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SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

4/12/24

END SEM/RE-EXAM EXAMINATION DEC/JAN 2024-25

Program: B.Tech. (Civil) ENGINEERING Sem III

Duration: 3 Hours

Course Code: BS-BTC 302

Maximum Points: 100

Course Name: Engineering Geology

Semester: III

NOTE: Start a new question on a fresh sheet.

Q. No.	Questions	Points	CO	BL	Mo No.
1	a. Write a descriptive note on erosional and depositional landforms associated with fluvial landforms. OR b. What is weathering? Write a note on the types of physical weathering.	10	1	2	1
2	a. i. Define minerals. ii. Samples of white coloured calcite and quartz are to be differentiated. How would you differentiate them? You are provided with a hardness box and streak plate. iii. What are the properties of minerals that you will test in a hand sample? Explain it with an example. OR a. Define minerals. List out the types of habits in minerals with relevant examples. How would you differentiate between a yellow, transparent sample of quartz and fluorite?	10	1	1 and 2	2
3	Match the following features with the associated rocks. 1. Phaneritic, plutonic igneous rock **A. Basalt** 2. Aphanitic, volcanic igneous rock **B. Granite** 3. Very fine-grained sedimentary rock. **C. Conglomerate** 4. Large clasts embedded in a fine-grained matrix. **D. Phyllite** 5. Non-Foliated metamorphic rock. **E. Quartzite** 6. Foliated metamorphic rock. **F. Claystone/Siltstone** 7. Metamorphic composed of CaCO3. **G. Gneiss** 8. Sedimentary rock composed of CaCO3. **H. Marble** 9. Preferred orientation of mafic and felsic minerals arranged in separate layers. **I. Limestone** 10. Fine grained metamorphic rock with layers and facility. **J. Slate**	20	1	2	3

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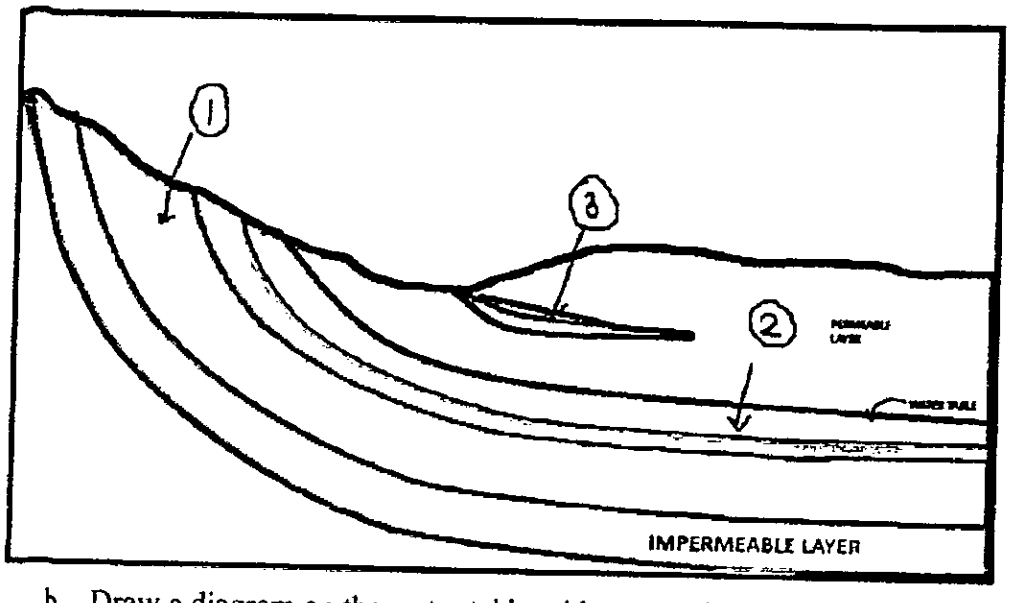
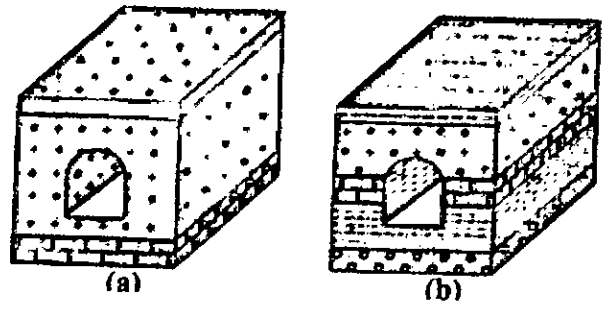
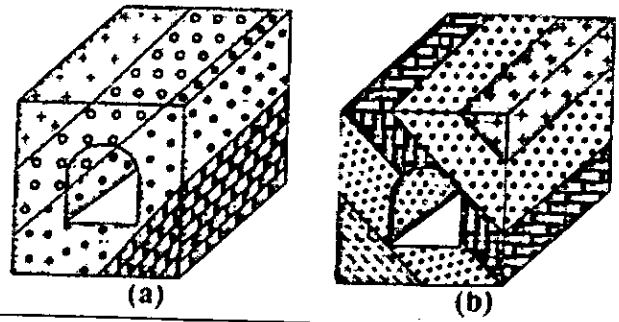
4	a. Draw the diagrams for antiform, anticline, syncline, and synform with ppropriate labels. b. Write a note on (any 3) 1. Principle of Inclusions. 2. Principle of order of superposition 3. Principle of lateral continuity 4. Principle of Uniformitarianism 5. Faults 6. Unconformities	10m 4A. 4m 4B. 6m	2 and 3	1 and 2	4
5	a. What is compressive strength? Which are the rocks with minimum and maximum compressive strength? b. What is porosity? Identify the factors that influence porosity. c. Which geological factors control the properties of good material for construction? d. Calculate the Rock Quality Designation for the following core sample and comment on its quality: Total length of core= 300 cm Core piece / Length of the core piece: L1 20cm; L2 15cm; L3 150mm; L4 100mm; L5 200mm; L6 50mm; L7 50mm; L8 20cm	15m 5a (5m) 5b (5m) 5c (2m) 5d (3m)	2 and 3	3	5
6	Write a note on (any 2): a. Self-potential method of geophysical investigation. b. Seismic method of geophysical investigation c. Direct method of geophysical investigation d. Magnetic of geophysical investigation	 5m	2 and 3	3	5

END SEM/~~RE~~-EXAM EXAMINATION DEC/JAN 2024-25

7	a. Identify the confined, unconfined, and perched aquifers in the diagram below. Write a note on the same.  b. Draw a diagram on the water table with appropriate labels.	15m 7a. 10m 7b. 5m	2	2	6
8	Which rocks are suitable for construction of tunnels? Comment on the stability of tunnels constructed in the conditions/attitudes of rocks given below: 1.  2.  	10	3	4	7
9	What are the suitable conditions of construction of (any 2): a. Gravity dam; b. Arch dam c. Buttress dam; d. Rockfill dam	5m	3	1	6

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END SEM/~~RE-EXAM~~ EXAMINATION DEC/JAN 2024-25

9/12/24

Program: B.Tech Civil Engineering Sem III

Duration: 3 hours

Course Code: PC-BTC301

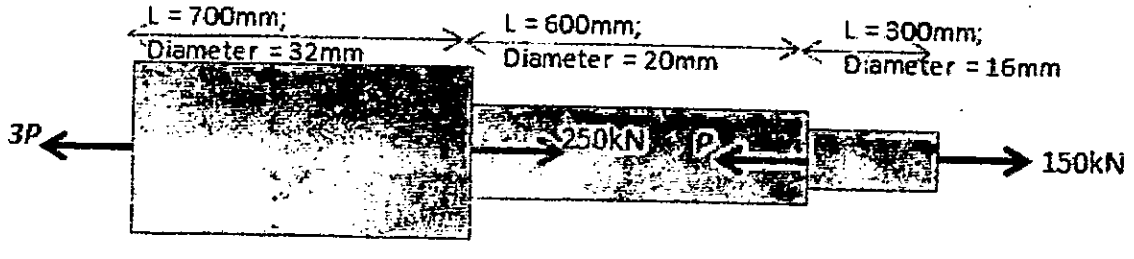
Maximum Points:100

Course Name: Mechanics of materials

Semester:III

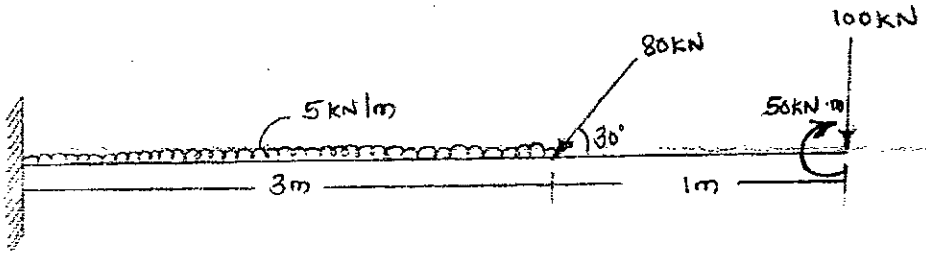
Notes : ***Attempt any 5 main questions out of 7; Assume any missing data and state the same clearly; Illustrate your answers with neat sketches***

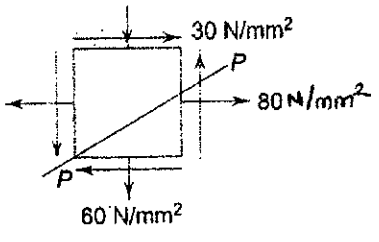
Q.No.	Questions	Points	CO	BL	Module No.
1.a)	With the help of stress-strain curve for mild steel explain the following terms: Proportional limit; Elastic limit; Yield stress; Ultimate stress Explain the difference between ductile and brittle materials in terms of failure surfaces and nature of stress strain curve.	10	02	03	01
1.b)	A bar of certain material 60 mm x 60 mm in cross section is subjected to an axial pull of 180 kN. The extension over a length of 100 mm is 0.05 mm and decrease in each side is 0.00525 mm. Calculate modulus of elasticity, Poisson's ratio, modulus of rigidity, and bulk modulus	08	02	04	01
1.c)	State the assumptions in theory of torsion	02	02	02	03
2.a)	A rod of steel 1.5 m in length is at a temperature of 20^0C. Find: i) the free expansion and the corresponding stress when the temperature is raised by 80^0 C. ii) stress if no expansion is allowed iii) stress when an expansion of 2 mm is allowed. Take $\alpha = 12 \times 10^{-6}/^0$ C, E = 210 GN/m^2.	08	02	03	01
2.b)	Obtain the value of P for equilibrium and find the change in length for the following assembly. E = 210GPa,	10	02	03	01



END SEM/~~RE-EXAM~~ EXAMINATION DEC/~~JAN~~ 2024-25

3	Draw the shear force, bending moment and axial force diagram for the beam shown below. Also find the maximum value of bending moment.	20	01	04	02



4.a)	A 300 x 600 mm timber beam is strengthened by the addition of 600 x 8 mm steel plates secured on both its sides. The flitched beam is simply supported and carries a uniformly distributed load of 40kN/m over an effective span of 8m. Find the maximum bending stresses in steel and timber at the mid-span. Take $E_S = 2 \times 10^5$ N/mm^2 and $E_T = 1 \times 10^4$ N/mm^2.	12	02	04	03
4.b)	A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3 mm thick. The length and internal diameter of the vessel are 85 cm and 40 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 3.2N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take $E = 2\times10^5$ N/mm^2 and μ=0.31	08	03	03	07
5.a)	A plane element is subjected to the stresses as shown in the figure below. Determine analytically: i) The principal stresses and their directions ii) The maximum shearing stresses and the directions of the plane in which they act. iii) Normal and shearing stresses on the inclined plane P-P having a normal inclined at 30^0 clockwise to the horizontal 	10	02	04	06

END SEM/~~RE-EXAM~~ EXAMINATION DEC/~~JAN~~ 2024-25

5.b)	Solve Q.5.a) using Mohr's circle	10	02	04	06
6.a)	An I section has top flange = 140mm x 15mm, bottom flange = 120mmx20mm and web = 280mm x 15mm. It is used as a cantilever beam over a span of 3.5m to carry a UDL of 10kN/m over its entire span. Draw the shear stress distribution diagram at the support.	10	02	03	04
6.b)	Obtain the shear centre for a channel section having flange as 220x10mm and web as 280x10mm (Total depth of section = 270mm). The section is subjected to a shear force of 30kN. Sketch the variation of shear flow across the section.	10	04	03	04
7.a)	A solid shaft has to carry a torque of 12 kNm. Find a suitable diameter for the shaft if the maximum stress is limited to 90 MPa and the angle of twist should not be more than 30 per metre length. G = 85 GPa. Also if this solid shaft is being replaced by a hollow shaft of same material, equal length and same allowable shear stress, having internal diameter equal to 0.85 times the external diameter, find the dimensions of the hollow shaft	10	02	04	05
7.b)	A 500 mm diameter reinforced concrete column has 8 bars of 20 mm diameter. The column is subjected to an axial compression of 875kN. Determine the stresses developed in concrete and steel. Assume $E_{steel} = 12E_{concrete}$	10	02	02	01

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End Semester Examination

S. Y. B. Tech **December 2024** 11/12/24

Program: Civil Engineering Sem III
Course Code: PC – BTC302
Course Name: Basics of Surveying

Duration: 3 hours
Maximum Points: 100
Semester: III

Instructions:

1. **Q.no.1 is compulsory.**
2. **Solve any FOUR from the remaining SIX questions.**
3. Write answer to each question on a new page.
4. Answers to be accompanied with appropriate sketches wherever necessary or required
5. Assume and state suitable data wherever necessary.

Q.No.	Questions	Points	CO	BL
1	a. Classify surveying based on instruments used. Provide examples of each type. **(4)**	**20**		1
	b. With proper sketches, differentiate between simple levelling and differential levelling. **(4)**			2
	c. Define contour lines and list any four key characteristics of contour lines. **(4)**			1
	d. List the precautions to be observed while using a theodolite during a survey **(4)**			1
	e. Explain the steps involved in the radiation method of plotting in plane table surveying. **(4)**			1
2	a. A surveyor is conducting a differential levelling survey with a 4m level staff over a long route using the rise and fall method. The following staff readings were taken in sequence, and the reduced level (RL) of the first station (A) is 150.000 m: 3.865, 3.345, 2.930, 1.950, 0.850, 3.795, 2.640, 1.540, 1.935, 0.865, 0.665. First reading was taken on the benchmark (B.M.). The level was shifted after the fifth and the eighth reading. 1. Draw the profile **(2)** 2. Prepare the field book page. **(2)** 3. Calculate the reduced levels (RLs) of all points using the rise and fall method. **(4)** [Show all the calculations] 4. Verify the arithmetic check. **(2)** 5. Find the difference between the first and the last point. **(2)**	**20**		3 2

End Semester Examination

December 2024

	b. Discuss the differences (atleast 2) between the trapezoidal rule, average ordinate rule, and Simpson's 1/3 rule for calculating the area of an irregular figure (6) Include examples of when each method would be most suitable. (2)			
3	a. Explain the difference between direct and indirect methods of contouring. **(6)**			2
	b. Discuss the advantages and limitations of both, direct and indirect methods of contouring, providing practical examples of where they are best suited. **(6)**			2
	c. A tachometer is set up at a station point P, and the following data is observed to a staff held vertically at a point Q: Vertical angle of line of sight: +5° 30' Stadia readings: 2.220 m, 2.000 m, 1.780 m Instrument height (HI) at station P: 1.400 m Constant values of the tachometer are: k = 100, C = 0 Reduced level (RL) of point P is 300.000 m Draw the plot showing all details. (2) Calculate the reduced level of point Q. **(3)** Calculate the horizontal distance between P & Q. **(3)**			2
4	a. Explain, with the help of neat sketches, the steps involved in the Block or Grid contouring. **(4)**	**20**		2
	b. A surveyor has collected data from a field using block contouring method, prepare contour lines **(4)** at 1-meter intervals for the following spot heights taken for a block of 5m x 5m: Point A: 150.2 m, Point B: 152.6 m, Point C: 149.8 m, Point D: 151.4 m.			3
	c. A theodolite closed traverse ABCDA was conducted, and the following data were recorded. Draw the traverse and check if the traverse is closed. Then, compute the error of closure. **(4)** Adjust the latitudes and departures if required. Use Bowditch's Rule to balance the traverse. **(4)** Compute the corrected latitude and departure and Independent coordinates for each side. **(4)**			3

Side	Length (m)	Bearing	Latitude (m)	Departure (m)
AB	200	N 45° E	141.42	141.42
BC	250	S 60° E	-125	216.51
CD	180	S 45° W	-127.28	-127.28
DA	150	N 30° W	129.9	-75

