T.Y. B.Tech Civil WP END SEM

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEM / ~~RE-EXAM~~ EXAMINATION MAY / ~~JUN~~ 2026

Program: Third Year B. Tech Civil Engineering (Working Professionals)
Course Code: PC-BTC604
Course Name: Design of RCC Elements

Duration: 3 Hrs.
Maximum Points: 100
Semester: VI

25/05/2026

Instructions for the Students:

1. **Attempt any 05 (FIVE) questions**
2. **Assume suitable data if necessary and state it clearly.**
3. **Illustrate your answers with neat sketches wherever required.**
4. **Use of IS 456: 2000 is permitted.**

Q. No.	Questions	Points	CO	BL	Module No.
1 a	i. Explain the working stress method of design of RCC structures.	05	1	3	1
	ii. Determine the design constants for M25 Concrete and Fe 500 steel in Limit state method.	05	1	3	3
1 b	A RCC beam is simply supported over a span of 8 m and carries a superimposed uniformly distributed load of 15 kN/m over the entire span. The cross section of the beam is 230 mm X 750 mm. If the grade of concrete is M20 and grade of the steel is Fe-415, determine the area of tension steel required. **Use Working Stress Method**	10	2	4	2
2 a	A RCC beam has a cross section of 230 mm X 750 mm. The beam is reinforced with 3 bars of 25 mm diameter on tension side and 2 bars of 25 mm diameter on compression side. If the grade of concrete is M20 and grade of the steel is Fe-415, determine the maximum superimposed uniformly distributed load the beam can carry over the entire span. **Use Working Stress Method.**	10	2	3	2
2 b	A RCC beam is simply supported over a span of 5 m and has a cross section of 230 mm X 600 mm. the beam is reinforced with 3 bars of 25 mm diameter on tension side. If the grade of concrete is M25 and grade of the steel is Fe-415, determine the maximum superimposed uniformly distributed load the beam can carry over the entire span. **Use Limit State Method.**	10	2	3	4

END SEM / ~~RE-EXAM~~ EXAMINATION MAY / ~~JUN~~ 2026

3 a	A RCC beam is simply supported over a span of 4 m and carries a superimposed uniformly distributed load of 40 kN/m over the entire span. The cross section of the beam is 230 mm X 600 mm. If the grade of concrete is M30 and grade of the steel is Fe-250, determine the area of compression steel and tension steel required assuming a balanced doubly reinforced section. **Use Limit State Method.**	10	2	4	4
3 b	A T beam has following properties: Width of Flange = 2100 mm Depth of Flange = 100 mm Width of Web = 230 mm Effective depth = 550 mm The beam is subjected to a factored bending moment of 500 kN-m. If the grade of concrete is M-25 and grade of the steel is Fe-500, Determine the area of tension steel required. **Use Limit State Method.**	10	2	4	4
4 a	A simply supported beam of span 8 m carries a superimposed uniformly distributed load of 40 kN/m over the entire span. The beam has a cross section of 300 mm X 600 mm and is reinforced with 3 bars of 25 mm diameter on tension side. The width of support is 230 mm. Design shear reinforcement using vertical stirrups considering the grade of concrete as M30 and grade of the steel as Fe-415. Note that 1 bars of 25 mm diameter are bent up at 45^0 near the support. **Use Limit State Method.**	10	2	5	4
4 b	A beam has a cross section of 300 X 600 mm and is subjected to a factored bending moment of 80 kN-m, factored torsional moment of 40 kN-m and a factored shear force of 80 kN. If the grade of concrete is M20 and grade of the steel is Fe-415, determine the area of steel required and the hear reinforcement required in the form of vertical stirrups only. **Use Limit State Method.**	10	2	5	4

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5 a	A RCC Column has a dimension of 600 mm X 600 mm. it is reinforced with 12 bars of 25 mm diameter as main reinforcement. The Column has unsupported length of 3.2 m and both ends of the column are effectively held in position and restrained against rotations. Determine the load carrying capacity of the column if concrete grade is M30 and steel grade is Fe-500. **Use Limit State Method.**	10	3	4	6
5 b	A RCC Column has a dimension of 400 mm X 600 mm. The Column has unsupported length of 3 m and both ends of the column are effectively held in position and restrained against rotations. Determine the area of the steel if the factored load resisted by the column is 1500 kN at an eccentricity of 100 mm about minor axis of the column. Assume concrete grade as M25 and steel grade as Fe-500. **Use Limit State Method.**	10	3	4	6
6	A slab is to be designed over a room size of 3 m X 7.5 m, measured internally. The slab is resting on 230 mm thick brick walls on all longer sides. Live load on the slab is expected as 3 kN/m^2 and floor finish load as 1 kN/m^2. The grade of concrete is M20 and grade of steel is Fe-415. Design the slab and sketch the reinforcement details.	20	3	5	5
7	A column has a dimension of 300 mm X 1000 mm and carries an axial compressive load of 1200 kN at service stage. Design an isolated pad footing for the column if safe bearing capacity of soil is 200 kN/m^2. Assume the grade of concrete as M20 and grade of the steel as Fe-415. **Use Limit State Method.**	20	4	5	7

Chart 38 COMPRESSION WITH BENDING — Rectangular Section — Reinforcement Distributed Equally on Two Sides

