CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, July/August 2021
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Use Taylor's series method to find $y(1.5)$ from $y' = xy^{\frac{1}{3}}$, $y(1) = 1$, consider upto third order derivative term. **(06 Marks)**

b. Find $y(0.2)$ by using modified Euler's method given that $y' = x + |\sqrt{y}|$, $y(0) = 1$. Take $h = 0.2$ and carry out two modifications at each step. **(07 Marks)**

c. If $5xy' + y^2 = 2$, $y(4) = 1$, $y(4.1) = 1.0049$, $y(4.2) = 1.0097$, $y(4.3) = 1.0143$ then find $y(4.4)$ by using Milne's method. **(07 Marks)**

2 a. Use Taylor's series method to find $y(1.02)$ from $y' = xy - 1$, $y(1) = 2$ consider upto fourth order derivative term. **(06 Marks)**

b. Use Runge-Kutta method to find $y(0.2)$ from $y' = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ taking $h = 0.2$. **(07 Marks)**

c. Use Adam Bashforth method to find $y(0.4)$ from $y' = x + y^2$, $y(0) = 1$, $y(0.1) = 1.1$, $y(0.2) = 1.231$, $y(0.3) = 1.402$ **(07 Marks)**

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

b. Find $y(0.1)$ by using Runge-Kutta method given that $y'' = x^3(y + y')$, $y(0) = 1$, $y'(0) = 0.5$ taking step length $h = 0.1$. **(07 Marks)**

c. If α and β are the roots of $J_n(\alpha) = 0$ then show that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

4 a. Prove that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\cos x$. **(06 Marks)**

b. Find $y(0.4)$ by using Milne's method given $y'' + y' = 2e^x$, $y(0) = 2$, $y'(0) = 0$, $y(0.1) = 2.01$, $y'(0.1) = 0.2$, $y(0.2) = 2.04$, $y'(0.2) = 0.4$, $y(0.3) = 2.09$, $y'(0.3) = 0.6$. **(07 Marks)**

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

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

b. Find the analytic function $f(z) = u + iv$ in terms of z given that $U = \frac{2\sin 2x}{e^{2y} + e^{-2y} - 2\cos 2x}$. **(07 Marks)**

c. Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)}$ where C is the circle $|z| = 3$. **(07 Marks)**

6 a. If $f(z)$ is analytic function then prove that, $\left[\frac{\partial|f(z)|}{\partial x}\right]^2 + \left[\frac{\partial|f(z)|}{\partial y}\right]^2 = |f'(z)|^2$. **(06 Marks)**

b. Discuss the transformation $W = e^z$. **(07 Marks)**

c. Find the bilinear transformation that maps the points $z = -1, i, 1$ onto the points $W = 1, i, -1$. Also find the invariant points. **(07 Marks)**

7 a. Find the value of K such that the following distribution represents a finite probability distribution. Hence find its mean and standard deviation. Also find

(i) $P(x \leq 1)$ (ii) $P(x > 1)$ (iii) $P(-1 < x \leq 2)$

x	−3	−2	−1	0	1	2	3
P(x)	K	2K	3K	4K	3K	2K	K

(06 Marks)

b. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students where marks will be

(i) Less than 65 (ii) More than 75 (iii) Between 65 and 75 (A(1) = 0.3413)

(07 Marks)

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

X \ Y	−2	−1	4	6
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Find : (i) E(X)E(Y) (ii) E(XY)

(iii) Covariance of (XY) (iv) Correlation of X and Y. **(07 Marks)**

8 a. Derive mean and variance of the exponential distribution. **(06 Marks)**

b. The joint probability distribution for two random variables X and Y as follows: **(07 Marks)**

Find (i) E(X) and E(Y)

(ii) E(XY)

(iii) Covariance (X, Y)

(iv) Correlation of X and Y.

