



Bharatiya Vidya Bhavan's

# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058

End Sem - December 2023 Examinations



Program: *DT* Civil Engg. *Sem VII*

Duration: 3 hr

Course Code: PC-BTC701

Maximum Points: 100

Course Name: Design of Concrete Structures

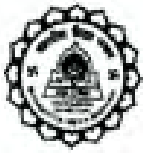
Semester: VII

**Notes:**

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

*mmmm*

| Q.No. | Questions   | Points | CO      | BL    | Module No. |
|-------|---|--------|---------|-------|------------|
| 1     | The staircase room for a four storeyed framed structure of a residential building is of size 4m X 6m between centre of columns. The columns are of size 350 mm x 350mm. The width of beam and supporting wall is 300 mm. The floor to floor height is 3.2 m. Use M-35, Fe-500D. Design a suitable dog-legged stairs. Draw reinforcement details.                                  | 20     | 1,2,3,4 | 4,5,6 | 1          |
| 2     | A reinforced cantilever RW is supporting backfill of height 4.5m above ground level with density of soil = 18 kN/m <sup>3</sup> , Angle of repose = 30°, S.B.C of soil = 180 kN/m <sup>2</sup> and coefficient of friction between concrete and soil = 0.3. Design stem and toe slab of the wall showing all stability checks. Draw reinforcement details also. Use M30 & Fe 500. | 20     | 1,2,3,4 | 4,5,6 | 5          |
| 3     | Design circular tank using approximate method with fixed base resting on ground and free at top for capacity of 550m <sup>3</sup> . Height of tank is restricted to 5.0m. Use M-30 and Fe-415. Draw reinforcement details. $\sigma_{ct} = 1.5N/mm^2$ and $\sigma_{st} = 130N/mm^2$ . Assume $j = 0.86$  | 20     | 1,2,3,4 | 4,5,6 | 6          |
| 4     | For the floor system shown in figure 1, design SLAB S1-S2-S3. Take live load = 4kN/m <sup>2</sup> and 250mm soil fill on slab S1 and S3 (density 18kN/m <sup>3</sup> ). Use M30 and Fe-500. Draw reinforcement details along the section shown. Give all checks.  | 20     | 1,2,3,4 | 4,5,6 | 3          |
| 5     | For the floor system shown in figure 2, design beam B1-B2-B3-B4. Use M30 and Fe-500. Draw reinforcement details. Assume slab depth as 150mm and assume 200mm soil fill (density 18 kN/m <sup>3</sup> ) on slab S1 and S2. Give all checks with proper detailing of the beams.   | 20     | 1,2,3,4 | 4,5,6 | 4          |
| 6a    | Write note on joints provided in water tank.  | 07     | 1,2,3,4 | 2,3   | 7          |
| 6b    | Design circular tank using approximate method with flexible base resting on ground and free at top for capacity of  | 13     | 1,2,3,4 | 4,5,6 | 7          |



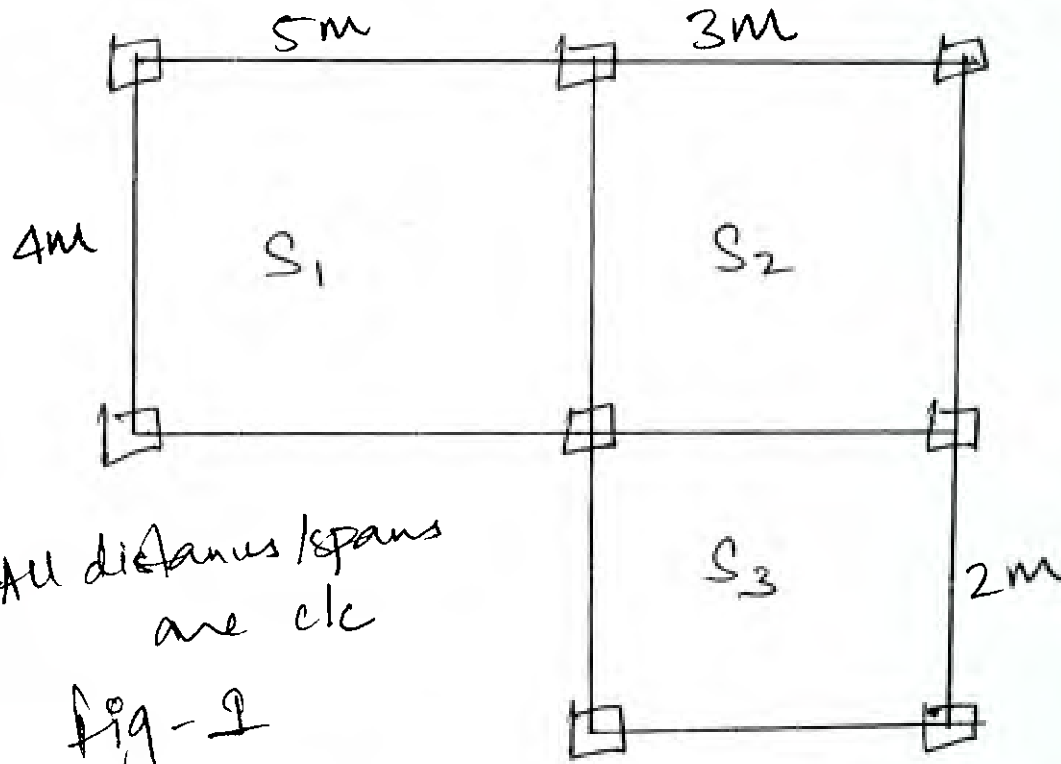
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End Sem - December 2023 Examinations

|   |  |    |         |       |   |
|---|--|----|---------|-------|---|
|   | 400m <sup>3</sup> . Height of tank is restricted to 4.0m. Use M-30 and Fe-415. Draw reinforcement details. $\sigma_{ct} = 1.5\text{N/mm}^2$ and $\sigma_{st} = 130\text{N/mm}^2$ . Assume $j = 0.86$   |    |         |       |   |
| 7 | Design open rectangular water tank $L \times B \times H = 6\text{m} \times 2.5\text{m} \times 3\text{m}$ resting on ground. Use M 30 and Fe 415. Draw reinforcement details. $\sigma_{ct} = 1.5\text{N/mm}^2$ and $\sigma_{st} = 130\text{N/mm}^2$ . Assume $j = 0.86$ | 20 | 1,2,3,4 | 4,5,6 | 6 |