End Semester Examination

December 2024

		Independent coordinates, X and Y, of Station A are 5000.00m and 5000.00m respectively.			
5	a.	A line AB has a measured bearing of 45° but is affected by local attraction. Explain the steps to determine the correct bearing. **(4)**	**20**		
	b.	Explain the working of an auto level and its significance in modern surveying. **(4)**			
	c.	The ordinates of an irregular boundary at 10-meter intervals are as follows: 2.1 m, 3.5 m, 4.8 m, 5.2 m, 4.0 m, 3.2 m, and 2.0 m. Draw the plot. **(2)** Calculate the area enclosed by the boundary using: Trapezoidal rule **(5)** and Simpson's 1/3 rule **(5)**			
6	a.	Describe the construction, working, and use of a prismatic compass **(4)** and a surveyor's compass **(4)** and compare their features and applications in the field. **(4)**	**20**		
	b.	Explain the purpose and procedure of profile levelling and cross sectioning. **(8)**			
7	a.	Explain, with proper sketch, the purpose and procedure of reciprocal levelling. **(4)**	**20**		
	b.	Two points, A and B, are located on opposite banks of a river. To determine the difference in elevation between these points using reciprocal levelling, the following observations are made: From A to B: Reading on staff at A = 1.205 m, Reading on staff at B = 2.630 m. From B to A: Reading on staff at A = 1.820 m, Reading on staff at B = 2.195 m. Calculate the true difference in elevation between A and B, considering the effect of collimation error. **(4)**			
	c.	The cross-sectional areas of an earth embankment at 20 m intervals are as follows: 12 m^2, 18 m^2, 24 m^2, 30 m^2, and 20 m^2. Compute the volume of the embankment using: i. Trapezoidal formula **(5)** and Prismoidal formula **(5)** ii. Compare the results and give inference. **(2)**			

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END SEM/RE ~~EXAM~~ EXAMINATION DEC/~~JAN~~ 2024-25

13/12/24

Program: Civil Engineering S.Y. B.Tech Sem III **Duration: 3hr**

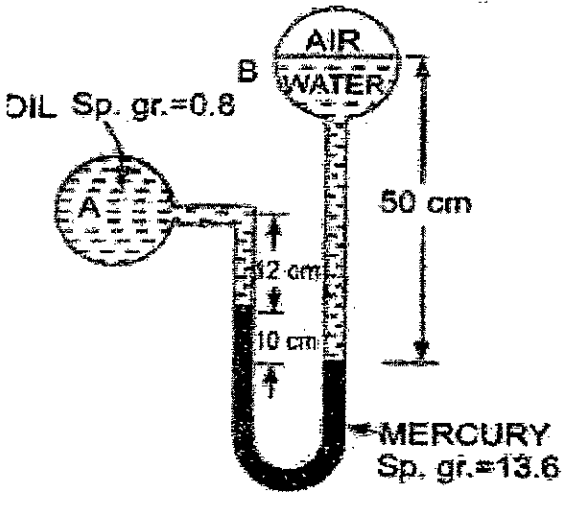
Course Code: PC-BTC304 **Maximum Points: 100**

Course Name: Fluid Mechanics **Semester: III**

Instructions

1. **Question no. 1 is compulsory.**
2. Attempt any 4 questions out of remaining 6 questions
3. Neat diagrams must be drawn wherever necessary.
4. Assume Suitable data if necessary and state it clearly.

Q.no.	Questions	Points	CO	BL	Mod
1 (a)	An oil film of thickness 1.5mm is used for lubrication between a square plate of size0.9m x 0.9 m and an inclined plane having an angle of inclination 20 degrees. The weight of the square plate is 392.4 N and it slides down the plane with a uniform velocity of 0.2 m/sec. Find the dynamic viscosity of oil.	6	CO1	BL2	1
(b)	State hydrostatic law and derive the expression for the same.	8	CO1	BL2	2
(c)	A trapezoidal plate measuring 1m at the top edge and 1.5m at the bottom edge is immersed in water with the plan making an angle of 30 degree to the free surface of water. The top and the bottom edges lie 0.5m and 1.0m respectively from the surface. Determine hydrostatic force on the plane.	6	CO1	BL2	3
2 (a)	Discuss the types of fluid flows along with mathematical expressions and their example.	10	CO2	BL2	4
(b)	Prove that the maximum velocity in a circular pipe for laminar flow is equal to two times the average velocity of flow.	10	CO2	BL2	5
3 (a)	A block of wood of specific gravity 0.8 floats in water. Determine the meta centric height of the block if its size is 3m long X 2 m wide X 1m deep	7	CO1	BL2	3
(b)	Derive continuity equation for 3D flow	9	CO1	BL2	4
(c)	Compare veturimeter and orifice meter.	4	CO1	BL2	4
4(a)	A triangular plate of 1 m base and 1.5m altitude is immersed in water. The plane of the plate is inclined at 30 degrees with the free water surface and the base is parallel to and at a depth of 2m from water surface. Find the total pressure on the plate and the position of center of pressure.	8	CO1	BL3	3
4(b)	An oil of specific gravity of 0.8 is flowing through a venturimeter having inlet diameter 20 cm and throat diameter 10 cm.	6	CO2	BL3	4

	The oil mercury differential manometer shows a reading of 25 cm. Calculate the discharge of oil through the horizontal venturimeter. Take Cd= 0.98				
4 (c)	Prove that equipotential lines are orthogonal to streamlines at all points of intersections.	6	CO2	BL2	4
5(a)	The velocity component in a 2-D flow field for an incompressible fluid is expressed as follows	8	CO2	BL3	4
	Check whether the velocity potential exists or not? $u = \frac{y^3}{3} + 2x - x^2y, \quad v = xy^2 - 2y - \frac{x^3}{3}$ If exists obtain an expression for stream function Ψ.				
b	Discuss the characteristics of turbulent flow.	6	CO3	BL1	5
c	Define coefficient of discharge, coefficient of velocity and coefficient of contraction and derive relation between them	6	CO2	BL2	4
6 (a)	Discuss the determination velocity of flow in pipe or channel with the help of Pitot tube.	6	CO2	BL1	4
(b)	Describe Reynolds experiment along with the characteristics of laminar and Turbulent flow.	8	CO3	BL2	5
(c)	A manometer is connected at the two points A and B as shown in figure.	6	CO1	BL3	2
	 At B air pressure is 7.848N/cm2 (absolute), fine the absolute pressure at A				
7 (a)	Explain with sketches 3 methods of control of boundary layer separation	6	CO3	BL2	6
(b)	An annular plate of 2m external diameter and 1m internal diameter with its greatest and least depths below the surface being 1.5m and 0.75m respectively.	8	CO2	BL3	3
	Calculate the magnitude, direction and location of the force acting upon one side of the plate due to water pressure.				
(c)	A U tube is made up of two capillaries of bores 1.2 m and 2.4 mm respectively.	6	CO1	BL2	1
	The tube is held vertical and partially filled with liquid of surface tension 0.06 N/m and zero contact angle. If the estimated difference in the level of two menisci is 15 mm, determine the mass density of the liquid.				

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END SEM/~~RE-EXAM~~ EXAMINATION DEC/~~JAN~~2024-~~25~~

16/12/24

Program: B.Tech. Civil Engineering S.Y. Sem I/II **Duration:** 3 Hour

Course Code: PC-BTC 305 **Maximum Points:** 100

Course Name: Concrete Technology **Semester:** III

Notes:

1. Attempt ***any ~~FIVE~~ questions out of SEVEN*** questions
2. Answers to all sub questions should be grouped together
3. Draw neat diagrams wherever required
4. Assume suitable data if necessary and state the clearly.

Q.No.	Questions	Points	CO	BL	Module No.
1	a) Explain in detail the procedure for conducting core test of concrete.	06	2	2	05
	b) Give in details the classification of aggregates used in concrete.	06	3	1	01
	c. Explain the components and working of RMC plant observed during site visit.	08	3	3	01
2	a). Design a concrete mix of M50 grade using IS 10262:2019; for pile foundation with severe exposure condition. Take a standard deviation of 5 MPa. Use, OPC 53 grade cement, the specific gravities of cement-3.15; Fly ash-2.4, GGBS-2.8; plasticizer-1.1; specific gravities of Coarse Aggregate (10 mm-2.65, 20 mm-2.68) and specific gravity of Fine Aggregate are 2.87. Fineness Modulus of Fine Aggregate is 3.21 (Zone-I). A slump of 175 mm is necessary. The water absorption of coarse aggregate is 1.2% and free moisture aggregate is 0.6%. The water absorption of fine aggregate is 2.4% and free moisture aggregate is 3.46%. ***Assume any missing data suitably and state them.***	15	02	3	02
	b). Highlight the importance of carbonation of concrete from durability perspective.	05	02	1	05
3	a. Design concrete for M 35 grade using DOE method. Refer the data from Que2a and chart attached at the end of manuscript.	12	02	3	02
	b. Discuss in detail the problems due to hot weather concreting. Suggest suitable measures to improve the performance.	08	03	2	04
4	a. Design concrete for specified design strength of 35 N/mm2 using ACI Method; consider the data related to the properties of material as given in Que.No.2a.	13	2	3	02
	b. Explain in details procedure for ultrasonic pulse velocity test used to measure quality of concrete.	07	1	2	05

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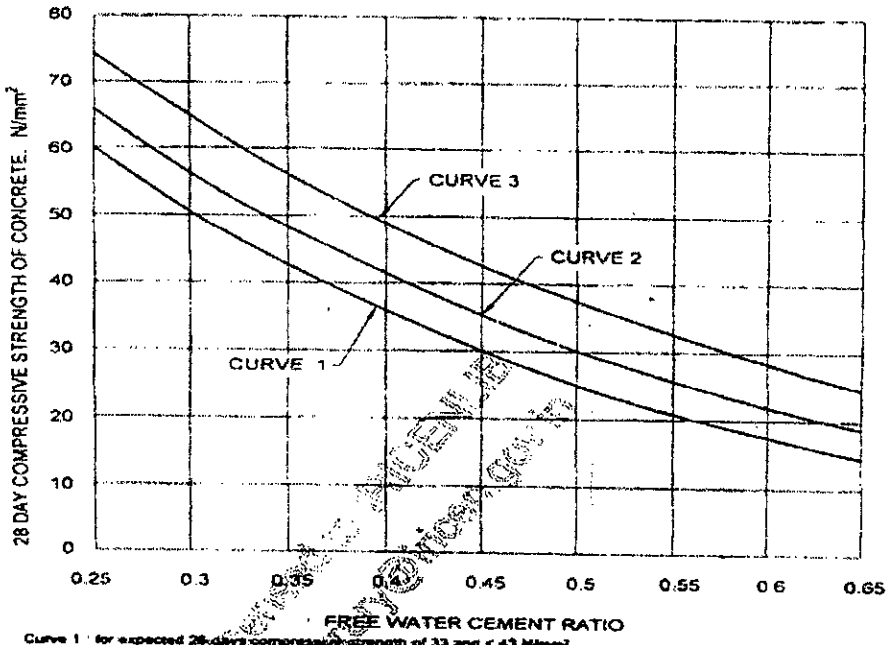
5.	a. It is proposed to design SCC of grade M45, consider w/c of 0.32, and the percentage of fine aggregate passing from 125 micron as 3.8 %. Assume suitable powder content between 400-600 kg /m3 and other data from the que2a.	12	2	3	2
	b. Explain in detail various aspects considered to improve the quality of high performance concrete.	08	3	2	3
6	a) State the advantages and disadvantages of self-compacting concrete.	06	3	1	3
	b). Explain the salient Features of high performance concrete.	06	3	2	3
	c. Discuss various methods of concrete transportation with their suitability.	08	2	1	4
7	Write short notes on (any four)	20			
	i. Types of Retarders	5	1	2	1
	ii. Rice husk ash	5	1	1	1
	iii. Sulphate Resisting Cement	5	3	2	3
	iv. Silica fume	5	2	1	1
	v. types of Plasticizers	5	1	2	1
	vi. Hydration products	5	3	3	1

Reference Tables for IS 10262:2019 Method of Concrete mix design



Curve 1 : for expected 28-days compressive strength of 33 and < 43 N/mm²
Curve 2 : for expected 28 days compressive strength of 43 and < 53 N/mm².
Curve 3 : for expected 28-days compressive strength of 53 N/mm² and above

NOTES

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 *and* 9.1.2*)*

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

IS 10262 : 2019

Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Water-Cementitious Materials Ratio of 0.50

(Clause 5.5*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.54	0.52	0.50	0.48
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.73	0.72	0.71	0.69

NOTES

1 Volumes are based on aggregates in saturated surface dry condition.

2 These volumes are for crushed (angular) aggregate and suitable adjustments may be made for other shape of aggregate.

3 Suitable adjustments may also be made for fine aggregate from other than natural sources, normally crushed sand or mixed sand may need lesser fine aggregate content. In that case, the coarse aggregate volume shall be suitably increased.

4 It is recommended that fine aggregate conforming to Grading Zone IV, as per IS 383 shall not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions

Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate

(Clause 5.3*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Water Content[1] kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

[1] Water content corresponding to saturated surface dry aggregate.

Table 3 Approximate Air Content

(Clause 5.2*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Entrapped Air, as Percentage of Volume of Concre
(1)	(2)	(3)
i)	10	1.5
ii)	20	1.0
iii)	40	0.8

5.2.1 The actual values of air content can also adopted during mix proportioning, if the site data least 5 results) for similar mix is available.

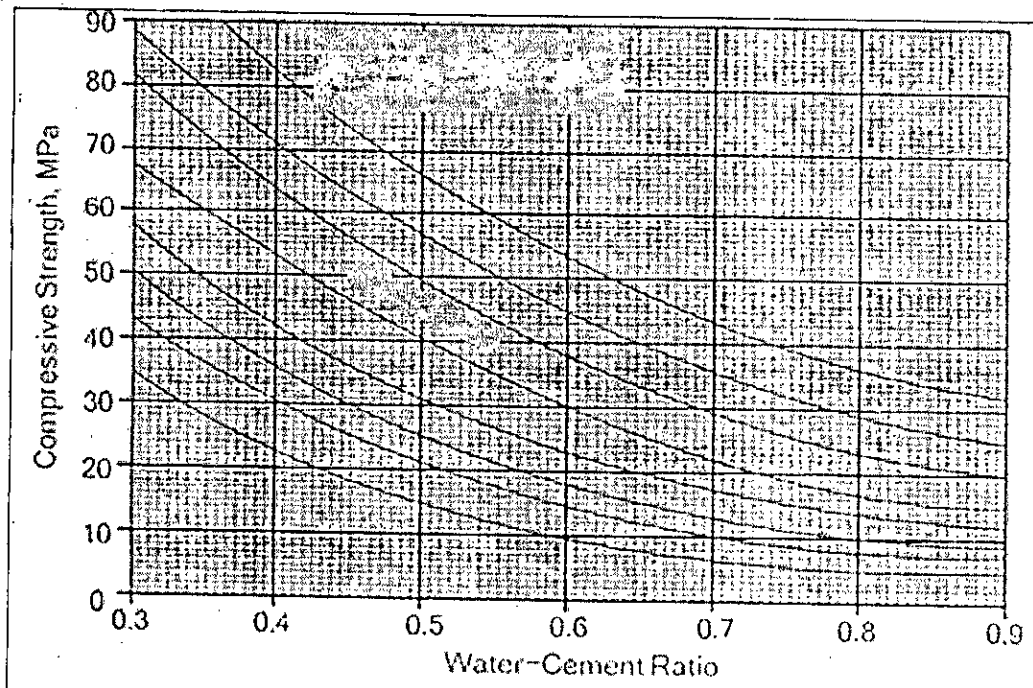


Table 20.47. App. Free water content required for various workability according to 1988 British Method

Aggregate		*Water content kg/m³ for slump*			
Max. size mm	*Type*	0 — 10 mm	10 — 30 mm	30 — 60 mm	60 — 180 mm
		Vee Bee seconds > 12	6 — 12	3 — 6	0 — 3
10	Un crushed	150	180	205	225
	crushed	180	205	230	250
20	Un crushed	135	160	180	195
	crushed	170	190	210	225
30	Un crushed	115	140	160	175
	crushed	155	175	190	205

Table 20.48. Reduction in water content of table 21.47 when fly ash used.

