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10MAT31

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. For the function :

$$f(x) = \begin{cases} x & \text{in} \quad 0 < x < \pi \\ x - 2\pi & \text{in} \quad \pi < x < 2\pi \end{cases}$$

Find the Fourier series expansion and hence deduce the result $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \cdots\cdots$. **(07 Marks)**

b. Obtain the half range Fourier cosine series of the function $f(x) = x(\ell - x)$ in $0 \le x \le \ell$. **(06 Marks)**

c. Find the constant term and first harmonic term in the Fourier expansion of y from the following table :

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(07 Marks)

2 a. Find the Fourier transform of the function :

$$f(x) = \begin{cases} 1 & \text{for} \quad |x| \le a \\ 0 & \text{for} \quad |x| > a \end{cases}$$ and hence evaluate : $\int_0^\infty \frac{\sin x}{x} dx$. **(07 Marks)**

b. Obtain the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx, m > 0$. **(06 Marks)**

c. Solve the integral equation : $\int_0^\infty f(x) \cos px dx = \begin{cases} 1-p, & 0 \le p \le 1 \\ 0, & p > 1 \end{cases}$ and hence deduce the value of $\int_0^\infty \frac{\sin^2 t}{t^2} dt$. **(07 Marks)**

3 a. Obtain the various possible solutions of the two dimensional Laplace's equation $u_{xx} + u_{yy} = 0$ by the method of separation of variables. **(07 Marks)**

b. A string is stretched and fastened to two points 'ℓ' apart. Motion is started by displacing the string in the form $y = a \sin\left(\frac{\pi x}{\ell}\right)$ from which it is released at time t = 0. Show that the displacement of any point at a distance 'x' from one end at time 't' is given by $y(x, t) = a \sin\left(\frac{\pi x}{\ell}\right) \cos\left(\frac{\pi ct}{\ell}\right)$. **(06 Marks)**

c. Obtain the D' Alembert's solution of the wave equation $u_{tt} = c^2 u_{xx}$ subject to the conditions $u(x, 0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = a$. **(07 Marks)**

4 a. For the following data fit an exponential curve of the form $y = a e^{bx}$ by the method of least squares :

x	5	6	7	8	9	10
y	133	55	23	7	2	2

(07 Marks)

b. Solve the following LPP graphically :
Minimize $Z = 20x + 10y$
Subject to the constraints : $x + 2y \leq 40$
$3x + y \geq 30$
$4x + 3y \geq 60$
$x \geq 0$ and $y \geq 0$. **(06 Marks)**

c. Using Simplex method, solve the following LPP :
Maximize : $Z = 2x + 4y$
Subject to the constraints $3x + y \leq 22$
$2x + 3y \leq 24$
$x \geq 0$ and $y \geq 0$. **(07 Marks)**

PART – B

5 a. Using the Regula – Falsi method to find the fourth root of 12 correct to three decimal places. **(07 Marks)**

b. Apply Gauss – Seidal method, to solve the following of equations correct to three decimal places :
$6x + 15y + 2z = 72$
$x + y + 54z = 110$
$27x + 6y - z = 8.5$
(carry out 3 iterations). **(06 Marks)**

c. Using Rayleigh power method, determine the largest eigen value and the corresponding eigen vector, of the matrix A in six iterations. Choose $[1\ 1\ 1]^T$ as the initial eigen vector :

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}.$$ **(07 Marks)**

6 a. Using suitable interpolation formulae, find y(38) and y(85) for the following data :

x	40	50	60	70	80	90
y	184	204	226	250	276	304

(07 Marks)

b. If $y(0) = -12$, $y(1) = 0$, $y(3) = 6$ and $y(4) = 12$, find the Lagrange's interpolation polynomial and estimate y at $x = 2$. **(06 Marks)**

c. By applying Weddle's rule, evaluate : $\int_0^1 \frac{x\,dx}{1+x^2}$ by considering seven ordinates. Hence find the value of $\log_e 2$. **(07 Marks)**

