Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

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

END SEMESTER EXAMINATION –May-2019

Program: Civil Engg.

Course Code: PEC-BTC- 819

Course Name: AIIP

Duration:3 hrs.

Maximum Points: 100

Semester: VIII

Notes:

1. **Q.1. is compulsory & Solve any four from remaining six questions;**

Q.No.	Questions	Points	CO	BL	PI
1.	Solve any four: 1. Stakeholders & their role in Infrastructure project 2. Market Appraisal 3. Break-even analysis 4.Niti Aayog 5.Social Cost benefit analysis	20	1-3	III	2.1.3
2.a	Explain necessity of project appraisal. Also explain technical appraisal in detail.	10	1	III	1.3.1
2.b	Explain characteristics of infrastructure project in detail. Compare Rural infrastructure Vs Urban Infrastructure.	10	1	IV	1.3.1
3.a	A company has an investible surplus of Rs.40,00,000/- there are six projects identified for good investment. The capital outlays an NPV are tabulated below. Find the optimum combination of projects to satisfy budgetary constraints of Rs.40,00,000/-	10	2	III	1.3.1
3.b	Explain various types of infrastructure finance available in India. Also explain characteristics of Infrastructure finance.	10	2,3	II	1.3.1

Project	Intial Capital outlay	NPV
A	20,00,000/-	65,00,000/-
B	15,00,000/-	55,00,000/-
C	10,00,000/-	32,50,000/-
D	8,00,000/-	29,00,000/-
E	4,00,000/-	20,00,000/-
F	2,00,000/-	9,00,000/-

<table>
<tr><td>4.a</td><td>"PPP is preferred mode of financing in Infrastructure Finance" Justify above statement with any four common PPP model in India with example</td><td>10</td><td>2,3</td><td>II</td><td>1.3.1</td></tr>
<tr><td>4.b</td><td>Explain payback period and solve following problem,

Investment on the project is Rs.15,00,000/-. It is expected to take 2 year for implementation of the project. And the project is expected to earn profit from 3 year onwards. The estimated profit ,tax & depreciation as under:

<table><tr><td></td><td>3 rd year</td><td>4 th year</td><td>5 th year</td><td>6 th year</td><td>7 year</td></tr><tr><td>Operating profit</td><td>1.7</td><td>1.85</td><td>2.2</td><td>2.52</td><td>2.12</td></tr><tr><td>Tax</td><td>0.7</td><td>0.6</td><td>0.72</td><td>0.88</td><td>0.69</td></tr><tr><td>Depreciation</td><td>3.6</td><td>2.42</td><td>1.68</td><td>0.99</td><td>0.70</td></tr></table>(all values in Rs. Lakh)

Find payback period.

Explain limitation of Payback period.</td><td>06</td><td>3</td><td>II</td><td>2.1.3</td></tr>
<tr><td>4.c</td><td>Explain any four issues in Infrastructure financing in India.</td><td>04</td><td>3</td><td>II</td><td>1.2.1</td></tr>
<tr><td>5.a</td><td>Define inflation and effect of inflation on financial appraisal of project.

Calculate the real internal rate of return by assuming 10% on compound basis every year,

<table><tr><td>Year</td><td>Cash outflow (in Rs./-)</td><td>Cash Inflow (in Rs./-)</td></tr><tr><td>0</td><td>10,00,000/-</td><td>-</td></tr><tr><td>1</td><td>—</td><td>4,00,000/-</td></tr><tr><td>2</td><td>—</td><td>2,50,000/-</td></tr><tr><td>3</td><td>—</td><td>2,50,000/-</td></tr><tr><td>4</td><td>—</td><td>2,00,000/-</td></tr><tr><td>5</td><td>—</td><td>2,00,000/-</td></tr><tr><td>6</td><td>—</td><td>1,50,000/-</td></tr></table></td><td>10</td><td>2</td><td>III</td><td>1.2.1</td></tr>
<tr><td>5.b</td><td>A} What is project Audit? Explain various phases of project audit.

B} Make a list of causes of project failure.</td><td>10</td><td>2,3</td><td>I</td><td>1.2.1</td></tr>
</table>

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END SEMESTER EXAMINATION –May-2019

6.a	A} Define Following terms; 1. Strategic plan, 2. Implementation strategy, 3. Strategic implementation process, 4. Systematic implementation plan. B} Explain best practices in Implementation planning for Infrastructure projects.	10	3	I	1.2.1
6.b	What are the different types of project plans should be consider while implementing infrastructure project?	10	3	I	1.2.1
7.a	Explain the following components of project implementation along with one example, 1. Design 2. Contracts & agreement 3. Installation	10	3	II	1.2.1
7.b	Your organization has won a tender to create a new "Software as a Service" product, and you're in charge of the project. You decide to use a Gantt chart to organize all of the necessary tasks, and to calculate the likely overall timescale for delivery. Construct GANTT chart ,  A. High level analysis 1 week B. Selection of server hosting 1 day C. Configuration of server 2 weeks D. Detailed analysis of core modules 2 weeks	10	3	VI	1.2.1

	E. Detailed analysis of supporting modules	2 weeks				
	F. Development of core modules	3 weeks				
	G. Development of supporting modules	3 weeks				
	H. Quality assurance of core modules	1 week				
	I. Quality assurance of supporting modules	1 week				
	J. Initial client internal training	1 day				
	K. Development and QA of accounting reporting	1 week				
	L. Development and QA of management reporting	1 week				
	M. Development of management information system	1 week				
	N. Client internal user training	1 week				

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End Semester Examination, May, 2019

Program: B. Tech. Civil **Duration: 3 Hr.**

Course Code: PEC – BTC - 813 **Maximum Points: 100**

Course Name: Pavement Design and Construction (Elective – II)

Semester: VIII

Notes: Assume suitable data if required

Q.No.	Questions	Points	CO	BL	PI
Q.1.	Write short notes on (solve any four) (i) Temperature Stress in Concrete Pavement (ii) Burmister two and Three Layer Theory (iii) Equivalent Single Wheel Load (ESWL) (iv) Construction procedure of fly ash embankments (v) Mechanistic approach in Pavement Design	20	01 01 01 01 03	02	1.6.1
Q.2.					
a	Discuss the Factors to be Consider for Design of Cement Concrete Pavements for Low Volume Roads	01	01	02	1.6.1
b	Explain field procedure of conducting the Pate Bearing Test. How the modulus of subgrade reaction can calculate. Discuss how you will apply the correction for plate size and worst moisture condition.	10	04	03	1.6.1
Q.3.					
a	Discuss with neat sketch field procedure of construction of cement concrete Roads.	10	04	03	1.6.1
b	The plate bearing test were conducted using 30 cm diameter plate on subgrade soil and over a base course of thickness 30 cm. the pressure yield at 0.25 cm deflection on subgrade and base course were 1.2 kg/cm^2 and 2.5 kg/cm^2 respectively. Design the thickness of base course required for a wheel load of 5100 kg with a tyre pressure of 5.5 kg/cm^2 for an allowable deflection of 0.25 cm using Burmister two layers theory. If 7.5 cm thick bituminous concrete layer having modulus of elasticity 5000 kg/cm^2 to be provided at the top of base, calculate the equivalent thickness of base to be replace, also design three layers system. Draw a neat sketch showing the cross section of pavement.	10	01	04	2.5.1

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End Semester Examination, May, 2019

