CBCS SCHEME

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17MAT41

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Using Taylor's series method, compute the solution of $\frac{dy}{dx} = x - y^2$ with $y(0) = 1$ at $x = 0.1$, correct to fourth decimal place. **(06 Marks)**

b. Using modified Euler's formula, solve the $\frac{dy}{dx} = x + \left|\sqrt{y}\right|$ with $y(0.2) = 1.23$ at $x = 0.4$ by taking $h = 0.2$. **(07 Marks)**

c. The following table gives the solution of $\frac{dy}{dx} = x^2 + \frac{y}{2}$. Find the value of y at $x = 1.4$ by using Milne's Predictor-Corrector method.

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514

(07 Marks)

OR

2 a. Using modified Euler's method, solve $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with y(20) = 5 at $x = 20.2$ by taking $h = 0.2$. **(06 Marks)**

b. Employ the Range-Kutta method of fourth order to solve $\frac{dy}{dx} = 3x + \frac{y}{2}$, with $y(0) = 1$ at $x = 0.1$ by taking $h = 0.1$. **(07 Marks)**

c. Using Adams-Bashforth method, find y when $x = 1.4$ given $\frac{dy}{dx} = x^2(1+y)$, with y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979 **(07 Marks)**

Module-2

3 a. Using Runge-Kutta method of fourth order solve the differential equation, $\frac{d^2y}{dx^2} = x^3\left(y + \frac{dy}{dx}\right)$ for $x = 0.1$. Correct to four decimal places with initial conditions $y(0) = 1$, $y'(0) = 0.5$. **(06 Marks)**

b. Obtain the series solution of Legendre Differential equation leading to Pn(x). **(07 Marks)**

c. With usual notation, show that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. **(07 Marks)**

OR

4 a. Apply Milne's method to compute y(1.4) given that $2\frac{d^2y}{dx^2} = 4x + \frac{dy}{dx}$ and

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	3.0657

(06 Marks)

b. State and prove Rodrigue's formula. **(07 Marks)**

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

Module-3

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

b. If $V = e^{-2y} \sin 2x$, find the analytic function f(z). **(07 Marks)**

c. Find the bilinear transformation that maps the points 0, i, ∞ onto the points $1, -i, -1$. **(07 Marks)**

OR

6 a. State and prove Cauchy's theorem on complex integration. **(06 Marks)**

b. Evaluate $\oint_C \frac{z^2+5}{(z-2)(z-3)} dz$, where $C : |z| = \frac{5}{2}$. **(07 Marks)**

c. Discuss the transformation $W = Z + \frac{1}{Z}$. **(07 Marks)**

Module-4

7 a. A box contains 100 transistors, 20 of which are defective and 10 are selected at random, find the probability that (i) all are defective (ii) at least one is defective (iii) all are good (iv) at most three are defective. **(06 Marks)**

b. Show that mean and standard deviation of exponential distribution are equal. **(07 Marks)**

c. The joint probability is,

X \ Y	0	1	2	3
0	0	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$	0

(i) Find marginal distributions of X and Y.
(ii) Also find E(X), E(Y) and E(XY). **(07 Marks)**

OR

8 a. Find the mean and variance of binomial distribution. **(06 Marks)**

b. In an examination taken by 500 candidates the average and the standard deviation of marks obtained (normally distributed) are 40% and 10%. Find approximately,
(i) How many will pass, if 50% is fixed as a minimum?
(ii) What should be the minimum if 350 candidates are to pass?
(iii) How many have scored marks above 60%? **(07 Marks)**

c. Suppose X and Y are independent random variables with the following distributions:

x_i	1	2
$f(x_i)$	0.7	0.3

y_j	−2	5	8
$g(y_j)$	0.3	0.5	0.2

Find the joint distribution of X and Y. Also find the expectations of X and Y and covariance of X and Y. **(07 Marks)**