7 a. Using finite difference equation, solve $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = u(4, t) = 0$, $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ upto four time steps. Choose $h = 1$ and $k = 0.5$. **(07 Marks)**

b. Solve the equation $u_t = u_{xx}$ subject to the conditions $u(0, t) = 0$, $u(1, t) = 0$, $u(x, 0) = \sin(\pi x)$ for $0 \le t \le 0.1$ by taking $h = 0.2$. **(06 Marks)**

c. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown. Find the first iterative values of $u_i (i = 1 - 9)$ to the nearest integer. **(07 Marks)**

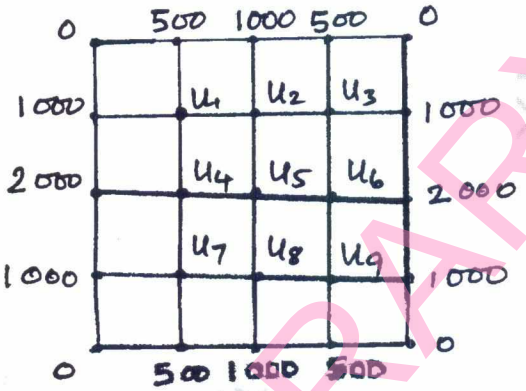

Fig.Q7(c)

8 a. Find the z – transform of $2n + \sin(n\pi/4) + 1$. **(07 Marks)**

b. Obtain the inverse z – transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

c. Using z – transform, solve the following difference equation :
$u_{n+2} + 2u_{n+1} + u_n = n$ with $u_0 = u_1 = 0$. **(07 Marks)**

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10CV32

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Building Materials and Construction Technology

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. What are the requirements of good foundation? **(05 Marks)**
b. Explain with help of sketches various types of foundation. **(05 Marks)**
c. What is meant by combined footing? What do you adopt it? **(05 Marks)**
d. Explain safe bearing capacity of soil and the methods of estimating bearing capacity. **(05 Marks)**

2 a. Compare English bond, Flemish bond and double Flemish bond. **(06 Marks)**
b. Explain classification of stone masonry. **(06 Marks)**
c. Compare brick masonry and stone masonry. **(08 Marks)**

3 a. How do you classify arches? **(06 Marks)**
b. Define lintel. How are they classified according to materials of their construction? **06 Marks)**
Draw a neat sketch of a segmental arch and explain various technical terms used in arch work. **(08 Marks)**

4 a. Explain types of pitched roofs. **(06 Marks)**
b. Factors affecting the choice of a flooring materials, briefly explain. **(06 Marks)**
c. Draw a neat sketch of king-post truss and show the various components. **(08 Marks)**

PART – B

5 a. List the factors affecting the location of doors and windows. **(06 Marks)**
b. Explain types of doors. **(06 Marks)**
c. Write a note on the following : i) Casement windows ii) Louvered windows iii) Bay windows iv) Clear – storey window. **(08 Marks)**

6 a. What are the requirements of a good stair? **(06 Marks)**
b. Explain classification of stairs. **(06 Marks)**
c. Draw plan and section of typical dog legged RCC stair. **(08 Marks)**

7 a. What are the main objectives of plastering? **(05 Marks)**
b. Explain types of plaster finishes. **(05 Marks)**
c. What are the defects in painting? **(04 Marks)**
d. Explain the procedure of painting :
i) Wood surface ii) Plastered surface iii) Iron and steel surface. **(06 Marks)**

8 a. Explain methods of damp proofing. **(06 Marks)**
b. What are the materials used for damp proofing course? **(06 Marks)**
c. What do you understand by under pinning? When do you require it? Explain the pit method of under pinning. **(08 Marks)**

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10CV33

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Strength of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define : (i) Lateral strain (ii) Elastic limit **(04 Marks)**

b. Derive an expression for the deformation of tapering circular bar subjected to axial force. **(08 Marks)**

c. Determine the deformation of circular bar of varying cross section subjected to forces as shown in Fig. Q1 (c). Take E = 210 kN/mm^2. **(08 Marks)**

