Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER November 2025 / [redacted] January 2026

Program: Civil Second Year B.teich Civil sem III **Duration:3 hours**

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

Course Name:Laplace Linear Algebra & Complex analysis **Semester:III**

21/11/25

Notes: 1) Attempt any 5 out of 7 questions

2) Use of non-programmable calculator is allowed.

Q.No.	Questions	Points	CO	BL	Modul No.
1a)	$\mathcal{L}\left\{e^{-t}\left(3\sinh 2t - 5\cosh 2t\right)\right\}$	06	1	1,2	1
1b)	If $A=\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$, Find two non singular matrices P and Q such that PAQ = I. Hence find A^{-1}.	06	3	1,2,3	4
1c)	Show that $A=\frac{1}{2}\begin{bmatrix}\sqrt{2} & -i\sqrt{2} & 0\\ i\sqrt{2} & -\sqrt{2} & 0\\ 0 & 0 & 2\end{bmatrix}$ is unitary and hence find A^{-1}	08	3	2,3	4
2a)	Test for consistency and solve: $5x+3y+7z=4, 3x+26y+2z=9, 7x+2y+10z=5$	06	3	1,3	4
2b)	Find the bilinear transformation which maps z = 2, 1, 0 onto w = 1, 0, i	06	2	2	3
2c)	Find the Laplace transforms of f(t), where $f(t)=\begin{cases}t^2, 0<t<1\\ 0, t>1\end{cases}$	08	1	1,2,3	1

END SEMESTER November 2025 / ~~RE – EXAM~~ January 2026

3a)	Evaluate $\mathcal{L}^{-1}\left\{\frac{s}{s^4+8s^2+16}\right\}$ using convolution theorem	10	1	1,3	2
3b)	Use Cayley-Hamilton theorem to find $2A^5 - 3A^4 + A^2 - 4I$ where $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$.	10		2,3	5
4a)	Find all the eigen values and eigenvectors of the matrix $A = \begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$	10	3	1,2,3	5
4b)	Solve $\frac{dy}{dt} + 2y + \int_0^t y\,dt = \sin t$ Given $y(0) = 1$	10	1	1,2	2
5a)	Evaluate: $\mathcal{L}^{-1}\left\{\frac{s+1}{(s^2+2s+2)^2}\right\}$	10	1	1,2,3	2
5c)	Find the image of the semi infinite, strip $x > 0, 0 < y < 2$ under the transformation $w = iz + 1$.	10	2	2,3	3
6a)	If $A = \frac{1}{3}\begin{pmatrix} 1 & 2 & a \\ 2 & 1 & b \\ 2 & -2 & c \end{pmatrix}$ is orthogonal find a, b and c	06	3	1,3	4

END SEMESTER November 2025 / [redacted] January 2026

6b)	Evaluate $\mathcal{L}^{-1}\left\{\frac{6s-4}{s^2-4s+20}\right\}$	06	1	1,2,3	2
6c)	Find the rank of the matrix $\begin{bmatrix} -1 & 2 & 3 & -2 \\ 2 & -5 & 1 & 2 \\ 3 & -8 & 5 & 2 \\ 5 & -12 & -1 & 6 \end{bmatrix}$	08		2,3	4
7a)	For the values of λ and μ, the following system of equations $2x+3y+5z=9, 7x+3y-2z=8, 2x+3y+\lambda z=\mu$ will have (i) unique solution, ,(Ii) no solution	06	3	1,2	4
7b)	Evaluate: $\mathcal{L}^{-1}\left\{\log\left(1+\frac{1}{s^2}\right)\right\}$	06	1	1,2,3	2
7c)	If $u=\frac{\sin 2x}{\cosh 2y+\cos 2x}$, find $f(z)$ using Milne Thomson method	08	2	2,3	3

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

~~END SEMESTER November 2025~~ / RE - EXAM ~~January 2026~~

Program: Civil S.Y. B. Tech (Civil) Sem III **Duration:3 hours**

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

Course Name:Laplace Linear Algebra & Complex analysis **Semester:III**

6/11/25

Notes: 1) Attempt any 5 out of 7 questions

2) Use of non-programmable calculator is allowed.

Q.No.	Questions	Points	CO	BL	Mo No
1a)	Evaluate $\mathcal{L}\left\{\frac{\cos 2t \sin t}{e^t}\right\}$	06	1	1,2	1
1b)	If $A=\begin{bmatrix}3 & -3 & 4\\ 2 & -3 & 4\\ 0 & -1 & 1\end{bmatrix}$, Find two non singular matrices P and Q such that PAQ = I. Hence find A^{-1}.	06	3	1,2,3	4
1c)	Define a unitary matrix. if $N=\begin{bmatrix}0 & 1+2i\\ -1+2i & 0\end{bmatrix}$ is a matrix, then show that $(I-N)(I+N)^{-1}$ is a unitary matrix, where I is an identity matrix.	08	3	2,3	4
2a)	Solve $2x-y+z+w=0$, $x-y-w=0$, $x+2z+2w=0$	06	3	1,3	4
2b)	Find the bilinear transformation which maps z = 2, 1, 0 onto w = 1, 0, i	06	2	2	3
2c)	Find the Laplace transforms of f(t), where $f(t)=\begin{cases}t, & 0<t<4\\ 5, & t>4\end{cases}$	08	1	1,2,3	1

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

3a)	Prove that: $\mathcal{L}^{-1}\left\{\frac{1}{(s^2+a^2)^2}\right\}=\frac{1}{2a^3}(\sin at - at\cos at)$ using convolution theorem	10	1	1,3	2
3b)	Verify Cayley-Hamilton's theorem for $A=\begin{bmatrix}2&-1&1\\-1&2&-1\\1&-1&2\end{bmatrix}$ & hence obtain A^{-1}.	10		2,3	5
4a)	Find the values and eigen vectors of the matrix. $A=\begin{bmatrix}8&-6&2\\-6&7&-4\\2&-4&3\end{bmatrix}$	10	3	1,2,3	5
4b)	Solve $y''+y=t$ Given $y(0)=1$ $y'(0)=-2$	10	1	1,2	2
5a)	Evaluate: $\mathcal{L}^{-1}\left\{\frac{s+1}{(s^2+2s+2)^2}\right\}$	10	1	1,2,3	2
5c)	Show that the transformation $w=\frac{3-z}{z-2}$ transforms the circle with center $\left(\frac{5}{2},0\right)$ and radius $\frac{1}{2}$ in the $z-$plane into the imaginary axis in the $w-$plane	10	2	2,3	3

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

6a)	If $A=\frac{1}{3}\begin{pmatrix}1 & 2 & a\\ 2 & 1 & b\\ 2 & -2 & c\end{pmatrix}$ is orthogonal find a, b and c	06	3	1,3	4
6b)	Evaluate: $\mathcal{L}^{-1}\left\{\frac{3s+7}{s^2-2s-3}\right\}$	06	1	1,2,3	2
6c)	Find the rank of the matrix $\begin{bmatrix}-1 & 2 & 3 & -2\\ 2 & -5 & 1 & 2\\ 3 & -8 & 5 & 2\\ 5 & -12 & -1 & 6\end{bmatrix}$	08		2,3	4
7a)	For what values of 'a' and 'b' the equations $x+2y+3z=4$ $x+3y+4z=5$ $x+3y+az=b$ Have iii) No solution iv) A unique solution Infinite number of solutions	06	3	1,2	4
7b)	Evaluate: $\mathcal{L}^{-1}\left\{\log\left\lvert\frac{s^2+b^2}{s^2+a^2}\right\rvert\right\}$	06	1	1,2,3	2
7c)	Find an analytic function $w=u+iv$ given that $v=\frac{x}{x^2+y^2}+\cosh x\cos y$	08	2	2,3	3

B

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER November 2025

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

Course Code: BS-BTC302 **Maximum Points: 100**

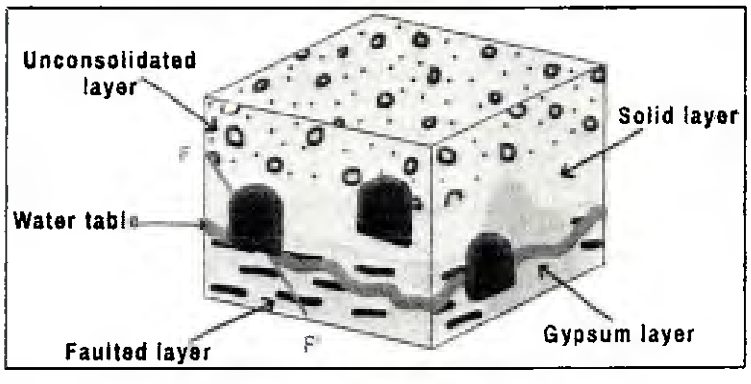
Course Name: Engineering Geology **Semester: III**