Module-5

9 a. The average income of persons was Rs.210 with a standard deviation of Rs.10 in sample of 100 people of a city. For another sample of 150 persons, the average income was Rs.220 with standard deviation of Rs.12. The standard deviation of the incomes of the people of the city was Rs.11. Test whether there is any significant difference between the average incomes of the localities. (Use $Z_{0.05} = 1.96$) **(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? ($t_{0.05}$ for 11 d.f = 2.201). **(07 Marks)**

c. Define stochastic matrix. Find a unique fixed probability vector for the matrix $\begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$. **(07 Marks)**

OR

10 a. Explain the following terms:
(i) Type I and Type II errors.
(ii) Null hypothesis.
(iii) Level of significance.
(iv) Confidence limits. **(06 Marks)**

b. Eleven school boys were given a test in mathematics carrying a maximum of 25 marks. They were given a month's extra coaching and a second test of equal difficulty was held thereafter. The following table gives the marks in two tests.

Boy	1	2	3	4	5	6	7	8	9	10	11
Marks (I test)	23	20	21	18	18	20	18	17	23	16	19
Marks (II test)	24	19	18	20	20	22	20	20	23	20	17

Do the marks give evidence that the students have benefitted by extra coaching? (Given $t_{0.05} = 2.228$ for 10 d.f) **(07 Marks)**

c. Three boys A, B and C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball, find the probabilities that after three throws (i) A has the ball, (ii) B has the ball, (iii) C has the ball. **(07 Marks)**

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CBCS SCHEME

17CV42

USN

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

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Assume any missing data, if any.***

Module-1

1 a. Explain different forms of structures with examples. **(04 Marks)**

b. Distinguish between determinate and indeterminate structures with examples. **(04 Marks)**

c. Find the forces in all the members of the truss shown in Fig. Q1 (c) and tabulate it. **(12 Marks)**

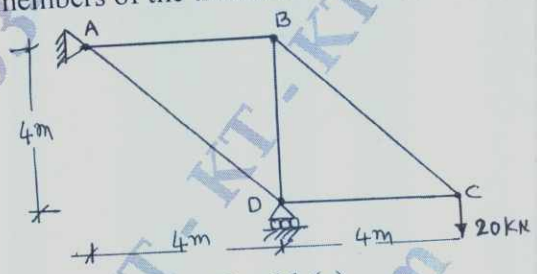

Fig. Q1 (c)

OR

2 a. List the assumptions made in the analysis of pin jointed plane truss. **(04 Marks)**

b. Determine the static and kinematic indeterminancy for the structures shown in Fig. Q2 (b). **(06 Marks)**

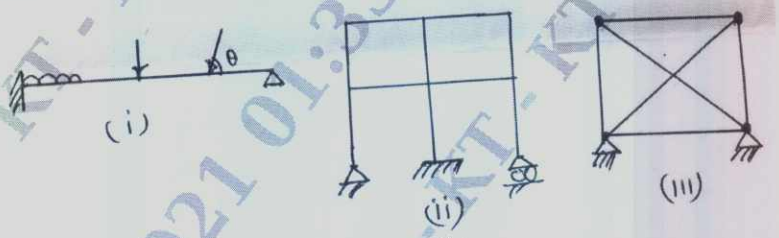

Fig. Q2 (b)

c. Find the forces in the members DE, DF and EF of the truss shown in Fig. Q2 (c) by method of sections. **(10 Marks)**

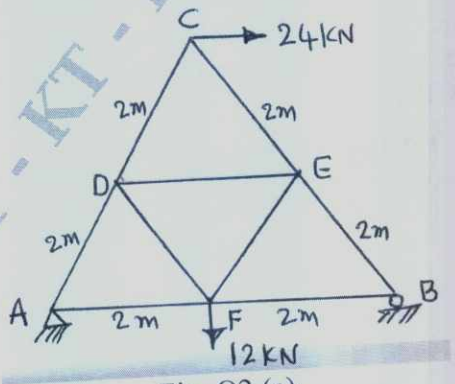

Fig. Q2 (c)

Module-2

3 a. Derive the differential equation of deflection curve for the beam. **(06 Marks)**

b. State conjugate beam theorems. **(04 Marks)**

c. Find deflection at 'C' and slope at A and B for the beam shown in Fig. Q3 (c) using moment area method. **(10 Marks)**