% of fly ash in cementitious material	*Slump in mm Vee Bee seconds*	*Reduction in water content kg/m³*			
		0 — 10 > 12	10 — 30 6 — 12	30 — 60 3 — 6	60 — 180 0 — 3
10		5	5	5	10
20		10	10	10	15
30		15	15	20	20
40		20	20	25	25
50		25	25	30	30

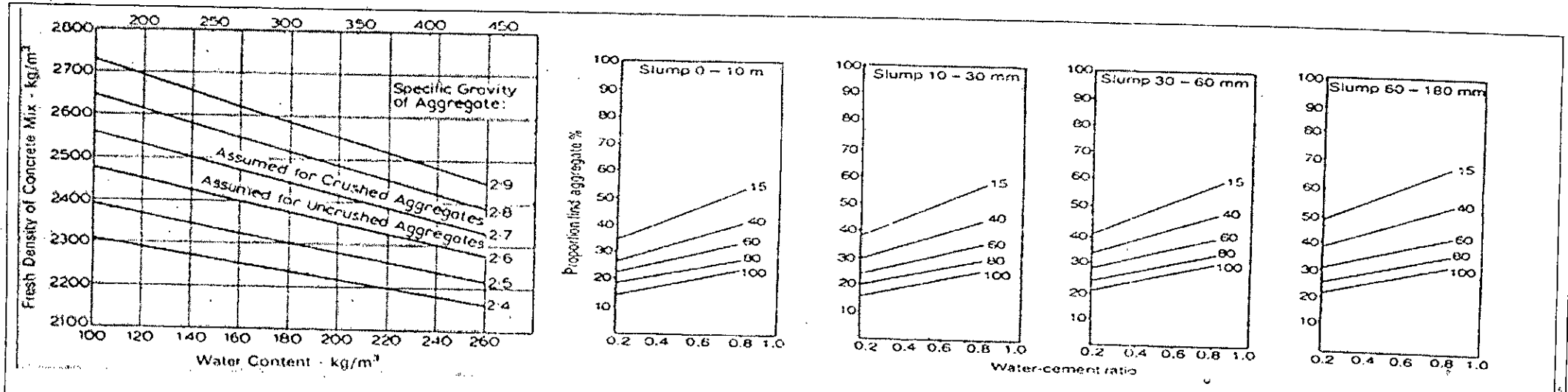


Fig 20.12. (*b*)

Table 1,2 and 3 for ACI Method Concrete Mix Design

(1) Dry Bulk Volume of coarse aggregate/ unit volume of concrete as per ACI 211.1-91

Maximum size of aggregate	Bulk volume of dry rodded CA /unit volume of concrete for fineness modulus of sand of			
FM	2.4	2.6	2.8	3.00
10	0.5	0.48	0.46	0.44
12.5	0.59	0.57	0.55	0.53
20 (25,40,50,70)	0.66	0.64	0.62	0.60
150	87	0.85	0.83	0.81

(2) Relation between water/cement ratio & average compressive strength of concrete, as per ACI211.1-91

Average compressive strength at 28 days	Effective water/cement ratio (by mass)	
MPa	Non air entrained concrete	Air entrained concrete
45	0.38	
40	0.43	
35 (30,25,20)	0.48	0.4
15	0.8	0.71

(3) Requirements of ACI-318-89 for w/c ratio & strength for special exposure conditions

Exposure condition	Maximum w/c ratio, normal density aggregate concrete	Minimum design strength, low density aggregate concrete MPa
Concrete intended to be watertight		
(a) Exposed to fresh water	0.5	25
(b) Exposed to sea water	0.45	30
Concrete exposed to freezing in a moist condition	0.45	30
For corrosion protection of reinforced concrete exposed to de-icing salts, sea water	0.4	33

Table 4,5 and 6 for ACI Method Concrete Mix Design

(4) Recommended value of slump for various types of construction as per ACI 211.1-91

Type of construction	Range of slump (mm)
Reinforces foundation walls & footings	20-80
Plain footings,substructure wall	20-80
Beams & reinforced walls	20-100
Building columns	20-100
Pavements & slabs	20-80
Mass concrete	20-80

(5) Approximate requirements for mixing water & air content for different workabilities & nominal maximum size of aggregates as per ACI211.1-91

Non air entrained concrete				
Workability or slump (mm)	Water content, kg/m3 of concrete for indicated maximum aggregate size			
	10 mm (25, 40,50,70)	12.5 mm	20 mm	150 mm
30-50 mm	205	200	185	125
80-100 mm	225	215	200	140
150-180 mm	240	230	210	
Approx. entrapped air (%)	3	2.5	2	0.2

(6) First estimate of density of fresh concrete as pe ACI 211.1-91

Maximum size of aggregate (mm)	First estimate of density of fresh concrete	
	Non air entrained kg/m3	Air entrained kg/m3
10	2285	2190
12.5 (20,25/40:50)	2315	2235
	2355	2280
150	2505	2435

As per ACI in absence of record; required increase in mean strength for specified design strength

Specified design Strength (Mpa)	Less than 21	21-35	35 or more
Required Increase in mean strength (Mpa)	7	8.5	10

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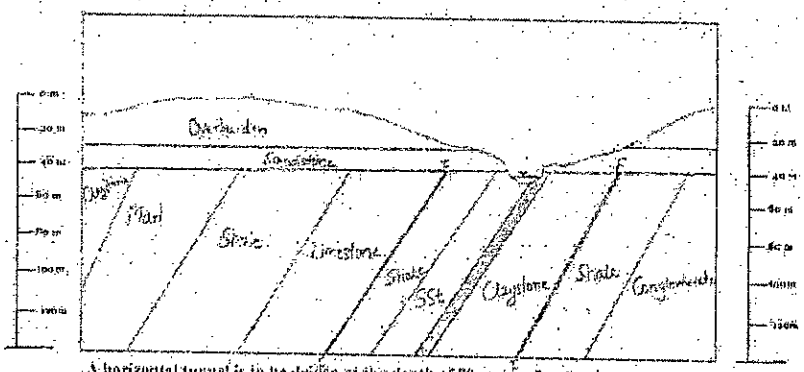
END SEM/RE-EXAM EXAMINATION JAN 2025

Q.6	Solve the following questions.				
1.	List out the direct methods of geological investigation.	5			
2.	What is sorption? What happens if the value of sorption exceeds 60%?	5			
3.	A rock sample has the following properties: • Volume of voids: 35 cm^3 • Total volume of the sample: 140 cm^3 Calculate the porosity of the sample. Express the answer as a percentage.	5			
4.	Write a note on (any 1)	5			
i.	Seismic method of geophysical investigation				
ii.	Self-potential method of geophysical investigation			1,	
iii.	Gravity method of geophysical investigation		1, 2	2, 3	5
7A	Solve the following questions:				7
1.	Which rocks are suitable for construction of tunnels?	2			
2.	Comment on the issues that will be encountered if a tunnel is to be constructed at the depth of 80m in the diagram below.	8			
	 A horizontal tunnel is to be driven at the depth of 80 meters for the given hypothetical geological section. Comment on the various possible problems that might be encountered during tunneling with an emphasis on the lithological aspect of the area.				
7B	Solve the following questions.	10		1,	6
	How is an unconfined aquifer different from confined and perched aquifers?		3	2, 3, 4	

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End Semester/~~Re-exam~~ – January/~~February~~ 2025

13/1/25

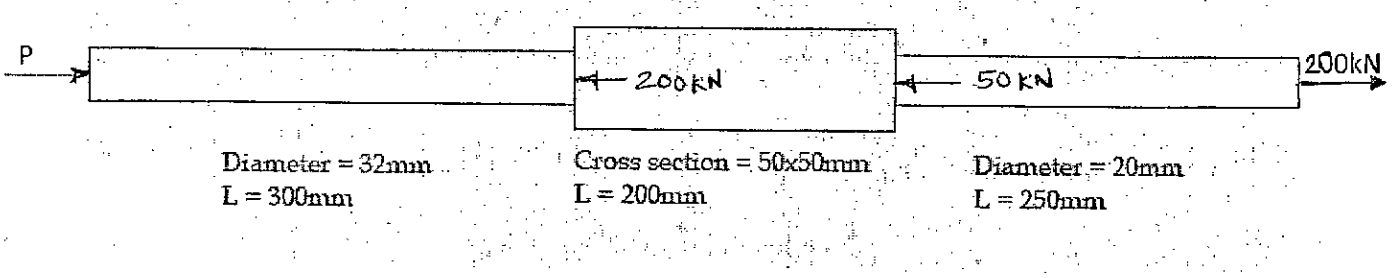
Program: B.Tech Civil Engineering (Working Professional) Duration: 3 Hours

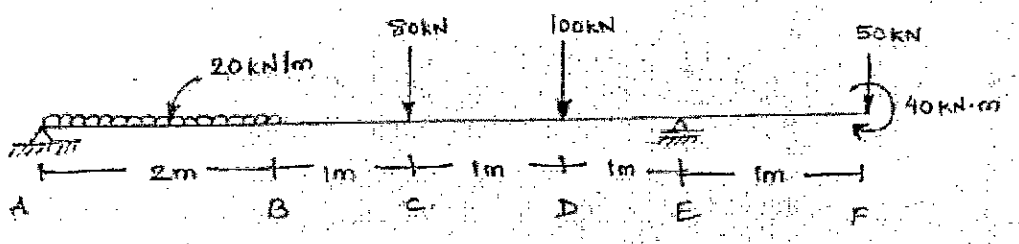
Course Code: PC-BTC301 Maximum Points: 100

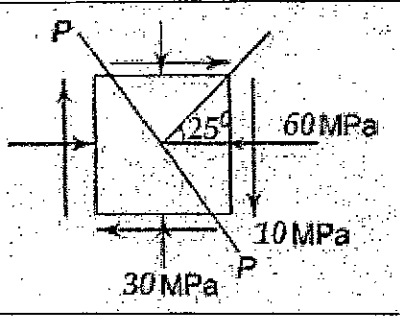
Course Name: Mechanics of materials Semester: III

Notes:

- Attempt any 5 main questions
- Draw neat sketches to support your answers
- Assume suitable data if missing and state the same clearly.

Q.No.	Questions	Points	CO	BL	Module
1. a)	Explain and sketch the stress strain curve obtained for ductile materials under tensile test. Mark and define the following points : Elastic limit, Yield stress, Ultimate stress, Modulus of elasticity.	10	02	02	01
1.b)	Analyze the axial stresses in the bar of varying cross section as shown below and obtain the total change in length	10	02	03	01
					
2.a)	A bar with rectangular cross section is subjected to an axial pull of 150kN along its length. If it is originally 2m long, 30mm wide and 20mm thick, evaluate the following values : a) Change in length b) Change in width c) Change in thickness d) Modulus of rigidty and bulk modulus Take E=200GPa and Poisson's ratio = 0.3	10	02	03	01
2.b)	A rod of steel 1m in length at a temperature of 20°C. Find: i)the free expansion/contraction when the	10	02	03	01

	temperature is raised to 110° C; ii)stress in bar if no expansion is allowed and iii)stress when an expansion of 0.5 mm is allowed. Take $\alpha = 12 \times 10^{-6}$/° C, $E = 2 \times 10^5$ N/mm².				
3	Draw the SFD and BMD for the beam shown in fig. below. Also obtain maximum bending moment and its point of action.	20	01	03	02
					
4.a)	A 150 x 400 mm timber beam is strengthened by the addition of 100 x 4 mm steel plates secured at its top and bottom surfaces. The flitched beam is simply supported and carries a uniformly distributed load of 30kN/m over an effective span of 10m. analyse the following: i)Bending stresses in timber beam before strengthening ii)Bending stresses in timber and steel plates after strengthening Take $E_s = 2 \times 10^5$N/mm² and $E_T = 1 \times 10^4$ N/mm².	10	02	03	03
4.b)	A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 6 mm thick. The length and internal diameter of the vessel are 70 cm and 35 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 1.5MPa. Also calculate the increase in length, diameter and volume of vessel. Take E = 2×105 MPa and μ=0.3	10	03	03	07
5.a)	A plane element is subjected to the stresses as shown in the figure below. Determine **analytically**: i) The principal stresses and their directions ii) The maximum shearing stresses iii) Normal and shearing stresses on the inclined plane P-P	10	02	03	06

					
5.b)	Solve Q 5.a) **graphically** using Mohr's circle	10	02	03	06
6.a)	An I beam having flanges as (250x10)mm and web as (8x350) mm is used as a simply supported beam over 5m span and carries a UDL of 10kN/m. Calculate the shear stresses induced at support section and sketch its variation along the depth.	10	01, 02	03	04
6.b)	Obtain the shear centre for a channel section having flanges = 150x12mm and web = 250x10mm. The section is subjected to a shear force of 30kN. Sketch the variation of shear flow across the section.	10	04	03	04
7.a)	The maximum shear stress developed on the surface of a solid circular shaft subjected to torsion is 150MPa. Analyse the maximum shear stress that will develop if the diameter of shaft is increased by 50%.	05	02	03	05
7.b)	A solid shaft has to carry a torque of 15 kNm. Find a suitable diameter for the shaft if the maximum stress is limited to 100 MPa and the angle of twist should not be more than 20 degrees per metre length. G = 85 GPa. If this solid shaft is to be replaced by a hollow shaft of same material, equal length and same allowable shear stress, having external diameter equal to 1.3 times the internal diameter, find the cross section dimensions of the hollow shaft.	10	02	03	05
7.c)	Define torsion. State the assumptions in theory of torsion. Explain the terms in torsion equation with neat sketch	05	02	02	05

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END-SEM/~~RE-EXAM~~ Examinations, January/~~February~~ 2025

15/1/25

Total points: 100

Duration: *Total Time allotted will be 3Hr.*

Class: B.TECH (Civil Engineering) [Working Professional]. Semester: II

Program: CIVIL

Name of the Course: **Basics of Surveying** Course Code : **PC-BTC303**

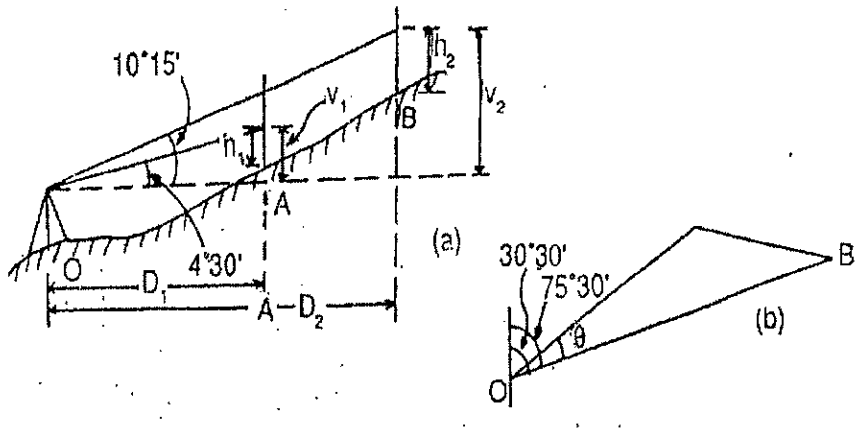
Instructions:

1. **All Questions are compulsory.**
2. Assume suitable data if necessary and state the clearly.

Que. No		Points	CO	BL	Module no
Q1	A. The following observations were made using tachometer fitted with anallatic lens, the multiplying constants being 100.	10	1,2	3	4

Instrument station	HI	Staff station	WCB	Vertical angle	Hair readings	Remarks
O	1.550	A	$30^0 30' 0''$	$4^0 30' 0''$	1.155, 1.755,2.355	RL of O= 150.000
		B	$75^0 30' 0''$	$10^0 15' 0''$	1.250, 2.000, 2.750	

Calculate the distance AB and RLs of A and B. Find also the gradient of line AB.



	B. Determine the values of stadia constants from the following observations.	10	2	3	4

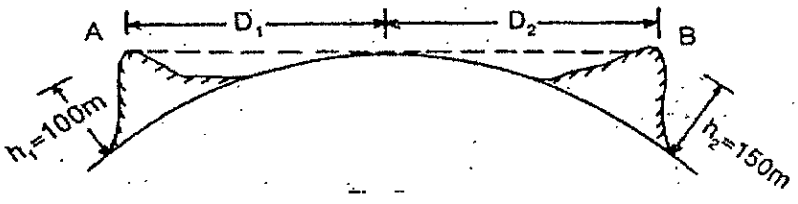
Instrument station	Staff reading on	Distance(m)	Stadia readings	
			Lower	Upper
O	A	150	1.255	2.750
	B	200	1.000	3.000
	C	250	0.750	3.255

Q 2	A. Describe the process of method of repetition and reiteration.	05	2	2	3
	B. What are fundamental lines of theodolite and what should be relation in between them.	05	1	1	3
	C. An incomplete traverse table is obtained as follows-	10	2,4	3	3

Line	Length(m)	Bearing
AB	100	??
BC	80.5	$140^0 30' 0''$
CD	60	$220^0 30' 0''$
DA	??	$310^0 15' 0''$

Calculate length of DA and Bearing of AB.

