importance of each module. **(08 Marks)**

b. Explain the role Engineering Geology in civil engineering projects. **(08 Marks)**

OR

2 a. Name the physical properties which are helpful to identify the minerals. Explain streak and Fracture of a mineral with suitable examples. **(08 Marks)**

b. With a neat sketch explain the structure and composition of the earth. **(08 Marks)**

Module-2

3 What are igneous rocks? How are they formed? Explain the classification of igneous rocks with suitable examples. Mention the engineering considerations of igneous rocks. **(16 Marks)**

OR

4 a. With a neat sketch, explain the development of folds, joints, faults and unconformities in rocks. **(08 Marks)**

b. Mention the engineering considerations of folds, joints, Faults and unconformities. **(08 Marks)**

Module-3

5 Define weathering. Explain the types of weathering. Add a note on effects of weathering on civil engineering projects. **(16 Marks)**

OR

6 a. Explain Geomorphological aspects in the selection of site for a Dam. **(08 Marks)**

b. What are Landslides? Explain the causes and prevention of landslides. **(08 Marks)**

Module-4

7 a. With a neat sketch explain the Hydrologic cycle. **(06 Marks)**

b. Explain Groundwater exploration by electrical resistivity method. **(10 Marks)**

OR

8 Write a note on :

a. Aquifer and its types

b. Classification of subsurface water

c. Porosity and permeability

d. Specific yield and specific retention **(16 Marks)**

Module-5

9 Write a note on :

a. Applications of Remote sensing
b. Applications of Geographic Information system (GIS)
c. Applications of Global Positioning system (GPS).
d. Uses of Geological maps. **(16 Marks)**

OR

10 Write a note on :

a. Impact of mining on Environment
b. Natural Disaster and their mitigation
c. Definition and uses land sat imageries
d. Impact of Reservoirs on environment. **(16 Marks)**

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CBCS Scheme

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15CV36

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Building Materials and Construction

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Write the requirements of good building stones. **(04 Marks)**

b. Explain the factors causing deterioration of stonework and preservation of stonework. **(06 Marks)**

c. Briefly explain the tests conducted on bricks. **(06 Marks)**

OR

2 a. Write the requirements of good mortar. **(04 Marks)**

b. Briefly explain the tests conducted on fine aggregates.
i) Sieve analysis; ii) Specific gravity test. **(06 Marks)**

c. Briefly explain the importance of size, shape and texture on coarse aggregates. **(06 Marks)**

Module-2

3 a. Write the essential requirements of good foundation. **(04 Marks)**

b. With neat sketches, explain the following types of foundation:
i) Combined footing; ii) Strap footing. **(06 Marks)**

c. With neat sketch, write the features of English bond and Flemish bond. **(06 Marks)**

OR

4 a. Briefly explain classification of stone masonry. **(06 Marks)**

b. With neat sketch, explain various joints provided in stone masonry. **(06 Marks)**

c. Write the advantages of cavity walls. **(04 Marks)**

Module-3

5 a. Define lintel and write the function of lintel. **(04 Marks)**

b. With neat sketch explain various components of a segmental arch. **(06 Marks)**

c. Write the requirements of good floor and factors affecting selection of flooring material. **(06 Marks)**

OR

6 a. Write the requirements of good roof. **(04 Marks)**

b. Write the advantages and disadvantages of flat roof compared to pitched roof. **(06 Marks)**

c. With the help of neat sketch, explain various components of queen post truss. **(06 Marks)**

Module-4

7 a. Explain the following doors with neat sketches:
i) Partly paneled and glazed door; ii) Revolving door. **(06 Marks)**

b. Explain the following windows with neat sketches:
i) Bay window; ii) Corner window. **(06 Marks)**

c. Write the requirements of good stair. **(04 Marks)**

OR

8 a. Briefly explain classification of stairs. **(04 Marks)**

b. Plan a dog legged stair for a building in which the vertical distance between the floors is 3.6mt. The stair hall measures 2.5m × 5m. **(06 Marks)**

c. Write short notes on: i) Shoring; ii) Under pinning. **(06 Marks)**

Module-5

9 a. Write the objectives of plastering and requirement of good plaster. **(06 Marks)**

b. Discuss the defects in plastering. **(06 Marks)**

c. Briefly explain method of applying stucco plastering. **(04 Marks)**

OR

10 a. Briefly explain the methods of damp proofing. **(06 Marks)**

b. Explain in brief defects in painting and constituents of a point. **(06 Marks)**