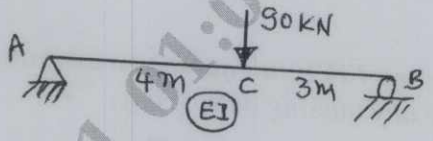

Fig. Q3 (c)

OR

4 a. State and prove moment area theorems. **(06 Marks)**

b. Find deflection at end of the Cantilever beam of span 'L' carrying udl of w/m runover entire span. Take EI constant using conjugate beam method. **(04 Marks)**

c. Find deflection at the load points C and D for the simply supported beam shown in Fig. Q4 (c) using Maculay's method. Take EI = 12000 kN-m^2 **(10 Marks)**

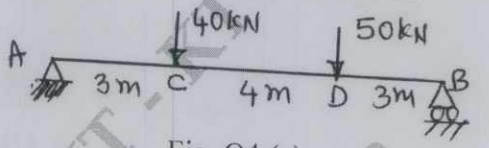

Fig. Q4 (c)

Module-3

5 a. State and prove in Castigliano's theorem – 1. **(06 Marks)**

b. State the principle of virtual forces. **(04 Marks)**

c. Determine the deflection at 'C' of the beam shown in Fig. Q5 (c) using strain energy method. **(10 Marks)**

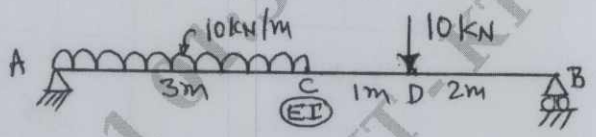

Fig. Q5 (c)

OR

6 a. Derive the expression for the strain energy stored in a beam due to flexure. **(06 Marks)**

b. Distinguish between strain energy and complimentary energy. **(04 Marks)**

c. Determine the horizontal deflection at 'C' of the truss loaded as shown in Fig. Q6 (c) using unit load method. All the members have same cross sectional area of 1500 mm^2 and E = 200 GPa. **(10 Marks)**

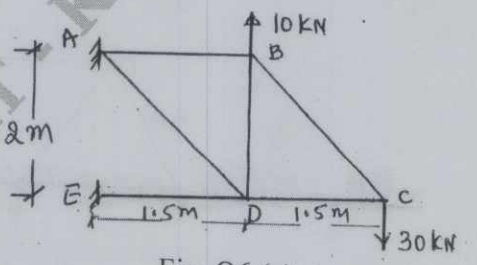

Fig. Q6 (c)

Module-4

7 a. A three hinged parabolic area has a span of 24 m and a central rise of 4 m. It carries concentrated loads of 75 kN at 18 m from the left support and udl of 45 kN/m over the left half of the portion. Determine the moment, normal thrust and radial shear at a distance 6 m from the left support. **(12 Marks)**

b. A cable used to support two loads of 40 kN and 40 kN across a span of 60 m. The cable length is 62 m. The loads acting at 20 m from left and right support. Find the tension in various segments of the cable shown in Fig. Q7 (b). **(08 Marks)**

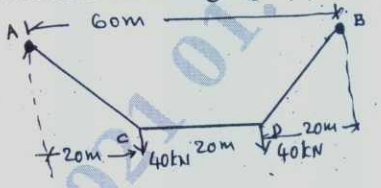

Fig. Q7 (b)

OR

8 a. A cable is suspended from two points A and B which are 80 m apart. A is 5 m below B. The lowest point on the cable is 10 m below A. The cable supports a udl of 20 kN/m over entire span. Calculate (i) reactions at supports (ii) Maximum tension in cable. **(08 Marks)**

b. A three hinged parabolic arch of span 50 m has its supports at depth 4m and 16 m below crown shown in Fig. Q8 (b). Determine reactions at the supports and bending moments under the loads. Also draw BMD. **(12 Marks)**

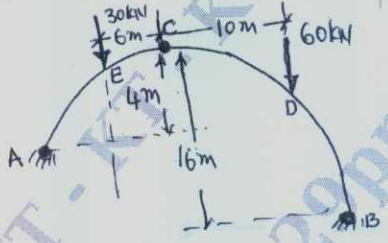

Fig. Q8 (b)

