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10MAT41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Use Picards method to obtain the solution of $\frac{dy}{dx} = e^x - y$, $y(0) = 1$ and hence find $y(0.2)$ considering upto third approximation. **(06 Marks)**

b. Using Runge-Kutta method of fourth order find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

c. Find $y(0.2)$ using modified Euler's method correct to four decimal places for the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$, taking $h = 0.1$. **(07 Marks)**

2 a. Solve $\frac{dy}{dx} = 1 + zx$, $\frac{dz}{dx} = -xy$ with $y(0) = 0$, $z(0) = 1$ at $x = 0.3$ by applying Runge-Kutta method of fourth order. **(06 Marks)**

b. Obtain the solution of the equation $2y'' = 4x + y'$ with initial conditions $y(1) = 2$, $y(1.1) = 2.2156$, $y(1.2) = 2.464$, $y(1.3) = 2.7514$ and $y'(1) = 2$, $y'(1.1) = 2.3178$, $y'(1.2) = 2.6725$ and $y'(1.3) = 3.0657$ by computing $y(1.4)$ applying Milne's method. **(07 Marks)**

c. Use Picard's method to obtain the second approximation to the solution of $\frac{d^2y}{dx^2} - x^3\frac{dy}{dx} - x^3y = 0$ given $y(0) = 1$, $y'(0) = \frac{1}{2}$ and hence find $y(0.1)$. **(07 Marks)**

3 a. State and prove Cauchy-Riemann equations in polar form. **(06 Marks)**

b. Find the analytic function $f(z)$ whose imaginary part is $\left(r - \frac{k^2}{r}\right)\sin\theta$, $r \neq 0$ and hence find the real part of $f(z)$. **(07 Marks)**

c. If $f(z)$ is a regular function of z, show that $\left[\frac{\partial}{\partial x}|f(z)|\right]^2 + \left[\frac{\partial}{\partial y}|f(z)|\right]^2 = |f'(z)|^2$. **(07 Marks)**

4 a. Find the image of the triangular region bounded by the lines $x = 1$, $y = 1$, $x + y = 1$ under the transformation $W = Z^2$. **(07 Marks)**

b. If $f(z)$ is analytic within and on C (simple closed curve) and 'a' is a point within 'c' prove that $f(a) = \frac{1}{2\pi i}\int_C \frac{f(z)}{z-a}dz$. **(06 Marks)**

c. Evaluate $\int_C \frac{e^{2z}}{(z+1)^2(z-2)}$ where C is the circle $|z| = 3$. **(07 Marks)**

PART – B

5 a. Obtain the series solution of Bessel's differential equation. **(07 Marks)**

b. Derive the Rodrigues formula. **(06 Marks)**

c. If $x^3 + 2x^2 - x + 1 = aP_0(x) + bP_1(x) + cP_2(x) + dP_3(x)$ using Rodrigue's formula find the values of a, b, c, d. **(07 Marks)**

6 a. If A and B are events with $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{4}$, $P(\bar{B}) = \frac{5}{8}$ find $P(A \cap B)$, $P(\bar{A} \cap \bar{B})$, $P(\bar{A} \cup \bar{B})$ and $P(\bar{A} \cap B)$. **(06 Marks)**

b. In a college boys and girls are equal in proportion. It was found that 10 out of 100 boys and 25 out of 100 girls were referring same author text book. If a student using that was selected at random, what is the probability of being a boy? **(07 Marks)**

c. A bag contains three coins, one of which is two headed and the other two are normal and fair. A coin is chosen at random from the bag and tossed four times in Succession if head turns up each time, what is the probability that this is the two headed coin. **(07 Marks)**

7 a. Find the value of 'K' such that the following distribution represents a finite probability distribution. Hence find the mean (μ) and standard deviation (σ). Also find $P(X \leq 1)$, $P(X>1)$ and $P(-1 < X \leq 2)$. **(06 Marks)**

X	-3	-2	-1	0	1	2	3
P(X)	k	2k	3k	4k	3k	2k	k

b. If the mean and standard deviation of the number of correctly answered questions in a test given to 4096 students are 2.5 and $\sqrt{1.875}$, find an estimate of the number of candidates answering correctly (i) 8 or more questions (ii) 2 or less (iii) 5 questions. **(07 Marks)**

c. Derive the expressions for the mean and standard deviation of exponential distribution. **(07 Marks)**

8 a. Certain tubes manufactured by a company have mean life time of 800 hours and standard deviation of 60 hours. Find the probability that a random sample of 16 tubes taken from the group will have mean life time, (i) between 790 hours and 810 hours. (ii) less than 785 hours. **(06 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following result.