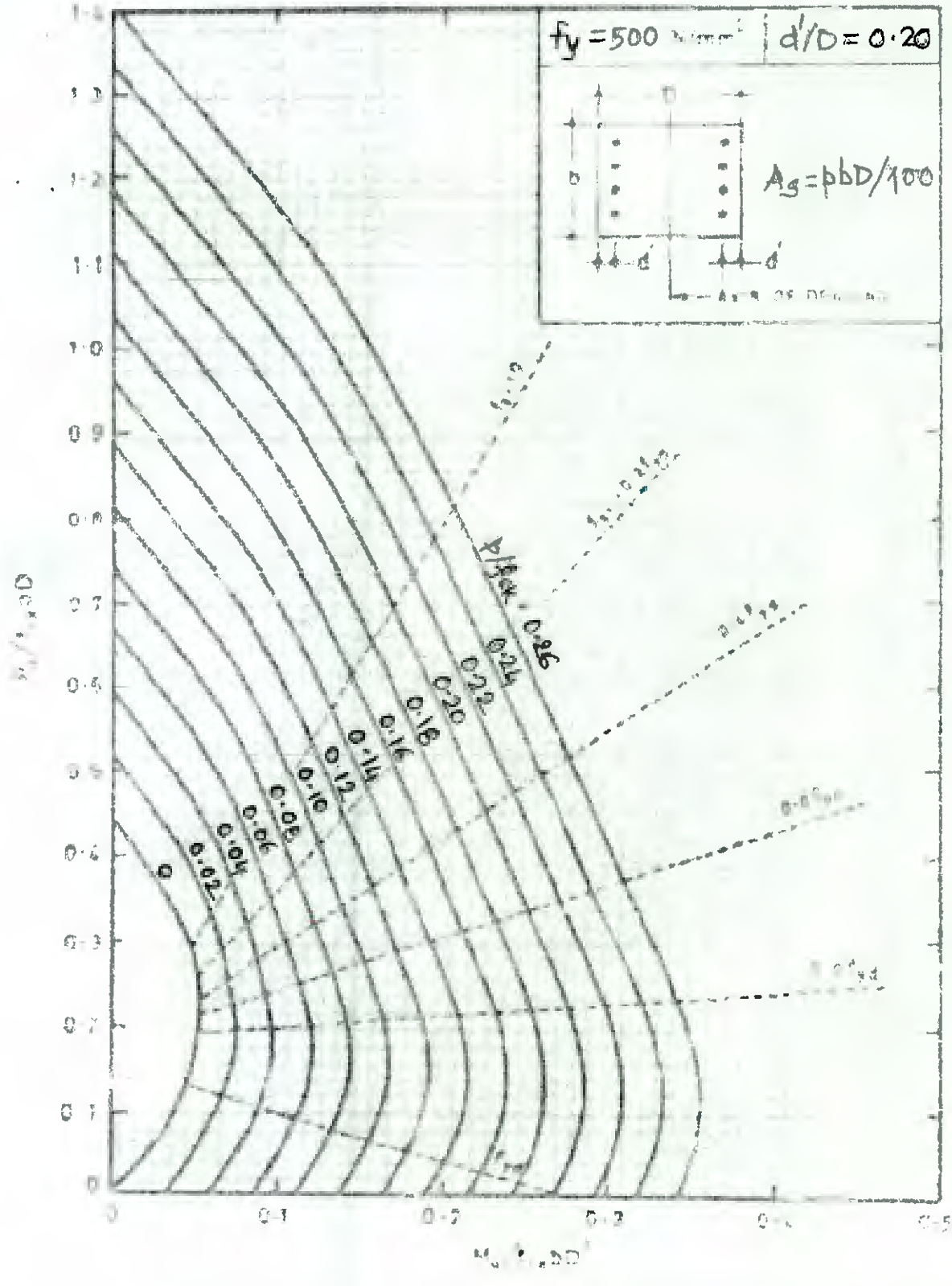


Chart 37 COMPRESSION WITH BENDING – Rectangular Section — Reinforcement Distributed Equally on Two Sides

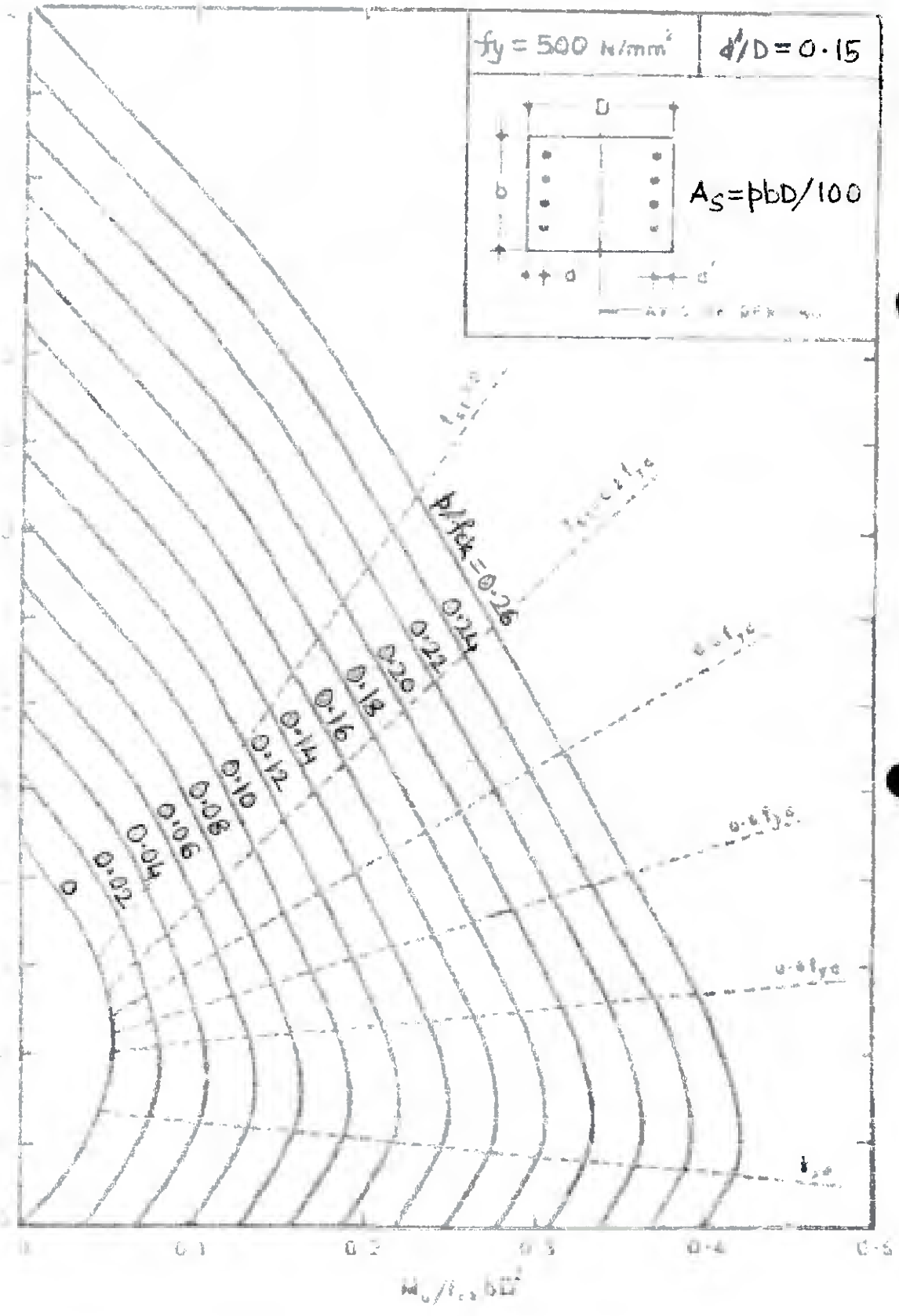
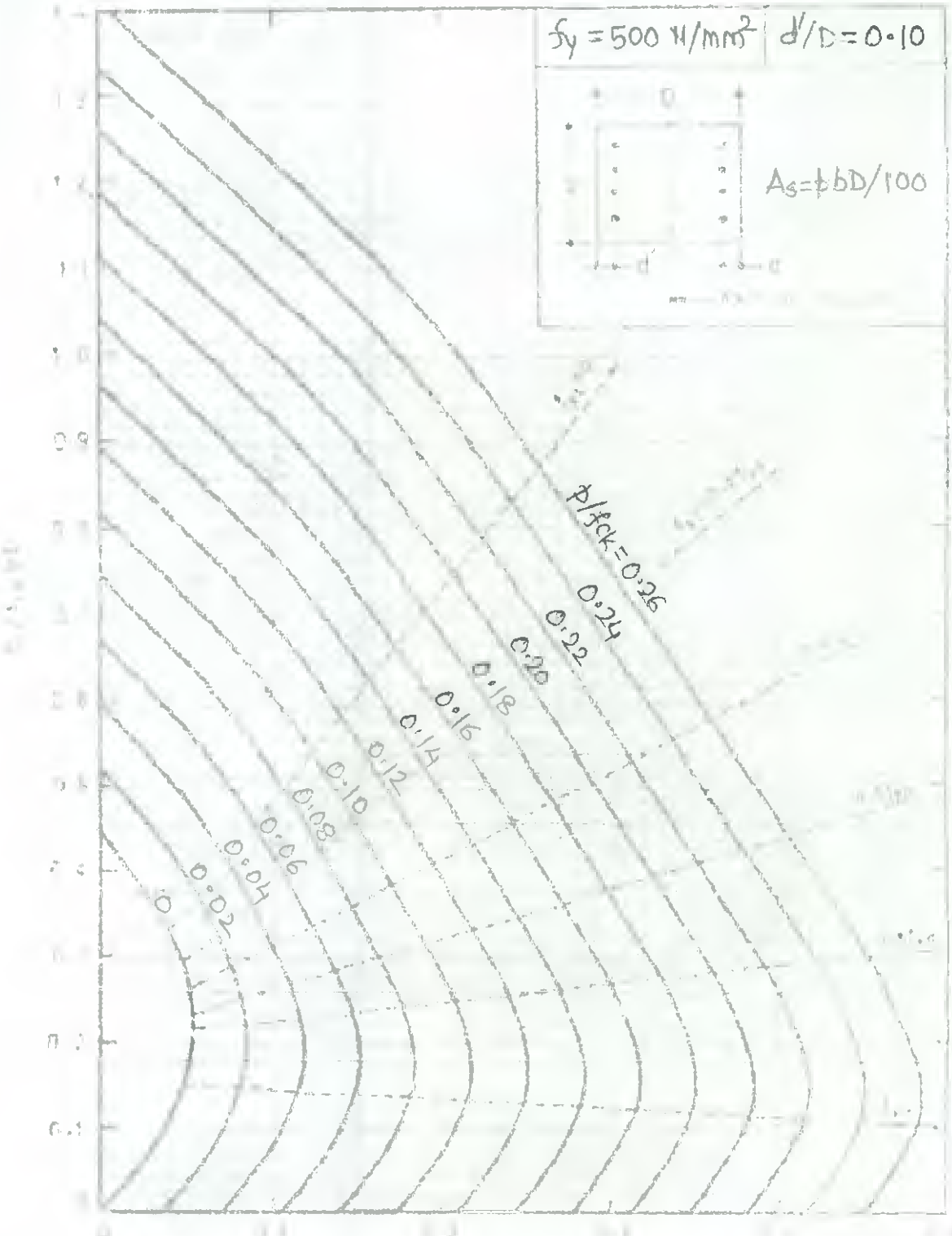