Q.4.					
a	Discuss the Procedure for preparation and approval of DPR in PMGSY scheme.	06	04	03	1.6.1
b	Cement concrete pavement has a thickness of 30 cm. design the tie bar in longitudinal joint using the data given below; Allowable working stress in steel tie bar = 1250 kg/cm^2 Unit weight of concrete = 2400 kg/m^3 Allowable working stress between steel tie bar and concrete = 17.5 kg/cm^2 Coefficient of friction = 1.2	07	01	04	5.4.1
c	Calculate the wheel load stress due to edge loading and corner loading using Westergaards approach and Modified Westergards approach using following data Wheel load = 5100 kg, Modulus of Elasticity of Concrete = 3.1 *10^5 kg/cm^2 Modulus of subgrade reaction, k = 8 kg/cm^3, Thickness of slab = 22 cm Radius of loaded area = 16 cm, Poisons ratio = 0.15	07	01	04	5.4.1
Q.5.					
a	Kansas Triaxial Method for Flexible Pavement Design	06	01	04	
b	Discuss Rutting and Fatigue failure criteria	06	04	03	
c	Design the thicknesses of different layers of flexible using triaxial method for the following data. Wheel load = 5100 kg, Radius of contact area = 15 cm, Traffic coefficient, X = 1.25, Rainfall coefficient, Y = 0.8, design deflection, Δ = 0.25 cm, modulus of elasticity of subgrade soil E_s = 130 kg/cm^2, modulus of elasticity of base course material, E_{buse}= 375 kg/cm^2, modulus of elasticity of bituminous concrete layer material = 1200 kg/cm^{2}and the thickness of bituminous concrete is 9.0 cm.	08	01	04	5.4.1
Q.6.					
a	How will you decide Optimum Quantity of Lime required for Stabilization of Subgrade soil through Laboratory test.	06	04	02	2.5.1
b	A Plate Bearing Test conducted on subgrade soil using 30 cm diameter plate. The load value and corresponding average dial gauge readings are given in the Table 1. Determine the modulus of subgrade reaction. Apply the correction for plate size.	07	01	03	5.4.1

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End Semester Examination, May, 2019

c	The diameter of largest size particle is 50 mm. estimate the percentage 40 mm, 25 mm, 20 mm, 12.5 mm, 10 mm, 4.75 mm, 2.36 mm, 1.18 mm and 0.075 mm size particles in a given mix for maximum density using Fuller formula.	07	04	04	2.5.1
Q.7.					
a	Explain Benkelman Beam Theory	05	02	02	1.6.1
b	Discuss classification of Low cost Roads	05	04	01	1.6.1
c	The Benkelman beam study was conducted on a stretch of 10 km long road and 10 sets of observations taken are given in Table 2. If the least count of dial gauge is 0.01 calculate the rebound deflection. The traffic volume study shows that the road carries a traffic of 2200 cvpd, the temperature at the time of Benkelman beam study was 31^{0}c and subgrade moisture correction factor is 1.2, calculate overlay thickness to be provide above existing pavement. (assume VDF = 2.5, LDF = 0.75, Design Life = 10 years)	10	02	03	5.4.1

Table 1.

Mean dial gauge reading in mm	0	0.30	0.55	0.80	1.12	1.40	1.75	2.10	2.20	2.25
Load value in kg	0	600	1200	1350	1810	1960	2110	2200	2280	2370

Table 2.

Sets of Observation	D_0	D	D_f
1	0	33	30
2	0	37	32
3	103	41	38
4	104	36	33
5	105	35	33
6	101	42	39
7	101	43	40
8	0	41	38
9	0	42	40
10	0	29	26

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Sardar Patel College of Engineering

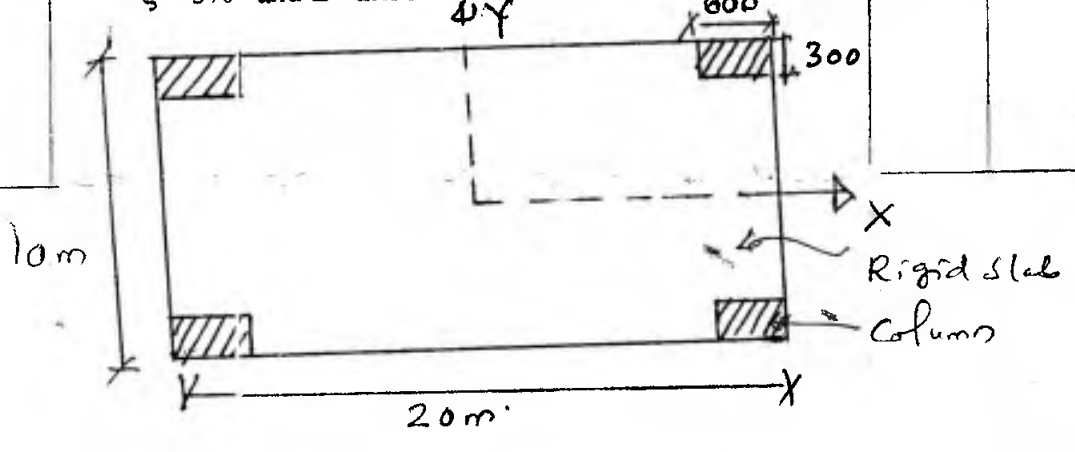
(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.
End Semester Examination
May - 2019

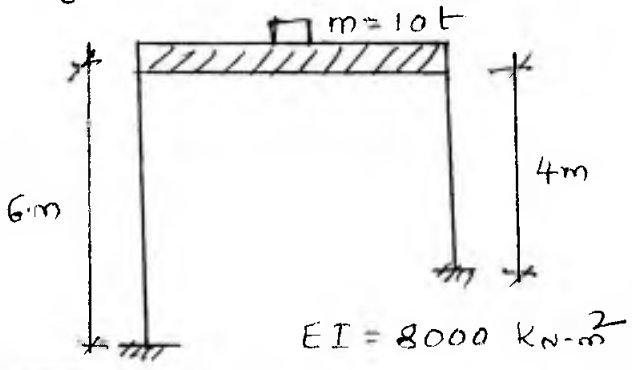
Max. Marks: 100 Duration: 3 Hours
Class: B.Tech. Semester: VIII Program: Civil Engineering
Name of the Course: Earthquake Engineering Course Code : PEC- BTC 502

Instructions:

- Attempt any FIVE questions out of SEVEN questions.
- Answers to all sub questions should be grouped together.
- Figures to the right indicate full marks.
- Assume suitable data if necessary and state the same clearly.

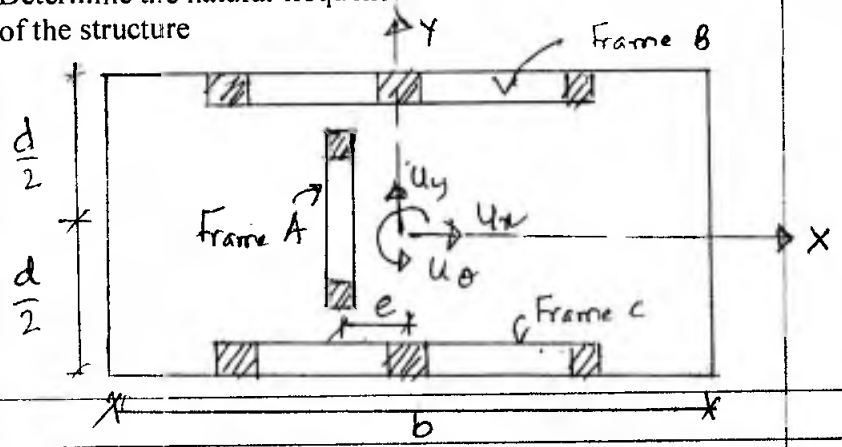
Question No		Points	CO	BL	PI
Q1 (a)	(i) What is Random dynamic Load? Briefly explain how the analysis of structure to random of dynamic Load is done.	3	1	1	2.1.1
	(ii) What is an earthquake? How the earthquakes are classified based on their causes?	3		1	1.2.1
	(ii) Explain the different types of seismic waves and their characteristics	4		2	1.2.1
Q1(b)	(i) A single storey structure with rigid slab is supported on four corner columns as shown in figure. The height of structure is 6.0 m. In general what will be the degrees of freedom for this structure? And specify these DoF. Calculate the natural frequency of the structure for excitation in X and Y direction separately.	5	1	3	1.3.1, 1.4.1
	(ii) If the system is subjected to harmonic force with amplitude of 100 KN and excitation frequency of 25 rad/sec at slab level in X direction, evaluate the maximum lateral displacement of the slab. The weight on slab is 150Kg/m^2, uniformly distributed. Assume $\xi = 5\%$ and E= 2x10^4 N/mm^2.	5		3	1.3.1, 1.4.1



