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10MAT31

Third Semester B.E. Degree Examination, June/July 2013

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. Obtain the Fourier series expansion of $f(x) = \begin{cases} x, & \text{if } 0 \le x \le \pi \\ 2\pi - x, & \text{if } \pi \le x \le 2\pi \end{cases}$ and hence deduce that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \ldots\ldots$ **(07 Marks)**

b. Find the half range Fourier sine series of $f(x) = \begin{cases} x, & \text{if } 0 < x < \pi/2 \\ \pi - x, & \text{if } \pi/2 < x < \pi \end{cases}$. **(06 Marks)**

c. Obtain the constant term and coefficients of first cosine and sine terms in the expansion of y from the following table: **(07 Marks)**

x	0	60°	120°	180°	240°	300°	360°
y	7.9	7.2	3.6	0.5	0.9	6.8	7.9

2 a. Find the Fourier transform of $f(x) = \begin{cases} a^2 - x^2, & |x| \le a \\ 0, & |x| > a \end{cases}$ and hence deduce $\int_0^\infty \frac{\sin x - x\cos x}{x^3} dx = \frac{\pi}{4}$. **(07 Marks)**

b. Find the Fourier cosine and sine transform of $f(x) = xe^{-ax}$, where $a > 0$. **(06 Marks)**

c. Find the inverse Fourier transform of e^{-s^2}. **(07 Marks)**

3 a. Obtain the various possible solutions of one dimensional heat equation $u_t = c^2 u_{xx}$ by the method of separation of variables. **(07 Marks)**

b. A tightly stretched string of length l with fixed ends is initially in equilibrium position. It is set to vibrate by giving each point a velocity $V_o \sin\left(\frac{\pi x}{l}\right)$. Find the displacement u(x, t). **(06 Marks)**

c. Solve $u_{xx} + u_{yy} = 0$ given u(x, 0) = 0, u(x, 1) = 0, u(1, y) = 0 and u(0, y) = u_0, where u_0 is a constant. **(07 Marks)**

4 a. Using method of least square, fit a curve $y = ax^b$ for the following data. **(07 Marks)**

x	1	2	3	4	5
y	0.5	2	4.5	8	12.5

b. Solve the following LPP graphically:
Minimize $Z = 20x + 16y$
Subject to $3x + y \ge 6$, $x + y \ge 4$, $x + 3y \ge 6$ and $x, y \ge 0$. **(06 Marks)**

c. Use simplex method to
Maximize $Z = x + (1.5)y$
Subject to the constraints $x + 2y \le 160$, $3x + 2y \le 240$ and $x, y \ge 0$. **(07 Marks)**

PART – B

5 a. Using Newton-Raphson method find a real root of $x + \log_{10} x = 3.375$ near 2.9, corrected to 3-decimal places. **(07 Marks)**

b. Solve the following system of equations by relaxation method:
$12x + y + z = 31, \quad 2x + 8y - z = 24, \quad 3x + 4y + 10z = 58$ **(07 Marks)**

c. Find the largest eigen value and corresponding eigen vector of following matrix A by power method

$$A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}.$$

Use $X^{(0)} = [1, 0, 0]^T$ as the initial eigen vector. **(06 Marks)**

6 a. In the given table below, the values of y are consecutive terms of series of which 23.6 is the 6^{th} term, find the first and tenth terms of the series. **(07 Marks)**

x	3	4	5	6	7	8	9
y	4.8	8.4	14.5	23.6	36.2	52.8	73.9

b. Construct an interpolating polynomial for the data given below using 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 Weddle's rule taking 7-ordinates and hence find $\log_e 2$. **(06 Marks)**

7 a. Solve the wave equation $u_{tt} = 4u_{xx}$ subject to $u(0, t) = 0$; $u(4, t) = 0$; $u_t(x, 0) = 0$; $u(x, 0) = x(4 - x)$ by taking $h = 1$, $k = 0.5$ upto four 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 computations for two levels taking $h = \frac{1}{3}$ and $k = \frac{1}{36}$. **(07 Marks)**

c. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown in Fig.Q7(c). **(06 Marks)**

