CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. From Taylor's series method, find y(0.1), considering upto fourth degree term if y(x) satisfying the equation $\frac{dy}{dx} = x - y^2$, $y(0) = 1$. **(06 Marks)**

b. Using Runge-Kutta method of fourth order $\frac{dy}{dx} + y = 2x$ at $x = 1.1$ given that $y = 3$ at $x = 1$ initially. **(07 Marks)**

c. If $\frac{dy}{dx} = 2e^x - y$, $y(0) = 2$, $y(0.1) = 2.010$, $y(0.2) = 2.040$ and $y(0.3) = 2.090$, find $y(0.4)$ correct upto four decimal places by using Milne's predictor-corrector formula. **(07 Marks)**

OR

2 a. Using modified Euler's method find y at $x = 0.2$ given $\frac{dy}{dx} = 3x + \frac{1}{2}y$ with $y(0) = 1$ taking $h = 0.1$. **(06 Marks)**

b. Given $\frac{dy}{dx} + y + zy^2 = 0$ and $y(0) = 1$, $y(0.1) = 0.9008$, $y(0.2) = 0.8066$, $y(0.3) = 0.722$. Evaluate $y(0.4)$ by Adams-Bashforth method. **(07 Marks)**

c. Using Runge-Kutta method of fourth order, find $y(0.2)$ for the equation $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

Module-2

3 a. Apply Milne's method to compute $y(0.8)$ given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following table of initial values.

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

(06 Marks)

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

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$ leading to $J_n(x)$. **(07 Marks)**

OR

4 a. Given $y'' - xy' - y = 0$ with the initial conditions $y(0) = 1$, $y'(0) = 0$, compute $y(0.2)$ and $y'(0.2)$ using fourth order Runge-Kutta method. **(06 Marks)**

b. Prove $J_{-1/2}(k) = \sqrt{\frac{2}{\pi x}}\cos x$. **(07 Marks)**

c. Prove the Rodfigues formula $P_n(x) = \frac{1}{2^n n!}\frac{d^n y}{dx^n}(x^2-1)^n$ **(07 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equations in Cartesian form. **(06 Marks)**

b. Discuss the transformation $w = z^2$. **(07 Marks)**

c. By using Cauchy's residue theorem, evaluate $\int_C \frac{e^{2z}}{(z+1)(z+2)}dz$ if C is the circle $|z| = 3$. **(07 Marks)**

OR

6 a. Prove that $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ **(06 Marks)**

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

c. Find the bilinear transformation which maps $z = \infty$, i, 0 into $w = -1$, $-i$, 1. **(07 Marks)**

Module-4

7 a. Find the mean and standard of Poisson distribution. **(06 Marks)**

b. In an examination 7% of students score less than 35 marks and 89% of the students score less than 60 marks. Find the mean and standard deviation if the marks are normally distributed given A(1.2263) = 0.39 and A(1.4757) = 0.43 **(07 Marks)**

c. The joint probability distribution table for two random variables X and Y is as follows:

X \ Y	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine:

i) Marginal distribution of X and Y

ii) Covariance of X and Y

iii) Correlation of X and Y **(07 Marks)**

OR

8 a. A random variable X has the following probability function:

x	0	1	2	3	4	5	6	7
P(x)	0	K	2k	2k	3k	K^2	$2k^2$	$7k^2+k$

Find K and evaluate $P(x \geq 6)$, $P(3 < x \leq 6)$. **(06 Marks)**

b. The probability that a pen manufactured by a factory be defective is 1/10. If 12 such pens are manufactured, what is the probability that

i) Exactly 2 are defective

ii) Atleast two are defective

iii) None of them are defective. **(07 Marks)**

c. The length of telephone conversation in a booth has been exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made

i) Ends in less than 5 minutes

ii) Between 5 and 10 minutes. **(07 Marks)**

Module-5

9 a. A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the dia cannot be regarded as an unbiased die. **(06 Marks)**

b. A group of 10 boys fed on diet A and another group of 8 boys fed on a different disk B for a period of 6 months recorded the following increase in weight (lbs):

Diet A:	5	6	8	1	12	4	3	9	6	10
Diet B:	2	3	6	8	10	1	2	8		

Test whether diets A and B differ significantly t.05 = 2.12 at 16df. **(07 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(07 Marks)**