All distances/spans are etc

fig-I

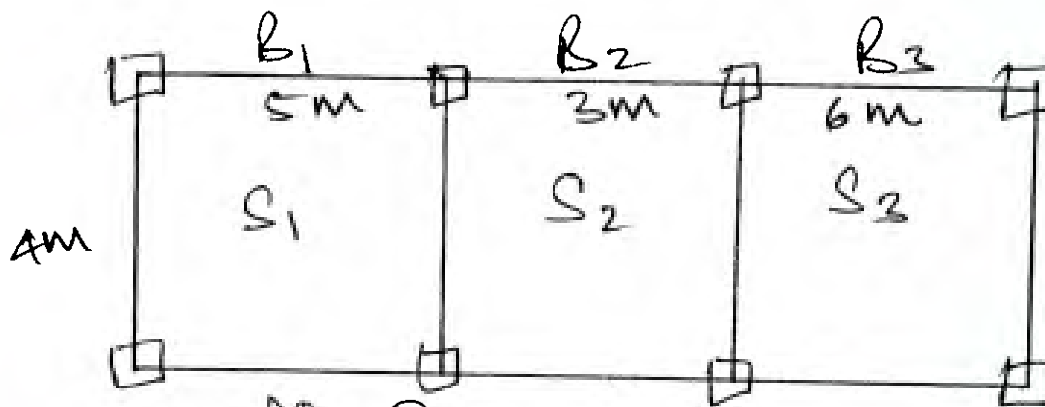


fig-II



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End Semester Re- Examination  
February - 2024



12/2/24

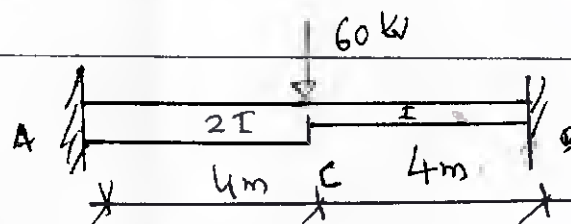
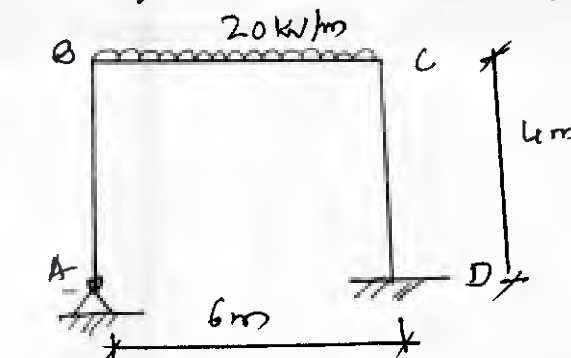
Max. Marks: 100  
Class: B.Tech. Civil - VII Semester: VII  
Name of the Course: Advanced Structural Analysis

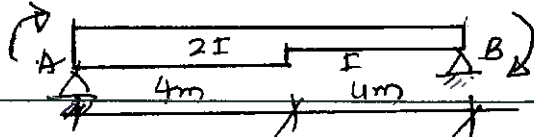
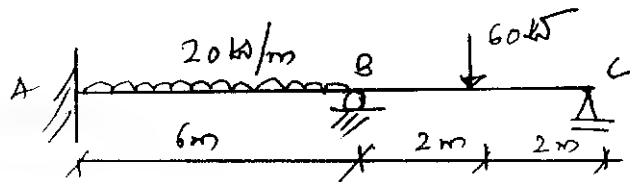
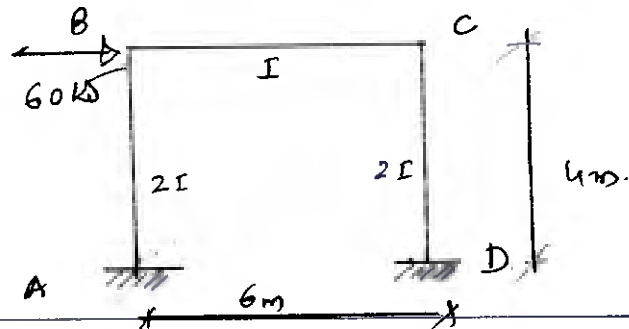
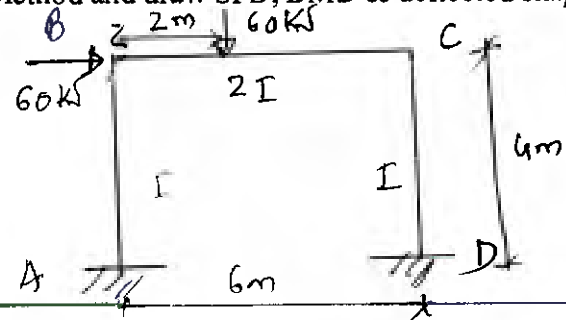
Duration: 3Hours  
Program: Civil Engineering  
Course Code : PEC- BTC721