Q 3	A. The following offsets were taken from a chain line to an irregular boundary line at an interval of 10 m:	08	1,3	2	5
	0, 2.50, 3.50, 5.00, 4.60,3.20, 0 m Compute the area between the chain line, the irregular boundary line and the offsets by 1) The mid-ordinate rule 2) The average-ordinate rule 3) The Trapezoidal rule 4) Simpsons rule				
	B. What is Two-point problem? Explain with a neat sketch procedure of solving a two-point problem in plane table surveying.	08	2,3	1	5
	C. What are advantages and disadvantages of plane table surveying?	04	2,4	1	5
Q 4	A. Explain the characteristics of contours with diagrams	10	1,2	1	2
	B. Explain the methods of contouring.	10	1,2	1	2
Q 5	A. The line of sight from two stations A and B just grazes the sea level. If the height of A and B above sea level are 100m and 150m respectively. Find the distance AB (Diameter of earth= 12880km)	05	3	2	2

	 B. The following consecutive readings were taken with a level and a 4-m levelling staff on a continuously sloping ground at a common interval of 30 m: 0.855(on A) , 1.545m 2.355, 3.115, 3.825, 0.455, 1.380, 2.055, 2.855, 3.455, 0.585, 1.015, 1.850, 2.755, 3.84599(on B). The RL of A was 380.500m. Make entries in level book and apply the usual checks. Determine the gradient of AB.	15	1,4	3	2
Q 6	A. The following are the bearings observed in traversing, with a compass, an area where local attraction was suspected. Find the amount of local attraction at a different station, the correct bearings of lines and the included angles. Draw a sketch of the plot assuming AB= 180 m, BC= 120m, CD= 60m and show in it all included angles.	15	1,4	2	1
	B. Explain Dip of magnetic needle and local attraction.	05	1	1	1
Q 7	A. Explain the steps of fieldwork in chain surveying. B. Explain with figure types of offsets.	10 10	1,3 1,2	1 1	1 1

Line	FB.	BB
AB	$59^0 00' 0"$	$239^0 00' 0"$
BC	$139^0 30' 0"$	$317^0 00' 0"$
CD	$215^0 15' 0"$	$36^0 30' 0"$
DE	$208^0 0' 0"$	$29^0 00' 0"$
EA	$318^0 30' 0"$	$138^0 45' 0"$

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END SEMESTER EXAMINATION-DEC-2024 7/12/24

SET: I

S.Y. B.Tech Civil Sem III

Program: Civil Engineering **Duration: 3.00 hrs.**

Course Code: PC-BTC-303 **Maximum Points: 100**

Course Name: Building Drawing with CAD **Semester: III**

Notes: 1. Q.1 is compulsory & attempts any four out of remaining six.

2. Illustrate answer with neat sketches wherever required.

3. Make suitable assumptions where necessary and state them clearly.

Q.No.	Questions	Points	BL	CO	Module No
1.	A) Draw to a suitable scale developed plan for ground floor of G+1 storey bungalow for a PWD Engineer on a site of the data given below. 1. Plot size: 14 M x 18 M. (FSI: 1.2) 2. Road is on south side parallel to 18 M direction 3. Wind direction is E-SW-W & climatic zone is hot and humid 4. Requirements of Engineer a. Office room b. Master bed room c. Living room d. Children bed room e. Kitchen cum dining room f. Guest bed room g. Staircase/bath/WC/store/verandah are to be provided B) Draw terrace plan for above question.	15+05	L4	1-5	1-5
2	A. Draw to a suitable scale line plan of first floor for Q.1A. B. State: Built up area, Rera carpet area, carpet area, super built up area, FAR for Q.1A.	15+05	L2	1-5	1/5
3	A. Draw to a suitable scale, line plan of public library building opening on a plot size 30 M x 40 M. Show all units with dimension and position of door, & windows.	20	L3	2-5	1,2
4	A. Discuss the need, objectives and five pillars of Real Estate Regulation Act, 2016 (RERA). B. Explain following principles of planning in detail, 1. Privacy 2. Circulation	10+10	L2	2	1

5	A. Discuss the necessities of building byelaws. Also explain building bylaws related to height of building and frontage of building. B. Draw a front side elevational plan for Q.1A	10+10	L2/3	2-5	1/3/5
6	A. Draw to a suitable scale Foundation plan for Q.1A. B. Draw to a suitable scale site plan for Q.1A.	10+10	L3	1-3	1/3/5
7	A. Draw to a suitable scale Water supply & Drainage plan for Q.1A. B. Draw to a suitable scale Electricity& Furniture plan for Q.1A.	10+10	L3	1-3	1/3/5

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END SEM/RE-EXAM EXAMINATION JAN/FEB 2024-25 (WPS)

SET: II

Program: Civil Engineering **Duration: 3.00 hrs.**

Course Code: PC-BTC-303 **Maximum Points: 100**

Course Name: Building Drawing with CAD **Semester: III**

Notes: 1. Q.1 is compulsory & attempts any four out of remaining six.

2. Illustrate answer with neat sketches wherever required.

3.Make suitable assumptions where necessary and state them clearly.

Q.No.	Questions	Points	BL	CO	Module No
1.	A) Draw to a suitable scale developed plan for ground floor of G+1 storey bungalow for Dentist on a site of the data given below. 1. Plot size: 12 M x 16 M. (FSI: 1.2) 2. Road is on south side parallel to 12 M direction 3. Wind direction is E-SW-W & climatic zone is humid. 4. Requirements of Engineer a. Clinic b. Master bed room c. Living room d. Children bed room e. Kitchen cum dining room f. Guest bed room g. Staircase/bath/WC/store/verandah are to be provided B) Draw terrace plan for above question.	15+05	L4	1-5	1-5
2	A. Draw to a suitable scale line plan of first floor for Q.1A. B. State: Built up area, Rera carpet area, carpet area, super built up area, FAR for Q.1A.	15+05	L2	1-5	1/5
3	A. Draw to a suitable scale, line plan of Post office building opening on a plot size 35 M x 50 M. Show all units with dimension and position of door, & windows.	20	L3	2-5	1,2
4	A. Discuss the Real Estate Regulation Act, 2016 (RERA) in detail. B. Explain following principles of planning in detail, 1. Privacy 2. Roominess	10+10	L2	2	1
5	A. Discuss the building bylaws in detail along with diagrams for height of building and front margin. B. Discuss the site selection criteria's for residential building in detail.	10+10	L2/3	2-5	1/3/5

6	A. Draw to a suitable scale Foundation plan for Q.1A. B. Draw to a suitable scale site plan for Q.1A.	10+10	L3	1-3	1/3/5
7	A. Write a short note on perspective drawing in detail. B. Differentiate between load-bearing structures and framed structures.	10+10	L3	1-3	1/3/5

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24/12/24

ENDSEMESTER EXAMINATION/~~RE-EXAMINATION~~ DEC24-~~JAN25~~

Program: CIVIL S.Y. B.Tech Civil Sem III **Duration: 03 Hours**

Course Code: BS-BTC301 **Maximum Points:100**

Course Name: Laplace linear algebra & complex analysis **Semester: III**

- **Attempt any five out of seven questions**
- **Use of scientific calculator is allowed.**

QNO.	QUESTION	POINTS	CO	BL	Module No.
Q1a)	Find the image of $\|z-3i\|=3$ under the mapping $w=\frac{1}{z}$.	06	2	2	3
Q1 b)	Using convolution theorem evaluate $L^{-1}\left\{\frac{s}{(s^2+4)(s^2+1)}\right\}$	06	1	3,5	2
Q1 c)	If $A=\begin{bmatrix} 2+i & 3 & -1+3i \\ -5 & i & 4-2i \end{bmatrix}$ Show that A^*A is a Hermitian matrix, where A^* is the conjugate transpose of A.	08	2	1	4
Q2a)	Show that $x+y+z=6$, $x+2y+3z=14$, $2x+4y+7z=30$ Is a consistent system of equations and hence solve them.	06	3	2	4
Q2b)	If f(z)=u+iv is an analytic function of $z=x+iy$ and $u-v=\frac{e^y-\cos x+\sin x}{\cosh y-\cos x}$, find f (z) subject to the condition that $f\left(\frac{\pi}{2}\right)=\frac{3-i}{2}$	06	2	2	3
Q2c)	Find $\mathcal{L}\left[\frac{d}{dt}\left(\frac{1-\cos 2t}{t}\right)\right]$	08	1	3	1
Q3 a)	Given $f(t)=\begin{cases} t+1, & 0\le t\le 2 \\ 3, & t>2 \end{cases}$ find $\mathcal{L}[f(t)]$, $\mathcal{L}[f'(t)]$	10	1	2	1
Q3c)	Find the eigen values and eigenvectors of the matrix	10	3	4,5	5

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ENDSEMESTER EXAMINATION/RE-EXAMINATION DEC24-JAN25

	$A=\begin{bmatrix}2 & -2 & 3\\ 1 & 1 & 1\\ 1 & 3 & -1\end{bmatrix}$				
Q4 a)	Find non – singular matrices P and Q such that P A Q is in normal form $A=\begin{pmatrix}1 & 2 & 3 & 4\\ 2 & 1 & 4 & 3\\ 3 & 0 & 5 & -10\end{pmatrix}$ Hence find rank of A.	10	3	3	4
Q4 b)	Solve $y''+y=t$ using laplace transform Given $y(0)=1$ & $y'(0)=-2$	10	1	3	2
Q5 a)	Evaluate: $L^{-1}\{cot^{-1}(1+s^2)\}$	10	1	2	2
Q5 b)	Find 4^A where $A=\begin{bmatrix}3/2 & 1/2\\ 1/2 & 3/2\end{bmatrix}$ using Cayley – Hamilton theorem	10	3	2	5
Q6a)	Using laplace transforms Prove that $\int_0^\infty \frac{e^{-t}\sin^2 t}{t}dt=\frac{1}{4}\log 5$	06	1	4	1
Q6 b)	Prove that the matrix $\frac{1}{\sqrt{3}}\begin{bmatrix}a+ic & -b+id\\ b+id & a-ic\end{bmatrix}$ is unitary if $a^2+b^2+c^2+d^2=1$	06	2	3	4
Q6 c)	Find the analytic function whose real part is $u=e^x(x\cos y-y\sin y)$	08	2	3	3
Q7 a)	Determine the value of 'p' such that the rank of matrix is 3 $A=\begin{pmatrix}1 & 1 & -1 & 0\\ 4 & 4 & -3 & 1\\ p & 2 & 2 & 2\\ 9 & 9 & p & 3\end{pmatrix}$	06	3	3	4
Q7 b)	Evaluate $\mathcal{L}\{e^{-3t}\sin 3t\sinh 4t\}$	06	1	2	1
Q7c)	Find the bilinear transformation that maps the point $z_1=-i, z_2=0, z_3=i$ into the points $w_1=-1, w_2=i, w_3=1$ respectively. Into what curve the y – axis is transformed to this transformation?	08	2	3,5	3

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End Sem/~~Re-Examinations~~ Working Professional- January 2025

Program: Civil Engineering **Duration: 3hr**

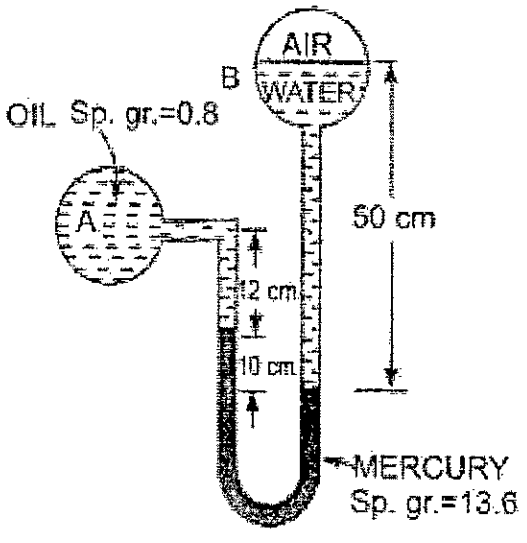
Course Code: PC-BTC306 **Maximum Points: 100**

Course Name: Fluid Mechanics **Semester: III**

Instructions

1. **Attempt any 5 Questions.**
2. Neat diagrams must be drawn wherever necessary.
3. Assume Suitable data if necessary and state it clearly.

Q. No.	Questions	Points	CO	BL	Mod
1a	Determine the viscosity of a liquid having a kinematic viscosity 6 stokes and specific gravity 2.0	4	CO1	BL2	1
1b	Find the capillary rise of water in a tube 0.03 cm diameter. The surface tension of water is 0.0735N/m	4			1
1c	State and Prove Pascal's law	8	CO1	BL2	2
1d	An oil of specific gravity of 0.8 is under a pressure of 137.2kN/m^2	4	CO1		2
	i) What is the pressure head expressed in meter of water? ii) What is the pressure head expressed in meter of oil?				
2a	Discuss the classification of fluids.	8	CO2	BL2	1
2b	A rectangular plane 3.0m wide and 4.0 m deep is immersed in water in such a way that its plane makes an angle of 30 degrees with the free surface. Determine the total pressure on one face of the plate and position of the center of pressure when its upper edge is 2m below the free surface.	8	CO1	BL3	3
2c	Brief about the classification of pressure measuring devices.	4	CO1	BL1	2
3a	A differential manometer is connected to two pipes A and B as shown in the figure. At B air pressure is 7.848N/cm^2. Find absolute pressure at A.	6	CO1	BL2	2



3b	Derive continuity equation for 3 dimensional flow.	8	CO2	BL2	4
3c	A body of dimensions width 2m, depth 1.5m and length 4m floats horizontally in water. Find the volume of water displaced and position of center of buoyancy. G for wooden block is 0.7.	6	CO1	BL3	3
4a	Describe Reynolds experiment, along with the characteristics of laminar and Turbulent flow.	8	CO3	BL2	5
4b	Discuss classification notches and orifices.	4	CO2	BL1	4
4c	Water flows through a pipe AB 1.2m dia at 3m/s and then passes through a pipe BC 1.5m dia. At C the pipe branches.	8	CO1	BL3	4
	Branch CD is 0.8 m in diameter and carries one third of flow in AB. The flow velocity in branch CE2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and diameter of CE				
5a	Prove that equipotential lines are orthogonal to streamlines at all points of intersections.	6	CO2	BL2	4
5b	Explain in detail stream line, pathline and streak line.	6	CO2	BL2	4
5c	Discuss the development of boundary layer along the flat plate and any 2 method to control the separation of boundary layer.	8	CO3	BL2	6
6a	State Bernoulli's theorem. Explain in depth the applications of the same.	8	CO3	BL2	
6b	In a fluid, the velocity field is given by	8	CO1	BL3	4
	$V=(3x+2y)i + (2z+3x^2)j+(2t-3z)k$ Determine a) The velocity components u, v and w at any point in the flow field. b) The speed at point(3,2,3) c) The speed at t=4sec at point (0,0,4) d) Also classify the velocity field as steady, or unsteady, uniform or non-uniform and 1D, 2D and 3D flow.				
6c	Differentiate Newtonian and non-Newtonian fluids.	4	CO1	BL1	4
7a	A 25 cm diameter pipe carries oil of specific gravity 0.9 at a velocity of 3m/sec. at another section the diameter is 20cm. Find the velocity at this section and also mass rate of flow of oil.	8	CO3	BL2	4
7b	Discuss the conditions of a equilibrium of a submerged bodies.	6	CO1	BL2	3
7c	An open tank contains water upto a depth of 2m and above it an oil of specific gravity 0.9 for a depth of 1m. Find the pressure intensity a) At the interface of the two liquids b) At the bottom of the tank.	6	CO1	BL3	

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End Semester/~~Re-examination~~ 2024-25

Program: S.Y.B.Tech_WP (Civil) **Duration: 3 Hours**

Course Code: BS-BTC301 **Maximum Points: 100**

Course Name: Laplace Linear Algebra and Complex Analysis

Semester: III

Note:

1. **Attempt Any Five Questions**
2. **Answers to the sub questions should be grouped together**

		Questions	Points	CO	BL	Module
1	a	Test the consistency of the following system of linear equations and if possible, solve $2x+3y-z-2=0$ $x+2y+z+3=0$ $3x+y-2z-1=0$	6	4	BL5	4
	b	Find the sum and product of Eigen values of A^{-1}, where $A=\begin{bmatrix}3&1&6&8\\0&2&5&7\\0&0&5&3\\0&0&0&-1\end{bmatrix}$	6	4	BL5	4
	c	Evaluate $(i)\,L\{e^{-3t}\sin 4t\cdot\cos 3t\}$ $(ii)\,L\{t\cos(at+b)\}$, where a and b are constants.	8	1	BL3	1
2	a	Find Eigen Values and Eigen Vectors of the following matrix $A=\begin{bmatrix}3&4\\4&-3\end{bmatrix}$	6	4	BL5	5
	b	Under the transformation $w=\frac{1}{z}$, find the image of $\lvert z-3\rvert=2$	6	3	BL2	3