c. Describe the procedure of painting on new wood work. **(04 Marks)**

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CBCS Scheme

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15MATDIP31

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

1 a. Simplify $\frac{(\cos 3\theta - i\sin 3\theta)^2(\cos 4\theta + i\sin 4\theta)^5}{(\cos\theta + i\sin\theta)^3(\cos 2\theta - i\sin 2\theta)^4}$. **(06 Marks)**

b. Determine λ such that $\vec{a} = \hat{i} + \hat{j} + \hat{k}$, $\vec{b} = 2\hat{i} - 4\hat{k}$ and $\vec{c} = \hat{i} + \lambda\hat{j} + 3\hat{k}$ are coplanar. **(05 Marks)**

c. Find sine angle of two vectors $4\hat{i} + 3\hat{j} + \hat{k}$ and $2\hat{i} - \hat{j} + 2\hat{k}$. **(05 Marks)**

OR

2 a. Express $\frac{1}{2+i} - \frac{(1+i)^2}{3+i}$ in the form a + ib. **(06 Marks)**

b. Find modulus and amplitude of $1 + \cos\theta + i\sin\theta$. **(05 Marks)**

c. If $\vec{a} = 3\hat{i} + 7\hat{j} - 2\hat{k}$, $\vec{b} = 2\hat{i} + 5\hat{j} + 10\hat{k}$ find $(\vec{a} + \vec{b}) \times (\vec{a} - \vec{b})$. **(05 Marks)**

Module-2

3 a. If $y = a\cos(\log x) + b\sin(\log x)$ show that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. **(06 Marks)**

b. With usual notation prove that $\tan\varphi = r\frac{d\theta}{dr}$. **(05 Marks)**

c. If $u = e^{ax+by} f(ax - by)$ prove that $b\frac{\partial u}{\partial x} + a\frac{\partial u}{\partial y} = 2abu$. **(05 Marks)**

OR

4 a. Find n^{th} derivative of $y = e^x \sin 4x \cos x$ **(06 Marks)**

b. Find pedal equation of $r = a(1 + \cos\theta)$. **(05 Marks)**

c. If $u = f(x - y, y - z, z - x)$ show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(05 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi} \sin^5(x/2)dx$. **(06 Marks)**

b. Evaluate $\int_0^{2a} x^2\sqrt{2ax - x^2}\,dx$. **(05 Marks)**

c. Evaluate $\int_0^1 \int_x^{\sqrt{x}} xy\,dy\,dx$. **(05 Marks)**

OR

6 a. Evaluate $\int_0^a \frac{x^3 dx}{\sqrt{a^2 - x^2}}$. **(06 Marks)**

b. Evaluate $\int_0^1 \int_0^{\sqrt{1-y^2}} x^3 y \, dx \, dy$. **(05 Marks)**

c. Evaluate $\int_0^a \int_0^x \int_0^{x+y} e^{x+y+z} \, dz \, dy \, dx$. **(05 Marks)**

Module-4

7 a. A particle moves along the curve c : $x = t^3 - 4t$, $y = t^2 + 4t$, $z = 8t^2 - 3t^3$ where t denotes time. Find velocity and acceleration at $t = 2$. **(06 Marks)**

b. Find unit normal vector to surface $Q = x^2yz + 4xz^2$ at (1, -2, -1). **(05 Marks)**

c. Show that $\vec{f} = (2xy^2 + yz)\hat{i} + (2x^2y + xz + 2yz^2)\hat{j} + (2y^2z + xy)\hat{k}$ is irrotational. **(05 Marks)**

OR

8 a. A particle moves along the curve c : $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where 't' is the time. Find the components of velocity and acceleration at $t = 1$ in the direction $\hat{i} - 3\hat{j} + 2\hat{k}$. **(06 Marks)**

b. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at (2, -1, 2). **(05 Marks)**

c. If $\phi = 2x^3y^2z^4$ find div(gradϕ). **(05 Marks)**

Module-5

9 a. Solve : $\sec^2 x \tan y \, dx + \sec^2 y \tan x \, dy = 0$. **(06 Marks)**

b. Solve : $x^2y \, dx - (x^3 + y^3) \, dy = 0$. **(05 Marks)**

c. Solve : $(y^3 - 3x^2y) \, dx - (x^3 - 3xy^2) \, dy = 0$. **(05 Marks)**

OR

10 a. Solve : $\frac{dy}{dx} = \frac{y}{x} + \sin\left(\frac{y}{x}\right)$. **(06 Marks)**

b. Solve : $(x^2 + y^2 + x)dx + xy \, dy = 0$. **(05 Marks)**

c. Solve : $\frac{dy}{dx} + y \cot x = \cos x$. **(05 Marks)**

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