CBCS SCHEME

USN | | | | | | | | | |

15MAT41

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Engineering Mathematics - IV

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Use of Statistical table is allowed.***

Module-1

1 a. Employ Taylor's Series Method to find 'y' at x = 0.2. Given the linear differential equation $\frac{dy}{dx} = 3e^x + 2y$ and y = 0 at x = 0 initially considering the terms upto the third degree. **(05 Marks)**

b. Use fourth order Runge – Kutta method to solve $(x + y)\frac{dy}{dx} = 1$, y(0.4) = 1 at x = 0.5 correct to four decimal places (Take h = 0.1). **(05 Marks)**

c. Apply Adams – Bash fourth method to solve $\frac{dy}{dx} = x^2(1 + y)$, given that y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548 and y(1.3) = 1.979 to evaluate y(1.4). **(06 Marks)**

OR

2 a. Given $\frac{dy}{dx} = x^2 + y$, y(0) = 1. Find correct to four decimal places y(0.1) using modified Euler's method taking h = 0.05. **(06 Marks)**

b. Use Milne's Predictor and Corrector method to compute y at x = 0.4, given $\frac{dy}{dx} = 2e^x - y$ and

x	0	0.1	0.2	0.3
y	2	2.010	2.040	2.090

(05 Marks)

c. Use Fourth order Runge – Kutta method to fond y(1.1), given $\frac{dy}{dx} + y - 2x = 0$, y(1) = 3 with step size h = 0.1. **(05 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} - x\frac{dy}{dx} - y = 0$ with the initial conditions y(0) = 1, y'(0) = 0. Compute y(0.2) using Runge – Kutta method. **(05 Marks)**

b. Show that $J_{1/2}(1) = \sqrt{\frac{2}{\pi x}}\ \mathrm{Sin}\ x$. **(05 Marks)**

c. Derive Rodrigue's formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2 - 1)^n$. **(06 Marks)**

OR

4 a. Apply Milne's method to compute y(0.8). Given that $\frac{d^2y}{dx^2} = 2y\frac{dy}{dx}$ and the following table of initial values. **(05 Marks)**

x	0	0.2	0.4	0.6
y	0	0.2027	0.4228	0.6841
y'	1	1.041	1.179	1.468

b. Express $f(x) = x^3 + 2x^2 - 4x + 5$ interms of Legendre Polynomials. **(05 Marks)**

c. Show that $\int_0^1 x\, J_n(\alpha x)\ J_n(\beta x)\, dx = 0$, If $\alpha \neq \beta$. Where α , β are roots of $J_n(x) = 0$. **(06 Marks)**

Module-3

5 a. Derive Cauchy – Riemann equations in Cartesian form. **(05 Marks)**

b. Using Cauchy's Residue theorem, evaluate the integral $\int_C \frac{ze^z}{z^2-1}dz$, where C is the circle $|Z| = 2$. **(05 Marks)**

c. Find the Bilinear transformation that transforms the points $Z_1 = 0$, $Z_2 = 1$, $Z_3 = \infty$ into the points $W_1 = -5$, $W_2 = -1$, $W_3 = 3$ respectively. **(06 Marks)**

OR

6 a. State and prove Cauchy's theorem. **(05 Marks)**

b. Evaluate $\int_C \frac{\sin^2 Z}{(Z-\pi/6)^3}dz$, where 'C' is the circle $|Z| = 1$, using Cauchy's integral formula. **(05 Marks)**

c. Construct the analytic function whose real part is $x + e^x \cos y$. **(06 Marks)**

Module-4

7 a. Obtain Mean and Variance of Exponential distribution. **(05 Marks)**

b. Find the binomial probability distribution which has mean 2 and variance $\frac{4}{3}$. **(05 Marks)**

c. The Joint probabilities distribution for two Random Variations X and Y as follows :

