CBCS Scheme

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15MAT41

Fourth Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

Note: **1.** ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Use of statistical tables is permitted.***

Module-1

1 a. Use Taylor's series method to find y at x = 1.1, considering terms upto third degree given that $\frac{dy}{dx} = x + y$ and y(1) = 0. **(05 Marks)**

b. Using Runge-Kutta method, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$; y(0) = 1, taking h = 0.2. **(05 Marks)**

c. Given $\frac{dy}{dx} = x^2 - y$, y(0) = 1 and the values y(0.1) = 0.90516, y(0.2) = 0.82127, y(0.3) = 0.74918, evaluate y(0.4), using Adams-Bashforth method. **(06 Marks)**

OR

2 a. Using Euler's modified method, find y(0.1) given $\frac{dy}{dx} = x - y^2$, y(0) = 1, taking h = 0.1. **(05 Marks)**

b. Solve $\frac{dy}{dx} = xy$; y(1) = 2, find the approximate solution at x = 1.2, using Runge-Kutta method. **(05 Marks)**

c. Solve $\frac{dy}{dx} = x - y^2$ with the following data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762, compute y at x = 0.8, using Milne's method. **(06 Marks)**

Module-2

3 a. Using Runge-Kutta method of order four, solve $y'' = y + xy'$, y(0) = 1, y'(0) = 0 to find y(0.2). **(05 Marks)**

b. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(05 Marks)**

c. If α and β are two distinct roots of $J_n(x) = 0$ then prove that $\int_0^1 x J_n(\alpha x) J_n(\beta x) dx = 0$, if $\alpha \neq \beta$. **(06 Marks)**

OR

4 a. Given $y'' = 1 + y'$; y(0) = 1, y'(0) = 1, compute y(0.4) for the following data, using Milne's predictor-corrector method.

y(0.1) = 1.1103	y(0.2) = 1.2427	y(0.3) = 1.399
y'(0.1) = 1.2103	y'(0.2) = 1.4427	y'(0.3) = 1.699.

(05 Marks)

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

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

Module-3

5 a. Derive Cauchy-Riemann equations in polar form. **(05 Marks)**

b. Evaluate $\oint_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$ where C is the circle $|z| = 3$, using Cauchy's residue theorem. **(05 Marks)**

c. Find the bilinear transformation which maps $z = \infty$, i, 0 on to $w = 0$, i, ∞. **(06 Marks)**

OR

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

b. If $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$, find the corresponding analytic function $f(z) = u + iv$. **(05 Marks)**

c. Discuss the transformation $w = z^2$. **(06 Marks)**

Module-4

7 a. Derive mean and standard deviation of the binomial distribution. **(05 Marks)**

b. If the probability that an individual will suffer a bad reaction from an injection of a given serum is 0.001, determine the probability that out of 2000 individual (i) exactly 3 (ii) more than 2 individuals will suffer a bad reaction. **(05 Marks)**

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

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

Determine: i) Marginal distribution of X and Y ii) Covariance of X and Y
iii) Correlation of X and Y **(06 Marks)**

OR

8 a. Derive mean and standard deviation of exponential distribution. **(05 Marks)**

b. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks are normally distributed. Given $P(0 < z < 1.2263) = 0.39$ and $P(0 < z < 1.14757) = 0.43$. **(05 Marks)**

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

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

Compute: i) E(X) and E(Y) ii) E(XY) iii) COV(X, Y) iv) $\rho(X, Y)$ **(06 Marks)**

Module-5

9 a. Explain the terms: i) Null hypothesis ii) Type I and Type II errors. **(05 Marks)**

b. The nine items of a sample have the values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5? **(05 Marks)**

c. Given the matrix $A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$ then show that A is a regular stochastic matrix. **(06 Marks)**

OR

10 a. A die was thrown 9000 times and of these 3220 yielded a 3 or 4, can the die be regarded as unbiased? **(05 Marks)**

b. Explain: i) Transient state ii) Absorbing state iii) Recurrent state **(05 Marks)**

c. A student's study habits are as follows. If he studies one night, he is 70% sure not 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. In the long run, how often does he study? **(06 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2018
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Find the rank of the matrix $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ by reducing to echelon form. **(06 Marks)**

b. Use Cayley-Hamilton theorem to find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. **(05 Marks)**

c. Apply Gauss elimination method to solve the equations $x+4y-z=-5$; $x+y-6z=-12$; $3x-y-z=4$ **(05 Marks)**

OR

2 a. Find all the eigen values and eigen vector corresponding to the largest eigen value of $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. **(06 Marks)**

b. Find the rank of the matrix by elementary row transformations $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$. **(05 Marks)**

c. Solve the system of linear equations $x+y+z=6$; $2x-3y+4z=8$; $x-y+2z=5$ by Gauss elimination method. **(05 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2}+4y=\tan 2x$ by the method of variation of parameters. **(06 Marks)**

b. Solve $\frac{d^2x}{dt^2}+5\frac{dx}{dt}+6x=0$, given $x(0)=0$, $\frac{dx}{dt}(0)=15$. **(05 Marks)**

c. Solve $(D^2+5D+6)y=e^x$. **(05 Marks)**

OR

4 a. Solve by the method of undetermined coefficients $(D^2-2D+5)y=25x^2+12$. **(06 Marks)**

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

c. Solve $(D^2-2D-1)y=e^x\cos x$. **(05 Marks)**

Module-3

5 a. Find the Laplace transforms of, (i) $t\cos^2 t$ (ii) $\frac{1-e^{-t}}{t}$ **(06 Marks)**

b. Find the Laplace transforms of, (i) $e^{-2t}(2\cos 5t-\sin 5t)$ (ii) $3\sqrt{t}+\frac{4}{\sqrt{t}}$. **(05 Marks)**

c. Express the function, $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

OR

6 a. Find the Laplace transform of the periodic function defined by $f(t) = E\sin\omega t$, $0 < t < \frac{\pi}{\omega}$ having period $\frac{\pi}{\omega}$. **(06 Marks)**

b. Find the Laplace transform of $2^t + t\sin t$. **(05 Marks)**

c. Find the Laplace transform of $\frac{2\sin t \sin 5t}{t}$. **(05 Marks)**

Module-4

7 a. Using laplace transforms method, solve $y'' - 6y' + 9 = t^2e^{3t}$, $y(0) = 2$, $y'(0) = 6$. **(06 Marks)**

b. Find the inverse Laplace transforms of, (i) $\frac{s^2 - 3s + 4}{s^3}$ (ii) $\frac{s+3}{s^2 - 4s + 13}$ **(05 Marks)**

c. Find the inverse Laplace transforms of, (i) $\log\left(\frac{s+1}{s-1}\right)$ (ii) $\frac{s^2}{(s-2)^3}$ **(05 Marks)**

OR

8 a. Solve the simultaneous equations $\frac{dx}{dt} + 5x - 2y = t$, $\frac{dy}{dt} + 2x + y = 0$ being given $x = y = 0$ when $t = 0$. **(06 Marks)**

b. Find the inverse Laplace transforms of $\cot^{-1}\left(\frac{s}{2}\right)$. **(05 Marks)**

c. Find the inverse Laplace transforms of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$. **(05 Marks)**

Module-5

9 a. For any three arbitrary events A, B, C prove that ,
$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$ **(04 Marks)**

b. A class has 10 boys and 5 girls. Three students are selected at random, one after the other. Find probability that, (i) first two are boys and third is girl (ii) first and third boys and second is girl. (iii) first and third of same sex and the second is of opposite sex. **(06 Marks)**

c. In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body. (i) what is the probability that mathematics is being studied ? (ii) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl? (iii) a boy? **(06 Marks)**

OR

10 a. State and prove Bayes theorem. **(04 Marks)**

b. A problem in mathematics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved? **(06 Marks)**

c. A pair of dice is tossed twice. Find the probability of scoring 7 points. (i) Once, (ii) at least once (iii) twice. **(06 Marks)**

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15CV42

Fourth Semester B.E. Degree Examination, June/July 2018
Analysis of Determinate Structures

Time: 3 hrs. Max. Marks: 80

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. Determine the degree of static indeterminacy for the following structures [Fig.Q.1(a)]. **(08 Marks)**

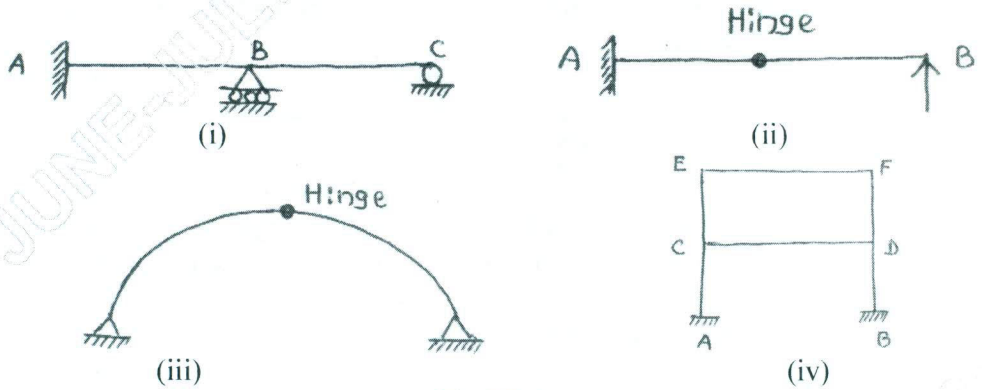

Fig.Q1(a)

b. Determine the forces in all the members of a truss shown in the Fig.Q.1(b) by method of joints and tabulate the results. **(08 Marks)**

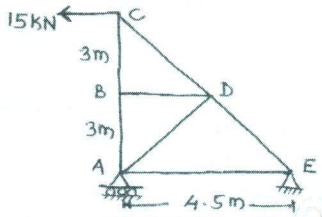

Fig.Q1(b)

OR

2 a. Differentiate between statically determinate and indeterminate structures. **(06 Marks)**

b. State the assumptions made in the analysis of truss. **(02 Marks)**

c. A truss of span 9m is loaded as shown in Fig.Q.2(c). Find the forces in the members marked 1, 2 and 3. **(08 Marks)**

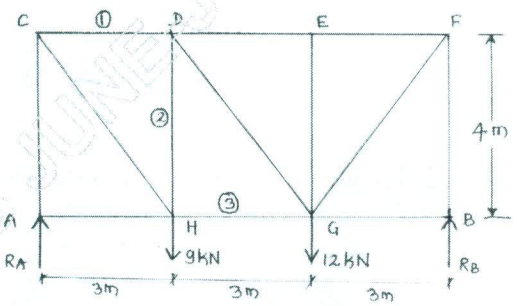

Fig.Q.2(c)

Module-2

3 a. Determine the slope at supports and maximum deflection of a simply supported beam subjected to UDL throughout the span 'L'. Use Double Integration Method. **(08 Marks)**

b. A cantilever of length 2m carries a point load of 20kN at the free end and another load of 20kN at its centre. If $E = 10^5 N/mm^2$ and $I = 10^8 mm^4$ for the cantilever, then determine by moment-area method, the slope and deflection at the free end. Refer Fig.Q.3(b). **(08 Marks)**

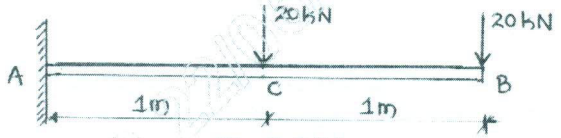

Fig.Q.3(b)

OR

4 a. Compute the deflection under concentrated load for the beam shown in Fig.Q.4(a) by using Macaulay's method. **(08 Marks)**

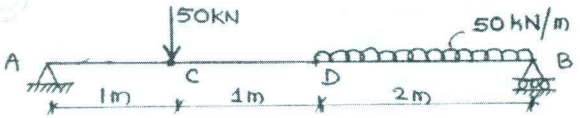

Fig.Q.4(a)

b. A cantilever beam AB of length 2m is carrying a point load 10kN at 'B'. The moment of inertia for the right half of the cantilever is $10^8 mm^4$ where as that for the left half is 2×10^8 mm^4. If $E = 2 \times 10^8$ kN/m^2, find the slope and deflection at the free end of the cantilever. Refer Fig.Q.4(b). Use Conjugate Beam Method. **(08 Marks)**

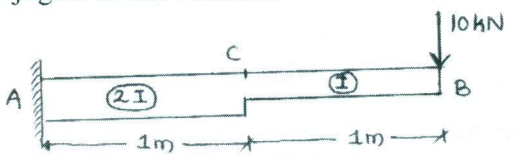

Fig.Q.4(b)

Module-3

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

b. Determine the vertical deflection at 'C' in the frame shown in Fig.Q.5(b). Take $E = 200 \times 10^6$ kN/m^2 and $I = 3 \times 10^7$ mm^4. Use Strain – Energy method. **(10 Marks)**

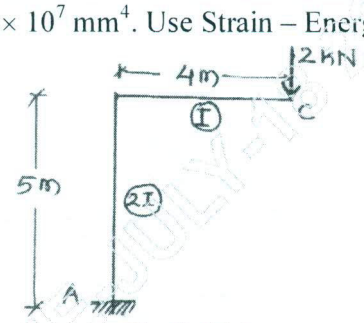

Fig.Q.5(b)

OR

6 a. Find the central deflection of a simply supported beam carrying a point load at mid span shown in Fig.Q.6(a) by using Unit Load method. **(06 Marks)**

Fig.Q.6(a)

b. The cross-sectional area of the members is as indicated in Fig.Q.6(b). Using Strain – Energy method, find the strain energy stored due to loading. Take E = 200 kN/m^2. **(10 Marks)**

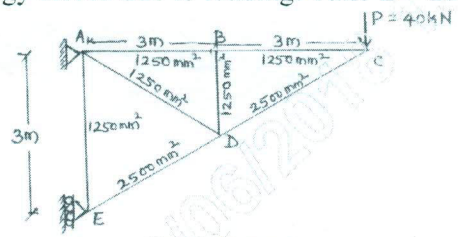

Fig.Q.6(b)

Module-4

7 a. A three hinged parabolic arch hinged at the springing and crown points has a span of 40m and central rise of 8m. It carries a UDL of 20kN/m over the left half of the span together with a concentrated load of 100kN at the right quarter span point. (Centre of right span). Find the reactions at the supports, normal thrust and radial shear at a section 10m from left support. **(08 Marks)**

b. A cable of span 20m and dip 4m carries a UDL of 20kN/m over the whole span. Find: i) Maximum tension in the cable; ii) Minimum tension in the cable; iii) The length of the cable. **(08 Marks)**

OR

8 a. A three hinged parabolic arch of span 20m and central rise of 5m carries a point load of 200kN at 6m from left hand support as shown in Fig.Q.8(a).

i) Find the reaction at the supports A and B.

ii) Draw the bending moment diagram for the arch and indicate the position of maximum bending moment. **(10 Marks)**

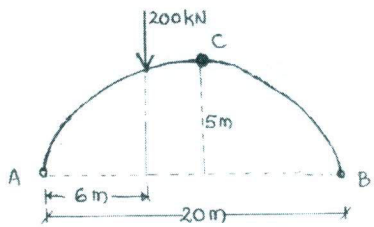

Fig.Q.8(a)

b A cable, supported on piers 80m apart at the same level, has a central dip of 8m. Calculate the maximum tension in the cable, when it is subjected to UDL of 30kN/m throughout the length. Also determine the vertical force on the piers, if the back stay is inclined at 60° to the vertical and cable passes over a pulley. **(06 Marks)**

Module-5

9 a. Define a Influence line diagram. What are the uses of ILD? **(06 Marks)**

b. Determine the reaction R_A by using ILD (influence line diagram) for beam loaded as shown in Fig.Q.9(b). **(10 Marks)**

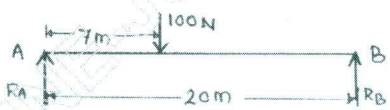

Fig.Q.9(b)

OR

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

b. Draw the ILD for shear force and bending moment for a section 5m from left end of a simply supported beam 20m long. Hence calculate the maximum SF and maximum BM at the section due to an UDL of length 8m and intensity 10kN/m. **(10 Marks)**