Chart 36 COMPRESSION WITH BENDING – Rectangular
Section – Reinforcement Distributed Equally on Two Sides



f_y 500

$f_y = 500\ N/mm^2$ $d'/D = 0.05$

$A_s = pbD/100$

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Sardar Patel College of Engineering

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END SEM/RE-EXAM EXAMINATION -MAY / ~~JULY~~ 2026

(WORKING PROFESSIONAL)

Program: Civil Engineering Third Year B.Tech W.P **Duration: 3hr**
Course Code: PC-BTC601 **Maximum Points: 100**
Course Name: Construction Engineering and Management **Semester: VI**
Instructions:

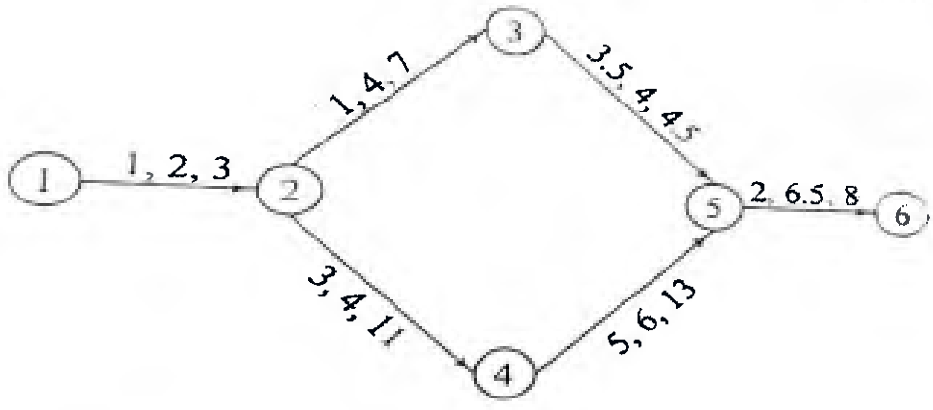
28/05/2026

1. **Attempt any 5 questions out of 7 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	Module
1	a	A certain project takes 40 days along the critical path and has a variance of 9 days. Compute the expected completion time for the project with the following probabilities. (i) 94.5% (ii) 46% (iii) 75%	6	CO2	BL1	3
	b	A construction company purchases 40,000 bags of cement annually. Each bag of cement costs ₹ 480 and the cost incurred in procuring each lot is ₹ 350. The cost of carrying is 35%. What is the most economic order quantity? What is the average inventory level? If the lead time of procuring cement is 3 weeks, determine the reorder point.	6	CO2	BL2	4
	c	It is proposed to carryout construction of rigid pavement road project in a metro city Mumbai. Discuss critical issues which needs to be addressed well in advance so that time and cost overrun can be avoided.	8	CO4	BL2	2 & 5
2		A contract is awarded to you for the construction of rigid pavement road project in a metro city Mumbai. a) Draw WBS for the project. b) Suggest suitable organization structure for the same. c) List the records to be maintained on the site during the construction of rigid pavement road. d) Discuss the causes of accidents in the construction of rigid pavement road.	20	CO1 CO2 CO3	BL3	2,4,5 & 6
3	a	A construction project consist of following activities for which activity durations are given in weeks.	10	CO2	BL2	3

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration Weeks	2	8	10	6	3	3	7	5	2	8

i) Draw network diagram.

		ii) Perform forward pass and backward pass calculation and determine total duration in weeks. iii) Determine critical path and comment about it. iv) Calculate total float. v) Calculate free float, Independent float and interfering float.				
	b	Discuss inspection and quality control Plan for highway construction project. List out the preliminary tests to be carried out on the material and their frequency.	10	CO3	BL2	6
4	a	The following network shows a three time estimates for each activity.	10	CO2	BL3	3
		 i) Expected time of completion and critical path ii) Variance of the project iii) Probability of completion if the scheduled time is reduced one day iv) Probability of completion if the schedule time is extended by one day v) Probability of completion if the schedule time is not changed.				
	b	Prepare a checklist for (i) Brick work in residential building (ii) Concreting work for the slab	10	CO2	BL2	6
5	a	Differentiate Quality control and quality assurance in the context of concreting work for the slab.	7	CO1	BL2	6
	b	Differentiate resource levelling and resource smoothening	3	CO2	BL1	7
	c	Prepare A, B and C ranking of the different items for the data given below .Graph is mandatory.	10	CO2	BL3	4

Item no	No. of units	Unit cost ₹	Item no	No. of units	Unit cost ₹
1	8000	10.0	7	70000	6.0
2	25000	5.0	8	4000	10.0
3	1600	10.0	9	500	8.0
4	700	30.0	10	30000	4.0
5	39000	5.0	11	12000	18.0
6	42000	4.0	12	4500	8.0

6	a	Justify the statement that construction projects of MTHL is a unique project.	6	CO1	BL1	1

	b	Draw cash flow diagram for the project details given below.		4	CO3	BL2	4

Description	Machine X	Machine Y
Purchase Price ₹	15,00,000.00	20,00,000.00
Machine Life (Years)	8	9
Salvage value at the end of Machine life ₹	2,00,000.00	3,00,000.00
Annual O & M Cost ₹	3,00,000.00	2,50,000.00

	c	Discuss the different types of classification of materials along with their criteria.	10	CO2	BL2	4
7	a	It is proposed to carryout construction of Highway project, suggest suitable PPE along with their specific purpose/use.	8	CO4	BL2	6
	b	Data for the network is as shown below	12	CO3	BL3	7

Activity		Normal Duration In week	Normal Duration In week	Normal Cost ₹	Crash cost ₹
A	10-20	12	6	14000	29000
B	10-30	16	10	8000	17000
C	20-30	8	2	12000	18000
D	20-40	10	6	16000	30000
E	30-40	10	6	10000	22000

i) Indirect cost of the project is ₹ 3000/- per week.
ii) Draw project network and find critical path.
iii) Find optimum cost and optimum duration.
iv) Draw time scaled diagram for each stage during crashing.