X \ Y	-3	2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Find i) Marginal distributions of X and Y ii) Co-variance of X and Y. Also verify that X and Y are independent iii) Correlation of X and Y. **(06 Marks)**

OR

8 a. A certain number of articles manufactured in one batch were classified into three categories according to a particular characteristic, being less than 50, between 50 and 60 and greater than 60. If this characteristic is known to be normally distributed, determine the mean and standard deviation for this batch if 60% , 35% and 5% were found in these categories. [$\phi(0.25) = 0.0987$, $\phi(1.65) = 0.4505$]. **(05 Marks)**

b. Obtain the mean and standard deviation of Poisson distribution. **(05 Marks)**

c. Define Random variable. The pdf of a variate X is given by the following table :

X	0	1	2	3	4	5	6
P(X)	K	3K	5K	7K	9K	11K	13K

i) Find K, if this represents a valid probability distribution.
ii) Find $P(x \geq 5)$ and $P(3 < x \leq 6)$. **(06 Marks)**

Module-5

9 a. Coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and test the goodness of fit [$\Psi^2_{0.05} = 9.49$ for 4 d.f]. **(06 Marks)**

Number of heads	0	1	2	3	4
Frequency	5	29	36	25	5

b. Find a Unique fixed Probability vector for the regular stochastic matrix.

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$

(05 Marks)

c. A group of boys and girls were given an intelligence test. The mean score. S.D score and numbers in each group are as follows :

	Boys	Girls
Mean	74	70
SD	8	10
n	12	10

Is the difference between the means of the two groups significant at 5% level of significance [$t_{.05} = 2.086$ for 20 d,f]. **(05 Marks)**

OR

10 a. A coin was tossed 400 times and the head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% level of significance. **(05 Marks)**

b. The weight of 1500 ball bearings are normally distributed with a mean of 635 gms and S.D of 1.36 gms. If 300 random samples of size 36 are drawn from this populations. Determine the expected mean and S.D of the sampling distribution of means if sampling is done i) With replacement ii) without replacement. **(05 Marks)**

c. Every year, a man trades his car for a new car. If he has a Maruti, he trades it for an Ambassador. If he has an Ambassador, he trades it for a Santro. However, if he has a Santro, he is just as likely to trade it for a new Santro as a trade it for a Maruti or an Ambassador. In 2000 he bought his first car which was a Santro. Find the probability that he has
i) 2002 Santro ii) 2002 Maruti. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | | **15CV42**

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Analysis of Determinate Structures

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Determine static and Kinematic in determinacies of the structures shown in Fig Q1(a) i), ii), iii).

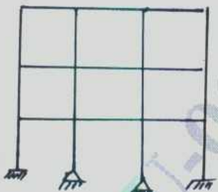
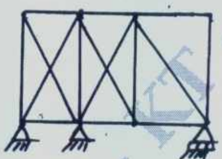
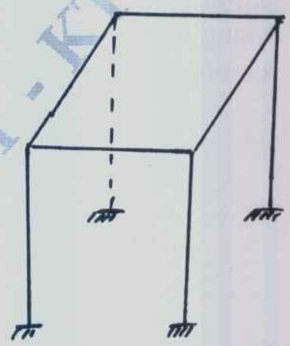

Fig Q1(a) – i)   Fig Q1(a) – ii)   Fig Q1(a) – iii)   **(08 Marks)**

b. Determine the forces in the numbered members of the loaded truss shown in Fig Q1(b) using method of sections.