Q2 (a)	A heavy table is supported by flat steel legs, it's natural time period in lateral direction is 0.5 sec. When a 500N plate is clamped on its surface, the natural period is lengthened to 0.7 sec. what is the weight and effective lateral stiffness of the table	**4**	**1**	**3**	**1.3.1, 1.4.1**
Q2 (b)	(i) A single story frame with rigid girder as shown in figure below is to be designed for ground motion, the response spectrum of which is shown in figure1. Determine the design value of lateral deformation and bending moments in the columns (ii) (ii) If the columns of the frame are hinged at base, determine the design values of lateral deformation and bending moments in columns. Comment on the influence of base fixity on the design deformation and bending moments  	**4** **4**	**2**	**3** **3**	**2.4.1** **3.3.1**
Q2(c)	A two storey frame with free vibration characteristics as given below is subjected to a ground motion defined by $\ddot{u}_g = u_{g0} \sin \bar{\omega} t$ where $\ddot{u}_{g0}$ = **0.2g** and $\bar{\omega}$ = **25.0** rad/sec. Calculate maximum displacements of each storey. Assume damping ratic ξ = 5%.	**8**	**1,2**	**4**	**2.3.1**

Floor No.	Mass (t)	Mode No.	ω, rad/sec	Mode Shapes	
				Φ_{i1}	Φ_{i2}
1	20	1	14.58	1.0	1.481
2	15	2	3 .07	1.0	-0.822

Q3	A three storey single bay frame has storey height of **4 m.** each. All columns are **300 mm** wide **X 600 mm** deep& beams are very stiff. The mass on each and floor is **25 t.** **E = 20000 Mpa**. Calculate natural frequencies & mode shapes.	**20**	**1**	**4**	**2.4.1**

Q4 (a)	The plan of one storey building is as shown in figure. The structure consists of a roof idealized as a rigid diaphragm, supported on three frames A, B, and C as shown. The roof weight is uniformly distributed and has magnitude 200 Kg/m^2. The lateral stiffness are K_y = 16000 KN/m for frame A and K_x =25000 KN/m for frames B and C. The plan dimensions are b= 30 m d=20m and e=3.0m. The height of building is 10m. Determine the natural frequencies and modes of vibrations of the structure 	8	1,2	4	2.4.1
Q4(b)	If the above structure is subjected to ground motion $\ddot{u}_{gy}$ only in Y direction. write down the equations of motion for the system	4	2	4	2.4.1
Q4(c)	As a special case, if e= 0, and the above system is subjected to the ground motion only in Y direction, the response spectrum of which is shown in figure1. Determine the design value of lateral deformation, base shear and bending moment for the system.	8	2	4	2.4.1
Q5(a)	What is response spectrum? Explain briefly, the response spectrum characteristics.	5	2	2	1.2.1
Q5(b)	Explain the procedure to construct elastic response spectrum for a single recorded ground motion.	5	2	2	2.4.1
Q5(c)	A two story frame has the following free vibration characteristics. The frame is to be designed for the ground motion characterized by the design spectrum given in the figure 1 but scaled to peak ground acceleration of **0.5g**. Calculate the design values of lateral deformation of floors.	10	2	4	2.4.1 2.3.2

4

		Floor No.	Mass (t)	Mode No.	ω, rad/sec	Mode Shapes				
						Φ_{i1}	Φ_{i2}			
		1	20	1	14.58	1.0	1.481			
		2	15	2	38.07	1.0	-0.822			
Q6 (a)	Explain how the magnitude and intensity of an earthquake are measured.							**4**	**1**	**2**	**1.2.1**
Q6 (b)	State the limitation of Equivalent Static Method. As per IS 1893-2016, under what conditions this method is permitted to use to calculate the earthquake forces.							**3**	**3**	**2**	**2.4.3** 6·2·1
Q6 (c)	As per IS 1893-2016, how many mode need to be considered in the earthquake force calculation by Response Spectrum Method							**2**	**3**	**2**	**2.4.3** 6·2·1
Q6 (d)	Using response spectrum method, calculate the seismic force on each floor of the frame whose pre vibration properties are given below. Use the following additional data: Z=0.24, I =1.5, R=4.0 and ξ = 5%. Assume foundation strata as medium soil and use response spectrum given in figure 2.							**11**	**3**	**5**	**5.1.1** 6·2·1
	Story No.	Mass No.	Mass (t)	ω rad/sec	Mode shapes					
					Φ_{i1}	Φ_{i2}	Φ_{i3}			
	1	1	20	15.73	0.399	0.747	1.0			
	2	2	20	49.85	1.0	0.727	-0.471			
	3	3	20	77.82	-0.908	1.0	-0.192			
Q7 (a)	What is ductility of a structure? Explain the importance of ductility in seismic resistant structures.							**3**	**3**	**2**	**6.2.1**
Q7 (b)	Briefly explain the different types of structural systems used in a building structure to resist lateral loads due earthquake							**3**	**3**	**2**	**6.2.1**
Q7 (c)	Explain the provisions of IS 13920-2016, for (i)Beams: General provisions, longitudinal reinforcement and web reinforcement (ii) Shear Walls: General requirements and coupling beams connecting two shear walls.							**12**	**3**	**2**	**6.2.1**
Q7 (d)	What is Shear Wall (Structural wall)? Explain the advantages of shear walls.							**2**	**3**	**2**	**6.2.1**

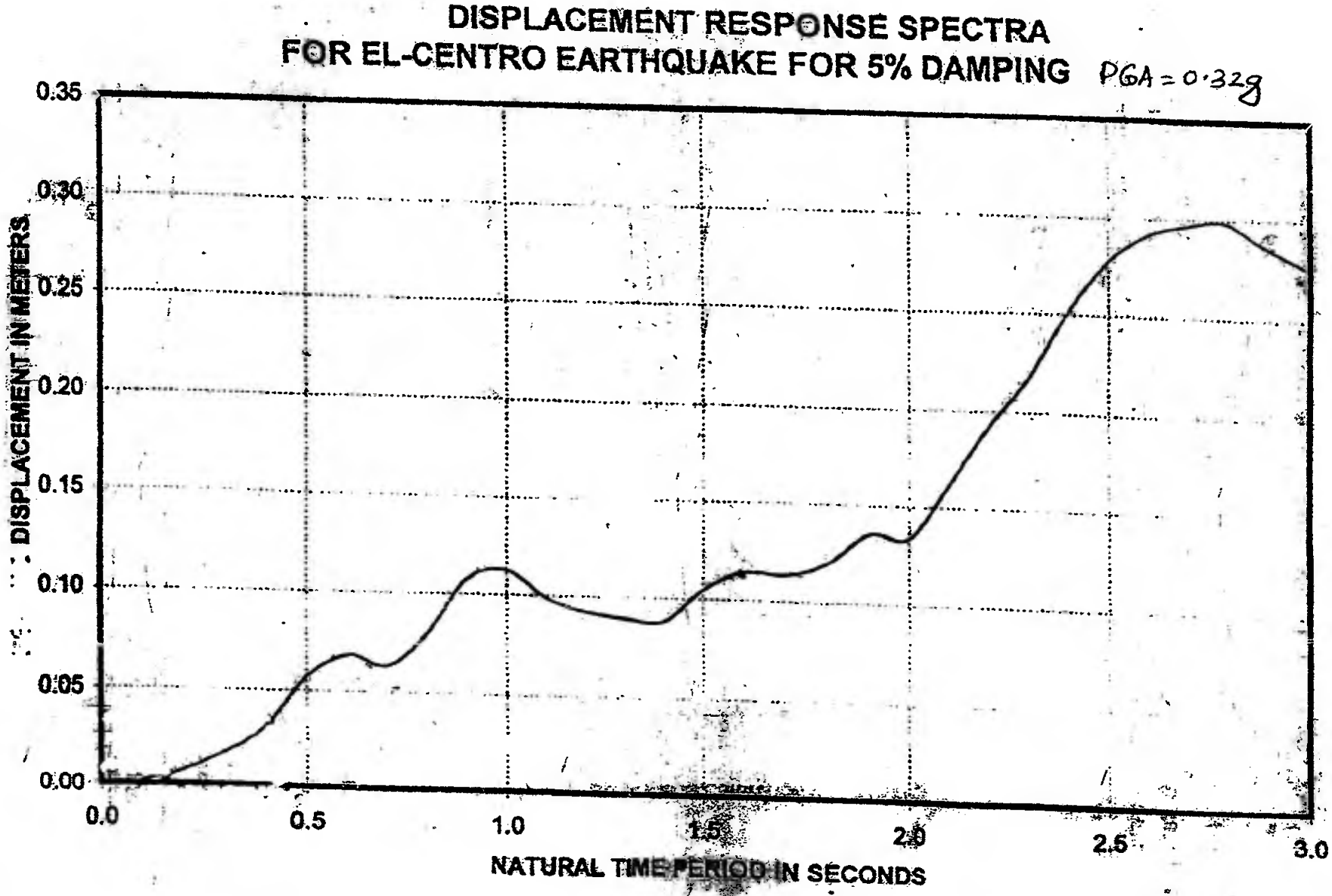

DISPLACEMENT RESPONSE SPECTRA
FOR EL-CENTRO EARTHQUAKE FOR 5% DAMPING PGA = 0.32g
DISPLACEMENT IN METERS
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
NATURAL TIME PERIOD IN SECONDS