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End Semester/~~Re-examination~~ 2024-25

	c	Reduce the following matrix to normal form and hence find its rank. $A=\begin{bmatrix}2 & 1 & 4 & -1\\ 1 & 2 & 1 & 3\\ 4 & 5 & -1 & 2\\ 8 & 7 & 7 & 1\end{bmatrix}$	8	4	BL3	4
3	a	Prove that $v=x^4-6x^2y^2+y^4$ is a harmonic function and find corresponding harmonic conjugate	6	3	BL4	3
	b	Evaluate $L^{-1}\left\{\frac{3s+1}{(s-1)^2(s+2)}\right\}$	6	1	BL5	2
	c	Verify Cayley Hamilton Theorem for the following matrix and find A^{-1}, if it exists $A=\begin{bmatrix}0 & c & -b\\ -c & 0 & a\\ b & -a & 0\end{bmatrix}$	8	4	BL5	5
4	a	Determine constants a,b and c if $A=\frac{1}{3}\begin{bmatrix}1 & 2 & a\\ 2 & 1 & b\\ 2 & -2 & c\end{bmatrix}$ is orthogonal.	6	4	BL5	4
	b	Evaluate $\int_0^\infty te^{-3t}\cos 4t\,dt$	6	2	BL3	1
	c	Using Convolution Theorem, Evaluate $L^{-1}\left\{\frac{1}{(s+3)(s-2)^3}\right\}$	8	1	BL3	2
5	a	Evaluate $L\left\{\frac{e^{-at}-e^{-bt}}{t}\right\}$	6	1	BL4 ,5	2
	b	Find the map of the straight line $3x+2y=1$ by the transformation	6	3	BL4	3

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		$w=\frac{1}{z}$				
	c	Evaluate $(i)\,L\{\sin t\cdot\sin 2t\cdot\sin 3t\}$ $(ii)\,L\{e^{-2t}f(t)\}$ where $L\{f(t)\}=\frac{2s-3}{s^2+s+1}$	8	1	BL2 BL4	1
6	a	Evaluate $L^{-1}\left\{\frac{2s+3}{(s-1)(s-2)(s-3)}\right\}$	6	1	BL5	2
	b	Evaluate $L\left\{\left(t+e^{-t}+\sin t\right)^2\right\}$	6	1	BL3	1
	c	For the following matrix A, find two non-singular matrices P and Q such that PAQ is in the normal form. $A=\begin{bmatrix}1&2&3&4\\2&1&4&3\\3&0&5&-10\end{bmatrix}$	8	4	BL3 BL5	4
7	a	Find the analytic function $f(z)=u+iv$ whose imaginary part is $v=x^2-y^2+\frac{x}{x^2+y^2}$	5	3	BL2 BL3	3
	b	Evaluate $L^{-1}\left\{\log\left(\frac{(s-1)(s-2)}{s^2+4}\right)\right\}$	5	1	BL5	2
	c	Find Eigen Values and Eigen Vectors of the following matrix $A=\begin{bmatrix}2&1&1\\2&3&2\\3&3&4\end{bmatrix}$	10	4	BL1 BL3	5

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END SEM/~~RE-EXAM~~ EXAMINATION FOR WORKING PROFESSIONAL JAN/FEB 2024-25

Program: B.Tech. Civil Engineering
Course Code : **PC-BTC305**
Course Name : **Concrete Technology**

Duration: 3 Hour
Maximum points: 100
Semester: III

Instructions:

1. Attempt ***any FIVE questions out of SEVEN*** questions
2. ~~Answers to all sub questions should be grouped together~~
3. Draw neat diagrams wherever required
4. Assume suitable data if necessary and state the clearly.

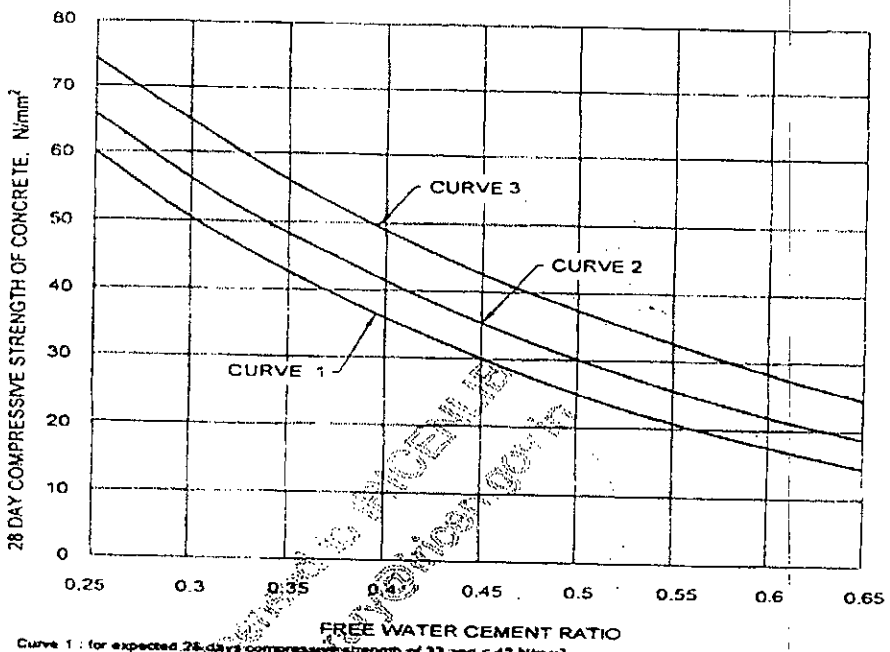
Que. No.	Descriptions	Points	CO	BL	Module No.
Q1	(a) "Ready mix Concrete turns out to be a boon for Indian construction industry" justify your answer. Also discuss the various units and their functions you have observed during site visit.	08	3	2	05
	(b) How workability of normal concrete and SCC measured at site to examine the quality of fresh concrete?	07	3	4	04
	(c) Highlight the importance of Alkai-Silica reaction on durability of concrete.	05	1	2	01
Q2	a. Differentiate between weigh batching and volume batching of concrete	5	1	3	03
	b. **Design concrete for M35 grade using guidelines given in IS 10262:2019 for the following data.**	15	2	2	03

Exposure condition: **Severe**	Maximum size of aggregate —20 mm	Method of placement – crane and bucket	Specific gravity of 20 mm aggregate (M_2)- 2.80
Strength of cement OPC —43 grade	Workability — slump, 100 mm	Type of coarse aggregate — angular coarse aggregate	Specific gravity of 10 mm aggregate (M_1) — 2.70
Zone of sand — I	Water absorption- M_2-1.8% & M_1- 1.3% Total moisture content M_2-0.7% & M_1- 0.8%	Water absorption fine aggregate- 3.1% Total moisture content in fine aggregate – 5.6 %	Specific gravity of fine aggregate — 2.85

Q3	(a) Design concrete for **M 25** grade using DOE method. Refer the data from Que2 and chart attached at the end of manuscript. Consider maximum permissible ratio of 0.55 and minimum cement content as 325 kg per cum.	12	3	4	3
	(b) Why corrosion of steel reinforcement occurs in concrete? Explain in detail the procedure for conducting Half-cell potentiometric test.	08	2	2	5

Q4	(a) **Design concrete for M30 grade using ACI Method; consider the data related to the properties of material as given in Que.No.2.** (b) **Discuss** problems occurs in cold weather concreting. Suggest suitable measures to improve the performance.	12 8	2 1	3 2	3 4
Q5	(a) It is proposed to **design SCC** of grade M35 for slump flow of 600-800 mm, consider w/c of 0.34, and the percentage of fine aggregate passing from 125 micron as 4.1 %. Assume suitable powder content between 400-600 kg /$m^3$and other data from the que2a. **(b)** Distinguish between (i) Hydrophobic cement and low heat cement (ii) Hand mixing vs. Machine mixing	**12** **8**	1 2	2 2	3 1,3
Q6	(a) What are the benefits of High Performance concrete (HPC)? Discuss in brief different properties of HPC. (b) Explain the effect of w/c on strength, durability and workability of concrete. (c) How Silica fume act as sustainable material to improve the performance of concrete?	**10** **6** **4**	1 3 2	2 3 3	4 2 1
Q7	Write explanatory notes on the following *(any Four)* i) Materials for HPC ii) Ultrasonic pulse velocity test iii) pH test of concrete iv) Testing of chemical admixture v) Bulking of sand vi) Bogues compound	**5** **5** **5** **5** **5** **5**	3 2 3 1 1 3	2 2 2 2 2 2	4 5 5 3 1 1

Reference Tables for IS 10262:2019 Method of Concrete mix design



Curve 1 : for expected 28-days compressive strength of 33 and < 43 N/mm².
Curve 2 : for expected 28 days compressive strength of 43 and < 53 N/mm².
Curve 3 : for expected 28-days compressive strength of 53 N/mm² and above.

NOTES

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 *and* 9.1.2*)*

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

IS 10262 : 2019

Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Water-Cementitious Materials Ratio of 0.50

(Clause 5.5*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.54	0.52	0.50	0.48
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.73	0.72	0.71	0.69

NOTES

1 Volumes are based on aggregates in saturated surface dry condition.

2 These volumes are for crushed (angular) aggregate and suitable adjustments may be made for other shape of aggregate.

3 Suitable adjustments may also be made for fine aggregate from other than natural sources, normally, crushed sand or mixed sand may need lesser fine aggregate content. In that case, the coarse aggregate volume shall be suitably increased.

4 It is recommended that fine aggregate conforming to Grading Zone IV, as per IS 383 shall not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions.

Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate

(Clause 5.3*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Water Content[1] kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

[1] Water content corresponding to saturated surface dry aggregate.

Table 3 Approximate Air Content

(Clause 5.2*)*

Sl No.	Nominal Maximum Size of Aggregate mm	Entrapped Air, as Percentage of Volume of Concre
(1)	(2)	(3)
i)	10	1.5
ii)	20	1.0
iii)	40	0.8

5.2.1 The actual values of air content can also adopted during mix proportioning, if the site data least 5 results) for similar mix is available.

Reference charts for DOE Method

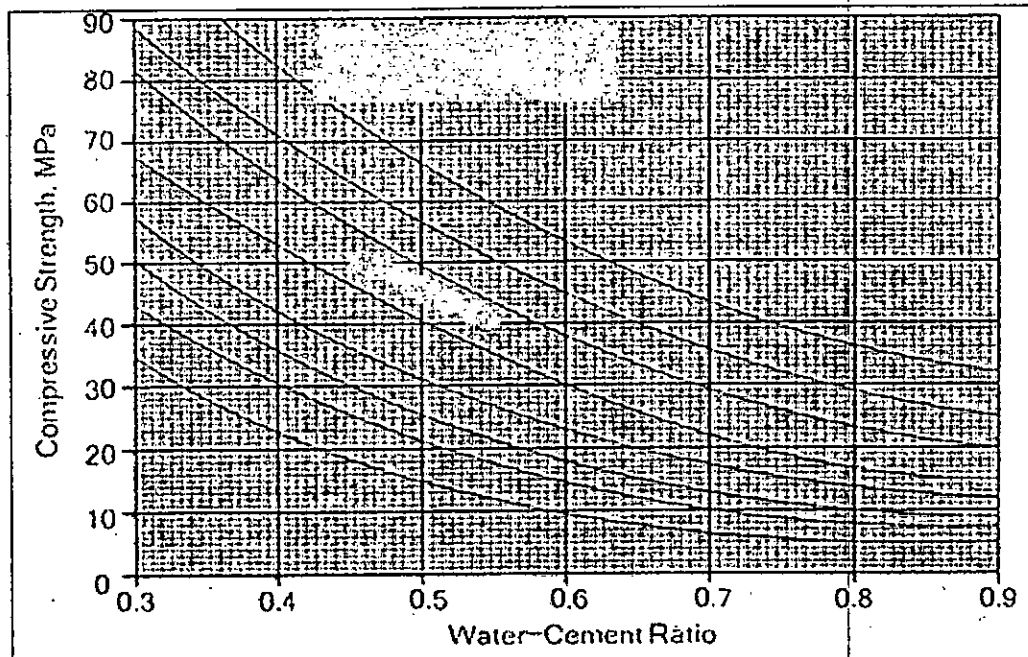
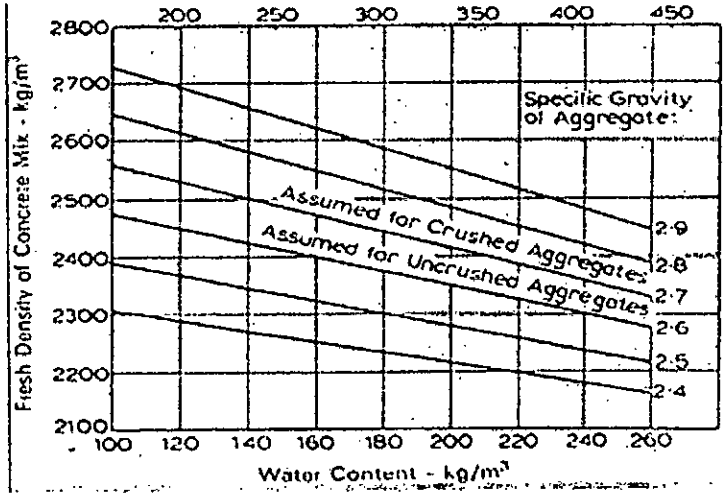


Table 20.47. App. Free water content required for various workability according to 1988 British Method

Aggregate		Water content kg/m³ for slump			
Max. size mm	Type	0 — 10 mm	10 — 30 mm	30 — 60 mm	60 — 180 mm
		Vee Bee secons > 12	6 — 12	3 — 6	0 — 3
10	Un crushed	150	180	205	225
	crushed	180	205	230	250
20	Un crushed	135	160	180	195
	crushed	170	190	210	225
30	Un crushed	115	140	160	175
	crushed	155	175	190	205

Table 20.48. Reduction in water content of table 21.47 when fly ash used.

% of fly ash in cementitious material	Slump in mm Vee Bee seconds	Reduction in water content kg/m³			
		0 — 10 > 12	10 — 30 6 — 12	30 — 60 3 — 6	60 — 180 0 — 3
10		5	5	5	10
20		10	10	10	15
30		15	15	20	20
40		20	20	25	25
50		25	25	30	30



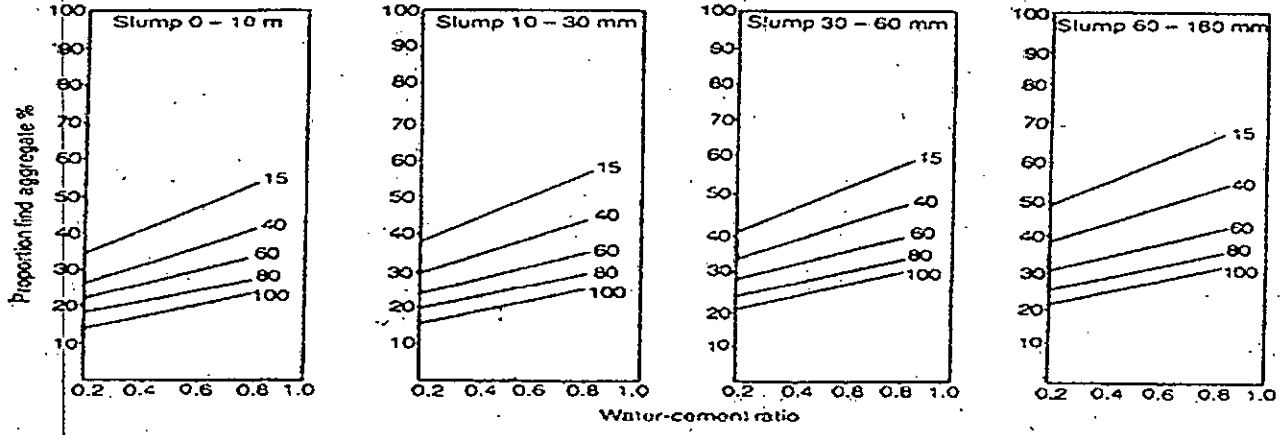


Fig 20.12. (b)

Table 20.46 App Compressive strength of concrete in Mpa with w/c of 0.5 as per DOE for OPC (Type I) and SRC (Type v) at diff time period

Type of cement		3 days	7 days	28 days	91 days
OPC	Uncrushed	18-22	27-30	40-42	48-49
SRC	Crushed	23-27	33-36	47-49	55-56

Table 1,2 and 3 for ACI Method Concrete Mix Design

(1) Dry Bulk Volume of coarse aggregate/ unit volume of concrete as per ACI 211.1-91

Maximum size of aggregate	Bulk volume of dry rodded CA /unit volume of concrete for fineness modulus of sand of			
FM	2.4	2.6	2.8	3.00
10	0.5	0.46	0.46	0.44
12.5,	0.59	0.57	0.55	0.53
20 (25,40,50,70)	0.66	0.64	0.62	0.60
150	.87	0.85	0.83	0.81

(2) Relation between water/cement ratio & average compressive strength of concrete, as per ACI211.1-91

Average compressive strength at 28 days	Effective water/cement ratio (by mass)	
MPa	Non air entrained concrete	Air entrained concrete
45	0.38	-
40	0.43	-
35 (30,25,20)	0.48	0.4
15	0.8	0.71

(3) Requirements of ACI-318-89 for w/c ratio & strength for special exposure conditions