Module-5

9 a. Draw ILD for SF and BM at a section 3 m from left support for a S.S beam of span 12 m. Calculate maximum SF and BM at this section due to rolling load 5 m long and 2 kN/m intensity. **(08 Marks)**

b. A series of wheel loads crosses over a girder of span 15 m from left to right with 40 kN load leading as shown in Fig. Q9 (b). Determine maximum BM and SF at a section 4 m from left support. **(12 Marks)**

Fig. Q9 (b)

OR

10 a. Draw influence line diagram for shear force at any section from first principles. **(04 Marks)**

b. What is influence line and state the importance of influence lines? **(04 Marks)**

c. A train of five wheel loads crosses a simply supported beam of span 30 m as shown in Fig. Q10 (c). Calculate maximum positive and negative SF at midspan and absolute maximum BM anywhere in the span. **(12 Marks)**

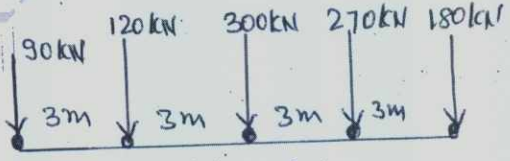

Fig. Q10 (c)

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CBCS SCHEME

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17CV43

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define dimensional homogeneity. Give two examples. **(04 Marks)**

b. Explain how repeating variables are selected for dimensional analysis in π-theorem. Also state π-theorem. **(06 Marks)**

c. The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by

$$T = D^5N^2\rho\phi\left(\frac{\mu}{D^2N\rho}\right).$$

Prove this by Buckingham's π - theorem. **(10 Marks)**

OR

2 a. Define (i) Metacentric height (ii) Buoyancy (iii) Prototype (iv) Similitude. **(08 Marks)**

b. What do you understand by Froude model law? Mention its applications. Derive any 5 scale ratios for physical quantities based on Froude model law. **(12 Marks)**

Module-2

3 a. Derive Chezy's equation for flow through an open channel. Bring out relation between N and C. **(10 Marks)**

b. A trapezoidal channel has to carry 142 m^3/minute of water is designed to have a minimum cross section. Find the bottom width and depth of the bed slope is 1 in 1200, the side slopes at 45° and Chezy's coefficient is 55. **(10 Marks)**

OR

4 a. What is specific energy? Define and draw specific energy curve and also derive expressions for critical depth and critical velocity. **(10 Marks)**

b. The discharge of water through a rectangular channel of width 6m is 18 m^3/sec when depth of flow of water is 2m. Calculate

(i) Specific energy of the flowing water
(ii) Critical depth and critical velocity
(iii) Value of minimum specific energy
(iv) State whether the flow is subcritical or supercritical. **(10 Marks)**

Module-3

5 a. Explain the term hydraulic jump with a neat sketch. Derive an expression for loss of energy due to hydraulic jump. **(10 Marks)**

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

OR

6 a. With a neat sketch, explain what is back water curve and afflux. Derive an expression for length of backwater curve. **(10 Marks)**

b. Find the slope of the free water surface in a rectangular channel of width 15m having depth of flow 4m. Discharge through channel is 40 m^3/sec. Bed of channel is having a slope of 1 in 4000. Take Chezy's C = 50. **(10 Marks)**

Module-4

7 a. With a neat sketch explain the concept of velocity triangles. **(10 Marks)**

b. A jet of water having a velocity of 35 m/s impinges on a series of vanes moving with a velocity of 20 m/s. The jet makes an angle of 30° to direction of motion of vanes when entering and leaves at 12°.
(i) Draw velocity Δ^{les} at inlet and outlet
(ii) Find angles of vane tips so that water enters and leaves without shock.
(iii) Work done per unit wt. of water entering the vanes. **(10 Marks)**