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CBCS Scheme

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15CV43

Fourth Semester B.E. Degree Examination, June/July 2018
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. What is meant by Dimensional Homogeneity? Give example. **(06 Marks)**

b. 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 using dimensional analysis prove $T = D^5 N^2 \rho \, \phi\left[\frac{\mu}{D^2 N \rho}\right]$. **(10 Marks)**

OR

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

b. A ship 300m long moves in a sea water, whose density is 1030 kg/m^3. A 1:100 model of this ship is to be tested in a wind tunnel. The velocity of air in the wind tunnel around the model is 30m/s and the resistance of the model is 60N. Determine the velocity of ship in sea water and also the resistance of the ship in sea water. The density of air is 1.24 kg/m^3. Take the kinematic viscosity of sea water and air as 0.012 stokes and 0.018 stokes respectively. **(10 Marks)**

Module-2

3 a. Explain classification of flow in open channel. **(06 Marks)**

b. Derive conditions for most economical rectangular channel. **(04 Marks)**

c. A trapezoidal channel has side slopes of 1H:2V and the slope of bed is 1 in 1500. The area of the section is 40m^2. Find the most economical dimensions of channel. Also determine the discharge of the channel. Take C = 50. **(06 Marks)**

OR

4 a. Explain with sketch the specific energy curve. **(06 Marks)**

b. The discharge of water through a rectangular channel of width 8m is 15 m^3/s, when depth of flow of water is 1.2m. Calculate:

i) Specific energy of flowing water.

ii) Critical depth and critical velocity.

iii) Value of minimum specific energy. **(10 Marks)**

Module-3

5 a. Derive equation of a hydraulic jump in a horizontal rectangular channel. **(10 Marks)**

b. A hydraulic jump forms at the downstream end of a spillway carrying 17.93 m^3/s discharge. If the depth before jump is 0.8m, determine the depth after jump and energy loss. **(06 Marks)**

OR

6 a. Explain following slope profiles: i) Critical slope ii) Mild slope iii) Steep slope also draw profiles of M1, M2 and M3. **(06 Marks)**

b. Derive expression for the length of backwater curve. **(10 Marks)**

Module-4

7 a. Derive expression for force and work done on a curved plate, which is moving in the direction of jet. **(06 Marks)**

b. A jet of water having a velocity of 40 m/s strikes a curved vane which is moving with a velocity of 20 m/s. The jet makes an angle of 30° with the direction of motion of vane at inlet and leaves at angle of 90° to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vanes without shock. **(10 Marks)**

OR

8 a. Explain classification of Turbines. **(06 Marks)**

b. The Penstock supplies water from a reservoir to the pelton wheel with a gross head of 500m. One-third of gross head is lost in friction in the penstock. The rate of flow of water through the nozzle fitted at the end of penstock is 2 m^3/s. The angle of deflection of the jet is 165°. Determine the power given by the water to the runner and also hydraulic efficiency take speed ratio as 0.45 and coefficient of velocity as 1. **(10 Marks)**

Module-5

9 a. Explain with a neat sketch the working of a inward flow reaction turbine (Francis turbine). **(06 Marks)**

b. A Kaplan turbine runner is to be designed to develop 9100 kW. The net available head is 5.6m. If the speed ratio is 2.09, flow ratio is 0.68, overall efficiency is 86% and the diameter of the boss is 1/3 × diameter of the runner. Find the diameter of the runner, its speed and specific speed of the turbine. **(10 Marks)**

OR

10 a. Explain components and working of a centrifugal pump. **(06 Marks)**

b. A centrifugal pump having outer diameter = 2 times the inner diameter and running at 1000 RPM works against a total head of 40m. The velocity of flow through the impeller is constant and equal to 2.5 m/s. The vanes are set back at an angle of 40° at outlet. If the outer diameter of the impeller is 500mm and width at outlet is 50mm, determine: i) Vane angle at inlet ii) Work done by impeller on water/sec iii) Manometric efficiency. **(10 Marks)**

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CBCS SCHEME

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15CV/CT44

Fourth Semester B.E. Degree Examination, June/July 2018
Concrete Technology

Time: 3 hrs. Max. Marks: 80

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. Why is concrete the most widely used engineering material? **(04 Marks)**
b. What is an admixture? Name different types of admixtures. **(04 Marks)**
c. Explain the manufacture of cement by dry process, with neat flow chart. **(08 Marks)**

OR

2 a. What are Bogue's compounds? Explain the influence of C_2S in strength gaining process. **(06 Marks)**
b. Name the different tests on cement. **(04 Marks)**
c. Explain briefly the action of accelerator and super plasticizers in the concrete mix, also name any two accelerators used in industry. **(06 Marks)**

Module-2

3 a. What is workability? Explain the factors affecting workability. **(08 Marks)**
b. Explain good and bad practices of making of fresh concrete. **(08 Marks)**

OR

4 a. What is segregation? How to prevent segregation in the concrete mix? **(08 Marks)**
b. Name the tests conducted on workability of concrete. **(04 Marks)**
c. What is curing? Name the methods of curing. **(04 Marks)**

Module-3

5 a. What is strength of concrete? What are the factors affecting the strength of concrete? **(08 Marks)**
b. Define creep, what are the factors affecting the creep of concrete. **(08 Marks)**

OR

6 a. How do you define durability? What are the factors improves the durability of concrete and explain briefly? **(08 Marks)**
b. What is sulphate attack? How to minimize sulphate attack? Also mention its action with equations. **(08 Marks)**

Module-4

7 a. Explain the main factors on which the IS-10262 mix design depends. **(08 Marks)**
b. Draw flow chart of IS code mix design. **(08 Marks)**

OR

8 It is required to design a M_{35} grade concrete mix having a slump of the order of 150-175mm for pile foundations of a structure. Use IS:10262-Indian standard recommended guidelines to estimate preliminary mix proportions. Consider very severe exposure condition during the service life of the structure.

Data:

I) Size of aggregate = 10mm to 20m
II) Specific gravity of aggregate = 2.67
III) Moisture content = 1 percent
IV) Absorption = 0.5 percent
V) Fine aggregate fineness modulus = 2.80 (grading zone I)
VI) Specific gravity = 2.62
VII) Moisture content = 4.1
VIII) Absorption = 1%
IX) Cement OYC grade 53
X) Specific gravity of cement = 3.15.

Other conditions

i) Standard deviation = 2MPa
ii) Air content = 4 to 5%
iii) Maximum allowable w/c ratio = 0.45
iv) Minimum cement content = 340 kg/m^3
v) Density of water = 1000 kg/m^3
vi) Bulk density of

Cement = 1450 kg/m^3
Fire aggregate = 1700 kg/m^3
Coarse aggregate = 1800 kg/m^3. **(16 Marks)**

Module-5

9 a. What is RMC? What are the factors on which the property of RMC depends? **(08 Marks)**

b. What is light weight concrete? Name the aggregates used as light weight aggregate? Explain its property. **(08 Marks)**

OR

10 a. What is self compacting concrete? How it is different from high performance concrete? **(04 Marks)**

b. What are the different types of fibers used in fiber reinforced concrete? **(04 Marks)**

c. Explain maximum and minimum values of workability values measured in L-box. V-tunel and flow test. Explain the above tests briefly. **(08 Marks)**

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CBCS SCHEME

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15CV46

Fourth Semester B.E. Degree Examination, June/July 2018
Advanced Surveying

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define degree of a curve. Establish the relationship between degree of a curve and its radius. **(04 Marks)**

b. Two tangents intersect each other at a chainage of 59 + 60, the deflection angle being 50°30′. It is required to connect the two tangents by a simple curve of 15 chain radius. Taking peg interval of 100 links, calculate the necessary data for setting out the curves by Rankine's method of deflection angles. Take length of the chain as 20m = 100 links. Also write a brief procedure for setting out the curve. **(12 Marks)**

OR

2 a. Distinguish between a compound curve and a reverse curve with sketches. **(06 Marks)**

b. A compound curve consists of two simple circular of radii 350m and 500m, respectively and is to be laid out between two tangents T_1I and IT_2. PQ is the common tangent and D is the point of compound curvature. The angles $\angle IPQ$ and $\angle IQP$ are 55° and 25° respectively. Given the chainage of point of intersection as 1800.00m, calculate the chainages of T_1, T_2 and D. **(10 Marks)**

Module-2

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

b. From a triangulation satellite station 'Q' 5.80m away from the main station A, the following directions were observed :
A : 0° 0′ 0″, B : 132° 18′ 30″, C: 232° 24′ 6″, and D : 296° 6′ 11″.
The inter connected base lines AB, AC and AD were measured as 3265.50m, 4022.20m and 3086.40m respectively. Determine the directions of AB, AC and AD. **(10 Marks)**

OR

4 a. Define the terms :
i) True error
ii) Residual error
iii) Conditioned equation
iv) Indirect observation. **(04 Marks)**

b. Three observed angles α, β and γ from a station P with probable errors of measurement are given below :
$\alpha = 78° 12′ 12″ \pm 2″$,
$\beta = 136° 48′ 30″ \pm 4″$,
$\gamma = 144° 59′ 8″ \pm 5″$
Determine their corrected values. **(12 Marks)**

Module-3

5 a. Define the terms :
   i) Celestial sphere
   ii) Hour angle
   iii) Prime vertical
   iv) Latitude of a place. **(04 Marks)**

b. Find the shortest distance between two places A and B given that their latitudes are 12°N and 13° 04′N with respective longitudes 72° 30′ E and 80° 12′ E. **(12 Marks)**

OR

6 a. Briefly explain the solution of spherical triangle by Napiers rule of circular parts. **(06 Marks)**

b. The standard time meridian in India is 80° 30′ E. If the standard time of place is $20^{H}\ 24^{M}\ 06^{S}$, find the local mean time of two places having the longitudes as 20° E and 20° W respectively. **(10 Marks)**

Module-4

7 a. With a neat sketch, derive the expression for the scale of a vertical photograph. **(08 Marks)**

b. A line AB 2.00 kilometer long, lying at an elevation of 500m measures 8.65cm on a vertical photograph of focal length 20cm. Determine the scale of the photograph at an average elevation of 800m. **(08 Marks)**

OR

8 a. Define the terms :
   i) Tilt
   ii) Exposure station
   iii) Principal point
   iv) ISO centre. **(08 Marks)**

b. Mention the reasons for photograph over lap. Justify the same. **(08 Marks)**

Module-5

9 a. Define EDM. **(03 Marks)**

b. Explain the working of remote sensing equipment. **(05 Marks)**

c. What are the advantages of LIDAR technology? **(08 Marks)**

OR

10 a. Explain the working of total station. **(08 Marks)**

b. Explain the civil engineering applications in GIS and remote sensing. **(08 Marks)**

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CBCS SCHEME

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17MAT41

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Use Taylor's series to obtain approximate value of y at x = 0.1 for the differential equation $\frac{dy}{dx} = 2y + 3e^x$, $y(0) = 0$. **(06 Marks)**

b. Apply Runge Kutta method of fourth order to find an approximate value of y when x = 0.2 for the equation $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$, $y(0) = 1$ taking h = 0.2. **(07 Marks)**

c. Using Milne's predictor – corrector method, find y when x = 0.8 given $\frac{dy}{dx} = x - y^2$, $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. **(07 Marks)**

OR

2 a. Given that $\frac{dy}{dx} = \log(x + y)$ and y(1) = 2, then find y(1.2) in step of 0.2 using modified Euler's method carry out two iterations. **(06 Marks)**

b. Using fourth order Runge-Kutta method to find y at x = 0.2 equation given that $\frac{dy}{dx} = x + y$, y(0) = 1 and h = 0.2. **(07 Marks)**

c. Given $\frac{dy}{dx} = x^2(1 + y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979. Evaluate y(1.4) by Adam's-Bashforth predictor-corrector method. **(07 Marks)**

Module-2

3 a. Using Runge-Kutta method, solve $\frac{d^2y}{dx^2} = x\frac{dy}{dx} - y^2$ for x = 0.2, correct to three decimal places, with initial conditions $y(0) = 1$, $y'(0) = 0$. **(06 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$, then $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(07 Marks)**

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

OR

4 a. Apply Milne's predictor-corrector method to compute y(0.4) given the differential equation $\frac{d^2y}{dx^2} = 1 + \frac{dy}{dx}$ and the following initial values:
$y(0) = 1, y(0.1) = 1.1103, y(0.2) = 1.2427, y(0.3) = 1.399$
$y'(0) = 1,\ y'(0.1) = 1.2103,\ y'(0.2) = 1.4427,\ y'(0.3) = 1.699$ **(06 Marks)**

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

c. With usual notation, derive the Rodrigue's formula $P_n(x) = \frac{1}{(2^n)n!}\frac{d^n}{dx^n}(x^2-1)^n$. **(07 Marks)**

Module-3

5 a. Find the bilinear transformation which map the points z = 0, 1, ∞ into the points $w = -5, -1, 3$ respectively. **(06 Marks)**

b. Derive Cauchy-Riemann equations in Cartesian form. **(07 Marks)**

c. Evaluate $\int_C \frac{z^2}{(z-1)^2(z+2)}dz$ where $C: |z| = 2.5$ by residue theorem. **(07 Marks)**

OR

6 a. If $f(z)$ is a regular function of z, 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. Discuss the transformation $W = Z^2$. **(07 Marks)**

c. Evaluate $\int_C \frac{e^{2z}}{(z+1)(z+2)}$, where C is the circle $|z| = 3$, using Cauchy residue theorem. **(07 Marks)**

Module-4

7 a. The probability density function of a variate x given by the following table:

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

Find the value of K, mean and variance. **(06 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make, was normally distributed with an average life of 2040 hours and S.D. of 60 hours. Estimate the number of bulbs likely to burn for, (i) more than 2150 hours, (ii) less than 1950 hours, (iii) more than 1920 hours and but less than 2160 hours.
Given : $A(0 < z < 1.83) = 0.4664$, $A(0 < z < 1.33) = 0.4082$ and $A(0 < z < 2) = 0.4772$ **(07 Marks)**

c. A joint probability distribution is given by the following table:

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

Determine the marginal probability distributions of X and Y. Also find COV(X, Y). **(07 Marks)**

OR

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

b. In a certain town the duration of a shower is exponentially distributed within mean 5 minute. What is the probability that a shower will last for,
(i) less than 10 minutes (ii) 10 minutes or more
(iii) between 10 and 12 minutes. **(07 Marks)**

c. Given,

Y / X	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 distribution of X and Y.
(ii) Find E(X), E(Y) and E(XY). **(07 Marks)**

Module-5

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. Five dice were thrown 96 times and number 1, 2 or 3 appearing on the face of the dice follows the frequency distribution as follows:

No. of dice showing 1, 2 or 3 :	5	4	3	2	1	0
Frequency :	7	19	35	24	8	3

Test the hypothesis that the data follow a binomial distribution at 5% level of significance $\left(\chi^2_{0.05} = 11.07 \text{ for d.f is } 5\right)$. **(07 Marks)**

c. A student's study habits are as follows:
If he studies one night, he is 70% sure not 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. In the long run how often does he study? **(07 Marks)**

OR

10 a. If $p = \begin{pmatrix} 0 & \frac{2}{3} & \frac{1}{3} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} & 0 \end{pmatrix}$, find the fixed probabilities vector. **(06 Marks)**

b. A random sample of 10 boys had the following I.Q's : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Does this supports the hypothesis that the population mean of I.Q's is 100 at 5% level of significance? ($t_{0.05} = 2.262$ for 9 d.f) **(07 Marks)**

c. Explain : (i) Transient state (ii) Absorbing state (iii) Recurrent state. **(07 Marks)**

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CBCS SCHEME

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17MATDIP41

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Find the rank of the matrix $A=\begin{bmatrix}1 & 2 & 3 & -1\\ 2 & -1 & -3 & -1\\ 1 & 0 & 1 & 1\\ 0 & 1 & 1 & -1\end{bmatrix}$. **(07 Marks)**

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

c. Find the Eigen values of the matrix $\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$. **(06 Marks)**

