

Hall Ticket Number :										
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R-20

Code: 20A133T
II B.Tech. I Semester Regular & Supplementary Examinations December 2023
Fluid Mechanics and Hydraulic Engineering
(Civil Engineering)
Max. Marks: 70
Time: 3 Hours

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. In Part-A, each question carries **Two marks**.
3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A
(Compulsory question)

- | | | |
|--|----|----|
| 1. Answer <i>all</i> the following short answer questions (5 X 2 = 10M) | CO | BL |
| a) Why viscosity of gases increases with increase temperature? | 1 | 1 |
| b) What is difference between rotational flow and irrotational flow of fluids? | 2 | 1 |
| c) What are Practical applications of Bernoulli's equation? | 3 | 1 |
| d) What is water hammer pressure in pipes? | 4 | 1 |
| e) What is the function of Surge tank? State its location? | 5 | 1 |

PART-B

Answer five questions by choosing one question from each unit (5 x 12 = 60 Marks)

Marks	CO	BL
-------	----	----

UNIT-I

- | | | | |
|--|----|---|---|
| 2. a) What is difference between Newtonian and Non Newtonian fluids? Explain the Newton's Law of Viscosity? | 6M | 1 | 2 |
| b) Calculate the capillary rise/fall in a glass tube of 2.5 mm in diameter when immersed in water and mercury. Take surface tension of water as 0.0725 N/m and for mercury is 0.52 N/m. The specific gravity of mercury is 13.6 and angle of contact is 130° | 6M | 1 | 3 |

OR

- | | | | |
|---|----|---|---|
| 3. a) What is centre of pressure? Derive an expression of centre pressure on inclined submerged plan surface | 6M | 1 | 6 |
| b) A Circular plate 3 m diameter is immersed in water in such way that the plane of the plate makes an angle of 60° with the free surface of water. Determine the total pressure and the position of the center of pressure when the upper edge of plate is 2 m below the free surface of the water | 6M | 1 | 3 |

UNIT-II

- | | | | |
|--|----|---|---|
| 4. a) Derive the continuity equation for three-dimensional flow. | 6M | 2 | 6 |
| b) A pipe (1) 450 mm in diameter branches into two pipes (2 and 3) of diameters 300 mm and 200 mm respectively. If the average velocity in 450 mm diameter pipe is 3 m/s find:
(i) Discharge through 450 mm diameter pipe
(ii) Velocity in 200 mm diameter pipe if the average velocity in 300 mm pipe is 2.5 m/s. | 6M | 2 | 3 |

OR

- | | | | |
|--|----|---|---|
| 5. a) Differential between stream function and velocity potential function? State their relationship | 6M | 2 | 2 |
|--|----|---|---|

- b) A stream function is defined by the expression $\psi = 2x^2 - 2y^3$. Calculate the components of velocity and velocity potential at point (3,1)

6M 2 3

UNIT-III

6. a) Derive Impulse- Momentum equation
- b) A 45° reducing bend is connected in a pipe line, the diameters at the inlet and outlet of the bend being 600mm and 300mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829N/cm² and rate of flow of water is 600litres/s.

6M 3 6

6M 3 3

OR

7. a) Write briefly and Sketch neatly the following i) Pitot tube and ii) Venturimeter
- b) A discharge of 0.06 m³/s was measured over a right-angled notch. While measuring the head over the notch, an error of 1.5mm was made. Determine the percentage error in the discharge, if the co-efficient of discharge for the notch is 0.6.

6M 3 1

6M 3 3

UNIT-IV

8. a) Using Hagen -Poiseuille equation, derive an expression for the head loss in a pipe of diameter D and length L in terms of Reynolds number and Velocity head
- b) Calculate the pressure drop and power required to maintain 0.05m³/s of petrol (Sp.gr. 0.7) through a steel pipe 0.2 m diameter and 1000 m long. Take coefficient of friction, $f = 0.0025$.