Notes: Draw diagram wherever necessary

24/11/25

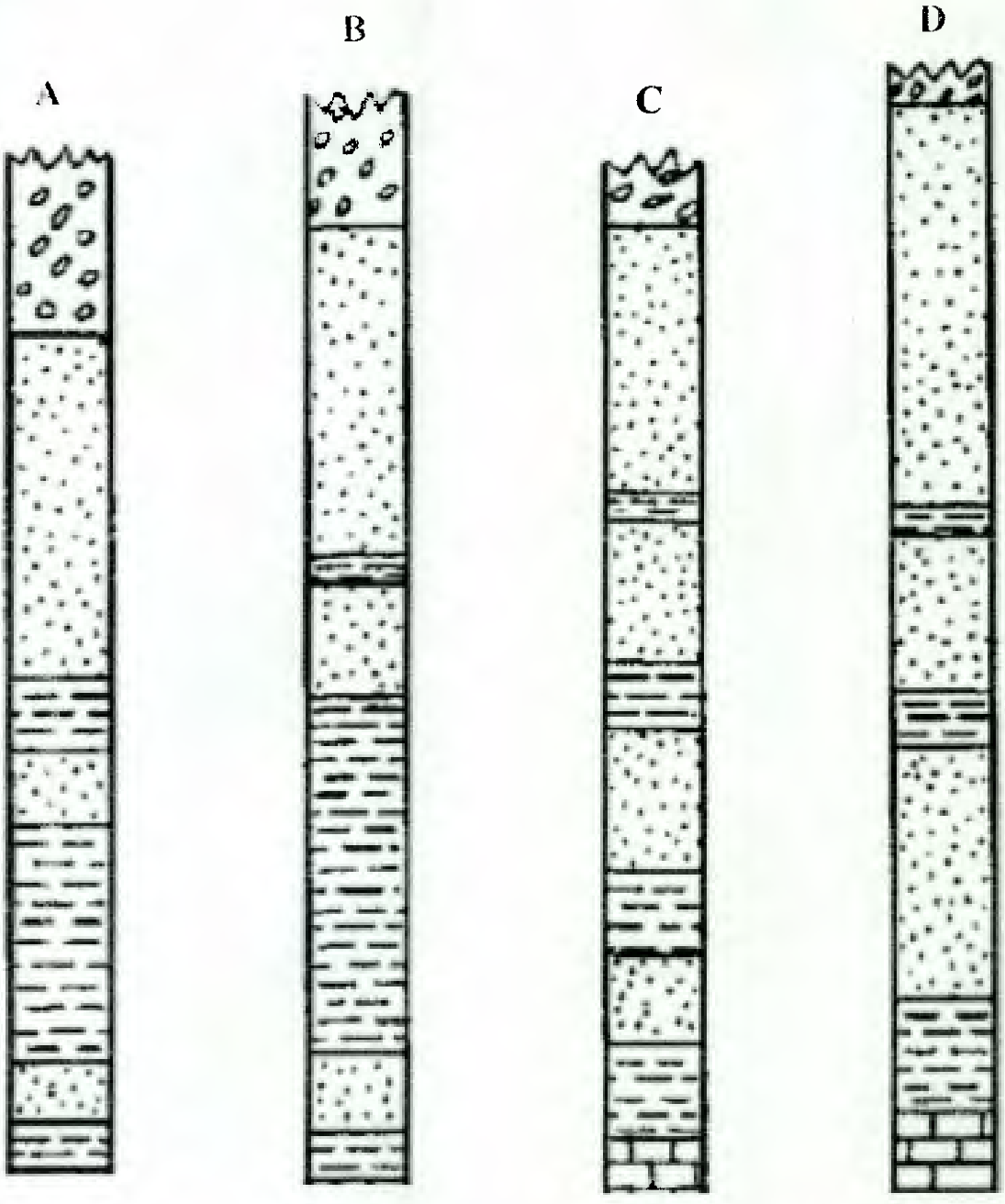
Q.No.	Questions	Points	CO	BL	Module No.
1	a. Explain the interior of the Earth and also mention the discontinuities between each layer. b. Write a short note on shadow zone. c. Discuss the exfoliation weathering. What are types of chemical weathering? Explain.	5 + 5 + 10	CO1	1	1
2	a. Analyze how light-dependent physical properties help in the identification and classification of minerals in hand specimen. b. What are the common rock-forming minerals, and how are these minerals classified based on their anions or anionic groups?	10 + 10	CO2	2,3	2
3	a. What are rock structures and explain what are different types of structure shown by igneous rocks. b. Explain the different types of structures found in metamorphic rocks. Based on these structures, which metamorphic rocks are considered more stable and suitable for construction projects and why?	10 + 10	CO1	2	3
	OR				
4	a. Define the following along with diagram 1. What is a bed? 2. Planar bedding 3. Cross bedding 4. Graded bedding 5. Ripple marks b. As an engineer you have to investigate a site where you have encountered an igneous rock terrain. What are their	10 + 10	CO1, CO3	1, 3,4	3

P.T.O

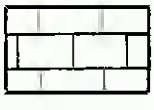
	various properties of igneous rocks you will consider as an engineer to ensure a safe construction?				
5	a. What is a fault? Define terms related to faults. What are different types of faults, explain with the help of simple diagrams. b. Draw the stratigraphic correlation. Explain the types of rocks (are they igneous, metamorphic or sedimentary) and also write their order of superposition.	10 + 10	CO1, CO3	1,3	4
	OR				
6	a. Explain types of folds also write in detail the engineering significance of folds. b. Discuss the Indian stratigraphy from oldest layer to recent.	10 + 10	CO1, CO2	2	4
7	a. Look at the image below and discus which tunnel is most ideal and why, also discusses the problem with other tunnels. If you drilled a borehole of 100 cm for site investigation and you found the following fragments – 14cm, 11cm, 31cm, 15cm, 17cm and loose rock. What the RQD and state the quality of the rock?  OR b. As a site investigator during tunnelling, evaluate and compare sites with different rock types, analyze the structural problems you may encounter, and develop strategies to mitigate them effectively. Also explain various geophysical methods used.	20	CO3	3,4	5

END

Q5.b.

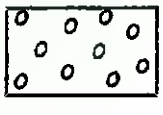


Shale



Limestone

Sandstone



Conglomerate

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

RE-EXAM Jan-2026

~~END SEMESTER November 2025~~

S.Y. B.Tech Sem III

Program: S.Y. Civil Engineering **Duration: 3 hours**

Course Code: BS-BTC302 **Maximum Points: 100**

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

Notes: Draw diagram wherever necessary

9/11/26

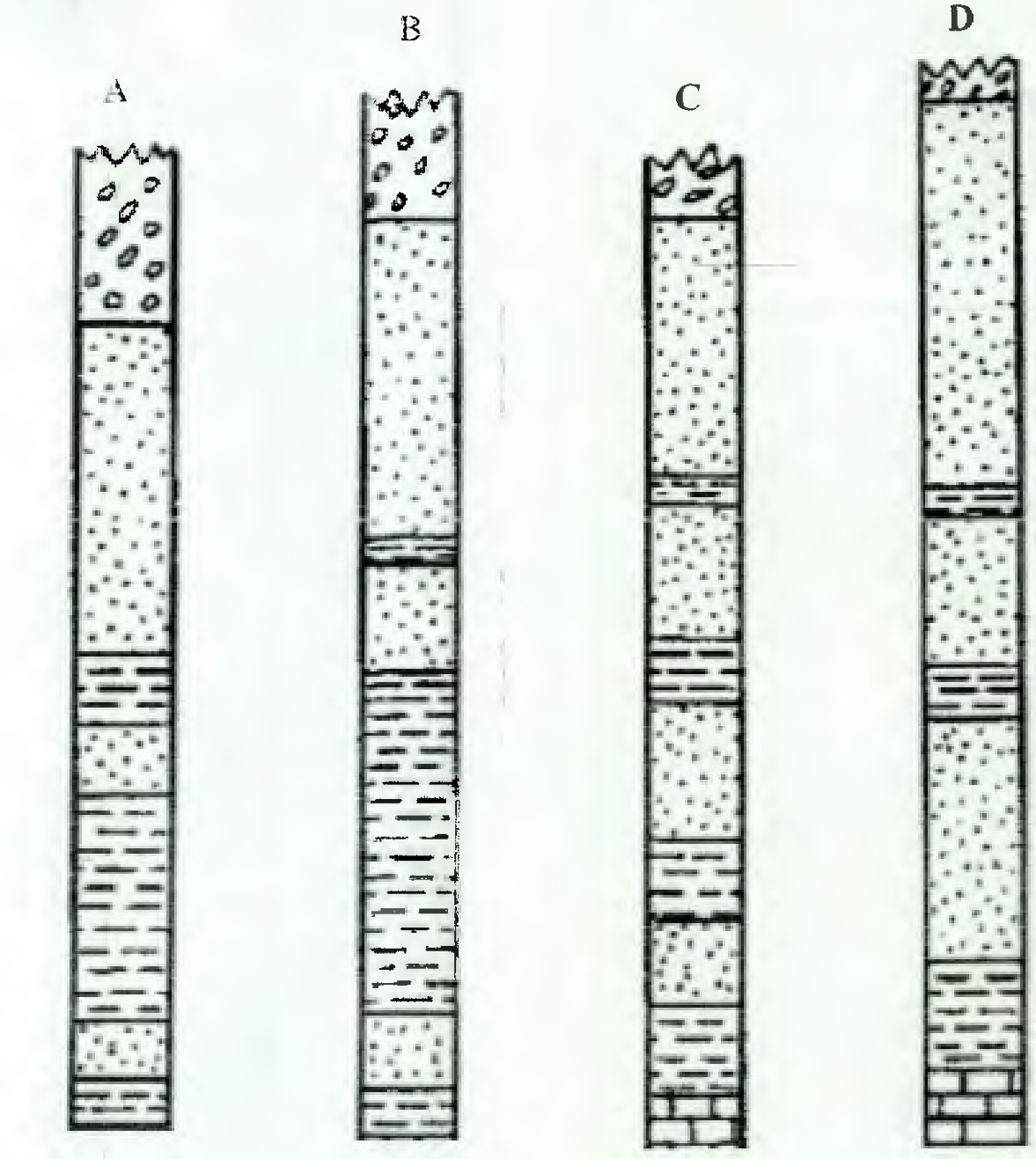
Q.No.	Questions	Points	CO	BL	Module No.
1	a. Define different types of seismic waves. b. Explain with a simple diagram, the interior of Earth. c. List and explain types of Physical weathering and what are different types of Erosional landforms which are caused by the wind.	5 + 5 + 10	CO1	1	1
2	a. List the minerals on Moh's scale of hardness and explain the different mineral forms in detail. b. What are common rock forming minerals and explain the minerals based on their anionic classification?	10 + 10	CO1	2	2
3	a. Define metamorphism. What are different types of metamorphism also explain different structures of metamorphism and type of metamorphism which has given rise to it. b. Give a detail information on formation of sedimentary rocks and explain what are types of sedimentary rocks.	10 + 10	CO1	2	3
	OR				
4	a. Classify and explain igneous rocks based on I. Based on mode of occurrence II. Based on SiO_2 percentage III. Based on color index b. You are assigned to investigate a sedimentary rock formation exposed along a new highway cutting that contains a prominent clay layer within the sequence. Discuss the potential problems you may encounter during the study and interpretation of these rocks, considering their petrological and engineering characteristics.	10 + 10	CO1, CO3	1, 3,4	3