OR

10 a. Define the terms:
   i) Null hypothesis
   ii) Type-I and Type-II error
   iii) Confidence limits **(06 Marks)**

b. The t.p.m. of a Markov chain is given by $P = \begin{bmatrix} 1/2 & 0 & 1/2 \\ 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \end{bmatrix}$. Find the fined probabilities vector. **(07 Marks)**

c. Two boys B_1 and B_2 and two girls G_1 and G_2 are throwing ball from one to another. Each boy throws the ball to the other boy with probability 1/2 and to each girl with probability 1/4. On the other hand each girl throws the ball to each boy with probability 1/2 and never to the other girl. In the long run how often does each receive the ball? **(07 Marks)**

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CBCS SCHEME

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17CV42

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Analysis of Determinate Structures

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Explain the different types of trusses, with neat sketches. **(04 Marks)**

b. State the assumptions made in the analysis of truss. **(04 Marks)**

c. Find the forces in all members of the pin jointed truss shown in Fig.Q1(c) by method of joints.

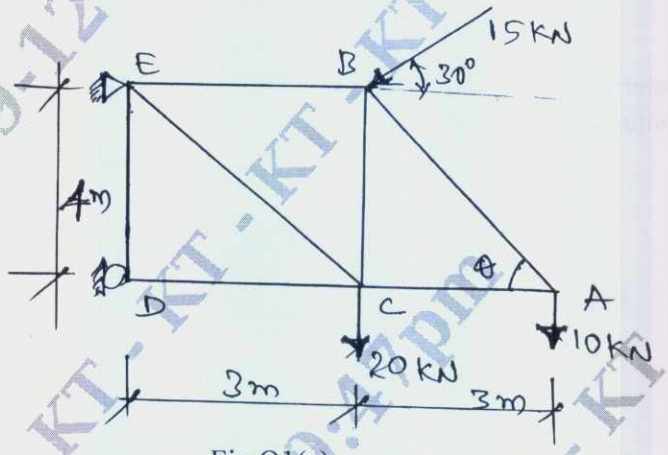

Fig.Q1(c) **(12 Marks)**

OR

2 a. Differentiate between statically determinate and indeterminate structures. **(04 Marks)**

b. Explain linear and non linear systems. **(04 Marks)**

c. Find the forces in the members EB, EC and DC by method of sections shown in Fig.Q2(c).

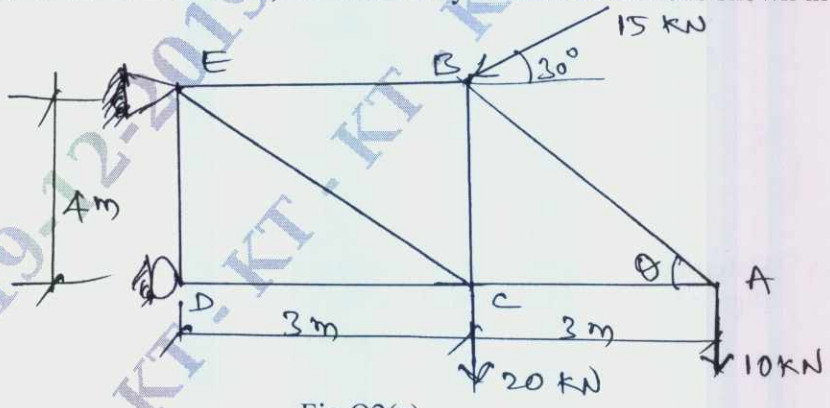

Fig.Q2(c) **(12 Marks)**

Module-2

3 a. State the first and second moment area theorems. **(04 Marks)**

b. Derive the Moment Curvature Equation for deflection. **(06 Marks)**

c. Determine slope and deflection for the simply supported beam subjected to point load at mid span shown in Fig.Q3(c).

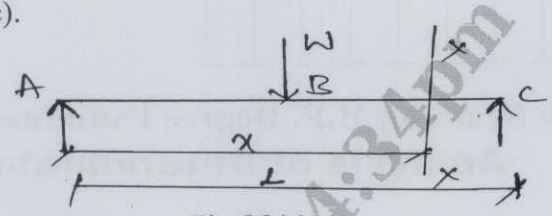

Fig.Q3(c) **(10 Marks)**

OR

4 a. Find the maximum slope and deflection at free end for the loaded beam shown in Fig.Q4(a) by Moment Area method.

