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10MAT41

Fourth Semester B.E. Degree Examination, June/July 2014

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. Obtain a solution upto the third approximation of y for x = 0.2 by Picard's method, given that $\frac{dy}{dx} + y = e^x$; y(0) = 1. **(06 Marks)**

b. Apply Runge-Kutta method of order 4, to find an approximate value of y for x = 0.2 in steps of 0.1, if $\frac{dy}{dx} = x + y^2$ given that y = 1 when x = 0. **(07 Marks)**

c. Using Adams-Bashforth formulae, determine y(0.4) given the differential equation $\frac{dy}{dx} = \frac{1}{2}xy$ and the data, y(0) = 1, y(0.1) = 1.0025, y(0.2) = 1.0101, y(0.3) = 1.0228. Apply the corrector formula twice. **(07 Marks)**

2 a. Apply Picard's method to find the second approximation to the values of 'y' and 'z' given that $\frac{dy}{dx} = z$, $\frac{dz}{dx} = x^3(y+z)$, given y = 1, $z = \frac{1}{2}$ when x = 0. **(06 Marks)**

b. Using Runge-Kutta method, solve $\frac{d^2y}{dx^2} - x\left(\frac{dy}{dx}\right)^2 + y^2 = 0$ for x = 0.2 correct to four decimal places. Initial conditions are x = 0, y = 1, y' = 0. **(07 Marks)**

c. Obtain the solution of the equation $\frac{2d^2y}{dx^2} = 4x + \frac{dy}{dx}$ at the point x = 1.4 by applying Milne's method given that y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649. y(1.3) = 2.7514, y'(1) = 2, y'(1.1) = 2.3178, y'(1.2) = 2.6725 and y'(1.3) = 3.0657. **(07 Marks)**

3 a. Define an analytic function in a region R and show that f(z) is constant, if f(z) is an analytic function with constant modulus. **(06 Marks)**

b. Prove that $u = x^2 - y^2$ and $v = \frac{y}{x^2+y^2}$ are harmonic functions of (x, y) but are not harmonic conjugate. **(07 Marks)**

c. Determine the analytic function f(z) = u + iv, if $u - v = \frac{\cos x + \sin x - e^{-y}}{2(\cos x - \cosh y)}$ and $f(\pi/2) = 0$. **(07 Marks)**

4 a. Find the images of the circles |z| = 1 and |z| = 2 under the conformal transformation $w = z + \frac{1}{z}$ and sketch the region. **(06 Marks)**

b. Find the bilinear transformation that transforms the points 0, i, ∞ onto the points 1, –i, –1 respectively. **(07 Marks)**

c. State and prove Cauchy's integral formula and hence generalized Cauchy's integral formula. **(07 Marks)**

PART – B

5 a. Obtain the solution of the equation $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+\left(x^2-\frac{1}{4}\right)y=0$. **(06 Marks)**

b. Obtain the series solution of Legendre's differential equation.

$$(1-x^2)\frac{d^2y}{dx^2}-2x\frac{dy}{dx}+n(n+1)y=0$$ **(07 Marks)**

c. State Rodrigue's formula for Legendre polynomials and obtain the expression for $P_4(x)$ from it. Verify the property of Legendre polynomials in respect of $P_4(x)$ and also find $\int_{-1}^{1}x^3P_4(x)dx$. **(07 Marks)**

6 a. Two fair dice are rolled. If the sum of the numbers obtained is 4, find the probability that the numbers obtained on both the dice are even. **(06 Marks)**

b. Given that $P(\overline{A}\cap\overline{B})=\frac{7}{12}$, $P(A\cap\overline{B})=\frac{1}{6}=P(\overline{A}\cap B)$. Prove that A and B are neither independent nor mutually disjoint. Also compute P(A/B) + P(B/A) and $P(\overline{A}/\overline{B})+P(\overline{B}/\overline{A})$. **(07 Marks)**

c. Three machines M_1, M_2 and M_3 produces identical items. Of their respective outputs 5%, 4% and 3% of items are faulty. On a certain day, M_1 has produced 25% of the total output, M_2 has produced 30% and M_3 the remainder. An item selected at random is found to be faulty. What are the chances that it was produced by the machine with the highest output? **(07 Marks)**