OR

2 a. Solve the system of equation by Gauss elimination method,

$2x+y+4z=12$

$4x+11y-z=33$

$8x-3y+2z=20$ **(07 Marks)**

b. Using Cayley-Hamilton theorem find A^{-1}, given

$A=\begin{bmatrix}1 & 4\\ 2 & 3\end{bmatrix}$. **(07 Marks)**

c. Find the rank of the matrix by reducing in to row echelon form, given

$A=\begin{bmatrix}1 & 2 & 3 & 2\\ 2 & 3 & 5 & 1\\ 1 & 3 & 4 & 5\end{bmatrix}$. **(06 Marks)**

Module-2

3 a. Solve by method of undetermined co-efficient $y''-4y'+4y=e^{x}$. **(07 Marks)**

b. Solve $\frac{d^3y}{dx^3}-2\frac{d^2y}{dx^2}+4\frac{dy}{dx}-8y=0$. **(07 Marks)**

c. Solve $y''+2y'+y=2x$. **(06 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2}+y=\sec x\tan x$ by method of variation of parameter. **(07 Marks)**

b. Solve $y''-4y'+13y=\cos 2x$. **(07 Marks)**

c. Solve $6\frac{d^2y}{dx^2}+17\frac{dy}{dx}+12y=e^{-x}$. **(06 Marks)**

Module-3

5 a. Express the following function into unit step function and hence find $L[f(t)]$ given $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$. **(07 Marks)**

b. Find $L\left[\frac{1-e^{-at}}{t}\right]$. **(07 Marks)**

c. Find $L[t.\cos at]$. **(06 Marks)**

OR

6 a. Find $L[\sin 5t.\cos 2t]$. **(07 Marks)**

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

c. Find $L[\cos 3t.\cos 2t.\cos t]$. **(06 Marks)**

Module-4

7 a. Employ Laplace transform to solve the equation $y''+5y'+6y=5e^{2x}$ given $y(0)=2,\ y'(0)=1$. **(07 Marks)**

b. Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)(s+3)}\right]$. **(07 Marks)**

c. Find $L^{-1}\left[\frac{s+5}{s^2-6s+13}\right]$. **(06 Marks)**

OR

8 a. Using Laplace transforms solve $y''+4y'+4y=e^{-t}$ given $y(0)=0,\ y'(0)=0$. **(07 Marks)**

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

c. Find $L^{-1}\left[\frac{2s-5}{4s^2+25}\right]+L^{-1}\left[\frac{8-6s}{16s^2+9}\right]$. **(06 Marks)**

Module-5

9 a. State and prove Baye's theorem. **(07 Marks)**

b. A shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out of 3 shots. Find the probability that the target is being hit.

(i) When both of them try.

(ii) By only one shooter. **(07 Marks)**

c. If A and B are any two mutually exclusive events of S, then show that $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. **(06 Marks)**

OR

10 a. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective out put of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item non produced by machine C. **(07 Marks)**

b. Prove the following : (i) $P(\phi)=0$ (ii) $P(\overline{A})=1-P(A)$ **(07 Marks)**

c. If A and B are events with $P(AUB)=\frac{7}{8}$, $P(A\cap B)=\frac{1}{4}$ and $P(\overline{A})=\frac{5}{8}$ find P(A), P(B) and $P(A\cap\overline{B})$. **(06 Marks)**

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CBCS SCHEME

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15MAT41

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. Using the Taylor's series method, solve $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$ at the point $x = 0.1$. Consider the series upto third degree terms. **(05 Marks)**

b. By using the modified Euler's method, solve $\frac{dy}{dx} = \log_e(x + y)$, $y(1) = 2$ at the point $x = 1.2$. Take $h = 0.2$ and carry out two modifications. **(05 Marks)**

c. Solve $\frac{dy}{dx} = x - y^2$ at $x = 0.8$, using Adams - Bashforth method, given that $y(0) = 0$, $y(0.2) = 0.02$, $y(0.4) = 0.0795$, $y(0.6) = 0.1762$. **(06 Marks)**

OR

2 a. Employ the Taylor's series method to find $y(4.1)$ given that $\frac{dy}{dx} = \frac{1}{x^2 + y}$, $y(4) = 4$. Consider terms upto third degree. **(05 Marks)**

b. Given $\frac{dy}{dx} = 3e^x + 2y$ and $y(0) = 0$. Find $y(0.1)$ using the Range-Kutta method. Take step length $h = 0.1$ **(05 Marks)**

c. Given $5x\frac{dy}{dx} + y^2 - 2 = 0$ and the set of values of (x, y) given in the following table, find y at $x = 4.5$ using the Milne's method.

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

(06 Marks)

Module-2

3 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. **(05 Marks)**

b. Express $f(x) = x^3 + 2x^2 - x - 3$ in terms of Legendre polynomials. **(05 Marks)**

c. If α and β are two distinct roots of $J_n(x) = 0$ then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(06 Marks)**

OR

4 a. Apply Milne's method to compute $y(0.4)$ given that $y'' + xy' + y = 0$ and the table

x	0	0.1	0.2	0.3
y	1	0.995	0.9801	0.956
y'	0	-0.0995	-0.196	-0.2867

(05 Marks)

b. Explain $J_{-1/2}(x)$ in terms if cos x. **(05 Marks)**

c. Derive Rodrigue's formula

$$P_n(x) = \frac{1}{2^n \cdot n!} \frac{d^n}{dx^n}\left[(x^2-1)^n\right]$$ **(06 Marks)**

Module-3

5 a. Define analytic function and obtain Cauchy – Riemann equations in Polar form. **(05 Marks)**

b. Evaluate $\int_c \frac{dz}{z^2-4}$ in the cases where 'C' is the circle |z+2| = 1 using Cauchy's integral formula. **(05 Marks)**

c. Discuss the transformation $w = z^2$. **(06 Marks)**

OR

6 a. Given $u = 3x^2y - y^3$. Find the analytic function f(z). **(05 Marks)**

b. Evaluate $\int_c \frac{e^z}{(z-1)(z-5)^2} dz$, where C is the circle | z | = 8 using Cauchy's Residue theorem. **(05 Marks)**

c. Find the bilinear transformation which maps the points z = 0, i, ∞ on to the points w = 1, –i, –1 respectively. **(06 Marks)**

Module-4

7 a. A random variable x has the following probability function for various values of 'x'

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

(i) Find k (ii) Evaluate $P(x < 6)$, $P(x \geq 6)$ and $P(3 < x \leq 6)$ **(05 Marks)**

b. Obtain Mean and Standard Deviation of the Exponential Distribution. **(05 Marks)**

c. A communication channel receives independent pulses at the rate of 12 pulses per micro second. The probability of transmission error is 0.001 for each micro second. Compute the probabilities of (i) no error during a micro second (ii) one error per micro second (iii) atleast one error per micro second (iv) two errors (v) atmost two errors. **(06 Marks)**

OR

8 a. The pen manufactured by a company will be defective is 0.1. If 12 such pens are selected at random, find the probability that
(i) exactly 2 will be defective
(ii) atleast 2 will be defective
(iii) none will be defective **(05 Marks)**

b. In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and S.D. of the distribution. (S.D = Standard deviations $\phi(0.5) = 0.1915$, $\phi(1.4) = 0.4192$). **(05 Marks)**

c. The joint probability distribution table for two random variables X and Y 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 the marginal probability distributions of X and Y. Also compute (i) Expectations of X, Y and XY (ii) Covariance of X and Y. **(06 Marks)**

Module-5

9 a. Certain tubes manufactured by a company have mean life time of 800 hours and standard deviation of 60 hours. Find the probability that a random sample of 16 tubes taken from the group will have a mean life time
(i) between 790 hours and 810 hours
(ii) less than 785 hours
(iii) more than 820 hours
(iv) between 770 hours and 830 hours. **(05 Marks)**

b. A group of 10 boys fed on a diet A and another group of 8 boys fed on a different diet B for a period of 6 months recorded the following increase in weights (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 regarding their effect on increase in weight. ($t_{0.05}$ for 16 d.f = 2.12). **(05 Marks)**

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

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$$ **(06 Marks)**

OR

10 a. A random sample for 1000 workers in company has mean wage of Rs. 50 per day and standard deviation of Rs. 15. Another sample of 1500 workers from another company has mean wage of Rs. 45 per day and standard deviation of Rs. 20. Does the mean rate of wages varies between the two companies? Find the 95% confidence limits for the difference of the mean wages of the population of the two companies. **(05 Marks)**

b. Five dice were thrown 96 times and the numbers 1,2 or 3 appearing on the face of the dice follows the frequency distribution as below.

Number of dice showing 1, 2 or 3	5	4	3	2	1	0
Frequency	7	19	35	24	8	3

Test the hypothesis that the data follows a binomial distribution $\left(\chi^2_{0.05} = 11.07 \text{ for 5 d.f.}\right)$ **(05 Marks)**

c. A student's study habits are as follows. If he studies one night, he is 70% sure not 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. In the long run how often does he study? **(06 Marks)**

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CBCS SCHEME

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15MATDIP41

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. Find the rank of the matrix,

$$\begin{bmatrix} -2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & -1 & -1 \end{bmatrix}$$

By reducing it to the echelon form. **(05 Marks)**

b. Solve the following system of equations by Gauss Elimination method.

$4x + y + z = 4$

$x + 4y - 2z = 4$

$3x + 2y - 4z = 6$ **(05 Marks)**

c. Find all the eigen values and the eigen vector corresponding to the least eigen value of the matix.

$$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$$ **(06 Marks)**

OR

2 a. Find the rank of the matrix,

$$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$$

By applying elementary row transformations. **(05 Marks)**

b. Solve the following system of equations, by Gauss-Elimination method:

$x + 2y + z = 3,$

$2x + 3y + 3z = 10,$

$3x - y + 2z = 13$ **(05 Marks)**

c. Using Cayley-Hamilton theorem, find the inverse of the matrix,

$$\begin{bmatrix} 5 & 3 \\ 3 & 2 \end{bmatrix}$$ **(06 Marks)**

Module-2

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

b. Solve : $(D^2 + 3D + 2)y = 1 + 3x + x^2$ **(05 Marks)**

c. Using the method of variation of parameters, solve :

$(D^2 + 1)y = \sec x \tan x$. **(06 Marks)**

OR

4 a. Solve : $(D^3 - 5D^2 + 8D - 4)y = e^{2x}$. **(05 Marks)**

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

c. By the method of undetermined coefficients, solve :
$(D^2 - D - 2)y = 10 \sin x$. **(06 Marks)**

Module-3

5 a. Find the Laplace transform of,
(i) $\sin^2 2t$ (ii) $e^{-t}(3\sinh 2t - 2\cosh 3t)$ **(05 Marks)**

b. Find $L\left\{\frac{\cos at - \cos bt}{t}\right\}$. **(05 Marks)**

c. If $f(t) = t^2$, $0 < t < 2$ and $f(t+2) = f(t)$ for $t > 2$. Find $\alpha\{f(t)\}$. **(06 Marks)**

OR

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

b. Find (i) $L\{te^{-t} \sin 4t\}$ (ii) $L\left\{\int_0^t e^{-t} \cos t dt\right\}$. **(05 Marks)**

c. Express $f(t) = \begin{cases} \cos t, & 0 < t < \pi \\ \sin t, & t > \pi \end{cases}$ in terms of unit-step function and hence find $L\{f(t)\}$.
(06 Marks)

Module-4

7 a. Find the inverse Laplace transform of :
(i) $\frac{3s-4}{16-s^2}$ (ii) $\frac{s}{s^2-a^2}$ **(06 Marks)**

b. Find $L^{-1}\left\{\frac{3s+7}{s^2-2s-3}\right\}$ **(05 Marks)**

c. Solve the equation, $y'' + 4y' + 3y = e^{-t}$, with $y(0) = 1$, $y'(0) = 1$, using Laplace transforms.
(05 Marks)

OR

8 a. Find $L^{-1}\left\{\frac{5s+3}{(s-1)(s^2+2s+5)}\right\}$. **(06 Marks)**

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

c. Solve the equation $y'' + 6y' + 9y = 12t^2e^{-3t}$, with $y(0) = y'(0) = 0$, using Laplace transforms. **(05 Marks)**

Module-5

9 a. For any two events A and B, prove that
(i) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
(ii) $P(\overline{A} \cap B) = P(B) - P(A \cap B)$ **(05 Marks)**

b. Given $P(A) = 0.4$, $P\left(\frac{B}{A}\right) = 0.9$ and $P\left(\frac{\overline{B}}{\overline{A}}\right) = 0.6$, find $P\left(\frac{A}{B}\right)$ and $P\left(\frac{A}{\overline{B}}\right)$. **(06 Marks)**

c. State and prove Bayes's theorem. **(05 Marks)**

OR

10 a. Let A and B be events with $P(A)=\frac{1}{2}$, $P(A\cup B)=\frac{3}{4}$, $P(\overline{B})=\frac{5}{8}$. Find $P(A\cap B)$, $P(\overline{A}\cap\overline{B})$, $P(\overline{A}\cup\overline{B})$ and $P(B\cap\overline{A})$. **(06 Marks)**

b. In a certain engineering college, 25% of First semester students have failed in Mathematics, 15% have failed in Chemistry and 10% have failed in both Mathematics and Chemistry. A student is selected at random.

(i) If he has failed in Chemistry, what is the probability that he has failed in Mathematics?

(ii) If he has failed in Mathematics, what is the probability that he has failed in Chemistry? **(05 Marks)**

c. Three machines A, B and C produce respectively 60%, 30%, 10% of total number of items in a factory. Percentage of defective output of these machines are respectively 2%, 3% and 4%. An item selected at random is found to be defective. Find the probability that it is produced by machine C. **(05 Marks)**

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10MAT41

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

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

PART – A

1 a. Using Taylor's series method, solve the differential equation $\frac{dy}{dx} = x^2y + 1$ with y(0) = 0 at x = 0.4. Consider terms up to fourth degree. **(06 Marks)**

b. Solve the differential equation $\frac{dt}{dx} = -xy^2$ under the initial condition y(0) = 2, by using the modified Euler's method at x = 0.1 and x = 0.2. Take the step size h = 0.1 and carryout two modifications at each step. **(07 Marks)**

c. Apply Adams-Bashforth method to solve the equation $\frac{dy}{dx} = x^2(1+y)$ given y(1) = 1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979. Evaluate y(1.4). **(07 Marks)**

2 a. Solve the differential equations:
$\frac{dy}{dx} = 1 + xz$, $\frac{dz}{dx} = -xy$ for x = 0.3 using fourth order Runge-Kutta method. Initial values are x = 0, y = 0, z = 1, Take h = 0.3. **(06 Marks)**

b. Apply Picard's method upto third approximation to find y and z for the equation $\frac{d^2y}{dx^2} = 1 + \frac{dy}{dx}$ given y(0) = 1 = y'(0). **(07 Marks)**

c. Apply Milne's method to compute y(0.8) given that $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ and the following initial values y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795 y(0.6) = 0.1762, y'(0) = 0, y'(0.2) = 0.1996, y'(0.4) = 0.3937, y'(0.6) = 0.5689. **(07 Marks)**

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

b. Find the analytic function whose imaginary part is $e^x(x\sin y + y\cos y)$. **(07 Marks)**

c. If f(z) is an analytic function then prove that
$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)|f(z)|^2 = 4|f'(z)|^2$ **(07 Marks)**

4 a. Discuss the Transformation $W = e^z$. **(06 Marks)**

b. Find the bilinear transformation which maps the points 1, i, -1 onto the points i, 0, -1 respectively. **(07 Marks)**

c. Evaluate $\int_C \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)^2(z-2)} dz$ where C is the circle $|z| = 3$, using Cauchy's integral formula. **(07 Marks)**