X \ Y	−4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

c. In a certain factory turning out razor blades there is a small chance of 0.002 for any blade to the defective. The blades are supplied in packets of 10. Using Poisson distribution find the approximate number of packets containing (i) No defective blade (ii) One defecting blade (iii) Two defective blades in a consignment of 10000 packets. **(07 Marks)**

9 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. **(06 Marks)**

b. A certain stimulus administered to each of 12 patients resulted in the following increases of blood pressure 5, 2, 8, -1, 3, 0, -2, 1, 5, 0, 4, 6. Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure. $(t(11)_{00.05} = 2.2)$ **(07 Marks)**

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

$$\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1/2 & 1/2 & 0 \end{bmatrix}.$$

(07 Marks)

10 a. Define the terms : (i) Null hypothesis (ii) Type – I and Type II error.

(iii) Tests of significance. **(06 Marks)**

b. In experiments on pea breeding the following frequencies of seeds were obtained:

Round and Yellow	Wrinkled and Yellow	Round and Green	Wrinkled and Green	Total
315	101	108	32	556

Theory Predicts that the frequencies should be in proportions 9:3:3:1. Examine the correspondence between theory and experiment $\left(\psi^2_{0.05} = 7.815\right)$. **(07 Marks)**

c. A students study habits are as follows. If he studies one night, he is 30% sure to study the next night, on the other hand, if he does not study one night he is 60% sure not to study the next night as well. Find the transition matrix for the chain of his study. In the long run how often does he study? **(07 Marks)**

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CBCS SCHEME

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17CV42

Fourth Semester B.E. Degree Examination, July/August 2021
Analysis of Determinate Structures

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. State the assumptions made in the analysis of truss. **(03 Marks)**

b. What are linear and non-linear systems? Explain. **(03 Marks)**

c. Determine the degree of static indeterminacy for the following structures [Refer Fig.Q1(c)]

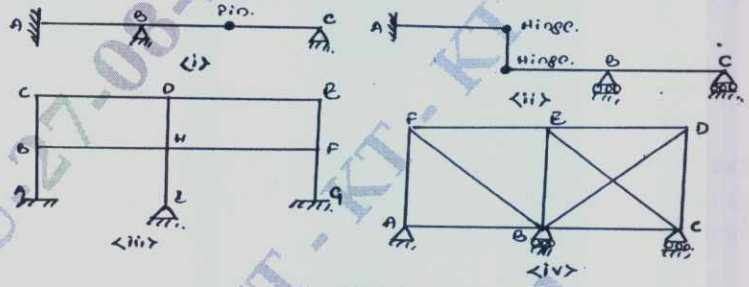

Fig.Q1(c) **(08 Marks)**

d. Analysis the forces in the members of the truss by method of joints and tabulate the forces. [Refer Fig.Q1(d)] **(06 Marks)**

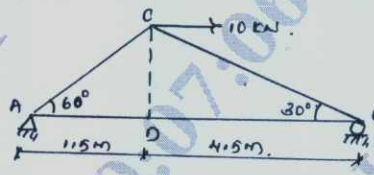

Fig.Q1(d)

2 a. Differentiate between statically determinate and indeterminate structure with examples. **(06 Marks)**

b. Determine the forces in all the members of the truss by using methods of sections and tabulate the forces. [Refer Fig.Q2(b)] **(14 Marks)**

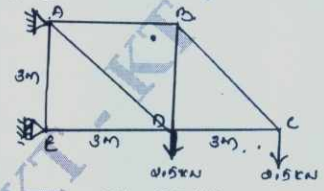

Fig.Q2(b)

3 a. Derive the moment - curvature equation for deflection. **(08 Marks)**

b. A SSB spanning 8m carries concentrated loads of 60 kN and 30 kN at a distance of 2 m and 4 m from the left support. Determine the slopes at the ends and location and magnitude of the maximum deflection. Assume E = 200 GPa and I = 20×10^8 mm^4 (Macaulay's method). [Refer Fig.Q3(b)]