6M 4 6

6M 4 3

OR

9. a) Explain the Moody's chart and its significance in design of pipe flow problems
- b) A pipe line of 600 mm diameter is 1.5 km long. To increase the discharge, another line of the same diameter pipe is introduced parallel to the first in the second half of the length. If $f = 0.01$ and head at inlet is 300 mm. Calculate the increase in discharge

4M 4 2

8M 4 3

UNIT-V

10. a) Explain the working principle of pelton turbine with neat sketches
- b) What is Cavitation? Explain its causes, effects and remedies

6M 5 2

6M 5 2

OR

11. a) What is minimum starting speed of centrifugal pump? Derive its basic equation
- b) A centrifugal pump delivers water against a net head of 14.5 m and design speed of 1000 rpm. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300 mm and outlet width 50 mm. Determine the discharge of the pump if the manometric efficiency is 95%.

6M 5 6

6M 5 3

*** End ***

Hall Ticket Number :									
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R-20

Code: 20AC36T
 II B.Tech. I Semester Regular & Supplementary Examinations December 2023
Managerial Economics and Financial Analysis
 (Common to CE & ECE)

Max. Marks: 70 Time: 3 Hours

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. In Part-A, each question carries **Two marks**.
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A
(Compulsory question)

- | | | |
|---|----|----|
| 1. Answer all the following short answer questions (5 X 2 = 10M) | CO | BL |
| a) What is Demand Schedule? | 1 | L1 |
| b) List out the determinants of cost | 2 | L1 |
| c) Briefly explain about monopoly. | 3 | L1 |
| d) What is profitability index | 4 | L1 |
| e) What is going concern concept? | 5 | L1 |

PART-B

Answer *five* questions by choosing one question from each unit (5 x 12 = 60 Marks)

- | | Marks | CO | BL |
|---|-------|----|----|
| UNIT-I | | | |
| 2. a) Define law of demand. What are its exceptions? Explain. | 6M | 1 | L2 |
| b) Explain nature and scope of Managerial economics. | 6M | 1 | L2 |

OR

- | | | | |
|--|-----|---|----|
| 3. Write a short note on the following. i) Survey Method
ii) Expert Opinion Method iii) Test Marketing | 12M | 1 | L2 |
|--|-----|---|----|

UNIT-II

- | | | | |
|---|----|---|----|
| 4. a) Define production. Explain the law of variable proportions of the production. | 6M | 2 | L2 |
| b) Explain Law of Returns to scale with appropriate examples. | 6M | 2 | L2 |

OR

- | | | | |
|--|----|---|----|
| 5. a) What do you mean by Iso-Quants? Explain the law of returns to scale of production. | 6M | 2 | L2 |
| b) Define Break-Even-Point. Explain Assumptions and uses of Break Even Analysis | 6M | 2 | L2 |

UNIT-III

- | | | | |
|---|-----|---|----|
| 6. Discuss why perfect Competition is better form of competition when compared to Monopoly. | 12M | 3 | L3 |
|---|-----|---|----|

OR

7. a) Explain the features of partnership company. What are its advantages and disadvantages? 6M 3 L2
- b) What are the different forms of business organizations? Comment on their relative merits and demerits. 6M 3 L2

UNIT-IV

8. From the following information calculate the net present value of the two projects and suggest which of the project should be accepted assuming a discounting rate is 10% (I year 0.909, II Year 0.857, III Year 0.751, IV Year 0.698, V Year 0.591)

	Project X	Project Y
Investment	Rs 20,000	Rs,30,000
Estimated Life	5 Years	5 years
Scrape value	Rs 1000	Rs 1000

Project cash flows are as follows

Year	Project X	Project Y
1	5,000	20,000
2	10,000	10,000
3	10,000	5,000
4	3,000	3,000
5	2,000	2,000

12M 4 L4

OR

9. What factors should a finance manager take into consideration while raising sources of capital? 12M 4 L2

UNIT-V

10. Journalize the following transactions in the books of Mr. Hari.
April 2022

1. Mr. Hari started business with cash Rs. 50,000.
2. Purchased furniture for cash Rs. 10,000.
4. Purchased goods for cash Rs. 25,000.
5. Bought goods from Mr. Kamallesh Rs. 15,000.
6. Sold goods for cash Rs. 36,000.
8. Sold goods to Mr. Ram for Rs. 30,000.
10. Paid cash to Mr. kamallesh Rs. 15,000.
14. Received cash from Mr. Ram Rs. 18,000.
16. Purchased goods from Mr. Sohan Rs. 6,000.
18. Paid rent for office Rs. 1,000.
26. Received commission Rs. 750.
27. Paid salary to Mr. Bopal Rs. 1,200