7 a. In a quiz contest of answering 'Yes' or 'No', what is the probability of guessing atleast 6 answers correctly out of 10 questions asked? Also find the probability of the same if there are 4 options for a correct answer. **(07 Marks)**

b. Define exponential distribution and obtain the mean and standard deviation of the exponential distribution. **(07 Marks)**

c. If X is a normal variate with mean 30 and standard deviation 5, find the probabilities that (i) $26 \le X \le 40$, (ii) $X \ge 45$, (iii) $|X-30|>5$. [Give that $\phi(0.8)=0.2881$, $\phi(2.0)=0.4772$, $\phi(3.0)=0.4987$, $\phi(1.0)=0.3413$] **(06 Marks)**

8 a. Certain tubes manufactured by a company have mean life time of 800 hrs and standard deviation of 60 hrs. Find the probability that a random sample of 16 tubes taken from the group will have a mean life time (i) between 790 hrs and 810 hrs, (ii) less than 785 hrs, (iii) more than 820 hrs. [$\phi(0.67)=0.2486$, $\phi(1)=0.3413$, $\phi(1.33)=0.4082$]. **(06 Marks)**

b. A set of five similar coins is tossed 320 times and the result is:

No. of heads:	0	1	2	3	4	5
Frequency:	6	27	72	112	71	32

Test the hypothesis that the data follow a binomial distribution. [Given that $\chi^2_{0.05}(5)=11.07$] **(07 Marks)**

c. It is required to test whether the proportion of smokers among students is less than that among the lectures. Among 60 randomly picked students, 2 were smokers. Among 17 randomly picked lecturers, 5 were smokers. What would be your conclusion? **(07 Marks)**

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10CV42

Fourth Semester B.E. Degree Examination, June / July 2014
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. Explain the manufacturing process of OPC both by wet and dry process (using flow chart only). **(10 Marks)**

b. Explain any two tests on cement in detail. **(10 Marks)**

2 a. What is grading of aggregate? Explain its significance in improving the properties of concrete. **(05 Marks)**

b. What are flakiness and elongation index? Explain their effects on properties of concrete. **(05 Marks)**

c. Explain impact and abrasion tests on coarse aggregate. **(10 Marks)**

3 a. Explain measurement of workability of concrete using,
i) Compaction factor method.
ii) Vee-bee consistometer method. **(10 Marks)**

b. Explain manufacture of concrete in detail. **(10 Marks)**

4 a. What is the role of admixtures in concrete? Mention any three chemical and mineral admixtures. **(05 Marks)**

b. Explain factors affecting the workability of concrete by using admixtures. **(10 Marks)**

c. Explain the role of fly ash as a admixture. **(05 Marks)**

PART – B

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

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

6 a. Explain briefly the relationship between modulus of elasticity and compressive strength of concrete. **(05 Marks)**

b. Explain the method of measurement of creep of concrete. **(10 Marks)**

c. Explain factors affecting creep of concrete. **(05 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 a. Explain the concept of concrete mix design. **(05 Marks)**

b. Explain the procedure of concrete mix design using I.S.code. **(10 Marks)**

c. Explain different variables in proportioning of concrete. **(05 Marks)**

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10CV43

Fourth Semester B.E. Degree Examination, June/July 2014
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. Differentiate between :
(i) Determinate and indeterminate structures
(ii) Degree of redundancy and degree of freedom
(iii) Linear structure and non-linear structure
(iv) Deflection and deformation **(10 Marks)**

b. Determine the strain energy stored in a member when it is subjected to an axial load and strain energy stored in beam subjected to bending moment. Use standard notations. **(10 Marks)**

2 a. Find the maximum slope and deflection for the beam shown in Fig.Q2(a) using moment area method. Take EI = 10.2×10^3 kNm^2. **(10 Marks)**

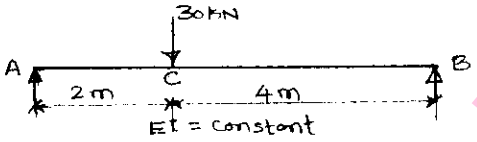

Fig.Q2(a)

