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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2017
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. Find y(0.1) by using Taylor's series method, given that $y' = \sqrt{x^2 + y}$, $y(0) = 0.8$. Consider upto third order derivative terms. **(06 Marks)**

b. Given : $\frac{dy}{dx} = \frac{1}{1+x^2} - 2y^2$, $y(0) = 0$. Find $y(0.5)$, by taking $h = 0.25$, using Euler's modified method. **(07 Marks)**

c. If $y' = \frac{1}{x+y}$, $y(0) = 2.0000$, $y(0.2) = 2.0933$, $y(0.4) = 2.1755$, $y(0.6) = 2.2493$, find $y(0.8)$ by using Adams-Bash forth method. **(07 Marks)**

2 a. Using the Picard's method, obtain the 2nd order approximate solution of the problem at $x = 0.2$, $\frac{dy}{dx} = x + yz$; $\frac{dz}{dx} = y + zx$, $y(0) = 1$ and $z(0) = -1$. **(06 Marks)**

b. Using the R-K method, find the solution at $x = 0.1$ of an equation; $y'' - x^2y' - 2xy - 1 = 0$ with the conditions $y(0) = 1$, $y'(0) = 0$ and step size 0.1. **(07 Marks)**

c. Given that $y'' + xy = 0$, $y(0) = 1$, $y(0.1) = 1.0998$, $y(0.2) = 1.1987$, $y(0.3) = 1.2955$, $y'(0) = 1$, $y'(0.1) = 0.9946$, $y'(0.2) = 0.9773$, $y'(0.3) = 0.946$, find $y(0.4)$, using Milne's method. (Apply corrector formula only once). **(07 Marks)**

3 a. Derive Cauchy-Riemann equations in the polar form. **(06 Marks)**

b. If $f(z) = u + iv$ is an analytic function, then prove that the family of curves; $u(x, y) = C_1$, $v(x, y) = C_2$, C_1 and C_2 being constants, interfect orthogonally. Is the converse true? Justify your answer. **(07 Marks)**

c. In a two dimensional fluid flow; if the velocity potential is $e^{-x}\cos y + xy$, find the stream function. **(07 Marks)**

4 a. Find the bilinear transformation which maps the points $z = 1, i, -1$ onto the points $w = i, 0, -i$. Also find the invariant points. **(06 Marks)**

b. Discuss the transformation, $w = z + \frac{K^2}{z}$, where $z \neq 0$, $K \neq 0$. **(07 Marks)**

c. State and prove the Cauchy's theorem. **(07 Marks)**

PART – B

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

b. Derive the Rodrigue's formula. **(07 Marks)**

c. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(06 Marks)**

6 a. 'A' can hit a target 3 times in 5 shots, 'B' 2 times in 5 shots and 'C' 3 times in 4 shots. They fire a volley. Find the probability that (i) 2 shots hit (ii) at least 2 shots hit. **(06 Marks)**

b. If A and B are events with $P(A) = \frac{1}{2}$, $P(A \cup B) = \frac{3}{4}$, $P(\overline{B}) = \frac{5}{8}$ find $P(A \cap B)$, $P(\overline{A} \cap \overline{B})$, $P(\overline{A} \cup \overline{B})$ and $P(\overline{A} \cap B)$. **(07 Marks)**

c. State and prove Baye's theorem. **(07 Marks)**

7 a. (i) Is the function defined as follows a density function? $f(x) = e^{-x}, x \geq 0$, $f(x) = 0$, $x < 0$.

(ii) If so, determine the probability that the variate having this density will fall in the interval (1, 2).

(iii) Also find the cumulative probability function F(2). **(06 Marks)**

b. Obtain the mean and standard deviation of the Poisson distribution. **(07 Marks)**

c. The life of an electric bulb is normally distributed with mean life of 200 hours and S.D. of 60 hours. Out of 2500 bulbs, find the number of bulbs which are likely to last between 1900 and 2100 hours. Given that $P(0 < Z < 1.67) = 0.4525$. **(07 Marks)**

8 a. Explain the following terms briefly: (i) Null hypothesis (ii) Type I and Type II errors (iii) Confidence limits. **(06 Marks)**

b. Two types of batteries are tested for their length of life and the following results are obtained:

Battery A : $n_1 = 10$, $\bar{x}_1 = 500$ hrs, $\sigma_1^2 = 100$

Battery B : $n_2 = 10$, $\bar{x}_2 = 560$ hrs, $\sigma_2^2 = 121$.