P.T.O

5	a. Explain **any 5** of the following 1. Define strike of the bed 2. Define dip of the bed 3. Define inlier and outlier 4. Define joint set with diagram 5. What is a hinge of a fold? 6. Explain the axial plane of the fold b. Draw the stratigraphic correlation. Explain the types of rocks (are they igneous, metamorphic or sedimentary) and also write their order of superposition.	10 + 10	CO1, CO3	1,3	4
	OR				
6	a. With the help of diagram explain different terms related to fold. b. Explain the 6 principle of stratification and what are different types of stratigraphic contact explain with a diagram	10 + 10	CO1, CO2	2	4
7	You are a site investigator assigned to conduct a geological investigation for a proposed tunnel passing through hilly terrain composed of sedimentary and metamorphic rocks. Discuss the following points in simple terms: 1. The main aims and importance of doing a geological investigation before starting tunnel construction and different methods of surface investigation. 2. How geological factors like rock type (lithology), structure, and groundwater can affect the tunnel's design, route, and safety. OR A dam is proposed to be constructed across a river in an area. As a site investigator you are asked to understand the geological stability of the site before construction. Explain: 1. The important geological conditions that should be checked before choosing a dam site. 2. What could be the unfavourable conditions 3. If you drilled a borehole of 150 cm for site investigation and you found the following fragments – 21cm, 12cm, 10cm, 39cm, 18cm, 16cm and loose rock. What the RQD and state the quality of the rock?	20	CO3	3,4	5

END

Q5.b.



Shale

Limestone

Sandstone

Conglomerate

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER November 2025 / [redacted] January 2026

Second Year

Program: B.Tech Civil Engineering Sem III

Duration: 3 hours

Course Code: PC-BTC301

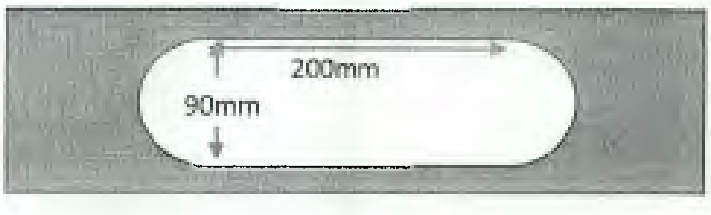
Maximum Points:100

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***

26/11/25

Q.No.	Questions	Points	CO	BL	Module No.
1.a)	For a prismoidal block as having dimensions 2000x400x250mm, the forces acting are 60kN, 80kN and 100kN on the faces admeasuring 2000x400mm, 400x250mm and 2000x250mm.All forces are tensile in nature. Evaluate changes in dimensions of the block and change in volume.	10	01	03	01
2.b)	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 on full span and a central point load of 50kN. Calculate the shear stresses induced at support section and sketch the variation.	10	03	03	04
2.a)	A reinforced concrete column 500 mm × 500 mm in a section is reinforced with 8 steel bars of 25 mm diameter, the column is carrying a load of 1000 kN. Find the stress in the concrete and steel bars. Take E for steel = 200×10^3 N/mm^2 and E for concrete = 25×10^3 N/mm^2	08	01	03	01
2.b)	A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 3.5 mm thick. The length and internal diameter of the vessel are 85 cm and 30 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 5.2N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take E = 2×10^5 N/mm^2 and μ=0.32	08	04	03	07
2.c)	Evaluate the force required to punch a slotted hole with semi circular ends as shown in a 5mm thick steel plate.  	04	01	03	01

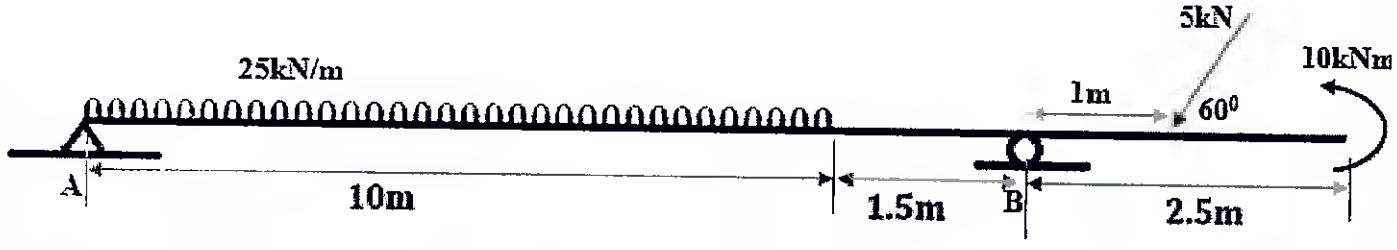
Bharatiya Vidya Bhavan's

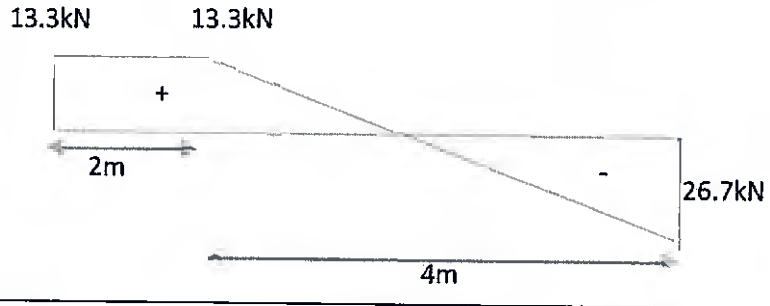
SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER November 2025 / ~~RE- EXAM~~ January 2026

3.a)	Draw the shear force, bending moment and axial force diagram for the beam AB as shown below. Also find the maximum value of bending moment.	15	02	04	02



3.b)	Draw the bending moment diagram and loading diagram from the shear force diagram of simply supported beam as shown below.  	05	02	04	02
4.a)	A 400 x 800 mm timber beam is strengthened by the addition of 300 x 8 mm steel plates secured at its bottom surface only. 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	03	04	03
4.b)	A bar of varying cross section consists of two sections of length 700mm and 900mm with cross sections 400 mm^2 and 625 mm^2 respectively. It is subjected to an axial pull of 100 kN. Take E = 200 GPa. Find the safe force such that the elongation is not more than 2mm and the stress in any section is less than 200MPa	08	01	03	01
5.a)	A bar of 30mm diameter is subjected to a pull of 80 KN. The measured extension on a gauge length of 240 mm is 0.1mm and change in diameter is 0.005 mm, calculate the Poisson's ratio and all three elastic constants.	08	01	04	01
5.b)	Explain the term "Factor of safety" and its need in engineering applications related to structures.	02	01	02	01

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER November 2025 / [redacted] January 2026

5.c)	Obtain the shear centre for a channel section having flange as 250x15mm and web as 280x10mm (Total depth of section = 310mm).	10	03	03	04
6.a)	A plane element is subjected to the stresses as σ_x = 20MPa (Tensile) and σ_y=15MPa (Compressive). 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 a plane whose normal is inclined at 25^0 (anticlockwise) with horizontal	10	02	04	06
6.b)	Solve Q.6.a) using Mohr's circle	10	02	04	06
7.a)	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	01	02	01
7.b)	A solid cylindrical steel shaft transmits a power of 600 kW at 300 r.p.m. If the shear stress is not to exceed 85 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 0.65 times the external diameter, find the dimensions of the hollow shaft	10	02	03	05