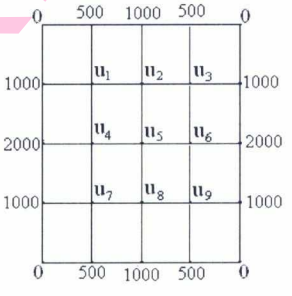

Fig.Q7(c)

8 a. Find the z-transform of: i) $\sin h\, n\theta$; ii) $\cos h\, n\theta$. **(07 Marks)**

b. Obtain the inverse z-transform of $\frac{8z^2}{(2z-1)(4z-1)}$. **(07 Marks)**

c. Solve the following difference equation using z-transforms:
$y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = y_1 = 0$ **(06 Marks)**

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10CV32

Third Semester B.E. Degree Examination, June/July 2013
Building Materials and Construction Technology

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define foundation and discuss various functions of foundation. **(06 Marks)**
b. What are the causes of failure of foundation? **(06 Marks)**
c. Mention the different types of foundations? Under what circumstances pile foundation being adopted? **(08 Marks)**

2 a. With neat sketches show any four joints in stone masonry. **(08 Marks)**
b. Explain with neat sketch random rubble masonry. **(06 Marks)**
c. Draw the plan of 1½ brick wall of English bond. **(06 Marks)**

3 a. Define a Lintel. Explain R.C.C. lintel with a sketch. **(06 Marks)**
b. Suggest suitable measures to avoid failure of an arch. **(06 Marks)**
c. Draw the neat sketches of the following:
i) Segmental arch ii) Relieving arch. **(08 Marks)**

4 a. Define roof. What are the requirements of a good roof? **(06 Marks)**
b. What are the factors affecting selection of flooring materials. **(07 Marks)**
c. Sketch neatly lean-to-roof and name the parts. **(07 Marks)**

PART – B

5 a. Define the technical terms used in doors and windows:
Frame, Shutters, Style, Panel, Lockrail. **(05 Marks)**
b. Write briefly on any two of the following with neat sketches:
i) Panelled door ii) Bay window iii) Ventilators iv) Revolving door. **(10 Marks)**
c. Draw the elevation and section of a Glazed window. **(05 Marks)**

6 a. What are the requirements of a good stairs? **(08 Marks)**
b. Plan a dog-legged stair for a building in which the vertical distance between the floors is 3.6 m. The stair hall measures 2.5m×5.0m. **(12 Marks)**

7 a. What are the objects of plastering? List the requirements of a good plaster. **(08 Marks)**
b. What are the defects arise in plastering? **(06 Marks)**
c. Explain the procedure of painting for iron and steel surfaces. **(06 Marks)**

8 a. What is damp proof course? Explain its necessity in a building. **(06 Marks)**
b. What are the requirements of good formwork? **(06 Marks)**
c. What do you mean by shoring and underpinning? **(08 Marks)**

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10CV/EV33

Third Semester B.E. Degree Examination, June/July 2013

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. Briefly explain the behaviour of ductile material under gradually increasing tensile load. **(05 Marks)**

b. Derive the relationship between modulus of rigidity and modulus of elasticity. **(05 Marks)**

c. A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in Fig.Q1(c). Calculate the force P_2 necessary for equilibrium, if P_1 = 45 kN, P_3 = 450 kN and P_4 = 130 kN. Determine the total elongation of the member, assuming the modulus of elasticity to be 2.1×10^5 N/mm^2. **(10 Marks)**

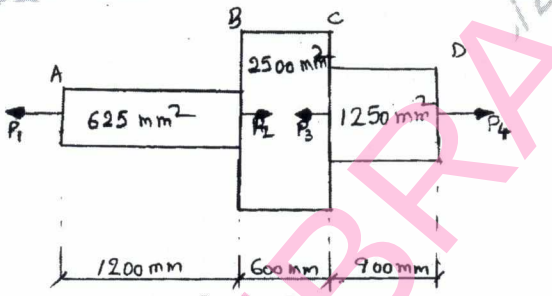

Fig.Q1(c)