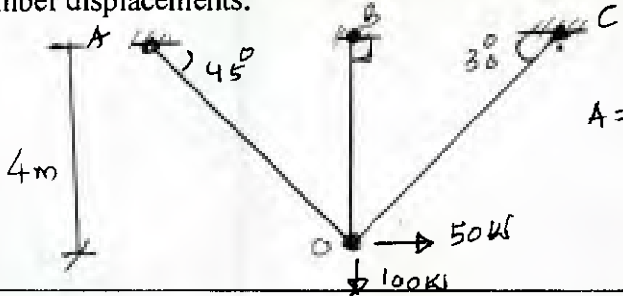
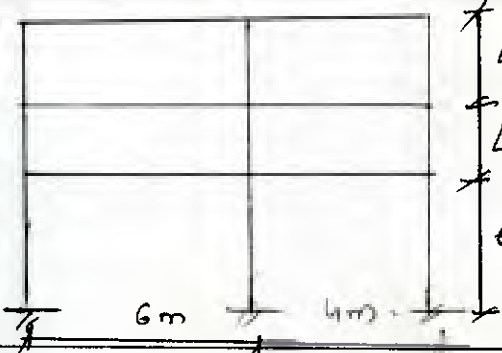
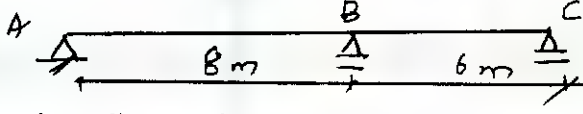
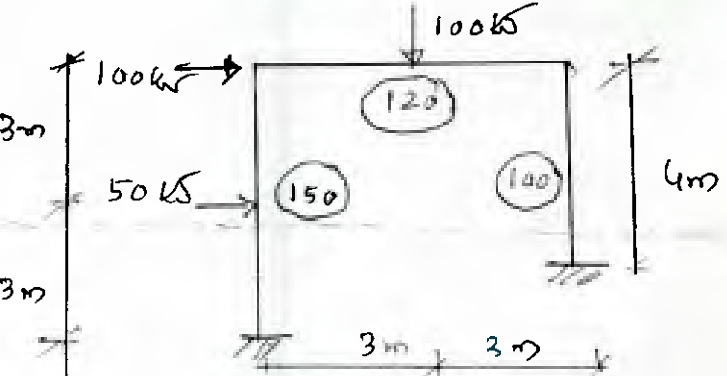
**Instructions:**

- Answer to any five 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.

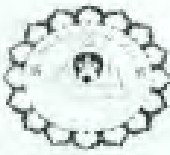
| Question No |  | Max. Marks | Course outcome | Module No. |
|-------------|--|------------|----------------|------------|
| Q1 (a)      | (i) Define statically determinate and indeterminate structures with examples   | 2          | 1,2            | 1          |
|             | (ii) Explain pin jointed plane frame structure in terms of internal forces, degrees of freedom and its behavior with example.  | 2          |                |            |
| Q1 (b)      | Analyse the rigid jointed frame shown in Figure by flexibility method and draw BMD and deflected shape. Note that A settles down by 10 mm. $EI = 1 \times 10^4 \text{ KN-m}^2$ | 8          | 2              | 4          |
| Q2(a)       | Using Column Analogy Method, analyse the beam shown in figure and draw BMD and Deflected shape.  | 8          | 2              | 4          |



|        |   |    |      |   |
|--------|---|----|------|---|
| Q2 (b) | <p>For the non-prismatic beam element shown in figure calculate the rotational stiffness at A and COF from A to B.</p>    | 8  | 2    | 4 |
| Q2 (b) | <p>Analyse the beam shown in figure by Matrix Stiffness Method</p>    | 12 | 1, 6 | 2 |
| Q3(a)  | <p>Derive the modified stiffness and carry over factor for a symmetric beam with odd number of spans (axis of symmetry passing through center of beam) subjected to</p> <ol style="list-style-type: none"> <li>symmetric loads</li> <li>Anti symmetric loads</li> </ol> | 4  | 1    | 3 |
| Q3 (b) | <p>Analyse the frame shown in figure by Elastic Centre Method and draw BMD and deflected shape.</p>   | 16 | 2    | 4 |
| Q4     | <p>Analyse the frame shown in figure by Modified Moment Distribution Method and draw SFD, BMD &amp; deflected shape</p>   | 20 | 1    | 3 |

|       |  |        |     |   |
|-------|--|--------|-----|---|
| Q5(a) | <p>Analyse pin jointed plane frame shown in figure by Matrix Stiffness Method and calculate the member forces and member displacements.</p>  <p><math>A = 1000 \text{ mm}^2</math> for all</p>           | 10     | 1,6 | 2 |
| Q5(b) | <p>Analyse the frame shown in figure by Cantilever Method and draw SFD, BMD and deflected shape.</p>    | 10     | 3   | 6 |
| Q6(a) | <p>(i) Define ILD and state its significance in structural analysis<br/>(ii) State Muller Breslau's Principle</p>  | 2<br>2 | 5   | 5 |
| Q6(b) | <p>For the beam shown in figure, construct the ILD for:<br/>(i) Reaction at 'C' <math>R_C</math><br/>(ii) Bending Moment at 'B' <math>M_B</math></p>  <p>Show the ordinates of ILD at 2m intervals</p> | 16     | 5   | 5 |
| Q7(a) | <p>Using plastic analysis, determine the load factor for the frame loaded as shown in figure. The Plastic Moment capacity of each member in KN-m is indicated in the figure.</p>                       | 16     | 5   | 7 |

|              |  |          |          |          |
|--------------|--|----------|----------|----------|
| <b>Q7(b)</b> | <b>i) Explain the need of approximate methods of Analysis</b>  | <b>2</b> | <b>3</b> | <b>6</b> |
|              | <b>(ii) Is Elastic centre method is flexibility method or stiffness method? Justify your answer.</b> | <b>2</b> | <b>2</b> | <b>4</b> |



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 End Semester Examination  
 December - 2023