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

7/1/26

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

Program: ~~B.~~Tech Civil Engineering Sem III

Duration: 3 hours

Course Code: PC-BTC301 7/1/26

Maximum Points:100

Course Name: Mechanics of materials

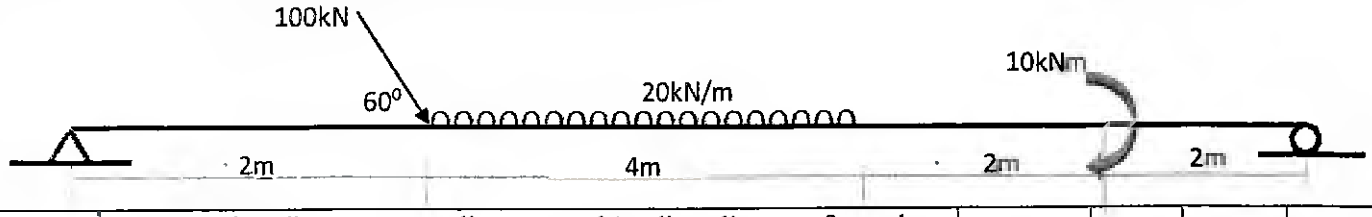
Semester:III

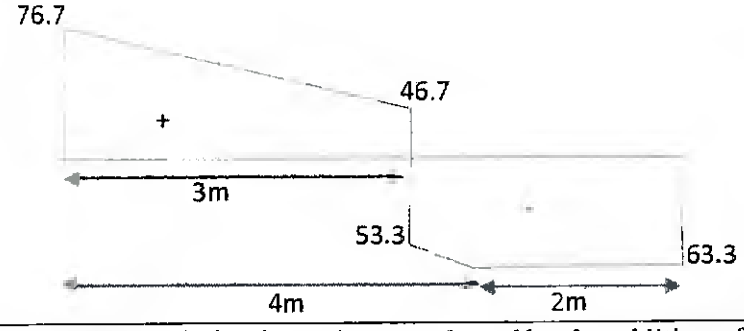
Notes : ***Attempt any 5 main questions out of 7; Assume any missing data and state the same clearly; Illustrate your answers with neat sketches***

Q.No.	Questions	Points	CO	BL	Module No.
1.a)	A rod of steel 2.5 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 70^0 C. ii) stress if no expansion is allowed iii) stress when an expansion of 1 mm is allowed. Take $\alpha = 12 \times 10^{-6}/^0$ C, E = 210 GN/m^2.	10	01	03	01
1.b)	An I section has top flange = 150mm x 15mm, bottom flange = 120mmx20mm and web = 300mm x 15mm. It is used as a cantilever beam over a span of 2.5m to carry a UDL of 5kN/m over its entire span and a point load of 20kN at free end. Draw the shear stress distribution diagram at the support.	10	03	03	04
2.a)	A mild steel rod of 25 mm internal diameter and 400 mm long is enclosed centrally inside a hollow copper tube of external diameter 35 mm and internal diameter of 30 mm. The ends of the tube and rods are rigidly connected together and the composite bar is subjected to an axial pull of 50 kN. If modulus of elasticity for steel and copper is 200 MPa and 100 MPa respectively, find the stresses developed in the rod and tube.	08	01	03	01
2.b)	A cylindrical vessel, whose ends are closed by means of rigid flange plates, is made up of steel plate 2.5 mm thick. The length and internal diameter of the vessel are 45 cm and 20 cm respectively. Determine the longitudinal and hoop stresses in the cylindrical shell due to an internal fluid pressure of 2.5N/mm^2. Also calculate the increase in length, diameter and volume of vessel. Take E = 2×10^5 N/mm^2 and μ=0.32	08	04	03	07
2.c)	Explain the assumptions made in the theory of pure bending	04	03	02	03

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

3.a)	Draw the shear force, bending moment and axial force diagram for the beam AB as shown below. Also find the maximum value of bending moment.	15	02	04	02



3.b)	Draw the bending moment diagram and loading diagram from the shear force diagram (in kN) of simply supported beam as shown below.  	05	02	04	02
4.a)	A 350 x 750 mm timber beam is strengthened by the addition of 300 x 8 mm steel plates secured at its top surface only. The composite beam is simply supported and carries a uniformly distributed load of 10kN/m over an effective span of 6m. Find the maximum bending stresses in steel and timber at the mid-span. Take Es = 2 x 10^5 N/mm^{2}and ET = 1 x10^4 N/mm^2.	12	03	04	03
4.b)	A timber beam 120 mm wide and 200 mm deep is simply supported over a span of 4 m. The beam carries a UDL of 3kN/m over the entire length. Find the maximum bending stress induced anywhere in the beam. Plot the bending stress distribution at the **quarter span** cross section of the beam.	08	03	04	03
5.a)	A bar of 25mm diameter is subjected to a pull of 50 KN. The measured extension on a gauge length of 200 mm is 0.1mm and change in diameter is 0.003 mm, calculate the Poisson's ratio and all three elastic constants.	08	01	04	01
5.b)	Explain the term "Factor of safety" and its need in engineering applications related to structures.	02	01	02	01
5.c)	Obtain the shear centre for a channel section having flange as 250x10mm and web as 270x8mm (Total depth of section = 300mm).	10	03	03	04

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

6.a)	A plane element is subjected to the stresses as σ_x = 10MPa (Tensile) ; σ_y=2MPa (Tensile) ; τ_{xy}= 10N/mm^2. 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 a plane whose normal is inclined at 35^0 (anticlockwise) with horizontal	10	02	04	06
6.b)	Solve Q.6.a) using Mohr's circle	10	02	04	06
7.a)	A solid cylindrical steel shaft transmits a power of 750 kW at 100 r.p.m. If the shear stress is not to exceed 105 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 0.68 times the external diameter, find the dimensions of the hollow shaft	10	02	03	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	01	02	01

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

November 28/11/25

END SEMESTER December 2025 / ~~RE-EXAM~~ February 2026

Second Year B. Tech Sem III

Program: Civil Engineering

Course Code: PC-BTC302

Course Name: Basics of Surveying

Duration: 03 hrs.

Maximum Points: 100

Semester: III

Notes:

1. Question 1 is compulsory
2. Solve any FOUR from the remaining SIX Questions
3. Accompany your answers with suitable sketch, examples, facts and figures, wherever necessary.
4. Start each main question from new page.

Q.no	Question	Points	CO	BL	Module
Q.1	**Answer the following: Any 4**	**20**	1	1,2	
a	Define surveying. Explain the fundamental principles of surveying with suitable examples.	5			1
b	Explain temporary and permanent adjustments of a dumpy level. Why are permanent adjustments necessary?	5			2
c	What are the essential axes of a transit theodolite? Explain their relationships	5			3
d	Explain the principle of Electronic Distance Measurement (EDM). Mention any two types of EDM instruments.	5			4
e	List all accessories used in plane table surveying with the function / purpose of each accessory.	5			5
Q.2	**Answer the following:**	**20**	1,2,3,4	1,2,3	
a	Classify surveying based on method, nature of field, and instrument used. Give one example for each class.	5			1
b	An instrument with fixed stadia hairs is set up at station A. The axis of the instrument has a reduced level (RL) = 120.500 m. The vertical angle of sight to a staff held at station B is 3° 30′ (upwards). On the staff, held vertical, the readings of the upper and lower stadia hairs are 2.745 m and 1.345 m respectively; the reading at the central hair is 1.850 m. The stadia constants are: multiplicative constant, k =100 and additive constant, c = 0.20m. Neglect curvature and refraction. Derive the stadia formula for inclined sight (angle of elevation) and staff held vertical (5). Draw the sketch for the field data given (2). Find horizontal distance between A and B (3). Find the reduced level of point B (ground at staff base) (5).	15			4
Q.3	**Answer the following:**	**20**	1,2,3,4	1,2,3	
a	Explain the radiation and intersection methods of plane table surveying. State the advantages and limitations of these methods.	10			5
b	The following staff readings were taken during profile levelling along a proposed road center line: 1.965, 2.455, 3.285, 1.245, 1.855, 2.455, 2.985, 0.965, 1.785, 2.665. The	10			2

END SEMESTER December 2025 / ~~RE-EXAM~~ February 2026

	level was shifted twice, after station 3 and station 7. The staff reading taken on a Benchmark (BM) - 0.855m with RL = 100m. Staff is held vertically. Tabulate the readings in a field book (2). Compute the Reduced Levels (RLs) of all points using the Height of Instrument (HI) method (5). Apply the arithmetical check (1). Draw a neat profile (longitudinal section) (1). Comment on the nature of the ground (1).					
Q.4	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**		
a	A surveyor measured offsets from a straight baseline of length 150 m at 25 m intervals (including both ends). The measured perpendicular offsets to the nearer boundary are: At 0 m: 2.00 m, 25 m: 5.40 m, 50 m: 9.20 m, 75 m: 8.60 m, 100 m: 6.30 m, 125 m: 3.10 m, 150 m: 0.80 m Using the trapezoidal rule, compute the area between the baseline and the boundary.	10				5
b	Describe the procedure of computing area by Simpson's rule. Under what conditions is Simpson's rule applicable?	10				5
Q.5.	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**		
	The following are the corrected bearings (WCBs) and measured lengths of the sides of a 5-sided closed traverse ABCDEA, taken during a surveying operation. Assume the traverse is clockwise, and independent coordinates of station A are taken as 1000,1000.	20				3

Line	WCB	Length (m)
AB	72°30′	165
BC	138°15′	142
CD	182°45′	158
DE	255°00′	151
EA	328°20′	147

1) Prepare Gale's Traverse Table. (1)
2) Compute the Latitudes and Departures. (2)
3) Calculate the Consecutive Coordinates. (4)
4) Check for closing error and compute the error. (3)
5) Apply Bowditch's Rule. (3)
6) Compute corrected latitudes and departures. (2)
7) Compute the corrected consecutive coordinates. (2)
8) Compute the independent coordinates. (2)
9) Draw the traverse showing the details. (1)

Q.6.	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
a	Explain the method of repetition for measuring horizontal angles with a theodolite. Why does it improve accuracy?	10			3
b	Explain the working principle and components of a Total Station. List four advantages in comparison with	10			4

END SEMESTER December 2025 / ~~RE – EXAM~~ February 2026

	conventional instruments.				
Q.7.	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
a	Distinguish between plane surveying and geodetic surveying based on purpose, accuracy, area covered, and applications	5			1
b	Define contour and contour interval. Explain the factors that influence the selection of contour interval for a survey project.	5			2
c	Mention any five modern advancements that transformed surveying practice.	5			4
d	Describe the procedure for measuring the area of an irregular figure using a roller digital planimeter. Mention key precautions.	5			5

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

~~END SEMESTER December~~ 2025 / RE - EXAM February 2026

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

Course Code: PC-BTC302

Course Name: Basics of Surveying

Duration: 03 hrs.