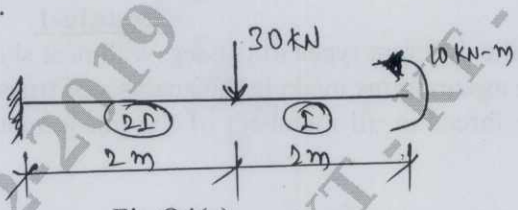

Fig.Q4(a) **(10 Marks)**

b. Determine the slope and deflection of the cantilever beam shown in Fig.Q4(b), using conjugate beam method.

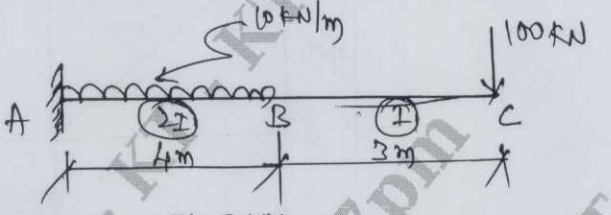

Fig.Q4(b) **(10 Marks)**

Module-3

5 a. Derive the expression for strain energy stored in an prismatic element subjected to pure bending moment. **(08 Marks)**

b. Determine the deflection at the center of the loaded simply supported beam as shown in Fig.Q5(b) by Castiglion's theorem.

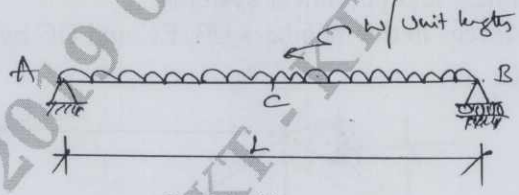

Fig.Q5(b) **(12 Marks)**

OR

6 a. Determine the horizontal displacement of the roller support end A of the frame shown in Fig.Q6(a), take EI = 8000 kN-m^2 by unit load method.

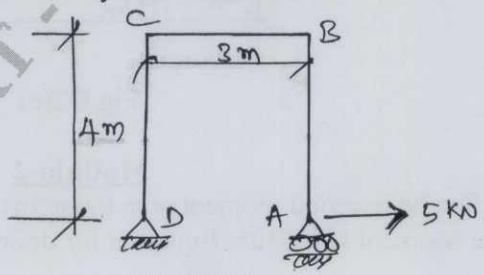

Fig.Q6(a) **(10 Marks)**

b. Determine the deflection at the load point for the beam shown in Fig.Q6(b) by using strain energy method.

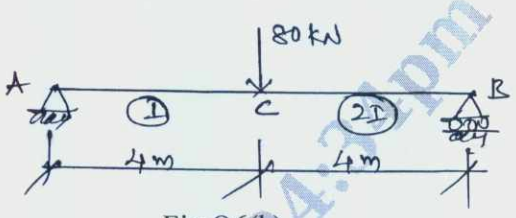

Fig.Q6(b) **(10 Marks)**

Module-4

7 a. Show that $L_C = L + \frac{8h^2}{3L}$ for a cable of span L and UDL of intensity W kN-m. **(08 Marks)**

b. A three hinged parabolic arch of span 24 m rise 6 m with hinged at abutments and at crown point. Arch subjected to a point loads of 50 kN and 150 kN at a distance of 8m and 20 m from left supports, determine, reactions at supports, radial shear and normal thrust at a distance of 6m both from left and right support and draw Bending Moment Diagram. **(12 Marks)**

OR

8 a. A cable of 20 m and dip 4m carries a UDL of 20 kN-m over the whole span, find the maximum tension in the cable and length of the cable. **(08 Marks)**

b. A three hinged parabolic arch is having a span of 36 m. It is subjected to UDL 30 kN/m from left support hinge to crown hinge. Determine the normal thrust, radial shear and bending moment at quarter span point located from left support. **(12 Marks)**

Module-5

9 a. What are the uses of influence line diagram? **(04 Marks)**

b. Draw the influence line diagram for shear force at a section for a simply supported beam subjected to single point load. **(06 Marks)**

c. Find the shear force at the section G for the loaded simply supported beam by using influence line diagram. Also find shear forces. [Refer Fig.Q9(c)]

