USN | | | | | | | | | | |

10MAT31

Third Semester B.E. Degree Examination, June/July 2014
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find Fourier series of $f(x) = 2\pi x - x^2$ in $[0, 2\pi]$. Hence deduce $\sum_{1}^{\infty} \frac{1}{(2n-1)^2} = \frac{\pi^2}{8}$. Sketch the graph of f(x). **(07 Marks)**

b. Find Fourier cosine series of $f(x) = \sin\left(\frac{m\pi}{\ell}\right)x$, where m is positive integer. **(06 Marks)**

c. Following table gives current (A) over period (T):

A (amp)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98
t (sec)	0	T/6	T/3	T/2	2T/3	5T/6	T

Find amplitude of first harmonic. **(07 Marks)**

2 a. Find Fourier transformation of $e^{-a^2x^2}$ $(-\infty < x < \infty)$ hence show that $e^{-x^2/2}$ is self reciprocal. **(07 Marks)**

b. Find Fourier cosine and sine transformation of

$$f(x) = \begin{cases} x & 0 < x < a \\ 0 & x \geq a \end{cases}$$

(06 Marks)

c. Solve integral equation $\int_0^{\infty} f(x)\cos sx\,dx = \begin{cases} 1-s & 0 < s < 1 \\ 0 & s \geq 1 \end{cases}$. Hence deduce $\int_0^{\infty} \frac{1-\cos x}{x^2}dx = \frac{\pi}{2}$. **(07 Marks)**

3 a. Find various possible solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by separable variable method. **(07 Marks)**

b. Obtain solution of heat equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial t^2}$ subject to condition u(0, t) = 0, u(ℓ, t) = 0, u(x, 0) = f(x). **(06 Marks)**

c. Solve Laplace equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ subject to condition u(0, y) = u(ℓ, y) = u(x, 0) = 0; $u(x, a) = \sin\left(\frac{\pi x}{\ell}\right)$. **(07 Marks)**

4 a. The revolution (r) and time (t) are related by quadratic polynomial $r = at^2 + bt + c$. Estimate number revolution for time 3.5 units, given

Revolution	5	10	15	20	25	30	35
Time	1.2	1.6	1.9	2.1	2.4	2.6	3

(07 Marks)

b. Solve by graphical method,
Minimize $Z = 20x_1 + 10x_2$ under the constraints $2x_1 + x_2 \geq 0$; $x_1 + 2x_2 \leq 40$; $3x_1 + x_2 \geq 0$; $4x_1 + 3x_2 \geq 60$; $x_1, x_2 \geq 0$. **(06 Marks)**

c. A company produces 3 items A, B, C. Each unit of A requires 8 minutes, 4 minutes and 2 minutes of producing time on machine M_1, M_2 and M_3 respectively. Similarly B requires 2, 3, 0 and C requires 3, 0, 1 minutes of machine M_1, M_2 and M_3. Profit per unit of A, B and C are Rs.20, Rs.6 and Rs.8 respectively. For maximum profit, how many number of products A, B and C are to be produced? Find maximum profit. Given machine M_1, M_2, M_3 are available for 250, 100 and 60 minutes per day. **(07 Marks)**

PART – B

5 a. By relaxation method, solve $-x + 6y + 27z = 85$, $54x + y + z = 110$, $2x + 15y + 6z = 72$. **(07 Marks)**

b. Using Newton Raphson method derive the iteration formula to find the value of reciprocal of positive number. Hence use to find $\frac{1}{c}$ upto 4 decimals. **(06 Marks)**

c. Using power rayley method find numerical largest eigen value and corresponding eigen vector for $\begin{bmatrix} 10 & 2 & 1 \\ 2 & 10 & 1 \\ 2 & 1 & 10 \end{bmatrix}$ using $(1, 1, 0)^T$ as initial vector. Carry out 10 iterations. **(07 Marks)**

6 a. Fit interpolating polynomial for f(x) using divided difference formula and hence evaluate f(z), given f(0) = - 5, f(1) = -14, f(4) = -125, f(8) = -21, f(10) = 355. **(07 Marks)**

b. Estimate t when f(t) = 85, using inverse interpolation formula given : **(06 Marks)**

t	2	5	8	14
f(t)	94.8	87.9	81.3	68.7

c. A solid of revolution is formed by rotating about x-axis, the area between x-axis, lines x = 0, x = 1 and curve through the points with the following co-ordinates.