2 a. Define: i) Modular ratio, ii) Volumetric strain. **(04 Marks)**

b. A load of 2 MN is applied on a column 500 mm × 500 mm. The column is reinforced with four steel bars of 10 mm diameter, one in each corner. Find the stresses in the concrete and steel bars. Take "E" for steel as 2.1×10^5 N/mm^2 and for concrete as 1.4×10^4 N/mm^2. **(08 Marks)**

c. A steel rod of 20 mm diameter passes centrally through a copper tube of 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the protecting parts of the rod. If the temperature of the assembly is raised by 50°C, calculate the stresses developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 N/m^2 and α for steel and copper as 12×10^{-6}/°C and 18×10^{-6}/°C. **(08 Marks)**

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

b. A rectangular bar is subjected to a direct stress (σ) in one plane only. Prove that the normal and shear stresses on an oblique plane are given by $\sigma_n = \sigma \cos^2 \theta$ and $\sigma_t = \frac{\sigma}{t} \sin 2\theta$.

θ = Angle made by oblique plane with the normal cross section of the bar. **(06 Marks)**

c. Two wooden pieces 100 mm × 100 mm in cross section are glued together along line AB as shown in Fig.Q3(c). What maximum axial force 'P' can be applied if the allowable shearing stress along AB is 1.2 N/mm^2? **(10 Marks)**

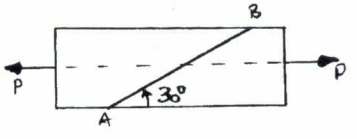

Fig.Q3(c)

4 a. Define: i) Shear force, ii) Bending moment. **(04 Marks)**

b. Through sketch list the important type of beams. **(05 Marks)**

c. Fig.Q4(c) shown the shear force diagram for a simply supported beam. Obtain the loading pattern and also draw the bending moment diagram. **(11 Marks)**

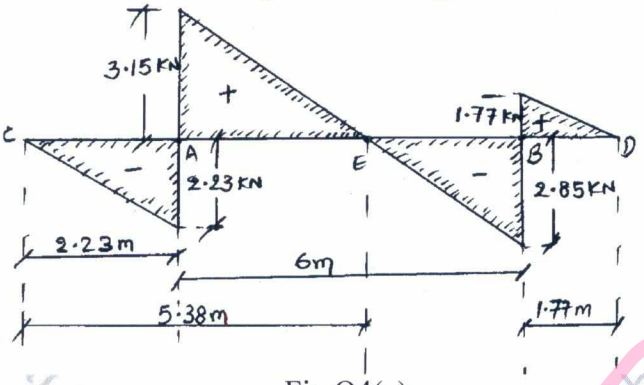

Fig.Q4(c)

PART – B

5 a. Define: i) Neutral axis, ii) Section modulus, iii) Moment of resistance. **(06 Marks)**

b. Calculate the maximum bending stress induced in a cast iron pipe of external diameter 40 mm, internal diameter 20 mm and of length 4 metre when the pipe is simply supported at its ends and carries a point load of 80 N at its centre. **(06 Marks)**

c. A beam is simply supported and carries a uniformly distributed load of 40 kN/m over the entire span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm^2 and moment of inertia of the section is 7×10^8 mm^4, find the span of the beam. **(08 Marks)**

6 a. Define: i) Deflection, ii) Elastic curve. **(04 Marks)**

b. Derive an expression for the slope and deflection of a simply supported beam carrying a point load at the centre. **(10 Marks)**

c. A beam 3m long, simply supported at its ends, is carrying a point load "W" at the centre. If the slope at the ends of the beam should not exceed 1^o, find the deflection at the centre of the beam. **(06 Marks)**

7 a. Define: Torsional rigidity, ii) Polar moment of inertia. **(04 Marks)**

b. For a circular shaft subjected to torsion, derive the relationship between the torque transmitted and shear stress induced in the shaft. **(06 Marks)**

c. A hollow circular shaft is to transmit 300 kW power at 80 rpm. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter is 0.6 of the external diameter, find the external and internal diameter assuming that the maximum torque is 1.4 times the mean. **(10 Marks)**

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

b. Using Euler's theory, derive an equation for the crippling load of a long column pinned at both ends. **(06 Marks)**

c. A simply supported beam of length 4 metre is subjected to a uniformly distributed load of 30 kN/mt over the whole span and deflects 15 mm at the centre. Determine the crippling load when this beam is used as a column with both the ends hinged. **(10 Marks)**