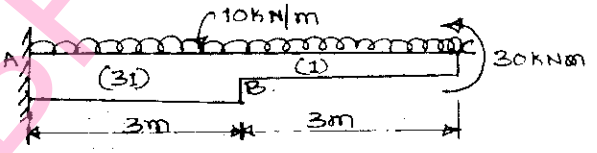

Fig.Q2(b)

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

3 a. Determine the deflection for a simply supported beam shown in Fig.Q3(a) at midspan using strain energy method. Take EI = 3×10^4 kNm^2. **(10 Marks)**

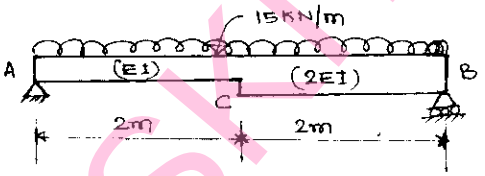

Fig.Q3(a)

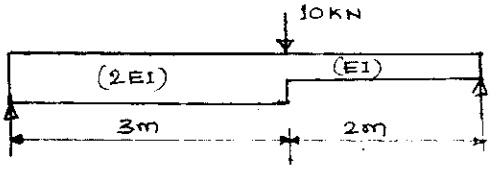

Fig.Q3(b)

b. Determine the deflection for a simply supported beam shown in Fig.Q3(b) under the point load by strain energy method. Take E = 200×10^6 kN/m^2 and I = 25×10^{-6} m^4. **(10 Marks)**

4 a. Analyse the fixed beam shown in Fig.Q4(a) by strain energy method. Also draw B.M.D. **(10 Marks)**

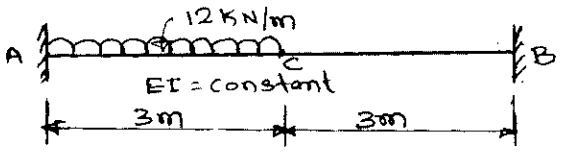

Fig.Q4(a)

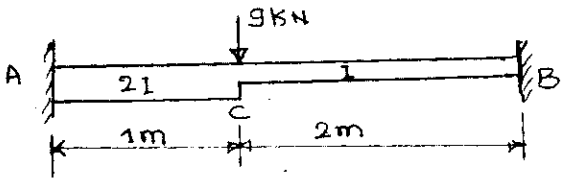

Fig.Q4(b)

b. Analyse the fixed beam shown in Fig.Q4(b) by strain energy method. Also draw B.M.D. **(10 Marks)**

PART – B

5 a. A three hinged symmetrical arch of span 20 m, hinges are provided at supports and crown of the arch. The rise at crown is 5 m and arch is subjected to a point load of 200 kN at 6 m from the left support. Find the reactions at supports and calculate normal thrust and radial shear at 6 m from left support. Draw the bending moment diagram and also indicate the position of maximum positive and negative bending moment. **(10 Marks)**

b. A cable is supported on piers at 80 m apart at the same level has a central dip of 8 m. Calculate maximum tension in the cable, when it is subjected to UDL of 30 kN/m throughout the length. Also determine the vertical force on pier, if the back stay is inclined at 60° to the vertical when (i) the cable passes over a pully, (ii) the cable passes over a saddle. **(10 Marks)**

6 a. Analyse the propped cantilever beam shown in Fig.Q6(a), using consistant deformation method, if support B sinks by 10 mm. Take EI = 40000 kNm^2. Also draw the BMD and SFD. **(10 Marks)**

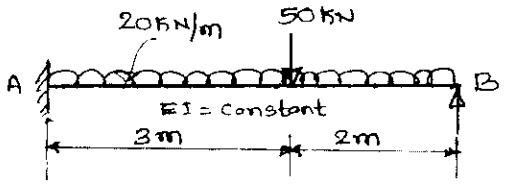

Fig.Q6(a)

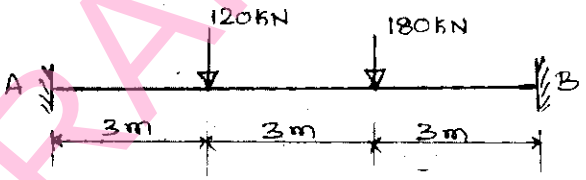

Fig.Q6(b)

b. Analyse the fixed beam shown in Fig.Q6(b) using consistent deformation method. Draw the BMD and SFD. **(10 Marks)**