Standard Normal Probabilities

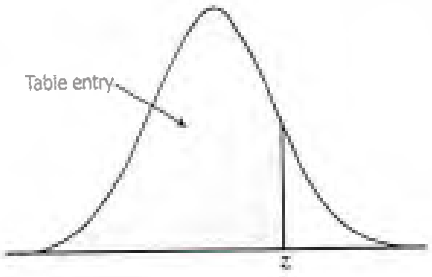


Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
0.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
0.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
0.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
0.4	.6554	.6591	.6628	.6664	.6700	.6736	.6772	.6808	.6844	.6879
0.5	.6915	.6950	.6985	.7019	.7054	.7088	.7123	.7157	.7190	.7224
0.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
0.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
0.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
0.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9452	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9656	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9761	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9821	.9826	.9830	.9834	.9838	.9842	.9846	.9850	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9957	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998

Standard Normal Probabilities

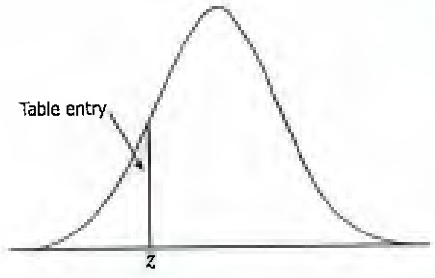


Table entry for z is the area under the standard normal curve to the left of z.

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
−3.4	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0002
−3.3	.0005	.0005	.0005	.0004	.0004	.0004	.0004	.0004	.0004	.0003
−3.2	.0007	.0007	.0006	.0006	.0006	.0006	.0006	.0005	.0005	.0005
−3.1	.0010	.0009	.0009	.0009	.0008	.0008	.0008	.0008	.0007	.0007
−3.0	.0013	.0013	.0013	.0012	.0012	.0011	.0011	.0011	.0010	.0010
−2.9	.0019	.0018	.0018	.0017	.0016	.0016	.0015	.0015	.0014	.0014
−2.8	.0026	.0025	.0024	.0023	.0023	.0022	.0021	.0021	.0020	.0019
−2.7	.0035	.0034	.0033	.0032	.0031	.0030	.0029	.0028	.0027	.0026
−2.6	.0047	.0045	.0044	.0043	.0041	.0040	.0039	.0038	.0037	.0036
−2.5	.0062	.0060	.0059	.0057	.0055	.0054	.0052	.0051	.0049	.0048
−2.4	.0082	.0080	.0078	.0075	.0073	.0071	.0069	.0068	.0066	.0064
−2.3	.0107	.0104	.0102	.0099	.0096	.0094	.0091	.0089	.0087	.0084
−2.2	.0139	.0136	.0132	.0129	.0125	.0122	.0119	.0116	.0113	.0110
−2.1	.0179	.0174	.0170	.0166	.0162	.0158	.0154	.0150	.0146	.0143
−2.0	.0228	.0222	.0217	.0212	.0207	.0202	.0197	.0192	.0188	.0183
−1.9	.0287	.0281	.0274	.0268	.0262	.0256	.0250	.0244	.0239	.0233
−1.8	.0359	.0351	.0344	.0336	.0329	.0322	.0314	.0307	.0301	.0294
−1.7	.0446	.0436	.0427	.0418	.0409	.0401	.0392	.0384	.0375	.0367
−1.6	.0548	.0537	.0526	.0516	.0505	.0495	.0485	.0475	.0465	.0455
−1.5	.0668	.0655	.0643	.0630	.0618	.0606	.0594	.0582	.0571	.0559
−1.4	.0808	.0793	.0778	.0764	.0749	.0735	.0721	.0708	.0694	.0681
−1.3	.0968	.0951	.0934	.0918	.0901	.0885	.0869	.0853	.0838	.0823
−1.2	.1151	.1131	.1112	.1093	.1075	.1056	.1038	.1020	.1003	.0985
−1.1	.1357	.1335	.1314	.1292	.1271	.1251	.1230	.1210	.1190	.1170
−1.0	.1587	.1562	.1539	.1515	.1492	.1469	.1446	.1423	.1401	.1379
−0.9	.1841	.1814	.1788	.1762	.1736	.1711	.1685	.1660	.1635	.1611
−0.8	.2119	.2090	.2061	.2033	.2005	.1977	.1949	.1922	.1894	.1867
−0.7	.2420	.2389	.2358	.2327	.2296	.2266	.2236	.2206	.2177	.2148
−0.6	.2743	.2709	.2676	.2643	.2611	.2578	.2546	.2514	.2483	.2451
−0.5	.3085	.3050	.3015	.2981	.2946	.2912	.2877	.2843	.2810	.2776
−0.4	.3446	.3409	.3372	.3336	.3300	.3264	.3228	.3192	.3156	.3121
−0.3	.3821	.3783	.3745	.3707	.3669	.3632	.3594	.3557	.3520	.3483
−0.2	.4207	.4168	.4129	.4090	.4052	.4013	.3974	.3936	.3897	.3859
−0.1	.4602	.4562	.4522	.4483	.4443	.4404	.4364	.4325	.4286	.4247
−0.0	.5000	.4960	.4920	.4880	.4840	.4801	.4761	.4721	.4681	.4641

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SARDAR PATEL COLLEGE OF ENGINEERING

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

End Semester Exam May 2026/Re-Exam – July 2026

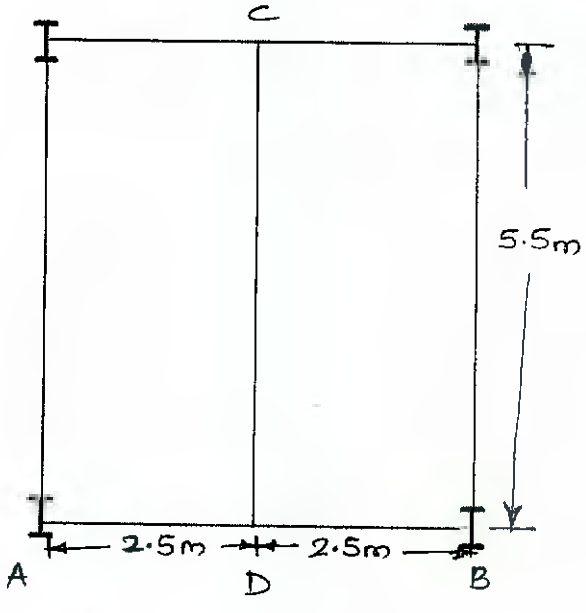
Program: B.Tech –Civil Engineering(WP) Third year **Duration: 3 Hour**

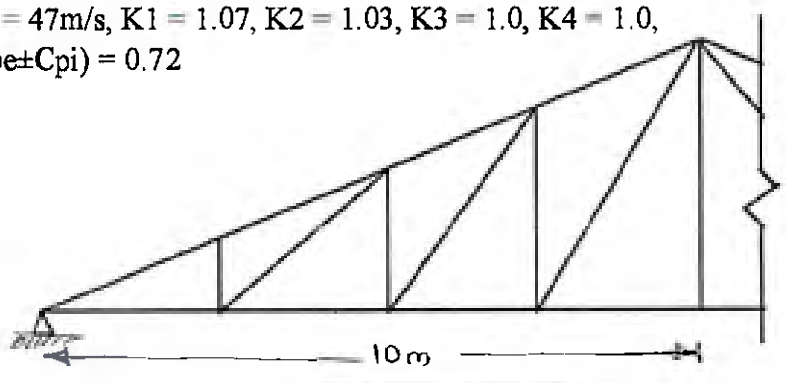
Course Code: PC-BTC602 **Maximum Points: 100**