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10CV/EV34

Third Semester B.E. Degree Examination, June/July 2013

Surveying – I

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. Explain the classification of survey. **(08 Marks)**

b. Explain the basic principles of surveying. **(06 Marks)**

c. What is Ranging? Explain indirect method of ranging. **(06 Marks)**

2 a. List the different tape corrections. Explain and give expressions for tape corrections. **(10 Marks)**

b. A 30 m chain was tested, before measurement of the day's work and found to be correct. After measuring 3000 m, the chain, was found to be 5 cm too long. At the end of day's work after measuring 5400 m, the chain was found to be 10 cm too long. What was the true distance chained? **(06 Marks)**

c. A rectangular plot was measured with a 20 m chain which was 12 cm too long. The area obtained was 117600 m^2. Find the true area of plot. **(04 Marks)**

3 a. With neat sketches, explain obstacles in chaining. **(08 Marks)**

b. With a neat diagram, explain the working of an optical square. **(07 Marks)**

c. A chain line ABC crosses a river, B and C being on the near and distant banks respectively. The respective bearings of C and A taken at D, a point 45 m measured at right angles to AB from B are 300° and 210°. The length of AB is 24 m. Find the width of the river. **(05 Marks)**

4 a. Define the terms true bearing, magnetic bearing, whole circle bearing and quadrantal bearing. **(04 Marks)**

b. The following bearings were observal with a compass. Calculate the interior angles.

Line	AB	BC	CD	DE	EA
Fore bearing	60° 30′	122° 0′	46° 0′	205° 30′	300° 0′

(10 Marks)

c. On an old map, a line was drawn to a magnetic bearing of 320°30′ when the declination was 3°30′ W. Find the present bearing of the line if the declination is 4°15′ E. **(06 Marks)**

PART – B

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

b. Explain dependant and independent coordinates. **(04 Marks)**

c. Following are the observed bearings of a closed traverse:

Line	PQ	QR	RS	SP
F.B	124° 30′	68° 15′	310° 30′	200° 15′
B.B	304° 30′	246° 0′	135° 15′	17° 45′

At what station local attraction was suspected. Determine the correct bearings of the lines. **(10 Marks)**

6 a. Define the terms: level surface, bench mark, reduced level, back sight. **(04 Marks)**

b. Explain the temporary adjustments of dumpy level. **(06 Marks)**

c. The following readings were observed successively with a leveling instrument. The instrument was shifted after 5th and 11th readings. Draw a page of level book and determine the R.L. of various points by H.I. method if the R.L. of 1st point was 264.350 m.

0.485, 1.020, 1.787, 3.395, 3.875, 0.360, 1.305, 1.785, 2.675, 3.385, 3.885, 1.835, 0.435 and 1.705. **(10 Marks)**

7 a. Write a note on profile leveling and cross sectioning. **(08 Marks)**

b. Explain the characteristics of contours. **(07 Marks)**

c. What is meant by orientation? Explain any one method of orientation. **(05 Marks)**

8 Write short notes on any FOUR:

a. Traversing

b. Grade contour

c. Curvature and refraction

d. Classification of maps and their numbering

e. Precision and accuracy

f. Profile leveling. **(20 Marks)**

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10CV35

Third Semester B.E. Degree Examination, June/July 2013
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 if any.

PART – A

1 a. Write units of i)Surface tension; ii) Dynamic viscosity; iii) Power; iv) Momentum and v) Pressure. **(05 Marks)**

b. Illustrate capillary rise and drop with appropriate sketches clearly indicating the fluids involved in each case. **(05 Marks)**

c. A thin plate is placed between two flat surfaces 'h' cm apart such that the viscosity of the liquids on the top and bottom of the plate are μ_1 and μ_2 respectively. Determine the position of the thin plate such that the viscous resistance to uniform motion of the thin plate is minimum. Assume 'h' to be very small. **(10 Marks)**