12M 5 L3

OR

11. The following trading and profit and loss account of a Fantasy Ltd. For the year 31/03/2011 is given below.

Particulars	Amount	Particulars	Amount
To Opening stock	76,250	By Sales	5,00,000
To Purchases	3,15,250	By Closing stock	98,500
To Carriage	2,000		
To Wages	5,000		
To Gross profit c/d	2,00,000		
Total	5,98,500	Total	5,98,500
To Administration expenses	1,01,000	By Gross profit b/d	2,00,000
To Selling and distribution expenses	12,000	By Non operating income (Profit on sale of shares)	6,000
To Non operating expenses	2,000		
To Financial expenses	7,000		
To Net profit c/d	84,000		
Total	2,06,000	Total	2,06,000

Calculate:

- Gross profit ratio
- Expenses ratio
- Operating ratio
- Net profit ratio
- Operating (net) profit ratio

*** End ***

12M 5 L3

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R-20

Code: 20AC31T
 II B.Tech. I Semester Regular & Supplementary Examinations December 2023
Partial Differential Equations and Numerical Methods
 (Common to CE & ME)

Max. Marks: 70 Time: 3 Hours

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. In Part-A, each question carries **Two marks**.
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A
(Compulsory question)

- | | | |
|---|-----|----|
| 1. Answer all the following short answer questions (5 X 2 = 10M) | CO | BL |
| a) Write the formula of Newton –Raphson method. | CO1 | L1 |
| b) Show that $(1 + \Delta)(1 - \nabla) = 1$ | CO2 | L1 |
| c) Write Simpsons 1/3 rule. | CO3 | L1 |
| d) Using Euler's method, find an approximate value of y corresponding to $x = 0.25$,
given that $\frac{dy}{dx} = 1 + xy$ and $y = 1$ when $x = 0$. | CO4 | L3 |
| e) Write One-dimensional Heat flow equation, Two-dimensional Laplace equation. | CO5 | L1 |

PART-B

Answer five questions by choosing one question from each unit (5 x 12 = 60 Marks)

Marks CO BL

UNIT-I

- | | | | |
|--|----|-----|----|
| 2. a) Find a root of the equation $x^3 - 4x - 9 = 0$ using bisection method correct to three decimal places. | 6M | CO1 | L4 |
| b) Find the root of the equation $x^3 + x^2 - 1 = 0$ by using Iteration method. | 6M | CO1 | L4 |

OR

- | | | | |
|---|----|-----|----|
| 3. a) Find a real root of the equation $\cos x = xe^x$ by using regula – falsi method correct to four decimal places. | 6M | CO1 | L4 |
| b) Using Newton-Raphson method, find a root of the equation $3x = \cos x + 1$. | 6M | CO1 | L3 |

UNIT-II

- | | | | |
|--|----|-----|----|
| 4. a) Given $\sin 45^\circ = 0.7071$, $\sin 50^\circ = 0.7660$, $\sin 55^\circ = 0.8192$, $\sin 60^\circ = 0.8660$, find $\sin 52^\circ$, using Newton's forward formula. | 6M | CO2 | L4 |
| b) Find the cubic polynomial which takes the following values | | | |

x	0	1	2	3
f(x)	1	2	1	10

6M CO2 L4

OR

5. a) Evaluate $f(9)$ by using Lagrange's formula with the following data

x	5	7	11	13	17
f(x)	150	392	1492	2366	5202

6M CO2 L5

- b) Find the missing term in the table

X	2	3	4	5	6
Y	45.0	49.2	54.1	-	67.4

6M CO2 L4

UNIT-III

6. Given that

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.0	13.625	24.0	38.875	59.0

Find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ at $x=1.5$ and $x=4.0$

12M CO3 L4

OR

7. Evaluate
- $\int_0^1 \frac{1}{1+x} dx$
- using

i) Trapezoid rule ii) Simpson's $1/3^{\text{rd}}$ rule and iii) Simpson's $3/8^{\text{th}}$ rule.