29/12/23

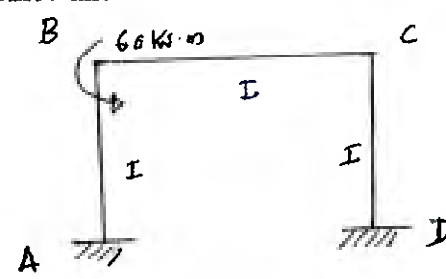
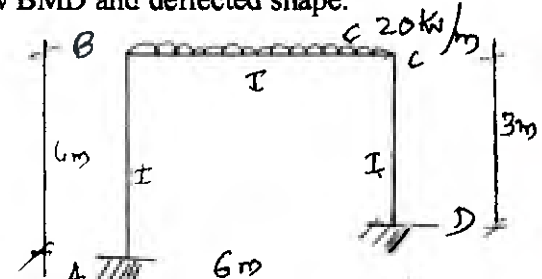
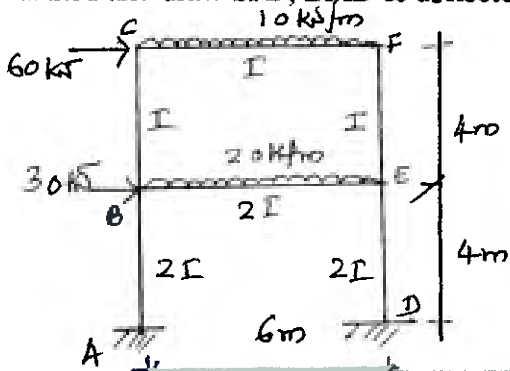
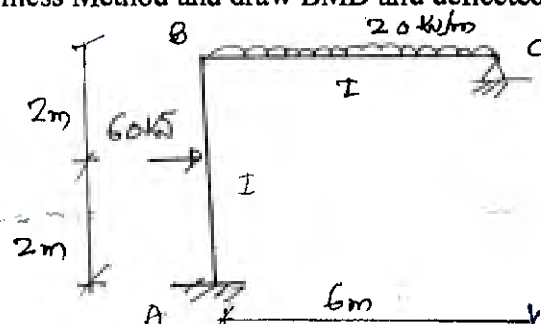
Max. Marks: 100  
 Class: B.Tech. Civil - VII Semester: VII  
 Name of the Course: Advanced Structural Analysis

Duration: 3Hours  
 Program: Civil Engineering  
 Course Code : PEC- BTC721

**Instructions:**

- Answer to any five 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 |   | Max. Marks | Course outcome | Module No. |
|-------------|---|------------|----------------|------------|
| Q1 (a)      | <p>Analyse the rigid jointed frame shown in Figure by flexibility method and draw BMD and deflected shape. Note that D supported on elastic foundation, which is restrained against vertical and horizontal deflection and can rotate partially. <math>EI = 1 \times 10^4 \text{ KN-m}^2</math> and <math>K_4 = 10^4 \text{ Kn-m/rad}</math>.</p> | 10         | 2              | 4          |
| Q1 (b)      | <p>Using Column Analogy Method, analyse the beam shown in figure and draw BMD and Deflected shape.</p>  | 10         | 2              | 4          |
| Q2 (a)      | <p>For the non-prismatic beam element shown in figure calculate the rotational stiffness at A and COF from A to B.</p>  | 10         | 2              | 4          |

|                      |  |           |            |          |
|----------------------|--|-----------|------------|----------|
| <p><b>Q2 (b)</b></p> | <p>Analyse the frame shown in figure by Modified Moment Distribution method and draw BMD and SFD</p>                        | <p>10</p> | <p>1</p>   | <p>3</p> |
| <p><b>Q3(a)</b></p>  | <p>Derive the modified stiffness and carry over factor for a column with fixed support of a single storey, single bay symmetric frame subjected to Anti -symmetric loads</p>                                 | <p>3</p>  | <p>1</p>   | <p>3</p> |
| <p><b>Q3 (b)</b></p> | <p>Analyse the frame shown in figure by Elastic Centre Method and draw BMD and deflected shape.</p>                        | <p>17</p> | <p>2</p>   | <p>4</p> |
| <p><b>Q4</b></p>     | <p>Analyse the frame shown in figure by Modified Moment Distribution Method and draw SFD, BMD &amp; deflected shape</p>  | <p>20</p> | <p>1</p>   | <p>3</p> |
| <p><b>Q5(a)</b></p>  | <p>Analyse rigid jointed plane frame shown in figure by Matrix Stiffness Method and draw BMD and deflected shape.</p>     | <p>10</p> | <p>1,6</p> | <p>2</p> |





Program: B.Tech. Civil Engineering (UG) *SEM VII*

Course Code: PE-BTC-731

Course Name: Surface Hydrology

Duration: 03 Hrs.