Figure 1

6

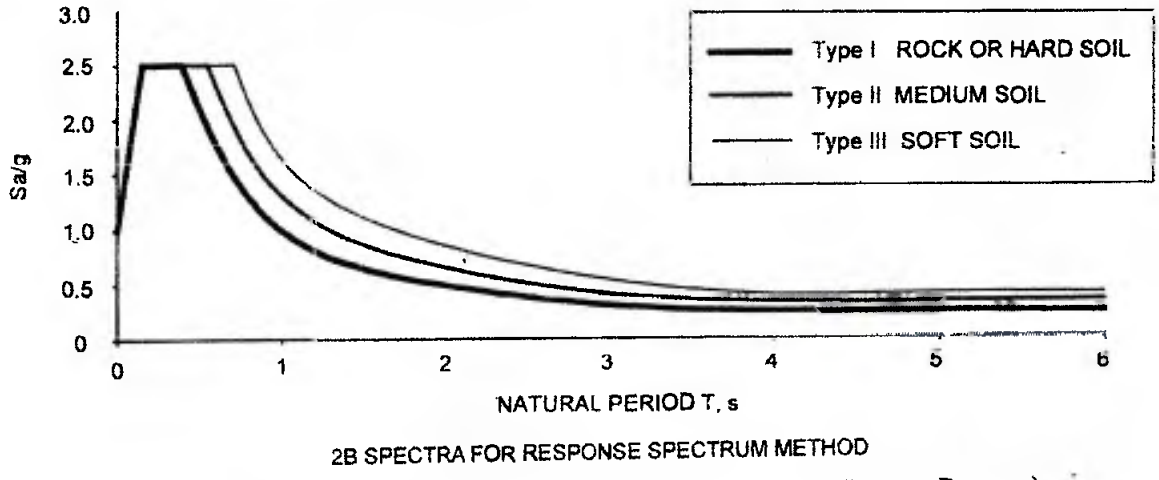


FIG. 2 DESIGN ACCELERATION COEFFICIENT (S_a/g) (CORRESPONDING TO 5 PERCENT DAMPING)

Fig. 2. Q6.(d)

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END SEMESTER EXAMINATION –May-2019

Program: Civil Engg. **Duration:3 hrs.**

Course Code: HSM-BTC- 805 **Maximum Points: 100**

Course Name: E & M **Semester: VIII**

Notes:

1. **Q.1. is compulsory & Solve any four from remaining six questions;**

Q.No.	Questions	Points	CO	BL	PI
1.	Solve any four: 1.Entrepreneurial Culture 2. Functions of Management 3. SWOT analysis 4. Socio economic origins of entrepreneurship 5. Line & line & staff organization.	20	1-3	III	2.1.3
2.a	What are the different barriers affecting to entrepreneurship process?	10	1	I	2.1.3
2.b	Explain the various classification/types of entrepreneurs along with one example. (any 10)	10	1	II	2.1.3
3.a	Explain the necessity of entrepreneurial motivation. Also explain the McClelland Need for Achievement Theory	10	2	II	2.1.3
3.b	Explain various types of Ownership structures in organization.	10	3	II	2.1.3
4.a	Define the small scale industry and also Highlight the chief characteristics of it	10	3	I	2.1.3
4.b	A.] a product currently sells for Rs. 12/unit. The variable costs are Rs.4/unit and 10000 units are sold annually and a profit of Rs.30, 000 is realized per year. A new design will increase the variable cost by 20% and fixed cost by 10% but sales will increase to 12000 units per year. a) at what selling price do we break even b) if selling price to be kept same what will the annual profit?	10	3	I	1.1.1

<table>
<tr><td></td><td>B] A project with 3 year life and cost of Rs.100000 is generating revenue of Rs.25000, 45000 & 65000 in first, second & third year respectively. If discount rate is 8% what is the NPV?</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5.a</td><td>Journalize the following transactions in the books of Mr. Amit Kelkar for Dec 2018.
<table>
<tr><th>Date</th><th>Transactions</th><th>Amount</th></tr>
<tr><td>1</td><td>He started the business with cash</td><td>40000</td></tr>
<tr><td>3</td><td>Purchased goods on credit from Mr.Nitin.</td><td>1800</td></tr>
<tr><td>8</td><td>Purchased furniture from Alam furniture Mart on credit</td><td>3400</td></tr>
<tr><td>10</td><td>Deposited money in bank of MAHARASHTRA</td><td>8500</td></tr>
<tr><td>12</td><td>Cash sales</td><td>600</td></tr>
<tr><td>16</td><td>Paid in full to Alam furniture Mart</td><td>-</td></tr>
<tr><td>19</td><td>Paid electricity charges</td><td>7000</td></tr>
<tr><td>24</td><td>Received commission</td><td>3000</td></tr>
<tr><td>26</td><td>Sold goods worth on credit to Aakash</td><td>5000</td></tr>
<tr><td>27</td><td>Paid insurance premium for goods by cheque</td><td>900</td></tr>
</table></td><td>10</td><td>3</td><td>III</td><td>2.1.3</td></tr>
<tr><td>5.b</td><td>Post above (Q.6.a) transactions into Mr. Amit kelkar's Ledger & balance all accounts.</td><td>10</td><td>3</td><td>III</td><td>2.1.3</td></tr>
<tr><td>6.a</td><td>Prepare Trading Account, Profit and loss Account & Balance sheet for Q.6.a.</td><td>10</td><td>3</td><td>II</td><td>2.1.3</td></tr>
<tr><td>6.b</td><td>Explain the importance of Management in entrepreneurship with any five characteristics of management.</td><td>10</td><td>1,3</td><td>II</td><td>6.1.1</td></tr>
<tr><td>7.a</td><td>"Management is an art, science or profession" Justify above statement with examples.</td><td>10</td><td>1,3</td><td>V</td><td>7.2.1</td></tr>
<tr><td>7.b</td><td>Discuss contribution made by "Fredrick Taylor" towards scientific management.</td><td>10</td><td>1,3</td><td>VI</td><td>7.2.1</td></tr>
</table>

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Sardar Patel College of Engineering

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

End Semester Examination, May- 2019

Max. Marks: 100 Duration: 3 hour

Class: Final Year B.Tech. Semester: VIII Program: Civil

Name of the Course: **Construction Management** Course Code : **PC- BTC- 803**

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

	Question No. 1 (solve any **five** from **a to g**)	**Points**	**CO**	**BL**	**PI**
Q1	(a) Why construction Industry is called Unique and Temporary?	**4**	1	1	1.3.1
	(b) "*All contracts are Agreements but all Agreements are not contract*", justify statement with suitable examples.	**4**	3	1	1.3.1
	(c) Discuss the factors affecting Job layout.	**4**	1	2	1.4.1
	(d) Differentiate Q.C. and Q.A.	**4**	2	2	1.4.1
	(e) Explain with neat sketch working capital cycle	**4**	2	1	1.3.2
	(f) Describe steps to be considered for project monitoring.	**4**	1	1	1.3.1
	(g) Explain the term resource 'smoothening'.	**4**	2	2	1.4.1
Q2	**(a)** Three time estimates t_0, t_m, t_p in days in each activity in a project are given below, draw the network diagram.	**10**	1	2	2.3.2

Sr. No.	Activity	t_0,	t_m,	t_p
1	1-2	4	7	16
2	1-3	5	14	23
3	2-4	7	16	19
4	3-4	4	7	10
5	4-5	3	6	9
6	3-5	8	17	32

Find the expected duration and variance of each activity.