OR

8 a. Draw a typical layout of a hydroelectric plant and explain various heads. **(10 Marks)**

b. A Pelton wheel is to be designed for following specifications:
Shaft power = 11,772 kW ; Head = 380 m ; Speed = 750 rpm ; Overall efficiency = 86% ; Jet diameter not to exceed $1/6^{th}$ of wheel ϕ. Determine (i) Wheel diameter (ii) No. of Jets. **(10 Marks)**

Module-5

9 a. Define Draft Tube. Explain the draft tube theory with a sketch. **(10 Marks)**

b. Draw Kaplan turbine and label the parts legibly. Give the working proportions. **(10 Marks)**

OR

10 a. With the help of a neat sketch, explain main parts of a centrifugal pump. **(07 Marks)**

b. The diameter of an impeller of a centrifugal pump at inlet and outlet are 30cm and 60 cm respectively. The velocity of flow at outlet is 2.0 m/s and the vanes are set back at an angle of 45° at the outlet. Determine the minimum starting speed of the pump of manometer η is 70%. **(08 Marks)**

c. Write a short note on multistage pumps. **(05 Marks)**

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CBCS SCHEME

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17CV/CT44

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Concrete Technology

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Any missing data may be suitably assumed.*
3. *IS 10262 : 2009 design code is allowed.*

Module-1

1 a. Describe any five tests that can be done on cement. **(10 Marks)**
b. Explain manufacture of cement by wet process with flow chart. **(10 Marks)**

OR

2 a. Explain impact and abrasion tests on coarse aggregate. **(10 Marks)**
b. Explain the properties of chemical admixtures and their role in concrete. **(10 Marks)**

Module-2

3 a. Define workability and list the factors affecting workability and explain them. **(10 Marks)**
b. List the various tests to measures workability and explain VEE BEE consistometer test. **(10 Marks)**

OR

4 a. Explain manufacture of concrete in detail. **(15 Marks)**
b. Explain the following : i) Segregation ii) Bleeding. **(05 Marks)**

Module-3

5 a. Explain following : i) Maturity of concrete ii) Modulus of Rupture. **(06 Marks)**
b. What are the different methods of testing hardened property of concrete? Explain. **(14 Marks)**

OR

6 a. Explain different types of shrinkages in concrete. **(10 Marks)**
b. Explain Rebound hammer and ultrasonic pull velocity test. **(10 Marks)**

Module-4

7 Design the concrete mix for M20 grade concrete with following data :

a.	Characteristics compressive strength at 28 days	=	20MPa
b.	Maximum size of aggregate	=	20mm
c.	Workability	=	Slump (100mm)
d.	Degree of quality control	=	Good
e.	Type of exposure	=	Mild
f.	Specific gravity of cement	=	3.15
g.	Specific gravity of coarse aggregate	=	2.60
h.	Specific gravity of fine aggregate	=	2.60
i	Sand conforming to zone 2		

Assume any other data suitably. **(20 Marks)**

OR

8 With the help of the following data, design M30 grade concrete :

a.

Design stipulations :			
i)	Characteristics compressive strength at 28 day	=	30MPA
ii)	Maximum size of aggregate	=	20mm
iii)	Degree of workability	=	Slump (75mm)
iv)	Degree of quality control	=	good
v)	Type of exposure	=	severe

b.

Test data for materials :			
i)	Specific gravity of cement	=	3.15
ii)	Specific gravity of coarse aggregate	=	2.64
iii)	Specific gravity of fine aggregate	=	2.61
iv)	Water absorption of coarse aggregate	=	0.5%
v)	Water absorption of fine aggregate	=	1.0%
vi)	Grading of fine aggregate	=	zone 02

Any missing data may be suitably assumed. **(20 Marks)**

Module-5

9 a. Explain the advantages and disadvantages of RMC. **(10 Marks)**

b. Explain the properties of SCC. **(10 Marks)**

OR

10 a. What is Light weight concrete? State its advantages. **(10 Marks)**

b. Write a note on Fiber Reinforced Concrete. **(10 Marks)**

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CBCS SCHEME

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17CV45

Fourth Semester B.E. Degree Examination, Jan./Feb. 2021
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing data if any, may be suitably assumed.***

