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10MAT31

Third Semester B.E. Degree Examination, Dec.2013/Jan.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 the Fourier series expansion of the function $f(x) = |x|$ in $(-\pi, \pi)$, hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty} \frac{1}{(2n-1)^2}$. **(06 Marks)**

b. Obtain the half-range cosine series for the function, $f(x) = (x-1)^2$ in the interval $0 \le x \le 1$ and hence show that $\pi^2 = 8\left\{\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + ...\right\}$ **(07 Marks)**

c. Compute the constant term and first two harmonics of the Fourier series of f(x) given by, **(07 Marks)**

x	0	$\frac{\pi}{3}$	$\frac{2\pi}{3}$	π	$\frac{4\pi}{3}$	$\frac{5\pi}{3}$	2π
f(x)	1.0	1.4	1.9	1.7	1.5	1.2	1.0

2 a. Obtain the Fourier cosine transform of $f(x) = \frac{1}{1+x^2}$. **(06 Marks)**

b. Find the Fourier transform of $f(x) = \begin{cases} 1-x^2 & \text{for } |x| \le 1 \\ 0 & \text{for } |x| > 1 \end{cases}$ and evaluate $\int_0^{\infty} \frac{x\cos x - \sin x}{x^3} dx$. **(07 Marks)**

c. Find the inverse Fourier sine transform of $\frac{s}{1+s^2}$. **(07 Marks)**

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

b. Solve the one-dimensional wave equation, $C^2 \frac{\partial^2 u}{\partial x^2} = \frac{\partial^2 u}{\partial t^2}$, $0 < x < l$ under the following conditions (i) $u(0, t) = u(l, t) = 0$ (ii) $u(x, 0) = \frac{u_0 x}{l}$ where u_0 is constant (iii) $\frac{\partial u}{\partial t}(x,0) = 0$. **(07 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 $\frac{\partial u}{\partial t}(x,0) = 0$. **(06 Marks)**

4 a. Find the best values of a, b, c, if the equation $y = a + bx + cx^2$ is to fit most closely to the following observations. **(07 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

b. Solve the following by graphical method to maximize $z = 50x + 60y$ subject to the constraints, $2x + 3y \le 1500$, $3x + 2y \le 1500$, $0 \le x \le 400$ and $0 \le y \le 400$. **(06 Marks)**

c. By using Simplex method, maximize $P = 4x_1 - 2x_2 - x_3$ subject to the constraints, $x_1 + x_2 + x_3 \le 3$, $2x_1 + 2x_2 + x_3 \le 4$, $x_1 - x_2 \le 0$, $x_1 \ge 0$ and $x_2 \ge 0$. **(07 Marks)**

PART – B

5 a. Using Newton-Raphson method, find a real root of $x\sin x + \cos x = 0$ nearer to π, carryout three iterations upto 4-decimals places. **(07 Marks)**

b. Find the largest eigen value and the corresponding eigen vector of the matrix,

$$\begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$$

By using the power method by taking the initial vector as $[1\ 1\ 1]^T$ carryout 5-iterations. **(07 Marks)**

c. Solve the following system of equations by Relaxation method:
$12x + y + z = 31$; $2x + 8y - z = 24$; $3x + 4y + 10z = 58$ **(06 Marks)**

6 a. A survey conducted in a slum locality reveals the following information as classified below,

Income per day in Rupees 'x'	Under 10	10 – 20	20 – 30	30 – 40	40 – 50
Numbers of persons 'y'	20	45	115	210	115

Estimate the probable number of persons in the income group 20 to 25. **(07 Marks)**

b. Determine f(x) as a polynomials in x for the data given below by using the Newton's divided difference formula. **(07 Marks)**

x	2	4	5	6	8	10
f(x)	10	96	196	350	868	1746

c. Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by using Simpson's $\left(\frac{1}{3}\right)^{rd}$ rule by taking 6 – equal strips and hence deduce an approximate value of $\log_e 2$. **(06 Marks)**

7 a. Solve the wave equation, $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$, subject to u(0, t) = 0, u(4, t) = 0, $u_t(x, 0) = 0$ and $u(x, 0) = x(4 - x)$ by taking h = 1, K = 0.5 upto 4-steps. **(07 Marks)**

b. Solve numerically the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions, u(0, t) = 0 = u(1, t), $t \geq 0$ and $u(x, 0) = \sin \pi x$, $0 \leq x \leq 1$, carryout the computation for two levels taking $h = \frac{1}{3}$ and $K = \frac{1}{36}$. **(07 Marks)**

c. Solve $u_{xx} + u_{yy} = 0$ in the following square region with the boundary conditions as indicated in the Fig. Q7 (c). **(06 Marks)**