PART – B

5 a. Find the solution of the Laplace's equation in cylindrical system leading to Bend's differential equation. **(06 Marks)**

b. Derive Rodrigue's formula

$$P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}(x^2-1)^n$$ **(07 Marks)**

c. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(07 Marks)**

6 a. A five figure number is formed by the digits 0, 1, 2, 3, 4 without repitition. Find the probability that the number is divisible by 4. **(06 Marks)**

b. If A and B are any two events with $P(A) = \frac{1}{2}$, $P(B) = \frac{1}{3}$, $P(A \cap B) = \frac{1}{4}$ find $P(A/B)$, $P(B/A)$, $P(A/\overline{B})$, $P(\overline{A}/\overline{B})$, $P(\overline{B}/\overline{A})$. **(07 Marks)**

c. The contents of three boxes are 1 white, 2 red, 3 green balls, 2 white, 1 red, 1 green balls and 4 white, 5 red, 3 green balls. Two balls are drawn from the box chosen at random. These are found to be one white and one green. Find the probability that the balls are from the third box. **(07 Marks)**

7 a. The probability distribution of a random variable X is given by the following table:

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

Find: $P(X < 5)$, $P(X \geq 6)$, $P(3 < X \leq 6)$. Also find mean and variance. **(06 Marks)**

b. Find mean and variance of Binomial distribution. **(07 Marks)**

c. In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find mean and standard deviation. Give A(0.5) = 0.19, A(1.4) = .42 where A(z) is the area under the standard normal curve from 0 to z. **(07 Marks)**

8 a. Explain the following terms:
i) Null hypothesis
ii) Significances level
iii) Confidence limits. **(06 Marks)**

b. A die was thrown 9000 times and a throw of 5 or 6 was obtained 3240 times on the assumption of random throwing, do the data indicate an unbiased die. **(07 Marks)**

c. A Machinist is making engine parts with axle diameter of 0.7inch. A random sample of 10 parts shows mean diameter 0.742 inch with a standard deviation of 0.04 inch. On the basis of this sample, would you say that the work is inferior? Given for $\rho = 9$, $T_{0.05} = 2.262$. **(07 Marks)**

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MATDIP401

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Advanced Mathematics – II

Time: 3 hrs. Max. Marks:100

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

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

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

b. If ℓ_1, m_1, n_1 and ℓ_2, m_2, n_2 are the direction cosines of two lines then angle θ between the lines is $\theta = \cos^{-1}(\ell_1 \ell_2 + m_1 m_2 + n_1 n_2)$. **(07 Marks)**

c. If a line makes angles $\alpha, \beta, \gamma, \delta$ with four diagonals of a cube, show that : $\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = 4/3$. **(07 Marks)**

2 a. Find the equation of the plane through (1, –2, 2), (–3, 1, –2) and perpendicular to the plane $2x - y - z + 6 = 0$. **(06 Marks)**

b. Find the equation of the line passing through the points (1, 2, –1) and (3, –1, 2). At what point does it meet the yz – plane. **(07 Marks)**

c. Show that the lines $\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5}$ and $\frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3}$ intersect. Find the point of intersection and the equation of the plane in which they lie. **(07 Marks)**

3 a. Show that the position vectors of the vertices of a triangle $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} + 4\hat{k}$ from a right–angle triangle. **(06 Marks)**

b. Prove that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$. **(07 Marks)**

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

4 a. If $\frac{d\vec{A}}{dt} = \vec{W} \times \vec{A}$, $\frac{d\vec{B}}{dt} = \vec{W} \times \vec{B}$, show that $\frac{d}{dt}(\vec{A} \times \vec{B}) = \vec{W} \times (\vec{A} \times \vec{B})$. **(06 Marks)**

b. A particle moves along the curve $x = t^3 + 1$, $y = t^2$, $z = 2t + 5$, where t is the time. Find the components of its velocity and acceleration at time t = 1 in the direction $2\hat{i} - 3\hat{j} - 6\hat{k}$. **(07 Marks)**

c. Find the angle between the surfaces $x^2yz + 3xz^2 = 5$ and $x^2y^3 = 2$ at (1, –2, –1). **(07 Marks)**

5 a. Find unit vector normal to the surface $x^2y + 2xz^2 = 8$ at the point (1, 0, 2). **(06 Marks)**

b. Prove that $curl(\phi \vec{A}) = (grad\phi) \times \vec{A} + \phi curl \vec{A}$. **(07 Marks)**

c. Prove that $\nabla^2(r)^n = n(n+1)r^{n-2}$, where $r = |x\,i + y\,j + z\,k|$. **(07 Marks)**

6 a. Find Laplace transform of coshat. **(06 Marks)**

b. If $f(t)=\begin{cases}2t & \text{for } 0\le t\le 5\\ 1 & \text{for } t>5\end{cases}$, find L[f(t)]. **(07 Marks)**

c. Find $L\left[\frac{\cos 2t-\cos 3t}{t}\right]$. **(07 Marks)**

7 a. By using the convolution theorem find the inverse Laplace transforms of $\frac{1}{s^2(s+5)}$. **(06 Marks)**

b. Find $L^{-1}\left[\frac{(3s+7)}{s^2+2s-3}\right]$. **(07 Marks)**

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

8 a. Using Laplace transform solve :

$\frac{d^2y}{dt^2}+4\frac{dy}{dt}+4y=e^{-t}, y(0)=0=y'(0)$. **(10 Marks)**

b. Solve the system of equations by the method of Laplace transform

$(D-2)x+3y=0, 2x+(D-1)y=0$

Where $D=\frac{d}{dt}$, given that $x=8, y=3$ at $t=0$. **(10 Marks)**

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CBCS SCHEME

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17CV42

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
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 suitably.***

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

Module-1

1 a. Define linear and nonlinear systems. **(06 Marks)**

b. Distinguish between static indeterminacy and kinematic indeterminacy. **(06 Marks)**

c. Determine static and kinematic indeterminacy for the following structures.

Fig Q1(c) – (i)

Fig Q1(c) – (ii) **(08 Marks)**

OR

2 a. What are the assumptions made in the analysis of trusses? **(04 Marks)**

b. Distinguish perfect and imperfect frames. **(04 Marks)**

c. Find the forces in all members of truss shown in Fig Q2(c).

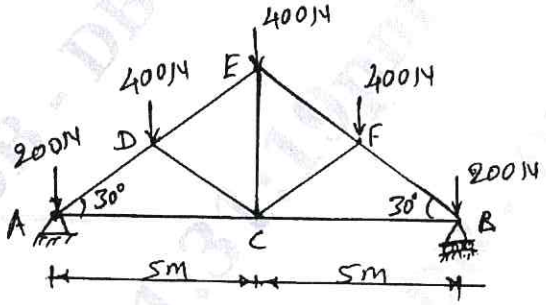

Fig Q2(c) **(12 Marks)**

Module-2

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

b. Find the slope and deflection at the free end of cantilever beam subjected to udl w/m on its entire length by moment area method. **(06 Marks)**

c. For the cantilever beam shown in Fig Q3(c), compute the slope and defection at the free end. Take EI = 4×10^{12} Nmm^2. Use Macaulay's method.

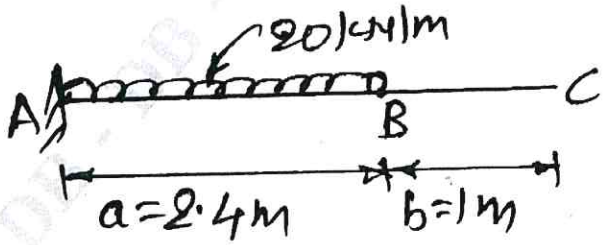

Fig Q3(c) **(10 Marks)**

OR

4 a. Determine the slopes at the supports and deflection under the point load by conjugate beam method.

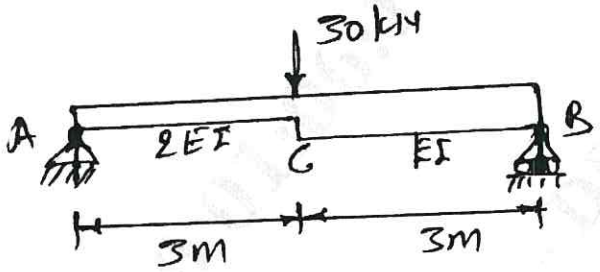

Fig Q4(a) **(10 Marks)**

b. Determine the defection under the load points shown in Fig Q4(b) by Macanlay's method. Take EI = 1×10^{12} Nmm^2.

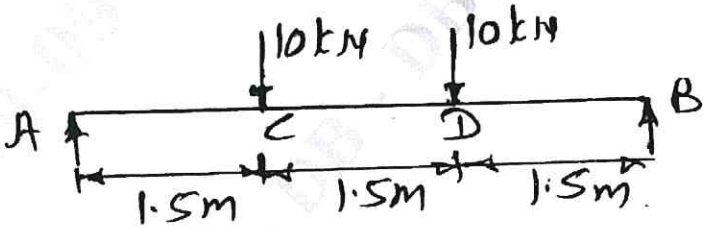

Fig Q4(b) **(10 Marks)**

Module-3

5 a. Derive the strain energy stored in a beam due to bending. **(06 Marks)**

b. Compute the deflection and rotation (slope) at the free end C of cantilever beam by unit load method. Shown in Fig Q5(b). Take E = 200 GPa I = 8×10^7 mm^4.

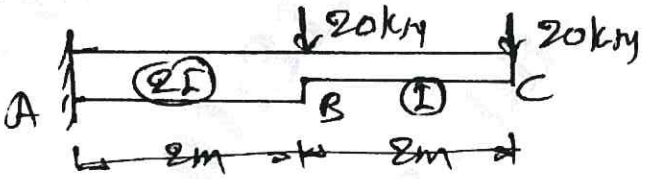

Fig Q5(b) **(14 Marks)**

OR

6 a. Determine the horizontal deflection at D for the frame shown in Fig Q6(a) by Castiglione's theorem. Take EI constant. E = 2×10^5 N/mm^2, I = 8×10^8 mm^4.

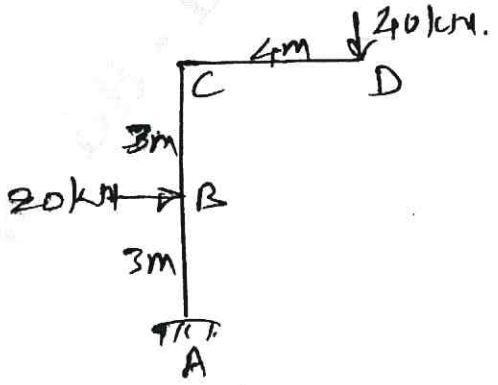

Fig Q6(a) **(11 Marks)**

b. Find the vertical deflection at joint C for the truss shown in Fig Q6(b) by unit load method c/s area of CD and DE are each 2500mm^2 and those of other are each 1250 mm^2. Take E = 200 kN/mm^2

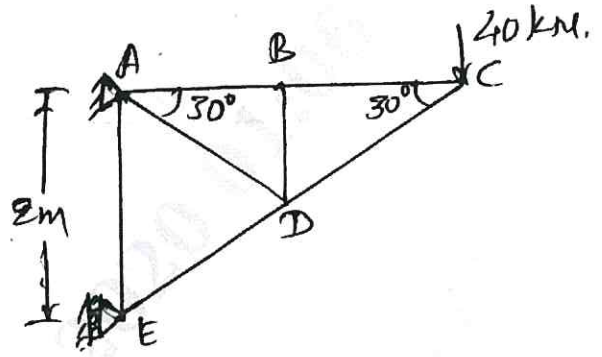

Fig Q6(b) **(09 Marks)**

Module-4

7 A three hinged parabolic arch of span 18m and rise to crown hinge 3m carries a load of 120kN at the left quarter span. Find the BM, normal thrust and radial shear at section under the load. Also find maximum positive and negative b.m. in the arch. Sketch BMD. **(20 Marks)**

OR

8 A cable of span 120m and dip 10m carries a load of 6kN/m of horizontal span. Find the maximum tension in the cable and inclination of cable at the support. Find the forces transmitted to the supporting pier if the cable passes over smooth pulleys on top of pier. The anchor cable is at 30° to the horizontal. Determine the maximum bending moment for the pier if height of pier is 15m. **(20 Marks)**

Module-5

9 a. What are the uses of influence lines? **(05 Marks)**

b. A simply supported beam has a span of 15m. A udl of 40kN/m and 5m long crosses the girder from left to right. Draw the influence line diagram for SF and BM at a section 6m from left end. Using these diagrams. Calculate maximum SF and BM at this section. Also determine the position and magnitude of absolute maximum BM in the beam. **(15 Marks)**

OR

10 A train of 5 wheel loads as shown in Fig Q10 crosses a simply supported beam of span 24m from left to right. Calculate the maximum positive and negative SF values at the centre of span and the absolute maximum B.M anywhere in the span.

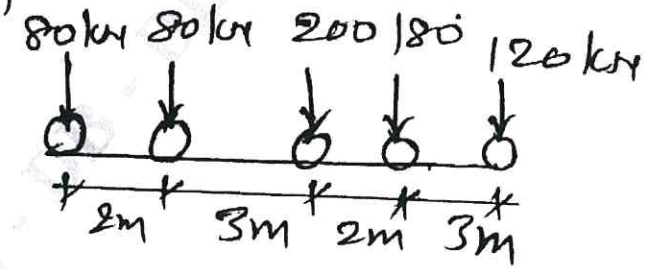

Fig Q10 **(20 Marks)**

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CBCS SCHEME

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17CV43

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Applied Hydraulics

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 suitably.

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

Module-1

1 a. Differentiate between dimensionally homogeneous and non-homogeneous with an example each. **(06 Marks)**

b. What is dimensional analysis? Mention its uses. **(06 Marks)**

c. Capillary rise 'h' depends upon density 'ρ', acceleration due to gravity, 'g', surface tension, 'σ' and radius of tube, 'r'. Show by Buckingham π – theorem that,

$$\frac{h}{r} = \phi\left[\frac{\sigma}{\rho g r^2}\right]$$ **(08 Marks)**

OR

2 a. Explain Reynold's model law and give the areas where it is applied. **(06 Marks)**

b. What are distorted and undistorted models? **(04 Marks)**

c. The discharge and velocity of flow over the model of a spillway of a dam were measured to be 2.0 m^3/s and 2.5 m/s respectively. If the model is built to a scale of 1:36, compute the velocity and discharge over its prototype. **(10 Marks)**

Module-2

3 a. Derive Chezy's equation for uniform flow in open channel and thereby deduce Manning's formula for velocity in open channel. **(08 Marks)**

b. A circular open channel laid to a gradient of 1:9000 carries a discharge of 0.40 m^3/s. If the depth of flow is 1.25 times the radius of channel, find the diameter of the channel. Assume rugosity coefficient for channel surface as 0.015. **(12 Marks)**

OR

4 a. How do you define specific energy of a flowing? Draw specific energy curve and explain various parameters. **(06 Marks)**

b. Enumerate the characteristics of critical flow through open channels. **(04 Marks)**

c. The discharge in a 4.0 m wide rectangular channel at 1.0m depth of flow is 4.0 m^3/s. Compute (i) Specific energy for 1.0m depth of flow (ii) Critical depth (iii) Alternate depth to 1.0m. **(10 Marks)**

Module-3

5 a. Define hydraulic jump in an open channel flow. Give its applications. **(06 Marks)**

b. Prove that the critical depth (y_c) and the alternate depths y_1 and y_2 are related by the expression, $y_c^3 = \frac{2y_1^2 y_2^2}{(y_1 + y_2)}$, in a rectangular open channel. **(06 Marks)**

c. In a rectangular channel of width 6.0m, the sluice gate discharges with a velocity of 5.0 m/s at a depth of 0.40m. Determine whether a hydraulic jump will occur. Also find (i) Jump height (ii) Energy lost per kg of water and (iii) Power lost in the hydraulic jump. **(08 Marks)**

OR

6 a. Explain classification of surface profiles with neat sketches. **(10 Marks)**

b. A rectangular channel 10m wide carries a discharge of 40 m^3/s. If at a section in this channel, the depth of flow is 1.50m, how far upstream or downstream from this section will the depth be 2.0m. Take channel bedslope as 0.00009 and Manning's N = 0.017. **(10 Marks)**

Module-4

7 a. Derive an expression for the force exerted by a jet striking a moving symmetrical curved vane striking at the center and hence how that the maximum efficiency of this jet-vane system is limited to 16/27. **(10 Marks)**

b. A jet water moving at 20 m/s impinges on a symmetrical curved vane so shaped to deflect the jet through 120°. If the vane is moving at 5.0 m/s, find the angle of jet so that there is no shock at the inlet. Also determine the absolute velocity at the exit in magnitude and direction and the work done per unit weight of water. **(10 Marks)**