Horse A:	28	30	32	33	29	34
Horse B:	29	30	30	24	27	29

Test whether you can discriminate between the two horses. Use $t_{0.05} = 2.2$ and $t_{0.02} = 2.72$ **(07 Marks)**

c. A die is thrown 264 times and the number appearing on the face (x) follows the frequency distribution as mentioned below:

x	1	2	3	4	5	6
f	40	32	28	58	54	60

Calculate the value of χ^2. **(07 Marks)**

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10CV42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Concrete Technology

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Use of IS-10262-2009 is permitted.***

PART – A

1 a. Name Bogues' compound in cement. Explain the manufacture of OPC cement by dry process with the help of flow chart only. **(10 Marks)**

b. What are the tests usually conducted on cement in the laboratory. Explain any two tests. **(10 Marks)**

2 a. Explain the importance of size, shape and texture of coarse aggregates on the quality of concrete. **(10 Marks)**

b. Explain bulking of sand and its importance. **(10 Marks)**

3 a. What are the tests commonly employed to measure workability? Explain any two tests to measure workability. **(10 Marks)**

b. List and explain the factors that affect the workability of concrete. **(10 Marks)**

4 a. What are chemical admixtures? Explain plastisizers, accelerators and retarders. **(10 Marks)**

b. Explain the following:
(i) Fly ash (ii) Silica fume (iii) Rice husk ash (iv) GGBS. **(10 Marks)**

PART – B

5 a. Explain factors affecting strength of concrete. **(10 Marks)**

b. Explain flextural strength and split tensile strength tests on concrete. **(10 Marks)**

6 a. Explain the factors affecting the modulus of elasticity of concrete. **(05 Marks)**

b. Explain the relation between modulus of elasticity and compressive strength. **(05 Marks)**

c. Explain creep and shrinkage of concrete. **(10 Marks)**

7 a. Define durability of concrete and explain its significance. **(05 Marks)**

b. Explain the effects of freezing and thawing on the durability of concrete. **(05 Marks)**

c. What is sulphate attack on concrete? Explain methods of controlling it. **(10 Marks)**

8 Design a concrete mix of M_{35} grade as per IS10262-2009, with the following stipulations:
i) Grade designation – M_{35}.
ii) Type of cement – OPC43 grade confirming to IS12269-1987.
iii) Maximum nominal size of aggregate – 20 mm.
iv) Minimum cement content – 290 kg/m^3
v) Maximum W/C ratio – 0.55
vi) Workability – 125 mm (slump)
vii) Exposure condition – moderate (for RCC)
viii) Method of concrete placing – pumping.
ix) Degree of supervision – Good.
x) Type of aggregate – sub angular aggregate.
xi) Maximum cement content – 450 kg/m^3
xii) Chemical admixture type – super plastisizers.
(Capable of reducing water content upto 25% maximum). **(20 Marks)**

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10CV43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Structural Analysis – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Difference between determinate and indeterminate structures. **(05 Marks)**

b. Determine the static and kinematic in determinacy for the following structures shown in Fig.Q1(b)(i), (ii) & (iii). **(06 Marks)**

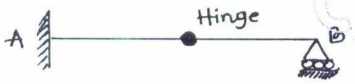

Fig.Q1(b)(i)

Fig.Q1(b)(ii)

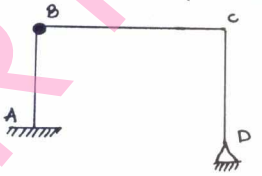

Fig.Q1(b)(iii)

c. Derive an expression for strain energy due to bending. **(09 Marks)**

2 a. Determine the slope and deflection at the free end for the cantilever beam shown in Fig.Q2(a). Using moment area method.