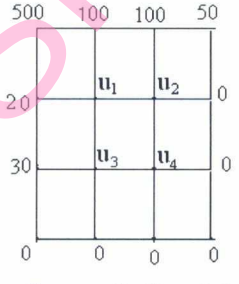

Fig. Q7 (c)

8 a. Find the z-transform of, (i) $\sinh n\theta$ (ii) $\cosh n\theta$ (iii) n^2 **(07 Marks)**

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

c. Solve the difference equation, $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ by using z-transform. **(07 Marks)**

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10CV32

Third Semester B.E. Degree Examination, Dec.2013/Jan.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. Explain the essential requirements of a good foundation. **(05 Marks)**

b. What is safe bearing capacity of a soil? Briefly explain various methods adopted to improve it. **(07 Marks)**

c. Draw neat labelled sketches of the following types of foundations and explain where they are adopted (i) Raft foundation, (ii) Strap footing. **(08 Marks)**

2 a. Explain any two of the following:
i) Reinforced brick work ii) Partition walls iii) Cavity walls **(08 Marks)**

b. List any four commonly used building stones and state their suitability in construction. **(04 Marks)**

c. Draw neat sketches of the following and explain:
i) Ashlar masonry ii) Rubble masonry **(08 Marks)**

3 a. Explain the following terms with respect to an arch:
key stone, span, intrados, rise, voussoirs. **(05 Marks)**

b. Define lintel and chajja. Draw a neat labelled diagram of a reinforced concrete lintel with chajja projection showing the position of reinforcement. **(07 Marks)**

c. Give the classification of arches and explain stability of an arch. **(08 Marks)**

4 a. Discuss the advantages of a flat roof. Briefly explain its advantages. **(08 Marks)**

b. List the types of pitched roofs. **(04 Marks)**

c. Discuss the various flooring material used briefly. Explain any two of them in detail. **(08 Marks)**

PART – B

5 a. Write short notes on the following:
i) Collapsible steel door ii) Bay window **(08 Marks)**

b. Explain the factors to be considered while locating the position of doors and windows in a building. **(06 Marks)**

c. What are the salient features of a framed panelled door? Explain. **(06 Marks)**

6 a. Draw the plans of the following types of stairs. Briefly explain them.
i) Dog-legged stairs ii) Open newel stairs **(10 Marks)**

b. Draw the section of a typical stair and level all the parts? Explain each part. **(10 Marks)**

7 a. Explain various defects in plastering. **(06 Marks)**

b. List the various constituents of a good paint. Discuss each constituent of paint. **(08 Marks)**

c. Explain the process of distempering. **(06 Marks)**

8 a. Explain the terms: i) Shoring, ii) Slip forming, iii) Guiniting **(06 Marks)**

b. Discuss the causes and effects of dampness in a building. **(08 Marks)**

c. List the important properties and uses of the following building materials:
i) Aluminum ii) Plastic iii) Varnish **(06 Marks)**

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10CV33/10EV33

Third Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Strength of Materials

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define 'Bulk modulus". **(03 Marks)**

b. Derive an expression for the deformation of a member due to self weight. **(05 Marks)**

c. A member is of total length 2 m its diameter is 40 mm for the first 1 m length. In the next 0.5 m length, it's diameter gradually reduces from 40 mm to 'd' mm. For the remaining length of the member, the diameter remains 'd' mm uniform. When this member is subjected to axial tensile force of 150 kN, the total elongation observed is 2.39 mm. Determine the diameter 'd'. Assume $E = 2 \times 10^5$ N/mm^2. **(12 Marks)**

2 a. Define 'Composite member'. **(03 Marks)**

b. What are 'Temperature stresses'? **(03 Marks)**

c. A bar of brass 25 mm diameter is enclosed in a steel tube of 25 mm internal diameter and 50 mm external diameter. The bar and the tube are rigidly connected at both the ends. Find the stresses in the two materials, if the temperature of the system is raised from 15°C to 95°C. Assume $E_S = 2 \times 10^5$ MPa, $\alpha_S = 11.6 \times 10^{-6}$/ °C, $E_b = 1 \times 10^5$ MPa and $\alpha_b = 18.7 \times 10^{-6}$/ °C. **(14 Marks)**