OR

8 a. Draw a general layout of a hydro-electric power plant and give the function of each of the components in brief. **(10 Marks)**

b. A Pelton wheel running at a speed of 600 rpm under a head of 820 m develops 13200 kW power. If the coefficient of jet $C_v = 0.98$, Speed ratio, $\phi = 0.46$ and jet diameter is 1/16 of wheel diameter, calculate (i) Pitch circle diameter (ii) Diameter of the jet (iii) Quantity of water supplied to the wheel and (iv) the number of jets required. Assume overall efficiency as 85%. **(10 Marks)**

Module-5

9 a. Draw a neat sketch of a Francis turbine and explain its components. **(04 Marks)**

b. What is a draft tube? Explain its function in a reaction turbine. **(06 Marks)**

c. A Kaplan turbine runner is to be designed to develop 9100 kW power. The net available head is 5.6m. If the speed ratio = 2, flow ratio = 0.68, overall efficiency = 86% and the diameter of boss is equal to $1/3^{rd}$ the diameter of runner, find the diameter of runner, the speed and specific speed of turbine. **(10 Marks)**

OR

10 a. Explain various heads and efficiencies of centrifugal pumps. **(10 Marks)**

b. A centrifugal pump with radial inflow delivers 0.08 cumecs of water against a total head of 40m. If the outer diameter of the impeller is 30cm and its width at the outer periphery is 1.25 cm, find the blade angle at exit. The speed of the pump is 1500 rpm and its manometric efficiency is 80%. **(10 Marks)**

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CBCS SCHEME

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17CV45

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. Define : (i) Void Ratio (ii) Porosity (iii) Air content (iv) Degree of saturation (v) Water content. **(05 Marks)**

b. Starting from 3-phase diagram, with usual notation prove that

$$\gamma_d = \frac{(1-n_a)G\gamma_w}{1+GW}$$ **(07 Marks)**

c. A sample of soil has a volume of 1000 C.C and a weight of 17.5N. The specific gravity of soil solid 2.52. If dryout weight is 15.8 kN/m^3, determine the water content, void ratio, submerged unit weight and degree of saturation. **(08 Marks)**

OR

2 a. Briefly explain consistency limit and indices and explain activity of clay. **(08 Marks)**

b. The sample of sand above water table was found to have natural water content of 15% and unit weight of 18.484 kN/m^3. Laboratory test on a dry sample indicated e_{min} = 0.5 and e_{max} = 0.85 for densest and loosest state respectively. Compute the degree of saturation and relative density. Assume G = 2.65. **(06 Marks)**

c. Explain various correction factors in hydrometer analysis. **(06 Marks)**

Module-2

3 a. Explain the concept of electrical diffuse double layer. **(06 Marks)**

b. Mention three different clay mineral commonly found in soil. Explain any one with their structures. **(06 Marks)**

c. Differentiate between :
(i) Primary and secondary valency forces
(ii) Flocculated structures and dispersed structures. **(08 Marks)**

OR

4 a. State and explain briefly the factors affecting compaction of soil. **(06 Marks)**

b. Calculate the compactive energies applied for standard and modified proctor test. **(06 Marks)**

c. Following are the observations of compaction test:

Water content %	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil (N)	16.67	18.54	19.92	19.52	19.23	18.83

Volume of compaction mould = 950 cc

G = 2.65

(i) Draw compaction curve (ii) Report the MOD and OMC

(iii) Draw 100% saturation line. **(08 Marks)**

Module-3

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

b. Explain the following terms:
(i) total stress (ii) Neutral stress (iii) effective stress (iv) Quick sand condition. **(08 Marks)**

c. A 1.25m layer of soil, G = 2.65 and porosity = 35% is subject to an upward seepage head of 1.85m. What depth of coarse and would be required above the soil to provide a factor of safety of 2.0 against piping assuming that the coarse sand has same porosity and specific gravity as soil and that there is negligible headloss in the sand. **(06 Marks)**

OR

6 a. Briefly explain the factors affecting the permeability of soils. **(10 Marks)**

b. Derive an expression for coefficient of permeability used in variable head permeability test. **(10 Marks)**

Module-4

7 a. What is a pre-consolidation pressure? Explain the Casagrande's method of determining the pre-consolidation pressure from laboratory consolidation test. **(08 Marks)**

b. Write short note on pore water pressure in soils. **(06 Marks)**

c. A soil sample 20mm thick takes 20 minutes to reach 20% of consolidation. Find the time taken by for a clay layer 6m thick to reach 40% consolidation. Assume double drainage in both the cases. **(06 Marks)**

OR

8 a. With spring analogy, explain consolidation. **(10 Marks)**

b. A saturated soil has a compression index of 0.25. Its void ratio at a stress of 10 kPa is 2.02 and its permeability is 3.4×10^{-7} mm/s Compute.
(i) Change in void ratio if stress is increased to 19 kN/m^2
(ii) Settlement in (i) if he soil stratum is 5m thick
(iii) Time required for 40% consolidation if drainage is one way. **(10 Marks)**

Module-5

9 a. List the merit and demerits of triaxial shear test over Direct Shear test. **(08 Marks)**

b. Explain the classification of shear test based on drainage condition. **(06 Marks)**

c. In an unconfined compression test, a sample of sandy clay 8 cm long and 4 cm diameter fails under a load of 120 N at 10% strain. Compute the shearing resistance taking into account the effect of change in cross-section of the sample. **(06 Marks)**

OR

10 a. Explain Mohr-Coulomb failure theory of soil. **(06 Marks)**

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

c. In a shear test conducted on a river sand, the following result were obtained.

Normal force (N)	80	160	240	320	400	480
Shear force (N)	50	101	149	201	248	302

Determine 'C' and 'ϕ'. **(08 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | |

17CV46

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Advanced Surveying

Time: 3 hrs. Max. Marks: 100

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

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

Module-1

1 a. List the different methods of setting out simple circular curve. Explain the Rankine's method of setting out simple circular curve. **(08 Marks)**

b. Two tangents intersect at chainage of 1190 mt, the deflection angle being 36°. Compute all the data necessary to set out a simple circular curve of radius 300 mt by deflection angle method. Take peg interval as 30 mt. Tabulate the results. **(12 Marks)**

OR

2 a. What is a Transition curve? List the function 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 300 mt and that of the second is 400 mt. Chainage of intersection point is 1500 mt. Calculate the chainages of tangent points and that of point of compound curvature. **(07 Marks)**

c. Two parallel railway lines are to be connected by a reverse curve of different radii. If the lines are 10 mt apart and the maximum distance between the tangent points measured parallel to the straight is 45 mt. Calculate the radius of the second branch, if that of first branch is 65 mt. Also calculate the length of both the branches. **(07 Marks)**

Module-2

3 a. Mention the points to be considered in the selection of triangulation stations. **(08 Marks)**

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

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

The station S and C are to the opposite sides at the line AB, calculate the correct angle ABC, if the lengths of AB and BC are 5276.5 and 4932.2 m respectively. **(12 Marks)**

OR

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

b. Find the most probable values of the angles, from the following given equations.

$A = 42° 36' 28''$ Weight 2
$B = 28° 12' 42''$ Weight 1
$C = 65° 25' 16''$ Weight 1
$A + B = 70° 49' 14''$ Weight 2
$B + C = 93° 37' 55''$ Weight 1 **(12 Marks)**

Module-3

5 a. Define the following terms:
(i) Celestial sphere (ii) Vertical circle (iii) The sensible horizon (iv) Zenith and Nadir **(08 Marks)**

b. Find the GMT corresponding to following LMT:
(i) 9 h 40 m 12s A.M at a place in Longitude 42° 36′ W
(ii) 4 h 32 m 10s A.M at a place in Longitude 56° 32′ E **(12 Marks)**

OR

6 a. Define the following terms:
(i) Celestial horizon (ii) The Altitude
(iii) The hour angle (iv) The prime vertical. **(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 LMT 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) Expose station
(iv) Oblique photograph **(08 Marks)**

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

OR

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

b. Describe how mosaic differ from a map. **(04 Marks)**

c. A section line AB appears to be 10.16 cm on a photograph for which the focal length is 16 cm. The corresponding line measures 2.54 cm on a map which is to a scale of $1/50{,}000$.
The terrain has an average elevation of 200 m above MSL. Calculate the flying altitude at the aircraft, above MSL, when the photograph was taken. **(10 Marks)**

Module-5

9 a. What is GIS? List the applications of GIS in Civil Engineering. **(10 Marks)**

b. Explain the basic principle of GPS and its applications in civil engineering. **(10 Marks)**

OR

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

b. Define Remote Sensing. Explain the stages of idealized Remote Sensing. **(10 Marks)**

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CBCS SCHEME

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15CV42

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Analysis of Determinate Structures

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. Define degree of freedom, give an example. **(03 Marks)**

b. Find the degree of static indeterminacy and kinematic indeterminacy for the structure shown in Fig.Q.1(b) (i) (ii) and (iii).

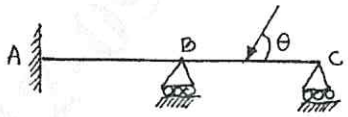


Fig.Q.1(b)(i)

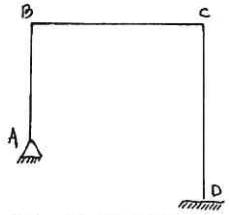


Fig.Q.1(b)(ii)

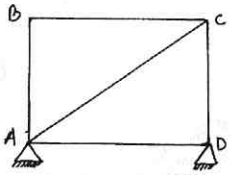
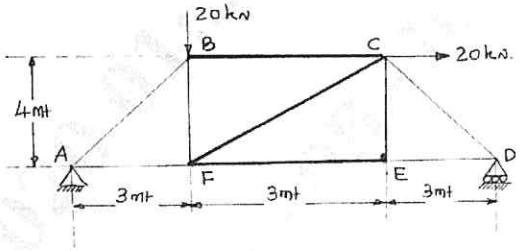


Fig.Q.1(b)(iii)

(06 Marks)

c. Determine the forces in the members BC, CF, FE by the method of sections as shown in Fig.Q.1(c). **(07 Marks)**

Fig.Q.1(c)

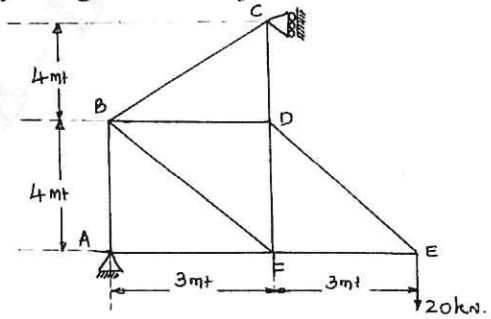


OR

2 a. What are the Assumptions made in the Analysis of trusses? **(04 Marks)**

b. Determine the magnitude and nature of forces in all the members of the pin-jointed plane truss shown in Fig.Q.2(b) by using method of joints. **(12 Marks)**

Fig.Q.2(b)



Module-2

3 a. Determine the slope at the supports and deflection at mid span of simply supported beam AB of length '*l*' as shown in Fig.Q.3(a) by using double integration method. **(08 Marks)**

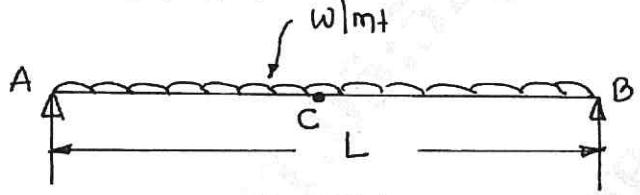


Fig.Q.3(a)

b. Determine the slope at supports and deflection at point load as shown in Fig.Q.3(b) by using Macaulay's method. **(08 Marks)**

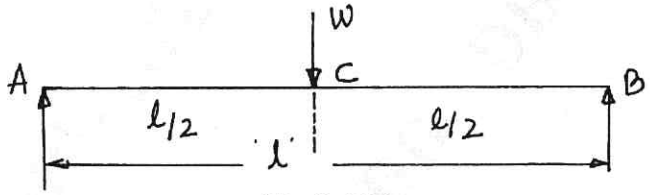


Fig.Q.3(b)

OR

4 a. Using the moment area method to determine the slope at its ends and deflection at point 'D' of simply supported beam as shown in Fig.Q.4(a). Take EI is 2×10^5 kN-m^2. **(08 Marks)**

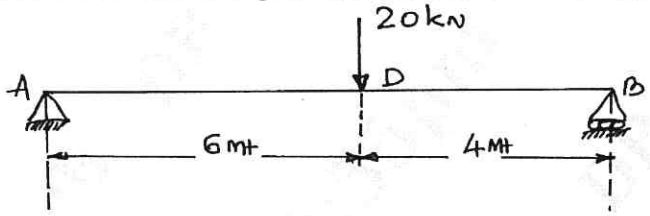


Fig.Q.4(a)

b. Find the slope at the supports and deflection under the load for the beam shown in Fig.Q.4(b). Take E = 2×10^5N/mm^2 and I = 5.13×10^8mm^4, by using conjugate beam method. **(08 Marks)**

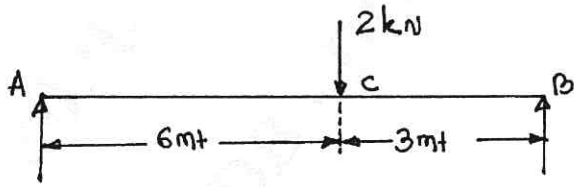


Fig.Q.4(b)

Module-3

5 a. Derive an expression for strain energy stored due to bending. **(08 Marks)**

b. Determine the deflection at the load point 'C' for the beam shown in Fig.Q.5(b) by using strain energy method. **(08 Marks)**

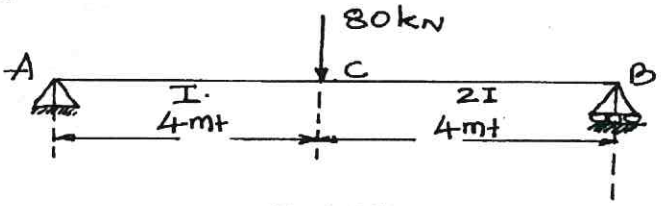


Fig.Q.5(b)

OR

6 a. State Castigliano's first and second theorems. **(04 Marks)**

b. Find the deflection under the concentrated load for the beam shown in Fig.Q.6(b). Using Castigliono's theorem and take $E = 2 \times 10^8 kN/m^2$ and $I = 14 \times 10^{-6} m^4$. **(12 Marks)**

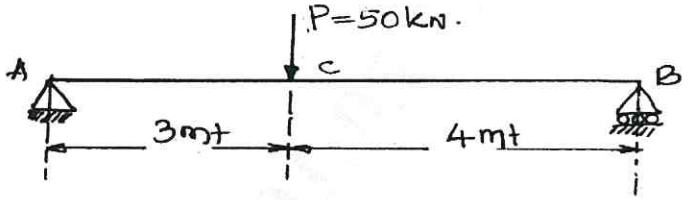


Fig.Q.6(b)

Module-4

7 A three hinged parabolic arch has a span of 30mt and central rise of 6mt. The arch carries a UDL of intensity 30kN/mt, over left half portion and a concentrated load of 60kN at 9mt from right hand support. Determine the bending moment, normal thrust, radial shear at 9mt from left hand support. **(16 Marks)**

OR

8 A cable is suspended between two points 'A' and 'B' 80mt apart horizontally and a central dip of 8mt. It supports a UDL of intensity 30kN/mt throughout its length. Calculate the maximum tension in the cable and length of the cable. Also determine the vertical force in the cable, if the back stay is inclined at 30° to the horizontal and the cable passes over smooth pulley. Supports are at the same level. **(16 Marks)**

Module-5

9 a. What is an influence line? And explain its importance in structural analysis. **(06 Marks)**

b. Determine the maximum bending moment at a section 5mt from the left support as shown in Fig.Q.9(b). **(10 Marks)**