7 Analyse the continuous beam shown in Fig.Q7 using three moment equation and draw bending moment diagram and shear force diagram. Also indicate the position of maximum positive and negative bending moment in the span AB and BC. **(20 Marks)**

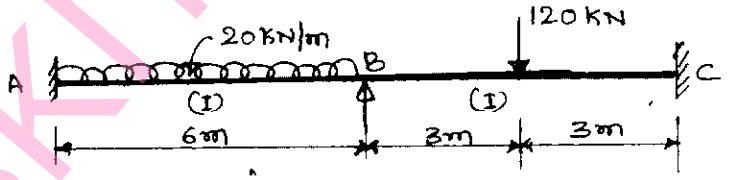

Fig.Q7

8 A two hinged parabolic arch of span 24 m and rise 3 m is uniformly loaded over the left half of the span with 30 kN/m and a concentrated load of 70 kN at the crown. Determine the horizontal thrust assuming secant variation for moment of inertia. **(20 Marks)**

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10CV44

Fourth Semester B.E. Degree Examination, June/July 2014
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 suitably.
3. Draw neat sketches.

PART – A

1 a. Explain the following terms:
i) Face left and face right observations
ii) Transit and non transit theodolites. **(04 Marks)**

b. With neat sketch and tabular column explain measurement of horizontal angle by reiteration method. **(10 Marks)**

c. With neat sketches explain prolonging a straight line by a theodolite in adjustment and theodolite not in adjustment. **(06 Marks)**

2 a. What is spire test? With neat sketch, explain how it is carried. **(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 1.40m. Determine the staff readings on A and B to give a horizontal line of sight. Determine the R.L. of B, if that of A is 200.0m. **(10 Marks)**

3 a. What is a total station? List out the advantages of total station. **(06 Marks)**

b. To find the elevation of the top of a hill, a flag staff of 4m height was erected with its top at Q. Observations were made from two stations M and N, 60m apart and not in line with Q. The angles of elevation to the top of the flag staff from stations M and N were measured as 10°50′ and 11°28′ respectively. The horizontal angle measured at M between N and the top of the flag staff was 56°30′ and that measured at N between M and the top of the flag post was 62°10′.
If the reading on B.M. with an elevation of 400.0m when the instrument was at M and the line of sight was horizontal is 1.785m, determine the elevation of the top of the hill. If the staff reading on the B.M. When the instrument was at N, was 1.794m determine the elevation of the top of the flag hill and compare with the earlier computed value. **(14 Marks)**

4 a. Derive the expressions for distance and elevation when the staff is held vertical and the line of sight is inclined. **(08 Marks)**

b. A tacheometer was set up at station A and the following readings were obtained on a vertically held staff:

Station	Staff station	Vertical angle	Cross-hair readings in m	Remarks
A	B.M.	-2°18′	3.225, 3.55, 3.875	RL of B.M. = 437.655m
	B	+8°36′	1.650, 2.515, 3.380	

Calculate the horizontal distance from A to B and the R.L. of B if the constants of the instrument were K = 100 and C = 0.4. **(12 Marks)**

PART – B

5 a. With neat sketches, explain different types of curves. **(06 Marks)**

b. What do you mean by degree of curve? Derive the relation between degree and radius of a simple curve based on chord definition. **(05 Marks)**

c. Two tangents intersect at chainage 59 + 60, the deflection angle being 50°30′. Calculate the necessary data for setting out a curve of 15 chains radius to connect the two tangents if it is intended to set out the curve by offsets from chord produced. Take peg interval equal to 100 links, length of chain being equal to 20m (100 links). **(09 Marks)**