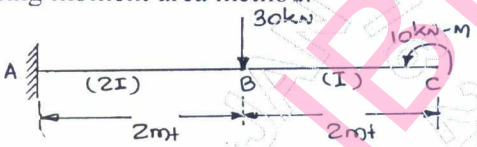

Fig.Q2(a) **(10 Marks)**

b. Determine the slope at the support and deflection under the point load as shown in Fig.Q2(b). Using conjugate beam method.

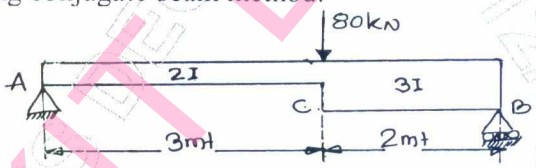

Fig.Q2(b) **(10 Marks)**

3 a. i) State and prove Maxwell's reciprocal theorem. **(06 Marks)**

ii) State Castigliano's first and second theorems. **(04 Marks)**

b. Using Castigliano's theorem, determine the deflection at the load point for the simply supported beam shown in Fig.Q3(b). Take EI is constant.

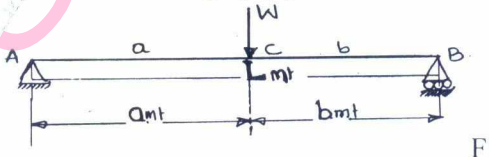

Fig.Q3(b) **(10 Marks)**

4 a. Find the deflection under the concentrated load for beam shown in Fig.Q4(a). Using strain energy method. Take $E = 2 \times 10^8$ kN/m^2, $I = 14 \times 10^{-6}$ m^4.

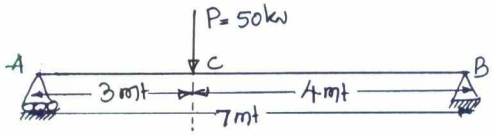

Fig.Q4(a) **(10 Marks)**

b. Determine the horizontal displacement of the roller support end 'A' of the frame shown in Fig.Q4(b) by using unit load method. Take EI = 8000 kN-m^2.

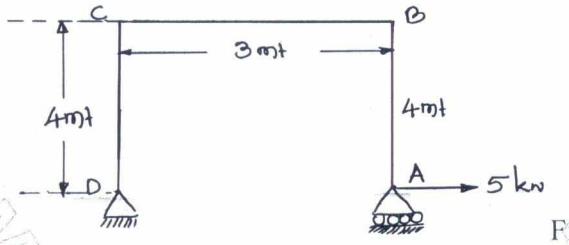

Fig.Q4(b) **(10 Marks)**

PART – B

5 a. A three hinged parabolic arch has a span of 30 mt and a central rise of 6 mt. The arch carries a UDL of intensity 3 kN/mt. Over left half portion and a concentrated load of 6 kN at a distance of 9 mt from right hand support, compute the bending moment, normal thrust and radial shear at 9 mt from left hand support. **(10 Marks)**

b. A suspension bridge of 120 mt span has a central dip of 12 mt and a UDL of 15 kN/m of whole span. Determine:
i) The maximum and minimum tension in a cable.
ii) The size of the cable, if the permissible stress of the cable material is 200 N/mm^2.
iii) The length of the cable. **(10 Marks)**

6 Determine all the reaction components and, draw shear and moment diagrams for the beam shown in Fig.Q6.

Fig.Q6 **(20 Marks)**

7 Analyze the beam shown in Fig.Q7 and draw shear force and bending moment diagrams by using Clapeyron's theorem.

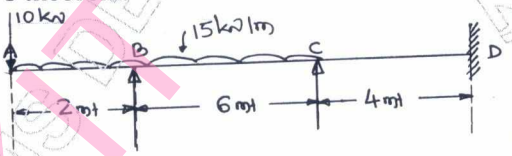

Fig.Q7 **(20 Marks)**

8 A two hinged parabolic arch of span 40 mt and carries a udl of 30 kN/mt over left half portion and a concentrated load of 120 kN at 5 mt from right hand support. Find the horizontal thrust and normal thrust and radial sheath at 10 mt from right hand support. [Refer Fig.Q8]