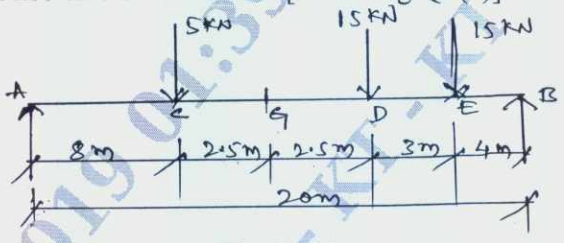

Fig.Q9(c) **(10 Marks)**

OR

10 a. Explain the procedure for generating influence line diagrams. **(04 Marks)**

b. Determine the influence line diagram for the forces in the members U_1U_2 U_2U_3 L_2L_3 U_2L_2 and U_2L_3 for the part truss as shown in Fig.Q10(b).

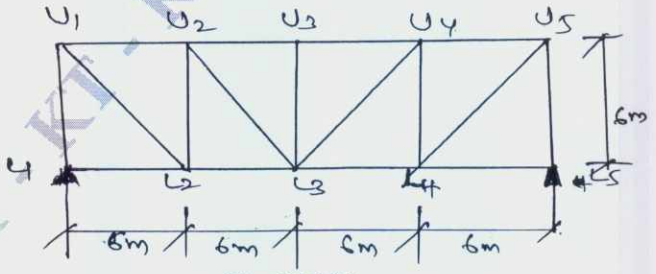

Fig.Q10(b) **(16 Marks)**

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17CV43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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 the terms: (i) Model (ii) Prototype (iii) Model analysis (iv) Hydraulic similitude **(06 Marks)**

b. In 1 in 40 model of spillway the velocity and discharge are 2m/s and 2.5 m^3/s. Find the corresponding velocity and discharge in the prototype. **(04 Marks)**

c. Using Buckingham's π - theorem, derive the following relationship $R = \rho V^2 D^2 \phi\left(\frac{\mu}{\rho VD}, \frac{H}{D}\right)$

where R = resistance, ρ = density, V = velocity of flow, D = diameter, μ = viscosity and H = height. **(10 Marks)**

OR

2 a. Explain the types of similarities in model analysis. **(06 Marks)**

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

c. Explain the experimental method of determination of meta-centric height. **(06 Marks)**

Module-2

3 a. Distinguish between pipe flow and open channel flow. **(04 Marks)**

b. Derive Chezy's equation for uniform flow in open channel with usual notations. **(08 Marks)**

c. A trapezoidal channel with side slopes 3H:2V has to be designed to carry 10 m^3/s at velocity of 1.5 m/s, so that the amount of concrete lining for the bed and sides is minimum. Find: (i) The wetted perimeter (ii) Slope of bed if Manning's N = 0.014 **(08 Marks)**

OR

4 a. For most economical trapezoidal section show that half of the top width is equal to one of the side slope length. **(06 Marks)**

b. Explain with neat sketch the specific energy curve. **(06 Marks)**

c. A discharge of 18 m^3/s flows through a rectangular channel 6m wide at a depth of 1.6 m. Find: (i) specific energy (ii) critical depth (iii) critical velocity (iv) value of minimum specific energy. **(08 Marks)**

Module-3

5 a. Define the term hydraulic jump. Derive an expression for a hydraulic jump in a horizontal rectangular channel. **(10 Marks)**

b. Find the slope of the free water surface in a rectangular channel of width 20 m having depth of flow 5m. The discharge through the channel is 50 m^3/s. The bed of the channel is having a slope of 1 in 4000. Take the value of Chezy's constant C = 60. **(10 Marks)**

OR

6 a. Explain the following slope profiler, (i) Critical slope (ii) Mild slope (iii) Steep slope and also draw profile of M_1, M_2 and M_3. **(10 Marks)**

b. A sluice gate discharges water into a horizontal channel with a velocity of 5m/s and depth of flow is 0.4 m. The width of the channel is 6m. Determine whether a hydraulic jump will occur, and if so find its height and loss of energy per kg of water. Also determine the power lost in the hydraulic jump. **(10 Marks)**

