IV ME, CV (5)

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10MAT41

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Using Taylor series method, solve $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$ at $x = 0.2$. **(06 Marks)**

b. Using Runge – Kutta method of fourth order solve for $y(0.1)$, $y(0.2)$ given that $\frac{dy}{dx} = y(x + y)$, $y(0) = 1$. **(07 Marks)**

c. Given $\frac{dy}{dx} = x^2 (1 + y)$ and $y(1) = 1$, $y(1.1) = 1.233$, $y(1.2) = 1.548$, $y(1.3) = 1.979$, evaluate $y(1.4)$ by Milne's Predictor – Corrector method. **(07 Marks)**

2 a. Approximate y and z at $x = 0.1$, using Picard's method for the solution of the equations $\frac{dy}{dx} = z$, $\frac{dz}{dx} = x^3 (y + z)$, given that $y(0) = 1$ and $z(0) = ½$. **(06 Marks)**

b. Using Runge – Kutta fourth order method to solve $y'' = xy' - y$, $y(0) = 3$, $y'(0) = 0$, find y and z at $x = 0.1$. **(07 Marks)**

c. Apply Milne's method to compute $y(0.4)$ given that $y'' + xy' + y = 0$ and the values $y(0) = 1$, $y(0.1) = 0.995$, $y(0.2) = 0.9801$, $y(0.3) = 0.956$, $y'(0) = 0$, $y'(0.1) = -0.0995$, $y'(0.2) = -0.196$, $y'(0.3) = -0.2867$. **(07 Marks)**

3 a. Prove that the C – R equations in polar form. **(06 Marks)**

b. Show that $f(z) = z^n$, where n is a positive integer is analytic and hence find its derivative. **(07 Marks)**

c. If $\phi + i\Psi$ represents the complex potential of an electrostatic field where $\Psi = x^2 - y^2 + \frac{x}{x^2 + y^2}$, find ϕ. **(07 Marks)**

4 a. Find the Bilinear transformation which maps the points 1, i – 1 into 0, 1, ∞. **(06 Marks)**

b. State and prove the Cauchy's integral formula. **(07 Marks)**

c. Evaluate $\int_C \frac{e^{2z}}{(z+1)(z-2)} dz$, where c : | z | = 3. **(07 Marks)**

PART – B

5 a. Find the solution of the Laplace's equation in cylindrical system leading to Bessel's differential equation. **(06 Marks)**

b. Derive Rodrigue's formula $P_n(x) = \frac{1}{2^n n!} \frac{d^n}{dx^n} (x^2 - 1)^n$. **(07 Marks)**

c. Express $f(x) = x^4 + 3x^3 - x^2 + 5x - 2$ in terms Legendre polynomials. **(07 Marks)**

6 a. Define the Empherical and Axiomatic definition of probability and give an example of each. **(06 Marks)**

b. Of the cigarette smoking population 70% are men and 30% are women, 10% of these men and 20% of these women smoke wills. What is the probability that person seen smoking a wills will be a man? **(07 Marks)**

c. The chance that a doctor will diagnose a disease correctly is 60%. The chance that a patient will die after correct diagnose is 40% and the chance of death by wrong diagnosis is 70%. If a patient dies, what is the chance that his disease was correctly diagnosed? **(07 Marks)**

7 a. Derive the mean and variance of Binomial distribution. **(06 Marks)**

b. If x is an exponential distribution with mean 4, evaluate i) $P(0 < x < 1)$ ii) $P(x > 2)$ and iii) $P(-\infty < x < 10)$. **(07 Marks)**

c. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be i) less than 65 ii) More than 75 and iii) between 65 and 75. **(07 Marks)**

8 a. Define the following terms :
i) Type I – error and Type II – error ii) Level of significance. **(06 Marks)**

b. A certain stimulus administered to each of the 12 patients resulted in the following :
Change in blood pressure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4, can it be concluded that the stimulus will increase the blood pressure? (t. 05 for 11 d.f = 2.201). **(07 Marks)**

c. The theory predicts the proportion of beans in the four groups G_1, G_2, G_3, G_4 should be in the ratio 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? (at 5% LOS for 3 d.f = 7.815). **(07 Marks)**