2 a. Derive equation for hydrostatic law of pressure variation. **(08 Marks)**

b. If mercury barometer reads 700mm and Bourdon gauge at a point in a flow system reads 500 kN/m^2, what is the absolute pressure at the point? **(04 Marks)**

c. Fig.Q.2(c) shows a glass funnel fitted to a U tube-manometer. The manometer reading is 0.25m when the tunnel is empty what is the manometer reading when the tunnel is completely fitted with water? Take funnel height = 2m. **(08 Marks)**

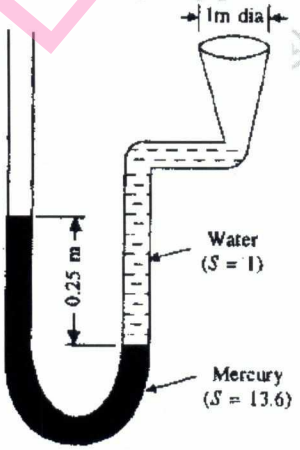


Fig.Q.2(c)

3 a. Prove that for a plate submerged in horizontal position in water the centre of pressure is same as centroid of the plate. **(10 Marks)**

b. Fig.Q.3(b) shows a rectangular flash board AB which is 4.5m high and is pivoted at C. What must be the maximum height of C above B so that the flash board will be on the verge of tipping when water surface is at A? Also determine if the pivot of the flash board is at a height h = 1.5m, the reactions at B and C when the water surface is 4m above B. **(10 Marks)**

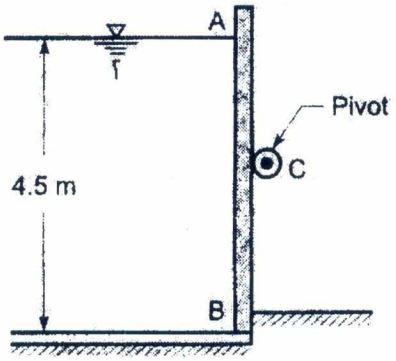


Fig.Q.3(b)

4 a. In a flow the velocity vector is given by $V = 3x\vec{i} + 4y\vec{j} - 7z\vec{k}$. Determine the equation of the stream line passing through a point M(1, 4, 5). **(10 Marks)**

b. The velocity potential ϕ for a two dimensional flow is given by $(x^2 - y^2) + 3xy$. Calculate: i) the stream function ψ and ii) the flow rate passing between the stream lines through (1, 1) and (1, 2). **(10 Marks)**

PART – B

5 a. Fig.Q.5(a) shows nozzle at the end of a pipe line discharging oil from a tank to atmosphere. Estimate the discharge from the nozzle when the head 'H' in the tank is 4m. The loss in the pipe can be taken as $20\ V^2/2g$, where 'V' is the velocity in the pipe. The loss of energy in the nozzle can be assumed to be zero. Also, determine the pressure at the base of the nozzle. **(10 Marks)**

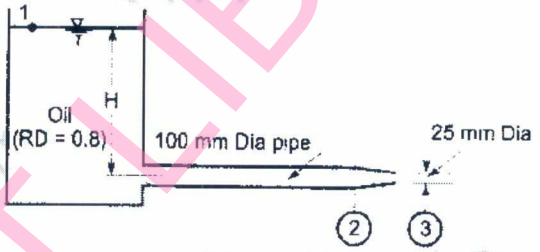


Fig.Q.5(a)

b. 250 LPS of water is flowing in a pipe having a diameter of 300mm. If the pipe is bent by 135°. Find the magnitude and direction of the resultant force on the bend. The pressure of the water flowing is 400 kN/m^2. Take specific weight of water as 9.81 kN/m^3. Refer Fig.Q.5(b). **(10 Marks)**