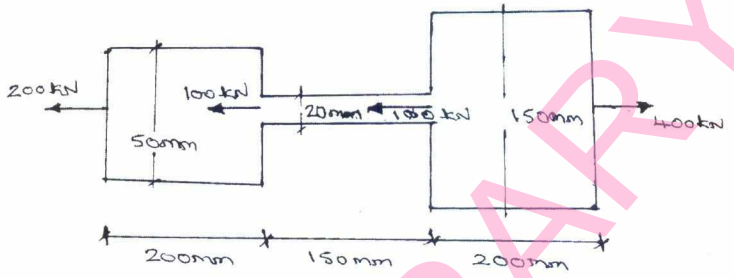

Fig. Q1 (c)

2 a. For a given material E is 100 kN/mm^2 and shear modulus is 40 kN/mm^2. Find the bulk modulus and lateral contraction of round bar of 50 mm diameter and 2.5 m long, when stretched by 2.5 mm. Take $\mu = 0.25$. **(06 Marks)**

b. Write note on temperature stresses. **(04 Marks)**

c. A brass tube 100 mm internal diameter and 10 mm thick is enclosed in a steel tube 120 mm internal diameter and 10 mm thick. Both the tubes are rigidly fixed to each other and carries an axial load of 3000 kN. The tubes are of same length 3 m. Determine the load carried and stress induced in each material. Also determine the amount by which it shortens. $E_S = 200\ kN/mm^2$, $E_B = 100\ kN/mm^2$ **(10 Marks)**

3 a. The stresses on a strained element are as shown in Fig. Q3 (a)

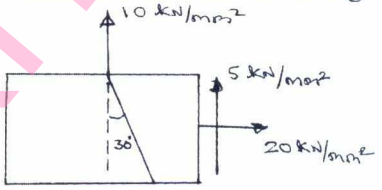

Fig. Q3 (a)

Determine :

i) Stresses when the element is rotated through an angle of 30° as shown.

ii) Principal plane and principal stresses.

iii) Maximum shear stress and their planes. **(14 Marks)**

b. Show that sum of any two orthogonal components of stresses at a point is constant. **(06 Marks)**

4 a. For the Cantilever beam shown in Fig. Q4 (a), obtain SFD and BMD. **(06 Marks)**

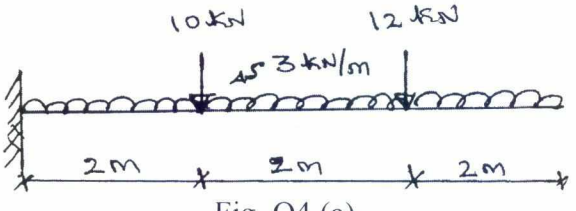

Fig. Q4 (a)

b. Draw SFD and BMD for the beam shown in Fig. Q4 (b). Indicate point of contraflexure if any. **(14 Marks)**

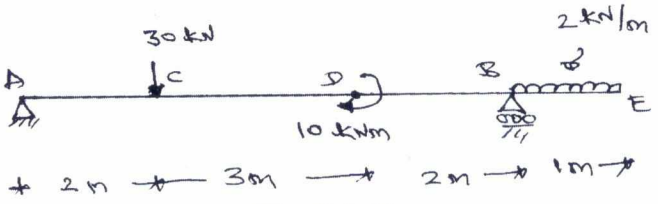

Fig. Q4 (b)

PART – B

5 a. Derive the expression $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ for pure bending. **(08 Marks)**

b. The T-section shown in Fig. Q5 (b) is subjected to a shear force of 100 kN. Draw shear stress distribution diagram and find maximum shear stress. **(12 Marks)**