3 a. What are 'principal stresses'? **(03 Marks)**

b. An element is subjected to a tensile stress of 100 N/mm^2. Another compressive stress of 50 N/mm^2 is applied perpendicular to the direction of tensile stress. Construct Mohr's circle. **(05 Marks)**

c. At a point in an elastic material, the stresses on two perpendicular planes are 80 N/mm^2 (tensile) and 60 N/mm^2 (compressive). There is also a shear stress of 40 N/mm^2. Find the normal stress and shear stress on a plane making an angle of 30° with the plane on which the tensile stress acts. Also, find the values of principal stresses and the location of principal planes (adopt analytical method). **(12 Marks)**

4 a. A simply supported beam AB of span 'l' is subjected to an eccentric point load W at a distance of 'a' from left support and 'b' from right support. Develop the general expressions for shear force and bending moment. Draw BMD and SFD. **(08 Marks)**

b. An overhanging beam is of total length 5 m. The supported length AB = 4 m. The length of overhang BC = 1 m. There is a UDL of 20 kN/m starting from A upto a length of 2 m. There is a point load of 40 kN at 2m from A. Another point load of 20 kN is acting at the free end of overhanging portion. Draw SFD and BMD. Find the values of maximum SF and BM. Also, locate the point of contraflexure. **(12 Marks)**

PART – B

5 a. Derive the general bending equation $\frac{M}{I} = \frac{f}{y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. A T section is having a flange of 200 mm × 50 mm. The web is also 200 mm × 50 mm. It is subjected to a bending moment of 15 kN. m. Draw the bending stress distribution across the section, indicating the salient values. **(10 Marks)**

6 a. A simply supported beam is of span 'l'. It is subjected to UDL of intensity w/unit length over it's entire length. Derive an expression for maximum deflection assuming flexural rigidity as EI. **(08 Marks)**

b. A beam of uniform section is 10 m long. it is simply supported at it's ends. It carries loads of 100 kN and 80 kN at distances of 2 m and 6 m respectively from the left end. Calculate deflection under each load. Assume E = 200 GPa and I = 18×10^8 mm^4. **(12 Marks)**

7 a. List the assumptions made in the theory of torsion. **(05 Marks)**

b. Define 'Torsional rigidity'. **(03 Marks)**

c. Determine the diameter of a solid circular shaft which will transmit 400 kilowatts at 300 rpm. The maximum shear stress should not exceed 32 N/mm^2. The twist should not be more than 1° in a length of 2 m. Assume modulus of rigidity as 90 kN/mm^2. **(12 Marks)**

8 a. Define 'slenderness ratio' of a column. **(03 Marks)**

b. Distinguish short column and long column. **(03 Marks)**

c. The cross section of a column is a hollow rectangular section with it's external dimensions 200 mm × 150 mm. The internal dimensions are 150 mm × 100 mm. The column is 5 m long and fixed at both the ends. If E = 120 GPa, calculate the critical load using Euler's formula. Compare the above load with the value obtained from Rankine's formula. The permissible compressive stress is 500 N/mm^2. The Rankine's constant is 1/6000. **(14 Marks)**

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10CV/EV34

Third Semester B.E. Degree Examination, Dec. 2013/Jan. 2014
Surveying – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following with neat sketches :
i) Geodetic surveying
ii) Working from the whole to the part
iii) Numbering of Topo maps of India. **(12 Marks)**

b. Differentiate between :
i) Precision and accuracy
ii) Plan and map. **(08 Marks)**

2 a. Give brief description and uses of the following :
i) Steel band ii) Line ranger iii) EDM devices. **(06 Marks)**

b. The distance between two points, measured along a slope is 428 m. Find the horizontal distance between them if i) the angle of slope between the pints is 8° ii) The difference in level is 52 m iii) the slope is 1 in 4 and also iv) the hypotenusal allowance per chain of 20 m length for a slope angle of 10°. **(05 Marks)**

c. A steel tape of nominal length 30 m was suspended between supports to measure the length of a line the measured length of the line on a slope angle of the 2° 50′ is 29.859 m. The mean temperature during the measurement was 12°C and the pull applied was 100 N. If the standard length of the tape is 30.005 m @ 20°C and the standard pull is 45 N, calculate the corrected horizontal length. Take weight of the tape= 0.15N/m, its cross sectional area = 2.50 mm^2, $\alpha = 1.15 \times 10^{-5}$ per °C and $E = 2 \times 10^5$ N/mm^2. **(09 Marks)**