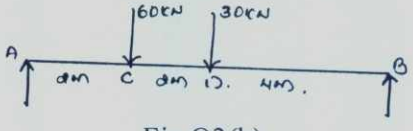

Fig.Q3(b) **(12 Marks)**

4 a. Find the maximum slope and deflection for the beam using moment area method. Take $EI = 10.2\times10^3$ kN-m^2 [Refer Fig.Q4(a)] **(10 Marks)**

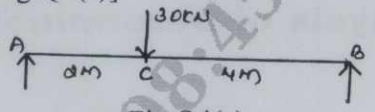

Fig.Q4(a)

b. Determine the slope at supports and deflection at mid-span of a SSB, using conjugate beam method. [Refer Fig.Q4(b)] **(10 Marks)**

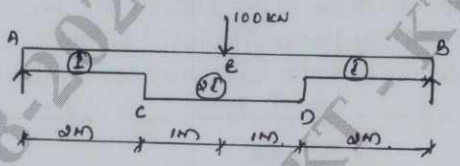

Fig.Q4(b)

5 a. Derive the expression for the strain energy stored in a beam due to flexure. **(04 Marks)**

b. Determine the deflection at the load point for the cantilever beam by using strain energy method. [Refer Fig.Q5(b)] **(08 Marks)**

Fig.Q5(b)

c. Find the vertical deflection at 'C' for the bent using strain energy method. Take EI constant. [Refer Fig.Q5(c)] **(08 Marks)**

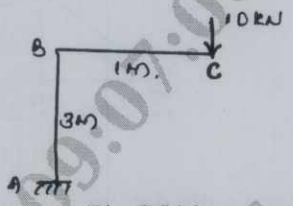

Fig.Q5(c)

6 a. Determine the deflection and slope at the free end of the cantilever beam using unit load method. Give EI = 2400 kN-m^2. [Refer Fig.Q6(a)] **(10 Marks)**

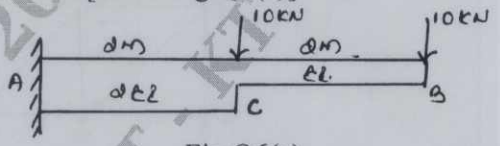

Fig.Q6(a)

b. The C/s area of each member of the truss is A = 400 mm^2 and E = 200 GPa. Determine the horizontal deflection of joint 'C' if a 4 kN force is applied to the truss at 'C'.

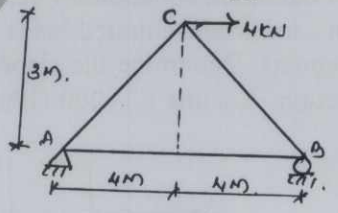

Fig.Q6(b) **(10 Marks)**

7 a. A three hinged parabolic arch hinged at the supports. A span of the arch is 24m and a central rise of 4m. It carries a concentrated load of 50 kN at 18m from the left support and a UDL of 30 kN/m over the left half portion. Determine the bending moment, normal thrust and radial shear at a section 6m from last support. **(12 Marks)**

b. A suspension table having supports at level has a span of 40m and maximum die of 4m. The cables is loaded with UDL of 10 kN/m. through its length. Calculate the maximum and minimum tension in the cable. Also find the length of the cable. **(08 Marks)**

8 a. A root-bridge 3 m wide is supported by two suspension cables with a central dip of 3m and horizontal span of 30m. Determine the maximum and minimum tension in the cable. Also determine the length of the cables and C/s area of the cable. The foot bridge has to carry a load of 10 kn/m^2. Permissible stress in the cable is 120 MPa. **(10 Marks)**

b. A light flexible cable 18m long is supported at two ends at the same level. The supports are 16mt apart. The cable is subjected to the uniformly distributed load of 10 kN/m of horizontal length over its entire span. Determine the reaction developed at the support, the tension that occurs at the support and its inclination to the horizontal. **(10 Marks)**

9 a. Determine the max. negative and max. positive shear force at point 'C' for the beam which is crossed by two connected wheel load 4m apart moving from left to right. The front wheel carries a load of 40 kN and the rear wheel 20 kN. [Refer Fig.Q9(a)]

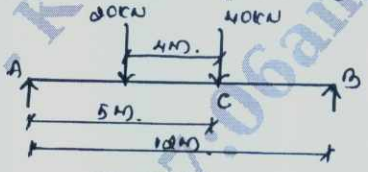

Fig.Q9(a) **(10 Marks)**

b. A moving UDL of 20 kN/m and 8 m long cross over a simply supported girder of span 20m. Determine

(i) Max. Positive and max. negative SF.