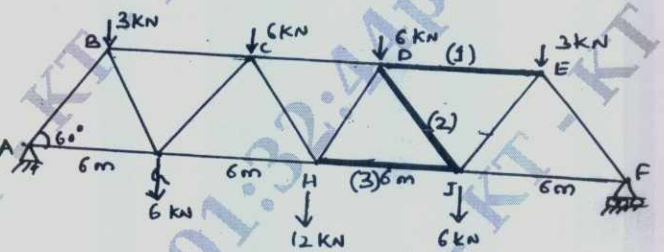

Fig Q1(b)   **(08 Marks)**

OR

2 Determine forces in all the members of the truss shown in Fig Q2 using method of joints.

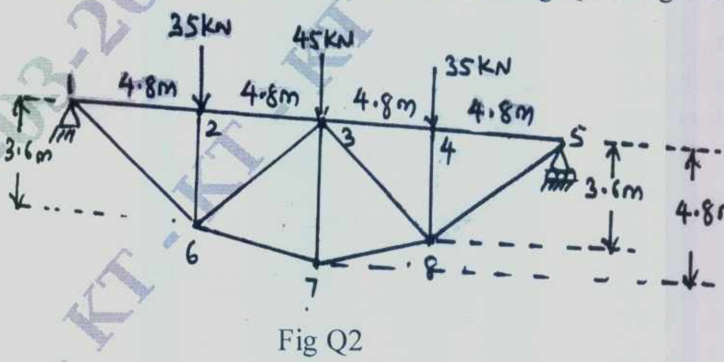

Fig Q2   **(16 Marks)**

Module-2

3 a. Determine maximum slope and maximum deflection for a simply supported beam subjected to a uniformly distributed load (throughout its span) using Double Integration method. **(06 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

b. Determine maximum slope and maximum deflection for the beam shown in Fig Q3(b) using Macaulay's method.

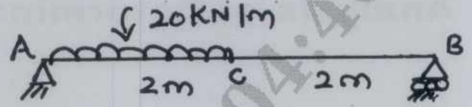

Fig Q3(b) **(10 Marks)**

OR

4 a. Obtain expression for maximum slope and maximum deflection for a Cantilever with a uniformly distributed load throughout its span, using moment-area method. **(06 Marks)**

b. Using Conjugate beam method determine maximum slope and maximum deflection for the simply supported beam shown in Fig Q4(b). $E = 204 \times 10^6$ kN/m^2 and $I = 50 \times 10^{-6}$m^4.

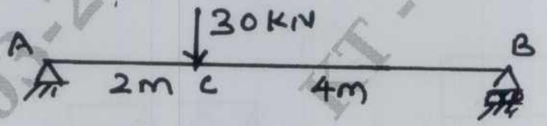

Fig Q4(b) **(10 Marks)**

Module-3

5 a. Determine vertical and horizontal deflections of the bent shown in Fig Q5(a), using Castigliano's method.

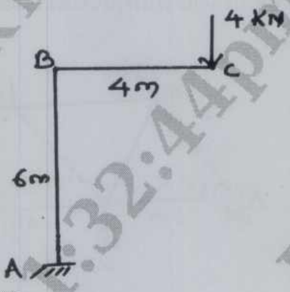

Fig Q5(a) **(12 Marks)**

b. Determine the expression strain energy stored in a member due to flexure, with usual notations. **(04 Marks)**

OR

6 Determine the vertical deflection at the free end of the truss shown in Fig Q6, using unit load method. The cross sectioned areas of members AD and DE are 1500mm^2, while those of other members are 1000mm^2. Take E = 200 kN/mm^2.

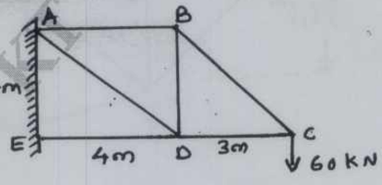

Fig Q6 **(16 Marks)**

Module-4

7 a. A three hinged parabolic arch of span 12m and central rise 3m is subjected to a uniformly distributed load of 30kN/m over its left half portion. Determine vertical reactions and horizontal thrust at the supports. Also determine Bending moment, Normal Thrust and Radial Shear at 3m from the left-hand support. **(12 Marks)**

b. A suspension cable 140m span and 14m central sag, carries a load of 1kN/m. calculate maximum and minimum tension in the cable. Find length of the cable. **(04 Marks)**