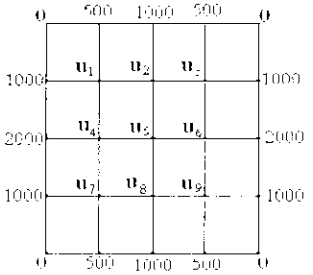
x	0	1/6	2/6	3/6	4/6	5/6	1
y	0.1	0.8982	0.9018	0.9589	0.9432	0.9001	0.8415

by Simpson's $3/8^{th}$ rule, find volume of solid formed. **(07 Marks)**

7 a. Using the Schmidt two-level point formula solve $\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$ under the conditions $u(0, t) = u(1, t) = 0$; $t \geq 0$; $u(1, 0) = \sin \pi x$ $0 < x < 1$, take $h = \frac{1}{4}$ $\alpha = \frac{1}{6}$. Carry out 3 steps in time level. **(07 Marks)**

b. Solve the wave equation $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to $u(0, t) = u(4, t) = u_t(x, 0) = 0$, $u(x, 0) = x(4-x)$ take $h = 1$ $k = 0.5$. **(06 Marks)**

c. Solve $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ in the square mesh. Carry out 2 iterations. **(07 Marks)**



8 a. State and prove recurrence relation of f-transformation hence find $Z_T(n)$, $Z_T(n^2)$. **(07 Marks)**

b. Find $Z_T[e^{n\theta}\cosh n\theta - \sin(nA + \theta) + n]$. **(06 Marks)**

c. Solve difference equation $u_{n+2} + 6u_{n+1} + 9u_n = n2^n$ given $u_0 = u_1 = 0$. **(07 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV32

Third Semester B.E. Degree Examination, June/July 2014
Building Materials and Construction Technology

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Discuss various functions served by foundations. **(05 Marks)**

b. With neat sketch define shallow and deep foundation. **(05 Marks)**

c. Design a strip footing for a brick wall 30 cm thick and 3.5m high above ground level. The wall carries a superimposed load of 12 tonnes per metre run. The soil has unit weight of 1700 kg/m^3, angle of repose of 30° and safe bearing capacity of 16 t/m^2. The footing may have lime concrete base, which has unit weight of 2000 kg/m^3 and modulus of rupture equal to 16 t/m^2. Take the unit weight of masonry as 1950 kg/m^3. **(10 Marks)**

2 a. Explain the meaning of masonry bonds. Indicate which component of masonry is a weaker component. For brick masonry, indicate what are the features of masonry bonds that increase the strength of wall. **(05 Marks)**

b. Draw plans of alternate courses of English and Flemish bonds for a 1½ brick thick wall. Name bricks in different locations on the sketch. **(10 Marks)**

c. Explain the classification of stone masonry. **(05 Marks)**

3 a. Sketch a semi-circular arch and show on it the following : Key stone ; Springing line ; Voussers ; Intrados ; Extrados ; Rise ; Span ; Spandrel. **(05 Marks)**

b. Enumerate with the help of sketches various types of arches based on its shape. **(10 Marks)**

c. Explain with sketch the R.C.C lintel. **(05 Marks)**

4 a. Sketch a king post roof truss with timber, provided with tile roofing. Name various components of truss on the sketch. **(06 Marks)**

b. Compare the merits and demerits of flat roof and pitched roof. **(06 Marks)**

c. Explain the following :
(i) Terrazzo flooring (ii) Mosaic flooring. **(08 Marks)**

PART – B

5 a. Explain the following doors with neat sketches:
(i) Partly paneled and glazed door (ii) Louvered door. **(10 Marks)**

b. Explain the following windows with neat sketches:
(i) Bay window (ii) Dormer window. **(10 Marks)**

6 a. With a neat sketch, label the different parts of a stair. Explain the terms involved. **(10 Marks)**

b. Plan a dog legged stair between two floors of 3.15 m height with roof thickness 15 cms. The size of staircase room is 2.5m × 5m. Draw the plan of the stair. **(10 Marks)**

7 a. Describe procedure for application of paint on wood surface and on new plastered surface with cement mortar. **(10 Marks)**

b. Discuss the defects in plastering. **(04 Marks)**

c. Describe procedure of providing stucco plastering. **(06 Marks)**

8 Write short notes on :
a. Damp proof course b. Classification of glasses c. Shoring d. Varnish **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV/EV33