Maximum Points: 100

Semester: VII

**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**.

*12/2/24*

| Q. No.        | Questions   | Points  | CO  | BL  | PI    |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
|---------------|---|---------|-----|-----|-------|-----|-----|-----|---|---|---------------|----|-----|-----|-----|----|-----|-----|-----|----|---|---|
| 1             | (a) Define hydrology. What role does hydrology play in the water resources planning?  | 10      | 1   | 2   | 1.5.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
|               | (b) Discuss the hydrologic losses: Interception, Depression storage and Infiltration and state the factors affecting.   | 10      | 1   | 3   | 1.5.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
| 2             | (a) Explain depth - area - duration relationship and intensity -duration - frequency relationship. State its importance in hydrology.   | 10      | 1   | 2   | 1.2.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
|               | (b) A catchment has eight rain gauge stations. In a year the annual rainfall recorded by the gauges are as follows:<br><table border="1" style="margin-left: 20px;"> <thead> <tr> <th>Station</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>E</th> <th>F</th> <th>G</th> <th>H</th> </tr> </thead> <tbody> <tr> <td>Rainfall (cm)</td> <td>92</td> <td>105</td> <td>185</td> <td>120</td> <td>95</td> <td>130</td> <td>100</td> <td>110</td> </tr> </tbody> </table> For a 10 % error in the estimate of the mean rainfall, calculate the optimum number of stations in the catchment. | Station | A   | B   | C     | D   | E   | F   | G | H | Rainfall (cm) | 92 | 105 | 185 | 120 | 95 | 130 | 100 | 110 | 10 | 1 | 2 |
| Station       | A   | B       | C   | D   | E     | F   | G   | H   |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
| Rainfall (cm) | 92  | 105     | 185 | 120 | 95    | 130 | 100 | 110 |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
| 3             | (a) Explain working principle of current meter. Give a stepwise outline of determining stream discharge using current meter.  | 10      | 1   | 2   | 1.3.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
|               | (b) Discuss the various methods of determining runoff from a drainage area. State three important formulae.   | 10      | 1   | 4   | 4.4.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
| 4             | (a) Explain mass curve analysis and state its significance in hydrologic analysis.  | 10      | 2   | 3   | 1.2.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
|               | (b) Differentiate between exceedance interval and recurrence interval. Explain rainfall frequency analysis.   | 10      | 2   | 4   | 3.8.2 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
| 5             | (a) What is hydrograph? Explain unit hydrograph theory. State its importance in hydrologic analysis.  | 10      | 2   | 2   | 1.3.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |
|               | (b) Given below are the ordinates of a 6-h unit hydrograph for a catchment. Estimate the ordinates of the DRH due to a rainfall excess of 3.2 cm occurring in 6-h. Plot unit hydrograph and DRH.  | 10      | 2   | 4   | 3.2.1 |     |     |     |   |   |               |    |     |     |     |    |     |     |     |    |   |   |



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**Re-Examinations February 2024**

**(2023-24)**



|   | Time (Hr.)   | 0  | 3  | 6  | 9     | 12  | 15  | 18  | 24  | 30  | 36 | 42 | 48 | 54 | 60 | 69 |  |  |  |  |
|---|--|----|----|----|-------|-----|-----|-----|-----|-----|----|----|----|----|----|----|--|--|--|--|
|   | UH Ordinate (m <sup>3</sup> /sec)  | 0  | 25 | 50 | 85    | 125 | 160 | 185 | 160 | 110 | 60 | 36 | 25 | 16 | 8  | 0  |  |  |  |  |
| 6 | (a) Define the terms: Design flood, Standard project flood, probable maximum flood and risk, reliability and safety margin with respect to design of hydraulic structure   | 10 | 2  | 2  | 3.3.1 |     |     |     |     |     |    |    |    |    |    |    |  |  |  |  |
|   | (b) Explain the procedure for hydrologic channel routing. Also explain prism and wedge storage in channel routing.   | 10 | 2  | 4  | 4.6.2 |     |     |     |     |     |    |    |    |    |    |    |  |  |  |  |
| 7 | (a) What is Hydrological forecasting? Why it is important? Explain with an example.  | 10 | 2  | 4  | 4.1.2 |     |     |     |     |     |    |    |    |    |    |    |  |  |  |  |
|   | (b) The following data for a river for an annual flood of N = 92 years, mean = 7250 m <sup>3</sup> /sec., standard deviation = 3200 m <sup>3</sup> /sec. is collected. Using Gumbel's method of flood discharge with a return period of 300 years, what are the (i) 95%, and (ii) 80% confidence limits for this estimate? Take: $\bar{Y}_n = 0.5588$ , $S_n = 1.21$ , $f_c = 1.96$ for 95% confidence and $f_c = 1.282$ for 80% confidence. | 10 | 2  | 5  | 4.6.4 |     |     |     |     |     |    |    |    |    |    |    |  |  |  |  |

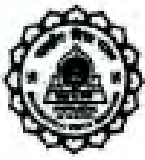
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**End Semester Examinations December 2023****(2023-24)****Program: B.Tech. Civil Engineering (UG)** *Level VII***Course Code: PE-BTC-731****Course Name: Surface Hydrology****Duration: 03 Hrs.****Maximum Points: 100****Semester: VII****Notes:**

- 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**.

*29/12/23*

| Q. No.              | Questions  | Points            | CO   | BL   | PI    |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
|---------------------|--|-------------------|------|------|-------|------|------|------|------|------|-----|------|---------------------|----|----|----|----|----|-----|-----|-----|-----|-----|--|--|--|--|
| 1                   | (a) Why water cycle important? How urbanization affects the water cycle? Explain.  | 10                | 1    | 2    | 1.5.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
|                     | (b) Explain Dalton's law of evaporation. A reservoir with a surface area of 250 hectares had the following average values of climate parameters during a week; water temperature 20 <sup>o</sup> C, Relative humidity = 40 %, wind velocity at 1 m above ground surface = 16 kmph, and ew = 17.54 mm (Hg). Estimate the average daily evaporation from the lake using Meyer's formula. | 10                | 1    | 3    | 1.5.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
| 2                   | (a) What are the transpiration and evapotranspiration losses? Explain AET, PET and Penman's equation.  | 10                | 1    | 2    | 1.2.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
|                     | (b) Explain causes of inconsistency in precipitation records and discuss double mass curve technique of test for consistency of record.  | 10                | 1    | 2    | 1.3.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
| 3                   | (a) How stream flow is measured? Explain any one method of stream gauging in detail with neat sketch. List out the factors affecting runoff.   | 10                | 1    | 2    | 1.3.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
|                     | (b) At a particular section of a stream by a stream gauging operation, following gauge and discharge was collected. Develop a gauge discharge relationship, take a - 7.55 m. and estimate the discharge corresponding to a gauge reading of 10.55 m at this gauging station.   | 10                | 1    | 4    | 4.4.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
|                     | <table border="1"> <tr> <td>Gauge reading (m)</td> <td>7.70</td> <td>7.75</td> <td>7.82</td> <td>7.87</td> <td>7.92</td> <td>7.98</td> <td>8.15</td> <td>8.55</td> <td>9.0</td> <td>9.25</td> </tr> <tr> <td>Discharge (cum/sec)</td> <td>20</td> <td>25</td> <td>50</td> <td>40</td> <td>60</td> <td>100</td> <td>140</td> <td>180</td> <td>260</td> <td>530</td> </tr> </table>      | Gauge reading (m) | 7.70 | 7.75 | 7.82  | 7.87 | 7.92 | 7.98 | 8.15 | 8.55 | 9.0 | 9.25 | Discharge (cum/sec) | 20 | 25 | 50 | 40 | 60 | 100 | 140 | 180 | 260 | 530 |  |  |  |  |
| Gauge reading (m)   | 7.70   | 7.75              | 7.82 | 7.87 | 7.92  | 7.98 | 8.15 | 8.55 | 9.0  | 9.25 |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
| Discharge (cum/sec) | 20   | 25                | 50   | 40   | 60    | 100  | 140  | 180  | 260  | 530  |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
| 4                   | (a) Discuss: methods of computing average rainfall and explain frequency analysis of point rainfall.   | 10                | 2    | 3    | 1.2.1 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |
|                     | (b) The intensity of the rainfall for successive 1 hr. period of a 6 hr. storm are 2, 6, 8, 9, 7 and 3 cm/hr. The runoff is 4 cm/hr. Calculate the $\phi$ -index (in cm/hr.). Assume $\phi$ -index to be lower than 2 cm/hr.   | 10                | 2    | 4    | 3.8.2 |      |      |      |      |      |     |      |                     |    |    |    |    |    |     |     |     |     |     |  |  |  |  |