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10CV42

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
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 code Book IS10262-2009 is allowed.***

PART – A

1 a. List at least Five of the various cement types being used in practice. Give their field application. **(10 Marks)**

b. Describe the following terms with respect to cement :
i) Normal consistency
ii) Water cement ratio
iii) Initial setting time
iv) Soundness. **(10 Marks)**

2 a. Explain the laboratory procedure to determine the SP. Gravity of coarse Aggregate sample. State the importance of size and shape of aggregate in concrete. **(10 Marks)**

b. Give the procedure to determine the Bulk density of fine aggregate sample. Describe the importance of the same. **(10 Marks)**

3 a. Define workability. Explain how
i) Mix proportion and
ii) Size of aggregate affect workability. **(10 Marks)**

b. What are the tests adopted in laboratory to determine workability of concrete mix? Brief the Advantages of slump test over compaction factor test. **(10 Marks)**

4 a. State the function of an 'Admixture' in concrete mix. Differentiate between chemical and mineral Admixtures. **(10 Marks)**

b. Describe the effect of fly ash on fresh concrete. **(10 Marks)**

PART – B

5 a. List the tests conducted to determine the properties of Hardened concrete. Explain how water cement ratio influences the strength of Hardened concrete. **(10 Marks)**

b. Brief the stress-strain behaviour of concrete under compression. How do you determine the modulus of elasticity of given concrete sample? **(10 Marks)**

6 a. Define the terms with respect to concrete:
i) Poisson's ratio
ii) Shrinkage
iii) Creep
iv) Elasticity
v) Compression strength. **(10 Marks)**

b. State the types of Shrinkage occurring in concrete. Explain plastic Shrinkage. **(10 Marks)**

7 a. Define the term permeability of concrete. Explain the factors that influence permeability of concrete. **(10 Marks)**

b. Discuss the process of disintegration of concrete due to acids. Suggest remedies to control sulphate attack. **(10 Marks)**

8 a. Brief the importance of mix design in "Concrete Technology". **(05 Marks)**

b. Obtain the first trial mix of M_{20} grade as per IS 10262 for the following requirements

Max size of aggregates angular shape		–	20mm
Degree of workability		–	0.90
Degree of quality control		–	Good
Types of Exposure		–	Mild
Properties of material available : –			
Cement specific gravity		–	3.15
Specific gravity of coarse aggregate		–	2.60
Specific gravity of fine aggregate		–	2.60
Free moisture content	Coarse aggregate	–	Nil
	Fine aggregate	–	20%
Water absorption	Coarse aggregate	–	0.50%
	Fine aggregate	–	1.0%

(15 Marks)

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10CV43

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017

Structural Analysis – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define: i) One, two and three dimensional structural systems with examples.
ii) Degrees of freedom with examples.
iii) Linear and non-linear structures. **(08 Marks)**

b. Find the degree of static indeterminacy of the following structures as shown in Fig.Q1(b).

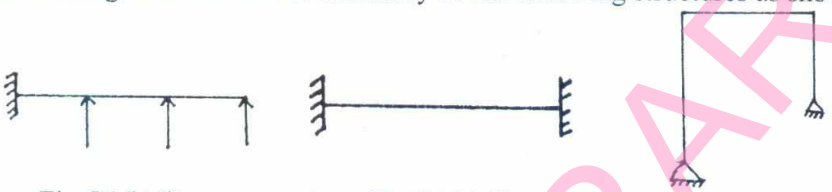

Fig.Q1(b)(i) Fig.Q1(b)(ii) Fig.Q1(b)(iii) **(06 Marks)**

c. Derive an expression for strain energy stored in a bar due to axial load. **(06 Marks)**

2 a. Find the slope at A, and deflection at C, in the beam shown in Fig.Q2(a), by moment area method. Take EI as constant.

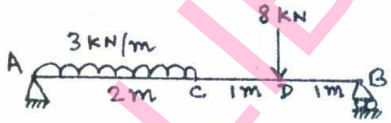

Fig.Q2(a) **(10 Marks)**

b. Find the slope and deflection at the free end of the cantilever beam shown in Fig.Q2(b) using conjugate beam method. Take EI = 2.5×10^6 kNm^2.