Module-4

7 a. Find an expression for the efficiency of a series of moving curved vanes when a jet of water strokes the vanes at one of the tips. Prove that maximum efficiency is 50% when u > v. **(10 Marks)**

b. A pelton wheel has to develop 13200 KW under a net head of 820 m while running at a speed of 600 rpm. If the coefficient of jet $C_V = 0.98$, speed ratio $\phi = 0.46$ and jet diameter is $\frac{1}{16}$ of wheel diameter, calculate (i) pitch circle diameter (ii) the diameter of the jet (iii) quantity of water supplied to the wheel (iv) Number of jets required. Assume overall efficiency as 85%. **(10 Marks)**

OR

8 a. Draw a neat sketch of a layout of hydroelectric power plant and explain the functions of each component. Also define different heads. **(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 the direction of vanes when entering and leaves at an angle of 120°. Draw the triangles of velocities at inlet and outlet and find,

(i) The angles of vanes tips so that water enters and leaves without shock.

(ii) The work done per unit weight of water entering the vanes

(iii) Efficiency. **(10 Marks)**

Module-5

9 a. What is a draft tube? What are the functions of draft tube? **(04 Marks)**

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

c. A Kaplan turbine develops 24647.6 KW power at an average head of 39 m. Assuming the speed ratio of 2, flow ratio of 0.6, diameter of boss equals to 0.35 times the diameter of runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine. **(10 Marks)**

OR

10 a. Explain manometric efficiency, mechanical efficiency and overall efficiency of a centrifugal pump. **(06 Marks)**

b. Define unit head, unit discharge and unit power. **(04 Marks)**

c. A centrifugal pump is to deliver 0.12 m^3/s at a speed of 1450 rpm against a head of 25 m. The impeller diameter is 250 mm, width at outlet is 50 mm. The manometric efficiency is 75%. Determine the vane angles at the outer periphery of the impeller. **(10 Marks)**

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17CV/CT44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Concrete Technology

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***IS – 10262 mix design code is allowed.***

Module-1

1 a. Explain the manufacturing process of cement by wet process using flow chart. **(10 Marks)**
b. Name chemical and mineral admixtures and explain flyash and Metakaolin admixtures in detail. **(10 Marks)**

OR

2 a. Define Hydrating Cement. With schematic representation, explain structure of hydrated cement paste. **(08 Marks)**
b. Name the alternatives of River sand and explain the properties of M – Sand. **(06 Marks)**
c. Explain the importance of Aggregate in concrete. **(06 Marks)**

Module-2

3 a. Explain two laboratory tests for measurement of workability. **(10 Marks)**
b. Explain the manufacturing process of concrete. **(10 Marks)**

OR

4 a. Explain the methods of curing. **(10 Marks)**
b. Describe the effect of heat of hydration during mass concerting at project sites. **(05 Marks)**
c. Explain Segregation and Bleeding. **(05 Marks)**

Module-3

5 a. Explain the factors influence the strength of Hardened concrete. **(06 Marks)**
b. What are the factors which affects the creep? **(04 Marks)**
c. Explain the types of Shrinkage in concrete. **(10 Marks)**

OR

6 a. What are the Internal and External factors influence the durability of concrete? **(12 Marks)**
b. Briefly explain the Rebound hammer test and Ultrasonic pulse velocity test. **(08 Marks)**

Module-4

7 a. Explain the concept of mix design. **(06 Marks)**
b. List out the data required for mix proportioning. **(04 Marks)**
c. Write the steps involved in the methods of mix design. **(10 Marks)**

OR

8 Design a concrete mix for M_{35} grade using fly ash. Other data are given below :

a. Type of cement OPC 43 grade
b. Type of flyash F type
c. Maximum size of aggregate 20 mm
d. Minimum cement content 320kg/m^3
e. Maximum water cement ratio 0.45
f. Workability 100 mm slump
g. Exposure condition Severe (RCC)
h. Method of placing concrete Pumping
i. Degree of supervision good
j. Chemical admixture Super plasticizer
k. Specific gravity of cement 3.15
l. Specific gravity of fly ash 2.2
m. Specific gravity of coarse aggregate 2.78
n. Specific gravity of fine aggregate 2.70
o. Water absorption :
   i) Coarse aggregate 0.5%
   ii) Fine aggregate Nil
p. Free surface moisture
   i) Coarse aggregate Nil
   ii) Fine aggregate 1.5%
q. Grading of coarse aggregate is confirming to table 2 of IS 383 and grading of fine aggregate is falling Zone I. **(20 Marks)**