Third Semester B.E. Degree Examination, June/July 2014
Strength of Materials

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define : i) Young's modulus ii) Shear modulus and iii) Poisson's ratio Write the relationship between them. **(05 Marks)**

b. Derive an expression for elongation of flat tapering bar subjected to an axial pull P. **(08 Marks)**

c. A signal is being worked by a steel wire 750 m long and 6 mm in diameter. Find the movement which must be given to the signal box end of wire at a pull of 1·6 kN, if the movement at the signal end is to be 250 mm. Take $E = 2 \times 10^5 N/mm^2$. **(07 Marks)**

2 a. A steel rod is 18 m long at a temperature of 25°C. Find the free expansion when the temperature is raised to 85°C. Also find the temperature stress produced when :
i) The expansion is fully prevented.
ii) The rod is permitted to expand by 4.5 mm.
$E = 200\ kN/mm^2$ and $\alpha = 12 \times 10^{-6}/°C$. **(06 Marks)**

b. Two forces of 50 kN and 100 kN are applied to a bar fixed between two unyielding supports. Compute the stresses induced in different materials. The material properties and the properties of the bar are indicated in Fig. Q2(b). **(14 Marks)**

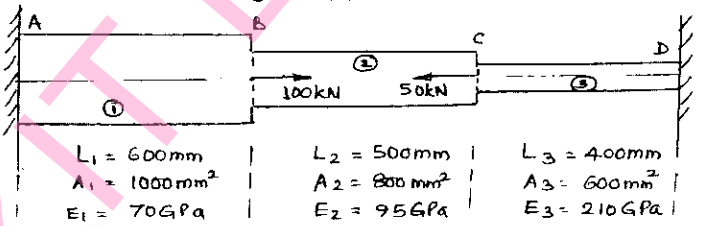


Fig. Q2(b)

3 a. Define : i) Principal stresses ii) Principal planes. **(04 Marks)**

b. Show that principal planes and maximum shearing planes are inclined at 45° with each other. **(04 Marks)**

c. At a point in a strained material, the state of stress is as shown in Fig. Q3(c). Compute : i) Principal stresses and principal planes ii) Maximum shearing stresses and maximum shearing planes. Sketch these planes. **(12 Marks)**

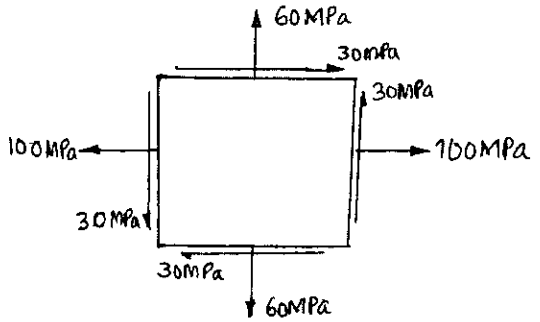


Fig. Q3(c)

4 a. Derive the relationship between BM, SF and intensity of udl. **(06 Marks)**

b. Draw SFD and BMD for the beam loaded as shown in Fig. Q4(b). Indicate the values at various points and locate point of contraflexure, if any. **(14 Marks)**

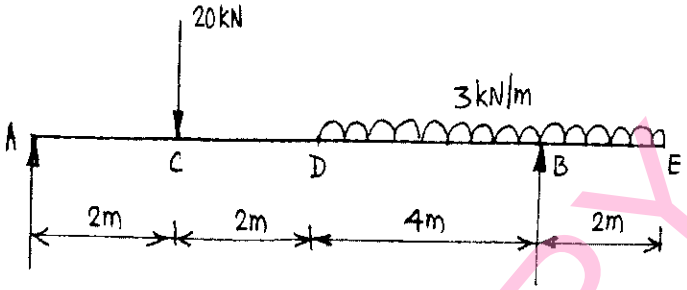


Fig. Q4(b)

PART – B

5 a. Compare the flexural strength of the following three beams :

i) I – section 320 mm × 160 mm with 20 mm thick flange and 13 mm thick web

ii) Rectangular section having depth twice the width

iii) Solid circular section

All the three beam sections have same cross-sectional area. **(12 Marks)**

b. Draw the shear stress diagram for a rectangular beam section and show that maximum shear stress is 1.5 times average shear stress. **(08 Marks)**