6 a. The following data refer to a compound curve which bears to the right:
Total deflection angle 93°
Degree of first curve = 4°
Degree of second curve = 5°
Point of intersection at 45 + 61 (20m units).
Determine in 20m units the running distance of the tangent points and the point of compound curvature, given that the latter point is 6 + 24 from the point of intersection at a back angle of 290°36′ from the first tangent. **(10 Marks)**

b. Two straight AB and CD intersect at V. BD is the common tangent of length 200m. It is proposed to introduce a reverse curve consisting of two arcs of equal radii between them. The angles ABD and CDB are 150°30′ and 43°42′ respectively. Calculate:
i) The common radius;
ii) The chainage of P.C., P.R.C. and P.T. if that of B is 9245.2m. **(10 Marks)**

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

b. What is a vertical curve? With sketch briefly explain different types of vertical curves. **(05 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. **(09 Marks)**

8 a. Plot the following cross-staff survey of a field ABCDEFG and calculate its areas. Refer Fig.Q.8(a). **(05 Marks)**

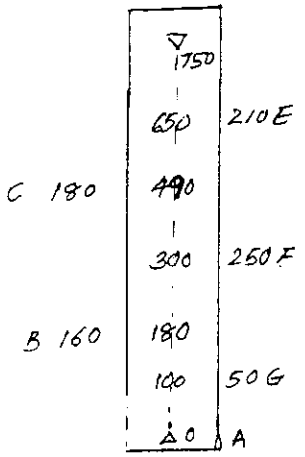

Fig.Q.8(a)

b. The following observations were made with a planimeter:

Sl.No	Area	I.R.	F.R.	N
1	Known area of 60cm^2	2.326	8.286	0
2	Unknown area	8.286	5.220	+1

The anchor point was placed outside the figure in both the cases with the same setting of the tracing arm. Calculate: i) the multiplier constant; ii) The unknown area. **(05 Marks)**

c. The following areas within the contour lines at the site of a reservoir and face of the proposal dam are as follows:

Contour	Area enclosed in sqm
100m	1000
103m	12800
106m	16600
109m	18800
112m	24400
115m	30600
118m	38400

Assuming 100m as the bottom level of the reservoir and 118 m as the water level, calculate the volume (capacity) of water that can be stored in the reservoir. Use trapezoidal and prismoidal formula. **(10 Marks)**

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10CV45

Fourth Semester B.E. Degree Examination, June / July 2014
Hydraulics and Hydraulic Machines

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. Define the terms : i) Model ii) Prototype iii) Model Analysis iv) Hydraulic similitude. **(06 Marks)**

b. State and explain Buckingham π – theorem citing an example. Also explain its advantages over Rayleigh's method of dimensional analysis. **(06 Marks)**

c. A pipe of diameter 1.8m is required to transport an oil of sp.gr 0.8 and viscosity 0.04 poise at the rate of $4m^3/s$. Tests were conducted on a 20cm diameter pipe using water at 20^0C. Find velocity and rate of flow in model. Viscosity of water at 20^0C is 0.01 poise. **(08 Marks)**

2 a. Differentiate between : i) Hydraulic depth and hydraulic mean depth ii) Steady and uniform flow iii) Alternate depth and conjugate depth iv) Open channel flow and pipe flow. **(06 Marks)**

b. Prove that for a trapezoidal channel of most economical section :
i) Half of top width = length of one of sloping sides ii) Hydraulic mean depth = ½ depth of flow. **(06 Marks)**

c. An open channel is to be constructed of trapezoidal section and with side slopes 1 vertical to 1.5 Horizontal. Find relation between bottom width and depth of flow for minimum excavation. If flow is to be 2.7 cumec, calculate the bottom width and depth of flow assuming C in Chezy's formula as 44.5 and bed slope is 1 in 4000. **(08 Marks)**

3 a. Derive an equation for gradually varied flow in open channels. Also state assumptions made in it. **(06 Marks)**

b. Explain classification of surface profiles in open channels with neat sketches. **(08 Marks)**

c. The specific energy for 6m wide rectangular channel is to be 5 kg – m/kg. if the rate of flow of water through channel is $24m^3/s$, determine alternate depths of channel. **(06 Marks)**

4 a. Explain impulse momentum principle and mention its applications. **(02 Marks)**

b. Show that maximum efficiency of jet striking on series of flat vanes mounted on periphery of a wheel never exceeds 50%. **(08 Marks)**

c. A 50mm diameter jet having a velocity of 25m/s, strikes a flat plate, the normal of which is inclined at 30^0 to axis of jet. Calculate the normal force exerted on plate i) when plate is stationary ii) when plate is moving with a velocity of 10m/s in the direction of jet. Find work done and efficiency when plate is moving. **(10 Marks)**