Module-1

1 a. Sketch the phase diagram for a soil and indicate the volumes and weights of the phases on it. Define : Void ratio , Degree of saturation and Water content. **(10 Marks)**

b. What is the purpose of soil classification? Describe any three methods of field identification of soils. **(10 Marks)**

OR

2 a. Describe the laboratory method of determining the plastic limit and shrinkage limit of a soil. **(10 Marks)**

b. A soil sample with specific gravity of solids 2.70 has a mass specific gravity of 1.84. Assuming the soil to the perfectly dry, determine the void ratio. **(05 Marks)**

c. Describe the processes of soil formation. **(05 Marks)**

Module-2

3 a. Define 'Structure of a soil'. With neat sketches, describe the different types of structures of soil. **(10 Marks)**

b. With a neat sketch, explain the electrical diffuse double layer theory. **(10 Marks)**

OR

4 a. Discuss on the factors that influence the compaction of soils. Indicate their influence with illustrative sketches of compaction curves. **(10 Marks)**

b. Write a note on 'Proctor's Needle' and its use in field compaction control. **(04 Marks)**

c. Discuss the different compacting equipments used for compacting the soil in field. **(06 Marks)**

Module-3

5 a. List and explain the various factors that affect the permeability of a soil. **(10 Marks)**

b. The discharge of water collected from a constant head permeameter in 15 minutes is 500mℓ. The internal diameter of permeameter is 5cm and the measured difference in head between two gauging points 15cm vertically apart is 40cm. Calculate the co-efficient of permeability. If the dry weight of the 15cm long sample is 4.86N and the specific gravity of the solid is 2.65. Calculate the seepage velocity. **(10 Marks)**

OR

6 a. Define Darcy's Law. Derive the Laplace equation for seepage flow. **(10 Marks)**

b. A deposit of cohesionless soil with a permeability of 10^{-4} m/s has a depth of 6m with an impervious rock below. A sheet pile wall is driven into this deposit to a depth of 3m. The wall extends above the surface of the soil by 3m and 3m depth of water acts on one side and water level on the other side is 6.5m above the impervious rock. Sketch the flow net and determine the seepage quantity per meter length of the wall. **(05 Marks)**

c. What is a Flow net? What are its characteristics and uses? **(05 Marks)**

Module-4

7 a. Explain the method of determination of coefficient of consolidation by Logarithmic time method. **(07 Marks)**

b. With a neat sketch, explain Casagrande method of determination of preconsolidation pressure. **(07 Marks)**

c. In a consolidation teat, the void ratio of soil sample decreases from 1.20 to 1.10, when the pressure increases from 160 kN/m^2 to 320 kN/m^2. Determine the coefficient of consolidation, if $K = 8 \times 10^{-7}$ mm/s. **(06 Marks)**

OR

8 a. Explain the Mass – Spring Analogy theory of consolidation as applied to saturated clay soils. **(07 Marks)**

b. Explain normally consolidated, under consolidation and over consolidated soils. **(06 Marks)**

c. There is a bed of compressible clay of 4m thickness with pervious sand on top and impervious rock at the bottom. In a consolidation test on an undisturbed specimen of clay from this deposit, 90% settlement was reached in 4 hrs. The specimen was 20mm thick. Estimate the time in years for the building founded over this deposit to reach 90% of its final settlement. **(07 Marks)**

Module-5

9 a. Enumerate the various laboratory and field tests employed for determining shear strength of soil. Explain the triaxial compression test. **(10 Marks)**

b. What do you mean by sensitivity and thixotrophy in soils? **(04 Marks)**

c. The stresses at failure on failure plane in a cohesionless soil mass are : Shear stress = $4kN/m^2$ and Normal stress = $10kN/m^2$. Determine the resultant stress on the failure plane, the angle of internal friction of soil and the angle of inclination of failure plane to the major principle plane. **(06 Marks)**

OR

10 a. Explain the types of shear tests based on drainage conditions. **(06 Marks)**

b. With a neat sketch, explain total and effective stress paths. **(06 Marks)**

c. The results of shear box test are as follows :