Maximum Points: 100

Semester: III

Notes:

8/1/26

1. Question 1 is compulsory
2. Solve any FOUR from the remaining SIX Questions
3. Accompany your answers with suitable sketch, examples, facts and figures, wherever necessary.
4. Start each main question from new page.

Q.no	Question	Points	CO	BL	Module
Q.1	**Answer the following: Any 4**	**20**	1	1,2	
a	Define geodetic surveying. How does it differ from plane surveying? Explain with appropriate examples.	5			1
b	Explain curvature and refraction corrections in levelling. Why are they essential in precise levelling?	5			2
c	Describe the temporary adjustments of a transit theodolite. Explain the importance of centering and levelling.	5			3
d	Explain the principle of a digital level. Mention any two advantages over an optical (auto) level.	5			4
e	Explain the orientation of plane table by compass with proper sketch.	5			5
Q.2	**Answer the following:**	**20**	1,2,3,4	1,2,3	
a	Classify surveying based on the purpose. Explain engineering survey, route survey, and construction survey with examples.	5			1
b	Derive the stadia formula for inclined sight (angle of depression) with vertical staff. (5) A tacheometer with fixed stadia hairs is set up at station P. The axis of the instrument has RL = 142.350 m. Vertical angle to a vertical staff at station Q = +4° 45′. Staff readings are: upper hair = 2.960 m, lower hair = 1.520 m, and central hair = 2.240 m. Instrument constants: k = 100, c = 0.30 m. Draw a neat sketch (2). Compute the horizontal distance PQ (3). Compute the RL of station Q. (5)	15			4
Q.3	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
a	Compare the radiation, resection, and traversing methods in plane table surveying. Mention advantages and limitations of each.	10			5
b	A profile levelling survey is performed along a proposed pipeline route. Readings are as follows: 1.865, 2.425, 3.015, 1.455, 1.760, 2.210, 2.940, 1.180, 1.945. BM with RL = 102.000 m gives a backsight = 0.975 m. Instruments were shifted after third and seventh reading. Tabulate the readings in a field book using the Height of	10			2

~~END SEMESTER December 2025~~ / RE - EXAM February 2026

	Instrument (HI) method (2). Compute the Reduced Levels (RLs) of all points (5). Apply the arithmetical check (1). Draw a neat profile (longitudinal section) (1). Comment on the nature of the ground (1).				
Q.4	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
a	The following offsets were measured from a baseline 180 m long at 20 m intervals: Compute the area enclosed using the trapezoidal rule.	10			5
b	Explain mid ordinate rule and average ordinate rule method for area calculation. Discuss conditions of its applicability.	10			5
Q.5.	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
	A closed traverse ABCDA was surveyed clockwise. Independent coordinates of A are (500, 500). The corrected bearings and lengths are: 1) Prepare Gale's Traverse Table. (1) 2) Compute the Latitudes and Departures. (2) 3) Calculate the Consecutive Coordinates. (4) 4) Check for closing error and compute the error. (3) 5) Apply Bowditch's Rule. (3) 6) Compute corrected latitudes and departures. (2) 7) Compute the corrected consecutive coordinates. (2) 8) Compute the independent coordinates. (2) 9) Draw the traverse showing the details. (1)	20			3
Q.6.	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
a	Explain the reiteration method of measuring horizontal angles. How does it help in reducing observational errors?	10			3
b	Explain the working of an electronic theodolite. State any four advantages over a conventional vernier theodolite.	10			4
Q.7.	**Answer the following:**	**20**	**1,2,3,4**	**1,2,3**	
a	Explain the principle of "working from whole to part."	5			1

Chainage (m)	Offset (m)	Chainage (m)	Offset (m)
0	1.80	100	3.95
20	4.35	120	2.55
40	7.10	140	1.40
60	6.45	160	0.95
80	5.20	180	0.60

Line	Bearing	Length (m)
AB	40°30'	210
BC	110°15'	165
CD	190°45'	180
DA	295°00'	195

~~END SEMESTER December 2025~~ / RE - EXAM February 2026

	Why is it important in surveying?				
b	Explain atleast five characteristics of contours.	5			2
c	Classify EDMs based on wavelength and working range.	5			4
d	Compare polar planimeter with digital roller planimeter	5			5

BharatiyaVidyaBhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER NOV- 2025/~~RE-EXAM~~ JAN 2026

Second B. tech **SET: I** 01/12/25

Program: Civil Engineering Sem III **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 G+1 story bungalow for a Middle income family on a site of the data given below. 1. Plot size: 14 M x 16 M. (FSI: 1.0) 2. Road is on south side parallel to 14 M direction 3. Wind direction is E-SW-W & climatic zone is hot and humid 4. Requirements of Family a. Master bed room b. Living room c. Children bed room d. Kitchen cum dining room e. Guest bed room f. Staircase/bath/WC/store/verandah are to be provided B) State: Built up area, RERA carpet area, carpet area, super built up area, FAR for Q.1A	15+05	L4	1-5	1-5
2	A. Draw to a suitable scale Foundation plan for Q.1A. B. Draw terrace plan for Q.1 A	15+05	L2	1-5	1/5
3	A. Draw to suitable scale the line plan of a Primary Health Care Center for approximately 500 villagers. Show different units with their sizes, position of doors and windows. (C2410001 to C2410045) OR Draw to suitable scale the line plan of a Post office on plot size of 300 Sq.m. Show different units with their sizes, position of doors and windows. (C2410046 onwards)	20	L3	2-5	1,2

4	A. Write the key features of the Real Estate (Regulation and Development) Act, 2016 B. Explain following principles of planning in detail, 1. Privacy 2. Circulation	10+10	L2	2	1
5	A. What do you mean by Building bylaws? Write a short notes on: (a) Interior open space (b) External open space (c) FSI (d) Minimum Plot size. B. Draw a front side elevation plan for Q.1A	10+10	L2/3	2-5	1/3/5
6	A. Draw the sectional elevation for Q.1A by assuming section line pass through one internal and external wall, staircase, WC or bath, door or window.	20	L3	1-3	2,3,4
7	A. Draw to a suitable scale ~~Front~~ Back elevation for Q.1.A. showing drainage details. B. Draw to a suitable scale Water supply, Drainage plan & Furniture plan for Q.1A.	10+10	L3	1-3	1/3/5

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER November 2025 / RE ~~EXAM~~ January 2026

Program: SY Civil Engineering (UG) B.Tech Sem III

Course Code: PC-BTC-304

Course Name: Fluid Mechanics

Duration: 03 Hrs.

Maximum Points: 100

Semester: III

03/12/25

Notes:

- Attempt ***any five*** questions.
- Answer to all sub questions should be grouped together.
- **Figure** to right indicates full marks.
- Assume suitable data wherever necessary and state it **clearly**.