Find students 't' and test whether there is a significant difference in the two means. ($t_{0.05} = 2.10$ and $t_{0.01} = 2.88$). **(07 Marks)**

c. Genetic theory states that children having one parent of blood type M and the other of blood type N will always be one of the three types M, MN, N and that the proportions of these types will on an average be 1 : 2 : 1. A report states that out of 300 children having one M parent and one N parent, 30% are found to be of type M, 45% of type MN and the remainder of type N. Test the theory by ψ^2 (chi-square) test. **(07 Marks)**

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10CV42

Fourth Semester B.E. Degree Examination, June/July 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 IS10262-2009 is permitted.*
3. *Assume any missing data suitably.*

PART – A

1 a. Define cement. List the different types of cement and what are its applications? **(10 Marks)**

b. What is normal consistency of cement? Explain how do you determine the same. **(10 Marks)**

2 a. Explain the effect of size, shape, texture and grading of aggregates on the strength of concrete. **(10 Marks)**

b. List the different types of test conducted on coarse aggregate and fine aggregate. Explain any one in each. **(10 Marks)**

3 a. What is workability of concrete? Discuss the various factors which influence the workability. **(10 Marks)**

b. Explain briefly relative to the concrete. i) Bleeding ii) Segregation iii) Compaction iv) Curing. **(10 Marks)**

4 Specify the type, its effect and its applications of the following admixture.
i) Accelerators ii) Retarders iii) G.G.B.S iv) Silica fumes. **(20 Marks)**

PART – B

5 a. Explain briefly :
i) W/C ration ii) Gel space Ratio iii) Accelerated curing. **(10 Marks)**

b. List the different types of test conducted on hardened concrete and explain any one of them. **(10 Marks)**

6 a. What is creep in concrete? What are the different factors which influences creep and Shrinkage in concrete? **(10 Marks)**

b. Discuss :
i) Relation between modulus of elasticity and strength of concrete.
ii) Factors affecting modulus of elasticity. **(10 Marks)**

7 Write shot notes on any FOUR :
a. Durability b. Permeability c. Carbonation d. Chloride attack
e. Sulphate attack f. Freezing and Thawing. **(20 Marks)**

8 a. List and explain briefly the factors influencing the choice of Mix proportions. **(10 Marks)**

b. Write the steps to be followed in I.S method of mix design. (Step by Step procedure). **(10 Marks)**

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10CV43

Fourth Semester B.E. Degree Examination, June/July 2017
Structural Analysis – I

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain with examples statically determinate and indeterminate structures. **(06 Marks)**

b. With usual notations derive an expression to determine strain energy due to bending in a beam. **(08 Marks)**

c. What are one dimensional, two dimensional and three dimensional structures? Give example for each. **(06 Marks)**

2 a. Determine the slope and deflection at the free end of the cantilever beam shown in Fig.Q2(a) by moment area method. EI = 8000 kNm^2. **(10 Marks)**

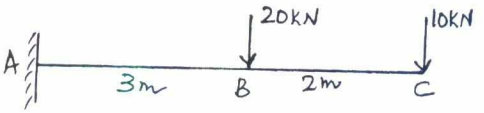

Fig.Q2(a)

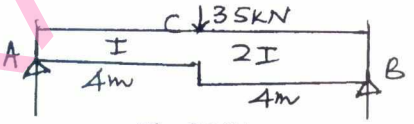

Fig.Q2(b)

b. Using conjugate beam method, find the deflection at point C and slope at A for the simply supported beam loaded as shown Fig.Q2(b). **(10 Marks)**

3 For the frame loaded as shown in Fig.Q3, calculate the vertical deflection at joint D. Take E = 200 kN/mm^2. Areas of each member in mm^2 is shown along the side of the member. Adopt unit load method. **(20 Marks)**