OR

8 A three hinged stiffening girder of a suspension bridge, of span 100m is subjected to two concentrated loads of 10kN each, placed at 20m and 40m respectively from the left end support. Determine bending moment and shear force at 30m from the left support. Also determine the maximum and minimum tensions in the supporting cable which has a central dip of 10m. **(16 Marks)**

Module-5

9 a. A simply supported beam has a span of 15m. A uniformly distributed load of 40 kN/m of length 5m passes over the beam from left to right. Using influence line diagram determine maximum bending movement at a section 6m from the left end. **(04 Marks)**

b. Four point loads 16, 30, 30 and 20kN have a centre to centre spacing of 2m between consecutive load and pass over a girder of 30m span from left to right with 20kN load leading. Calculate maximum bending moment and shear force at 8m from the left end, using influence line diagrams. **(12 Marks)**

OR

10 a. A train of concentrated loads shown in Fig Q10(a) move from left to right on a simply supported girder of span 16m. Determine absolute maximum bending moment developed in the beam.

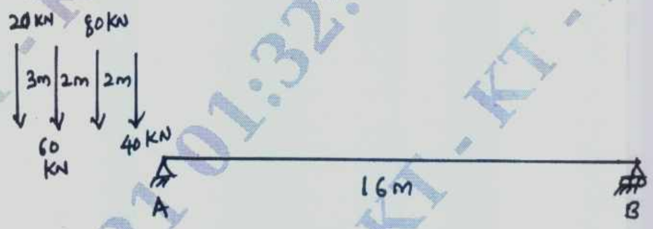

Fig Q10(a) **(08 Marks)**

b. Determine maximum forces in the members CE, DE and DF of the truss shown in Fig Q10(b), due to the dead load of 10 kN/m covering the entire span and a moving load of 20kN/m longer than the span passing over the truss. Consider the loads are transmitted through the lower chord.

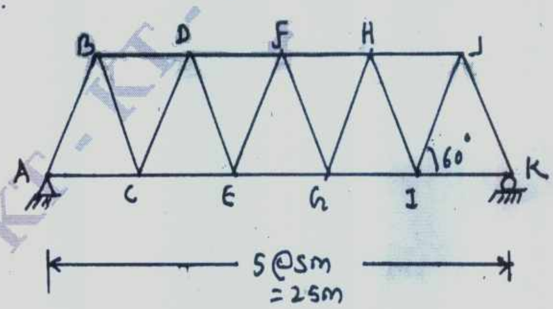

Fig Q10(b) **(08 Marks)**

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CBCS SCHEME

USN

15CV43

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. State and explain Buckingham π-theorem. **(06 Marks)**

b. Derive the scale ratios of the following as per Reynolds model law:
(i) Time (ii) Discharge (iii) Force (iv) Acceleration
(v) Work (vi) Power **(06 Marks)**

c. A spillway model is constructed such that the velocity and discharge in the model are respectively 2 m/s and 3 m^3/s. If the velocity in the prototype is 20 m/s, what is the length scale ratio and the discharge in the prototype? **(04 Marks)**

OR

2 a. Explain the procedure of determining the metacenter in the laboratory. **(08 Marks)**

b. The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and discharge Q. Express η as,

$$\eta = \phi\left[\frac{Q}{\omega D^3}, \frac{\mu}{\rho\omega D^2}\right]$$

where ϕ is the function. **(08 Marks)**

Module-2

3 a. Differentiate between:
(i) Hydraulic mean depth and hydraulic depth.
(ii) Steady flow and unsteady flow.
(iii) Critical flow, subcritical flow and supercritical flow. **(06 Marks)**

b. For most economical triangular section, show that crest angle is 90°. **(04 Marks)**

c. Water is flowing through a circular open channel at the rate of 500 lps, when the channel bed slope is 1 in 10000. Manning's n = 0.015. Find the diameter of channel if flow depth is 0.75 times the diameter. **(06 Marks)**