Exposure condition	Maximum w/c ratio, normal density aggregate concrete	Minimum design strength, low density aggregate concrete MPa
Concrete intended to be watertight		
(a) Exposed to fresh water	0.5	25
(b) Exposed to sea water	0.45	30
Concrete exposed to freezing in a moist condition	0.45	30
For corrosion protection of reinforced concrete exposed to de-icing salts, sea water	0.4	33

Table 4,5 and 6 for ACI Method Concrete Mix Design

(4) Recommended value of slump for various types of construction as per ACI 211.1-91

Type of construction	Range of slump (mm)
Reinforces foundation walls & footings	20-80
Plain footings,substructure wall	20-80
Beams & reinforced walls	20-100
Building columns	20-100
Pavements & slabs	20-80
Mass concrete	20-80

(5) Approximate requirements for mixing water & air content for different workabilities & nominal maximum size of aggregates as per ACI211.1-91

Non air entrained concrete				
Workability & air content (Slump)	Water content, kg/m3 of concrete for indicated maximum aggregate size			
	10 mm (25, 40,50,70)	12.5 mm	20 mm	150 mm
30-50 mm	205	200	185	125
80-100 mm	225	215	200	140
150-180 mm	240	230	210	-
Approx entrapped air (%)	3	2.5	2	0.2

(6) First estimate of density of fresh concrete as pe ACI 211.1-91

Maximum size of aggregate (mm)	First estimate of density of fresh concrete	
	Non air entrained kg/m³	Air entrained kg/m³
10	2285	2190
12.5 (20,25,40,50)	2315	2235
20	2355	2280
150	2505	2435

As per ACI in absence of record; required increase in mean strength for specified design strength

Specified design Strength (Mpa)	Less than 21	21-35	35 or more
Required Increase in mean strength (Mpa)	7	8.5	10

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10/1/25

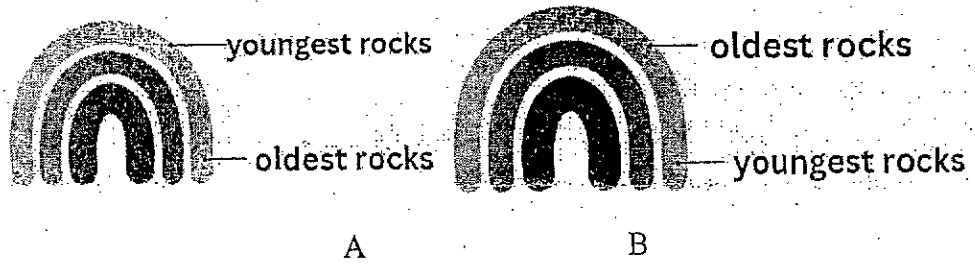
END SEM/RE-EXAM EXAMINATION JAN 2025

Program: B.Tech. (Civil) ENGINEERING | **Duration: 3 Hours**
Course Code: BS-BTC 302 | **Maximum Points: 100**
Course Name: Engineering Geology | **Semester: III**

NOTE: Attempt the question paper in either ascending sequence or descending sequence. Start a new question on a fresh sheet. Use of scientific calculators is permitted. Mention the correct question numbers in the answer sheet. Attempt any 5 questions out of the 7 questions.

No.	Questions	Points	CO	BL	Module No.
1 A	Solve the following questions.	4			
1.	What is a thalweg? Explain it using a diagram.	6			1
2.	Where do s-waves disappear in the internal layers of the Earth? What is the reason behind the disappearance?				
1.B	Solve the following questions	5			
1.	List out the common rock forming minerals.	2			2
2.	What is the difference between rocks and minerals?	3			
3.	Which of the following is a foliated metamorphic rock - quartzite, schist, and marble.		1	2	
.2A	Discuss the issues associated with a site which is:	10			
1.	An area with limestone and claystone bedding.				3
2.	An area with basalts which have vesicles and have columnar joints.				
3.	An area with foliated metamorphic rocks such as slates and schists.				
2B	Match the following.	10			1
	1. Focus/Hypocentre — **A.**The point on the surface that is directly perpendicular to the focus.				
	2. Epicentre — **B.**Measure the scale of absolute magnitude of an earthquake				
	3. S-waves — **C.**The point where the energy of an earthquake is released inside the Earth.				
	4. Richter scale — **D.**Measures the intensity of an earthquake based on based on the amount of destruction caused				
	5. Mercalli scale — **E.**Second to reach the epicenter		1, 2	1, 2, 3	
. 3A	Match the following features with the associated rocks.	10			
1	Foliated metamorphic rock. A. Phyllite/Schist			1,	
2	Metamorphic composed of CaCO3. B. Gneiss		1	2, 3	3

END SEM/RE-EXAM EXAMINATION JAN 2025

3	Sedimentary rock composed of CaCO3. C. Marble				
4	Preferred orientation of mafic and felsic minerals arranged in separate layers. D. Limestone				
5	Fine grained metamorphic rock with layers and fissility. E. Slate				
Q.3 B	**Solve the following questions.**				
1.	List out the properties of sedimentary rocks with examples.	5			
2.	Claystone, Sandstone, Gneiss, Conglomerate, Limestone. Find the odd one out and justify your answer.	5			
Q. 4	Solve the following questions.				
1.	Draw the diagrams of an antiform and synform. Identify the anticline and syncline from the diagrams below:  A B	5			
2.	What is the geological feature in which blocks of rocks move with respect to one another? Mention its types with a short description.	5			
3.	What are the factors causing landslides?	5			
4.	Comment on the type of dams that can be constructed at a location with:	5			
a.	Narrow valleys, and strong abutments				
b.	Wide valleys.				
c.	Strong foundation, and moderately narrow valleys.				
d.	Seismically active regions.			1,	
e.	Wide valleys with weak or permeable foundations.		1, 2	2, 3	4
Q.5A	Write a note on (any 5)				
1.	Dip and strike	10			4
2.	Right hand thumb rule for identifying the dip and strike				
3.	Principle of Original horizontality				
4.	Principle of Uniformitarianism				
5.	Unconformities				
6.	Principle of order of superpositions				
7.	Principle of inclusions				
8.	Principle of crosscutting relationships			1,	
Q. 5B	What is a cone of depression? Which factors influence this cone of depression?	10	1, 2	2, 3	6

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13/1/25

~~ENDSEMESTER EXAMINATION~~/RE-EXAMINATION ~~DEC24~~-JAN25

Program:CIVIL S.Y CE) Sem III

Duration: 03 Hours

Course Code: BS-BTC301

Maximum Points:100

Course Name: Laplace vectorcalculus & linearalgebra

Semester: III

- **Attempt any five out of seven questions**
- **Use of scientific calculator is allowed.**

QNO.	QUESTION	POINTS	CO	BL	Module No.
Q1a)	Find the analytic function whose real part is $u=\left(\frac{\sin 2x}{\cosh 2y-\cos 2x}\right)$	06	2	2	3
Q1 b)	Using convolution theorem evaluate $\mathcal{L}^{-1}\left\{\frac{s}{s^4+8s^2+16}\right\}$	06	1	3,5	2
Q1 c)	If $A=\begin{bmatrix}2+i & 3 & -1+3i\\ -5 & i & 4-2i\end{bmatrix}$ Show that A^*A is a Hermitian matrix, where A^* is the conjugate transpose of A.	08	2	1	4
Q2a)	Test for consistency and solve $x-2y+3t=2$ $2x+y+z+t=-4$ $4x-3y+z+7t=8$	06	3	2	4
Q2b)	Find the image of $\lvert z-3i\rvert=3$ under the mapping $w=\frac{1}{z}$.	06	2	2	3
Q2c)	Evaluate $\mathcal{L}\left\{\int_0^t te^{-3t}\sin 4t\,dt\right\}$	08	2	3	1
Q3 a)	Find L $\left[\frac{d}{dt}\left(\frac{1-\cos 2t}{t}\right)\right]$	10	1	2	1
Q3b)	Find the eigen values and eigenvectors of the matrix $A=\begin{bmatrix}1 & 2 & 0\\ 2 & 1 & -6\\ 2 & -2 & 3\end{bmatrix}$	10	3	4,5	3

~~ENDSEMESTER EXAMINATION~~/RE-EXAMINATION ~~DEC24~~-JAN25

Q4 a)	Find non – singular matrices P and Q such that P A Q is in normal form $A=\begin{bmatrix}1&2&-1&2\\2&5&-2&3\\1&2&1&2\end{bmatrix}$ Hence find rank of A.	10	3	3	4
Q4 b)	Solve using Laplace $\frac{dy}{dt}+2y+\int_0^t y\,dt=\sin t$ ~~Given $y(0)=1$~~	10	1	3	2
Q5 a)	Evaluate: $L^{-1}\{cot^{-1}(1+s^2)\}$	10	1	2	2
Q5 b)	Find the characteristic equation of the matrix $A=\begin{bmatrix}2&1&1\\0&1&0\\1&1&2\end{bmatrix}$. Verify Cayley – Hamilton theorem	10	3	2	5
Q6a)	Using laplace transforms Prove that $\int_0^\infty \frac{\sin 2t+\sin 3t}{te^t}dt=\frac{3\pi}{4}$	06	1	4	1
Q6 b)	Define a unitary matrix. if $N=\begin{bmatrix}0&1+2i\\-1+2i&0\end{bmatrix}$ is a matrix, then show that $(I-N)(1+N)^{-1}$ is a unitary matrix, where I is an identity matrix.	06	3	3	4
Q6 c)	Find the bilinear transformation which maps z = 2, 1, 0 onto w = 1, 0, i	08	2	3	3
Q7 a)	Determine the value of 'p' such that the rank of matrix is 3 $A=\begin{pmatrix}1&1&-1&0\\4&4&-3&1\\p&2&2&2\\9&9&p&3\end{pmatrix}$	06	3	3	4
Q7 b)	Obtain Laplace Transforms $f(t)=\sin\sqrt{t}$	06	2	2	1
Q7c)	Find the analytic function $f(z)=u+iv$ such that $u-v=(x-y)(x^2+4xy+y^2)$	08	1	3,5	3

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~~END SEM~~/RE-EXAM EXAMINATION ~~DEC~~/JAN 2024-25

14/11/25

Program: B.Tech Civil Engineering S.Y. Sem III

Duration: 3 hours

Course Code: PC-BTC301

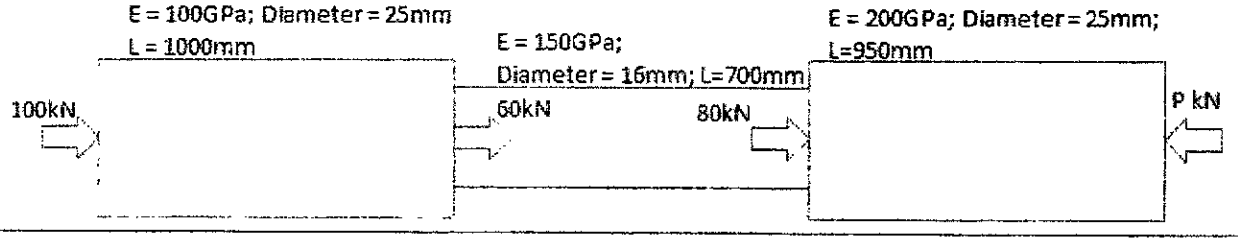
Maximum Points:100

Course Name: Mechanics of materials

Semester:III

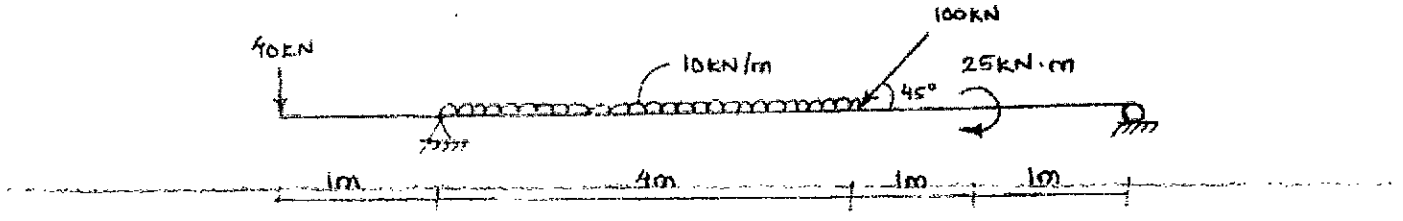
Notes : ***Attempt any 5 main questions out of 7; Assume any missing data and state the same clearly; Illustrate your answers with neat sketches***

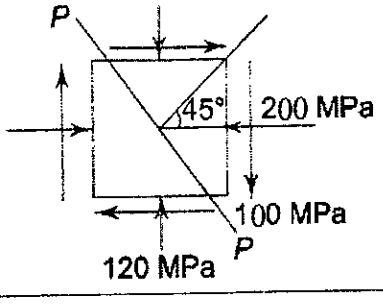
Q.No.	Questions	Points	CO	BL	Module No.
1.a)	A compound tube consists of a steel tube of 140 mm internal diameter and 155 mm external diameter and an outer brass tube of 160 mm internal diameter and 170 mm external diameter. Both the tubes are of 1.5 m length and are rigidly connected at both ends. If the compound tube carries an axial compressive load of 900 kN, find the change in length. Also find the stresses and the loads carried by each tube. $E_s = 2 \times 10^5$ N/mm^2, $E_b = 1 \times 10^5$ N/mm^2.	08	02	03	01
1.b)	In a tensile test on mild steel bar of 20 mm diameter, the elongation in a gauge length of 100 mm was 0.072 mm when the load was 45 kN. The reduction in diameter was 0.0036 mm. Find the value of Poisson's ratio and the elastic constants 'E', 'G' and 'K'.	08	02	04	01
1.c)	State the assumptions in theory of pure bending	04	02	02	03
2.a)	A rod of steel 2.5 m in length is at a temperature of 27^{0}C. Find: i) the free expansion and the corresponding stress when the temperature is raised to 110^0 C. ii) stress if no expansion is allowed iii) stress when an expansion of 2 mm is allowed. Take $\alpha = 12 \times 10^{-6}/^0$ C, E = 220 GN/m^2.	08	02	03	01
2.b)	Obtain the value of P for equilibrium and find the change in length for the following assembly	10	02	03	01



~~END SEM~~/RE-EXAM EXAMINATION ~~DEC~~/JAN 2024-25

3	Draw the shear force, bending moment and axial force diagram for the beam shown below. Also find the maximum value of bending moment.	20	01	04	02



4.a)	A 300 x 600 mm timber beam is strengthened by the addition of 300 x 8 mm steel plates secured at its top and bottom surfaces. The composite beam is simply supported and carries a uniformly distributed load of 50kN/m over an effective span of 8m. Find the maximum bending stresses in steel and timber at the mid-span. Take $E_S = 2 \times 10^5$ N/mm^2 and $E_T = 1 \times 10^4$ N/mm^2.	12	02	04	03
4.b)	A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 4 mm thick. The length and internal diameter of the vessel are 65 cm and 30 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 4N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take $E = 2\times10^5$ N/mm^2 and μ=0.3	08	03	03	07
5.a)	A plane element is subjected to the stresses as shown in the figure below. Determine analytically: i) The principal stresses and their directions ii) The maximum shearing stresses and the directions of the plane in which they act. iii) Normal and shearing stresses on the inclined plane P-P 	10	02	04	06

~~END SEM~~/RE-EXAM EXAMINATION ~~DEC~~/JAN 2024-25

5.b)	Solve Q.5.a) using Mohr's circle	10	02	04	06
6.a)	A T beam having flange as (120x10)mm and web as (150x10)mm is used as a simply supported beam over 3m span and carries a UDL of 15kN/m. Calculate the shear stresses induced at support section and sketch the variation of shear stress	10	02	03	04
6.b)	Obtain the shear centre for a channel section having flange as 200x10mm and web as 250x10mm (Total depth of section = 270mm). The section is subjected to a shear force of 20kN. Sketch the variation of shear flow across the section.	10	04	03	04
7.a)	A solid cylindrical steel shaft transmits a power of 500 kW at 200 r.p.m. If the shear stress is not to exceed 95 MPa, find its diameter. Also if this solid shaft is being replaced by a hollow shaft of same material, equal length and same allowable shear stress, having internal diameter equal to 0.75 times the external diameter, find the dimensions of the hollow shaft	10	02	04	05
7.b)	With the help of stress-strain curve for mild steel explain the following terms: 1. Proportional limit 2. Elastic limit 3. Yield stress 4. Ultimate stress Also, draw the stress-strain curve for brittle materials and explain the difference between ductile and brittle materials.	10	02	02	01

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~~End Semester Examination~~ Re-Exam
~~December 2024~~ Jan - 2025

15/1/25

S.Y. Semester III

Program: Civil Engineering
Course Code: PC – BTC302
Course Name: Basics of Surveying

Duration: 3 hours
Maximum Points: 100
Semester: III

Instructions:

1. **Q.no.1 is compulsory.**
2. **Solve any FOUR from the remaining SIX questions.**
3. Write answer to each question on a new page.
4. Answers to be accompanied with appropriate sketches wherever necessary or required
5. Assume and state suitable data wherever necessary.