Course Name: Design Of Steel Structures **Semester: VI**

01/06/2026

Notes:
1. Assume any missing data and state the same clearly
2. Use of IS 800-2007 and steel tables is allowed
3. Draw neat sketches to illustrate your answers
4. For all steel plates and angles, fy = 250MPa, fu= 410MPa

Q.No.	Questions	Points	CO	BL	Modu
1	A floor of hall has beam layout as shown in figure below:  RCC slab depth = 130mm; Floor finish load = 1.5kN/m^2 Live load = 3kN/m^2; Wall thickness = 200mm All beams support walls of height 2.3m ***Assuming the beam to be laterally supported – Design beam CD. Design connection between beam AB and CD (beam AB is of ISMB 500)***	20	1,3,4	4	1,6,7

2	The member of a roof truss carries the following unfactored loads : DL = 75kN (Tensile); LL = 80kN (Tensile); WL = 80kN (Compressive) a. What will be the design loads as per IS 800:2007 load combinations? b. Design the element as a tension member and also design its connection with 10mm thick gusset plate using 4.6grade bolts c Check the member designed above for the safety in compression according to the appropriate load combinations. Length of member = 2.5m	20	1,2,3	4	1,2,3
3.a)	A single angle strut (loaded through single leg) carries a design compressive force of 150kN. The length of member between centres of intersection is 1.75m. Design the section as per IS 800:2007. *Assume the connection to be hinged with two bolts at each end*	10	2	3	3
3.b)	Evaluate the design compressive load carrying capacity of a built up column section made of 4ISA 125x125x10 such that the outer dimension of the column is 450x450mm – Connected by 10mm thick plates on all four sides. *Both ends are restrained against translation only.* Length of member is 3.5m	10	3	3	3
4.	Design a built up laced column to carry 1850kN design axial load using two channels facing back to back. Also design lacing and its connection using 4.6grade bolts. The column is fixed at both ends and the clear length is 5m. Draw neat sketch showing all the details	20	2	3	3
5.a)	Design a stiffened seat connection for an ISMB 300 to transfer 70kN factored reaction to ISHB 400 using 4.6grade bolts. Draw neat sketch to show connection details	15	4	3	7
5.b)	Evaluate the load at each panel point due to wind load for the following details : Spacing between trusses = 7m; Rise = 3.5m; Vb = 47m/s, K1 = 1.07, K2 = 1.03, K3 = 1.0, K4 = 1.0, (Cpe±Cpi) = 0.72  	05	1,3	3	1,4

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Munshi Nagar, Andheri (W) Mumbai – 400058

End Semester Exam May 2026/Re-Exam – July 2026

6.a)	Design a gusseted base connection for a column of section ISHB 300 to transfer a design load of 1150kN on a concrete pedestal of M15 grade. Use 4.6 grade bolts of 20mm diameter.	12	3	3	5
6.b)	Design a welded connection for a double angle tension member (connected back to back on opposite sides of gusset) 2ISA 100x100x10. The member is subjected to a design axial force of 150kN.	08	2	3	1
7.a)	Explain the various failure modes of tension members with neat sketches	05	1	2	1
7.b)	Explain the various failure modes of bolted connections with neat sketches	05	2	2	1
7.c)	A simply supported beam ISMB 400 has been used over a span of 3.5m to carry a service load of 35kN/m. Check the safety of the beam in *shear, flexure and deflection* when the beam is ***laterally unsupported***	10	3	4	6

SARDAR PATEL COLLEGE OF ENGINEERING

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Munshi Nagar, Andheri (W) Mumbai – 400058

END SEMESTER MAY 2026 / ~~RE - EXAM~~ JULY 2026 (WP)

Program: T.Y. B.Tech. Working Professionals **Duration: 3 hr**

Course Code: PC-BTC671 **Maximum Points: 100**

Course Name: Ground Improvement Techniques **Semester: VI**

Note :1) Q1 is compulsory
2) Attempt any Four out for remaining Six questions
3) **Assume suitable Data** where ever required

03/06/2026

Q.No.	Questions	Points	CO	BL	Module No.
1	Attempt **Any Four**				
a	What do you mean by Radial consolidation, Vertical consolidation and total consolidation and relation between them?	5	1,2	1	1
b	Mention the applications and advantages of reinforced earth materials	5	1,2	1	2
c	Enlist the temporary ground improvement techniques and explain any one	5	1,2	2	3
d	What do you mean by stone column and what are the applications of it?	5	1,2	1	4
e	Explain soil stabilization and purpose of it	5	1,2	1	5
2 (a)	Discuss bitumen stabilization in detail and what are the factors influencing bitumen stabilization?	10	2,3	3	1
2 (b)	What are the fundamental principles of grouting? Discuss the parameters on which grout ability depend and what are the desirable characteristic of grouts?	10	1,2	2	2
3 (a)	A 10m high wall is to be built using sand fill and polymer grid reinforcement. The sand has Ø=20°, unit weight=20kN/m3. A surcharge load of 15kPa is to be allowed and a maximum safe bearing pressure for the foundation soil is 300kPa. Two grids of different design strength are available. Grid A at 20kN/m and grid B at 40kN/m. both have the bond coefficient F_b=0.9. The fill will be compacted in layers of 250mm thickness. Design the retaining wall.	15	2,3	3	2
3 (b)	Explain Mononobe and Okabe method to calculate capacity of strip anchors	05	1,2	1	1
4 (a)	To resist the earthquake, force an anchor of 5m is subjected in a sandy soil having a unit weight of 20kN/m^3. The angle of internal friction of the sand particle is=25° and the anchor is embedded at 7m depth below the ground level. Take K_h=K_v=0. Calculate the pullout capacity of vertical anchor. If the same anchor is used as horizontal what will be the capacity of the same. Assume K_h=0.1 and K_v=0.5 K_h for horizontal strip anchor	10	2,3	3	3
4 (b)	Explain the design layout of stone column	10	2,3	3	5
5 (a)	An embankment is proposed to be constructed over a layer of clay which is 8m thick undertaken by an impermeable stratum. The embankment is 3m high and the fill has a unit weight of 20kN/m3, the clay has the following properties CH =8m2 /year, CV = 4.5m2/year, mv=2.7×10-4 m2/kN and Sand drain having 400mm diameter are proposed to be installed in a square pattern at a spacing of 3m c/c. Determine the magnitude of settlement that can be expected due to consolidation of clay layer after 6 months of effective embankment loading?	15	2,3	3	6
5 (b)	Short note on marine soil	05	1,2	1	7

END SEMESTER MAY 2026 / ~~RE - EXAM~~ JULY 2026 (WP)

6 (a)	Sub-soil strata consist of soft silt clay up to 7m depth. In-situ undrained cohesion, i.e., Cu is 18kPa and other data are given below- Weight density above the ground W.T=17.65 kN/m^3 Effective density (submerged) below the ground water table =7.85kN/m^3 Ground water table is situated at 1m below the ground level. on the above of the stone column of water tank is to be supported on earthen pad foundation Diameter of the tank=79m Load intensity from the tank and the earthen pad is 147kPa Diameter of the stone column is 0.9m Design a stone column foundation system	**15**	2,3	3	5
6 (b)	Explain equal stain condition.	**05**	2,3	3	6
7 (a)	An oil tank is to be sited on a soft alluvial deposit of clay. Below the soft clay, there is a thick layer of stiff clay. It is decided that circular embankment with sand drains is inserted into the clay layer to pre-consolidate soil. The height of embankment is 6m and saturated unit weight of the soil is 18kN/m^3. The thickness of the clay layer is 7m. co efficient of volume change is 0.2m2/kN. Coefficient of consolidation in the vertical direction and the radial direction is 3.5m^2/year and 6.2m^2/year respectively. Diameter of sand drain is 40mm. the desired degree of consolidation is 90% in 6months. Take the spacing as 1.7m in triangular grid arrangement. Design the respective sand drain.	**15**	2,3	3	1
7 (b)	Explain the advantages and disadvantages of compaction grouting	**05**	2,3	3	2