(i) Determine expected duration of project.

(ii) Determine probability of completion of project, 3days before and 3 days after the normal duration.

(iii) Also determine the duration of the project, corresponding to (a) 95 % (b) 75% probability of completion.

(b) Discuss in detail the salient features of minimum wages act, 1948. **10** 3 2 2.1.2

Q3	**a)** Discuss the importance of wok instructions and checklist for the achievement of quality. **b)** The following table shows the details of activities of a small project: The indirect cost of project is Rs. 600 /- per day. Find: (i) Normal duration and the corresponding cost (ii) the optimum time cost combination	**08** **12**	2 1	2 1	2.3.2 1.4.1

Sr. No.	Activity	Duration in days		Cost (Rs. Thousand)	
		Normal	Crash	Normal	Crash
1	1-2	4	2	900	1200
2	1-3	2	1	7500	13500
3	2-4	6	3	1500	2625
4	2-5	4	3	1800	2400
5	3-5	5	3	1500	1800
6	3-7	10	5	3750	5250
7	4-5	5	5	1950	1950
8	5-6	8	6	3000	3150
9	5-7	2	2	1500	1500
10	6-8	7	5	3000	3500
11	7-8	8	6	2400	3000

Q4	**(a)** Activity data for small construction project are as given below: (i) Prepare resource histogram for early start schedule. (ii) Determine most preferred schedule. **(b)** You are appointed as a project manager for the construction of hydroelectric power project. Prepare job layout for the same.	**10** **10**	1 2	3 3	2.3.2 1.4.1

Activity	Duration(Days)	Resource Rate
P(1-2)	5	5
Q(1-3)	7	4
R(2-4)	4	2
Dummy(4-5)	-	-
S(2-5)	7	3
T(3-6)	7	6
U(5-7)	9	4
V(6-8)	4	4
W(7-8)	6	8

Q5	**(a)** Explain the concept of Work Breakdown Structure (WBS) and prepare a WBS for a project consisting of building an proposed engineering college building housing Civil, Electrical and Mechanical departments. **(b)** What do you mean by cost overruns in a construction project? Which methods would you suggests controlling the overruns?	**10** **10**	1 2	2 1	2.1.2 1.3.1
Q6	**(a)** What is Line Balance Technique? Give the suitable example which bring cut the various features of this technique. (b) Determine the EOQ for an item from the following: Annual demand= 400000, ordering cost = Rs. 150/-, Unit price of Item = Rs. 50/- . (Note: assume suitable value of carrying cost with justification). **(c)** Suggest different personnel protective equipment (PPE) to prevent accidents at site.	**08** **05** **07**	3 1 2	1 1 2	1.4.1 1.4.1 2.3.2

Q7	**(a)** What is the need and importance of materials management for construction projects? Discuss in brief the importance of A-B-C analysis.	**10**	3	2	1.3.4
	(b) The following table shows data related to a small construction project. Draw a network and give node numbering using Fulkerson's rule. Identify the critical path and critical activities. Also find the total float, free float and Independent float.	**10**	1	1	2.3.1

Activity	Following activity	Duration in days
H	J,M	5
J	K	3
K	L	20
L	B	11
M	N,P,T	4
N	Z	3
P	R,S	4
R	Y	3
S	W	5
T	W	3
W	X	2
X	A	20
Y	A	15
Z	A	16
A	B	9
B	-	5

Table 9.1 Normal Distribution Function

Normal Deviate − Z	Probability (%)	Normal Deviate + Z	Probability (%)
0	50.0	0	50.0
− 0.1	46.0	+ 0.1	54.0
− 0.2	42.1	+ 0.2	57.9
− 0.3	38.2	+ 0.3	61.8
− 0.4	34.5	+ 0.4	65.5
− 0.5	30.8	+ 0.5	69.2
− 0.6	27.4	+ 0.6	72.6
− 0.7	24.2	+ 0.7	75.5
− 0.8	21.2	+ 0.8	78.8
− 0.9	18.4	+ 0.9	81.6
− 1.0	15.9	+ 1.0	84.1
− 1.1	13.6	+ 1.1	86.4
− 1.2	11.5	+ 1.2	88.5
− 1.3	9.7	+ 1.3	90.3
− 1.4	8.1	+ 1.4	91.3
− 1.5	6.7	+ 1.5	93.3
− 1.6	5.5	+ 1.6	94.5
− 1.7	4.5	+ 1.7	95.5
− 1.8	3.6	+ 1.8	96.4
− 1.9	2.9	+ 1.9	97.1
− 2.0	2.3	+ 2.0	97.7
− 2.1	1.8	+ 2.1	98.2
− 2.2	1.4	+ 2.2	98.6
− 2.3	1.1	+ 2.3	98.9
− 2.4	0.8	+ 2.4	99.2
− 2.5	0.6	+ 2.5	99.4
− 2.6	0.5	+ 2.6	99.5
− 2.7	0.3	+ 2.7	99.7
− 2.8	0.3	+ 2.8	99.7
− 2.9	0.2	+ 2.9	99.8
− 3.0	0.1	+ 3.0	99.9

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SARDAR PATEL COLLEGE OF ENGINEERING
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End Semester Examination – May 2019

Program: B.Tech. Civil Engineering **Duration: 03 hours**

Course Code: PC - BTC802 **Maximum Points: 100**

Course Name: Quantity Survey Estimation & Valuation **Semester: VIII**

Notes:

1. **Question 1 is compulsory**
2. **Attempt any FOUR out of remaining SIX questions**
3. **Answer to each question should be written on a new page**
4. **Assume suitable data wherever necessary and state it clearly**

Q.No.	Questions	Points	CO	BL	PI
1	Answer the following: *(4 marks each)* a) State the Indian standard (IS) code for the following and give the importance of it in estimation and costing: i. Measurement of works ii. Recommendation for labour output	20	1	1	3.5.4
	b) Define 'Tender' for construction work. State the necessary elements of a tender notice to be drafted for any construction work.		3	1	3.5.2
	c) List all methods of valuation of land. List first five standard tables of valuation and its purpose.		4	1	3.5.4
	d) State the characteristics of mass haul diagram (MHD). Draw MHD for earthwork in excess, earthwork in deficit and balanced earthwork		2	1	3.5.4
	e) State the requirements of a good 'specification for materials' and specification for item of work'.		2	1	10.4.2
2	Prepare an estimate (quantities only) for the following items from given plan and section details in Fig.1. *(5 marks each)* Item1: Providing and laying M20 grade concrete in footings and columns upto plinth level Item 2: Providing and laying M20 grade concrete in plinth beams Item 3: Providing I class brickwork in CM 1:4 in walls. Item 4: Providing 15mm thick internal plaster in two coats in CM 1:4	20	1	4	2.8
3	The scope of work for the item 2 in Q.1 is described as: *'Providing and laying M20 grade in-situ concrete in plinth beams excluding formwork reinforcement'*				

	a) Give detailed specification for the item. b) Perform rate analysis for the item considering steel reinforcement as 2 % of the concrete volume. The labour output constants (days per cum) for the work are: Mason @ 0.20, Mazdoor @ 3.00, Bhisti @0.90, Mixer operator @0.10, vibrator @0.10. Taking the rate that you have worked out, calculate the cost of the item of work for the quantity you have estimated for item 2 in Q.2.	**10** **10**	2 2	3 4	10.4.2 2.8
4	a) The owner of a building gets a net annual rent of Rs. 35000. The future life of the building is estimated as 12 years. However, if recommended repairs are carried out immediately at an estimated cost of Rs. 3,00,000, the life of the building would be increased to 30 years. Assuming the rate of interest as 8% and rate of interest on sinking fund as 6%, determine whether it is economical to carry out the recommended repairs to the building. b) Explain the belting method of land valuation with a proper example.	10 **10**	4 4	4 2	2.8 2.6
5	a) Draft a typical tender notice for construction of a hostel building having capacity of 1000 students in your college campus. The proposed work is estimated to cost Rs.10 crores and duration of completion of the work is 18 months. b) Explain Unit price (Item rate) contract and state its suitability, advantages and disadvantages. c) Differentiate between Expression of Interest (EOI) and Request for Tender (RFT)	**08** **08** **04**	3 3 3	3 1 1	3.5.2 3.5.2 3.5.2
6	a) State the factors affecting the estimation and costing of earthwork in transportation works. b) Estimate the quantity of earthwork in cutting for a road of 10m formation width with the following data. Side slope is 2:1 (cutting and filling) and no cross slope. Estimate the total cost of earthwork if the cost of cutting is Rs.140/m^3 and cost of filling is Rs.80/m^3	**05** **15**	2 2	2 4	2.6.2 2.8