|                      |   |    |     |     |      |     |     |     |     |     |    |    |    |    |   |   |       |
|----------------------|---|----|-----|-----|------|-----|-----|-----|-----|-----|----|----|----|----|---|---|-------|
| 5                    | (a) Explain rainfall-runoff relationship and empirical method of runoff estimation. Discuss factors affecting runoff.   |    |     |     |      |     |     |     |     |     |    |    |    | 10 | 2 | 2 | 1.3.1 |
|                      | (b) The following are the ordinates of the flood hydrograph from a catchment area of 780 km <sup>2</sup> due to 6 hr. storm. Derive the 6 hr. unit hydrograph of the basin. Assume the base flow of 40 m <sup>3</sup> /s.   |    |     |     |      |     |     |     |     |     |    |    |    | 10 | 2 | 4 | 3.2.1 |
| Time (Hr.)           | 6   | 12 | 18  | 24  | 30   | 36  | 42  | 48  | 54  | 60  | 66 | 72 | 78 |    |   |   |       |
| Discharge (cum./sec) | 40  | 64 | 215 | 360 | 405  | 350 | 270 | 205 | 145 | 100 | 70 | 50 | 40 |    |   |   |       |
| 6                    | (a) Define the terms: Design flood, Standard project flood, probable maximum flood and risk, reliability and safety margin with respect to design of hydraulic structure  |    |     |     |      |     |     |     |     |     |    |    |    | 10 | 2 | 2 | 3.3.1 |
|                      | (b) An inflow hydrograph is measured for a cross section of a stream. Compute the outflow hydrograph at a point 5 km downstream using Muskingum method. Assume K = 12 h, x = 0.10 and that outflow equals inflow initially.   |    |     |     |      |     |     |     |     |     |    |    |    | 10 | 2 | 4 | 4.6.2 |
| Time (Hr.)           | 6   | 12 | 18  | 24  | 30   | 36  | 42  | 48  | 54  | 60  | 66 |    |    |    |   |   |       |
| Inflow (I) (cum/sec) | 50  | 75 | 150 | 450 | 1000 | 840 | 750 | 600 | 300 | 100 | 50 |    |    |    |   |   |       |
| 7                    | (a) What is hydrological draught? What are its component and their possible effects? Discuss.   |    |     |     |      |     |     |     |     |     |    |    |    | 10 | 2 | 4 | 4.1.2 |
|                      | (b) The following data for a river in Maharashtra for an annual flood of N = 95 years, mean = 7200 m <sup>3</sup> /sec., standard deviation = 3000 m <sup>3</sup> /sec. is collected. Using Gumbel's method of flood discharge with a return period of 300 years, what are the (i) 95%, and (ii) 80% confidence limits for this estimate? Take: $\bar{Y}_n = 0.5588$ , $S_n = 1.21$ , $f_c = 1.96$ for 95% confidence and $f_c = 1.282$ for 80% confidence. |    |     |     |      |     |     |     |     |     |    |    |    | 10 | 2 | 5 | 4.6.4 |

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**END SEM EXAMINATION, JAN. - 2024**

Program: Civil Engineering *Q.T. 2024*

Course Code: PE -BTC - 761 *sem VII*

Course Name: Pavement Design and Construction

Notes:

Duration: 3 Hr

Maximum Points: 100

Semester: - VII

*29/1/23*

1. Question 1 is compulsory
2. Solve any 4 Questions from remaining 6 questions
3. Assume suitable data if required
4. Draw the neat sketch if required

| Q.No. | Questions  | Points | CO | BL | Module No. |
|-------|--|--------|----|----|------------|
| Q.1.  |  |        |    |    |            |
| a     | Discuss the classification of pavement design methods.   | 08     | 01 | 01 | 01         |
| b     | State the Westergard equations for calculation of wheel load stress at interior, edge and corner region of the rigid pavements.  | 06     | 03 | 01 | 02         |
| c     | Enlist the advantage of rigid pavement over flexible pavements.  | 06     | 03 | 01 | 04         |
| Q.2.  |  |        |    |    |            |
| a     | A two lane single carriageway national highway is to be constructed on a subgrade soil having four days soaked CBR is 4 %. The road is carrying a traffic of 1400 cvpd on the last count and three years required for the construction of road after last count. If rate of growth of traffic is 7 %. Calculate the total thickness of the flexible pavement as per IRC 37 - 2001 guide line for a road passing through<br>(a) Plain area<br>(b) Hilly area<br>(assume design life is 15 years, use indicative value of VDF) | 08     | 02 | 03 | 02         |
| b     | Discuss about fatigue and rutting failure criteria. Also, state the fatigue and rutting equation given by IRC  | 06     | 02 | 02 | 02         |