Q. No.	Questions	Points	CO	BL	Module No.
1.	**Answer (any four)**				
	(a) What do you mean by fluid? Define mass density, weight density, specific volume and specific gravity.	05	1	2	1
	(b) What do you mean by cohesion and adhesion?	05	1	2	1
	(c) Explain law of viscosity and types of fluid based on viscosity.	05	1	2	1
	(d) Explain vapour pressure and saturation vapour pressure.	05	1	2	1
	(e) Two capillary tubes of diameter 1.5 mm and 3 mm are dipped in an oil of surface tension 0.036 N/m and specific weight 9350 N/m3. Find the difference of oil levels in the two tubes. Assume contact angle of 25^0.	05	3	2	1
2.	(a)State and derive Hydrostatic law.	10	1	3	2
	(b) A tank contains a liquid of specific gravity 0.82. Find the absolute and gauge pressure at a point which is 5 m below the free surface of the liquid. The atmospheric pressure head is equivalent to 760 mm of mercury.	10	1	4	2
3.	(a) Derive an expression for total pressure and depth of center of pressure from liquid surface for an inclined plane surface.	10	2	4	3
	(b) A hollow circular plate of 2 m external diameter and 1 m internal diameter is immersed vertically in water such that the centre of plate is 4 m deep from water surface. Find the total pressure and centre of pressure.	10	2	4	3

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER November 2025 / ~~RE - EXAM~~ January 2026

4.	(a)State Archimedes principle and explain the conditions of equilibrium of a floating body and submerged body.	10	2	3	3
	(b)A block of wood of specific gravity 0.70 floats in water. Determine the metacentric height of the block, if its size is 2 m long x 1 m wide x 0.80 m deep.	10	2	4	3
5.	(a) Prove that the stream lines (Ψ-lines) and equipotential lines (Φ-lines) are orthogonal to each other's.	10	3	4	4
	~~(b)In a two dimensional incompressible flow, the fluid~~ velocity components are given by u = x - 4y and v = -y-4x. Show that velocity potential exists and determine its form. Find also the stream function.	~~10~~	~~3~~	~~4~~	~~4~~
6.	(a) Derive Hagen-Poiseuille equation for laminar flow through a circular pipe.	10	2	3	5
	(b)An oil of specific gravity 0.90 and viscosity 0.125Ns/m^2 flow through a pipe of 30 mm diameter with a pressure drop of 0.38 N/cm^{2}in a length of 30m. Determine the discharge, shear stress intensity at the pipe wall and power required to maintain the flow.	10	2	4	5
7.	(a)Explain Reynold's stresses and Prandtl's mixing length theory. Discuss the concept of fluctuation of velocity and shear stress in turbulent flow.	10	2	4	5
	(b) What is boundary layer over a surface? Explain the concept of development of boundary layer over a flat plate and laminar and turbulent boundary layer including boundary layer in transition.	10	2	4	6

****

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

Program: SY Civil Engineering (UG) Sem III
Course Code: PC-BTC-304
Course Name: Fluid Mechanics

Duration: 03 Hrs.
Maximum Points: 100
Semester: III

12/1/26

Notes:

- Attempt ***any five*** questions.
- Answer to all sub questions should be grouped together.
- **Figure** to right indicates full marks.
- Assume suitable data wherever necessary and state it **clearly**.

Q.No.	Questions	Points	CO	BL	Module No.
1.	**Answer (any four)**				
	(a) What is Newton's law of viscosity? What do you mean by coefficient of dynamic viscosity and kinematic viscosity?	05	1	2	1
	(b) A liquid has a volume of 9 cu.m. and weight of 52 kN. Determine its specific weight, specific mass, specific volume and specific gravity.	05	1	2	1
	(c) Write short notes on vapour pressure and saturation vapour pressure.	05	1	2	1
	(d) For having a blood sample a fine glass of capillary of diameter 2 mm was held on freshly punctured fingertip. Estimate in ML the volume of blood sample so drawn. Take surface tension as 5×10^{-2} N/m and its contact angle with glass as zero degree. Take density of blood as 1060 kg/m^3.	05	1	2	1
	(e)Explain the principle of Venturimeter with its expression	05	3	2	3
2.	(a)State and prove Pascal's law.	10	1	3	2
	(b) A simple U tube manometer containing mercury is connected to a pipe in which oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to the atmosphere. Find the vacuum pressure in pipe, if the difference of mercury level in two limbs is 20cm and height of oil in the left limb from the center of pipe is 15 cm below.	10	1	4	2

~~END SEMESTER November 2025~~ / RE - EXAM January 2026

3.	(a) Derive an expression for total pressure and depth of center of pressure from liquid surface for a vertical plane surface.	10	2	4	3
	(b) A circular plate 4 m diameter is immersed in water in such a way that its greatest and least depth below the free surface is 5 m and 2.50 m respectively. Determine the total pressure on one face of the plate and position of center of pressure.	10	2	4	3
4.	(a)State Archimedes principle and explain the conditions of equilibrium of a floating body and submerged body.	10	2	3	3
	(b)A block of wood has a horizontal cross section 50cm x 50 cm and height h. It floats vertically in water. If the specific gravity of wood is 0.6, find the maximum height of the block so that it can remain in stable equilibrium.	10	2	4	3
5.	(a)Explain stream lines, equipotential lines, stream function (Ψ) and potential function (Φ).	08	3	4	4
	(b)(i) In a two dimensional incompressible flow, the fluid velocity components are given by u = x - 4y and v = -y-4x. Show that velocity potential exists.	06	3	4	4
	(b)(ii)State Euler's equation of motion and explain Bernoulli's theorem.	06	3	4	4
6.	(a)Derive Hagen-Poiseuilles equation for laminar flow through a circular pipe.	10	2	3	5
	(b)An oil of specific gravity 0.92 and viscosity 0.12Ns/m^2 flow through a pipe of 25 mm diameter with a pressure drop of 0.36 N/cm^{2}in a length of 32m. Determine the discharge, shear stress intensity at the pipe wall and power required to maintain the flow.	10	2	4	5
7.	(a) Explain the concept of fluctuation of velocity and shear stress in turbulent flow. Also explain Reynold's stresses and Prandtl's mixing length theory.	10	2	4	5
	(b) Explain the concept of development of boundary layer over flat plate and laminar and turbulent boundary layer, boundary layer thickness, displacement thickness, momentum thickness, energy thickness.	10	2	4	6

****

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

END SEM/~~RE-EXAM~~ EXAMINATION JAN/FEB 2025-26 S-1

End Semester Exam Nov 2025

Second Year

Program: B.Tech. Civil Engineering Sem III

Course Code : **PC-BTC305**

Course Name : **Concrete Technology**

Duration: 3 Hour

Maximum points: 100

Semester: III

05/12/25

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 Infrastructure development" justify your answer. Explain the processes involved in RMC.	08	3	2	05
	(b) Differentiate between medium and high workability. Explain the procedure for conducting slump cone test?	07	4	4	04
	(c) Explain the reaction mechanism of Sulphate resisting Cement.	05	1	2	01
Q2	**a.** Differentiate between Light weight and High density concrete	5	1	3	01
	b. Design concrete for M45 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 – Pumping	Specific gravity of 20 mm aggregate (M_2)– 2.68
Strength of cement **OPC —43 grade**	Workability — slump, **150 mm**	Type of coarse aggregate — angular coarse aggregate	Specific gravity of 10 mm aggregate (M_1) — 2.65
Zone of sand — II	Water absorption- M_2-1.4% & M_1- 1.6%, Total moisture content M_2-0.4% & M_1- 0.5%	Water absorption fine aggregate- 2.8 % Total moisture content in fine aggregate – 4.6 %	Specific gravity of fine aggregate — 2.80

Q3	**(a)** Design concrete for **M 30** grade using DOE method. Refer the data from Que2 and chart attached at the end of manuscript. Consider maximum permissible ratio of 0.50 and minimum cement content as 325 kg per cum (***Assume % passing of fine aggregate from 600 micron =37%).***	12	2	4	3
	(b) What is self-compacting concrete (SCC)? How will you measure workability of SCC?	08	4	2	4

Q4	**(a)** Design a Non-air entrained concrete exposed to fresh water of for M25 grade using ACI Method. Consider following data: OPC 53 grade cement, F.M. of fine Aggregate= 2.8; workability (Slump) = 100 mm, Maximum aggregate size-20 mm and bulk density of coarse Agg. = 1650 kg/m^3. Coarse Aggregates-Water absorption- M_2-1.4% & M_1- 1.6%; Total moisture content M_2-0.4% & M_1-0.5%. Water absorption in fine aggregate- 3.8 %, ***No moisture present.***	12	2	3	2
	(b) Discuss the importance of improving Interfacial Transition Zone in High Performance concrete.	04	3	2	4
	(c) What are the problems encountered during concreting at extreme cold condition?	04	3	3	1
Q5	**(a)** It is proposed to **design SCC** of grade M40 using OPC 53 grade cement for slump flow of 600-800 mm, consider w/c of 0.32. Suggested to use viscosity modifying admixture of 1.2% by weight of cement to reduce water Appx.30%; consider the percentage of fine aggregate passing from 125 micron as 3.75 %.	**10**	1	2	4
	(b) State the purpose of compaction of concrete. Explain different methods of compaction of concrete with their suitability.	**10**	3	2	1,3
Q6	(a) Describe in detail the methods of underwater concrete.	**10**	3	2	4
	(b) Distinguish between (i) Rapid Hardening and low heat cement (ii) Accelerator vs. Retarder	**10**	1	3	1
Q7	a) What are the properties of fine and coarse aggregates considered to find the suitability for concrete?	10	2	3	1
	b) Write explanatory notes on the following *(any two)*				
	i) Carbonation of concrete	**5**	2	2	5
	ii) pH test of concrete	**5**	3	2	5
	iii) Type of Mixers used for making concrete	**5**	1	2	3

Deign M45 grade of concrete using IS consider the following details:			
Cement OPC 43 grade	Exposure		