Chainage (m)	0	30	60	90	120	150
Ground level (m)	80.50	79.30	81.40	84.00	85.10	83.50
Formation level (m)	75.00	← Rising gradient of 1 in 30 →				

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Program: B.Tech. Civil Engineering **Duration: 03 hours**

Course Code: PC - BTC802 **Maximum Points: 100**

Course Name: Quantity Survey Estimation & Valuation **Semester: VIII**

Notes:

1. **Question 1 is compulsory**
2. **Attempt any FOUR out of remaining SIX questions**
3. **Answer to each question should be written on a new page**
4. **Assume suitable data wherever necessary and state it clearly**

Q.No.	Questions	Points	CO	BL	PI
1	Answer the following: *(4 marks each)* a) State the Indian standard (IS) code for the following and give the importance of it in estimation and costing: i. Measurement of works ii. Recommendation for labour output	20	1	1	3.5.4
	b) Define 'Tender' for construction work. State the necessary elements of a tender notice to be drafted for any construction work.		3	1	3.5.2
	c) List all methods of valuation of land. List first five standard tables of valuation and its purpose.		4	1	3.5.4
	d) State the characteristics of mass haul diagram (MHD). Draw MHD for earthwork in excess, earthwork in deficit and balanced earthwork		2	1	3.5.4
	e) State the requirements of a good 'specification for materials' and specification for item of work'.		2	1	10.4.2
2	Prepare an estimate (quantities only) for the following items from given plan and section details in Fig.1. *(5 marks each)* Item1: Providing and laying M20 grade concrete in footings and columns upto plinth level Item 2: Providing and laying M20 grade concrete in plinth beams Item 3: Providing I class brickwork in CM 1:4 in walls. Item 4: Providing 15mm thick internal plaster in two coats in CM 1:4	**20**	1	4	2.8
3	The scope of work for the item 2 in Q.1 is described as: *'Providing and laying M20 grade in-situ concrete in plinth beams excluding formwork reinforcement'*				

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END SEM - May 2019 Examinations

Program: Civil Engg. **Duration: 3 hr**

Course Code: PC-BTC801 **Maximum Points: 100**

Course Name: Design and Drawing of Reinforced Concrete Structures

Semester: VIII

Notes:

1) Attempt any one of the following.
2) Use of IS 456:2000 is permitted.
3) Figures to right indicate full marks.
4) Assume suitable data if necessary and state the same clearly

Q.No.	Questions	Points	CO	BL	PI
1.	For the floor system shown in figure**1**,design SLAB S1-S2-S3 Take live load =3KN/m^2 and 200mm soil fill (density 18Kn/m^3). Use M30 and Fe-500 Draw reinforcement details along the section shown. Give all checks.	20	1,2,3,4	4,5,6	3.1.3,2.1.4
2.	For the floor system shown in figure**1**,design beam b1-b2-b3. Use M30 and Fe-500.Draw reinforcement details. Assume slab depth as 200mm and assume 200mm soil fill (density 18 Kn/m^3) on slabs .Give all checks with proper detailing of the beams.	20	1,2,3,4	4,5,6	3.1.3,1.1.4
3.	A rectangular water tank 4.5m long ,2.25m wide and 2.25m high has its walls hinged at top and bottom.Design walls of tank .Use M30 and Fe 415.Use **IS code** method.	20	1,2,3,4	4,5,6	4.1.3,4.1.4
4.	Design circular tank using **approximate method** with fixed base resting on ground and free at top for capacity of 550m3.Height of tank is restricted to 5.2m.Use M-30 and Fe-415. Draw reinforcement details. σct =1.5N/mm2 and σst=130N/mm2.	20	1,2,3,4	4,5,6	3.1.2,2.1.4
5.	The staircase room for a four storeyed framed structureof a residential building is of size 3.9m X 5.3m between centre of columns. The columns are of size 250 mm x 250mm.The width of beam and supporting wall is 230 mm. The floor to floor height is 3.2 m .Use M-25,Fe-415.Design a suitable dog-legged stairs and draw details of reinforcement for both the flights	20	1,2,3,4	4,5,6	3.1.2,2.1.4
6.	A reinforced cantilever RW is supporting backfill of height 4.5m above ground level with density of soil =18 kN/m3,Angle of repose=30°,S.B.C of soil=175 kN/m2 and coefficient of friction between concrete and soil =0.3.Design the **Stem and heel of the wall only showing all stability checks**. Draw reinforcement details also. Use M30 & Fe 415.	20	1,2,3,4	4,5,6	3.1.2,2.1.4

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7.	The layout of the columns of the building is shown in figure 1.The outer column are 450x450mm in size and carry load of 1500kN each. The inner column are 450x450mm in size and carry a load of 1500kN each. Consider SBC of soil as 200kN/m2.Use M30 and Fe-415 Design only main beam of the raft foundation. Show reinforcement details also.	20	1,2,3,4	4,5,6	4.1.2,5.1.4

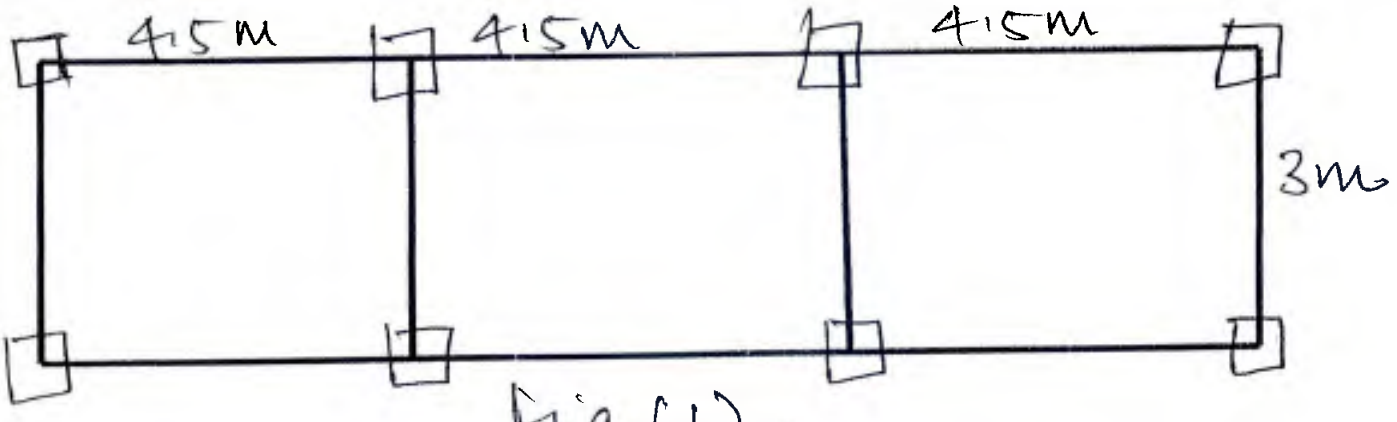


fig (I)