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END SEMESTER EXAMINATION MAY/JUNE 2026

Program: CIVIL ENGINEERING (Working Professional) **Duration: 3 hrs**

Course Code: PE-BTC641 Third Year **Maximum Points: 100**

Course Name: Solid and Hazardous Waste Management **Semester: VI**

03/06/2026

Notes: Q.1 is compulsory and attempt any four out of remaining six questions

Q. No.	Questions	Points	CO	BL	Module No.
1	Solve any Four: A. Advantages of Material Recycling Facility (MRF). B. Make a list of different types of wastes that can be accepted at a landfill site. C. Anaerobic digestion of solid waste. D. Process of plastic recycling. E. Indore Method of composting. F. Transportation modes of solid waste.	20	1-4	I,II	1-7
2	A. Define Primary collection of solid waste. Discuss the various collection systems with their advantages and disadvantages. B. Draw the sketch diagram of HCS & SCS. C. Solid waste from a new industrial area is to be collected in large containers, some of which will be used in conjunction with stationary compactors. Based on traffic at similar parks, it is estimated that the average time to drive from the garage to the first container and from the last container to garage each day will be 16 and 22 min, respectively. If the average time required to drive between containers is 6 min (dbc) and the one way distance to the disposal site is 15.5 mi/h for which speed limit is 55 mi/h (88.5 km/h). Assume 8-hour workday, S=0.133; a=0.016; b=0.018; Assume off route factor (W) as 0.15. (pc+uc - 0.4 hour/trip) D. Determine the pickup time per trip (in hrs/trip) E. Determine the time per trip (in hrs/trip) F. Determine the number of trip that can be made per day (in trip/day) G. Determine the actual length of the work day(in hours)	10+5+5	1-4	I,III	2,3
3	A. Discuss the various unit operations carried out at the processing station in solid waste management. B. Explain the various cost components involved in the solid waste collection system. C. Write a short note on: Hauled Container system.	10+5+5	1-4	I,II	3,4

END SEMESTER EXAMINATION MAY/JUNE 2026

4	A. What do you mean by Transfer station? Discuss the various types of transfer station in detail. B. What are the advantages of Anaerobic digestion of solid waste. C. Write a short note on :Process of Glass recycling.	10+5+5	1-4	I,II	3,4
5	A. What do you mean by composting? Discuss the various factors affecting the composting process. B. Define: Material Recycling Facility (MRF). Discuss any three issues at MRF facility. C. Discuss any two types of Material Recycling Facility (MRF) in India.	10+5+5	1-4	II	4
6	A. Define: Landfill. Discuss the various components of a sanitary landfill with neat sketches. B. Write a short note on :Process of Cardboard recycling. C. Discuss the advantages and disadvantages of landfill.	10+5+5	1-4	II	4,5
7	A. What do you mean by hazardous waste? Discuss following characteristics of hazardous waste materials in detail, ➢ Toxic ➢ Flammable B. Make a list of the requirements of hazardous waste containers as per Hazardous and other waste (Management & Trans boundary movement) Rules, 2016. C. Draw a standard hazardous waste transportation label.	10+5+5	1-3	II	6,7

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END SEMESTER EXAM MAY JUNE 2026-SET-A

Program: Civil [Minor] Third year
Course Code: MI-BT033 (WP)
Course Name: Sustainability Assessment

Duration: 3 hrs.
Maximum Points: 100 points
Semester: VI

05/06/2026

- **Notes: Question 1 is compulsory. Solve any four of remaining six**
- **Use illustrations wherever required**
- **Draw neat sketches/diagrams wherever required and give reasoning wherever required**
- **Assume suitable data if necessary and state them clearly**
- Figure on right indicate **maximum points** for the given question, **course outcomes attained , Bloom's Level and Module Number**

<table>
<tr><th>Q. No</th><th>Question Description</th><th>Pts</th><th>MN</th><th>BL</th><th>CO</th></tr>
<tr><td>Q1</td><td>
Answer these 7 questions related to OpenLCA results :
A university cafeteria is evaluating two single-use coffee cup options to reduce its environmental footprint. You have been hired to conduct a comparative LCA using OpenLCA.
System Description
Functional Unit: Serving 10,000 hot beverages (250 mL each) over one academic year.
System Boundary: Cradle-to-grave (raw material extraction → manufacturing → use → end-of-life).
Inventory Data
Option A: Single-Use Paper Cup (PE-Lined)
<table>
<tr><th>Life Cycle Stage</th><th>Input/Output</th><th>Value</th><th>Unit</th></tr>
<tr><td>Raw Materials</td><td>Paperboard</td><td>12.5</td><td>g/cup</td></tr>
<tr><td></td><td>Polyethylene (PE) lining</td><td>4.2</td><td>g/cup</td></tr>
<tr><td>Manufacturing</td><td>Electricity (grid mix)</td><td>0.018</td><td>kWh/cup</td></tr>
<tr><td></td><td>Natural gas (heating)</td><td>0.0025</td><td>m³/cup</td></tr>
<tr><td></td><td>Process water</td><td>0.15</td><td>L/cup</td></tr>
<tr><td>Transport</td><td>Truck (factory → cafeteria)</td><td>350</td><td>km</td></tr>
<tr><td></td><td>Payload per shipment</td><td>8,000</td><td>cups</td></tr>
<tr><td>End-of-Life</td><td>Landfill rate</td><td>95%</td><td>—</td></tr>
<tr><td></td><td>Incineration rate</td><td>5%</td><td>—</td></tr>
</table>
Option B: Single-Use PLA Cup (Bioplastic)
<table>
<tr><th>Life Cycle Stage</th><th>Input/Output</th><th>Value</th><th>Unit</th></tr>
<tr><td>Raw Materials</td><td>Polylactic acid (PLA)</td><td>9.8</td><td>g/cup</td></tr>
<tr><td>Manufacturing</td><td>Electricity (grid mix)</td><td>0.022</td><td>kWh/cup</td></tr>
<tr><td></td><td>Process water</td><td>0.08</td><td>L/cup</td></tr>
<tr><td>Transport</td><td>Truck (factory → cafeteria)</td><td>520</td><td>km</td></tr>
<tr><td></td><td>Payload per shipment</td><td>10,000</td><td>cups</td></tr>
<tr><td>End-of-Life</td><td>Industrial composting rate</td><td>30%</td><td>—</td></tr>
</table>
</td><td>20</td><td>2</td><td>4, 5</td><td>2</td></tr>
</table>

	Landfill rate	70%	—

Background Data (Use ELCD or Ecoinvent equivalents)

Process	Dataset Proxy
Paperboard production	Kraft paper, bleached, at plant
PE granulate	Polyethylene, LDPE, granulate
PLA granulate	Polylactide, granulate, at plant
Electricity	Electricity, medium voltage, national grid
Truck transport	Transport, freight, lorry 16–32 t, EURO5
Landfill (paper)	Disposal, paper, to sanitary landfill
Landfill (PLA)	Disposal, bioplastic, to sanitary landfill
Incineration	Disposal, municipal solid waste, to incineration
Industrial composting	Treatment, biowaste, composting

Impact Assessment Method

Use CML-IA baseline with the following impact categories:

1. Global Warming Potential (GWP 100a) — kg CO_2-eq
2. Acidification Potential (AP) — kg SO_2-eq
3. Eutrophication Potential (EP) — kg PO_4-eq
4. Abiotic Depletion (fossil fuels) — MJ

Questions

Part A: Model Setup and Inventory (6 Marks)

1. **[2 marks]** Define a product system in OpenLCA for Option A (Paper Cup). List the flows you would create and explain how you would link the foreground processes (cup manufacturing, transport, end-of-life) to background datasets.
2. **[2 marks]** The PLA cup claims "compostable" status, but only 30% actually reaches industrial composting. Explain how you would model this split end-of-life scenario in OpenLCA, including the use of allocation or multiple output processes if needed.
3. **[2 marks]** Calculate the total mass of materials transported to the cafeteria for each option over the functional unit (10,000 cups). Show your work.