(ii) Absolute max SF and Absolute B.M. on the beam. **(10 Marks)**

10 a. Define a influence line diagram and mention its application. **(04 Marks)**

b. The multiple point loads 100 kN, 120 kN, 80 kN and 150 kN with a spacing of 2m crosses a girder of span 30m from left to right with 100 kN load leading. [Refer Fig.Q10(b)]. Calculate

(i) Reactions at the supports

(ii) Max. SF at a section 10 m from left support.

(iii) Max. B.M. at a section 10m from left support.

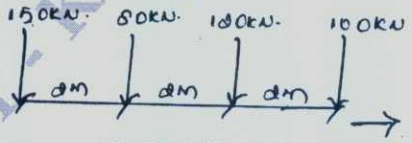

Fig.Q10(b) **(16 Marks)**

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CBCS SCHEME

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17CV43

Fourth Semester B.E. Degree Examination, July/August 2021
Applied Hydraulics

Time: 3 hrs. Max. Marks: 100

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

1 a. State Buckingham π-theorem. Explain the steps involved in adopting the theorem in dimensional analysis. **(07 Marks)**

b. Explain the stability cases of floating bodies with respect to center of gravity and metacentric height. **(07 Marks)**

c. A 1:64 model is constructed of an open channel in concrete which has Manning's n = 0.014. Find the value of n in model. The bed slope of model and prototype are same. **(06 Marks)**

2 a. Derive the various scale ratios of Froude model law. **(08 Marks)**

b. The pressure difference Δp in a pipe of diameter D, length L due to turbulent flow depends on velocity V, viscosity μ, density ρ and surface roughness K. Using Buckingham π-theorem, show that,

$$\Delta p = \rho V^2 \, \phi\left[\frac{L}{D}, \frac{\mu}{\rho V D}, \frac{K}{D}\right]$$ **(12 Marks)**

3 a. Derive Chezy's equation for the rate of uniform flow in open channel. **(08 Marks)**

b. Show that $\frac{Q^2}{g} = \frac{A^3}{T}$ for critical flow condition in open channel. **(06 Marks)**

c. The specific energy for a 5m wide rectangular channel is 4m. If Q = 20m^3/s, determine alternate depths. **(06 Marks)**

4 a. Draw specific energy curve. List the salient features. **(06 Marks)**

b. Derive the condition for most economical rectangular section and show that hydraulic mean depth is half the flow depth. **(07 Marks)**

c. A trapezoidal channel with side slopes of 3H:2V has to be designed to carry 10m^3/s of water at a velocity of 1.5m/s. Find the dimensions of channel for minimum lining. **(07 Marks)**

5 a. Define hydraulic jump. List its applications. **(05 Marks)**

b. Derive an equation to define the gradually varied flow profile. **(08 Marks)**

c. A hydraulic jump forms at the downstream end of a spillway carrying 17.93m^3/s discharge per meter width. If the depth before jump is 0.8m, what is the depth after jump and energy loss? **(07 Marks)**

6 a. Explain with neat sketches different types of GVF profiles. **(12 Marks)**

b. Derive an expression for energy loss due to hydraulic jump. **(08 Marks)**

7 a. State impulse-momentum equation. Give its applications. (04 Marks)

b. A jet of water of 50mm diameter and velocity 20m/s strikes a curved vane moving at 10m/s in the direction of jet. The jet leaves the vane at an angle of 60° to the direction of motion of vane at outlet. Determine:

i) The force exerted by the jet on the vane in the direction of motion.