OR

4 a. Define specific energy. Draw specific energy curve and explain salient points. For rectangular channel prove that $E_{min} = 1.5y_c$ at critical flow condition. E_{min} = minimum specific energy, y_c = Critical depth. **(10 Marks)**

b. A concrete lined circular channel of 3.6 m diameter has a bed slope of 1 in 600. Determine velocity and discharge for maximum velocity condition. Chezy's C = 50. **(06 Marks)**

Module-3

5 a. Derive the relationship between sequent depths of hydraulic jump in rectangular jump in terms of approaching Froude number. **(08 Marks)**

b. A horizontal rectangular channel 4 m wide carries a discharge of 16 m^3/s. Determine whether a jump occurs at an initial depth of 0.5 m or not. If a jump occurs, determine the sequent depth and energy loss. **(08 Marks)**

OR

6 a. In a rectangular channel, the Froude number before jump $F_1 = 2.5$. Compute the Froude number after jump. **(04 Marks)**

b. Give the classification of GVF profiles with neat sketches. **(12 Marks)**

Module-4

7 a. Show that for a free jet of water sriking at the center of semicircular vane, the maximum efficiency occurs when vane velocity is $\frac{1}{3}$ of jet velocity and $\eta_{max} = 59.2\%$. **(08 Marks)**

b. A jet of water having velocity 45 m/s impinges without shock on a series of curved vanes moving at 15 m/s, the direction of motion of vanes being 20° to that of jet. The relative velocity at the outlet is 0.9 of that at inlet and the absolute velocity of water at the exit is to be normal to the motion of vanes. Find : (i) Vane angles at entrance and exit
(ii) Hydraulic efficiency. **(08 Marks)**

OR

8 a. Give the classification of turbines based on different criteria. **(08 Marks)**

b. A penstock supplies water form a reservoir to the Pelton wheel with a gross head of 500 m. One third of the gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of the penstock is 2 m^3/s. The angle of deflection of jet is 165° when the vanes are stationary. Determine the power given by the water to the runner and also hydraulic efficiency. Take $C_V = 1.0$ and Speed ratio = 0.45. **(08 Marks)**

Module-5

9 a. Differentiate between :
(i) Francis turbine and Kaplan turbine.
(ii) Unit discharge and actual discharge.
(iii) Unit speed and specific speed. **(06 Marks)**

b. What is draft tube? What are its functions? **(04 Marks)**

c. A centrifugal pump running at 1450 rpm discharges 700 lps against a head of 23 m. If the diameter of the impeller is 250 mm and width is 50 mm, find the vane angle at the outer periphery. Take $\eta_{man} = 75\%$. **(06 Marks)**

OR

10 a. Define minimum starting speed of a centrifugal pump and derive the expression for the same. **(06 Marks)**

b. Define : (i) Suction head, (ii) Delivery head, (iii) Static head
(iv) Manometric head **(04 Marks)**

c. A Kaplan turbine produces 60000 kW power under net head of 25 m with an overall efficiency of 90%. Taking speed ratio = 1.6 and flow ratio = 0.5 with hub diameter = 0.35 times diameter, find the diameter and speed of the turbine. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | |

15CV45

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Basic Geo-Technical Engineering

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg. 42+8 = 50, will be treated as malpractice.

Module-1

1 a. With the help of three phase diagram, explain :
i) Void ratio
ii) Porosity
iii) Water content
iv) Degree of saturation. **(08 Marks)**

b. Explain the laboratory procedure to determine the water content present in the soil using hot air oven. **(04 Marks)**

c. An oven dried soil weighing 1.854N is placed in a pyknometer. The total weight of the pyknometer along with soil and water is 15.51N. The pyknometer with water alone weighs 14.34N. Determine the specific gravity of the soil. **(04 Marks)**