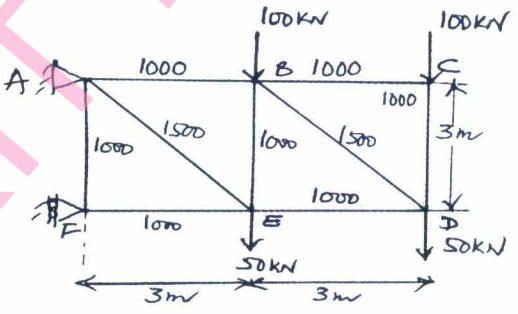

Fig.Q3

4 a. Determine the horizontal and vertical deflection at point C of the frame shown in Fig.Q4(a). E = 200 GPa, I = 6×10^7 mm^4 by strain energy method. **(12 Marks)**

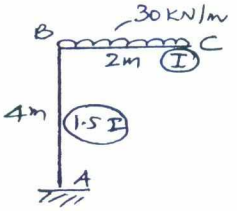

Fig.Q4(a)

b. Compute the deflection and rotation at free end of a cantilever loaded beam loaded as shown in Fig.Q4(b), using strain energy method. **(08 Marks)**

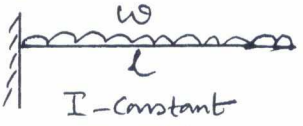

Fig.Q4(b)

PART – B

5 a. A three hinged parabolic arch of span 30 m and central rise of 5 m, is subjected to a concentrated load of 40 kN at 6 m from left support. The right hand half span of the arch is subjected to a UDL of 10 kN/m. Determine the normal thrust, radial shear and bending moment at 6 m from the left support. **(10 Marks)**

b. A suspension cable having support at the same level, has a span of 30m and maximum dip of 3m. The cable is subjected to UDL throughout. Find the length of the cable. Derive the formula you are going to use. **(10 Marks)**

6 a. For a rigidly fixed beam AB of span 5 m carrying a UDL of 12 kN/m over the entire span, draw SFD and BMD using the method of consistent deformation. **(10 Marks)**

b. For the propped cantilever shown in Fig.Q6(b). Compute the reaction at B and draw SFD and BMD. Locate the points of contraflexure if any. Use method of consistent deformation. **(10 Marks)**

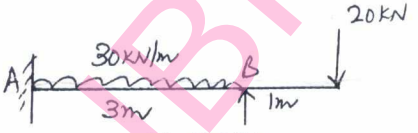

Fig.Q6(b)

7 Analyse the continuous beam loaded as shown in Fig.Q7 by Clapeyron's theorem of the three moments. EI remains constant. Draw SFD and BMD. Mark the salient points. **(20 Marks)**

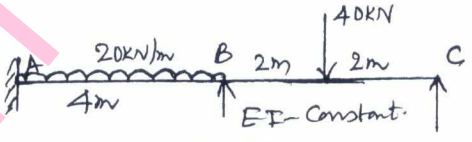

Fig.Q7

8 A two-hinged parabolic arch of span 30m and rise 6 m carries two point loads, each 60 kN, acting at 7.5m and 15m from the left end respectively. The moment of inertia varies as the secant of the slope. Determine the horizontal thrust and maximum positive and negative moments in the arch. **(20 Marks)**

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10CV/CT44

Fourth Semester B.E. Degree Examination, June/July 2017
Surveying – II

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the method of measurement of horizontal angle by reiteration method. Mention the advantages. **(10 Marks)**

b. Explain with neat sketches, the methods of prolonging a straight line using a theodolite, when the instrument is in adjustment and when not in adjustment. **(10 Marks)**

2 a. With a neat sketch, mention the fundamental lines of a transit and explain the relationship between them. **(10 Marks)**

b. Explain two peg method of testing and adjusting line of collimation of a dumpy level. **(10 Marks)**

3 a. Explain the method of determining the distance and elevation of an object when the base of the object is inaccessible and instrument stations are in the same vertical plane as that of the object. Derive the equation. **(10 Marks)**

b. To determine the elevation of the top of an electric pole, the following observations were made.