ii) Workdone per second by the jet. (08 Marks)

c. Draw the general layout of hydroelectric power plant and explain the functions of each part. (08 Marks)

8 a. Give the classification of turbines. Give examples. (04 Marks)

b. A pelton wheel turbine has to be designed for a head of 60m when running at 200rpm to develop 96kW power. $C_V = 0.98$, $u = 0.45 \times$ velocity of jet, $\eta_0 = 85\%$. Determine discharge, diameter of runner, diameter of jet, number of jets, number of buckets. Assume $d = \frac{1}{12}D$. (10 Marks)

c. Draw neat sketch of Pelton wheel turbine and explain working principle. (06 Marks)

9 a. Define unit quantities and give expressions. (03 Marks)

b. Draw neat sketch of Kaplan turbine and explain its working. (07 Marks)

c. A Kaplan turbine working under a head of 20m develops 11772kW power. The outer diameter of runner is 3.5m and boss diameter is 2m. The guide blade angles at the extreme edge of runner at inlet is 35°. $\eta_h = 88\%$ and $\eta_0 = 84\%$. The velocity of whirl at outlet is zero. Determine:

i) Runner vane angles at inlet and outlet

ii) Speed of turbine. (10 Marks)

10 a. Define heads and efficiencies of centrifugal pump. (07 Marks)

b. The outer diameter of an impeller of a centrifugal pump is 400mm and outer width is 50mm. The pump speed is 800rpm and head on pump is 15m. The vane angle at outlet is 40° $\eta_{man} = 75\%$. Determine:

i) Velocity of flow at outlet

ii) Velocity of water leaving the vane

iii) Discharge. (08 Marks)

c. Explain multistage centrifugal pumps. (05 Marks)

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CBCS SCHEME

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17CV/CT44

Fourth Semester B.E. Degree Examination, July/August 2021
Concrete Technology

Time: 3 hrs. Max. Marks: 100

Note: 1. ***Answer any FIVE full questions.***
2. ***Any missing data may be suitably assumed.***
3. ***Use IS10262:2009 design code is allowed.***

1 a. What are Bogue's compounds? Briefly explain their contribution towards gaining of strength of cement. **(10 Marks)**
b. Explain the importance of shape and texture of aggregate used in concrete. **(10 Marks)**

2 a. What is an admixture? Explain the effect of mineral admixture on fresh and hardened properties of concrete. **(10 Marks)**
b. What is grading of aggregate? Explain its significance in improving the properties of concrete. **(10 Marks)**

3 a. List out the good and bad practices of making and using fresh concrete. **(10 Marks)**
b. Explain factors affecting workability of concrete. **(10 Marks)**

4 a. Explain the process of heat of hydration of cement. **(10 Marks)**
b. Explain methods of curing of concrete in detail. **(10 Marks)**

5 a. Explain the process of sulphate attack and chloride attack on concrete. **(10 Marks)**
b. Explain factors affecting shrinkage of concrete. **(10 Marks)**

6 a. Explain factors influencing strength of concrete. **(10 Marks)**
b. Explain carbonation of concrete in detail. **(10 Marks)**

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

- Design stipulations :
  - (i) Characteristic compressive strength at 28 days = 30 MPa
  - (ii) Maximum size of aggregate = 20 mm
  - (iii) Degree of workability = Slump (75 mm)
  - (iv) Degree of quality control = Good
  - (v) Type of exposure = Severe
- 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 fine aggregate = 1.0%
  - (v) Water absorption of coarse aggregate = 0.5%
  - (vi) Grading of fine aggregate = Zone 2

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

8 Design the concrete mix for M20 grade concrete with following data:
Characteristic compressive strength at 28 days = 20 MPa.
Maximum size of aggregate = 20 mm
Workability = Slump (100 mm)
Degree of quality control = Good
Type of exposure = Mild
Specific gravity of cement = 3.15
Specific gravity of coarse aggregate = 2.60
Specific gravity of fine aggregate = 2.60
Sand conforming to zone 2.
Assume any other data suitably. **(20 Marks)**