PART - B

5 a. Explain the concept of velocity triangles. Also obtain an expression for work done per second by jet striking unsymmetrical moving vane tangentially at one end of the tips. **(10 Marks)**

b. A jet of water moving at 20m/s impinges on a symmetrical curved vane so shaped to deflect the jet through 120^0. If the vane is moving at 5m/s, find the angle of the jet so that there is no shock at inlet. Also determine the absolute velocity of jet at exit in magnitude and direction and the work done. **(10 Marks)**

6 a. Differentiate between : i) Impulse and Reaction turbine ii) Radial and Axial flow turbine iii) Kaplan and Propellor turbine. **(03 Marks)**

b. Show that maximum hydraulic efficiency of Pelton wheel is equal to $\frac{1+\cos\phi}{2}$ in which ϕ cannot be equal to zero for increasing efficiency. **(07 Marks)**

c. A Pelton wheel has to be designed for following data : Power to be developed = 6000 kW. Net head available = 300m ; Speed = 550 r.p.m. Ratio of jet diameter to wheel diameter = $\frac{1}{10}$; and overall efficiency = 85%. Find number of jets ; diameter of jet ; diameter of wheel ; and the quantity of water required. Assume co-eff of velocity as 0.98 and speed ratio as 0.46. **(10 Marks)**

7 a. Explain different types of draft tubes with neat sketches. Also explain their functions. **(04 Marks)**

b. Draw neat sketch of Kaplan turbine and explain its different parts. **(06 Marks)**

c. A Kaplan turbine produces 60,000 kW under a net head of 25m with an overall efficiency of 90%. Taking the value of speed ratio as 1.6, flow ratio as 0.5 and hub diameter as 0.35 times the outer diameter, find diameter and speed of turbine. **(10 Marks)**

8 a. Explain the following : i) Suction head ii) Delivery head iii) Static head iv) Manometric head. **(06 Marks)**

b. Derive an expression for minimum speed for starting a centrifugal pump. **(06 Marks)**

c. A centrifugal pump having outer diameter equal to two times the inner diameter and running at 1000 r.p.m works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5m/s. The vanes are set back at an angle of 40^0 at outlet. If the outer diameter of the impeller is 500mm and width at outlet is 50mm, determine :
i) Vane angle at inlet ii) Work done by impeller on water iii) Manometric efficiency. **(08 Marks)**

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10CV46

Fourth Semester B.E. Degree Examination, June/July 2014

Building Planning and Drawing

Time: 4 hrs. Max. Marks:100

Note: 1. ***SECTION-I is compulsory and answer any TWO full questions from SECTION-II.***
2. ***Assume suitable data wherever necessary.***

SECTION – I *(Compulsory)*

1 The line diagram of a residential building is given in Fig.Q1. Draw to a scale of 1:100.

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

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

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

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

Note: All load bearing walls are 230 mm thick and partition walls are 115 mm thick. All walls are in BBM of CM 1:6. The foundation is made of SSM in CM 1:6. The depth of the foundation is 1.2 m below ground level. The thickness of plinth bed is 150 mm, thickness of RCC 150 mm. the clear height of the roof from floor level is 3.1 m, and lintel are provided at 2.1 m.