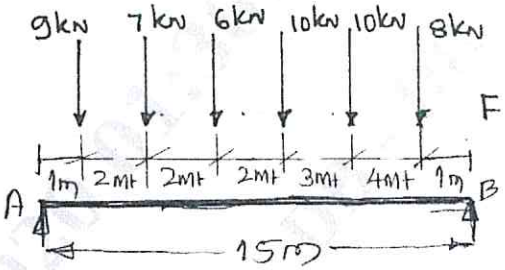


Fig.Q.9(b)

OR

10 Fig.Q.10 shows two wheel loads of 16kN and 18kN at a fixed distance apart of 2mt, cross a beam of 10mt span. Draw the influence line for bending moment and shear force for a point 4mt from the left abutment and find the maximum bending moment and shear force at that point. **(16 Marks)**

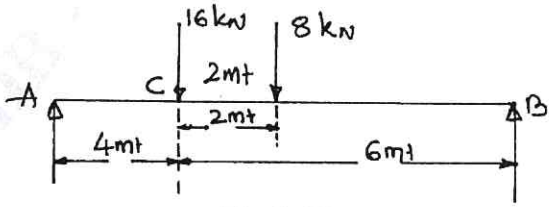


Fig.Q.10

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CBCS SCHEME

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15CV43

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Applied Hydraulics

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. What do you understand by dimensional homogeneity in dimensional analysis? Explain with an example. **(04 Marks)**

b. For a laminar flow in a pipe, the drop in pressure ΔP is a function of the pipe length l, its diameter d, mean velocity of flow v and dynamic viscosity μ. Using Rayleigh's method develop the expression for ΔP. **(08 Marks)**

c. Define centre of buoyancy, Meta centre, Meta centric height and buoyancy. **(04 Marks)**

OR

2 a. Chezy's formula for velocity of flow V for uniform flow in a open channel is written as $V = C\sqrt{RS}$.
where R = Hydraulic mean radius, S = Slope of bed of channel. Find dimension of Chezy's constant C. **(04 Marks)**

b. Oil of density 917 kg/m^3 and dynamic viscosity = 0.29 PaS flows in a pipe of diameter 15 cm at a velocity of 2 m/sec. What would be the velocity of flow of water in a 1 cm diameter pipe, to make the flows dynamically similar? The density and viscosity of water can be taken as 998 kg/m^3 and 1.31×10^{-3} PaS respectively. **(04 Marks)**

c. A solid cylinder of diameter 30 cm and height 15 cm is to float in water with its axis vertical in sea water (SG = 1.03). If the relative density of the cylinder material is 0.9, examine the stability of the cylinder. **(08 Marks)**

Module-2

3 a. What size of a circular drainage pipe is needed to carry 1.10 m^3/sec of discharge when flowing half full? The pipe is laid at a slope of 0.0004 and Mannings n for the material of the pipe can be taken as 0.018. **(05 Marks)**

b. Draw the specific energy curve for flow through a channel and mark salient points on it. **(05 Marks)**

c. A rectangular channel 2 m wide carries a discharge of 6.0 m^3/sec. Calculate the critical depth, specific energy at critical depth and critical velocity. **(06 Marks)**

OR

4 a. A wide rectangular channel carries a flow of 2.76 m^3/sec per metre width, the depth of flow being 1.524 m. Calculate the Critical depth, Velocity, Froude number and check type of flow. **(06 Marks)**

b. A trapezoidal channel with side slopes of 2H : 1 V has to be designed to carry 15 m^3/sec at a slope of 1/5000. Determine the dimensions of the most efficient section. Assume Manning's $\eta = 0.014$. **(08 Marks)**

c. State the conditions for a most economical rectangular channel section. **(02 Marks)**

Module-3

5 a. If in a hydraulic Jump occurring in a horizontal rectangular channel, the Froude's number before jump is 10.0 and energy loss is 3.20 m. Estimate the (i) Sequent depths (ii) The discharge intensity (iii) Froude's number after jump. **(08 Marks)**

b. Derive an expression for loss in head due to hydraulic jump. **(05 Marks)**

c. Briefly explain different types of slopes in a gradually varied flow in a channel section. **(03 Marks)**

OR

6 a. Derive the dynamic equation for a gradually varied flow in an open channel flow with usual notations. **(08 Marks)**

b. Water flows in a triangular channel of side slope 1 H : 1 V and longitudinal slope of 0.001. Determine whether the flow is mild, steep or critical when a discharge of 0.2 m^3/sec flows through it. Assume Manning's $\eta = 0.015$. For what range of depths will the flow be of type 1, 2 or 3? **(08 Marks)**

Module-4

7 a. A Pelton wheel is working under a head of 45 m and the discharge is 0.8 m^3/sec. The mean bucket speed is 14 m/sec. Find the overall efficiency and power produced if the Jet is deflected by the blades through an angle of 165°. Assume coefficient of velocity = 0.985 and mechanical efficiency $\eta_m = 0.95$. **(08 Marks)**

b. Derive an expression for a Jet striking a series of moving curved vanes at centre. Also find the condition for maximum efficiency of jet and maximum efficiency. **(08 Marks)**

OR

8 a. Give brief descriptions of classification of turbines. **(04 Marks)**

b. A Jet of water having a velocity of 45 m/sec impinges without shock on a series of vanes moving at 15 m/sec. The direction of motion of vanes being inclined at 20° to that of the jet. The relative velocity at outlet is 0.9 of that at inlet, and absolute velocity of water at exit is to be normal to motion of vanes. Find

(i) Vane angles at entrance and exit.
(ii) Workdone on vanes per unit weight of the water supplied by the jet.
(iii) The hydraulic efficiency. **(08 Marks)**

c. State and explain impulse momentum equation. **(04 Marks)**

Module-5

9 a. A Kaplan turbine produces 60000 kW under a net head of 25 m with an overall efficiency of 90%. Taking the value of speed ratio as 1.6 and flow ratio as 0.5 and hub diameter as 0.35 times the outer diameter, find the diameter and speed of turbine. **(08 Marks)**

b. What is a draft tube? List the functions of draft tube. Explain different types of draft tube with appropriate diagram. **(08 Marks)**

OR

10 a. With a neat diagram, explain principle, components and working of centrifugal pumps. **(08 Marks)**

b. A centrifugal pump has the following characteristics: Outer diameter of impeller = 800 mm. Width of impeller at outlet = 100 mm. Angle of impeller at outlet = 40°. The impeller runs at 550 rpm and delivers 0.98 m^3/sec of water under an effective head of 35 m. A 500 kW is motor is used to drive the pump. Determine manometric, mechanical and overall efficiencies of the pump. Assume water enters the impeller vanes radially at inlet. **(08 Marks)**

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CBCS SCHEME

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15CV45

Fourth Semester B.E. Degree Examination, Aug./Sept.2020
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. Differentiate between : i) Water content and degree of saturation. ii) Air content and percentage air voids iii) Specific gravity and mass specific gravity. **(06 Marks)**

b. With usual notations, derive the relation $\gamma = \frac{(G+Se)\gamma_w}{1+e}$. **(04 Marks)**

c. A saturated soil has a total volume of 130CC, total mass of 240g and oven dry mass of 180g. using fundamentals, calculate i) Water content ii) Specific gravity of soil solids and iii) Voids ratio of soil. **(06 Marks)**

OR

2 a. What are the three corrections to be applied to the hydrometer reading in the sedimentation analysis? Explain briefly. **(06 Marks)**

b. With a neat sketch, explain the use of 'Plasticity chart' in classifying the fine grained soils as per Indian standards. **(05 Marks)**

c. A soil has particles 86% finer than 4.75mm 7% finer than 75 microns, $C_u = 6.8$, $C_c = 1.4$, Liquid limit = 60% , Plastic limit = 25%. Classify the soil as per I.S. **(05 Marks)**

Module-2

3 a. Explain the clay minerals – Kaolinite and Montmorillonite using neat sketches of their structures. **(06 Marks)**

b. The data from a standard compaction test on a soil is given below :

Water Content %	8.5	12.2	13.75	15.5	18.2	20.2
Bulk Unit weight γ kN/m^3	17.64	19.0	19.6	20.09	19.89	19.4

i) Plot the compaction curve and determine OMC and MDD.
ii) Determine the degree of saturation at OMC.
iii) What is the range of water content to be used in field to achieve 95% relative compaction? **(10 Marks)**

OR

4 a. What are the factors affecting compaction? Explain any two of them. **(06 Marks)**

b. Compare I.S Light compaction test and I.S Heavy compaction test. **(04 Marks)**

c. A highway embankment is required to be constructed with a bulk unit weight of 20.34kN/m^3 at a water content of 13% for a total volume of 8000m^3. How much soil is required from a borrow pit which has a bulk unit weight of 19kN/m^3 and water content of 8%. Also calculate the extra water to be added. **(06 Marks)**

Module-3

5 a. State the Darcy's law along with the assumptions used. **(06 Marks)**

b. Derive the formula to determine the coefficient of permeability in falling head permeability test. **(06 Marks)**

c. During a variable head permeability test the water head dropped from 120cm to 100cm in 4 minutes. What would be the water head after another 4 minutes? **(04 Marks)**

OR

6 a. What are the characteristics of flow – net? **(04 Marks)**

b. Derive the formula to calculate seepage loss through isotropic soil below a concrete dam. **(06 Marks)**

c. The soil profile at a site is shown in the figure below. Calculate and draw the variation of σ, u and σ'. **(06 Marks)**

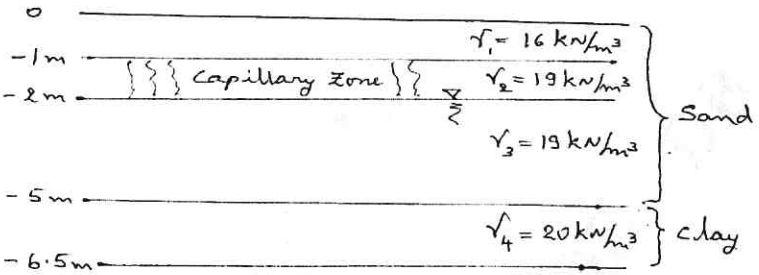


Fig.Q6(c)

Module-4

7 a. Define the following : i) N.C clay ii) O.C clay and iii) U.C clay. **(06 Marks)**

b. Explain with neat sketches the "Square Root of time method" to determine the coefficient of consolidation in the laboratory. **(06 Marks)**

c. A clay specimen 20mm thick has reached 50% consolidation in 6 hours under double drainage. What will be the time taken for the same clay in the field to reach 90% consolidation under double drainage , if the clay layer is 2m thick. **(04 Marks)**

OR

8 a. Differentiate between the following :

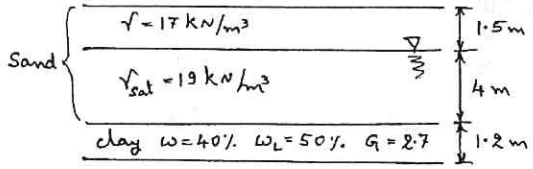
i) Compression Index and Coefficient of consolidation.

ii) Coefficient of compressibility and coefficient of volume compressibility. **(04 Marks)**

b. What is Pre – consolidation pressure? How is it determined by Casagrande's method? **(06 Marks)**

c. Calculate the primary consolidation settlement of the clay layer shown in the fig.Q8(c) , if the increase in effective stress is 15kN/m^2 at the centre of clay layer. **(06 Marks)**

Fig.Q8(c)



Module-5

9 a. Derive the relation between major and minor principal stresses in a Triaxial test with a neat sketch. **(06 Marks)**

b. The data from direct shear tests on a soil are given below. Shear box has internal dimensions of 60mm × 60mm. Plot the graph and determine the shear parameters. If the same soil is tested in Triaxial compression with a cell pressure of 100kN/m^2, what will be σ_1 at failure? **(10 Marks)**

Normal load (KN)	100	200	300
Shear force at failure (KN)	90	181	270

OR

10 a. What are the advantages and disadvantages of Direct shear test compared to Triaxial test? **(06 Marks)**

b. Consolidated undrained tests were done on a soil. Given the following data , determine the shear strength parameters based on : i) Total stresses and ii) Effective stresses. **(10 Marks)**

Cell pressure (kN/m^2)	150	300
Diameter stress at failure (kN/m^2)	102	200
Pore water pressure (kN/m^2)	80	156

CBCS SCHEME

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15CV46

Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
Advanced Surveying

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. With a neat sketch, derive an expression for following elements of a simple curve:
(i) Mid-ordinate (ii) External distance (iii) Long chord **(06 Marks)**

b. Calculate the ordinates at 10 m distances for a circular curve having a long chord 80 m and a versed size of 4 m. **(10 Marks)**

OR

2 a. List any four requirements of a transition curve. **(04 Marks)**

b. What are vertical cuves and why are they used? **(04 Marks)**

c. Two straight lines with a total deflection angle of 72° 30′ are to be connected by a compound curve of branches of equal length. The radius of the first arc is 350 m and that of the second arc is 500 m. The chainage of the vertex is 1525 m. Find the chainages of two tangent points and point of compound curvature. **(08 Marks)**

Module-2

3 a. List the criteria for selecting site for a triangulation station. **(04 Marks)**

b. Explain the concept of reduction to centre. **(04 Marks)**

c. What is a well conditioned triangle? Show that the bare angle for the best shaped triangle is 56°14′. **(08 Marks)**

OR

4 a. Explain : (i) Independent and dependent quantities.
(ii) Direct and indirect observation. **(04 Marks)**

b. Explain the three kinds of errors in measurements. **(04 Marks)**

c. Find the most probable values of angles M and N from following observations at station A.
M = 9°48′36.6″ weight 2
N = 54°37′48.3″ weight 3
M + N = 104°26′28.5″ weight 4 **(08 Marks)**

Module-3

5 a. Define the following terms :
(i) Zenith and Nadir.
(ii) Celestial sphere.
(iii) Spherical triangle.
(iv) Celestial Horizon. **(08 Marks)**

b. Find the shortest distance between two places A and B in kilometers, given that the latitudes of A & B are 15°0′ N and 12°6′ N and their longitudes are 50°12′ E and 54°0′ E respectively. Radius of Earth is 6370 km. **(08 Marks)**

OR

6 a. Explain Napier's rule of circular parts. **(08 Marks)**

b. What are the coordinate systems for specifying the position of a celestial body? Explain in brief. **(08 Marks)**

Module-4

7 a. List any six applications of aerial photogrammetry. **(06 Marks)**

b. Explain the following terms:

(i) Flying height (ii) Exposure station (iii) Vertical photograph

(iv) Tilted photograph (v) Oblique photograph **(10 Marks)**

OR

8 a. Explain in detail step by step procedure of aerial surveying. **(08 Marks)**

b. Derive an expression for scale of a vertical photograph. **(08 Marks)**

Module-5

9 a. Explain the working principle of total station. Also explain the three fundamental measurements in a total station. **(08 Marks)**

b. Define remote sensing and list its applications in different fields. **(08 Marks)**

OR

10 a. Write a note on EDM instruments. **(04 Marks)**

b. Explain the application of integrating remote sensing and GIS. **(12 Marks)**

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CBCS SCHEME

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15CV42

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

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

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

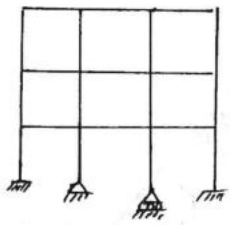

Fig Q1(a) – i)

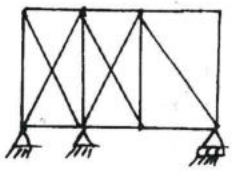

Fig Q1(a) – ii)