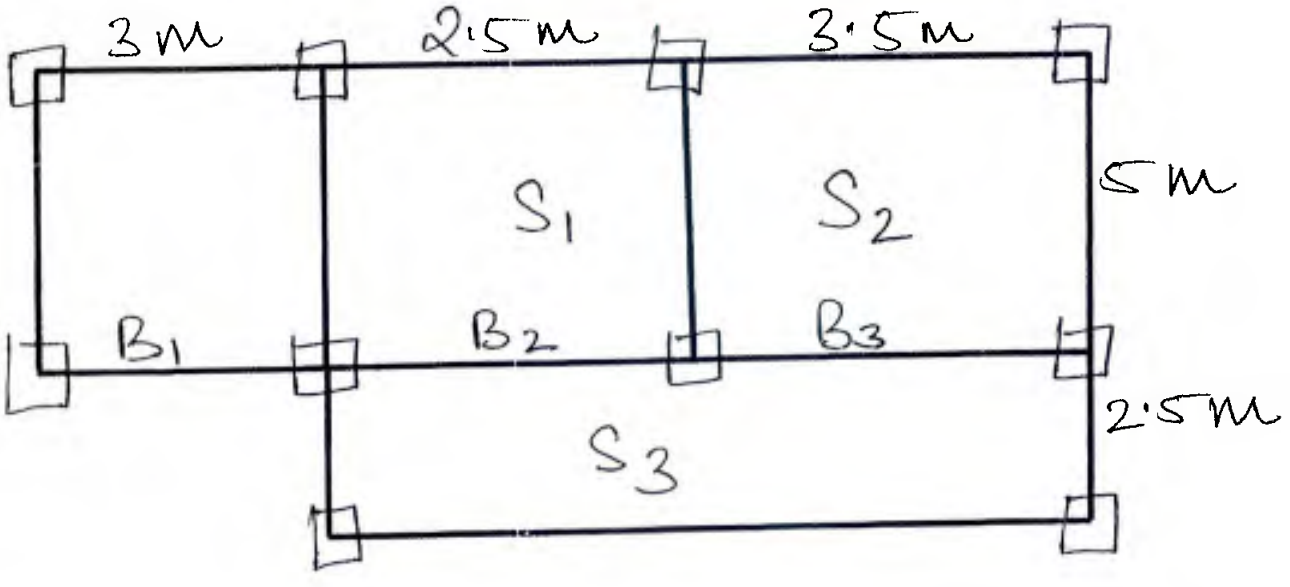


fig (II)

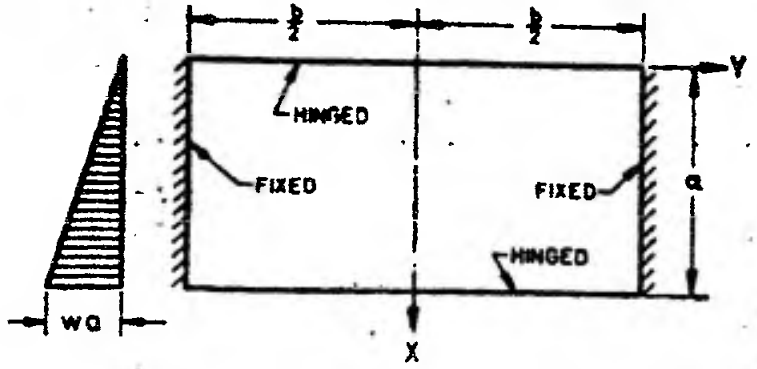
TABLE 6 MOMENT COEFFICIENTS FOR TANKS WITH WALLS HINGED AT TOP AND BOTTOM — *Contd*

c/a	x/a	$b/a=2{\cdot}0$									
		$y=0$		$y=b/4$		$y=b/2$		$z=c/4$		$z=0$	
		M_x	M_y	M_x	M_y	M_x	M_y	M_x	M_y	M_x	M_y
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2·00	1/4	+0·025	+0·013	+0·015	+0·009	−0·007	−0·037	+0·015	+0·009	+0·025	+0·013
	1/2	+0·042	+0·020	+0·028	+0·015	−0·012	−0·059	+0·028	+0·015	+0·042	+0·020
	3/4	+0·040	+0·016	+0·029	+0·013	−0·011	−0·053	+0·029	+0·013	+0·040	+0·016
1·75	1/4	+0·025	+0·013	+0·015	+0·009	−0·007	−0·036	+0·011	+0·008	+0·020	+0·013
	1/2	+0·042	+0·020	+0·028	+0·015	−0·012	−0·058	+0·022	+0·013	+0·035	+0·021
	3/4	+0·040	+0·016	+0·029	+0·013	−0·010	−0·052	+0·024	+0·012	+0·035	+0·017
1·50	1/4	+0·025	+0·013	+0·016	+0·009	−0·007	−0·034	+0·007	+0·006	+0·014	+0·013
	1/2	+0·043	+0·020	+0·028	+0·015	−0·011	−0·056	+0·015	+0·011	+0·027	+0·021
	3/4	+0·041	+0·016	+0·029	+0·013	−0·010	−0·050	+0·019	+0·010	+0·029	+0·017
1·25	1/4	+0·026	+0·013	+0·016	+0·010	−0·006	−0·032	+0·003	+0·003	+0·007	+0·011
	1/2	+0·043	+0·020	+0·029	+0·015	−0·010	−0·052	+0·008	+0·007	+0·018	+0·019
	3/4	+0·041	+0·016	+0·030	+0·013	−0·010	−0·048	+0·013	+0·008	+0·021	+0·016
1·00	1/4	+0·026	+0·013	+0·017	+0·010	−0·006	−0·028	−0·001	+0·000	+0·002	+0·008
	1/2	+0·044	+0·020	+0·030	+0·016	−0·009	−0·046	+0·002	+0·002	+0·007	+0·014
	3/4	+0·041	+0·016	+0·031	+0·014	−0·009	−0·044	+0·007	+0·004	+0·013	+0·013
0·75	1/4	+0·027	+0·013	+0·018	+0·010	−0·005	−0·024	−0·003	−0·004	−0·001	+0·002
	1/2	+0·045	+0·020	+0·031	+0·016	−0·008	−0·040	−0·002	−0·004	+0·000	+0·005
	3/4	+0·042	+0·016	+0·032	+0·014	−0·008	−0·041	+0·002	−0·002	+0·005	+0·008
0·50	1/4	+0·027	+0·013	+0·019	+0·010	−0·004	−0·021	−0·004	−0·010	−0·004	−0·007
	1/2	+0·046	+0·020	+0·033	+0·017	−0·007	−0·034	−0·006	−0·015	−0·006	−0·009
	3/4	+0·042	+0·016	+0·032	+0·015	−0·007	−0·037	−0·003	−0·010	−0·002	−0·003

(*Continued*)

TABLE 7 SHEAR AT EDGES OF WALL PANEL HINGED AT TOP AND BOTTOM

(*Clauses* 2.3.1, 2.3.3, 2.3.3.2, 2.3.4, 2.3.4.1 *and* 2.3.6)



	b/*a*					
	½	1	2	5	10	Infinity
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mid-point of bottom edge	$+0.140\,7\ wa^2$	$+0.241\,9\ wa^2$	$+0.329\,0\ wa^2$	—	—	$+0.333\,3\ wa^2$
Corner at bottom edge	$-0.257\,5\ wa^2$	$-0.439\,7\ wa^2$	$-0.583\,3\ wa^2$	—	—	$-0.600\,0\ wa^2$
Mid-point of fixed side edge	$+0.128\,0\ wa^2$	$+0.258\,2\ wa^2$	$+0.360\,4\ wa^2$	—	—	$+0.391\,2\ wa^2$
Lower third-point of side edge	$+0.173\,6\ wa^2$	$+0.311\,3\ wa^2$	$+0.402\,3\ wa^2$	—	—	$+0.411\,6\ wa^2$
Lower quarter-point of side edge	$+0.191\,9\ wa^2$	$+0.315\,3\ wa^2$	$+0.390\,4\ wa^2$	—	—	$+0.398\,0\ wa^2$
Total at top edge	$0.000\,0\ wa^2b$	$0.005\,2\ wa^2b$	$0.053\,8\ wa^2b$	$0.120\,3\ wa^2b$	$0.143\,5\ wa^2b$	$0.166\,7\ wa^2b$
Total of bottom edge	$0.048\,0\ wa^2b$	$0.096\,0\ wa^2b$	$0.181\,8\ wa^2b$	$0.271\,5\ wa^2b$	$0.302\,3\ wa^2b$	$0.333\,3\ wa^2b$
Total at one fixed side edge	$0.226\,0\ wa^2b$	$0.199\,4\ wa^2b$	$0.132\,2\ wa^2b$	$0.054\,1\ wa^2b$	$0.027\,1\ wa^2b$	$0.275\ wa^2b$*
Total at all four edges	$0.500\,0\ wa^2b$	$0.500\,0\ wa^2b$	$0.500\,0\ wa^2b$	$0.500\,0\ wa^2b$	$0.500\,0\ wa^2b$	$0.500\,0\ wa^2b$

NOTE 1 — Negative sign indicates that reaction acts in direction of load.
NOTE 2 — w = Density of the liquid.