Q.No.	Questions	Points	CO	BL
1	a. Explain the two basic principles of surveying. **(4)** b. List the fundamental lines of theodolite. State the desired relationship between these lines. **(4)** c. Enlist and explain the function of each of the instruments required for plane table surveying. **(4)** d. Describe the temporary adjustments of a level in a field. **(4)** e. With a neat sketch define and explain the term contour interval and horizontal equivalent. **(4)**	**20**		2 1 1 2 1
2	a. The following consecutive readings (in meters) were taken with a level intervals of 10m: 1.185, 2.604, 1.925, 2.305, 1.155, 0.864, 1.105, 1.685, 1.215, 1.545, and 0.605. The instrument was shifted after the readings 2.604, 0.864, and 1.215. The first reading was to a benchmark of assumed elevation 185.685m. 1. Draw the profile **(2)** 2. Prepare the field book page. **(2)** 3. Calculate the reduced levels (RLs) of all points using the rise and fall method. **(4)** [Show all the calculations] 4. Verify the arithmetic check. **(2)** 5. Find the difference between the first and the last point. **(2)** b. State the formula for calculating the area by the trapezoidal rule, average ordinate rule, and Simpson's 1/3 rule for calculating the area of an irregular figure **(6)** Include examples of when each method would be most suitable. **(2)**	**20**		3 2

Re ~~End Semester~~ Examination

~~December 2024~~ Jan - 2025

3	a. Explain in detail any one of the direct methods **(3)** and one of the indirect methods (3) of contouring. b. Discuss the characteristics (atleast 6) of contouring. **(6)** c. Explain the procedure to determine the horizontal distance and vertical distance between two staff station points, say A and B, by taking stadia hair measurements from a tacheometer at instrument station 'O'. Station 'B' is at higher level w.r.t the instrument level at station 'O' and station 'A' is at lower level w.r.t. the instrument level at station 'O'. The staff is held vertical. **(8)**	**20**		2 2
4	a. Derive the equation for determining the horizontal distance and vertical distance with stadia fixed hair method of tachometry when the line of sight is inclined (angle of elevation) and the staff is held vertical. **(8)** b. A theodolite closed traverse ABCDA was conducted, and the following data were recorded. Draw the traverse and check if the traverse is closed. Then, compute the error of closure. **(4)** Adjust the latitudes and departures if required. Use Transit Rule to balance the traverse. **(4)** Compute the corrected latitude and departure and Independent coordinates for each side. **(4)**	**20**		2 3 3
5	a. The fore bearings (FB) of the lines AB and BC are 146° 30' and 68° 30'. Calculate the included angle ABC. **(4)** b. Explain with a neat sketch the procedure for 'Profile levelling' and 'Cross sectioning'. (4) c. The following offsets (in metres) were taken at 30m intervals from a survey line to an irregular boundary line: 0, 7.4, 5.6, 6.3, 6.9, 7.5, 8.3, 0 Draw the plot. **(2)** Calculate the area enclosed by the boundary using: Trapezoidal rule **(5)** and Simpson's 1/3 rule **(5)**	**20**		3 2 3

Side	Length (m)	Bearing	Latitude (m)	Departure (m)
AB	250	86° 42'	107.97	3.77
BC	123	178° 06'	14.39	249.57
CD	256	270° 00'	-122.94	4.12
DA	108	2° 00'	0	-256.00

Independent coordinates, X and Y, of Station A are 200.00m and 100.00m respectively.

Re ~~End-Semester~~ Examination

~~December 2024~~ Jan - 2025

6	a. Draw neat and labelled typical cross sections of a prismatic compass **(4)** and a surveyor's compass **(4)** and compare their features, working, advantages, and limitations. **(4)** b. Describe the procedure of reciprocal levelling. **(4)** c. The following observations were made during the testing of a dumpy level. Determine whether the line of collimation (LoC) requires an adjustment. (4)	**20**		

Instrument at	Staff reading at	
	A	B
A	1.725	2.245
B	2.145	3.045

7	a. Explain, with proper sketch, the purpose and procedure of fly levelling. **(4)** b. Explain the difference between profile leveling and cross-section leveling in terms of their objectives and typical applications in linear infrastructure works.**(4)** c. A proposed road embankment has the following cross-sectional areas measured at regular intervals of 20 m along the length of the road: 25.54 m^2, 18.63 m^2, 22.45 m^2, 30.12 m^2, and 20.80 m^2. Compute the volume of the embankment using: i. Trapezoidal formula **(5)** and Prismoidal formula **(5)** ii. Compare the results and give inference. **(2)**	**20**		

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RE-EXAM EXAMINATION DEC/JAN 2024-25

16/1/25

Program: B.Tech. (Civil) ENGINEERING Sem VII **Duration: 3 Hours**

Course Code: BS-BTC 302 **Maximum Points: 100**

Course Name: Engineering Geology **Semester: III**

NOTE: Start a new question on a fresh sheet. Use of scientific calculators is permitted.

Draw neat labelled diagrams wherever necessary.

Q.No.	Questions	Points	CO	BL	Module No.
Q.1 a	Write a descriptive note on erosional and depositional landforms associated with aeolian landforms.	10			
	OR				
Q.1 b	What is erosion? What are the agents and processes involved in the modification of the surface of the Earth? Following this, comment on the types of landforms created by these agents		1	2	1
Q.2	Given below are the properties of some minerals, match the minerals with those properties.	10			
i.	Rhombohedral cleavage. hardness 3. **A. Quartz**				
ii.	Irregular habit, vitreous lustre, 7 hardness. **B. Calcite**				
iii.	Cubic habit, octahedral cleavage, hardness 4. **C. Talc**				
iv.	Soapy feel, hardness 1. **D. Gypsum**				
v.	Hardness 2, resinous to silky lustre. **E. Fluorite**		1	1, 2	2
Q.3a	Write a descriptive note on the types of igneous rocks. Explain the consequences of using a vesicular rock as construction material.	5			
Q.3b	What are the issues associated with constructions using sedimentary rocks such as limestones and claystones.	5			
Q. 3c	What are foliated metamorphic rocks? How does foliation affect the stability of a structure? Would you construct a structure of a foliated rock such as schist without any modification to the foundation?	10			
	OR				
Q. 3d	Write a note on the properties of sedimentary rocks.		1	2	3

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Q.4 a	Explain the risks associated with construction in a terrain with joint planes and faults.	4			
Q.4 b	Write a note on (any 3)	6			
A.	Principle of fossil succession.				
B.	Principle of Catastrophism				
C.	Principle of Original horizontality				
D.	Principle of cross cutting relationships				
E.	Faults				
F.	Folds		2, 3	1, 2	4
	Solve the following questions.				
Q. 5 a.	What is tensile strength? What can you infer from the tensile strength of a sample?	5			
b.	Calculate the porosity of a rock sample which has a volume of $200cm^3$. The volume of voids is $50cm^3$.	5			
c.	What is sorption? What are the accepted values of % sorption in rock samples?	2			
d.	Calculate the Rock Quality Designation for the following core sample and comment on its quality:	3			

Core piece	Length of the core piece
L1	50cm
L2	15cm
L3	450mm
L4	200mm
L5	200mm
L6	50mm
L7	50mm
L8	20cm

Total length of core= 400 cm

2, 3	3	5	

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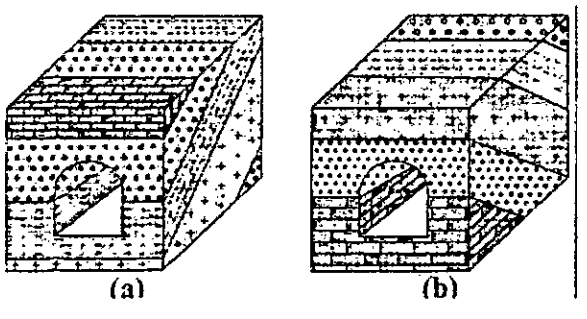
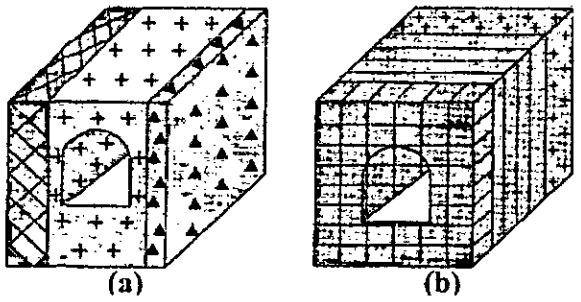
Q.6a	How is the seismic method of geophysical investigations helpful in understanding the substrata?				
	OR				
Q.6b	How is the magnetic method of geophysical investigations helpful in understanding the substrata?	5	2, 3	3	5
	Solve the following questions.				
Q.7 a.	Which are types of geological formations that influence the movement and storage of groundwater?	10			
	OR				
b.	Write a note on the various elements of water table with the help of a diagram.				
c.	Differentiate between confined and unconfined aquifer with a diagram. Add a note on perched aquifers.	5	2	2	6
Q. 8	Which rocks are suitable for construction of tunnels? Comment on the stability of tunnels constructed in the conditions/attitudes of rocks given below:				
a.	 (a) (b)	5			
b.	 (a) (b)	5	3	4	7

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RE-EXAM EXAMINATION DEC/JAN 2024-25

Q.9	What are the suitable conditions of construction of (any 2):	5			
a.	Gravity dam				
b.	Arch dam				
c.	Earth-fill dam				
d.	Rockfill dam		3	1	6

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~~END SEM~~/RE-EXAM EXAMINATION ~~DEC~~/JAN 2024-25

S.Y. (Civil) Sem III

Program: Civil Engineering

Duration: 3hr

Maximum Points: 100

Course Code: PC-BTC304

Semester: III

Course Name: Fluid Mechanics

Instructions

1. **Question no. 1 is compulsory.**
2. Attempt any 4 questions out of remaining 6 questions
3. Neat diagrams must be drawn wherever necessary.
4. Assume Suitable data if necessary and state it clearly.

Q.no.	Questions	Points	CO	BL	Mod
1(a)	State and explain Newton's law of viscosity and derive the equation for the same	6	CO1	BL1	1
(b)	The opening in a dam is 3m wide and 2m high. A vertical sluice is used to cover the opening. On the upstream side of the gate, the liquid of sp. Gr is 1.5 lies up to a height of 2.0 m above the top of the gate. Whereas on the downstream side the water is available up to a height of the top of the gate. Find the resultant force acting on the gate and center of pressure. Assume that gate is hinged at the bottom.	7	CO1	BL2	3
(c)	For a laminar steady flow, prove that the pressure gradient in a direction of motion is equal to the shear gradient normal to the direction of flow.	7	CO3	BL2	5
2 (a)	The water is flowing through the pipe of diameter 450 mm and is branched in to two pipes. Diameter of branch1 is 300mm, diameter of branch 2 is 200mm. If the average velocity in 450 mm diameter pipe is 3m/sec. a) Find the discharge through 450 mm diameter pipe. b) Velocity in 200mm diameter pipe if the average velocity in 300mm pipe is 2.5 m/sec	6	CO2	BL2	4
(b)	State and prove the Pascal's law of hydrostatics.	8	CO1	BL2	2
(c)	Discuss with diagram stream tube, stream line and streak line.	6	CO2	BL2	4
3 (a)	Derive an expression for the discharge through the venturimeter.	7	CO2	BL2	4
(b)	A uniform body of size 4m long X 2 m wide X 1m deep floats in water. What is the weight of body if the depth of immersion is 0.6 m? Determine the metacentric height also.	7	CO1	BL3	3
(c)	Discuss about the velocity distribution for laminar and turbulent flows in a pipe.	6	CO3	BL1	5
4(a)	State and Derive Bernoulli's equation along with the assumption made in it. Brief about the applications of Bernoulli's equation.	8	CO2	BL2	4

(b)	A square plate of size 1m X 1m and weighing 350N slides down an inclined plane with a uniform velocity of 1.5 m/s. The inclined plane is laid on a slope of 5 vertical to 12 horizontal and has an oil film of 1mm thickness. Calculate the dynamic viscosity of oil.	6	CO1	BL2	1
(c)	Discuss the types of fluid motions along with sketch.	6	CO2	BL2	4
5 (a)	A U tube differential manometer connects two pressure pipes A and B.	7	CO1	BL2	2
	Pipe A contains carbon tetrachloride having specific gravity 1.594 under a pressure of 11.772N/cm2 and pipe B contains oil of specific gravity 0.8 under a pressure of 11.772N/cm2. Pipe A lies 2.5 m above pipe B. Find the difference of pressure measured by mercury as fluid filling U-tube.				
(b)	Two velocity components are given in the following cases, find the third component such that they satisfy the continuity equation (a) $u= \log(y^2+z^2)$; $v= \log(x^2+z^2)$ (b) $u = \frac{-2xyz}{(x^2+y^2)^2}$ $w = \frac{y}{(x^2+y^2)}$	6	CO2	BL3	4
(c)	Define and discuss various hydraulic coefficients and derive relation between them.	6	CO2	BL2	4
6 (a)	Derive Euler's equation of motion along streamline.	8	CO2	BL2	4
(b)	A tank contains water up to height of 1m above the base.	7	CO1	BL3	3
	An immiscible liquid of specific gravity 0.8 is filled on the top of water up to 1.5 m height. Calculate (i) Total pressure on one side of the tank (ii) The position center of pressure for one side of the tank which is 3 m wide.				
(c)	Discuss Reynolds experiment and brief about Reynolds number.	5	CO2	BL2	5
7 (a)	Derive continuity equation for 1D flow	7	CO1	BL2	4
(b)	Explain the development of boundary layer on a flat plat.	6	CO3	BL2	6
(c)	Discuss the classification of fluids	7	CO1	BL2	1

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Re – ~~END SEMESTER EXAMINATION-DEC 2024~~ Jan-2025
S.Y (C) Sem II **SET: II** 20/1/25

Program: Civil Engineering **Duration: 3.00 hrs.**

Course Code: PC-BTC-303 **Maximum Points: 100**

Course Name: Building Drawing with CAD **Semester: III**

Notes: 1. Q.1 is compulsory & attempts any four out of remaining six.
2. Illustrate answer with neat sketches wherever required.
3. Make suitable assumptions where necessary and state them clearly.

Q.No.	Questions	Points	BL	CO	Module No
1.	A) Draw to a suitable scale developed plan for ground floor of G+1 storey bungalow for a politician on a site of the data given below. 1. Plot size: 18 M x 24 M. (FSI: 1.0) 2. Road is on south side parallel to 24 M direction 3. Wind direction is E-SW-W & climatic zone is hot 4. Requirements of owner a. Party Office and meeting room b. Master bed room c. Living room d. Children bed room e. Kitchen cum dining room f. Guest bed room g. Staircase/bath/WC/store/verandah are to be provided B) Draw terrace plan for above question.	15+05	L4	1-5	1-4
2	A. Draw to a suitable scale line plan of first floor for Q.1A. B. State: Built up area, Rera carpet area, carpet area, super built up area, FAR for Q.1A.	15+05	L2	1-5	2,3,4
3	A. Draw to a suitable scale, line plan of primary health care center building opening on a plot size 35 M x 40 M. Show all units with dimension and position of door, & windows.	20	L3	2-5	2,3,4
4	A. Discuss the need, objectives and responsibilities of promoter, agent and allotee under Real Estate Regulation Act, 2016 (RERA). B. Explain following principles of planning in detail, 1. Grouping 2. Prospect	10+10	L2	2	2

5	A. Discuss the necessities of building byelaws in building planning. Also explain building bylaws related to Minimum open space requirements and FSI. B. Draw a front side elevational plan for Q.1A	10+10	L2/3	2-5	2,3,4
6	A. Draw to a suitable scale Foundation plan for Q.1A. B. Draw to a suitable scale site plan for Q.1A.	10+10	L3	1-3	2,3,4
7	A. Draw to a suitable scale Water supply & Drainage plan for Q.1A. B. Draw to a suitable scale Electricity& Furniture plan for Q.1A.	10+10	L3	1-3	2,3,4

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~~END SEM~~/RE-EXAM EXAMINATION ~~DEC~~/JAN 2024-25

Program: B.Tech. Civil Engineering **Duration:** 3 Hour

Course Code: PC-BTC 305 **Maximum Points:** 100

Course Name: Concrete Technology **Semester:** III

Notes:

1. Attempt *any FIVE questions out of SEVEN* questions
2. Answers to all sub questions should be grouped together
3. Draw neat diagrams wherever required
4. Assume suitable data if necessary and state the clearly.