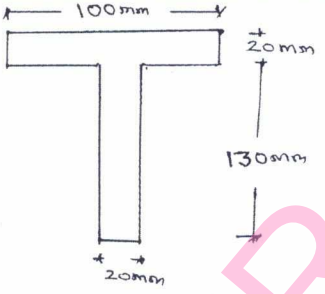

Fig. Q5 (b)

6 a. Derive the Euler-Bernoulli differential equation for flexure. **(06 Marks)**

b. Determine the deflections at free ends and also at centre for the beam of uniform cross section shown in Fig. Q6 (b). Given $E = 210$ kN/mm^2, $I = 40 \times 10^6$ mm^4. **(14 Marks)**

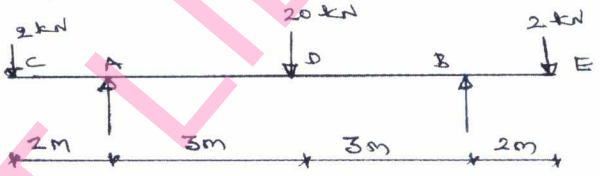

Fig. Q6 (b)

7 a. Prove that a hollow shaft is stronger and stiffer than a solid shaft of same material, length and weight. **(08 Marks)**

b. A solid shaft of circular cross section has to transmit 50 kW at 200 rpm. If the maximum allowable shear stress for the material is 70 N/mm^2, find the diameter of shaft. If the above shaft is to be replaced by a hollow shaft of same length having inside diameter 0.78 times the outer diameter, the material, torque carrying capacity and maximum shear stress being same, find the diameter for the proposed hollow shaft. What is the percentage saving in weight that can be achieved by changing over to hollow shaft? **(12 Marks)**

8 a. List the assumptions made in Euler's theory of columns. **(04 Marks)**

b. Derive an expression for Euler's buckling load for a column with both ends hinged. **(06 Marks)**

c. A hollow cylindrical column with both ends hinged is 6 m long and has an outer diameter of 120 mm and an inner diameter of 80 mm. Compare the crippling load by Euler's and Rankine's formula. What is the length of column if both crippling loads are equal? $E = 80{,}000$ N/mm^2. $\sigma_y = 550$ N/mm^2, Rankine's constant $= \frac{1}{1600}$. **(10 Marks)**

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10CV34

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Surveying – I

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Missing data, if any, may be suitably assumed.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. What are the principles of surveying? Explain. **(10 Marks)**

b. A rectangular plot of land measures 30 cm × 40 cm on a village map drawn to a scale of 100 m to 1 cm. Calculate its area in hectares. If the plot is re-drawn on a topo sheet to a scale of 1 km to 1 cm, what will be its area on the topo sheet? Also determine the R.F. of the scale of the village map as well as on the topo sheet. **(10 Marks)**

2 a. The distance between two stations was measured with a 20 m chain and found to be 1500 m. The same was measured with a 30 m chain and found to be 1476 m. If the 20 m chain was 5 cm too short, what was the error in the 30 m chain? **(10 Marks)**

b. With the aid of neat sketches explain the indirect method for determining horizontal distances applicable to sloping ground. **(10 Marks)**

3 a. Describe how to erect a perpendicular to a chain line from a point on it? **(10 Marks)**

b. Give the possible solutions for surveying area having obstacles to both chaining and ranging. **(10 Marks)**

4 a. Distinguish between whole circle bearing and reduced bearing systems. **(06 Marks)**

b. What do you mean by magnetic dip and magnetic declination? **(04 Marks)**

c. Determine the values of included angles in the closed compass traverse ABCD conducted in the clockwise direction, given the following fore bearings of their respective lines :

LINE	AB	BC	CD	DA
F, B	40°	70°	210°	280°

Apply check. **(10 Marks)**

PART – B

5 a. The following bearings were observed with a compass :

LINE	AB	BC	CD	DE	EA
F, B	74° 0′	91° 0′	166° 0′	177° 0′	189° 0′
B, B	254° 0′	272° 0′	343° 0′	0° 0′	8° 0′

Where do you suspected the local attraction? Find the corrected bearings. **(10 Marks)**

b. What do you mean by closing error? How do you correct it by Bowditch's rule and transit rules? Explain. **(10 Marks)**

6 a. Define the terms :
   i) Bench mark
   ii) MSL
   iii) Turning points
   iv) Fore sight. **(04 Marks)**

   b. Give step by step procedure for temporary adjustments of a dumpy level. **(06 Marks)**

   c. The following staff readings were taken with a level, the instrument having been moved after third, sixth and eight readings.