Instrument Station	Reading on B.M	Angle of elevation	Remarks
A	1.377 m	11° 53′	RL of BM = 30.15m
B	1.263 m	8° 5′	Distance AB = 30m

Station A and B and the top of the pole are in the same vertical plane. Find the elevation of the top of the pole. **(10 Marks)**

4 a. Derive the tacheometric equation for horizontal line of sight and hence obtain the tacheometric equation for inclined line of sight. **(10 Marks)**

b. An old temple is on a small hill adjoining a road. With a view of determining the distance of the temple and the height of the tower of the temple above its plinth, observations were taken from the centre of the road upon a vertically held staff.
(i) On the plinth of the entrance door of the temple.
(ii) On the top of the tower.
The tacheometer is fitted with anallactic lens the constant of the instrument being 100.

Instrument Station	Height of Instrument	Staff Station	Vertical angle	Staff reading
Centre of Road	1.560 m	Plinth	+14° 14′	1.530, 2.100, 2.670
		Top of tower	+17° 28′	1.260, 1.900, 2.540

Calculate :
(i) Distance of plinth from the road.
(ii) R.L. of plinth, given R.L. of road as 850.740 m
(iii) Height of tower. **(10 Marks)**

PART – B

5 a. What is meant by degree of curve? Establish the relationship between degree of a curve and its radius. **(08 Marks)**

b. Derive the expression for setting out simple curve by Rankine's deflection angle method. Explain the procedure. **(12 Marks)**

6 a. Two straights AB and BC intersect at B with a deflection angle of 75° and chainage of 3415m. The straights are to be connected by a compound curve with first arc of 600m and that of second arc of 400m radius. If the chainage of point of curve is 2992.05 m, find the central angles of two arcs and tangent distance of compound curve corresponding to small arc. **(10 Marks)**

b. Two parallel railway lines are to be connected by a reverse curve. If the lines are 10m apart and the maximum distance between the tangent points measured parallel to the straight is 50m, find

(i) the radius 'R', if $R_1 = R_2 = R$.

(ii) the radius 'R_2', if $R_1 = 50$ m. **(10 Marks)**

7 a. List the functions and requirements of a transition curve. **(06 Marks)**

b. Why vertical curves are provided on highways? List the different types of vertical curves with sketches. **(06 Marks)**

c. A parabolic vertical curve is to be set out to connect two uniform grades of +0.9% and – 1.1%. If the rate of change of grade is – 0.25% per 100m, calculate the reduced levels of pegs on the curve if the R.L. of the point of intersection is 215.35m. The chainage of the point of intersection is 2540.00m. **(08 Marks)**

8 a. What is zero circle of a planimeter? Explain any one method of determining the area of zero circle. **(08 Marks)**

b. The following perpendicular offsets were taken at 10m intervals from a survey line to an irregular boundary. 3.82, 4.37, 6.82, 5.26, 7.59, 8.90, 9.52, 8.42, and 6.43m. Calculate the area in square metre enclosed between the survey line, the irregular boundary line and the first and last offsets by

(i) Average ordinate rule

(ii) Trapezoidal rule

(iii) Simpson's rule. **(12 Marks)**

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10CV45

Fourth Semester B.E. Degree Examination, June/July 2017
Hydraulics and Hydraulic Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define Dimensional homogeneity of an equation. Give an example and state the uses of Dimensional Analysis. **(06 Marks)**

b. Using Buckingham's π – theorem, show that the efficiency (η) of a fan depends on the density (ρ) , Dynamic viscosity (μ) , Angular velocity (w), diameter 'D' of the rotor and the discharge 'Q'. Express efficiency (η) interms of dimensionless parameter. **(10 Marks)**

c. A 1:64 model is constructed of an open channel in concrete which has Mannings N = 0.014. Find the value of N for the model. **(04 Marks)**

2 a. Distinguish between Open channel flow and pipe flow. **(06 Marks)**

b. Show that the length of one sloping side of a most economical trapezoidal channel is equal to half of the top width. Also determine the hydraulic mean depth for this condition. **(08 Marks)**

c. A flow of water of 100 ℓps flows down in a Rectangular flume of width 600mm and having adjustable bottom slope of C = 56. Find the bottom slope necessary for uniform flow with a depth of flow of 300mm. Also find the conveyance 'K' of the flume. **(06 Marks)**