12M CO3 L5

UNIT-IV

8. Employ the Taylor's series method to find an approximate value of
- y
- at
- $x=0.1, 0.2, 0.3, 0.4$
- for the Differential equation
- $\frac{dy}{dx} = x^2 - y$
- ,
- $y(0) = 1$
- .

12M CO4 L4

OR

9. a) Using modified Euler's method, find an approximate value of
- y
- when
- $x = 0.2$
- given that
- $y' = y + e^x$
- ,
- $y(0) = 0$

6M CO4 L4

- b) Using Runge-kutta fourth order method, Solve
- $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$
- with
- $y(0) = 1$
- at
- $x = 0.2$

6M CO4 L3

UNIT-V

10. A string is stretched and fastened to two points
- l
- apart. Motion is started by displacing the string in the form
- $y = a \sin\left(\frac{f x}{l}\right)$
- from which it is released at time
- $t=0$
- . Show that the displacement of any point at a distance
- x
- from one end at time
- t
- is given by
- $y(x, t) = a \sin\left(\frac{f x}{l}\right) \cos\left(\frac{f c t}{l}\right)$

12M CO5 L3

OR

11. Solve the one-dimensional heat flow equation
- $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$
- given that
- $u(0, t) = 0$
- ,
- $u(l, t) = 0$
- and
- $u(x, 0) = 3 \sin\left(\frac{f x}{l}\right)$
- ,
- $0 < x < l$

12M CO5 L3

*** End ***

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R-20

Code: 20A132T

II B.Tech. I Semester Regular & Supplementary Examinations December 2023

Strength of Materials
(Civil Engineering)

Max. Marks: 70

Time: 3 Hours

- Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
 2. In Part-A, each question carries **Two marks**.
 3. Answer **ALL** the questions in **Part-A** and **Part-B**

PART-A

(Compulsory question)

- | | | |
|--|----|----|
| 1. Answer <i>all</i> the following short answer questions (5 X 2 = 10M) | CO | BL |
| a) What are elastic constants? List out these constants. | 1 | 1 |
| b) Write in brief about different loading conditions and supports for beams. | 2 | 1 |
| c) What is meant by section modulus of a section of a beam? | 3 | 1 |
| d) Write the equations for slope and deflection for a cantilever carrying a point load 'W' at the free end with a neat sketch. | 4 | 2 |
| e) Enlist the various theories of failures. | 5 | 2 |

PART-B

Answer five questions by choosing one question from each unit (5 x 12 = 60 Marks)

Marks CO BL

UNIT-I

- | | | | |
|---|-----|---|---|
| 2. A steel bar of 2 cm diameter and 20 cm length was subjected to a tension test. On applying a load of 20KN, the extension was found to be 0.0054 cm and the change in diameter was 0.00022 cm. Calculate the values of (i) Modulus of Elasticity (ii) Poisson's ratio and (iii) Change in Volume. | 12M | 1 | 3 |
|---|-----|---|---|

OR

- | | | | |
|---|-----|---|---|
| 3. A steel rod of 25 mm diameter passes through a brass tube of 25 mm internal diameter and 35 mm external diameter. The nut on the rod is tightened until a stress of 10 MPa is developed in the rod. The temperature of the tube is then raised by 60° C. What are the final stresses in the rod and the tube? Take $E_s=200\text{GPa}$ & $\alpha_s=0.000017/^\circ\text{C}$
$E_b=80\text{GPa}$ & $\alpha_b=0.000019/^\circ\text{C}$ | 12M | 1 | 3 |
|---|-----|---|---|

UNIT-II

- | | | | |
|--|-----|---|---|
| 4. A cantilever AB of length 4m is fixed at A and free at B. It carries a uniformly distributed load of 3KN/m over its entire span and a point load of 8KN at 1m from the free end. Draw SFD & BMD for the cantilever. | 12M | 2 | 3 |
|--|-----|---|---|