9 a. Explain various types of fibers used in concrete with their properties. **(10 Marks)**
b. Explain application of fibre reinforced concrete and light weight concrete. **(10 Marks)**

10 a. Write a note on RMC. **(10 Marks)**
b. Explain the materials used for manufacture of SCC. **(10 Marks)**

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CBCS SCHEME

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17CV45

Fourth Semester B.E. Degree Examination, July/August 2021
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks:100

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

1 a. With the help of the phase diagram, explain :
i) Dry density ii) Water content iii) Degree of saturation iv) Porosity. **(06 Marks)**

b. With usual notations, prove that $\gamma_d = \frac{G\gamma_w}{1+e}$. **(06 Marks)**

c. A soil sample weighing 19kN/m^3 has a water content of 30%. The specific gravity of soil particles is 2.70. Determine voids ratio, porosity and degree of saturation. **(08 Marks)**

2 a. Explain with the help of particle size distribution curve, the following types of soil.
i) Well graded soil ii) Poorly graded soil. **(06 Marks)**

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

c. The following readings were recorded during liquid limit test.

No. of blows	40	30	18	13
Water content (%)	35	37	39	42

Obtain the flow curve and find the liquid limit and flow index. **(08 Marks)**

3 a. Explain electrical diffuse double layer and absorbed water. **(06 Marks)**

b. With the help of neat sketches, explain any two clay minerals. **(06 Marks)**

c. During a compaction test a soil attains a maximum dry density of 18kN/m^3 at a water content of 12%. Determine the degree of saturation and percent air voids at maximum dry density. Also find the theoretical maximum dry density corresponding to zero air voids at optimum moisture content. Take G = 2.77. **(08 Marks)**

4 a. Explain the factors affecting the degree of compaction. **(06 Marks)**

b. Distinguish between standard proctor and modified proctor compaction tests. **(06 Marks)**

c. The following data refer to I.S light compaction list in a cylindrical mould of 1000 CC volume

Water content (%)	10	12	14.3	16	18.3
Weight of wet sample (kN)	19.63	21.37	21.93	21.68	21.14

Specific gravity of solids is 27. Plot the compaction curve and obtain maximum dry unit weight and optimum moisture content. Also draw the zero air void line. **(08 Marks)**

5 a. Define Darcy's Law derive an expression to relate discharge velocity and seepage velocity. **(06 Marks)**

b. Explain the factors affecting the permeability of soil. **(06 Marks)**

c. A sample in a variable head permeameter is 80mm in diameter and 100mm high. The permeability of the sample is estimated to be 10×10^{-3}mm/sec. If it is desired that the head in the stand pipe should fall from 240mm to 120mm in 3 minutes, determine the size of the stand pipe to be used for the test. **(08 Marks)**

6 a. With a neat sketch, explain the method of locating phreatic line for a homogeneous earth dam with a horizontal filter. **(06 Marks)**

b. Explain the following terms :
i) Total stress ii) neutral stress iii) effective stress iv) quick sand condition. **(06 Marks)**

c. A flow net drawn for seepage below a dam has 4 flow channels and 9 equipotential lines. There is 8m of water on the upstream side and no water on downstream of the dam. $K_x = 4 \times 10^{-4}$cm/sec and $K_y = 2 \times 10^{-4}$cm/sec. Calculate the seepage loss per day for every 100m length of the dam. **(08 Marks)**

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

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

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

8 a. Explain Casagrande method of determination of preconsolidation pressure. **(06 Marks)**

b. List the assumptions of Terzagh's one dimensional consolidation theory. **(06 Marks)**

c. A 2.2m thick layer of clay is suspected to a load increment of 200kN/m^2. A representation sample of the soil when tested in the laboratory showed that change in voids ratio corresponding to the same load increment was 0.10. If the initial void ratio is 0.62, determine the coefficient of volume compressibility and settlement of clay layer. **(08 Marks)**