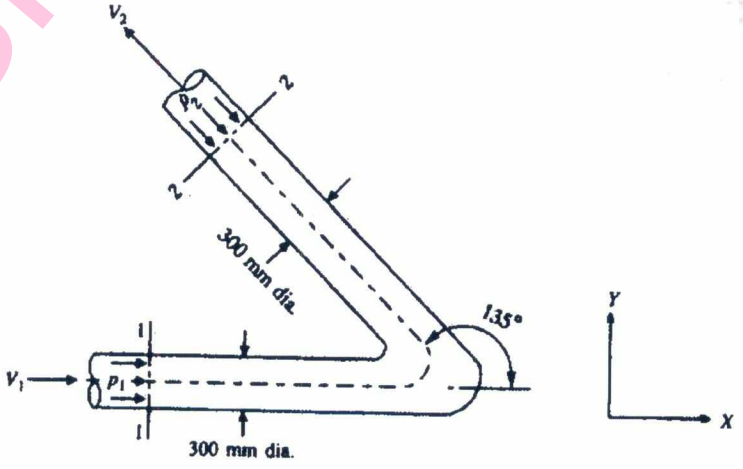


Fig.Q.5(b)

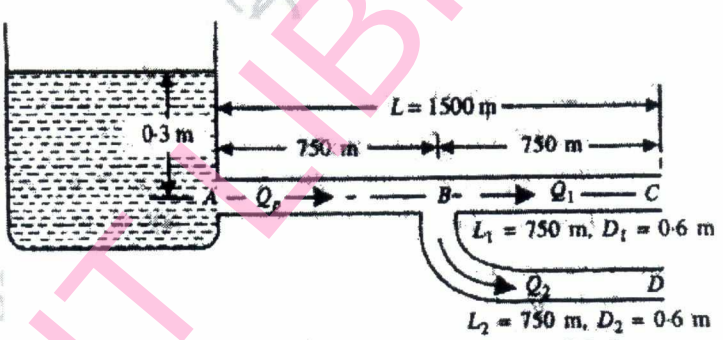
6 a. The following data were collected for a stream at a gauging station. Compute the discharge through the stream. Rating equation of current meter V = 0.3N + 0.05, N = revolutions per second, V = velocity in m/s. **(10 Marks)**

Distance from one end of water surface (m)	Water depth 'd' (m)	Current meter immersion at					
		0.6 d		0.2 d		0.8 d	
		Rev.	S	Rev.	S	Rev.	S
3	1.4	12	50	-	-	-	-
6	3.3	-	-	38	52	23	55
9	5.0	-	-	40	58	30	54
12	9.0	-	-	48	60	34	58
15	5.4	-	-	34	52	30	50
18	3.8	-	-	35	52	30	54
21	1.8	18	50	-	-	-	-

b. Compare manual and self recording depth gauges. **(04 Marks)**

c. A pitot tube is mounted on an airplane to indicate the speed of the plane relative to the prevailing wind. What differential pressure intensity in kPa will the instrument register when the plane is traveling at a speed of 200km/hr in a wind of 60 km/hr blowing against the direction of the plane? $e_{air} = 1.2$ kg/m^3. **(06 Marks)**

7 a. A pipe line of 600mm diameter is 1.5 km long. To increase the discharge another line of the same diameter is introduced parallel to the first in the second half of the length (Fig.Q.7(a). If the friction factor is 0.04 and the head at the inlet is 0.3m, calculate the increase in discharge. **(10 Marks)**



b. The velocity of water in a 60cm diameter and 15mm thick cast iron pipe ($E = 1.04 \times 10^{11}$ pa) is changed from 3 m/s to zero in 1.25 s by closure of a valve i) if the pipe length is 800m what will be the water hammer pressure at the valve? What will be the corresponding pressure rise if the closure takes place in; ii) 2 s and iii) 0.8s respectively? Bulk module of elasticity of water is 2.11×10^9 N/m^2. **(10 Marks)**

8 a. It is required to establish the throat diameter of a venturimeter in an installation of 100mm diameter pipe conveying water. The maximum range available in mercury-water differential manometer gauge is 50cm of mercury deflection. Find the maximum throat diameter which will indicate the fill gauge deflection when the flow rate is 20 LPs assuming coefficient of venturimeter as 0.984. **(10 Marks)**

b. A discharge of 0.06 m^3/s was measured over a right angled notch. While measuring the head over the notch an error of 1.5mm was made. Determine the percentage error in discharge if the coefficient of discharge for the notch is 0.6. **(10 Marks)**

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10CV36

Third Semester B.E. Degree Examination, June/July 2013
Applied Engineering Geology