3 a. Explain the principle of chain surveying. Why a well conditioned triangle is preferred? Examine whether a triangle having sides 80 m, 60 m and 40 m is well conditioned or not. **(10 Marks)**

b. An offset is measured with an accuracy of 1 in 30 and the error in laying out the direction is 4°. If the scale of plotting is 1 cm = 20 m, find the limiting length of the offset. **(04 Marks)**

c. A and B are two points 200 m apart on right bank of a river following east to west. A tree on the left bank is observed from A and B and the bearings of the tree are 20° and 330° respectively, as measured clockwise with respect to the north. Find the width of river. **(06 Marks)**

4 a. Differentiate between i) true meridian and magnetic meridian ii) Dip and declination iii) Isogonic and agonic lines. **(06 Marks)**

b. What is traversing? Explain the significance of open and closed traverse in compass surveying. **(04 Marks)**

c. The following bearings were observed for a closed traverse ABCDEA. Calculate the included angles. **(10 Marks)**

LINE	AB	BC	CD	DE	EA
BEARINGS	140° 30′	80° 30′	340° 0′	290° 30′	230° 30′

PART – B

5 a. Explain the terms and their significance :
   i) Local attraction
   ii) Independent and dependent co-ordinates
   iii) Bowditch and transit rules. **(10 Marks)**

b. The following bearings were observed in a compass traverse. Determine the stations affected by local attraction apply correction and find the corrected bearings. **(10 Marks)**

LINE	AB	BC	CD	DA
F. B	S 45° 30′ E	S 60° 00′ E	N 5° 30′ E	N 54° 30′ W
B.B	N 45° 30′ W	N 60° 40′ E	S 3° 20′ W	S 51° 40′ E

6 a. Illustrate with neat sketches : i) Profile leveling ii) Differential leveling iii) reciprocal leveling iv) Block leveling. **(08 Marks)**

b. An observer standing on the deck of a shop, just sees the top of the light house which is 40 m above the sea level if the height of the observer's eye is 8 m above the sea level, determine of the observer from the light house. **(04 Marks)**

c. The following observations were taken in reciprocal leveling

Instrument @	Staff readings @	
	A	B
A	1.625	2.545
B	0.725	1.405

Determine the R – L of B, if that of A is 100.800 m. Also calculate the angular error in collimation if the distance between A and B is 1000 m. **(08 Marks)**

7 a. Discuss the merits and demerits of using height of instrument and rise and fall methods. **(04 Marks)**

b. Define contour. Sketch contours to represent the following : i) uniform slope ii) Valley iii) Ridge iv) Vertical cliff v) Overhanging cliff. **(06 Marks)**

c. Find out the missing figures and complete the level book page. Apply usual arithmetic check.

Sl. No.	B.S	I.S	F.S	H.I	R.L	Remarks
1	4·390			X	X	Point – 1
2		X			192·00	Point – 2
3	3·910		6·520	X	X	Point – 3
4		5·390			191·620	B. M.
5		4·730			X	Point – 4
6		X			203.300	Point –5 Staff inverted
7	4·330		X		X	Point – 6
8			2·990		194·830	Point – 7

(10 Marks)

8 a. Discuss the advantages and disadvantages of plane tabling. **(08 Marks)**

b. Explain with neat sketches :
   i) Intersection method
   ii) Radiation
   iii) Strength of fix. **(12 Marks)**

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10CV35

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note:1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assume missing data suitably.***

PART – A

1 a. Define fluid. Distinguish between liquids and gasses. **(06 Marks)**

b. Explain the phenomenon of surface tension. Derive an expression for pressure inside a liquid droplet. **(06 Marks)**

c. A cylinder of 120 mm diameter rotates concentrically inside a fixed cylinder of diameter 125 mm. Both the cylinders are 300 mm long. Find the viscosity of the liquid that fills the space between the cylinders if a torque of 0.90 Nm required maintaining speed of 60 rpm. **(08 Marks)**