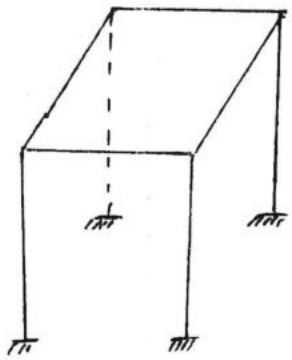

Fig Q1(a) – iii) **(08 Marks)**

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

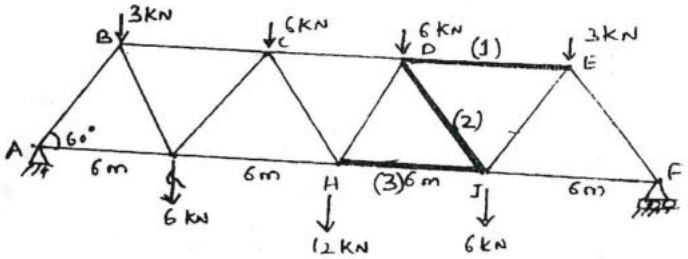

Fig Q1(b) **(08 Marks)**

OR

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

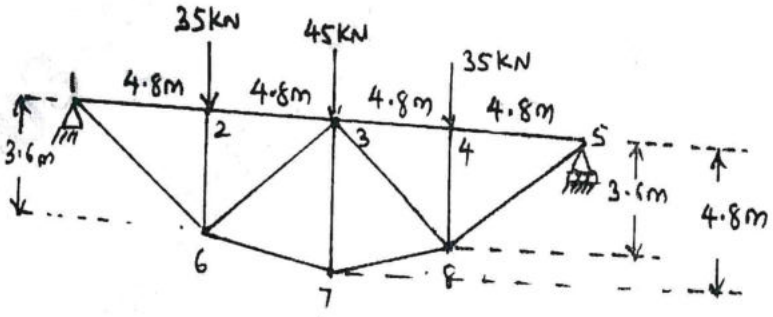

Fig Q2 **(16 Marks)**

Module-2

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

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

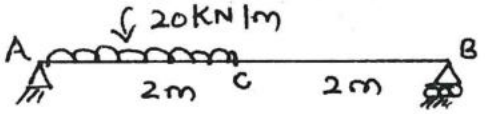

Fig Q3(b) **(10 Marks)**

OR

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

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

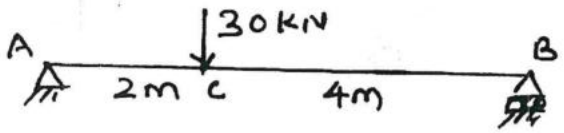

Fig Q4(b) **(10 Marks)**

Module-3

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

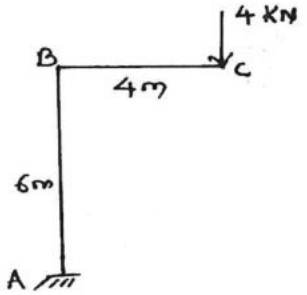

Fig Q5(a) **(12 Marks)**

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

OR

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

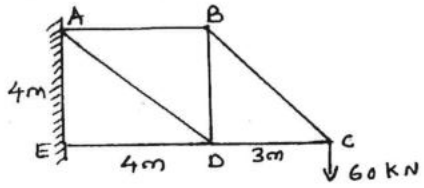

Fig Q6 **(16 Marks)**

Module-4

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

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

OR

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

Module-5

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

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

OR

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

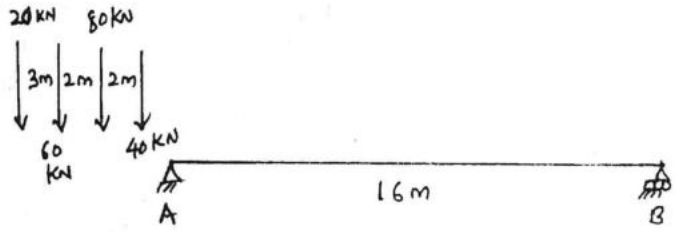

Fig Q10(a) **(08 Marks)**

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

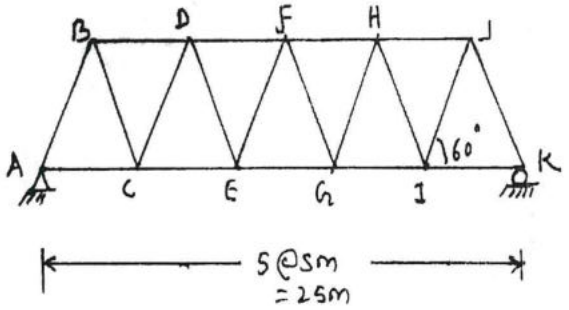

Fig Q10(b) **(08 Marks)**

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CBCS SCHEME

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15CV43

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

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

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

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

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

OR

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

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

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

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

Module-2

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

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

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

OR

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

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

Module-3

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

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

OR

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

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

Module-4

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

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

OR

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

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

Module-5

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

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

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

OR

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

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

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

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CBCS SCHEME

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15CV45

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

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

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

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

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

OR

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

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

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

Module-2

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

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

OR

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

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

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

Module-3

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

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

OR

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

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

Module-4

7 a. Explain Mass-Spring Analogy. **(08 Marks)**

b. Explain over consolidated soil, normally consolidated soil and under consolidated soil. **(08 Marks)**

OR

8 a. Explain square root of time fitting method. **(06 Marks)**

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

Module-5

9 a. Explain Mohr–Coulomb failure theory of soil. **(04 Marks)**

b. What are the factors affecting the shear strength of soil. **(04 Marks)**

c. A direct shear test was conducted on a soil and the following results were obtained.

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

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

OR

10 a. Explain the list procedure involved in conducting the direct shear list on soil. **(06 Marks)**

b. Define thixotrophy and sensitivity. **(04 Marks)**

c. When an unconfined compression test is conducted on a cylinder of soil, it fails under an axial stress of $120kN/m^2$. The failure plane makes an angle of 50° with the horizontal. Determine the cohesion and the angle of internal friction of soil. **(06 Marks)**

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CBCS SCHEME

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15CV46

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

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

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

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

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

OR

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

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

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

Module-2

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

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

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

OR

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

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

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

$A = 45°30'10''$ weight 2

$B = 40°20'20''$ weight 3

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

Module-3

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

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

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

OR

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

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

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

Module-4

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

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

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

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

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

OR

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

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

Module-5

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

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

OR

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

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

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CBCS SCHEME

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17CV42

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.***

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

Module-1

1 a. 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)**

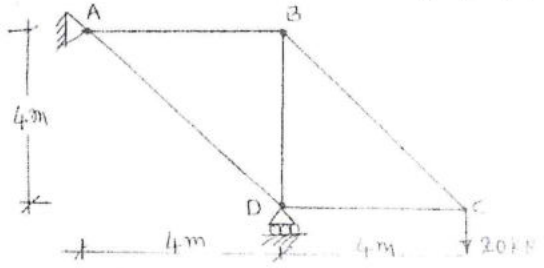

Fig. Q1 (c)

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)**

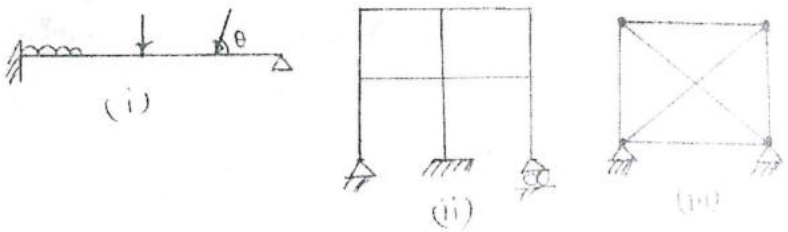

Fig. Q2 (b)

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)**

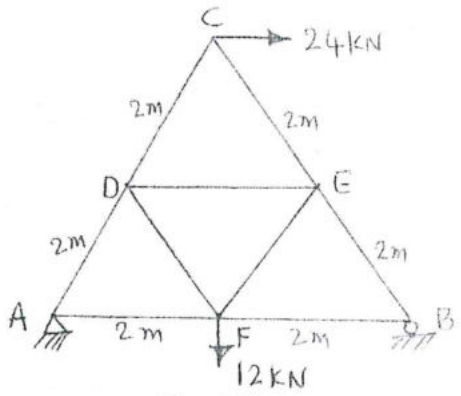

Fig. Q2 (c)

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)**

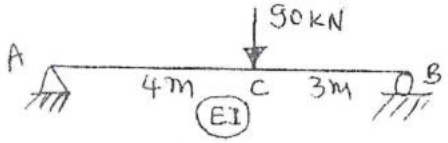

Fig. Q3 (c)

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)**

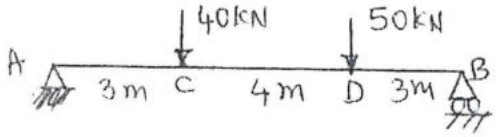

Fig. Q4 (c)

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)**

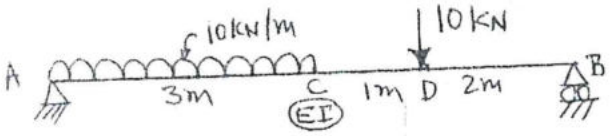

Fig. Q5 (c)

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)**

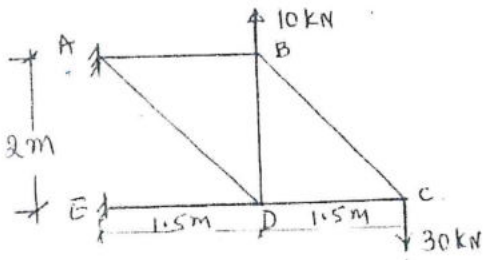

Fig. Q6 (c)

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)**

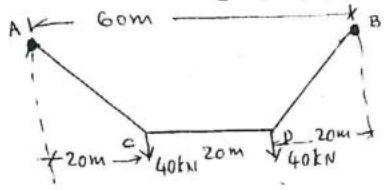

Fig. Q7 (b)

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)**

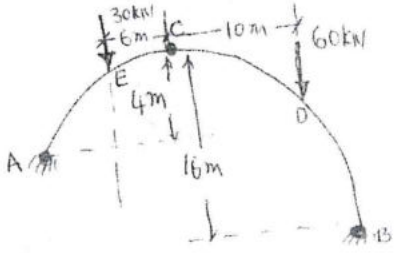

Fig. Q8 (b)

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)**

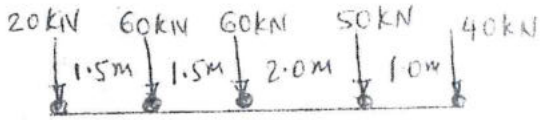

Fig. Q9 (b)

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)**

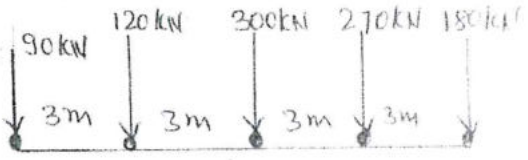

Fig. Q10 (c)

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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.

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

Module-1

1 a. 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

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

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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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.***

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

Module-1

1 a. 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.

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

Module-1

1 a. 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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15CV42

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

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

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

1 a. Distinguish between determinate and indeterminate structures with examples. **(06 Marks)**

b. Determine the degree of static indeterminacy for the structures shown in Fig. Q1 (b). **(10 Marks)**

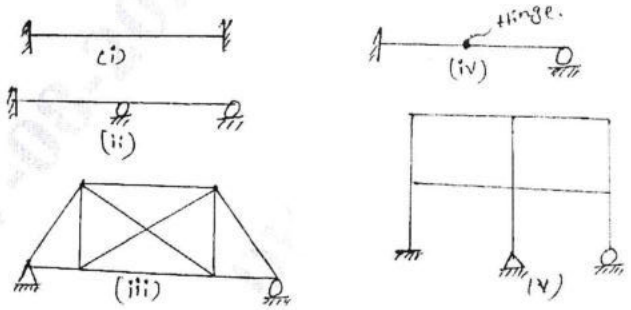

Fig. Q1 (b)

2 Determine the forces in all the members of the truss shown in the Fig. Q2, by the method of joints and verify the forces in members DB, EC and DC by the method of sections. **(16 Marks)**

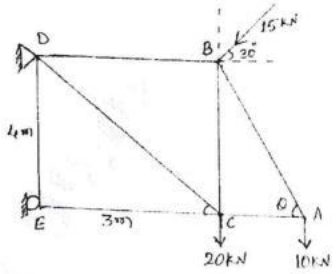

Fig. Q2

3 a. Determine the slope and deflection at the free end for the Cantilever beam shown in Fig. Q3 (a). Using moment area method. **(08 Marks)**

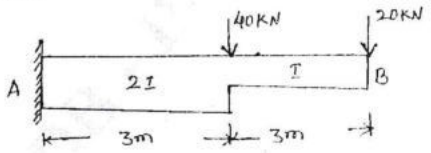

Fig. Q3 (a)

b. Find the deflection under loads and at mid span for the beam shown in Fig. Q3 (b) by conjugate beam method. Also find slope at the supports. **(08 Marks)**

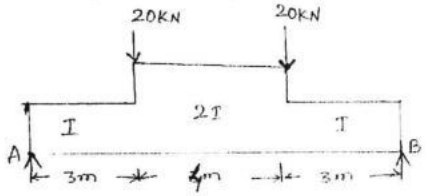

Fig. Q3 (b)

4 a. A Cantilever beam of span 6 m subjected to udl of 20 kN/m over entire span. Determine slope and deflection at free end. Using Double Integration method. **(06 Marks)**

b. A simply supported beam AB of span 7 m and carries a point load of 100 kN at a distance of 4 m from left end A as shown in Fig.Q4 (b). Find the deflection under the load and also maximum deflection in the beam. Using Double Integration Method. **(10 Marks)**

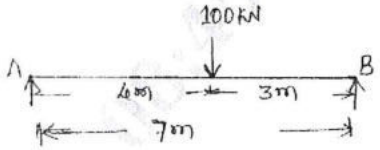

Fig. Q4 (b)

5 A steel truss of span 6 m is loaded as shown in Fig. Q5. The cross sectional area of each member is 500 mm^2. Calculate the vertical deflection at joint B. Take E = 200 GPa. **(16 Marks)**

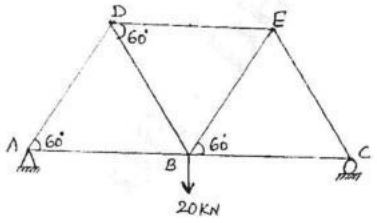

Fig. Q5

6 a. Obtain an expression for strain energy stored in a member when it is subjected to bending. **(06 Marks)**

b. Find the value of vertical and horizontal deflection at 'D' for the structure shown in Fig. Q6 (b) by Castiglione's theorem. **(10 Marks)**

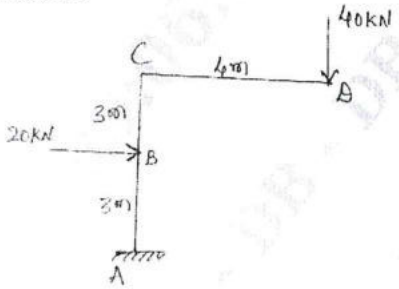

Fig. Q6 (b)

7 A three hinged parabolic arch has a span of 20 m and a rise of 5 m. It carries a udl of 2 kN/m over the left half of the span and a point load of 12 kN at 5 m from the right end. Find the B.M, normal thrust and radial shear at a section 4 m from left end. Draw BMD. **(16 Marks)**

8 A cable is suspended between two points A and B, 100 m apart and a central Dip of 8 m. It carries udl of 20 kN/m.

Determine

(i) Length of the cable.

(ii) Maximum and minimum tension in the cable.

(iii) Size of the cable, if the permissible stress of the cable material is 200 N/mm^2.

(iv) Calculate forces in the tower for both conditions. Take $\theta_A = 25^\circ$. **(16 Marks)**

9 a. What is an Influence line? Explain its importance in structural analysis. **(06 Marks)**

b. An N-type girder of span 12 m has to be designed for the member force CI as shown in Fig. Q9 (b). Draw ILD for member CI. **(10 Marks)**

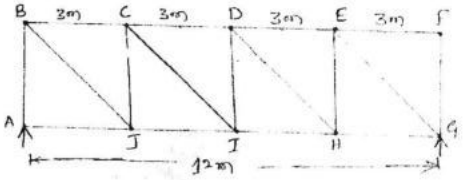

Fig. Q9 (b)

10 a. Using I.L , determine the B.M and S.F at 'X'. Due to the given system of loads as shown in Fig. Q10 (a). **(06 Marks)**

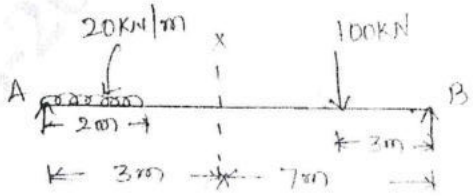

Fig. Q10 (a)

b. For a simply supported beam of span 28 m with the multiple points loads system as shown in Fig. Q10 (b). Compute the following by ILD principles.