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**END SEM EXAMINATION, JAN. - 2024**

|             |  |    |    |    |    |
|-------------|--|----|----|----|----|
| c           | State the assumptions made in Burmister Layer theory. Also, state the deflection equation for flexible plate and rigid plate.  | 06 | 02 | 01 | 01 |
| <b>Q.3.</b> |  |    |    |    |    |
| a           | A circular wheel load of 8160 kg is applied homogenous elastic single layer soil mass. Determine the vertical compressive stress under the center of wheel load at a depth of 20 cm, 25 cm, 30 cm, 35 cm and 40 cm. ( assume radius of contact area of wheel with pavement surface is 15 cm)   | 08 | 02 | 03 | 01 |
| b           | Discuss with neat sketch warping stress and frictional stress. Also, state the equations for calculation of warping stress at edge, interior and corner of the rigid pavement slab.  | 08 | 03 | 02 | 03 |
| c           | How will you decide the suitability of material for road construction  | 04 | 04 | 02 | 07 |
| <b>Q.4.</b> |  |    |    |    |    |
| a           | The surface water from the road side is drained to longitudinal side drain. From across the half of bituminous surface of total width 7.0 m, the shoulder and adjoining land on one side of drain is 10 m and on other side of longitudinal drain the water flow across from reserved land with grass covered with thin turf and 2 % cross slope to words side drain. The width of strip of reserved land is 30 m. The runoff coefficient for pavement, shoulder and reserved land with gross cover is 0.80, 0.30 and 0.38 respectively. The length of stretch of land parallel to road from where water is expected to flow to the side drain is 500 m. Estimate the quantity of runoff flowing through longitudinal drain. Also design the rectangular longitudinal drain. Take $n = 0.022$ , $v = 0.50$ m/sec. (1) Period of frequency = 25 years. (Use Chart for for Analysis) | 10 | 06 | 03 | 06 |
| b           | How will you decide the grain size distribution of filter material for design of subsurface drainage system?   | 05 | 06 | 03 | 06 |



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**END SEM EXAMINATION, JAN. - 2024**

|      |  |    |    |    |    |
|------|--|----|----|----|----|
| c    | the grain size distribution for foundation soil indicates that the percentage of particle finer than 0.30, 0.20, 0.08, 0.04, 0.02, 0.01, mm size are 95%, 85%, 65%, 45%, 15%, 5%, respectively. If the perforated pipe used as a drain pipe with 5mm diameter, draw a grain size distribution for foundation material. Also draw the grain size distribution curve for filter material to be used around perforated pipe. (Use semi Log paper)   | 05 | 06 | 03 | 06 |
| Q.5. |  |    |    |    |    |
| a    | The Benkelman Beam study was conducted for poor section of road. The 15 sets of observations were taken at site and rebound deflections calculated are shown below. The traffic on the last count was 750 cvpd and average temperature at site during the Benkelman Beam study was 30 <sup>o</sup> c. The ESWL and tyre pressure of the loaded truck used for the study was 4085 kg and 5.6 kg/cm <sup>2</sup> . The subgrade moisture factor is 1.3 and 3 years required for construction after last count. Design the WBM type overlay required. Also, calculate the thickness of BM type overlay. (assume 84 % of rebound deflection in overlay design) | 10 | 05 | 03 | 05 |
| b    | Discuss about reasons of development of following types of distresses. How you will repair the same.<br>(a) Pot holes, (b) Longitudinal rutting  | 10 | 05 | 01 | 05 |
| Q.6. |  |    |    |    |    |
| a    | Calculate the wheel load stress due to edge loading and corner loading using Modified Westergards approach using following data. Also calculate the warping stress at edge and corner region.<br>Wheel load = 5100 kg<br>Modulus of Elasticity of Concrete = $3.0 \times 10^5$ kg/cm <sup>2</sup><br>Modulus of subgrade reaction, k = 8 kg/cm <sup>3</sup><br>Thickness of slab = 25 cm<br>Radius of loaded area = 16 cm  | 10 | 03 | 03 | 03 |





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**END SEM EXAMINATION, JAN. - 2024**

|             |  |    |    |    |    |
|-------------|--|----|----|----|----|
|             | Poissons ratio = 0.15<br>Maximum difference of temperature between top and bottom of slab = 18 <sup>o</sup> c.<br>(Take C <sub>1</sub> = 0.72 and C <sub>2</sub> = 0.65)   |    |    |    |    |
| <b>b</b>    | Design the tie bar in longitudinal joint of cement concrete pavement having thickness 35 cm and width 3.5 m using the following<br>Density of concrete = 2400 kg/cm <sup>3</sup><br>Allowable working stress in Deformed steel bar = 2000 kg/cm <sup>2</sup><br>Permissible bond stress in concrete = 24.5 kg/cm <sup>2</sup><br>Coefficient of friction = 1.2 | 10 | 03 | 03 | 03 |
| <b>Q.7.</b> |  |    |    |    |    |
| <b>a</b>    | How will you decide the optimum quantity of fibers required for stabilization of subgrade.   | 07 | 04 | 01 | 04 |
| <b>b</b>    | Discuss about Layer system concepts in flexible pavement design  | 07 | 02 | 01 | 01 |
| <b>c</b>    | Discuss the steps involve for preparation of subgrade  | 06 | 04 | 02 | 04 |

**Q. 5 (a), Table 1.**

|      |      |      |      |      |
|------|------|------|------|------|
| 1.4  | 1.32 | 1.25 | 1.35 | 1.48 |
| 1.60 | 1.65 | 1.55 | 1.45 | 1.4  |
| 1.36 | 1.46 | 1.50 | 1.52 | 1.45 |