Part B: Impact Assessment and Comparison (11 Marks)

4. **[5 marks]** After running LCIA for both product systems, you obtain the following results:

Impact Category	Paper Cup (Option A)	PLA Cup (Option B)
GWP (kg CO_2-eq)	189.4	162.7
AP (kg SO_2-eq)	0.87	0.71
EP (kg PO_4-eq)	0.14	0.19
Abiotic Depletion (MJ)	2,415	1,980

Interpret these results. Which option performs better overall, and where does each option show trade-offs? Justify your recommendation.

5. **[4 marks]** Generate a contribution analysis for GWP in Option A. The breakdown is:

Process	Contribution to GWP
Paperboard production	52%
PE lining production	18%
Manufacturing (energy)	12%
Transport	6%

	Landfill emissions | 10% Incineration | 2% Identify the hotspots and propose two specific design or supply-chain interventions that the cafeteria or supplier could implement to reduce the GWP of Option A. 6. **[2 marks]** Explain how you would use OpenLCA's comparison feature to present these results to a non-technical stakeholder (e.g., cafeteria manager). Describe what visualisation you would generate and one limitation you would communicate. **7. [3 marks]Sensitivity Analysis** Conduct a sensitivity analysis by varying one key parameter: • Scenario 1: Increase PLA composting rate from 30% → 60% • Scenario 2: Reduce transport distance of PLA cups by 20% Answer the following: a) Which parameter change is likely to have a greater effect on GWP and why? *(2 marks)* b) What does this tell you about the robustness of your LCA conclusions? *(1 mark)*				
Q2 (a)	A construction project reports the following annual material flow: • Total material input: 500 tonnes (cement, steel, aggregates, etc.) • Useful output (final constructed structure): 320 tonnes The remaining material is either stored, wasted, or lost during construction activities. (a) Calculate the material stock (accumulation) within the system. *(2 marks)* (b) Interpret what this accumulation represents in a real construction scenario. *(2 marks)* (c) Identify one key sustainability concern associated with this imbalance. *(2 marks)* (d) Analyse two broader implications of such material inefficiency on: *(2 marks)* (i) Environmental performance (ii) Economic performance (e) Suggest two practical corrective measures to improve material efficiency and sustainability outcomes. *(2 marks)*	10	2	3-4	2
Q2 (b)	A rapidly growing city currently follows a "take–make–dispose" (linear economy) model, where raw materials are extracted, used for production and consumption, and finally discarded as waste without significant recovery or reuse (a) Identify three key environmental and resource-related consequences of this linear model. *(3 marks)* (b) Suggest two circular economy strategies that the city can adopt to reduce waste and improve resource efficiency. *(3 marks)* (c) Explain one real-world example where circular economy principles have been successfully implemented. *(4 marks)*	10	2	3-4	2
Q3(a)	Explain the concepts of process, flow, and stock in MFA. *(5 marks)*	05	1	3	1

Q3(b)	What is sustainability assessment? Explain its purpose in decision-making. *(5 marks)*	05	1	3	1
Q3(c)	Explain Cost–Benefit Analysis (CBA) and its limitations in sustainability assessment. *(5 marks)*	05	2	3	2
Q3(d)	Explain the concept of urban metabolism and its relevance to sustainability. *(5 marks)*	05	2	3	2
Q4 (a)	Define Environmental Impact Assessment (EIA) and explain its objectives.	05	3	3	3
Q4 (b)	Define Life Cycle Assessment (LCA) and explain its stages (cradle-to-grave). (5 marks)	05	3	3	3
Q4 (c)	How does MFA support resource management and circular economy? (5 marks)	05	2	3	2
Q4 (d)	Explain the importance of **functional unit and system boundary** in LCA with an example. *(5 marks)*	05	3	3	3
Q5 (a)	On 24 April 2013, the Rana Plaza building in Dhaka, Bangladesh collapsed, killing over 1,100 garment workers. Workers had reported cracks in the building the previous day but were forced to return. The factories supplied garments to major European and American brands. Wages were approximately $38/month with 12–16 hour shifts and virtually no union representation. **(a)** Identify the FOUR phases of S-LCA methodology and apply each phase to a garment supply chain for a global fashion brand. (4 marks) **(b)** Under the S-LCA stakeholder category of 'Workers', list FOUR social indicators that were clearly violated at Rana Plaza, with specific evidence from the case. (3 marks) **(c)** As an engineer designing an automated stitching system for Bangladesh garment factories, how does S-LCA guide your design decisions regarding worker displacement and safety? (3 marks)	10	3	4-5	3
Q5(b)	In engineering firm is conducting an S-LCA for installing 500 kW of rooftop solar panels on a Tier-2 Indian city's government buildings. The solar panels are imported from a Chinese manufacturer whose supply chain includes silicon mining in Xinjiang. **(a)** Define the Goal & Scope for this S-LCA. State the functional unit, system boundaries (from raw material to end-of-life), and geographic scope. [3 marks] **(b)** Identify THREE social hotspots in this supply chain and suggest measurable indicators (quantitative or binary) for each. [3 marks] **(c)** Compare Environmental LCA (ISO 14040) and Social LCA on any THREE dimensions relevant to this solar project IN DETAIL. [4 marks]	10	3	4-5	3-4
6(a)	Infosys became India's first large IT company to achieve carbon neutrality in FY2020. The following data is available from their sustainability disclosures: **FY** | **Scope 1+2 Intensity (tCO_2e/employee)** | **Employees**	10	4	4-5	3-4

	FY2018	1.80	2,04,107				
	FY2021	0.50	2,59,619				
	FY2023	0.22	3,43,234				
	(a) Calculate absolute Scope 1+2 GHG emissions (in tCO_2e) for FY2018 and FY2023. What is the percentage reduction in absolute terms? [3 marks] **(b)** Under GRI 305 (Emissions), explain the difference between Scope 1, Scope 2, and Scope 3 emissions with ONE example each relevant to an IT company like Infosys. [3 marks] **(c)** Infosys claims 'Carbon Neutrality since FY2020' but critics argue this ≠ Net Zero. Using the GRI framework and the concept of carbon offsets vs. actual emission reduction, evaluate this claim. [2 marks] **(d)** Map Infosys' achievements to at least TWO GRI 300-series standards and ONE BRSR Section C Principle. Explain why BRSR compliance is mandatory for Infosys. [2 marks]						
Q6 (b)	A state PWD is evaluating two pavement alternatives for a 12 km urban road. Analysis period: 25 years. Discount rate: 9%.			10	3	4	3
	Cost Element	**Option A: Bituminous (Flexible)**	**Option B: Cement Concrete (Rigid)**				
	Capital Cost (Year 0)	₹16 crore	₹24 crore				
	Annual O&M (Years 1–25)	₹55 lakh/yr	₹15 lakh/yr				
	Resurfacing (at Year 12)	₹4.5 crore	None				
	Salvage Value (Year 25)	₹0.60 crore	₹2.0 crore				
	(a) Compute the Life Cycle Cost (LCC) for both options step by step. **(b)** The government is considering adding an environmental cost of ₹12 lakh/year for air quality deterioration from construction dust for bituminous Option A. Using an environmental discount rate of 3%, recalculate the E-LCC of Option A. **(c)** Explain how the choice of discount rate (3% vs 9%) systematically biases a long-term infrastructure decision.						
Q7(a)	A 6th-semester student is assigned to develop a sustainability scorecard for a mid-sized Indian cement company that has high GHG emissions, significant water consumption from limestone mining, a workforce that is 75% male, no formal grievance mechanism for workers, and no third-party audit of its sustainability report. Using the materiality assessment process as per Global Reporting Initiative (GRI 3), identify four material topics, selecting one each from			10	4	4-5	4