Module-5

9 a. Explain the production of Ready Mixed concrete. **(12 Marks)**

b. What is Self Compacting Concrete? Explain the materials required for self compacting concrete used. **(08 Marks)**

OR

10 a. Explain the types of fibres used in Fiber Reinforced Concrete and its application. **(10 Marks)**

b. Explain properties of light weight concrete. **(04 Marks)**

c. List out advantages of Light weight concrete. **(06 Marks)**

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OR

6 a. State the characteristics and uses of flownets. **(08 Marks)**

b. Explain the terms superficial velocity and seepage velocity. Derive the relationship between them. **(06 Marks)**

c. If during a variable head permeability test on a soil sample, equal time intervals are noted for drops of head from h_1 to h_2 and again from h_2 to h_3. Find the relationship between h_1, h_2 and h_3. **(06 Marks)**

Module-4

7 a. Explain mass-spring analogy of consolidation of soils. **(06 Marks)**

b. Explain Casagrande's method of determination of pre consolidation pressure. **(06 Marks)**

c. The time to reach 40% consolidation of a two way drained saturated clay sample of 10mm thick in the laboratory is 40 secs. Determine the time required for 60% consolidation of the same soil 12m thick on an impervious layer subjected to same loading conditions. **(08 Marks)**

OR

8 a. Explain square root of time fitting method for determination of coefficient of consolidation. **(06 Marks)**

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

c. A layer of clay 8m thick underlies a proposed new building. The existing overburden pressure at the centre of clay layer is 290kN/m^2 and the load due to new building increases the pressure by 100kN/m^2. C_C = 0.45, W = 50%, G = 2.71. Estimate consolidation settlement. **(08 Marks)**

Module-5

9 a. Explain Mohr-Coulomb theory of shear strength. **(06 Marks)**

b. Explain the advantages and disadvantages of direct shear test over triaxial shear test. **(06 Marks)**

c. An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 38mm and was 80mm long. The load at failure measured as 30N and the axial deformation of the sample of failure was 12mm. Determine the unconfined compressive strength and undrained shear strength of clay. **(08 Marks)**

OR

10 a. Explain sensitivity and thixotropy. **(06 Marks)**

b. Explain vane shear test with a neat sketch. **(06 Marks)**

c. The triaxial tests carried out on soil samples gave the following results:

Confining pressure, kN/m^2	50	100	150
Deviator stress, kN/m^2	76	132	186
Pore water pressure, kN/m^2	35	59	83

Plot Mohr's circle and obtain effective shear parameters. **(08 Marks)**

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CBCS SCHEME

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17CV45

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. With the help of 3-phase diagram define: void ratio, porosity, water content and degree of saturation. **(08 Marks)**

b. Derive from first principles, the following phase relation:

$$\gamma_d = \frac{(1-n_a)G.\gamma_w}{1+WG}$$ **(06 Marks)**

c. With the help of particle size distribution curve explain: well graded soil, uniformly graded soil and gap graded soil. **(06 Marks)**

OR

2 a. With a neat sketch, explain the salient features of a plasticity chart. **(08 Marks)**

b. The natural dry density of a soil deposit was found to be 17.5kN/m^3. A sample of soil was brought to the laboratory and the minimum and maximum dry densities were found as 16kN/m^3 and 19kN/m^3 respectively. Calculate the density index for the soil deposit. **(06 Marks)**

c. How many cubic meters of soil can be formed with a void ratio of 0.5 from 100 cubic meters of soil having void ratio of 0.7. **(06 Marks)**

Module-2

3 a. List and explain various soil structures. **(06 Marks)**

b. What is the effect of compaction on soil properties? **(06 Marks)**

c. Following are the results of a standard proctor compaction test on a soil:

Water content, %	8.5	12.2	13.75	15.5	18.20
Weight of wet soil in kgs	1.8	1.94	2.0	2.04	2.03

Plot the compaction curve and get maximum dry density and OMC. Also plot ZAV line. Take G = 2.75 and volume of mould as 995 c.c. **(08 Marks)**