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

b. Explain the classification of shear tests based on drainage conditions. **(06 Marks)**

c. A soil ha unconfined compression strength of 120kN/m^2. In a triaxial compression test specimen of same soil when subjected to cell pressure of 40kN/m^2 failed at an additional stress of 160kN/m^2. Determine shear strength parameters. **(08 Marks)**

10 a. What are the factors affecting the shear strength of soil. **(06 Marks)**

b. What are the advantages and disadvantages of direct shear test? **(06 Marks)**

c. A vane 112.5mm long and 75mm in diameter was pressed into a soft soil at the bottom of a base hole. Torque was applied to fail the soil. The shear strength of clay was found to be 37 kN/m^2. Determine the torque that was applied. **(08 Marks)**

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CBCS SCHEME

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17CV46

Fourth Semester B.E. Degree Examination, July/August 2021
Advanced Surveying

Time: 3 hrs. Max. Marks: 100

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

1 a. Define degree of curve. Establish the relation between degree of curve and its radius. **(05 Marks)**

b. Two tangents AB and BC intersect at point B at chainage 150.50m calculate all the necessary data for setting out a circular curve of radius 100m and deflection angle 30° by the method of offsets from the long chord. **(10 Marks)**

c. Define the following terms:
i) Horizontal curve
ii) Compound curve
iii) Reverse curve
iv) Vertical curve
v) Transition curve. **(05 Marks)**

2 a. List the different methods of setting out simple circular curve. Explain the linear method of setting out simple curve by the method of offsets from chord produced. **(10 Marks)**

b. Two tangents intersect at chainage 1250m. The angle of intersection is 150° calculate all data necessary for setting out a curve of radius 250m by the deflection angle method. The peg intervals may be taken as 20m. Least count of the vernier is 20″. Calculate the data for field checking. **(10 Marks)**

3 a. What are the important factors to be considered in selection of site for base line? **(05 Marks)**

b. State and explain laws of weights. **(10 Marks)**

c. Explain three kinds of errors. **(05 Marks)**

4 a. Explain classification of Triangulation system. **(10 Marks)**

b. Give the classification of signals. Explain them with neat sketch. **(10 Marks)**

5 a. Define the following terms:
i) Celestial sphere
ii) Hour angle
iii) Prime vertical
iv) Sensible horizon
v) Latitude of place. **(05 Marks)**

b. Find the shortest distance between two places A and B given that the latitude of A and B are 15° 0′ N and 12° 6′ N and their magnitude are 50° 12′ E and 54° 0′ E respectively. Find also the direction of B on the great circle route radius of earth = 6370km. **(10 Marks)**

c. Mention the properties of spherical triangle. **(05 Marks)**

6 a. Briefly explain the solution of spherical triangle by Napier's rule of circular points. **(05 Marks)**

b. Explain with neat sketches coordinate systems. **(15 Marks)**

7 a. Explain Terrestrial photogrammetry with basic principle with neat sketch and their types. (10 Marks)

b. Define the following terms:
i) Camera axis ii) Focal length iii) Focal plane iv) Print v) Film base. (05 Marks)

c. Explain Horizontal and vertical angles from Terrestrial photograph. (05 Marks)

8 a. Explain Phototheodolite. (05 Marks)

b. Three points A, B and C were photographed and their coordinates with respect to the line joining the collimation marks on the photograph are

Point	x	y
a	-35.52mm	+21.43mm
b	+8.48mm	-16.38mm
c	+48.26mm	+36.72mm

The focal length of the lens is 120.80mm. Determine the Azimuths of the lines OB and OC if that of OA is 354° 34′. The axis of the camera was level at the time of the exposure at the station O. (10 Marks)

c. Explain Aerial camera with neat sketch. (05 Marks)

9 a. What are the properties of Electromagnetic waves? (05 Marks)

b. Explain types of EDM instruments. (10 Marks)

c. Briefly explain fundamental measurements of total station. (05 Marks)

10 a. Explain with neat sketch Idealized remote sensing system. (10 Marks)

b. What are the applications of GIS in civil engineering? (05 Marks)

c. Explain global positioning system. (05 Marks)

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MATDIP401

Fourth Semester B.E. Degree Examination, July/August 2021

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

Note: Answer any FIVE full questions.