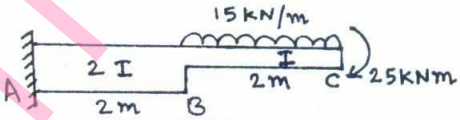

Fig.Q2(b) **(10 Marks)**

3 a. State: i) The first and second theorem of Castigliano, ii) The Bettis law and Maxwells theorem of reciprocal deflections. **(08 Marks)**

b. Compute the vertical displacement at the free end D, of the frame by strain energy method. If EI = 2×10^4 kNm^2, the frame is as shown in Fig.Q3(b).

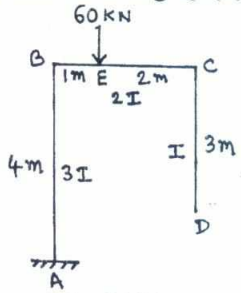

Fig.Q3(b) **(12 Marks)**

4 a. Analyze the propped cantilever subjected to the loadings as shown in the Fig.Q4(a), using strain energy method. EI is constant. Calculate "R" and "M_A".

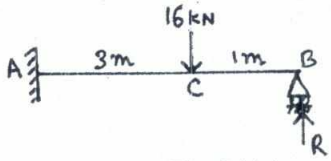

Fig.Q4(a) **(08 Marks)**

b. Analyze the fixed beam subjected to the loadings as shown in the Fig.Q4(b), using strain energy method. Calculate the fixed end moments and the vertical reactions at A and B.

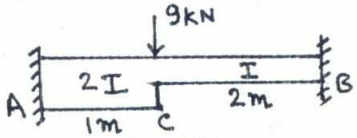

Fig.Q4(b) **(12 Marks)**

PART – B

5 a. Prove that the bending moment diagram follows the Funicular polygon in a three hinged parabolic arch subjected to uniformly distributed load throughout. **(10 Marks)**

b. A symmetrical suspension cable is parabolic in shape, and has a span of 250 m and a dip of 25 m. It supports a UDL of 25 kN/m over the whole span. If the maximum allowable stress is 130 N/mm^2, determine the length of the cable and area of the cable. **(10 Marks)**

6 a. Analyze the propped cantilever beam subjected to the loadings as shown in the Fig.Q6(a), by consistent deformation method. Support B sinks by 25 mm. Take E = 10 GPa and I = 20 × 10^6 mm^4. Draw BMD and SFD.

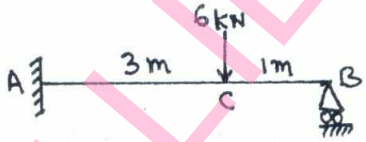

Fig.Q6(a) **(10 Marks)**

b. Analyze the fixed beam subjected to the loadings as shown in the Fig.Q6(b), by consistent deformation method. Draw SFD.

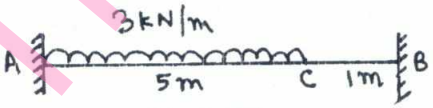

Fig.Q6(b) **(10 Marks)**

7 Analyze the continuous beam subjected to the loadings as shown in the Fig.Q7, using Claperons three moment theorem. Draw BMD. EI is constant throughout.

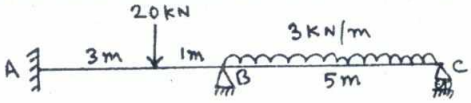

Fig.Q7 **(20 Marks)**

8 A parabolic arch hinged at the ends has a span of 60 m, and a rise of 12 m. A concentrated load of 8 kN acts at 15 m from the left hinge. The second moment of area varies as the secant of the inclination of the arch axis. Calculate the horizontal thrust and the reactions at the hinges. **(20 Marks)**

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10CV44

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Surveying – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. With neat sketch and tabular column, explain the measurement of horizontal angle by repetition method. List the errors that are eliminated by this method. **(10 Marks)**

b. Explain the procedures for extending a straight line using a transit when it is in adjustment and not in adjustment. **(10 Marks)**