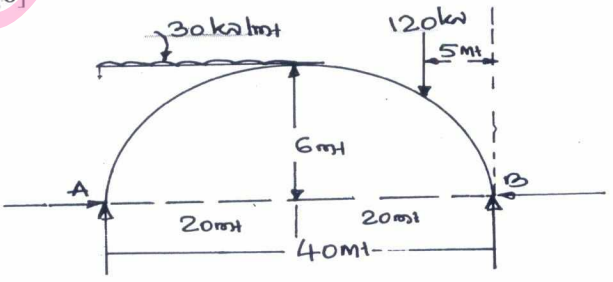

Fig.Q8 **(20 Marks)**

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10CV44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Surveying – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Differentiate between :
   i) Line of collimation and trunnion Axis
   ii) Horizontal axis and vertical axis
   iii) Temporary and Permanent adjustment. **(09 Marks)**

b. Explain the measurement of a horizontal Angle by repetition method. **(06 Marks)**

c. Explain the method of measurement of a vertical angle using a theodolite. **(05 Marks)**

2 a. Explain the object, necessity, test and adjustment of making the axis of the bubble tube perpendicular to the vertical axis of a dumpy level. **(08 Marks)**

b. Name the fundamental axis of theodolite. **(04 Marks)**

c. In a two Peg test on a dumpy level the following readings were taken :

Level at	Reading on		Remarks
	A	B	
O	1.682	1.320	'O' is exactly midway between A and B
A	1.528	1.178	distance between A and B = 100m

Is with the instrument of 'A' what should be the staff reading on 'B' in order to place the line of collimation truly horizontal. **(08 Marks)**

3 a. Derive the expression for the horizontal distance, vertical height and the elevation of object, whose base is accessible by single plane method. **(10 Marks)**

b. Determine the reduced level of a church spire 'C' from the following observations taken from two station A and B, 75 mtrs apart.
$\angle BAC = 62° 18'$, $\angle ABC = 72° 42'$
Angle of elevation from A to top of spire = 20° 12′
Angle of elevation form B to top spire = 21° 6′
Staff reading from A on BM of RL 400.00mtr = 2.240
Staff reading from B to same BM = 3.260m **(10 Marks)**

4 a. Write explanatory notes on use of anallatic lens and subtense bar in tachometry. **(08 Marks)**

b. A tachometer fitted with an anallatic lens was set up a station 'D' with the following :

Station sited	Bearing	Staff Readings			Vertical angle
A	340° 30′	0.800	1.855	2.910	+ 6° 30′
B	70° 30′	0.660	2.200	3.740	–4° 20′

Determine the distance AB and gradient from point A to point B. **(12 Marks)**

PART – B

5 a. Derive a relationship between radius and degree of a curve for arc. **(04 Marks)**

b. Derive the expression for perpendicular offset from tangent in linear method. **(06 Marks)**

c. Explain the method of setting out a simple circular curve by Rankin's method. **(10 Marks)**

6 a. A compound curve consisting of two arcs of radii 350m and 550mtr connects two straights AB and BC, which are intersected by a line PQ. The angles APQ and BQP are 139° 30′ and 36°24′ respectively. Determine the Chainages of the tangent points if the chainage of the intersection point B is 5425.191mtr. **(12 Marks)**

b. The first branch of a reverse curve has a radius of 200mtr. Find the radius of second branch so that the curve can connect parallel straights 18m apart. The distance between tangent points is to be 110m. Also calculate the length of two branches of the curve. **(08 Marks)**

7 a. What is transition curve and why it is used? Also explain with suitable sketch of shift. **(08 Marks)**

b. A parabolic vertical curve is to be set out between an upgradient of 0.8% and a down gradient of 0.4%. The chainage and RL of intersection point are 124.30m and 268.60m respectively. The rate of change of grade is 0.1%, per chain length of 30mtr. Calculate the chinage and RL of beginning, end and vertex point of the vertical curve. **(12 Marks)**

8 a. Explain the method of using planimeter in area calculations. **(06 Marks)**

b. What is 'zero circle of a planimeter? **(02 Marks)**

c. A road embankment is 8.0m wide and 200mtr length at the formation level with a side slope of 1.5:1. The embankment has a rising gradient of 1 in 100 mtr. The ground levels at every 50m along the centre line are as follows :

Distance (m)	0	50	100	150	200
RL (mtr)	164.5	165.2	166.8	167	167.2

The formation level of zero Chainage is 166mtr, calculate the volume of earth work. **(12 Marks)**

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10CV45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Hydraulic and Hydraulic Machines

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Assume missing data suitably and specify.