OR

4 a. Describe the three principal clay minerals. **(08 Marks)**

b. Explain electrical diffuse double layer and adsorbed water. **(06 Marks)**

c. What are the factors which affect compaction? **(06 Marks)**

Module-3

5 a. Derive an expression to obtain coefficient of permeability under falling head condition. **(06 Marks)**

b. Explain with a neat sketch the method of locating the phreatic line in a homogeneous earth dam with horizontal filter. **(06 Marks)**

c. Calculate the coefficient of permeability of a soil sample, 6 cms in height and 50cm^2 in cross-sectional area, if a quantity of water equal to 430ml passed down in 10 minutes, under an effective constant head of 40cms. On oven drying the test specimen has a mass of 498 gms. Taking the specific gravity of soil solids as 2.65, calculate the seepage velocity of water during the test. **(08 Marks)**

CBCS SCHEME

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17CV46

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. What is the relation between the degree of a curve and its radius? **(06 Marks)**

b. What are the requirements of an essential transition curve? **(06 Marks)**

c. A reverse curve AB is to be set out between two parallel railway tangents 32m apart. If the two arcs of the curve are to have same radius and the distance between tangents A and B is 160m, calculate the radius. The curve is to be setout from AB at 10m intervals along that line. Calculate the length of offsets. **(08 Marks)**

OR

2 a. Explain how a simple circular curve is setout by perpendicular offsets from long chord. **(06 Marks)**

b. Explain the features of vertical curves. **(04 Marks)**

c. Two straights AC and CB are intersected by a third line MN such that $\angle CMN = 45^\circ 30'$ and $\angle CNM = 35^\circ 30'$ and the distance MN = 320m. Find the radius of the curve which will be tangential to the three lines AC, MN and CB. If the chainage of the intersection point C is 4875.50m, calculate the chainages of the point of curve A and the point of tangency B. **(10 Marks)**

Module-2

3 a. Explain first order, second order and third order triangulation systems. **(06 Marks)**

b. Explain the three kinds of errors. **(06 Marks)**

c. From a satellite station S, 5.8m from main triangulation station A, the following directions were observed:

A	0°	0′	0″
B	132°	18′	30″
C	232°	24′	6″
D	296°	6′	11″

The lengths of AB, AC and AD were computed to be 3265.5m, 4022.2m and 3086.4m respectively. Determine the directions of AB, AC and AD. **(08 Marks)**

OR

4 a. What are the important factors to be considered in selection of site for a base line? **(06 Marks)**

b. Explain Satellite stations and reduction to centre. **(06 Marks)**

c. Find the most probable values of the angles A and B from the following observations at a station 0. **(08 Marks)**

A = 9°	48′ 36.6″	Weight 2
B = 54°	37′ 48.3″	Weight 3
A + B = 104°	26′ 28.5″	Weight 4

Module-3

5 a. Define the terms, celestial sphere, prime vertical and hour angle. **(06 Marks)**

b. Explain the solution of spherical triangle by Napiers rule. **(06 Marks)**

c. Determine the azimuth and altitude of a star from the following data:
Declination of star = 20° 30′ N
Hour angle of star = 42° 6′
Latitude of observer = 50°N **(08 Marks)**

OR

6 a. Mention the properties of a spherical triangle. **(06 Marks)**

b. Calculate the distance in kilometers between two pint A and B along the parallel of latitude, given that:
i) Lat. of A, 28° 42′ N; longitude of A, 31° 12′ W
Lat. of B, 28° 42′ N; longitude of B, 47° 24′ W
ii) Lat. of A 12° 36′ S; longitude of A, 115° 6′ W
Lat. of B 12° 36′ S; longitude of B, 150° 24′ E. **(08 Marks)**

c. The standard time meridian in India is 82° 30′ E. If the standard time at any instant is 20hours, 24 min, 6 secs, find the local mean time for a place having 20°E longitude. **(06 Marks)**

Module-4

7 a. Define: vertical photograph, tilted photograph and oblique photograph. **(06 Marks)**

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

c. A section line AB appears to be 10.16 cms on a photograph for which the focal length is 16cms. The corresponding line measures 2.54 cms on a map which is to a scale of 1:50000. The terrain has an average elevation of 200m above mean sea level. Calculate the flying altitude of the aircraft, above mean sea level when the photograph was taken. **(08 Marks)**