6 a. Find the expressions for maximum slope and maximum deflection for a cantilever beam subjected to point load at free end. **(06 Marks)**

b. A simply supported beam AB has a span of 5 m and carries a point load of 60 kN at a distance of 3 m from left end A. Find the ratio of maximum deflection to the deflection under point load. **(14 Marks)**

7 a. Prove the torsional formula, with usual notations,

$$\frac{T}{J} = \frac{G\theta}{L} = \frac{\tau}{R}$$ **(10 Marks)**

b. A 150 mm diameter solid steel shaft is transmitting 450 kW power at 90 rpm. Compute the maximum shearing stress. Find the change that would occur in the shearing stress, if the speed were increased to 360 rpm. **(10 Marks)**

8 a. List the assumptions made in Euler's theory of long columns. **(05 Marks)**

b. Derive the expression for Euler's buckling load for a column with both ends fixed. **(07 Marks)**

c. Determine the ratio of Euler's and Rankine's load for a hollow cast-iron column 150 mm outer diameter and 20 mm thick. It is 6 m long and hinged at both ends. Take E = 140 GPa, σ_c = 550 MPa and $\alpha = \frac{1}{1600}$. **(08 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV/EV34

Third Semester B.E. Degree Examination, June/July 2014
Surveying – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain basic principles of surveying. **(06 Marks)**

b. How do you classify survey? Explain in detail. **(08 Marks)**

c. Explain the following terms:
i) Accuracy; ii) Precision; iii) Discrepancy. **(06 Marks)**

2 a. Explain with neat sketch, the method of ranging of a chain line, with a line ranger instrument. **(08 Marks)**

b. Explain the indirect methods of chaining on a sloping ground. **(06 Marks)**

c. A 30m chain, used to find the volume of a cylindrical water tank, was found to be 2cm too long. The cylindrical water tank, measured by a 30m chain, was found to have a diameter of 8.45. Height of the tank is 20m. Find the true cubic content of the water tank. **(06 Marks)**

3 a. Define the following terms:
i) Base line
ii) Survey line
iii) Check line
iv) Tie line
v) Random line
vi) Tie station. **(06 Marks)**

b. Explain the construction and working of an optical square with neat sketch. **(08 Marks)**

c. In passing an obstacle in the form of a pond, stations 'A' and 'D' on the main line, were taken on the opposite sides of a pond. On the left of AD, a line AB = 200m long was laid down and a second line AC = 250m long was ranged on the right of AD, the points B, D and C being in the same straight line BD and DC were then chained and found to be 125m and 150m respectively. Find the length of AD **(06 Marks)**

4 a. Differentiate between:
i) Magnetic meridian and true meridian.
ii) Fore bearing and back bearing.
iii) While circle bearing and quadrantal bearing.
iv) Declination and dip of the needle. **(12 Marks)**

b. In a closed traverse ABCDEA, the bearing the line AB was measured as 150°30′ and the included angles were measured as below:
$\angle A = 130°10'$, $\angle B = 89°45'$; $\angle C = 125°22'$; $\angle D = 135°34'$; $\angle E = 59°9'$. Calculate the bearing of all the lines and apply check. **(08 Marks)**

PART – B

5 a. What is meant by local attraction? How is it detected? **(06 Marks)**

b. Explain Bowditch's rule and transit rule. **(06 Marks)**

c. In the following traverse ABCDE, the length and bearing of EA is omitted. Calculate the length and bearing of the line EA:

Line	Length (M)	F.B. bearing
AB	204.0	87°30′
BC	226.0	20°20′
CD	187.0	280°0′
DE	192.0	210°3′
EA	?	?

(08 Marks)

6 a. Explain the temporary adjustments of Dumpy level. **(04 Marks)**

b. Define the sensitiveness of bubble tube. How the sensitiveness of bubble tube is is determined. **(08 Marks)**

c. Two points A and B are 1530m apart across a wide river. The following reciprocal levels are taken with one level. **(08 Marks)**

Level at	Readings on	
	A	B
A	2.165m	3.810m
B	0.910m	2.355m

The error in the collimation adjustments of the level is 0.004m in 100m. Calculate the true difference of level between 'A' and 'B' and the refraction.