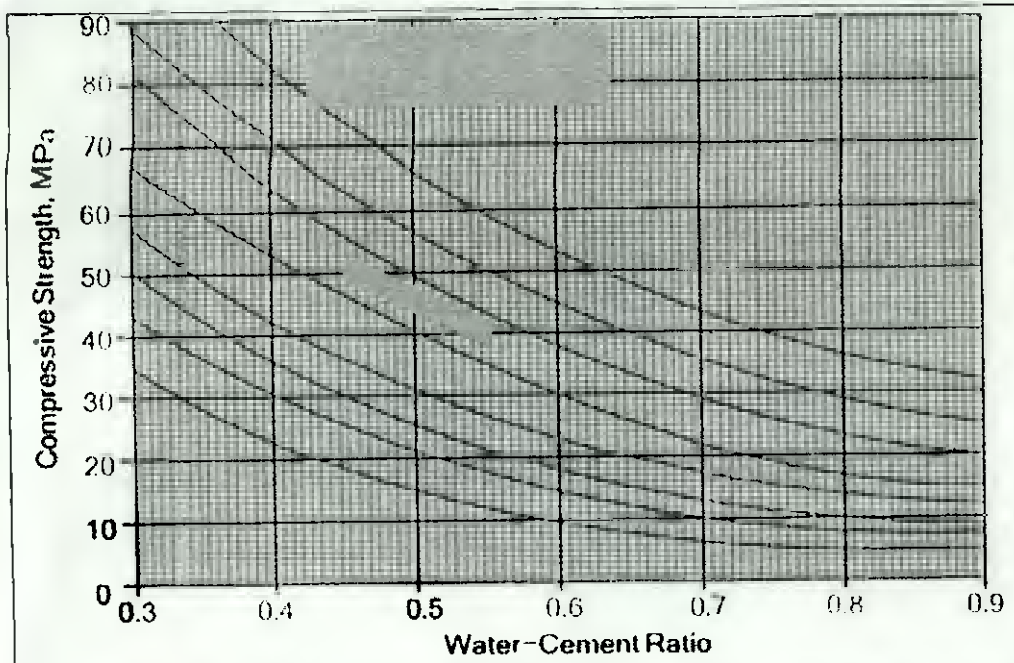
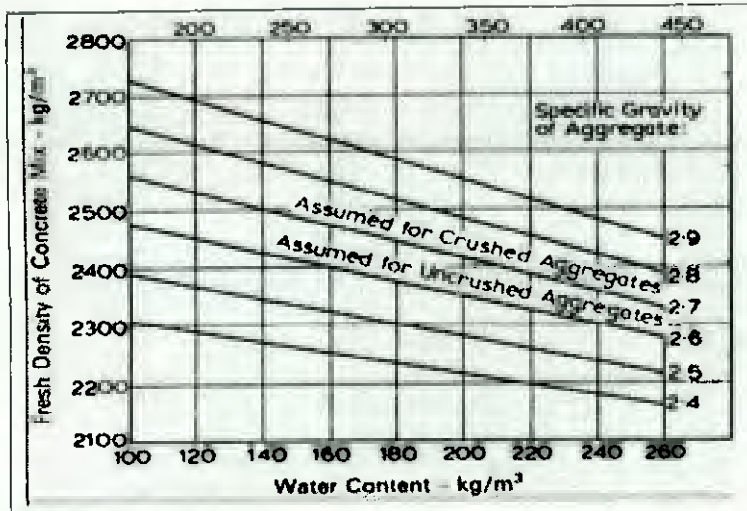


Table 20.47. App. Free water content required for various workability according to 1988 British Method

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



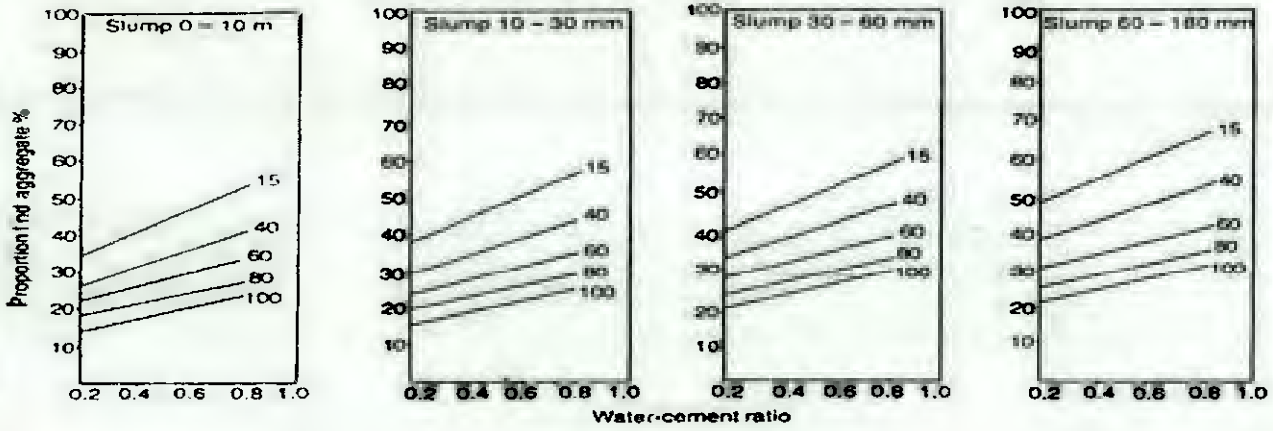


Fig 20.12. (b)

Table 20.46 App Compressive strength of concrete in Mpa with w/c of 0.5 as per DOE for OPC (Type I), SRC (Type v) and RHC 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
RHC	Uncrushed	25-29	34-37	46-48	53-54
RHC	Crushed	30-34	40-43	53-55	60-61

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

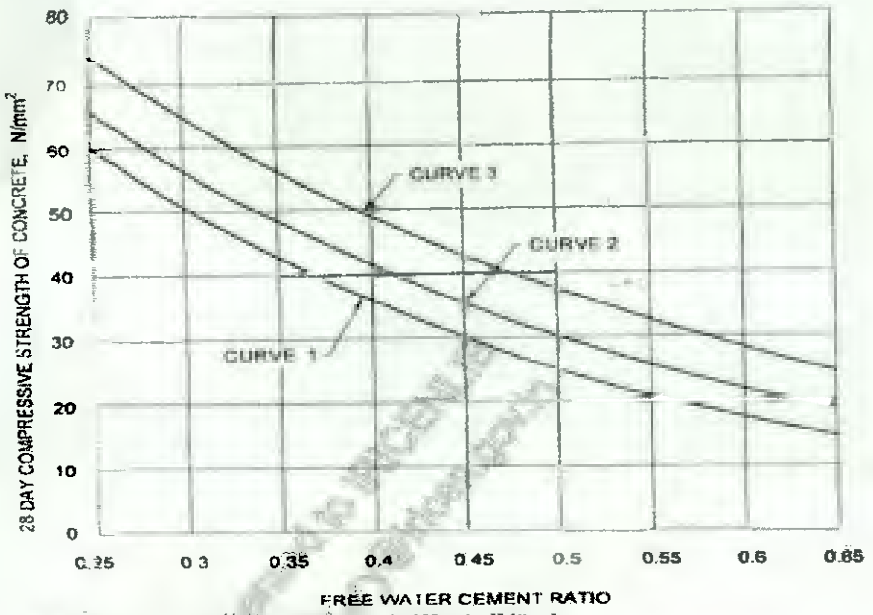
Non air entrained concrete				
Workability / air content (Slump)	Water content, kg/m³ of concrete for indicated maximum aggregate size			
	10 mm (25, 40,50,70)	12.5 mm	20 mm	150 mm
30-50 mm	205	200	185	125
80-100 mm	225	215	200	140
150-180 mm	240	230	210	-
Approx entrapped air (%)	3	2.5	2	0.2

(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**

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, namely, crushed sand or mixed sand and coarser 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 Concrete
(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 be adopted during mix proportioning, if the site data (at least 5 results) for similar mix is available

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

~~END-SEM~~ RE-EXAM EXAMINATION JAN/~~FEB~~ 2025-26 S-2

S.Y. 14/11/26

Program: B.Tech. Civil Engineering Sem III

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) Explain various methods of transporting concrete for different construction activities with their suitability. (b) Explain in detail procedure for conducting half- cell potential test. (c) What are the properties of hydrophobic cement?	10 05 05	3 4 1	4 3 2	03 05 01
Q2	a. Differentiate between Melamine and Naphthalene based plasticizer	5	1	3	01
	b. **Design concrete for M50 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 – Pumping	Specific gravity of 20 mm aggregate (M_2)- 2.70
Strength of cement **OPC —53 grade**	Workability — slump, **75 mm**	Type of coarse aggregate — angular coarse aggregate	Specific gravity of 10 mm aggregate (M_1) — 2.68
Zone of sand — III	Water absorption- **M_2-1.3% & M_1- 1.5%** Total moisture content **M_2-0.4% & M_1- 0.5%**	Water absorption fine aggregate- 3.2 % Total moisture content in fine aggregate – 2.5%	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 0.60 and minimum cement content as 325 kg per cum (***Assume % passing of fine aggregate from 600 micron =42%).*** (b) What are the types of chemical admixture used in construction?	12 08	2 4	4 2	3 4
Q4	(a) Design a Non-air entrained concrete exposed to fresh water of for M30 grade using ACI Method. Consider following data: OPC 43 grade cement, F.M. of fine Aggregate= 2.6; workability (Slump) = 70 mm, Maximum aggregate size-20 mm and	12	2	3	3