OR

8 a. Define: Perspective projection, Nadir point and tilt. **(06 Marks)**

b. List the reasons for keeping overlap in photographs. **(06 Marks)**

c. What is relief displacement? Derive its expression. **(08 Marks)**

Module-5

9 a. Mention the advantages of total station and describe its working principle. **(10 Marks)**

b. What is GIS? Mention its applications to Civil Engineering. **(10 Marks)**

OR

10 a. Explain the working principle of GPS. What are the differences between hand held GPS and differential GPS? **(10 Marks)**

b. What are the advantages of LIDAR technology? **(10 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Advanced Mathematics - II

Time: 3 hrs. Max. Marks:100

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

1 a. If $[l_1, m_1, n_1]$ and $[l_2, m_2, n_2]$ be the direction cosines of two lines subtending an angle θ between them then prove that $\cos\theta = l_1l_2 + m_1m_2 + n_1n_2$. **(06 Marks)**

b. Find the angle between two lines whose direction cosines satisfy the relations $l + m + n = 0$ and $2lm + 2nl - mn = 0$ **(07 Marks)**

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

2 a. Find the equation of the plane which bisects the line joining (3, 0, 5) and (1, 2, −1) at right angles. **(06 Marks)**

b. Show that the points (2, 2, 0), (4, 5, 1), (3, 9, 4) and (0, −1, −1) are coplanar. Find the equation of the plane containing them. **(07 Marks)**

c. Find the shortest distance and the equations of the line of shortest distance between the lines: $\frac{x-6}{3} = \frac{y-7}{-1} = \frac{z-4}{1}$ and $\frac{x}{-3} = \frac{y+9}{2} = \frac{z-2}{4}$. **(07 Marks)**

3 a. Show that the position vectors of the vertices of a triangle $\vec{a} = 4\hat{i} + 5\hat{j} + 6\hat{k}$, $\vec{b} = 5\hat{i} + 6\hat{j} + 4\hat{k}$ and $\vec{c} = 6\hat{i} + 4\hat{j} + 5\hat{k}$ form an isosceles triangle. **(06 Marks)**

b. Prove that the points with position vectors $4\hat{i} + 5\hat{j} + \hat{k}$, $\hat{j} + \hat{k}$, $3\hat{i} + 9\hat{j} + 4\hat{k}$ and $-\hat{i} + 5\hat{j} + 4\hat{k}$ are coplanar. **(07 Marks)**

c. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$ and $z = 3t - 5$ where t is the time t. Find the components of velocity and acceleration in the direction of the vector $\hat{i} - 3\hat{j} + 2\hat{k}$ at $t = 1$. **(07 Marks)**

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

b. Find the directional derivatives of the function $\phi = x^2yz + 4xz^2$ at (1,−2,−1) along $2\hat{i} - \hat{j} - 2\hat{k}$ **(07 Marks)**

c. Find div $\vec{F}$ and curl $\vec{F}$ at the point (1,−1, 1) where $\vec{F} = \nabla(xy^3z^2)$. **(07 Marks)**

5 a. If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $r = |\vec{r}|$ then prove that,

(i) $\nabla(r^n) = nr^{n-2}\vec{r}$ (ii) $\nabla.(r^n.\vec{r}) = (n+3)r^n$ **(06 Marks)**

b. Show that $\vec{F} = (2xy^2 + yz)\hat{i} + (2x^2y + xz + 2yz^2)\hat{j} + (2y^2z + xy)\hat{k}$ is irrotational and hence find a scalar function ϕ such that $\vec{F} = \nabla\phi$. **(07 Marks)**

c. Find the value of the constant 'a' such that $\vec{A} = y(ax^2 + z)\hat{i} + x(y^2 - z^2)\hat{j} + 2xy(z - xy)\hat{k}$ is Solenoidal. For this value of 'a' show that curl $\vec{A}$ is also solenoidal. **(07 Marks)**

6 a. Find the Laplace transform of, (i) $\sin 5t \cos 2t$ (ii) $(3t+2)^2$ **(06 Marks)**

b. Find the Laplace transform of $\frac{\cos at - \cos bt}{t}$. **(07 Marks)**

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

7 a. Find the inverse Laplace transform of $\frac{s+5}{s^2-6s+13}$. **(06 Marks)**

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

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

8 a. Using convolution theorem find the Laplace transform of $\frac{1}{s(s^2+a^2)}$. **(10 Marks)**

b. Solve the differential equation, $y'' + 5y' + 6y = 5e^{2x}$ under the condition $y(0) = 2$, $y'(0) = 1$ using Laplace transform. **(10 Marks)**

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