7 a. The following staff readings were observed successively with a level, the instrument having been moved after third, sixth and eighth readings: 2.228, 1.606, 0.988, 2.090, 2.864, 1.262, 0.602, 1.982, 1.044, 2.684 metres. Enter the above readings in the level book and calculate the R.L. of all points if the R.L. of the first reading was taken with a staff help on a bench mark of 432.384m. Adopt rised full method. **(10 Marks)**

b. What is a contour? What are the uses of a contour map? **(04 Marks)**

c. Name the different types of indirect contouring and explain any one of them. **(06 Marks)**

8 a. Describe briefly radiation method and intersection method of plane table survey with a neat sketch. **(10 Marks)**

b. Define three point problems. Discuss the solution of the three point problem by Bessel's graphical method. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV35

Third Semester B.E. Degree Examination, June/July 2014
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following fluid properties with units:
   i) Mass density.
   ii) Specific gravity.
   iii) Dynamic viscosity.
   iv) Vapour pressure.
   v) Capillarity. **(10 Marks)**

b. A 150mm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 151.0mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 N-m is required to rotate the inner cylinder at 100rpm. Determine the viscosity of the fluid. **(10 Marks)**

2 a. State and prove Pascal's law. **(06 Marks)**

b. With neat sketch, explain Bourdon's pressure gauge. **(06 Marks)**

c. An open tank contains water upto a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity
   i) At the interface of the two liquids and
   ii) At the bottom of the tank. **(08 Marks)**

3 a. Define: i) Total pressure; ii) Centre of pressure. **(04 Marks)**

b. Obtain an expression for total pressure and centers of pressure for inclined surface submerged in liquid. **(08 Marks)**

c. A trapezoidal channel 2m wide at the bottom and 1m deep has side slopes 1:1. Determine: i) Total pressure; ii) Centre of pressure, when it is full of water. **(08 Marks)**

4 a. Distinguish between: i) Laminar and turbulent flow; ii) Uniform and non uniform flow. **(04 Marks)**

b. Obtain an expression for continuity equation for three dimensional flows. **(08 Marks)**

c. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$. Determine the velocity at the point P(4, 5). Determine also the value of stream function ψ at the point P. **(08 Marks)**

PART – B

5 a. Derive Bernoulli's equation from Euler's equation with assumptions made. **(08 Marks)**

b. Derive the equation for the discharge through venturimeter. **(06 Marks)**

c. Water is flowing through a pipe having diameter 300mm and 200mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.52 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the flow through pipe is 40/ps. **(06 Marks)**

6 a. Define: i) Hydraulic gradient: ii) Energy gradient. **(04 Marks)**

b. Distinguish between compound pipe and equivalent pipe. **(06 Marks)**

c. At a sudden enlargement of water main from 240mm to 480mm diameter, the hydraulic gradient rises by 10mm. Estimate the rate of flow. **(10 Marks)**

7 a. Define hydraulic co-efficient and Determine the hydraulic co-efficients experimentally. **(10 Marks)**

b. A 25mm diameter nozzle discharges $0.76m^3$ of water/minute, when the head is 60m. The diameter of the jet is 22.5mm. Determine the values of C_c, C_v, C_d and loss of head due to fluid resistance. **(10 Marks)**

8 a. Distinguish between:

i) Sharp crested and broad crested weirs.

ii) Orifice and mouth piece.

iii) Broad crested weir and submerged weir. **(06 Marks)**

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

c. Water flows over a rectangular weir 1m wide at a depth of 15cm and afterwards passes through a triangular right angled weir. Taking C_d for rectangular weir 0.62 and for triangular 0.59. Find the depth over the triangular weir. **(08 Marks)**

* * * * *

USN | | | | | | | | | | |

10CV36

Third Semester B.E. Degree Examination, June/July 2014
Applied Engineering Geology

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With a neat sketch mention the different parts of the Earth interior and add a note on its composition. **(08 Marks)**

b. Define a mineral. **(02 Marks)**

c. Describe any two minerals with respect to their physical properties and add their uses:
(i) Calcite (ii) Asbestos (iii) Galena (iv) Magnetite. **(10 Marks)**

2 a. Define a rock with example. **(02 Marks)**

b. Describe with sketches the formation of primary structures in sedimentary rocks. **(08 Marks)**

c. Describe any two rocks with respect to their geological properties and also add a note on their engineering uses:
(i) Granite (ii) Basalt (iii) Limestone (iv) Gneiss **(10 Marks)**

3 a. What is soil and soil profile? Describe the methods of soil conservation. **(10 Marks)**

b. Define river and river system. Give a detail geological work of rivers. **(10 Marks)**