2 a. Explain with a neat sketch 'two peg method' adopted in the permanent adjustment of a level. **(10 Marks)**

b. A dumpy level was set up at L_1, exactly midway between A and B which are 50m apart. The readings on the staff when held on A and B were respectively 2.40m and 1.40m. The instrument was then shifted and set up at point L_2 on the line AB produced at 10m from A. The readings on the staff held at A and B were respectively 2.5m and 1.4m. Determine the staff readings on A and B to give a horizontal line of sight. Determine the RL of B, if that of A is 200.00m. **(10 Marks)**

3 a. Explain the method of determining the distance and elevation of an object using trigonometrical levelling, when the base is inaccessible and the instrument stations are in the same plane as that of the object. Derive the required equations. **(10 Marks)**

b. Find the reduced level of a Church spire 'C' from the following observation taken from two stations A and B, 50mt apart, angle BAC = 60° and angle ABC = 50°, angle of elevation from A to top of spire = 30°, angle of elevation from B to top of spire = 29°, staff reading from A on BM of RL 20m = 2.50m, staff reading from B to same BM = 0.50m. **(10 Marks)**

4 a. Derive the expressions for distance and elevation when the staff is held vertical and the line of sight is inclined. **(10 Marks)**

b. The following observations were made using a tacheometer fitted with anallactic lens having the constant to be 100 and the staff held vertical:

Inst. Stn	Ht. of instrument	Staff stn	WCB	Vertical angle	Hair reading
0	1.550	A	30° 30′	4° 30′	1.155, 1.755, 2.355
		B	75° 30′	10° 15′	1.250, 2.000, 2.750

Calculate: i) The horizontal distance AB; ii) RL of A and B and iii) Gradient from A to B, if RL of 0 is 150.000m. **(10 Marks)**

PART – B

5 a. What are the different methods of setting out a simple circular curve? **(04 Marks)**

b. Calculate the ordinates at 10mt distance for a circular curve having a long chord 80 meters and versed sine of 4 mts. **(06 Marks)**

c. Two tangents interest at a chainage 1000mt, the deflection angle being 28°. Calculate the necessary data to setout a simple circular curve of radius 250 mts. by Rankine's deflection angle method and tabulate the results. Peg interval = 20mt. Least count of theodotile = 20″. **(10 Marks)**

6 a. With neat sketch, explain the various elements of a compound curve. Derive the relations for calculating the chainages of tangent points. **(10 Marks)**

b. Two tangents AB and BC interest at B. Another line DE intersect AB and BC at D and E such that LADE = 150° and LDEC = 140°. The radius of the first curve is 200m and that of the second is 300m. Calculate all the necessary data for setting out a compound curve if the chainage of B is 1050m. **(10 Marks)**

7 a. What is transition curve? Discuss the purpose of introducing transition curve between a straight and a simple curve. **(06 Marks)**

b. What is vertical curve? With sketch briefly explain different types of vertical curves. **(04 Marks)**

c. A transition curve is required for a circular curve of 200m radius the gauge being 1.5m and maximum super elevation restricted to 15cm. The transition is to be designed for a velocity such that no lateral pressure is imposed on the rails and the rate of gain of radial acceleration is 30cm/sec^3. Calculate the required length of the transition curve and the design speed. **(10 Marks)**

8 a. What is Simpson's rule? Derive the expression for it. **(06 Marks)**

b. What is 'zero circle' of a planimeter? Explain any one method of finding its area. **(06 Marks)**

c. A road embankment is 10mt wide with side slopes 1½ to 1. Assuming the ground to be level in a direction transverse to the centre line, calculate the volume contained in a length of 120 meters, the centre of heights at 20m intervals being in meters. 2.20, 3.70, 3.80, 4.00, 3.80, 2.80, 2.50. **(08 Marks)**