3 a. Define Specific Energy and draw Specific Energy diagram. Derive an expression for critical depth and critical velocity in case of non uniform flow through rectangular channel. **(08 Marks)**

b. Find the slope of the free water surface in a rectangular channel of width 20m, having depth of flow 5m. The discharge through the channel is $50m^3/s$. The bed of the channel is having a slope of 1:4000. Take the value of C = 60. **(06 Marks)**

c. The hydraulic jump in a rectangular horizontal channel, the discharge per unit width is $2.5m^3/s/m$ and the depth before the jump is 0.25m. Estimate
i) The sequent depth and ii) The energy loss. **(06 Marks)**

4 a. State Impulse Momentum principle and thus give Impulse Momentum equation. Give 2 uses. **(06 Marks)**

b. Show that the force exerted by a Jet of water on an Inclined fixed plate in the direction of the Jet is given by $Fx = \rho a V^2 \sin^2 \theta$. **(08 Marks)**

c. A jet of water 7.5cm in diameter having velocity of 20m/s strikes a series of the flat plates arranged around the periphery of a wheel. If the plates are moving at a velocity of 5m/s, compute the force exerted by the jet on the plate, the workdone / sec and the efficiency of the jet. **(06 Marks)**

PART – B

5 a. A jet of water strikes an unsymmetrical moving curves plate tangentially at one of the tips. Derive an expression for the force exerted by the jet in the horizontal direction of motion. Also describe the velocity triangles and obtain an expression for work done and efficiency. **(12 Marks)**

b. A 15cm diameter jet moving at 30m/s impinges on a series of vanes moving at 15m/s in the direction of the jet. The jet leaves the vanes at 60^0 with the direction of motion of the vanes. Calculate i) The force exerted by the jet in the direction of motion of the vanes.
ii) Work done by the jet/sec. **(08 Marks)**

6 a. How the Hydraulic turbines are classified? Give examples. Describe the working of an Impulse turbine with a neat sketch. **(10 Marks)**

b. A Pelton wheel is to be designed for the following specifications :
Shaft powers = 5800 kW , Net head = 310m , Speed = 600rpm , Overall efficiency = 85% , $\frac{D}{dj} = 10$. (Ratio of wheel diameter to the jet diameter). Determine
i) The wheel diameter ii) The number of jets required iii) Diameter of the jet
iv) Quantity of water required. Assume speed ratio = 0.46 and CV = 0.98. **(10 Marks)**

7 a. What are the uses of Draft tube? Describe with neat sketches different types of draft tubes. **(08 Marks)**

b. What is Cavitation? What are the effects of Cavitation? **(04 Marks)**

c. A Kaplan turbine develops 15000 kW power at a head of 30m. The diameter of the boss is 0.35 times the diameter of the runner. Assuming a speed ratio of 2.0 , a flow ratio of 0.65 and an overall efficiency of 90%. Calculate i) Diameter of the runner ii) Rotational speed and iii) Specific speed. **(08 Marks)**

8 a. Define a centrifugal pump. Explain the main parts and working principle of single stage centrifugal pump with neat sketch. **(08 Marks)**

b. What is Priming of a centrifugal pump and why it is necessary? **(04 Marks)**

c. Calculate the vane angle at Inlet of a centrifugal pump, impeller having 300mm diameter at inlet and 600mm diameter at outlet. The Impeller vanes are set back at an angle of 45^0 to the outer rim and the entry of the pump is radial. The pump runs at 1000 rpm and the velocity of flow through the impeller is constant at 3m/s. Also calculate the work done by unit weight of water and the velocity and direction of water at outlet. **(08 Marks)**

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10CV46

Fourth Semester B.E. Degree Examination, June/July 2017

Building Planning and Drawing

Time: 4 hrs. Max. Marks:100

Note: ***Section I is compulsory and answer any two full questions from section II.***