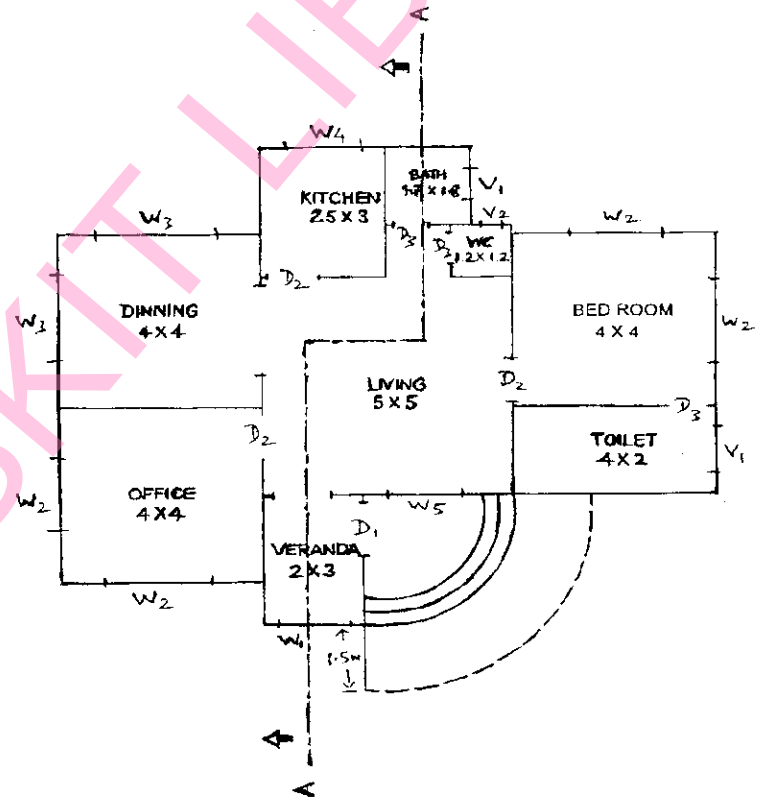

Fig.Q1

W_1 = 1.2 m × 1.5 m W_2 = 1.2 m × 1.2 m W_3 = 1.5 m × 1.2 m W_4 = 1.2 m × 0.75 m
W_5 = 1.2 m × 1.5 m V_1 = 1.0 m × 0.6 m V_2 = 0.4 m × 0.6 m D_1 = 1.2 m × 2.1 m
D_2 = 1.0 m × 2.1 m D_3 = 0.9 m × 2.1 m

SECTION - II

2 a. Draw cross section of a S.S. Masonry foundation to be provided for a load bearing wall of 230 mm thick brick wall. Use following data:

i) Width of foundation = 1.2 m
ii) Depth of foundation = 1.5 m
iii) Width of P.C.C. = 1.2 m
iv) Thickness of P.C.C. = CM 1:3:6 = 100 mm
v) Width of plinth beam = 0.45 m
vi) Thickness of plinth beam = 100 mm
vii) Height of plinth above ground level 0.6 m excluding the thickness of plinth beam.

(10 Marks)

b. Draw the front elevation and sectional plan view of fully glazed double shuttered window of size 1.2 m × 1.2 m. **(10 Marks)**

3 Prepare a bubble diagram and develop a line diagram for a primary health centre to a suitable scale. The primary health centre should consists of

i) Reception
ii) Doctor's consultation room
iii) Lady doctor's room
iv) Minor operation theatre
v) Nurse room
vi) Dispensary
vii) Store room
viii) Laboratory
ix) Toilets for ladies and gents separately. **(20 Marks)**

4 Prepare a bubble diagram for a office building and draw a single line diagram to a suitable scale for the following requirements.

i) Reception
ii) Execution office chambers - 2 Nos
iii) Office staff room
iv) Record room
v) Small meeting hall
vi) Toilets for ladies and gents separately. **(20 Marks)**

5 The line diagram of a residential building is shown in Fig.Q5. Prepare:

a. Water supply layout
b. Electrical layout. **(20 Marks)**

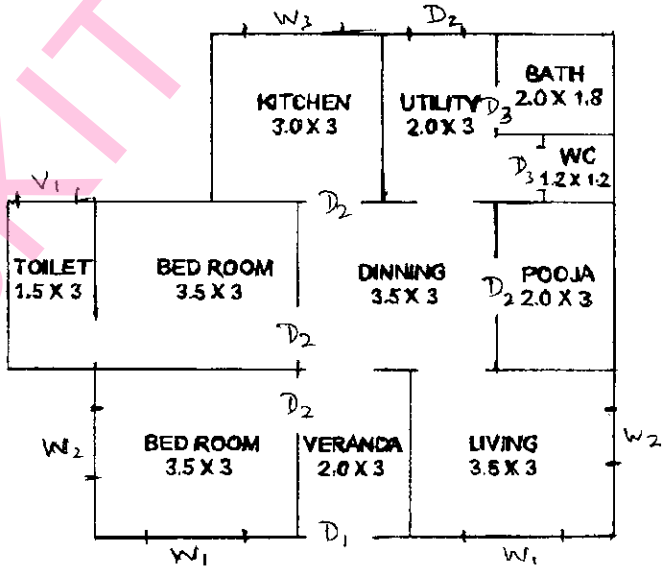

Fig.Q5

Assume suitable dimensions for doors and windows.