1 a. Find the angle between any two diagonals of a cube. **(06 Marks)**

b. Find the equation of the plane which passes through the points (0, 1, 1), (1, 1, 2) and (–1, 2 –2). **(07 Marks)**

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

2 a. Find the angle between the planes $x+y+2z-3=0$ and $2x+3y+3z-4=0$. **(06 Marks)**

b. Find the shortest distance between the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-2}{3}=\frac{y-4}{4}=\frac{z-5}{5}$ **(07 Marks)**

c. Find the image of the point (1, 6, 3) in the line $\frac{x}{1}=\frac{y-1}{2}=\frac{z-2}{3}$. **(07 Marks)**

3 a. If $\vec{A}=2\hat{i}-3\hat{j}-\hat{k}$ and $\vec{B}=\hat{i}+4\hat{j}-2\hat{k}$, find the angle between the vectors $\vec{A}$ and $\vec{B}$. **(06 Marks)**

b. If $\vec{a}=\hat{i}+\hat{j}-\hat{k}$, $\vec{b}=\hat{i}-\hat{j}+\hat{k}$ and $\vec{c}=\hat{i}-\hat{j}-\hat{k}$, evaluate (i) $[\vec{a}\ \vec{b}\ \vec{c}]$ (ii) $\vec{a}\times(\vec{b}\times\vec{c})$ **(07 Marks)**

c. Find the constant λ such that the vectors $2\hat{i}-\hat{j}+\hat{k}$, $\hat{i}+2\hat{j}-3\hat{k}$ and $3\hat{i}+\lambda\hat{j}+5\hat{k}$ are coplanar. **(07 Marks)**

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

b. If $\vec{r}=x\hat{i}+y\hat{j}+z\hat{k}$ and $r=|\vec{r}|$, show that $\nabla r^n=nr^{n-2}\vec{r}$. **(07 Marks)**

c. Find a unit vector normal to the surface $x^3+y^3+3xyz=3$ at (1, 2, –1). **(07 Marks)**

5 a. If $\vec{A}=\text{grad}(x^3+y^3+z^3-3xyz)$, find div $\vec{A}$ and curl $\vec{A}$. **(06 Marks)**

b. Find the constant a, b, c so that $\vec{F}=(x+2y+az)\hat{i}+(bx-3y-z)\hat{j}+(4x+cy+2z)\hat{k}$ is irrotational. **(07 Marks)**

c. Find angle between the surfaces $x^2+y^2+z^2=9$ and $x=z^2+y^2-3$ at (2, –1, 2). **(07 Marks)**

6 Find the Laplace transform of:

a. $e^{-3t}(2\cos 5t-3\sin 5t)$ **(05 Marks)**

b. $\sin 3t\sin 2t+t\cos t$ **(05 Marks)**

c. $\frac{\cos at-\cos bt}{t}$ **(05 Marks)**

d. $e^{2t}+4t^3-2\sin 3t+3\cos 3t+2^{-t}$ **(05 Marks)**

7 Find the inverse Laplace transform of

a. $\frac{s^2-3s+4}{s^3}$ **(05 Marks)**

b. $\frac{2}{(s-1)(s-2)(s-3)}$ **(05 Marks)**

c. $\log\left[\frac{s^2+1}{s(s+1)}\right]$ **(05 Marks)**

d. $\frac{2s-3}{s^2+4s+13}$ **(05 Marks)**

8 a. Solve using Laplace transformation method $y''+2y'-3y=\sin t,\ y(0)=y'(0)=0$. **(10 Marks)**

b. By Laplace transform method solve the equation $\frac{d^2y}{dt^2}+4\frac{dy}{dt}+3y=e^{-t}$ with $y(0) = 1$, $y'(0)=1$. **(10 Marks)**

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