OR

2 a. Define Liquid limit, plastic limit and shrinkage limit. **(06 Marks)**

b. Explain Indian standard soil classification system. **(06 Marks)**

c. Determine the dry density and void ratio. Given $V_b = 26kN/m^3$, W = 16%, G = 2.67. **(04 Marks)**

Module-2

3 a. Explain with sketches, the common clay minerals. **(08 Marks)**

b. A cohesive soil yields a maximum dry density of $18kN/m^3$ at on OMC of 16% during a standard proctor test. If G = 2.65. What is the degree of saturation? **(08 Marks)**

OR

4 a. Distinguish between standard proctor and modified proctor tests. **(04 Marks)**

b. Explain the laboratory procedure for conducting test on soil to determine its maximum dry density and optimum moisture content. **(06 Marks)**

c. What are the effects of compaction? **(06 Marks)**

Module-3

5 a. What is a flow net? What are the uses and characteristics of flow nets? **(08 Marks)**

b. Compute the quantity of water seeping under a weir per day for which the flow net has been constructed. The coefficient of permeability is 2×10^{-2}mm/s, $n_f = 5$ and $n_d = 18$. The difference in water level between O/S and D/S is 3.0m. The length of weir is 60m. **(08 Marks)**

OR

6 a. What are the factors affecting permeability? Explain them briefly. **(06 Marks)**

b. A soil sample 90mm high and 6000mm is in cross-section was subjected to a falling-head permeability test. The head fell from 500mm to 300mm in 1500s. The permeability of the soil was 2.4×10^{-3} mm/s. Determine the diameter of its stand pipe. **(10 Marks)**

Module-4

7 a. Explain Mass-Spring Analogy. (08 Marks)
b. Explain over consolidated soil, normally consolidated soil and under consolidated soil. (08 Marks)

OR

8 a. Explain square root of time fitting method. (06 Marks)
b. A 20m thick isotropic clay stratum over lies an imperrious rock. The coefficient of consolidation of soil is 5×10^{-8} mm^2/s. Find the time required for 50% and 90% consolidation. Time factors are 0.2 and 0.85 for u = 50% and u = 90% respectively. (10 Marks)

Module-5

9 a. Explain Mohr–Coulomb failure theory of soil. (04 Marks)
b. What are the factors affecting the shear strength of soil. (04 Marks)
c. A direct shear test was conducted on a soil and the following results were obtained.

Normal stress	kN/m^2	55	105	145
Shear stress	kN/m^2	30	36	41

Determine graphically, the cohesive strength and the angle of shearing resistance. (08 Marks)

OR

10 a. Explain the list procedure involved in conducting the direct shear list on soil. (06 Marks)
b. Define thixotrophy and sensitivity. (04 Marks)
c. When an unconfined compression test is conducted on a cylinder of soil, it fails under an axial stress of $120kN/m^2$. The failure plane makes an angle of 50° with the horizontal. Determine the cohesion and the angle of internal friction of soil. (06 Marks)

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CBCS SCHEME

USN | | | | | | | | | |

15CV46

Fourth Semester B.E. Degree Examination, Jan./Feb.2021
Advanced Surveying

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What are the elements of a simple circular curve? **(04 Marks)**

b. Calculate the ordinates at 10 m distance for a circular curve having a long chord of 80 m and a midordinate of 4 m. **(04 Marks)**

c. Two tangents intersect at chainage 1200 m, the deflection angle being 40°. Compute the data for setting out a 400 m radius curve by Rankine's deflection angles method. Take 30 m chord length. Tabulate the results. **(08 Marks)**

OR

2 a. With neat sketch, explain various elements of a compound curve. **(04 Marks)**

b. Define : (i) Transition curves (ii) Super elevation. **(04 Marks)**

c. A reverse curve is to be set out between two parallel tangents 10 m apart. The distance between the tangent points measured parallel to the tangents is 80 m. If the radius of the first branch is 150 m, calculate the radius of the second branch. Also calculate the lengths of the two branches. What would be the equal radius of the branches of the two reverse curve? If the chainage of first tangent point is 1988 cm, determine the chainages of the point of reverse curvature and the second tangent. **(08 Marks)**