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Briefly describe the zonal structure of the earth and add a note on its density and composition. **(06 Marks)**

b. Describe the property of cleavage and hardness in minerals. **(06 Marks)**

c. With the aid of physical properties, chemistry and uses, distigusih between
i) Quartz and calcite ii) Chalcopyrite and orthoclase. **(08 Marks)**

2 a. What are Igneous rocks? How are they classified? Give a brief account of mineralogy, texture and mode of occurrence of the following igneous rocks
i) Dunite ii) pegmatite iii) Basalt. **(08 Marks)**

b. Write short notes on current bedding. **(06 Marks)**

c. What is metamorphism? Mention the types of metamorphism and add a note on contact metamorphism. **(06 Marks)**

3 a. What is wreathering? Write a note on mechanical weathering by thermal effect. **(06 Marks)**

b. What are rivers? Describe the geological action of rivers and add a note on meandering of rivers. **(08 Marks)**

c. What is a soil and soil profile? Describe the various methods of conservation of soil erosion. **(06 Marks)**

4 a. What are earthquakes? Describe tectonic course of earthquakes. **(10 Marks)**

b. Write a note on causes of land slides. **(05 Marks)**

c. Write a brief note on costal land forms. **(05 Marks)**

PART – B

5 a. What are faults? How are they distinguished from joints and give a brief account of normal and reverse faults? **(10 Marks)**

b. Write short notes on recumbent and isoclinal fold. **(06 Marks)**

c. What is Dip and strike? **(04 Marks)**

6 Explain :

a. Tunneling a cross folded rocks. **(07 Marks)**

b. Dam fundations on folded rocks. **(07 Marks)**

c. Silting of reservoir. **(06 Marks)**

7 a. What is a water fable? And add a note on parched water table. **(05 Marks)**

b. What are aquifers? Write a note on confined aquifer. **(05 Marks)**

c. Explain the electrical resistivity method for exploration of ground water. **(10 Marks)**

8 Write a short notes on following :

a. Application of remote sensing in civil engineering

b. Impact of mining on environment

c. GPS

d. GIS. **(20 Marks)**

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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.

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2013

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Find modulus and amplitude of $1+\cos\theta+i\sin\theta$. **(06 Marks)**

b. If n is positive integer, prove that $(\sqrt{3}+i)^n+(\sqrt{3}-i)^n = 2^{n+1}\cos\left(\frac{n\pi}{2}\right)$. **(07 Marks)**

c. Find the cube root of $1+i$ and represent them in the Argand diagram. **(07 Marks)**

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

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

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

3 a. Prove that $\tan\phi = r\frac{d\theta}{dr}$ with usual notations. **(06 Marks)**

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

c. Expand $f(x) = \sqrt{1+\sin 2x}$ using Maclaurin's series upto 4^{th} term. **(07 Marks)**

4 a. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y} = \sin 2u$. **(06 Marks)**

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

c. If $u = \tan^{-1}x + \tan^{-1}y$ and $V = \frac{x+y}{1-xy}$, find the value of $\frac{\partial(u,v)}{\partial(x,y)}$. **(07 Marks)**

5 a. Obtain the reduction formula for $\int\cos^n x\,dx$ where n is a positive integer. **(06 Marks)**

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

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

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

b. Prove that $\left|\frac{1}{2}\right| = \sqrt{\pi}$. **(07 Marks)**

c. Show that $\int_0^{\pi/2}\sqrt{\sin\theta}\,d\theta \times \int_0^{\pi/2}\frac{1}{\sqrt{\sin\theta}}d\theta = \pi$ **(07 Marks)**

7 a. Solve $xy\frac{dy}{dx} = 1 + x + y + xy$. **(06 Marks)**

b. Solve $\left[x\tan\left(\frac{y}{x}\right) - y\sec^2\left(\frac{y}{x}\right)\right]dx + x\sec^2\left(\frac{y}{x}\right)dy = 0$ **(07 Marks)**

c. Solve $\frac{dy}{dx} + y\cot x = 4x\,\text{cosec}\,x$. **(07 Marks)**

8 a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 2e^{3x}$. **(06 Marks)**

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

c. Solve $\frac{d^2y}{dx^2} + 4y = 1 + x^2$ **(07 Marks)**

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