	Environmental, Social, Governance, and Economic dimensions (4 marks). For each material topic identified, suggest one quantitative KPI from relevant GRI 300 or 400 series standards, clearly stating the indicator and its unit of measurement (4 marks). Further, explain why Securities and Exchange Board of India requires the Business Responsibility and Sustainability Report (BRSR) to be signed off by the Board of Directors, and how this requirement improves the credibility of sustainability disclosures compared to voluntary reporting (2 marks).				
Q7(b)	Explain the fundamental principles of sustainability reporting as prescribed by the Global Reporting Initiative (such as materiality, stakeholder inclusiveness, sustainability context, completeness, accuracy, balance, clarity, comparability, timeliness, and verifiability) and briefly describe the key features and purpose of the Business Responsibility and Sustainability Reporting (BRSR) framework mandated by Securities and Exchange Board of India. (5 marks)	5	4	3	4
Q7(c)	A city with a population of 1 million installs solar photovoltaic systems generating 120 GWh/year. Before installation, the city's electricity demand was 400 GWh/year, entirely met by grid electricity with an emission factor of 0.9 kg CO_2/kWh. After solar installation, due to increased appliance usage and economic growth, total electricity demand rises to 550 GWh/year, of which solar still contributes 120 GWh/year, and the remaining is supplied by the grid. (a) Calculate the total annual CO_2 emissions before and after solar installation. Has environmental sustainability improved? Justify with calculations. (b) Identify the key sustainability trade-off demonstrated in this scenario. (c) Suggest two corrective measures (with brief justification) to ensure actual sustainability improvement.	5	1	5	1

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END SEMESTER MAY 2026 / ~~RE - EXAM~~ JULY 2026 (WP)

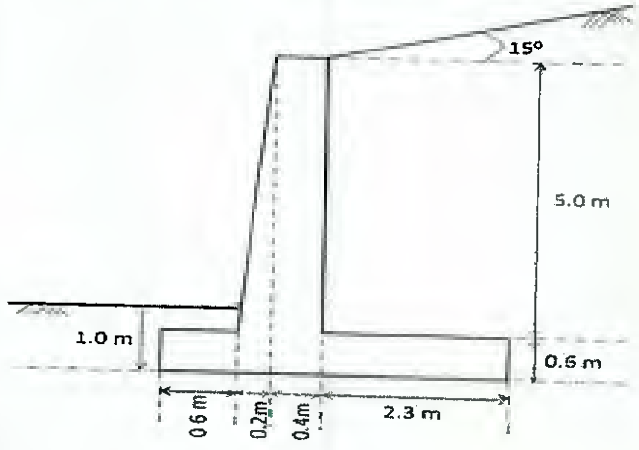
Program: T.Y. B.Tech. Working Professionals Civil Engg. **Duration: 3 hr**

Course Code: PC-BTC603 **Maximum Points: 100**

Course Name: Foundation Engineering **Semester: VI**

08/06/2026

Note :1) Q1 is compulsory
2) Attempt any Four out for remaining Six questions
3) **Assume suitable Data** where ever required

Q.No.	Questions	Points	CO	BL	Module No.
1	Attempt **Any Four**				
a	List out the difference between Rankines theory and Coulombs theory for lateral earth pressure theories	5	1,2	1	1
b	Explain the stability checks for design of retaining wall	5	1,2	1	2
c	Enlist the effect of water table on the bearing capacity of shallow foundation	5	1,2	2	3
d	Classify the piles based on load transfer mechanism and method of installation.	5	1,2	1	4
e	Sketch recommended pressure diagram for design of bracings in open cuts in clay.	5	1,2	1	5
2 (a)	Check the stability of the cantilever concrete retaining wall shown in figure below. The allowable bearing capacity of the soil is 500 kN/m². Other properties of the soil are as follows: Ø = 36°, γ = 18 kN/m³ and δ = 25°. 	15	2,3	3	2
2 (b)	What is negative skin friction and derive the expression for it in single and group piles	05	1,2	2	4
3 (a)	A retaining wall 12m height retains sand Ø=32° and γ=22 kN/m³ upto a dept of 6m from top. From 7 to 12 m the soil is cohesive with C=30 kN/m², Ø=25° and γ=20 kN/m³. The water table is at 6m from ground level. γ_{sat}=25 kN/m³ for cohesive soil. The retaining wall carries a uniform surcharge of 50 kN/m². Find the total active thrust on the wall and the point of application.	15	2,3	3	1
3 (b)	Difference between general shear failure, local shear failure & punching shear failure	05	1,2	1	3

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4 (a)	A braced cut, 5m wide and 6m deep is proposed in a cohesionless soil deposit having effective cohesion C= 0 and effective friction angle, Ø = 36°. The struts are provided at 0.5m, 2m, 3.5m, 5m. If the horizontal spacing of struts is 3m and unit weight of the deposit is 20KN/m³. Calculate the reaction and force in struts.	**10**	2,3	3	5
4 (b)	Explain the procedure of pile load test as per IS code recommendation.	**10**	2,3	3	4
5 (a)	A raft foundation is supported by a pile group consisting of 15 piles arranged in 3 rows. The diameter and length of pile is 300 mm and 15 m respectively. The spacing between piles is 1.2m.the foundation soil consists of soft clay having C=3.2t/m² and γ=1.9t/m³ Adhesion factor is taken as 0.5. Find the capacity of pile group	**15**	2,3	3	4
5 (b)	Write the assumptions made by Coulomb in developing earth pressure theory	**05**	1,2	1	1
6 (a)	A retaining wall 5 m high, retains a soil with c = 24 kN/m², Ø = 28° γ= 19 kN/m³ with horizontal surface level with the top of wall. Compute the total active and passive earth resistance on the wall and their point of application.	**10**	2,3	3	1
6 (b)	A strip footing is to be designed to carry a gross load of 900kN/m at a depth of 1m in sand. The shear parameters are C=0 kN/m² Ø =38°.find the width of footing if factor of safety of 3 is assumed water table is at foundation level γ=18 kN/m³ γ_{sat}=20 kN/m³given N_q=49, Nγ=67	**05**	2,3	3	3
6 (c)	What is group capacity of piles and mention how the allowable load is found from pile load test for single and group piles	**05**	2,3	3	5
7 (a)	A strip footing is to be designed for a given total load of 250 kN per m. Determine the width of strip footing by taking a factor of safety of 3 and use Terzaghi' bearing capacity equation. Take γ = 19 kN/m³, Ø= 35°, C= 5 kN/m² The depth of foundation is 1 m. Bearing capacity factors are given as: Nc = 46, Nq = 33, Nγ = 48.	**15**	2,3	3	3
7 (b)	Explain the type of piles based on mechanism of load transfer.	**05**	2,3	3	5