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MATDIP401

Fourth Semester B.E. Degree Examination, June / July 2014
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

1 a. Define direction cosine and direction ratio of a line. Hence show that $l^2 + m^2 + n^2 = 1$. **(06 Marks)**

b. For any cube show that angle between any two diagonals is $\cos^{-1}\left(\frac{1}{3}\right)$. **(07 Marks)**

c. Define plane. Derive equation of plane in general form. **(07 Marks)**

2 a. Find equation of plane passing through A(-1, 1, 1), B(1, -1, 1) and perpendicular to plane $x + 2y + 2z - 5 = 0$ **(06 Marks)**

b. Show that the line $\frac{x-4}{2} = \frac{y-2}{3} = \frac{z-3}{10}$ is parallel to plane $2x + 2y - z = 6$. Find distance between them. **(07 Marks)**

c. Show that lines $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5}$ and $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$ are coplanar. Find point of intersection. **(07 Marks)**

3 a. Find sine and cosine of angle between the vectors $4\hat{i} + 3\hat{j} + \hat{k}$, $2\hat{i} - \hat{j} + 2\hat{k}$. **(06 Marks)**

b. Show that points (4, 5, -1), (0, -1, -1), (3, 9, 4), (-4, 4, 4) are coplanar using vector method. **(07 Marks)**

c. Prove that $\left[\vec{a}+\vec{b},\ \vec{b}+\vec{c},\ \vec{c}+\vec{a}\right] = 2\left[\vec{a}, \vec{b}, \vec{c}\right]$. **(07 Marks)**

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

b. Find directional derivative of $x^2 + y^2 + 4xyz$ at (1, -2, 2) in the direction $2\hat{i} - 2\hat{j} + \hat{k}$. **(07 Marks)**

c. Show that $\text{grad}\left(\frac{1}{r}\right) = -\frac{\vec{r}}{r^2}$. **(07 Marks)**

5 a. For any scalar function ϕ show that $\text{curl}(\text{grad}\phi) = 0$. **(06 Marks)**

b. If $\vec{F} = \text{grad}\phi$, $\phi = x^2+y^2+z^2+xyz$, find $\nabla \cdot \left(\vec{F}\right)$ and $\nabla \times \left(\vec{F}\right)$ at (1, 1, 1). **(07 Marks)**

c. Find a, b, c so that $\vec{F} = (x + y + az)\hat{i} + (x + cy + 2z)\hat{j} + (x + 2y - z)\hat{k}$ is irrotational. Find scalar function. **(07 Marks)**

6 a. Find Laplace Transform if t^n and hence find $L\left(t^{\frac{1}{2}}\right)$. **(06 Marks)**

b. Find $L\left[e^{2t}\cos 3t + e^{-t}\sin 2t + t\sin t\right]$. **(07 Marks)**

c. Find $L\left[\frac{e^t(\cos 3t - \cos t)}{t}\right]$. **(07 Marks)**

7 a. Find $L[\sin t \ \sin 2t \ \sin 3t]$. **(06 Marks)**

b. Find $L[f(t)]$ where $f(t) = \begin{cases} 1 & 0 < t \le 1 \\ t & 1 < t \le 2 \\ t^2 & t > 2 \end{cases}$. **(07 Marks)**

c. Find $L^{-1}\left\{\log\sqrt{\frac{s+a}{s-b}}\right\}$. **(07 Marks)**

8 a. Find $L^{-1}\left\{\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}\right\}$. **(10 Marks)**

b. Solve by Laplace transformation, $\frac{d^2y}{dt^2} + 7\frac{dy}{dt} + 10y = 4e^{-3t}$, given $y(0) = 0, y'(0) = -1$. **(10 Marks)**

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