SECTION - I

1 Single line diagram of a residential building shown in Fig Q1, Draw to a scale of 1:100 the following views.

a. Plan @ sill level **(25 Marks)**

b. Front elevation **(15 Marks)**

c. Section along A-A **(15 Marks)**

d. Schedule of opening **(05 Marks)**

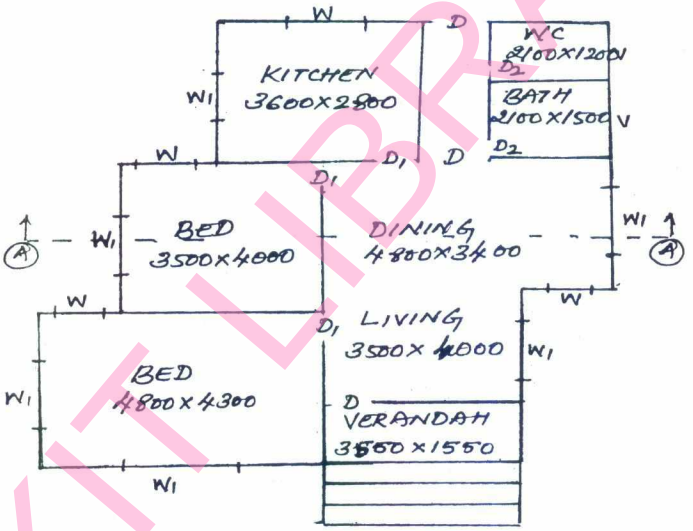

Fig Q1

Note : All Dimensions are in mm

Schedule of opening

Doors			Windows		
D	-	1.2 × 2.1m	W	-	1.2 × 1.2m
D_1	-	1.05 × 2.1m	W_1	-	1.5 × 1.2m
D_2	-	0.75 × 2.1m	VENTILATORS		
			V	-	0.75 × 0.45m

SECTION - II

2 a. Draw a plan and sectional elevation of R.C.C doglegged stair case for an office building which measures 2.5m × 5m. The vertical distance between the floors is 3.6m the width of staircase is 1.2m. The riser and tread are 150mm and 300mm respectively. **(10 Marks)**

b. Draw to a scale of 1:10 the elevation of fully paneled Double shutter Door for an opening of 1.2m × 2.1m. **(10 Marks)**

3 a. Prepare a bubble diagram for school building and develop single line diagram based on the bubble diagram, the following are particular shall be provided
i) Head masters room ii) Office iii) Staffroom iv) Class room – 10 Number
v) Sanitary block for boys and girls separately vi) Sports room vii) Library. **(10 Marks)**

b. Prepare bubble diagram and develop the line diagram for the primary health centre to suitable scale. The following are the particular shall be provided :
i) Entrance lobby ii) Doctors room iii) Examination room – 2 No.
iv) Minor operation theatre v) Nurse room vi) Dispensary
vii) Store room viii) Gents toilet xi) Ladies toilet
x) Technician room **(10 Marks)**

4 Prepare the detailed drawing (only plan) of single floor residential building for the following particular.
Plot – 9m × 13m
(East-west – 9m, North-south – 13m)
Road width – 7.5m @ South side of plot
Set back ; Front – 3m, Rear – 2m, side – 1.5m
and also find the floor area ration carpet area and floor space index of the building. **(20 Marks)**

5 The line diagram of Residential building in shown in Fig. Q5 prepare the water supply and sanitary layout plans with usual notations (select suitable scale) **(20 Marks)**

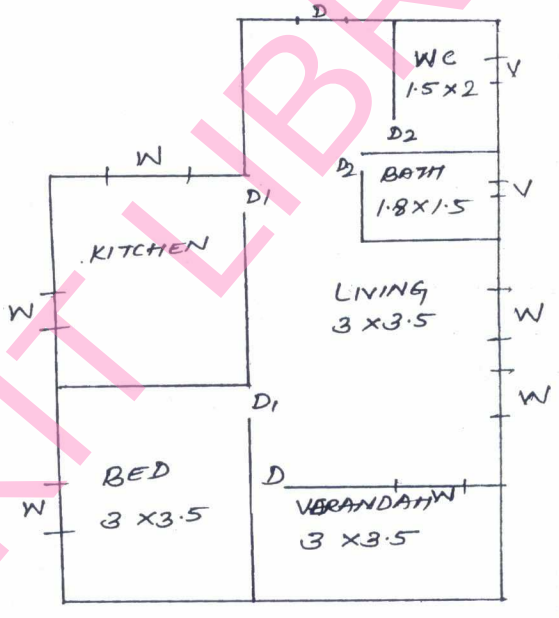

Fig Q5

Note : All Dimensions are in m
Schedule of opening.