OR

5. An overhanging beam of length 8m, resting over two supports 5m apart at a distance of 1m from left end. The beam carries a UDL of 3.0 kN/m over its entire length. Draw S.F and B.M diagrams and find out the position of contra flexure. 12M 2 3

UNIT-III

6. An I-Section beam 340mmx200mm has a web thickness of 10mm and flange thickness of 20mm. It carries a shear force of 120KN. Sketch the shear stress distribution across the section 12M 3 3

OR

7. A rolled steel joint of I-Section has the following dimensions. Flange width=250mm, Flange thickness=25mm, Overall depth=600mm; Web thickness=12mm. Calculate the safe UDL per meter length of the beam, if the effective span is 8m and the maximum stress in the steel is 103 N/mm². 12M 3 3

UNIT-IV

8. A cantilever of 3m length and of uniform rectangular cross section 150 mm wide and 300 mm deep is loaded with a 30 KN load at its free end. In addition to this it carries a uniformly distributed load of 20 KN/m run over its entire length, calculate: (i) The maximum slope and maximum deflection. (ii) The slope and deflection at 2 m for the fixed end. Take $E = 210 \text{ GN/m}^2$ 12M 4 3

OR

9. The cross section of a joist is a rectangular section 120mm X 200mm, with 120mm side horizontal. Sketch the shear stress distribution and hence find the maximum shear stress if it has to resist a shear force of 200KN. 12M 4 3

UNIT-V

10. Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. At a point in a strained material, the principal stresses are 100N/mm² Tensile and 40 N/mm² compressive. What is the maximum intensity of shear stress in the material at that point? 12M 5 3

OR

11. Define and explain the following theories of failure:
 (i) Maximum principal strain theory
 (ii) Maximum shear strain theory. 12M 5 1

*** End ***

Hall Ticket Number :

R-20

Code: 20A131T

II B.Tech. I Semester Regular & Supplementary Examinations December 2023

Advanced Surveying

(Civil Engineering)

Max. Marks: 70

Time: 3 Hours

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)2. In Part-A, each question carries **Two marks**.3. Answer **ALL** the questions in **Part-A** and **Part-B****PART-A****(Compulsory question)**

1. Answer **all** the following short answer questions (5 X 2 = 10M)
- | | CO | BL |
|--|----|----|
| a) What are the different phases of surveying | 1 | 1 |
| b) Define the term line of collimation and list the different types of bench mark | 2 | 1 |
| c) What do mean by face left and right position in a theodolite instrument | 3 | 1 |
| d) List the difference between EDM and DEM | 4 | 1 |
| e) A vertical photograph was taken from a height of 2000m above MSL. Determine the scale of photograph for an area at an average elevation of 200m above MSL, if focal length of camera is 20cm. | 5 | 2 |

PART-BAnswer **five** questions by choosing one question from each unit (5 x 12 = 60 Marks)

Marks CO BL

UNIT-I

2. a) The following bearings were observed in running a compass traverse:

Line	Fore Bearing	Back Bearing
AB	66°15'	244°00'
BC	129°45'	313°00'
CD	218°30'	37°30'
DA	306°45'	126°45'

Find the correct fore, back bearing and true bearings of the lines, given that the magnetic declination is 1°30'E

6M 1 3

- b) Explain how will you continue chaining when the following were obstructed
- A Pond
 - A River
 - A Hill
 - A Tall building

6M 1 3

OR

3. a) Three ships '*P*', '*Q*' and '*R*' started sailing from Cochin at the same time. The speed of all the three ships was the same at 35kmph. The bearing was measured and found to be N 70°E, S60°E and S10°E respectively. After an hour the captain of the ship '*Q*' determined the bearing of the other two ships with respect to his own ship and calculated the distances. Calculate the bearings and distances which might have been determined by the captain of ship '*Q*'
- 6M 1 3
- b) Explain the classification of surveying based on purpose and instruments used.
- 6M 1 2