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10CV45

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Hydraulics and Hydraulic Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. What is meant by dimensional homogenity of an equation? Explain with an example. **(05 Marks)**

b. Define and give expressions for,
i) Reynolds number
ii) Froude number
iii) Euler's number
iv) Weber number and
v) Mach number. **(05 Marks)**

c. A spill way model is to be built to a geometrically similar scale of 1/50 across a flume of 600mm width. The prototype is 15m high and maximum head on it is expected to be 1.5m. i) What height of the model and what head on the model should be used? ii) If the flow over the model at a particular head is 12 litre/s, what flow per metre length of the prototype is expected? iii) If the negative pressure in the model is 200mm, what is the negative pressure in prototype? Is it practicable? **(10 Marks)**

2 a. Derive an expression for discharge through open channel by Chezy's formula and obtain an expression for conveyance. **(10 Marks)**

b. A trapezoidal channel carries water of $25 m^3/s$ which has a side slope of 60°. Find the most economical channel cross section if C = 50 and slope of bed is 1 in 1000. [C = Chezy's constant]. **(10 Marks)**

3 a. Draw a typical plot of depth of flow v/s specific energy for a non-uniform flow and label the curves of energy. Further indicate point of critical depth, region of supercritical flow and subcritical flow. **(10 Marks)**

b. A rectangular channel of 8m wide discharges water through a sluice gate with a depth of flow of 0.4m, and velocity 6 m/s. Find whether hydraulic jump will occur and if so, find the height of hydraulic jump and loss of energy per kg of water. Also find the power lost in hydraulic jump. **(10 Marks)**

4 a. Using impulse-momentum principle, derive an expression for force normal to plate by the impact of jet at the centre of a stationary inclined plate. Further derive expressions for force in the direction of jet and normal to jet. The profile of plate is flat. **(10 Marks)**

b. A jet of water 150mm diameter strikes a series of flat plate normally with a velocity of 12m/s. The plate is moving with a velocity of 6m/s in the direction of jet. Find: i) the force exerted by the jet on the plate; ii) Work done by the jet on the plate per second; ii) Power of the jet; iv) Efficiency of moving plate. **(10 Marks)**

PART – B

5 a. Show that for a moving symmetrical curved vane impinged by a jet of water at the centre, the maximum hydraulic efficiency is given by, $\frac{8}{27}(1+\cos\theta)$, where θ = angle of deflection of water from the vane. **(10 Marks)**

b. A jet of water having velocity of 45 m/s impinges without shock on a series of vanes moving at 15m/s, the direction of motion of vanes being inclined at 20° to that of jet. The relative velocity at the outlet is 0.9 times of that at inlet. Absolute velocity of water at exit is to be normal to the motion of vanes. Find: i) Vane angles at entrance and exit; ii) Hydraulic efficiency. **(10 Marks)**

6 a. Draw energy block diagram of a Pelton wheel arrangement showing nozzle, Pelton wheel, shaft and give expressions for i) Power at the nozzle; ii) Kinetic energy of jet outside the nozzle; iii) Hydraulic power after the Pelton wheel; iv) Shaft power; v) Nozzle efficiency; vi) Hydraulic efficiency; vii) Mechanical efficiency and viii) Overall efficiency. **(10 Marks)**

b. Design a Pelton wheel turbine required to develop 1475 kW of power under a head of 160m at 410 rpm. Take overall efficiency as 85% and coefficient of velocity in the nozzle as 0.98 and speed ratio as 0.48, jet ratio = 12. **(10 Marks)**

7 a. Draw a neat diagram of cross section of a Kaplan turbine and explain its working principle. **(10 Marks)**

b. The hub diameter of a Kaplan turbine, working under a head of 12m, is 0.35 times the diameter of the runner. The turbine is running at 100rpm. If the vane angle of the extreme edge of the runner at outlet is 15°, and flow ratio = 0.6, find: i) Diameter of the runner; ii) Diameter of the boss and iii) Discharge through the runner.
Assume velocity of whirl at outlet as zero. **(10 Marks)**

8 a. For a centrifugal pump, write the definition and expression for i) Manometric efficiency; ii) Mechanical efficiency; iii) Overall efficiency in terms of manometric head, blade speed at outlet and velocity of whirl at outlet. **(10 Marks)**

b. A four stage centrifugal pump has four identical impellers, keyed to same shaft. The shaft is running at 400rpm and the total manometric head developed by the multistage pump is 40m. The discharge through pump is 0.2 m^3/s. The vanes of each impeller are having outlet angle as 45°. If the width and diameter of each impeller at outlet is 5cm and 60cm respectively. Find the manometric efficiency. **(10 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2016/Jan.2017
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