*Estimated.

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1	Answer the following: *(4 marks each)* a) State the Indian standard (IS) code for the following and give the importance of it in estimation and costing: i. Measurement of works ii. Recommendation for labour output b) Define 'Tender' for construction work. State the necessary elements of a tender notice to be drafted for any construction work. c) List all methods of valuation of land. List first five standard tables of valuation and its purpose. d) State the characteristics of mass haul diagram (MHD). Draw MHD for earthwork in excess, earthwork in deficit and balanced earthwork e) State the requirements of a good 'specification for materials' and specification for item of work'.	**20**	1 3 4 2 2	1 1 1 1 1	3.5.4 3.5.2 3.5.4 3.5.4 10.4.2
2	Prepare an estimate (quantities only) for the following items from given plan and section details in Fig.1. *(5 marks each)* Item1: Providing and laying M20 grade concrete in footings and columns upto plinth level Item 2: Providing and laying M20 grade concrete in plinth beams Item 3: Providing I class brickwork in CM 1:4 in walls. Item 4: Providing 15mm thick internal plaster in two coats in CM 1:4	**20**	1	4	2.8
3	The scope of work for the item 2 in Q.1 is described as: *'Providing and laying M20 grade in-situ concrete in plinth beams excluding formwork reinforcement'*				

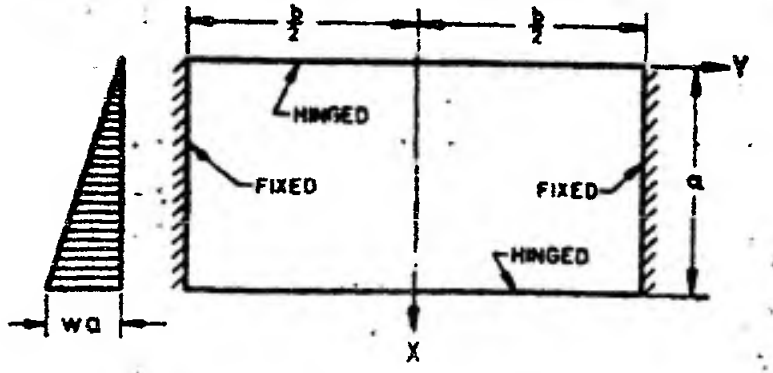
TABLE 6 MOMENT COEFFICIENTS FOR TANKS WITH WALLS HINGED AT TOP AND BOTTOM — *Contd*

c/a	x/a	b/a=2·0									
		y=0		y=b/4		y=b/2		z=c/4		z=0	
		M_x	M_y	M_x	M_y	M_x	M_y	M_x	M_y	M_x	M_y
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
2·00	1/4	+0·025	+0·013	+0·015	+0·009	−0·007	−0·037	+0·015	+0·009	+0·025	+0·013
	1/2	+0·042	+0·020	+0·028	+0·015	−0·012	−0·059	+0·028	+0·015	+0·042	+0·020
	3/4	+0·040	+0·016	+0·029	+0·013	−0·011	−0·053	+0·029	+0·013	+0·040	+0·016
1·75	1/4	+0·025	+0·013	+0·015	+0·009	−0·007	−0·036	+0·011	+0·008	+0·020	+0·013
	1/2	+0·042	+0·020	+0·028	+0·015	−0·012	−0·058	+0·022	+0·013	+0·035	+0·021
	3/4	+0·040	+0·016	+0·029	+0·013	−0·010	−0·052	+0·024	+0·012	+0·035	+0·017
1·50	1/4	+0·025	+0·013	+0·016	+0·009	−0·007	−0·034	+0·007	+0·006	+0·014	+0·013
	1/2	+0·043	+0·020	+0·028	+0·015	−0·011	−0·056	+0·015	+0·011	+0·027	+0·021
	3/4	+0·041	+0·016	+0·029	+0·013	−0·010	−0·050	+0·019	+0·010	+0·029	+0·017
1·25	1/4	+0·026	+0·013	+0·016	+0·010	−0·006	−0·032	+0·003	+0·003	+0·007	+0·011
	1/2	+0·043	+0·020	+0·029	+0·015	−0·010	−0·052	+0·008	+0·007	+0·018	+0·019
	3/4	+0·041	+0·016	+0·030	+0·013	−0·010	−0·048	+0·013	+0·008	+0·021	+0·016
1·00	1/4	+0·026	+0·013	+0·017	+0·010	−0·006	−0·028	−0·001	+0·000	+0·002	+0·008
	1/2	+0·044	+0·020	+0·030	+0·016	−0·009	−0·046	+0·002	+0·002	+0·007	+0·014
	3/4	+0·041	+0·016	+0·031	+0·014	−0·009	−0·044	+0·007	+0·004	+0·013	+0·013
0·75	1/4	+0·027	+0·013	+0·018	+0·010	−0·005	−0·024	−0·003	−0·004	−0·001	+0·002
	1/2	+0·045	+0·020	+0·031	+0·016	−0·008	−0·040	−0·002	−0·004	+0·000	+0·005
	3/4	+0·042	+0·016	+0·032	+0·014	−0·008	−0·041	+0·002	−0·002	+0·005	+0·008
0·50	1/4	+0·027	+0·013	+0·019	+0·010	−0·004	−0·021	−0·004	−0·010	−0·004	−0·007
	1/2	+0·046	+0·020	+0·033	+0·017	−0·007	−0·034	−0·006	−0·015	−0·006	−0·009
	3/4	+0·042	+0·016	+0·032	+0·015	−0·007	−0·037	−0·003	−0·010	−0·002	−0·005

(*Continued*)

TABLE 7 SHEAR AT EDGES OF WALL PANEL HINGED AT TOP AND BOTTOM

(*Clauses* 2.3.1, 2.3.3, 2.3.3.2, 2.3.4, 2.3.4.1 *and* 2.3.6)



	b/a					
(1)	½ (2)	1 (3)	2 (4)	5 (5)	10 (6)	Infinity (7)
Mid-point of bottom edge	+0·140 7 wa^2	+0·241 9 wa^2	+0·329 0 wa^2	—	—	+0·333 3 wa^2
Corner at bottom edge	−0·257 5 wa^2	−0·439 7 wa^2	−0·583 3 wa^2	—	—	−0·600 0 wa^2
Mid-point of fixed side edge	+0·128 0 wa^2	+0·258 2 wa^2	+0·360 4 wa^2	—	—	+0·391 2 wa^2
Lower third-point of side edge	+0·173 6 wa^2	+0·311 3 wa^2	+0·402 3 wa^2	—	—	+0·411 6 wa^2
Lower quarter-point of side edge	+0·191 9 wa^2	+0·315 3 wa^2	+0·390 4 wa^2	—	—	+0·398 0 wa^2
Total at top edge	0·000 0 wa^2b	0·005 2 wa^2b	0·053 8 wa^2b	0·120 3 wa^2b	0·143 5 wa^2b	0·166 7 wa^2b
Total of bottom edge	0·048 0 wa^2b	0·096 0 wa^2b	0·181 8 wa^2b	0·271 5 wa^2b	0·302 3 wa^2b	0·333 3 wa^2b
Total at one fixed side edge	0·226 0 wa^2b	0·199 4 wa^2b	0·132 2 wa^2b	0·054 1 wa^2b	0·027 1 wa^2b	0·275 wa^2*
Total at all four edges	0·500 0 wa^2b	0·500 0 wa^2b	0·500 0 wa^2b	0·500 0 wa^2b	0·500 0 wa^2b	0·500 0 wa^2b

NOTE 1 — Negative sign indicates that reaction acts in direction of load.
NOTE 2 — w = Density of the liquid.

*Estimated.