DOOR		WINDOWS		VENTILATOR	
D	1.2 × 2.1m	W	1.2 × 1.4m	V	0.75 × 0.4m
D_1	1.05 × 2.0m				
D_2	0.75 × 2.0m				

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MATDIP401

Fourth Semester B.E. Degree Examination, June/July 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. Find the angle between two lines whose direction cosines are given by $\ell + 3m + 5n = 0$ and $2mn - 6n\ell - 5\ell m = 0$. **(07 Marks)**

c. Find the coordinates of the foot of the perpendicular from A(1, 1, 1) to the line joining the points B(1, 4, 6) and C(5, 4, 4). **(07 Marks)**

2 a. Find the equation of the plane through (2, -1, 6) and (1, -2, 4) and perpendicular to the plane $x - 2y - 2z + 9 = 0$. **(06 Marks)**

b. Find the equation of a straight line through (7, 2, -3) and perpendicular to each of the lines. $\frac{x-1}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ and $\frac{x+2}{4} = \frac{y-3}{5} = \frac{z-4}{6}$. **(07 Marks)**

c. Find the angle between the planes $x - y + z - 6 = 0$ and $2x + 3y + z + 5 = 0$. **(07 Marks)**

3 a. If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are any three vectors then prove that

$$\vec{a} \times \left(\vec{b} \times \vec{c}\right) = \left(\vec{a} \cdot \vec{c}\right)\vec{b} - \left(\vec{a} \cdot \vec{b}\right)\vec{c}$$ **(06 Marks)**

b. If $\vec{A} = 4i + 3j + k$, $\vec{B} = 2i - j + 2k$ find a unit vector N perpendicular to the vectors $\vec{A}$ and $\vec{B}$ also show that $\vec{A}$ is not perpendicular to $\vec{B}$. **(07 Marks)**

c. Find the value of λ so that the points A(-1, 4, -3), B(3, 2, -5), C(-3, 8, -5) and D(-3, λ, 1) lie on the same plane. **(07 Marks)**

4 a. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = 3t - 5$ where t is time. Find the components of its velocity and acceleration in the direction of the vector $i - 3j + 2k$ at $t = 1$. **(06 Marks)**

b. Find the angle between tangents to the curve $x = t^2 + 1$, $y = 4t - 3$, $z = 2t^2 - 6t$ at $t = 1$ and $t = 2$. **(07 Marks)**

c. Find the directional derivative of $x^2yz + 4xz^2$ at (1, -2, -1) in the direction of $2i - j - 2k$. **(07 Marks)**

5 a. Prove that $\text{div}(\text{curl}\,\vec{A}) = 0$. **(06 Marks)**

b. Find the divergence and curl of the vector.

$\vec{F} = (xyz + y^2z)i + (3x^2y + y^2z)j + (xz^2 - y^2z)k$ **(07 Marks)**

c. Find the constants a, b, c so that the vector,

$\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is irrotational. **(07 Marks)**

6 Find :

a. $L[\sin 5t \sin 3t]$ **(05 Marks)**

b. $L[te^{8t} \cos 2t]$ **(05 Marks)**

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

d. $L\left[\int_0^t e^{2t} \frac{\sin at}{t} dt\right]$ **(05 Marks)**

7 a. Find $L^{-1}\left[\frac{2s-1}{s^2+2s+17}\right]$. **(05 Marks)**

b. Find $L^{-1}\left[\frac{s+1}{(s-1)^2(s+2)}\right]$. **(05 Marks)**

c. Find $L^{-1}\left[\cot^{-1}\left(\frac{s}{a}\right)\right]$. **(05 Marks)**

d. Using convolution theorem evaluate $L^{-1}\left[\frac{s}{(s+2)(s^2+9)}\right]$. **(05 Marks)**

8 a. Using Laplace transforms, solve $\frac{d^2y}{dt^2} + 2\frac{dy}{dt} - 3y = \sin t$ given $y(0) = y'(0) = 0$. **(10 Marks)**

b. Using Laplace transforms, solve $\frac{dx}{dt} + y = \sin t$, $\frac{dy}{dt} + x = \cos t$, given x = 2, y = 0 when $t = 0$. **(10 Marks)**

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