UNIT-II

4. a) The reduce level of ground at four points '*A*', '*B*', '*C*' and '*D*' are 54.35, 54.30, 54.20, 54.30m, respectively. A sewer is to be laid so that its invert is 3.048m below the ground at '*A*' and it falls with a uniform gradient of 1 in 400 to '*D*'. The distance '*AB*', '*AC*' and '*AD*' are 35.845, 80.742 and 134.7m respectively. Find the invert and depth of the trench at '*B*', '*C*' and '*D*'.
- 6M 2 3
- b) Describe briefly how leveling is carried out in the following cases:
(i) A small piece of land (ii) A large size land (iii) A borrow pit
- 6M 2 2

OR

5. a) The following staff readings were taken with a level 2.65, 3.74, 3.83, 5.27, 4.64, 0.38, 0.96, 1.65, 2.84, 3.48, 3.48, 4.68 and 4.26. The instrument was shifted after 4th, 7th and 10th reading. RL of the starting BM is 525.125m. Enter the reading in the form of level book page and reduce the level by rise and fall / collimation method and apply usual checks.
- 6M 2 3
- b) A railway embankment is made level for 180 m. the ground has a uniform slope of 1 in 12. The formation width is 9 m and the side slope is 2:1. The ground is level across the c/l of the embankment. Determine the volume of the embankment if the high end terminates vertically.
- 6M 2 3

UNIT-III

6. a) Discuss the types of errors can occur in theodolite work, and what methods or techniques are employed to mitigate or eliminate these errors?
- 6M 3 2
- b) Explain different methods of traversing with neat sketches.
- 6M 3 2

OR

7. a) Illustrate with neat sketches how Graphical and Bowditch's methods are used for adjusting the theodolite traverse survey.
- 6M 3 2

- b) Two instrument stations were selected 140m apart in the same vertical plane as the object. The vertical angles observed to the two stations were $10^{\circ}10'$ and $8^{\circ}20'$. The readings on a staff held at a bench mark of RL 250.00m were 2.35 and 1.05m from the stations, the instrument reading being higher for the station farther from the object. Find the RL of the object if the vertical angles were read on mark 4m from the ground.

6M 3 3

UNIT-IV

8. a) To determine the elevation of station Q in a tacheometer survey with anallatic lens, the following observations were made with the staff held vertical.

Instrument Station	H.I (m)	Staff Station	Vertical Angle	Staff Readings
O	1.55	B.M.	(-) 10°	1.335, 1.895, 2.460
O	1.55	C.P.	(+) $12^{\circ}30'$	0.780, 1.265, 1.745
Q	1.30	C.P.	(-) $9^{\circ}30'$	1.155, 1.615, 2.075

If R.L of B.M. is 450.555m, calculate R.L of P and find the slope from O to CP and CP to Q

6M 4 4

- b) Two tangents 'AB' and 'BC' intersect at a point 'B' at chainage 150.5m. Calculate all the necessary data for setting out a circular curve of radius 110m and deflection angle 30° by the method of offsets from the long chord.

6M 4 4

OR

9. a) Describe various techniques for addressing challenges encountered when setting out a circular curve
- b) To determine the gradients between two points 'A' and 'B' a tacheometer was set up at another station 'C' and the following observations were taken keeping the staff vertical.

6M 4 3

Staff at	Vertical angle	Stadia readings (m)
A	(+) $4^{\circ}20'0''$	1.300, 1.610, 1.920
B	(+) $0^{\circ}10'40''$	1.100, 1.410, 1.720

If the horizontal angle ABC is $35^{\circ}20'0''$, determine the average gradient between A and B. take ' $K=100$ ' and ' $C=0$ '

6M 4 4

UNIT-V

10. a) Discuss on how does DGPS enhance the accuracy and reliability of location data compared to traditional GPS, and what are some practical applications of DGPS technology in various industries

6M 5 2

- b) Explain the use of Total Station technology contribute to ensuring safe alignment in construction and infrastructure projects, and what are the best practices for implementing Total Station-based survey methods for enhanced safety 6M 5 2

OR

11. a) Explain the key challenges and advancements in ground radar penetration technology, and how does it impact fields such as geology, archaeology, and underground infrastructure assessment? 6M 5 2
- b) What advantages do drone-based surveys offer in maintaining safe alignment in critical infrastructure projects, and how can the integration of drones with surveying technologies improve safety protocols and risk assessment in the construction industry 6M 5 2

*** End ***