   2.225, 1.625, 0.985, 2.095, 2.795, 1.265, 0.605, 1.980, 1.045 and 2.685 m.

   Enter the above readings in a page of level book and calculate the RL of points. The first reading was taken on a bench mark of RL 100,000m. Use the rise and fall method. **(10 Marks)**

7 a. The following reciprocal levels were taken with one level

Instrument at	Readings on		Remarks
	A	B	
A	1.564	2.787	Distance AB = 100 m
B	0.436	1.695	RL of A = 190.850 m

   Determine :
   i) True difference in elevation between A and B
   ii) RL of B and
   iii) The collimation error. **(10 Marks)**

   b. Bring about different characteristics of contours. **(10 Marks)**

8 a. What are the methods of plane table surveying? Explain any two from them. **(10 Marks)**

   b. List the limitations of plane table surveying and give advantages of plane table. **(10 Marks)**

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10CV35

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Missing data may be assumed suitably.***

PART – A

1 a. Define the following terms along with symbols and units
i) Mass density ii) Specific weight iii) Specific gravity iv) Viscosity v) Surface tension. **(10 Marks)**

b. Derive an expression for capillary rise and capillary fall with sketches. **(06 Marks)**

c. Calculate the capillary effect in mm in a glass tube 3mm in diameter when immersed in i) Water ii) Mercury. Both the liquids are at 20°C and the values of the surface tensions for water and mercury at 20°C in contact with air are respectively 0.0736 N/m and 0.51 N/m. Contact angle for water is 0° and that of mercury is 130°. **(04 Marks)**

2 a. Define the terms pressure and pressure head. **(04 Marks)**

b. Briefly explain with sketches differential and simple manometers. **(12 Marks)**

c. The left leg of a U-tube mercury manometer is connected to a pipe line carrying water, the level of mercury in the leg being 0.6m below the centre of pipe line, and the right leg is open to atmosphere. The level of mercury in the right leg is 0.45m above that in the left leg and the space above mercury in right leg contains benzene of sp.gr 0.88 to height of 0.3m. Find the pressure head and intensity in the pipe. **(04 Marks)**

3 a. Derive an expression for total pressure and centre of pressure for a inclined plane surface submerged in the liquid. **(10 Marks)**

b. A vertical gate closes a horizontal tunnel 5m height and 3m wide running full with water. The pressure at the bottom of the gate is 196.2kN/m^2. Determine the total pressure on the gate and position of centre of pressure. **(05 Marks)**

c. An annular plate 4m external diameter and 2m internal diameter with its greatest and least depths below the surface of water being 3m and 1.5m respectively. Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure. **(05 Marks)**

4 a. Define and explain briefly the following
i) Velocity potential ii) Stream function. **(08 Marks)**

b. The velocity components of the two dimensional plane motion of a fluid are

$$u = \frac{y^2 - x^2}{(x^2 + y^2)^2} \quad \text{and} \quad V = -\frac{2xy}{(x^2 + y^2)^2}$$

Show that the fluid is incompressible and flow is irrotational. **(08 Marks)**

c. When 2500 litres of water flows per minute through a 0.3m diameter pipe which reduces to a 0.15m diameter pipe, calculate the velocities of flow in the two sections of pipe. **(04 Marks)**