Trail no	1	2	3	4
Normal stress, kN/m^2	50	100	200	300
Shear stress kN/m^2	36	80	154	235

Determine the shear parameters. Will the failure occur on the plane within the soil mass, when shear stress is 154 kN/m^2 and normal stress is $200kN/m^2$? **(08 Marks)**

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CBCS SCHEME

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17CV46

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. List the different methods of setting out simple circular curves. Explain the angular method of setting out simple circular curve by Rankines method of deflection angles. **(10 Marks)**

b. Two tangents intersect at a chainage 1000mt, the deflection angle being 28°. Calculate the necessary data to setout a simple circular curve of 200mt radius by Rankine's method of deflection angles. Take per interval as 10mt. **(10 Marks)**

OR

2 a. What is a transition curve? List the functions and essential requirements of an ideal transition curve. **(06 Marks)**

b. Two straight with a total deflection angle of 72° are to be connected by a compound curve of two branches of equal length. The Radius of the first branch is 300mt and that of the second branch is 400mt, chainage at intersection point is 1500mt. Calculate the chainages of tangent points and that of Point of Compound Curvature (PCC). **(08 Marks)**

c. Two parallel railway lines are to be connected by a reverse curve of different radii. If the lines are 10mt apart and maximum distance between tangent points measured parallel to the straight is 45mt, calculate the Radius of the second branch if that at first branch is 65mt, calculate the length at both the branches. **(06 Marks)**

Module-2

3 a. List the various factors, that are to be considered in the selection at site for base line and stations in triangulation survey. **(06 Marks)**

b. Write a note on classification of triangulation system. **(06 Marks)**

c. From an eccentric station S, 12.25mt to the west of the main station B, the following angles were measured

$\angle BSC = 76°25'32''$ $\angle CSA = 54°32'20''$

The stations S and C are to the opposite sides at the line AB, calculate the correct angle ABC, if the lengths AB and BC are 5286.5 and 4932.2m respectively. **(08 Marks)**

OR

4 a. State and explain laws of weights. **(08 Marks)**

b. The following are the mean valves observed in the measurement of three angles α, β and γ at one station.

$\alpha = 76°42'46''.2$ with weight 4

$\alpha + \beta = 134°36'32''.6$ with weight 3

$\beta + \gamma = 185°35'24''.8$ with weight 2

$\alpha + \beta + \gamma = 262°18'10''.4$ with weight 1

Calculate the most probable value of each angle. **(12 Marks)**

Module-3

5 a. Define the following terms:
   i) The Celestial sphere
   ii) The azimuth
   iii) The sensible horizon
   iv) The hour angle. **(08 Marks)**

   b. Find the G.M.T corresponding to the following LMT:
   i) 9h 10m 12s A.M at a place in longitude 42°36′W
   ii) 4h 32m 10s A.M, at a place in longitude 56°32′E **(12 Marks)**

OR

6 a. Define the following terms:
   i) Zenith and Wadir
   ii) The visible horizon
   iii) The prime vertical
   iv) The hour angle **(08 Marks)**

   b. The standard time meredian in India is 82°30′E. If the standard time at any instant is 20 hours 24 minutes 6 seconds, find the local mean time for two places having longitudes i) 20°E ii) 20°W. **(12 Marks)**

Module-4

7 a. Define the following terms:
   i) Vertical photograph
   ii) Flying height
   iii) Perspective projecting
   iv) Exposure station **(08 Marks)**

   b. A vertical photograph was taken at an altitude of 1200 meters above mean sea level. Determine the scale of the photograph for terrain lying at elevations of 80meters and 300meter if the focal length of the camera is 15cm. **(12 Marks)**

OR

8 a. List the reasons for keeping overlap in photographs. **(08 Marks)**

   b. Describe how mosaic differs from a map. **(06 Marks)**

   c. A section line AB appears to be 10.16cm on a photograph for which the focal length is 16cm. The corresponding line measures 2.54cm on a map which is to a scale 1/50,000. The terrain has an average elevation of 200m above mean sea level. Calculate the flying altitude at the aircraft, above mean sea level, when the photograph was taken. **(06 Marks)**