Module-2

3 a. Define satellite station and reduction to centre. **(04 Marks)**

b. Mention the points to be considered in the selection of triangulation station. **(04 Marks)**

c. Directions are observed from a satellite station S, 62.18 m from station C. Following results were obtained, $\angle A = 0°0'0''$, $\angle BSA = 71°54'32''$ and $\angle ASC = 296°12'02''$. The approximate lengths of AC and BC were 8240.60 m and 10863.60 m. Calculate the angle ACB. **(08 Marks)**

OR

4 a. Define : (i) Probable error (ii) Mean square error. **(04 Marks)**

b. State the laws of weights. **(04 Marks)**

c. Angles were measured on a station and the observations were recorded as follows. Find the mass probable values of angles A and B.

$A = 45°30'10''$ weight 2

$B = 40°20'20''$ weight 3

$A + B = 85°50'10''$ weight 1 **(08 Marks)**

Module-3

5 a. Define the terms : (i) The zenith and Nadir (ii) The declination (iii) Hour circle (iv) Prime vertical **(04 Marks)**

b. What is spherical triangle? Mention its properties. **(04 Marks)**

c. Find the shortest distance between two places A & B given that the latitude of A and B are $15°0'N$ and $12°6'N$ and their longitudes are $50°12'E$ and $54°0'E$ respectively. Radius of earth = 6370 kms. **(08 Marks)**

OR

6 a. Define the terms : (i) Celestial sphere (ii) Azimuth (iii) Hour angle (iv) Altitude **(04 Marks)**

b. Explain Astronomical triangle. **(04 Marks)**

c. Explain spherical excess and derive the expression for spherical excess. **(08 Marks)**

Module-4

7 a. Define : (i) Principal point (ii) Tilt (iii) Flying height (iv) Scale of a vertical photograph. **(04 Marks)**

b. A line AB measures 11.00 cm on a photograph taken with a camera having a focal length of 21.5 cm. The same line measures 3 cm on a map drawn to scale of $\frac{1}{45000}$. Calculate the flying height of the aircraft, if the average altitude is 350 m. **(04 Marks)**

c. Two points A and B having elevations of 650 m and 250 m respectively above datum, appear on a vertical photograph obtained with a camera of focal length of 250 mm and flying altitude of 2700 m above datum. Their photographic coordinates are as follows:

Point	Photographic coordinates	
	x cm	y cm
a	+ 3.65	+ 2.54
b	− 2.25	+ 5.59

Determine the length of the ground line AB. **(08 Marks)**

OR

8 a. Derive an expression for relief displacement on a vertical photograph. **(08 Marks)**

b. The scale of an aerial photography is $1\,\text{cm} = 100\,\text{m}$. The photograph size is $20\,\text{cm} \times 20\,\text{cm}$. Determine the number of photographs required to cover an area $10\,\text{km} \times 10\,\text{km}$, if the longitudinal lap is 60% and the side cap is 30%. **(08 Marks)**

Module-5

9 a. Mention the advantages of total station and also discuss the working principles of the same. **(08 Marks)**

b. What do you understand by Remote Sensing? Write a detailed note on applications of remote sensing. **(08 Marks)**

OR

10 a. Explain the basic principles of GPS and its application in surveying. **(08 Marks)**

b. What is GIS? Enumerate on GIS applications in civil engineering. **(08 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | 15MATDIP41

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the rank of the matrix
$$A = \begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 8 & 4 & -3 & -1 \end{bmatrix}$$
by applying elementary row transformations. **(06 Marks)**

b. Solve the system of equations by Gauss-elimination method:
$$x + y + z = 6$$
$$x - y + 2z = 5$$
$$3x + y + z = 8$$
(05 Marks)

c. Find all eigen values and eigen vectors of the matrix
$$A = \begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$$
(05 Marks)