PART – B

5 a. Define kinetic energy correction factor and derive an expression for the same. **(07 Marks)**

b. Define momentum equation. Derive an expression for force exerted by a fluid on a pipe bend. **(08 Marks)**

c. The 250 litres/s of water flowing in a pipe having diameter of 300mm. If the pipe is bent by 135° (i.e change from initial to final direction is 135°), find the magnitude and direction of the resultant force on the bend. The pressure of water flowing is 39.24×10^4 N/m^2 **(05 Marks)**

6 a. Explain :
i) Equivalent pipe ii) Pipe in parallel **(06 Marks)**

b. Explain minor losses. Give expression for head loss due to
i) Sudden expansion ii) Major loss. **(06 Marks)**

c. A valve is provided at the end of a cast iron pipe of diameter 150mm and of thickness 10mm. The water is flowing through the pipe, which is suddenly stopped by closing the valve. Find the maximum velocity of water, when the rise of pressure due to sudden closure of valve is 196.2×10^4 N/m^2. Take K for water as 19.62×10^8 N/m^2 and E for cast iron pipe as 11.772×10^{10} N/m^2. **(08 Marks)**

7 a. Explain briefly with neat sketch, the 'current meter', for measuring velocity in the streams. Give the equation for finding the velocity of flow using 'current meter'. **(08 Marks)**

b. Distinguish between :
i) Point gauge and hook gauge
ii) Weight gauge and float gauge
iii) Self recording gauge and staff gauge **(06 Marks)**

c. A pitot tube is inserted in a pipe of 300mm diameter. The static pressure in the pipe is 10mm of mercury (Vaccum). The stagnation pressure at the centre of the pipe, recorded by the pitot tube is 0.98×10^4 N/m^2. Calculate the rate of flow of water through pipe, if the mean velocity of flow is 0.85 times the central velocity. Take $C_V = 0.98$. **(06 Marks)**

8 a. Derive an expression for the discharge over a triangular notch. **(06 Marks)**

b. Explain with sketches i) Ogee weir ii) Broad crested weir **(06 Marks)**

c. Water is flowing in a rectangular channel of 1m wide and 0.75m deep. Find the discharge over a rectangular weir of crest length 600mm,if the head of water over the crest of weir is 200mm and water from channel flows over the weir. Take $C_d = 0.62$, Neglect end contractions. Take velocity of approach into consideration. **(08 Marks)**

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10CV36

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Applied Engineering Geology

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Write a brief note on the importance and utility of geological studies to civil engineers. **(05 Marks)**

b. Write a neat sketch and describe the different parts of the earth's interior. **(07 Marks)**

c. Write note on any two of the following with mineral examples :
CLEAVAGE ; STREAK ; FRACTURE ; TENACITY. **(04 Marks)**

d. Write the physical properties of any two of the following minerals :
GYPSUM ; CORUNDUM ; MAGNESITE ; HEMATITE. **(04 Marks)**

2 a. Define a rock and write how it is formed. **(02 Marks)**

b. Write the different concordant forms, with a neat diagram. **(06 Marks)**

c. Write about structures in sedimentary rock. **(06 Marks)**

d. What is Metamorphism? Describe the different agents of metamorphism. **(06 Marks)**

3 a. Describe the different types of chemical weathering. **(06 Marks)**

b. Write briefly on thermal weathering and spheroidal weathering. **(05 Marks)**

c. Describe the different drainage patterns of a river basin with diagrams. **(05 Marks)**

d. Write a note on Active dunes. **(04 Marks)**

4 a. What is an Earthquake? Describe how it causes. Write a brief note on earthquake resistant structure. **(06 Marks)**

b. What is Tsunami? Describe briefly the effects. **(04 Marks)**

c. With a neat diagram, write the different depth zones starting from shore. **(05 Marks)**

d. Write briefly about land slides and its remedial measures. **(05 Marks)**

PART – B

5 a. What is an Outcrop? Describe the terms strike and dip with a neat sketch. **(05 Marks)**

b. What is a Fold? Describe with a neat sketch, the different parts of a fold. **(05 Marks)**

c. What are the different tectonic and non – tectonic causes of folding? **(04 Marks)**

d. What is an Unconformity? Describe the different types of unconformities. **(06 Marks)**