2 a. State and prove hydrostatic law. **(06 Marks)**

b. What is manometer? Distinguish between U tube differential manometer and inverted U-tube differential manometer. **(06 Marks)**

c. Find the manometer reading h for the Fig. Q2 (c) shown below, **(08 Marks)**

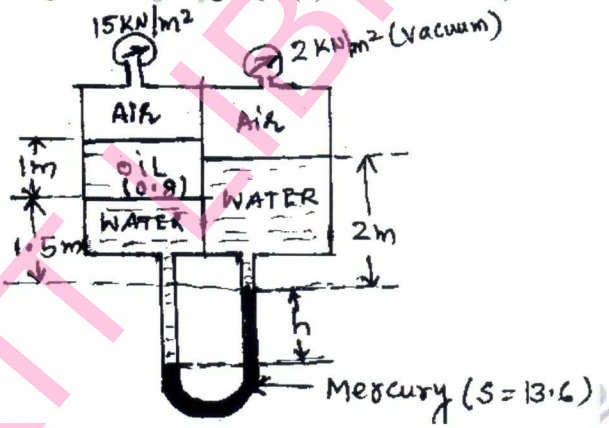

Fig. Q2 (c)

3 a. Derive the expressions for total pressure and centre of pressure on a vertical plate submerged in a static liquid. **(06 Marks)**

b. Explain the procedure of finding hydrostatic force on a curved surface. **(06 Marks)**

c. A circular plate 2.5 m diameter is immersed in water, its greatest and least depth below the free surface being 3 m and 1 m respectively. Find
i) the total pressure on one face of the plate and
ii) the position of centre of pressure. **(08 Marks)**

4 a. Distinguish between : i) Steady and unsteady flow ii) Uniform and non-uniform flow iii) Compressible and incompressible flow. **(06 Marks)**

b. Define the terms velocity potential function, stream function and establish the relation between them. **(06 Marks)**

c. A stream function is given by $\psi = 2x^2 - 2y^2$. Determine the velocity and velocity potential function at (1, 2). **(08 Marks)**

PART – B

5 a. Name the different forces present in a fluid flow. What are the forces considered for the Euler's equation of motion? **(04 Marks)**

b. State and prove Bernoulli's theorem. **(08 Marks)**

c. The diameters at the ends of a 16 m long vertical conical pipe conveying water are 0.5 m and 1.5 m. The loss of head between the ends is 2.65 m in either directions when the velocity at the smaller section is 9 m/s. If the smaller section is at the top and pressure head at this section is 2.15 m of water, find the pressure head at the lower end when the flow is, i) Downward and ii) Upward. **(08 Marks)**

6 a. Explain the phenomenon of water hammer. List the four factors affecting water hammer. **(06 Marks)**

b. Derive an expression for head loss due to sudden enlargement in a pipe flow. **(06 Marks)**

c. A pipe of 200 mm diameter and length 2000 m connects two reservoirs, having difference of water level as 20 m. Determine the discharge through the pipe. If an additional pipe of diameter 200 mm and length 1200 m is attached to the last 1200 m of the existing pipe, find the increase in discharge. Take f = 0.015 and neglect minor losses. **(08 Marks)**

7 a. With the help of a neat sketch, explain working of a current meter. **(06 Marks)**

b. Briefly explain, i) staff gauge ii) weight gauge and iii) float gauge **(06 Marks)**

c. A pitot tube inserted in a pipe of 300 mm diameter. The static pressure in pipe is 100 mm of mercury (vaccum). The stagnation pressure at the centre of the pipe, recorded by pitot tube is 9.81 kPa. Calculate the rate of flow of water through pipe. Take mean velocity as 0.85 times central velocity and $C_V = 0.98$. **(08 Marks)**

8 a. With the help of neat sketches, explain i) Cipolletti notch and ii) Ogee weir. **(06 Marks)**

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

c. A rectangular notch of crest width 400 mm is used to measure flow of water in a rectangular channel 600 mm wide and 450 mm deep. If the water level in the channel is 225 mm above the weir crest, find the discharge in the channel. For the notch assume $C_d = 0.63$ and take velocity of approach into account. **(08 Marks)**

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10CV36

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014

Applied Engineering Geology

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Assume missing data if any suitably.***

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. Explain the role of geology in the field of civil engineering. **(08 Marks)**
b. With a neat sketch, explain the different parts of internal constituents of the Earth. **(08 Marks)**
c. Describe the physical properties, chemical composition, engineering uses and group of the minerals: i) pyrite, ii) Biotite MICA. **(04 Marks)**