OR

2 a. Find all eigen values and all eigen vectors of the matrix
$$A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$$
(06 Marks)

b. Solve by Gauss elimination method:
$$3x + y + 2z = 3$$
$$2x - 3y - z = -3$$
$$x + 2y + z = 4$$
(05 Marks)

c. Find the inverse of the matrix $\begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ using Cayley-Hamilton theorem. **(05 Marks)**

Module-2

3 a. Solve $(D^3 - 6D^2 + 11D - 6)y = 0$ **(06 Marks)**

b. Solve $(D^2 + 6D + 9)y = 2e^{-3x}$ **(05 Marks)**

c. Solve by the method of variation of parameters $(D^2 + 1)y = \tan x$. **(05 Marks)**

OR

4 a. Solve $(D^3 - 5D^2 + 8D - 4)y = 0$ **(06 Marks)**

b. Solve $(D^2 - 4D + 3)y = \cos 2x$ **(05 Marks)**

c. Solve by the method of undetermined coefficients $y'' - y' - 2y = 1 - 2x$. **(05 Marks)**

Module-3

5 a. Find Laplace transform of $\cos^3 at$. **(06 Marks)**

b. A periodic function of period 2a is defined by

$$f(t)=\begin{cases} E & \text{for } 0\le t\le a \\ -E & \text{for } a\le t\le 2a \end{cases}$$ where E is a constant. Find $L\{f(t)\}$. **(05 Marks)**

c. Express the function $f(t)=\begin{cases} \cos t, & t\le\pi \\ \sin t, & t>\pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

OR

6 a. Find $L\left\{\dfrac{\cos at-\cos bt}{t}\right\}$ **(06 Marks)**

b. Find $L\{\sin t\sin 2t\sin 3t\}$ **(05 Marks)**

c. Express the function $f(t)=\begin{cases} t^2, & t\le 2 \\ 4t, & t>2 \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

Module-4

7 a. Find $L^{-1}\left\{\dfrac{2s+3}{s^3-6s^2+11s-6}\right\}$ **(06 Marks)**

b. Find $L^{-1}\left\{\cot^{-1}\left(\dfrac{s}{a}\right)\right\}$ **(05 Marks)**

c. Using Laplace transform method, solve the initial value problem $y''+5y'+6y=5e^{2t}$, given that $y(0)=2$ and $y'(0)=1$. **(05 Marks)**

OR

8 a. Find $L^{-1}\left\{\dfrac{s+2}{s^2-4s+13}\right\}$ **(06 Marks)**

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

c. Using Laplace transforms, solve the initial value problem $y'+y=\sin t$, given that $y(0)=0$. **(05 Marks)**

Module-5

9 a. For any two events A and B, prove that $P(A\cup B)=P(A)+P(B)-P(A\cap B)$ **(06 Marks)**

b. If A and B are any two events with $P(A)=\dfrac{1}{2}$, $P(B)=\dfrac{1}{3}$ and $P(A\cap B)=\dfrac{1}{4}$, find P(A/B), P(B/A), $P(\overline{A}/\overline{B})$ and $P(\overline{B}/\overline{A})$ **(05 Marks)**

c. From 6 positive and 8 negative numbers, 4 numbers are selected at random and are multiplied. What is the probability that the product is positive? **(05 Marks)**

OR

10 a. State and prove Baye's theorem. **(06 Marks)**

b. A book shelf contains 20 books of which 12 are on electronics and 8 are on mathematics. If 3 books are selected at random, find the probability that all the 3 books are on the same subject. **(05 Marks)**

c. The machines A, B, C produce 50%, 30% and 20% of the items in a factory. The percentage of defective outputs of these machines are 3, 4 and 5 respectively. If an item is selected at random is found to be defective, then determine the probability that the item was manufactured by machine A. **(05 Marks)**