4 a. What are landslides? Explain different types of landslides and land subsidence. Briefly

b. explain the preventive measures of landslides. **(10 Marks)**

c. What are Earthquakes? Mention the causes of earthquakes. Add a note on earthquake resistant structures. **(10 Marks)**

PART – B

5 a. Explain any two of the following with neat sketch:
(i) Dip and Strike (ii) Parts of fold (iii) Mural Joints **(10 Marks)**

b. What are faults? How are they caused? Describe the different types of faults with figures. **(10 Marks)**

6 a. Give an account of geological considerations to be considered in selection of suitable site for construction of dam on dipping, folded and faulted beds. **(10 Marks)**

b. What are tunnels? Enumerate the steps to be considered for tunneling through folded and faulted beds. **(10 Marks)**

7 a. Define ground water and hydrological cycle. Also explain water table and aquifer and its types. **(10 Marks)**

b. Describe in detail on location of groundwater by electrical resistivity method. **(10 Marks)**

8 a. Explain the application of the following in civil engineering projects:
(i) Remote sensing (RS) (ii) Geographical Information System (GIS) **(10 Marks)**

b. Describe the impact of quarrying mining and construction of dams on environment. **(10 Marks)**

* * * * *

USN | | | | | | | | | | |

MATDIP301

Third Semester B.E. Degree Examination, June/July 2014
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Find the modulus and amplitude of $\frac{5+3i}{4-2i}$ **(06 Marks)**

b. Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n}{2}+1}\cos\frac{n\pi}{4}$ **(07 Marks)**

c. Prove that $\left(\frac{\cos\theta + i\sin\theta}{\sin\theta + i\cos\theta}\right)^4 = \cos 8\theta + i\sin 8\theta$ **(07 Marks)**

2 a. Obtain the n^{th} derivative of $e^{ax}\sin(bx + c)$ **(06 Marks)**

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

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

3 a. Find the angle of intersection of the curves $r = \sin\theta + \cos\theta$, $r = 2\sin\theta$. **(06 Marks)**

b. Find the pedal equation of the curve $r^n = a^n\cos n\theta$. **(07 Marks)**

c. Using Maclaurin's series expand $\log(1 + \sin x)$ upto the term containing x^4. **(07 Marks)**

4 a. If $z = \frac{x^2+y^2}{x+y}$, then show that $\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$ **(07 Marks)**

b. If $u = \sin^{-1}\left(\frac{x^2+y^2}{x+y}\right)$, then prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \tan u$. **(06 Marks)**

c. If $u = x + 3y^2 - z^3$, $v = 4x^2yz$, $w = 2z^2 - xy$, evaluate $\frac{\partial(u,v,w)}{\partial(x,y,z)}$ at (1, –1, 0). **(07 Marks)**

5 a. Obtain the reduction formula for $I_n = \int_0^{\frac{\pi}{2}} \sin^n x\, dx$ **(06 Marks)**

b. Evaluate $\int_0^{\pi}\int_{2\sin\theta}^{4\sin\theta} r^3 dr d\theta$ **(07 Marks)**

c. Evaluate $\int_{-1}^{1}\int_{0}^{z}\int_{x-z}^{x+z}(x+y+z)dx\,dy\,dz$ **(07 Marks)**

6 a. With usual notations, prove that

$$\beta(m,n) = \frac{\Gamma(m)\ \Gamma(n)}{\Gamma(m+n)}$$ **(06 Marks)**

b. Show that $\int_0^{\pi/2} \sqrt{\sin\theta}\ d\theta \times \int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} = \pi$ **(07 Marks)**

c. Prove that $\beta(m, \frac{1}{2}) = 2^{2m-1}\beta(m, m)$ **(07 Marks)**

7 a. Solve $\frac{dy}{dx} = (4x + y + 1)^2$, if $y(0) = 1$. **(06 Marks)**

b. Solve $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$ **(07 Marks)**

c. Solve $\left\{y\left(1 + \frac{1}{x}\right) + \cos y\right\}dx + (x + \log x - x\sin y)dy = 0$ **(07 Marks)**

8 a. Solve: $(D^3 + D^2 + 4D + 4)y = 0$ **(06 Marks)**

b. Solve: $(D^2 - 5D + 1)y = 1 + x^2$ **(07 Marks)**

c. Solve: $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = e^{2x}\sin x$ **(07 Marks)**

* * * * *