2 a. Explain the structures present in sedimentary rocks with neat sketches. **(10 Marks)**
b. With neat sketches explain briefly different forms of igneous bodies. **(06 Marks)**
c. Write the characters of good building stones. **(04 Marks)**

3 a. Define weathering. Explain different types, add a note on engineering importance. **(10 Marks)**
b. Briefly write a note on geological work of river. **(06 Marks)**
c. Describe the various methods of conservation of soil erosion. **(04 Marks)**

4 Write notes on the following:
a. Earthquake resistant structures **(05 Marks)**
b. Causes and prevention of land slides **(05 Marks)**
c. Coastal landforms **(05 Marks)**
d. Tsunami and its effects **(05 Marks)**

PART – B

5 a. What is fault? How do you identify the faults in the field and add a note on its engineering importance. **(10 Marks)**
b. Explain the importance of folds in civil engineering structures. **(04 Marks)**
c. Add a note on various types of unconformities. **(06 Marks)**

6 a. Explain with a neat sketch the tunneling through folded rocks. **(06 Marks)**
b. Describe the various geological considerations required during the selection of a site for dam construction. **(14 Marks)**

7 a. How the electrical resistivity method is used in groundwater exploration? **(11 Marks)**
b. Give an account of artificial recharge of groundwater by various methods. **(09 Marks)**

8 a. What is GIS? And name the different components of GIS. **(05 Marks)**
b. What are the applications of a global positioning system (GPS)? **(05 Marks)**
c. What is remote sensing? Write its applications in civil engineering. **(05 Marks)**
d. Explain the impact of mining on groundwater regime. **(05 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2013/Jan.2014

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express the complex number $\frac{(1+i)(1+3i)}{1+5i}$ in the form x + iy. **(06 Marks)**

b. Find the modulus and amplitude of $\frac{(3-\sqrt{2i})^2}{1+2i}$. **(07 Marks)**

c. Expand $\cos^8\theta$ in a series of cosines multiples of θ. **(07 Marks)**

2 a. Find the n^{th} derivative of sin(ax + b). **(06 Marks)**

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

c. Find the nth derivative of $\left[\frac{1}{5(x-1)} + \frac{-3/2}{\left(\frac{-3}{2}-1\right)(2x+3)}\right]$. **(07 Marks)**

3 a. Using Taylor's theorem, express the polynomial $2x^3 + 7x^2 + x - 6$ in powers of (x – 1). **(06 Marks)**

b. Using Maclaurin's series, expand tan x upto the term containing x^5. **(07 Marks)**

c. If $Z = x^3 + y^3 - 3axy$ then prove that $\frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y}$. **(07 Marks)**

4 a. If $u = x \log xy$ where $x^3 + y^3 + 3xy = 1$, find $\frac{du}{dx}$. **(06 Marks)**

b. If z = f(x, y) and $x = e^u + e^{-v}$ and $y = e^{-u} - e^v$, prove that $\frac{\partial z}{\partial u} - \frac{\partial z}{\partial v} = x \cdot \frac{\partial z}{\partial x} - y\frac{\partial z}{\partial y}$. **(07 Marks)**

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

5 a. Obtain the reduction formula for $\int \sin^n x\, dx$. **(06 Marks)**

b. Evaluate $\int_0^a \frac{x^7 dx}{\sqrt{a^2 - x^2}}$. **(07 Marks)**

c. Evaluate $\int_1^2 \int_3^4 (xy + e^y) dy dx$. **(07 Marks)**

6 a. Evaluate $\int_0^1 \int_0^1 \int_0^1 e^{x+y+z} dx dy dz$. **(06 Marks)**

b. Find the value of $\left|\left(\frac{1}{2}\right)\right|$. **(07 Marks)**

c. Prove that $\beta(m,n) = \frac{|(m)\,|(n)}{|(m+n)}$. **(07 Marks)**

7 a. Solve $\frac{dy}{dx} = e^{3x-2y} + x^2 \cdot e^{-2y}$. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{x^2 - y^2}{xy}$ which is homogeneous in x and y. **(07 Marks)**

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

8 a. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^x$. **(06 Marks)**

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

c. Solve $(D^2 - 1)y = x \sin 3x + \cos x$. **(07 Marks)**

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