	bulk density of coarse Agg. = 1720 kg/m^3. Coarse Aggregates-Water absorption- M_2-1.3% & M_1- 1.5%; Total moisture content M_2-0.6% & M_1-0.55%. Water absorption in ***fine aggregate***- 3.5 %,***moisture content-2.7%.***				
	(b) Discuss the Advantages and disadvantages of High Performance concrete.	05	3	3	1
	(c) What are the measures can be taken to minimize the effect of Alkali Silica Reaction?	03	3	2	1
Q5	(a) It is proposed to **design SCC** of grade M35 using OPC 53 grade cement for slump flow of 600-800 mm, consider w/c of 0.34. Suggested to use viscosity modifying admixture of 1.1% by weight of cement to reduce water Appx.25%; consider the percentage of fine aggregate passing from 125 micron as 4.1 %.	**10**	1	2	4
	(b) What are the various methods of concrete curing, explain with their suitability.	**10**	3	2	1,3
Q6	(a) Describe in detail the monitoring and production of Ready mix Concrete.	**10**	3	2	4
	(b) How UPV and Rebound hammer test help to assess the onsite concrete quality?	**06**	1	3	5
	(c) Explain types of pore in concrete.	**04**	1	2	1
Q7	a) Explain the effect of size, shape and texture of fine and coarse aggregates on the properties concrete.	06	2	3	1
	b) Explain in detail the reaction mechanism of plasticizer with cement.	**04**	2	3	1
	Write explanatory notes on the following ***(any two)***				
	i) Light weight concrete	**5**	3	2	1
	ii) Mineral Admixtures	**5**	1	2	1
	iii) Type of compacting devices in concrete	**5**	1	2	1

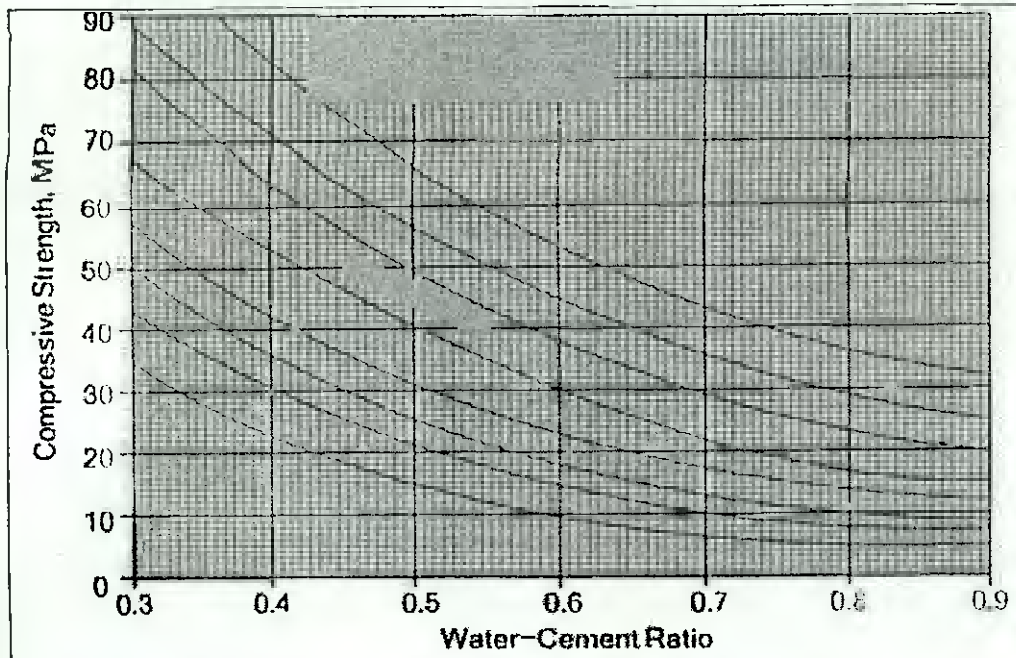
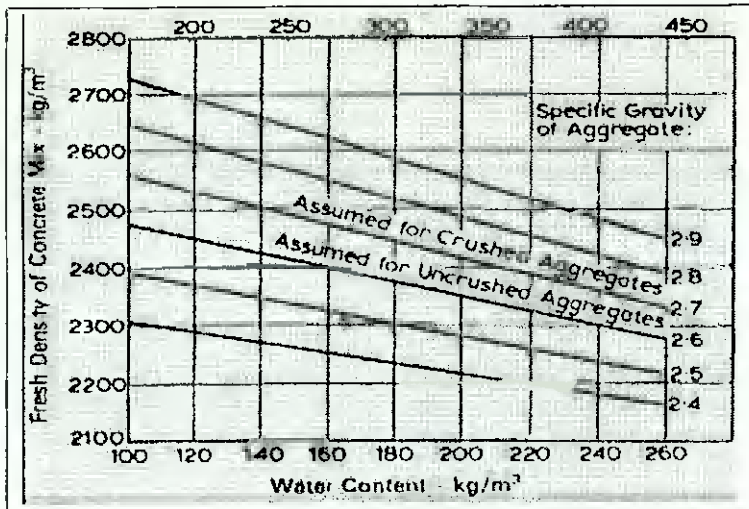


Table 20.47. App. Free water content required for various workability according to 1988 British Method

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



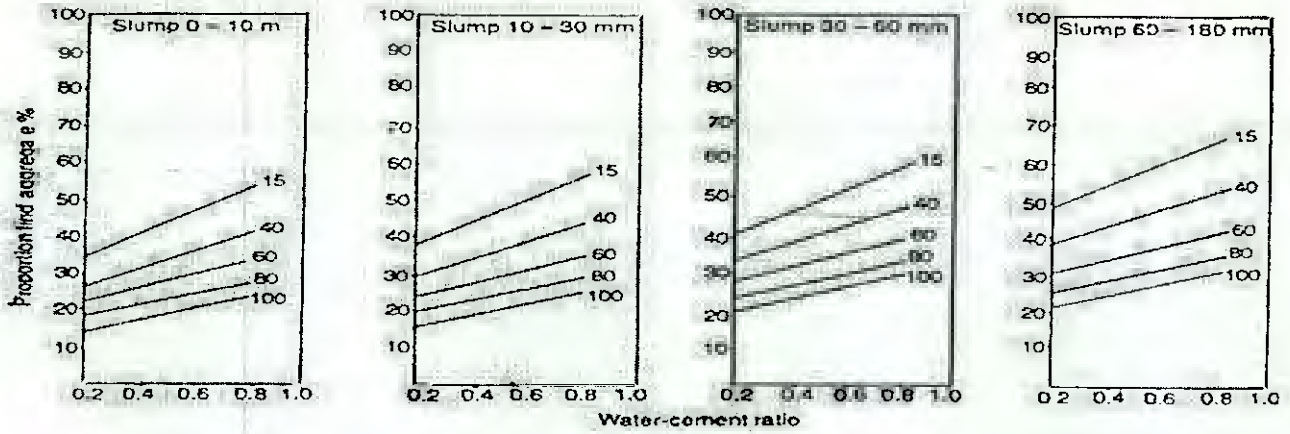


Fig 20.12. (b)

Table 20.46 App Compressive strength of concrete in Mpa with w/c of 0.5 as per DOE for OPC (Type I), SRC (Type v) and RHC 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
RHC*	Uncrushed	25-29	34-37	46-48	53-54
RHC	Crushed	30-34	40-43	53-55	60-61

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	35

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 ACI 211.1-91

Non air entrained concrete				
Workability or air content (Slump)	Water content kg/m3 of concrete for maximum nominal 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

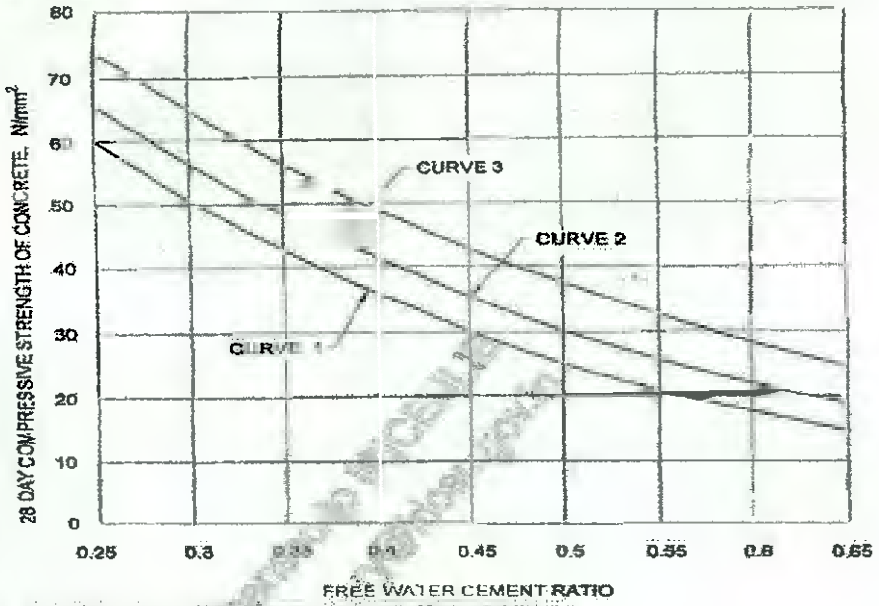
(6) First estimate of density of fresh concrete as pe ACI 211.1-91

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	2345	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**

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



Curve 1 : for expected 28-day 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 pozzolana 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 Concrete
(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 be adopted during mix proportioning, if the site data (at least 5 results) for similar mix is available.