Module-5

9 a. Define Remote sensing. List the applications in Civil Engineering. **(10 Marks)**

   b. What is GIS? With a neat sketch, explain the components of GIS. **(10 Marks)**

OR

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

   b. Explain the working principle of total stations and list the salient features of total station. **(10 Marks)**

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CBCS SCHEME

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17MATDIP41

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

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Find the rank of the matrix $\begin{bmatrix} 2 & 1 & 3 & 5 \\ 4 & 2 & 1 & 3 \\ 8 & 4 & 7 & 13 \\ 16 & 8 & -6 & -2 \end{bmatrix}$ by elementary applying row transformation. **(06 Marks)**

b. Solve the following system of linear equation by Gauss Elimination method $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$ **(07 Marks)**

c. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley-Hamilton theorem. **(07 Marks)**

OR

2 a. Reduce the matrix $\begin{bmatrix} 3 & -1 & 2 \\ -6 & 2 & 4 \\ -3 & 1 & 2 \end{bmatrix}$ into its echelon form and hence find its rank. **(06 Marks)**

b. Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} 5 & 4 \\ 1 & 2 \end{bmatrix}$. **(07 Marks)**

c. Solve the following system of linear equation by Gauss Elimination method $x + y + z = 9$, $x - 2y + 3z = 8$, $2x + y - z = 3$. **(07 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = 6e^{3x}$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = \cos 3x$ **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} + y = \tan x$ by the method of variation of parameters. **(07 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2} + 4y = x^2$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x + e^{-x}}{2}$ **(07 Marks)**

c. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 4e^{3x}$ by the method of undetermined coefficients. **(07 Marks)**

Module-3

5 a. Prove that $L[\text{Cosh at}] = \frac{s}{s^2 - a^2}$ **(06 Marks)**

b. Find the Laplace transform of cost cos2t cos3t **(07 Marks)**

c. Find the Laplace transform of $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a < t \le 2a \end{cases}$ where $f(t + 2a) = f(t)$ **(07 Marks)**

OR

6 a. Find the Laplace transform of sint sin2t sin3t. **(06 Marks)**

b. Find the Laplace transform of $t^2 \sin at$. **(07 Marks)**

c. Express $f(t) = \begin{cases} t^2 & 1 < t \le 2 \\ 4t & t > 2 \end{cases}$ interms of unit step function and hence find $L\{f(t)\}$. **(07 Marks)**

Module-4

7 a. Find the inverse Laplace transform of $\frac{1}{s(s+1)(s+2)}$ **(06 Marks)**

b. Find the inverse Laplace transform of $\log \frac{(s^2+1)}{s(s+1)}$ **(07 Marks)**

c. Using Laplace transform, solve $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$ under the initial condition $y(0) = 1$ $y'(0) = 0$. **(07 Marks)**

OR

8 a. Find the inverse Laplace transform of $\log\left(\frac{s+a}{s+b}\right)$. **(06 Marks)**

b. Find the inverse Laplace transform of $\frac{5s+3}{(s-1)(s^2+2s+5)}$. **(07 Marks)**

c. Solve by using Laplace transform $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 4y = e^{-t}$ under the initial condition $y(0) = 0$, $y'(0) = 0$. **(07 Marks)**

Module-5

9 a. Prove that $P(A \cup B) = P(A) + P(B) - P(A \cap B)$. **(06 Marks)**

b. Find the probability that a leap year selected at random will contain 53 Sundays. **(07 Marks)**

c. An office has 4 secretaries handling 20%, 60%, 15%, 5% respectively of the files of certain reports. The probabilities that they misfile such reports are respectively 0.05, 0.1, 0.1 and 0.05. Find the probability that a misfiled report is caused by the first secretary. **(07 Marks)**

OR

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

b. A problem is given to four students A, B, C, D whose chances of solving it are 1/2, 1/3, 1/4, 1/5 respectively. Find the probability that the problem is solved. **(07 Marks)**

c. Three 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. What is the probability that it is defective? If a selected item is defective, what is the probability that it is from machine A? **(07 Marks)**

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