PART – A

1 a. State and explain Buckingham's π – method. Give the guidelines for selection of repeating variables. **(06 Marks)**

b. Explain Geometric similarity, Kinematic similarity and Dynamic similarity. **(06 Marks)**

c. Using Buckingham's π – theorem, show that the discharge (Q) over a spillway is given by $Q = VD^2 f\left[\frac{\sqrt{gD}}{V}, \frac{H}{D}\right]$, where V is velocity of flow, D is depth at the throat , H is Head of water and g is acceleration due to gravity. **(08 Marks)**

2 a. Give the differences between Open channel flow and Pipe flow. **(04 Marks)**

b. Derive the expression for velocity of uniform flow in open channel flow given by Chezy. **(08 Marks)**

c. Determine the dimensions of most economical trapezoidal channel section to carry a discharge of 25 cumecs with a velocity of 1.2 m/sec. The side slopes of the channel are 2V : 3H. Find also the necessary bed slope required. Take Manning's n = 0.025. **(08 Marks)**

3 a. Explain the specific energy diagram, with a neat sketch. **(05 Marks)**

b. Obtain the expression for loss of energy head for a hydraulic jump in a rectangular channel. **(07 Marks)**

c. A 8m wide channel conveys 15m^3/s of water at a depth of 1.2m. Calculate i) Specific energy of the flowing water ii) Critical depth , Critical velocity and Minimum specific energy. **(08 Marks)**

4 a. Give the practical applications of Impulse momentum principle. **(04 Marks)**

b. Obtain the expression for efficiency in case of jet striking series flat plates mounted on the periphery of a wheel and value of maximum efficiency. **(08 Marks)**

c. A jet of water 2.5cms diameter strikes a hinged square plate at its centre with a velocity of 20m/s. The plate is deflected through an angle of 30^0. Find the weight of the plate. If the plate is not allowed to swing, find the force required at the lower edge of the plate to keep the plate in vertical position. **(08 Marks)**

PART – B

5 a. Obtain the expression for efficiency when jet striking an unsymmetrical moving curved vane tangentially at one of the tips. **(10 Marks)**

b. A jet of water of diameter 50mm, having a velocity of 20m/s strikes a curved vane which is moving with a velocity of 10m/s in the direction of the jet. The jet leaves the vane at an angle 60^0 to the direction of motion of vane at outlet. Determine
i) the force exerted by the jet in the direction of the motion and
ii) work done per second by the jet. **(10 Marks)**

6 a. Explain different efficiencies in case of turbine. **(08 Marks)**

b. Draw a neat sketch of Pelton wheel turbine and name the different parts. **(04 Marks)**

c. A Pelton wheel is to be designed for the following specifications :
Power = 9560 kW ; Head = 350 meters ; Speed = 750 rpm ;
Overall efficiency = 85% ; Jet ratio = 6. Determine the following i) The wheel diameter ii) Diameter of the jet and iii) the number of jets required. **(08 Marks)**

7 a. Explain Cavitation in turbines. **(06 Marks)**

b. Define Efficiency of draft tube and give its mathematical expression. **(04 Marks)**

c. A Kaplan turbine runner is to be designed to develop 10,000 kW. The net available head is 6.0m. The speed ratio is 2.09. The flow ratio is 0.68. The overall efficiency is 80% and diameter of boss is 1/3 the diameter of the runner. Find the diameter of the runner , its speed and the specific speed of the turbine. **(10 Marks)**

8 a. What is Priming of a centrifugal pump? Why it is necessary? **(06 Marks)**

b. Obtain the expression for minimum starting speed in a centrifugal pump. **(04 Marks)**

c. The outer diameter of an impeller of a centrifugal pump is 500mm and its outer width is 50mm. The pump is running at 1000 rpm and is working against a total head of 20m. The vane angle at the outlet is 30^0 and manometric efficiency is 70%. Determine
i) Velocity of flow at the outlet.
ii) The velocity of water leaving the vane.
iii) Angle made by the absolute velocity at outlet with the direction of motion at the outlet.
iv) Discharge. **(10 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Find the direction cosines ℓ, m, n of the line :
$x + y + z + 1 = 0$
$4x + y - 2z + 2 = 0$. **(06 Marks)**

b. Show that the lines $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - 4$ are coplanar. **(07 Marks)**

c. Find the angle between the line $\frac{x+4}{4} + \frac{y-3}{-3} = \frac{z+2}{1}$ and the plane $2x + 2y - z + 15 = 0$. **(07 Marks)**