Q.No.	Questions	Points	CO	BL	Module No.
1	a) Explain the working principle of Schmidt's Rebound Hammer test and limitations of this test.	06	1	2	05
	b) Explain high performance concrete. State the advantages of high performance concrete over conventional concrete?	06	3	1	01
	c. Explain degree of quality control and durability of concrete according to IS 456.	04	2	2	01
	d. Sate the advantages of ready mixed concrete over conventional methods.	04	3	1	04
2	a). Design a concrete mix of M40 grade using IS 10262:2019; for a footing work with moderate exposure condition. Take a standard deviation of 5 MPa. Use, OPC 53 grade cement, the specific gravities of cement-3.15; GGBS-2.8; plasticizer-1.1; fly ash-2.2; specific gravities of Coarse Aggregate (10 mm-2.67, 20 mm-2.70) and specific gravity of Fine Aggregate are 2.92. The bulk density of coarse aggregate is 1650 Kg/m3 and Fineness Modulus of Fine Aggregate is 2.95 (Zone-II). A slump of 75mm is necessary. The water absorption of coarse aggregate is 1% and free moisture in fine aggregate is 3%.	15	02	3	02
	b). Explain significance of bulking of sand with reference to volumetric batching in concrete production.	05	03	2	02
3	a. Design concrete for M 30 grade using DOE method. Refer the data from Que2a and chart attached at the end of manuscript.	13	02	3	02
	b. Discuss in detail the reaction mechanism of Retarders in concrete.	07	03	2	04

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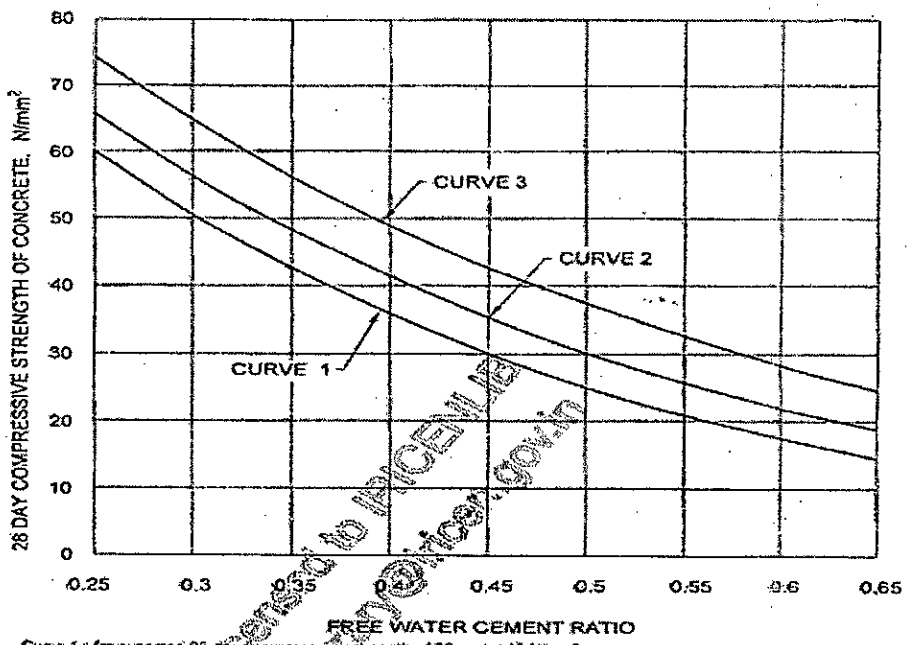
4	a. Design concrete for specified design strength of 25 N/mm2 using ACI Method; consider the data related to the properties of material as given in Que.No.2a. b. What is half cell-potential test? State why it is called half- cell, how electrode potential used to assess the corrosion level in steel.	13 07	2 1	3 1	2 5
5.	a. It is proposed to design SCC of grade M40, consider the percentage of fine aggregate passing from 125 micron as 4.1 %, and assume suitable powder content between 400-600 kg /m3 and data from the que2a. b. What is self-consolidating concrete? What are the materials used for SCC? c. Explain in detail mixing operation in concrete with type of mixers.	10 04 06	2 3 3	3 1 2	2 3 4
6	a) State the measures to be adopted to protect concrete in cold weather conditions. b). Explain in detail tremie method of underwater concrete with neat sketch. c. discuss various methods of compaction with their suitability.	05 07 08	3 3 3	1 2 2	1 1 4
7	Write short notes on (any four) i. compare silica fume with GGBFS ii. Metakaolin vs. fly ash iii. Mechanical properties of aggregate iv. Curing of concrete v. Carbonation test vi. Functioning of RMC plant	20 5 5 5 5 5 5	 1 3 2 3 2 2	 1 3 1 2 1 2	 1 1 1 4 5 5

Reference Tables for IS 10262:2019 Method of Concrete mix design



Curve 1 : for expected 28 days compressive strength of 33 and < 43 N/mm².
Curve 2 : for expected 28 days compressive strength of 43 and < 53 N/mm².
Curve 3 : for expected 28 days compressive strength of 53 N/mm² and above.

NOTES

Table 5 Minimum Cement Content, Maximum Water-Cement Ratio and Minimum Grade of Concrete for Different Exposures with Normal Weight Aggregates of 20 mm Nominal Maximum Size

(Clauses 6.1.2, 8.2.4.1 *and* 9.1.2)

Sl No.	Exposure	Plain Concrete			Reinforced Concrete		
		Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete	Minimum Cement Content kg/m³	Maximum Free Water-Cement Ratio	Minimum Grade of Concrete
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	Mild	220	0.60	–	300	0.55	M 20
ii)	Moderate	240	0.60	M 15	300	0.50	M 25
iii)	Severe	250	0.50	M 20	320	0.45	M 30
iv)	Very severe	260	0.45	M 20	340	0.45	M 35
v)	Extreme	280	0.40	M 25	360	0.40	M 40

NOTES

1 Cement content prescribed in this table is irrespective of the grades of cement and it is inclusive of additions mentioned in 5.2. The additions such as fly ash or ground granulated blast furnace slag may be taken into account in the concrete composition with respect to the cement content and water-cement ratio if the suitability is established and as long as the maximum amounts taken into account do not exceed the limit of pozzolona and slag specified in IS 1489 (Part 1) and IS 455 respectively.

2 Minimum grade for plain concrete under mild exposure condition is not specified.

Table 5 Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate for Water-Cement/Water-Cementitious Materials Ratio of 0.50

(Clause 5.5)

Sl No.	Nominal Maximum Size of Aggregate mm	Volume of Coarse Aggregate per Unit Volume of Total Aggregate for Different Zones of Fine Aggregate			
		Zone IV	Zone III	Zone II	Zone I
(1)	(2)	(3)	(4)	(5)	(6)
i)	10	0.54	0.52	0.50	0.48
ii)	20	0.66	0.64	0.62	0.60
iii)	40	0.73	0.72	0.71	0.69

NOTES

1 Volumes are based on aggregates in saturated surface dry condition.

2 These volumes are for crushed (angular) aggregate and suitable adjustments may be made for other shape of aggregate.

3 Suitable adjustments may also be made for fine aggregate from other than natural sources, normally, crushed sand or mixed sand may need lesser fine aggregate content. In that case, the coarse aggregate volume shall be suitably increased.

4 It is recommended that fine aggregate conforming to Grading Zone IV, as per IS 383 shall not be used in reinforced concrete unless tests have been made to ascertain the suitability of proposed mix proportions.

Table 4 Water Content per Cubic Metre of Concrete For Nominal Maximum Size of Aggregate

(Clause 5.3)

Sl No.	Nominal Maximum Size of Aggregate mm	Water Content[1] kg
(1)	(2)	(3)
i)	10	208
ii)	20	186
iii)	40	165

[1] Water content corresponding to saturated surface dry aggregate.

Table 3 Approximate Air Content

(Clause 5.2)

Sl No.	Nominal Maximum Size of Aggregate mm	Entrapped Air, as Percentage of Volume of Concre
(1)	(2)	(3)
i)	10	1.5
ii)	20	1.0
iii)	40	0.8

5.2.1 The actual values of air content can also adopted during mix proportioning, if the site data least 5 results) for similar mix is available.

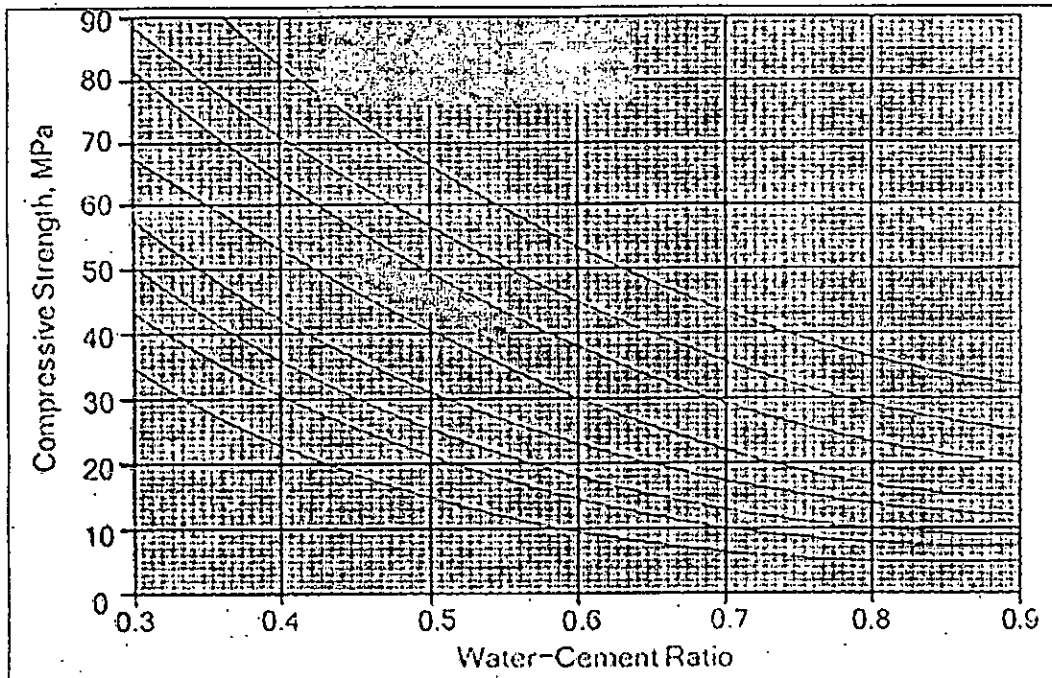
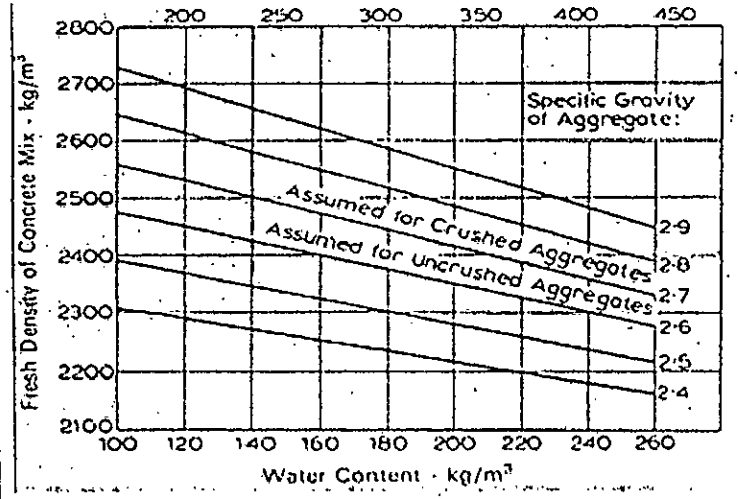


Table 20.47. App. Free water content required for various workability according to 1988 British Method

Aggregate		Water content kg/m³ for slump			
Max. size mm	Type	0 — 10 mm	10 — 30 mm	30 — 60 mm	60 — 180 mm
		Vee Bee seconds > 12	6 — 12	3 — 6	0 — 3
10	Un crushed	150	180	205	225
	crushed	180	205	230	250
20	Un crushed	135	160	180	195
	crushed	170	190	210	225
30	Un crushed	115	140	160	175
	crushed	155	175	190	205

Table 20.48. Reduction in water content of table 21.47 when fly ash used.

% of fly ash in cementitious material	Slump in mm Vee Bee seconds	Reduction in water content kg/m³			
		0 — 10 > 12	10 — 30 6 — 12	30 — 60 3 — 6	60 — 180 0 — 3
10		5	5	5	10
20		10	10	10	15
30		15	15	20	20
40		20	20	25	25
50		25	25	30	30



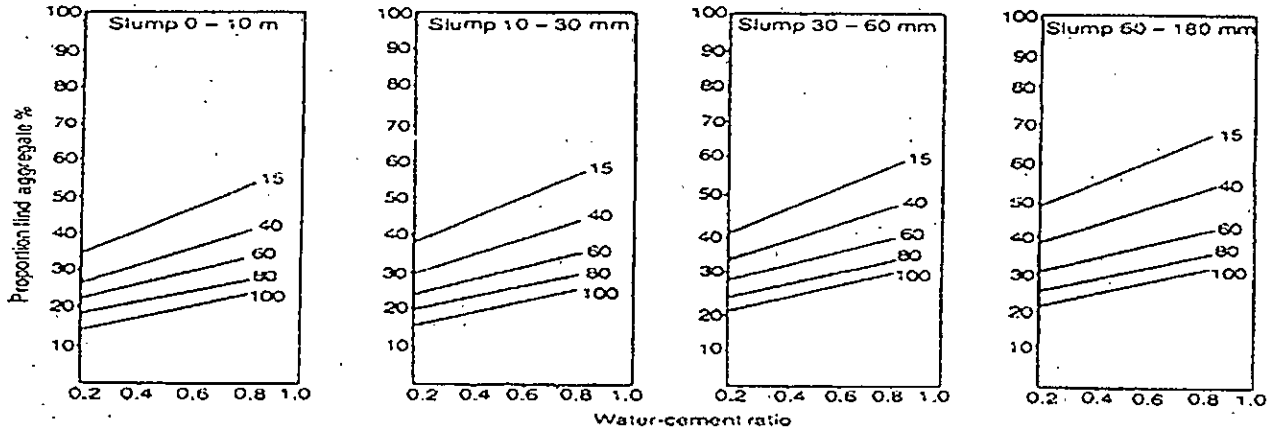


Fig 20.12. (b)

Table 1,2 and 3 for ACI Method Concrete Mix Design

(1) Dry Bulk Volume of coarse aggregate/ unit volume of concrete as per ACI 211.1-91

Maximum size of aggregate	Bulk volume of dry rodded CA /unit volume of concrete for fineness modulus of sand of			
FM	2.4	2.6	2.8	3.00
10	0.5	0.48	0.46	0.44
12.5,	0.59	0.57	0.55	0.53
20 (25,40,50,70)	0.66	0.64	0.62	0.60
150	.87	0.85	0.83	0.81

(2) Relation between water/cement ratio & average compressive strength of concrete, as per ACI211.1-91

Average compressive strength at 28 days	Effective water/cement ratio (by mass)	
MPa	Non air entrained concrete	Air entrained concrete
45	0.38	-
40	0.43	-
35 (30,25,20)	0.48	0.4
15	0.8	0.71

(3) Requirements of ACI-318-89 for w/c ratio & strength for special exposure conditions

Exposure condition	Maximum w/c ratio, normal density aggregate concrete	Minimum design strength, low density aggregate concrete MPa
Concrete intended to be watertight		
(a) Exposed to fresh water	0.5	25
(b) Exposed to sea water	0.45	30
Concrete exposed to freezing in a most condition	0.45	30
For corrosion protection of reinforced concrete exposed to de icing salts, sea water	0.4	33

Table 4,5 and 6 for ACI Method Concrete Mix Design

(4) Recommended value of slump for various types of construction as per ACI 211.1-91

Type of construction	Range of slump (mm)
Reinforces foundation walls & footings	20-80
Plain footings,substructure wall	20-80
Beams & reinforced walls	20-100
Building columns	20-100
Pavements & slabs	20-80
Mass concrete	20-80

(5) Approximate requirements for mixing water & air content for different workabilities & nominal maximum size of aggregates as per ACI211.1-91

Non air entrained concrete				
Workability or air content (Slump)	Water content, kg/m3 of concrete for indicted maximum aggregate size			
	10 mm (25, 40,50,70)	12.5 mm	20 mm	150 mm
30 -50 mm	205	200	185	125
80-100 mm	225	215	200	140
150-180 mm	240	230	210	-
Approx entrapped air (%)	3	2.5	2	0.2

(6) First estimate of density of fresh concrete as per ACI 211.1-91

Maximum size of aggregate (mm)	First estimate of density of fresh concrete	
	Non air entrained kg/m³	Air entrained kg/m³
10	2285	2190
12.5 (20,25,40,50)	2315	2235
20	2355	2280
150	2505	2435

As per ACI in absence of record; required increase in mean strength for specified design strength

Specified design Strength (Mpa)	Less than 21	21-35	35 or more
Required Increase in mean strength (Mpa)	7	8.5	10