1 a. Find the angle between any two diagonals of a cube. **(06 Marks)**

b. The direction cosines of three mutually perpendicular lines are l_1, m_1, n_1 l_2, m_2, n_2 and l_3, m_3, n_3. Show that the line with direction cosines $l_1+l_2+l_3$, $m_1+m_2+m_3$, $n_1+n_2+n_3$ is equally inclined to the above lines. **(07 Marks)**

c. Find the equations of the plane passing through the points (1, 2, 3) (0, 1, 4) and (0, 0, 1). **(07 Marks)**

2 a. Derive the equation to the plane in the intercept form $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=1$. **(06 Marks)**

b. Find the angle between the lines $\frac{x-1}{1}=\frac{y-5}{0}=\frac{z+1}{2}$ and $\frac{x+3}{3}=\frac{y}{5}=\frac{z-5}{2}$. **(07 Marks)**

c. Find the image of the point (1, 2, 3) in the line $\frac{x+1}{2}=\frac{y-3}{3}=-z$. **(07 Marks)**

3 a. Show that the position vectors of the vertices of a triangle $2i-j+k$, $i-3j-5k$, $3i-4j-4k$ form a right angled triangle. **(06 Marks)**

b. Find a vector of magnitude 12 units which is perpendicular to the vectors $\vec{a}=4i-j+3k$ and $\vec{b}=-2i+j-2k$. **(07 Marks)**

c. Find λ so that the points $A(-1,4,-3)$, $B(3,2,-5)$, $C(-3,8,-5)$ and $D(-3,\lambda,1)$ are coplanar. **(07 Marks)**

4 a. Find the unit tangent vector of the space curve $x=1+t^3$, $y=2t^3$, $z=2-t^3$ at $t=1$. **(06 Marks)**

b. Find the angle between the tangents to the curve $\vec{r}=\left(t-\frac{t^2}{2}\right)i+t^2j+\left(t+\frac{t^2}{2}\right)k$ at $t=\pm1$. **(07 Marks)**

c. A particle moves along the curve whose parametric equations are $x=t-\frac{t^3}{3}$, $y=t^2$ and $z=t+\frac{t^3}{3}$, where 't' is the time. Find the velocity and acceleration at any time 't'. Also find their magnitudes at t = 3. **(07 Marks)**

5 a. Find the angle between the surfaces $x^2+y^2+z^2=9$ and $x=z^2+y^2-3$ at $(2,-1,2)$. **(06 Marks)**

b. Find the constants a, b, c such that the vector ,
$\vec{F}=(x+y+az)i+(bx+2y-z)j+(x+cy+2z)k$ is irrotational. **(07 Marks)**

c. If $\vec{A}=\text{grad}(x^3+y^3+z^3-3xyz)$ then find $\text{div}\,\vec{A}$ and $\text{curl}\,\vec{A}$. **(07 Marks)**

6 a. Find the expression for $L[\sin at]$. **(05 Marks)**

b. Find $L[t \sin at]$. **(05 Marks)**

c. Find $L\left[\frac{1-e^{at}}{t}\right]$. **(05 Marks)**

d. Find $L[e^t \cos^2 2t]$. **(05 Marks)**

7 a. Find $L^{-1}\left[\frac{s}{(s+2)(s^2+1)}\right]$. **(06 Marks)**

b. Find $L^{-1}\left[\frac{s+2}{s^2+2s+2}\right]$. **(07 Marks)**

c. Find $L^{-1}\left[\log\left[\frac{s^2+1}{s(s-1)}\right]\right]$. **(07 Marks)**

8 a. Using Laplace transform solve:
$y'' - 2y' + y = e^{2t}$ with $y(0) = 0$ and $y'(0) = 1$. **(10 Marks)**

b. Solve using Laplace transformation, method $y'' + 2y' - 3y = \sin t$, $y(0) = y'(0) = 0$. **(10 Marks)**

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