2 a. Find the equation of the plane which passes through the points A(0, 1, 1), B(1, 1, 2), C(–1, 2, –2). **(06 Marks)**

b. Find the equation of the plane which passes through the point(3, –3, 1) and normal to the line joining the points (3, 2, –1) and (2, –1, 5). **(07 Marks)**

c. Find the equations to the two planes which bisects the angle between the planes :
$3x - 4y + 5z = 3$
$5x + 3y - 4z = 9$. **(07 Marks)**

3 a. Find the sides and the angle A of the triangle whose vertices are $\overline{OA} = I - 2J + 2K$, $\overline{OB} = 2I + J - K$, $\overline{OC} = 3I - J + 2K$. **(06 Marks)**

b. Show that the points $-6I + 3J + 2K$, $3I - 2J + 4K$, $5I + 7J + 3K$ and $-13I + 17J - k$ are coplanar. **(07 Marks)**

c. Prove that : $\left[\bar{B} \times \bar{C}, \bar{C} \times \bar{A}, \bar{A} \times \bar{B}\right] = \left[\bar{A}\,\bar{B}\,\bar{C}\right]^2$. **(07 Marks)**

4 a. A particle moves along the curve $x = t^2 + 1$, $y = t^2$, $z = 2t + 3 + \sin(\pi t)$ where t is the time. Find the velocity and acceleration at t = 1. **(06 Marks)**

b. If $\bar{A} = (\cos t)I + (\sin t)J + (4t)K$ and $\bar{B} = (t^3 + 1)I + J + (8t^2 - 3t^3)K$ then find :
i) $\frac{d}{dt}(\bar{A} + \bar{B})$ ii) $\frac{d}{dt}(\bar{A} \cdot \bar{B})$. **(07 Marks)**

c. If $\phi = 3x^2y - y^3z^2$, find grad ϕ at (1, –2, 1). Also find a unit normal vector to the surface $3x^2y - y^3z^2 = 6$ at (1, –2, 1). **(07 Marks)**

PART – B

5 a. If $\bar{A} = xyz\,I + 3x^2y\,J + (xz^2 - y^2z)K$ then find curl $\bar{A}$ at (1, 2, 3). **(06 Marks)**

b. Find the directional derivative of the scalar function $f(x, y, z) = x^2 + xy + z^2$ at the point A(1, –1, –1) in the direction of $2\hat{i} + 3\hat{j} + 2\hat{k}$. **(07 Marks)**

c. If $u = x^2 + y^2 + z^2$ and $\bar{r} = xI + yJ + zK$ then find div $(u\bar{r})$ in terms of u. if $\vec{f} = \nabla(x^3 + y^3 + 2^3 - 3xyz)$ find $\nabla \cdot \vec{f}$ and $\nabla \times \vec{f}$. **(07 Marks)**

6 a. Find the Laplace transform of f(t) defined as :

$$f(t) = \begin{cases} \frac{t}{6}, & \text{when } 0 < t < 6 \\ 1, & \text{when } t < 6 \end{cases}.$$ **(05 Marks)**

b. Find : i) $L(\cos t^2 t)$ ii) $L(t \sin h\, at)$ iii) $L\left(\frac{1}{t}\sin 2t\right)$. **(15 Marks)**

7 a. Find : $L(e^{2t} \cos 3t)$. **(06 Marks)**

b. Find : $L^{-1}\left(\frac{2h-5}{9s^2-25}\right)$. **(07 Marks)**

c. Find : $L^{-1}\left(\frac{s^2+4}{x^2+9}\right)$. **(07 Marks)**

8 a. Using Laplace transforms, find the solution of the initial value problem $y''-4y'+4y=64 \sin 2t$, $y(0) = 0$, $y'(0) = 1$. **(10 Marks)**

b. Using Laplace transforms, solve $y'' + 9y = \cos 2t$, $y(0) = 1$, $y'(0) = \frac{12}{5}$. **(10 Marks)**

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