(i) Maximum +ve and – ve SF at a section 12 m from left.

(ii) Maximum bending moment at a section 12 m from left. **(10 Marks)**

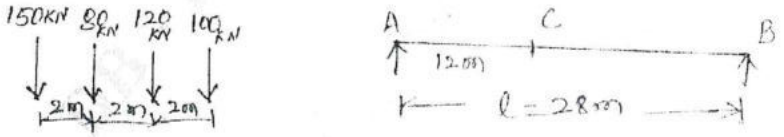

Fig. Q10 (b)

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15CV43

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

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions.

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

1 a. State the advantages of dimensional analysis. **(03 Marks)**

b. Define the terms: (i) A model (ii) Prototype and state the difference between distorted models and undistorted models. **(06 Marks)**

c. Find the volume of water displaced and position of centre of Buoyancy for a Wooden block of width 2.5 m and depth 1.5 m, when it floats horizontally in water. The density of wooden block is 650 kg/m^3 and its length 6m. **(07 Marks)**

2 a. State the Buckingham, π theorem and mention the advantages. **(04 Marks)**

b. A model of spillway is made to test in the laboratory. The discharge and the velocity of flow over the model is measured as 2.5 m^3/s and 1.5 m/s respectively. Find the discharge and the velocity over the prototype, which is 50 time larger than its model. **(06 Marks)**

c. Define:
(i) Geometric similarity
(ii) Kinematic similarity
(iii) Buoyancy
(iv) Metacentre **(06 Marks)**

3 a. What do you mean by conveyance of a channel section? **(02 Marks)**

b. A flow of water of 100 ℓps flows down in a rectangular flume of width 600 mm and having adjustable bottom slope. If Chezy's C = 56, find the bottom slope necessary for uniform flow with a depth of flow of 300 mm. **(06 Marks)**

c. Define specific energy. Draw specific energy curve and obtain an expression for critical depth and critical velocity. **(08 Marks)**

4 a. What do you mean by most efficient channel section? **(02 Marks)**

b. A Trapezoidal channel with side slopes 1:1 has to be designed to convey 10 m^3/s at a velocity of 2 m/s. So that the amount of concrete lining for the bed and sides is the minimum. Calculate:
(i) Area of lining required for 1m length of the channel
(ii) Bed slope of the channel if, N = 0.015. **(06 Marks)**

c. Derive Chezy's equation for discharge through uniform flow in an open channel. **(08 Marks)**

5 a. Derive the dynamic equation governing Gradually Varied Flow (GVF). **(08 Marks)**

b. In Hydraulic Jump occurring in a rectangular horizontal channel, the discharge per unit width is 2.5 m^3/s/m and the depth before the jump is 0.25 m. Compute : (i) Sequent depth (ii) Energy loss **(08 Marks)**

6 a. Explain the classification of surface profiles in an open channel with neat sketches. **(10 Marks)**

b. A rectangular channel with a bottom width of 4.0 m and a bottom slope of 0.0008 has discharge of 1.5 m^3/s. In a GVF, in this channel, the depth at a certain location is found to be 0.30 m. Assuming n = 0.016, determine the type of GVF profile. **(06 Marks)**

7 a. State Impulse Momentum Principle and give the Impulse Momentum Equation. **(02 Marks)**

b. Prove that the workdone per second by a jet striking on a series of moving curved radial vane is $\rho_{av_1} [Vw_1u_1 \pm Vw_2u_2]$ **(08 Marks)**

c. Two jets strike the buckets of a pelton wheel, which is having shaft power as 15450 KW. The diameter of each jet is 200 mm. If the net head of the turbine is 400 m. find the overall efficiency. Assume $C_V = 1$. **(06 Marks)**

8 a. Define (i) Absolute velocity (ii) Relative velocity, in the concept of velocity triangle. **(02 Marks)**

b. Draw a neat sketch of a layout of hydroelectric power plant and name the each component and different heads. **(06 Marks)**

c. A 15 cm diameter jet moving at 30 m/s impinges on a series of vanes moving at 15 m/s in the direction of the jet. The jet leaves the vanes at 60° with the direction of motion of the vanes, calculate:

(i) The force excerted by the jet in the direction of motion of the vanes.

(ii) Workdone by the jet/sec **(08 Marks)**

9 a. Define draft tube and mention its function. Draw the neat sketches of different types of draft tubes. **(06 Marks)**

b. What do you mean by minimum starting speed of a centrifugal pump? Give an expression for the same. **(04 Marks)**

c. A centrifugal pump delivers water against a net head of 10 m at 1000 rpm. The vanes are curved backwards and make an angle of 30° with the tangent at outer pheriphery. The impeller diameter is 30 cm and width is 5 cm at outlet. Determine the discharge if the manometric efficiency is 95%. **(06 Marks)**

10 a. What do you mean by multistage centrifugal pump? Distinguish between pumps in series and pumps in parallel. **(07 Marks)**

b. Define: (i) Unit head (ii) Unit discharge (iii) Unit power **(03 Marks)**

c. A Kaplan turbine develops 15000 KW power at a head of 30 m. The diameter of the boss is 0.35 times the diameter of the runner. Assuming a speed ratio of 2.0, a flow ratio of 0.65 and an overall efficiency of 90%. Calculate:

(i) Diameter of the runner

(ii) Rotational speed

(iii) Specific speed **(06 Marks)**

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CBCS SCHEME

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15CV45

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

Time: 3 hrs. Max. Marks: 80

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

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

1 a. With the help of 3-phase diagram, define Void ratio, Porosity, Water content and degree of saturation. **(08 Marks)**

b. A partially saturated soil sample obtained from an earthfill has a natural moisture content of 22% and a unit weight of 19.62 KN/m^3. Assuming G = 2.7, compute degree of saturation and void ratio. If subsequently the soil gets saturated, determine its unit weight. **(08 Marks)**

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

b. Liquid limit test on a clayey sample gave the following results. The plastic limit of the soil is 20%.

No. of blows	12	18	22	34
Water content, %	56	52	50	45

Plot flow curve and obtain liquid limit, flow index, plasticity index and toughness index. **(08 Marks)**

3 a. Define diffuse double layer and exchangeable ions with neat sketch. **(08 Marks)**

b. Explain the following clay minerals with neat sketches of their basic structural units:
(i) Kaolinite
(ii) Montmorillonite. **(08 Marks)**

4 a. Discuss the effect of compaction on different soil properties. **(06 Marks)**

b. Differentiate between standard and modified proctor tests. **(04 Marks)**

c. The observations of a standard Proctor's test are given below:

Dry density, KN/m^3	16.16	17.06	18.61	18.95	18.78	17.13
Water Content, %	5.02	8.81	11.25	13.05	14.40	19.25

(i) Plot compaction curve and determine OMC.
(ii) Also compute void ratio and degree of saturation at OMC. Take G = 2.77 **(06 Marks)**

5 a. What are the assumptions and limitations of Darcy's law? **(08 Marks)**

b. Explain with a neat sketch the method of locating the phreatic line in a homogeneous earth dam with horizontal filter. **(08 Marks)**

6 a. What is a flownet? Briefly explain the characteristics and user of flownets. **(08 Marks)**

b. A clay structure of thickness 8 m is located at a depth of 6 m below the ground surface, it is overlayed by fine sand. The water table is located at a depth of 2 m below ground surface. For find sand submerged unit weight is 10.2 KN/m^3. The moist unit weight of sand located above the water table is 16 KN/m^3. For clay layer G = 2.76 and W = 25%. Compute the effective stress at the middle of clay layer. **(08 Marks)**

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

b. How preconsolidation pressure is determined by casagrande's method? **(06 Marks)**

c. A soil sample 2 cms thickness takes 20 minutes to reach 20% consolidation. Find the time for a clay layer 6 cms thick to reach 40% consolidation. Assume double drainage in both the cases. **(04 Marks)**

8 a. What are curve fitting methods used in consolidation test? Explain any one with a neat sketch. **(08 Marks)**

b. There is a bed of compressible clay of 4 m 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 hours. The specimen was 20 mm thick. Estimate the time in years for the building founded over this deposit to reach 90% of its final settlement. **(08 Marks)**

9 a. What are the advantages and disadvantages of direct shear test over triaxial shear test? **(08 Marks)**

b. Explain sensitivity and thixotropy of clay. **(08 Marks)**

10 a. Explain Mohr-Coulomb failure theory of soil. **(06 Marks)**

b. What are the factors affecting shear strength of soil? **(04 Marks)**

c. In a shear test conducted on river sand, the following results were obtained:

Normal stress, KN/m^2	22.2	44.4	66.7	88.9
Shear stress, KN/m^2	13.9	28.06	41.4	55.8

Determine C and ϕ. **(06 Marks)**

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CBCS SCHEME

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15CV46

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

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions.*

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

1 a. With the help of a neat sketch differentiate between Apex distance and Mid ordinate. Also derive their expressions. **(06 Marks)**

b. The first branch of a reverse curve has a radius of 200 m. Find the radius of second branch, so that the curve can connect parallel straights 18 m apart. The distance between tangent points is to be 110 m. Also calculate the lengths of two branches of the curve. **(10 Marks)**

2 a. What is a transition curve? List the conditions to be fulfilled by a transition curve. **(06 Marks)**

b. Tabulate the necessary data to set out a right handed simple circular curve in the field having a radius of 250 m, connecting two straights which deflects at an angle of 30° at chainage 1250 m by Rankine's method. Take Peg interval of 20 m and least count of the instrument as 20″. **(10 Marks)**

3 a. What is meant by reduction to centre? Derive an expression for reducing the angles measured at the satellite station to the main station (any one case). **(08 Marks)**

b. Find the most probable values of the angles A and B from the following observations at a station 'O'.

$A = 49°48'36.6''$ weight 2

$B = 54°37'48.3''$ weight 3

$A + B = 104°26'28.5''$ weight 4 **(08 Marks)**

4 a. Enumerate the various laws of weights. **(07 Marks)**

b. The following are mean values 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

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

$\alpha + \beta + \gamma = 262°18'10.4''$ with weight 1

Calculate the most probable value of each angle. **(09 Marks)**

5 a. Explain the following terms:

(i) Celestial sphere.
(ii) Zenith and Nadir.
(iii) Latitude and co-latitude.
(iv) Azimuth and Declination. **(08 Marks)**

b. Determine the Azimuth and Altitude of a star from the following data:

(i) Declination of star = 20°30′ N
(ii) Hour angle of star = 42°6′
(iii) Latitude of the observer = 50°N **(08 Marks)**

6 a. Enumerate the various celestial co-ordinate systems. Explain Altitude and Azimuth system. **(08 Marks)**

b. Find the shortest distance between two places A and B, given that the longitudes of A and B are 15°0′ N and 12°6′ N and their longitudes are 50°12′ E and 54°0′ E respectively. Radius of earth = 6370 km. **(08 Marks)**

7 a. Explain the following terms :
(i) Tilted photograph.
(ii) Scale of a vertical photograph.
(iii) Stereoscope.
(iv) Flying height and Flight line. **(08 Marks)**

b. A vertical photograph was taken at an altitude of 1200 m above mean sea level. Determine the scale of the photograph for terrain lying at elevations of 80 meters and 300 metres if the focal length of the camera is 15 cm. Also find representative fraction. **(08 Marks)**

8 a. Write an explanatory note on overlaps and mosaics. **(06 Marks)**

b. Derive the expression for Relief Displacement on a vertical photograph. **(06 Marks)**

c. The scale of an aerial photograph is 1 cm = 100 m. The photograph size is $20\text{cm} \times 20\text{cm}$. Determine the number of photographs required to cover an area of $8\text{km} \times 12.5\text{km}$, if the longitudinal lap is 60 % and the side lap is 30%. **(04 Marks)**

9 a. Explain electromagnetic spectrum. State the wave length regions, along with their uses, for remote sensing applications. **(08 Marks)**

b. What do you understand by remote sensing? Differentiate between active and passive remote sensing. **(08 Marks)**

10 a. What is GIS? Enumerate the techniques used in GIS. What are the advantages of GIS? **(08 Marks)**

b. What is LIDAR? List out its components. Briefly outline its benefits. **(08 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.

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

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)]

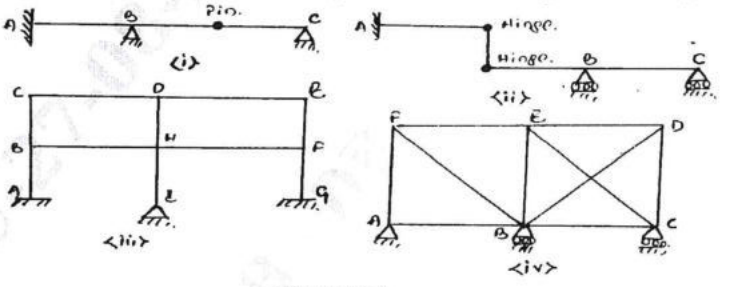

Fig.Q1(c) **(08 Marks)**

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

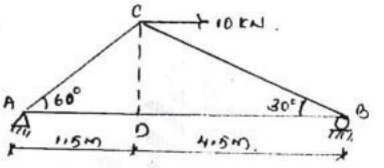

Fig.Q1(d)

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)**

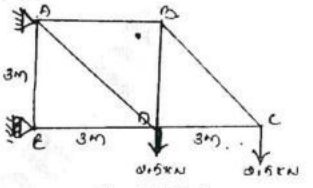

Fig.Q2(b)

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)]

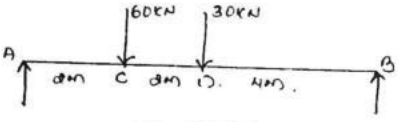

Fig.Q3(b) **(12 Marks)**

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

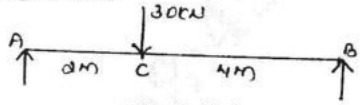

Fig.Q4(a)

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

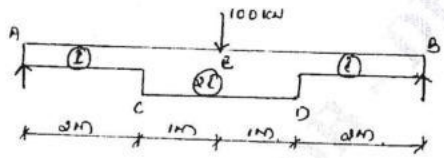

Fig.Q4(b)

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)**

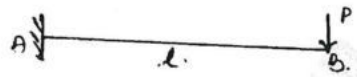

Fig.Q5(b)

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

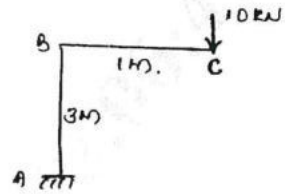

Fig.Q5(c)

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)**

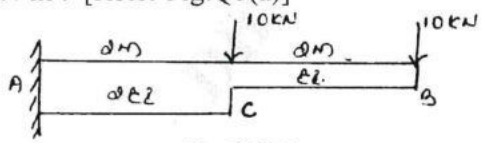

Fig.Q6(a)

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'.

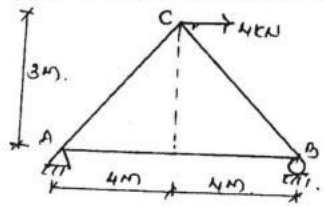

Fig.Q6(b) **(10 Marks)**

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)]

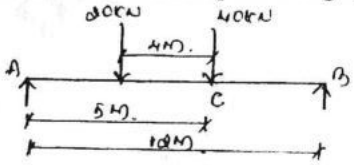

Fig.Q9(a) **(10 Marks)**

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.

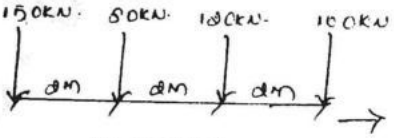

Fig.Q10(b) **(16 Marks)**

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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.***

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

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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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.***

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

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.***

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

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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