6 a. Write a note on dam foundation in upstream dipping beds. **(04 Marks)**

b. Describe the preventive measures of silting of the reservoirs. **(06 Marks)**

c. Write a note on tunneling through the fold axis of an anticline. **(05 Marks)**

d. What are the precautionary measures taken during the construction of highway in a hilly region? **(05 Marks)**

7 a. Describe with a neat diagram, the different zones of vertical distribution of ground water. **(05 Marks)**

b. Describe the selection of sites for well locations and spacing of wells. **(05 Marks)**

c. Write briefly on ground water investigation by electrical resistivity method. **(06 Marks)**

d. Write a note on salt water intrusion and remedial measures. **(04 Marks)**

8 a. What is Remote sensing? Write the principles and its applications in civil engineering with a sketch. **(06 Marks)**

b. Write a brief note on the impact of reservoir on environment. **(06 Marks)**

c. What are the impact of blasting of rocks? **(04 Marks)**

d. What is GIS? How it works? **(04 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Express the following in the form a + ib, $\frac{3}{1+i}-\frac{1}{2-i}+\frac{1}{1-i}$ and also find the conjugate. **(06 Marks)**

b. Show that $(a+ib)^n+(a-ib)^n = 2(a^2+b^2)^{n/2}\cos(n\tan^{-1}(b/a))$. **(07 Marks)**

c. Find the fourth roots of $1-i\sqrt{3}$ and represent them on an argand plane. **(07 Marks)**

2 a. Find the n^{th} derivative of cos 2x cos 3x. **(06 Marks)**

b. If $y = e^{a\sin^{-1}x}$ then prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-(n^2+a^2)y_n = 0$. **(07 Marks)**

c. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. **(07 Marks)**

3 a. Find the angle between the radius vector and the tangent to the curve $r = a(1-\cos\theta)$ at the point $\theta = \frac{\pi}{3}$. **(06 Marks)**

b. Find the pedal equation to the curve $r = a(1+\cos\theta)$. **(07 Marks)**

c. Obtain the Maclaurin's series expansion of the function $e^x \sin x$. **(07 Marks)**

4 a. If $u = e^{x^3+y^3}$, then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = 3u\log u$. **(06 Marks)**

b. If $u = f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z} = 0$. **(07 Marks)**

c. If $u = x^2+y^2+z^2$, $v = xy+yz+zx$, $w = x+y+z$, find $J\left(\frac{u,v,w}{x,y,z}\right)$. **(07 Marks)**

5 a. Obtain the reduction formula for $I_n = \int_0^{\pi/2}\cos^n x\,dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate : $\int_0^{2a}\int_0^{\sqrt{2ax-x^2}} xy\,dy\,dx$. **(07 Marks)**

c. Evaluate : $\int_0^1\int_0^1\int_0^1 (x+y+z)\,dx\,dy\,dz$. **(07 Marks)**

6 a. Prove that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

b. Evaluate: $\int_0^4 x^{3/2}(4-x)^{5/2}dx$. **(07 Marks)**

c. Evaluate: $\int_0^\infty x^6 e^{-3x}dx$. **(07 Marks)**

7 a. Solve: $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$. **(06 Marks)**

b. Solve: $(e^y+y\cos xy)dx+(xe^y+x\cos xy)dy=0$. **(07 Marks)**

c. Solve: $x^2ydx-(x^3+y^3)dy=0$. **(07 Marks)**

8 a. Solve: $\frac{d^3y}{dx^3}-6\frac{d^2y}{dx^2}+11\frac{dy}{dx}-6y=0$. **(06 Marks)**

b. Solve : $(D^2-4)y=e^x+\sin 2x$. **(07 Marks)**

c. Solve : $(D^2+D+1)y=1+x+x^2$. **(07 Marks)**

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