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**END SEM EXAMINATION, JAN. - 2024**

Q.2. (a)

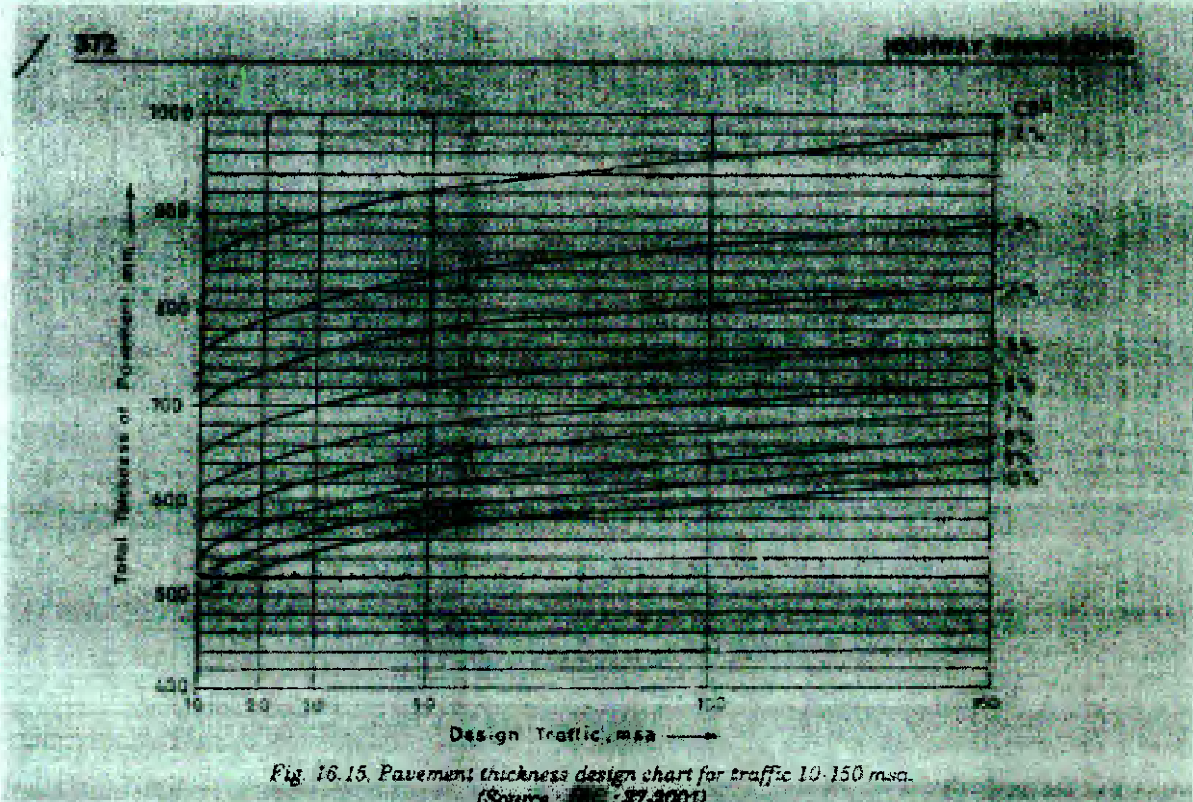
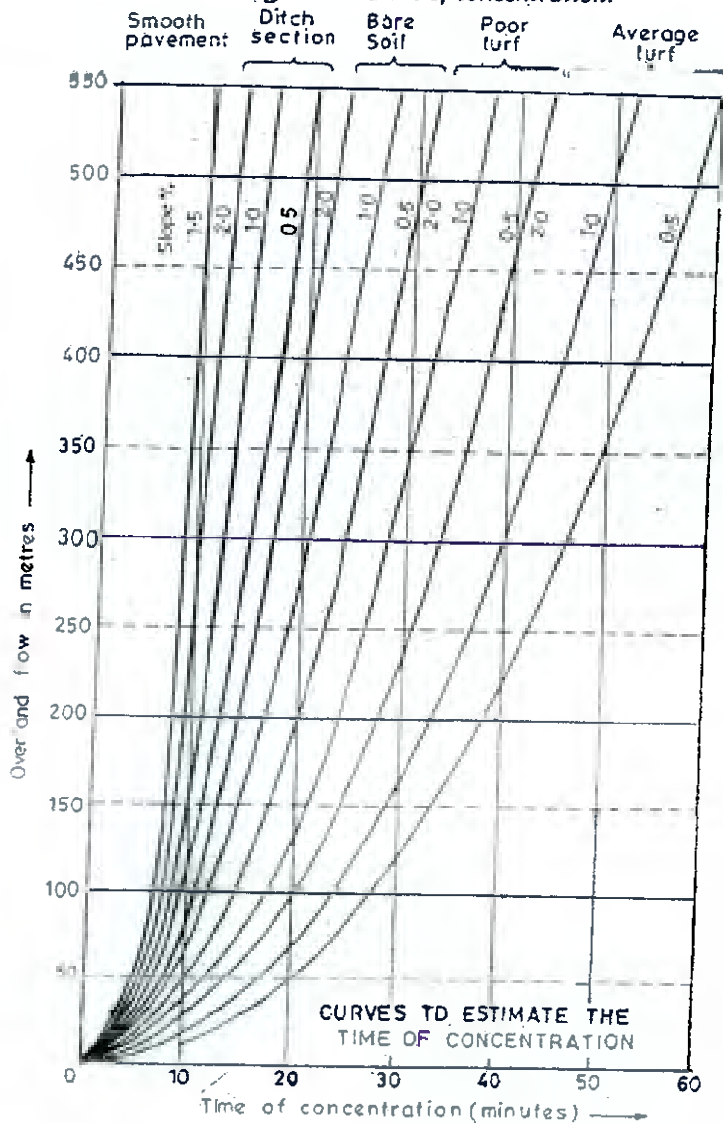


Fig. 12.13. Time of concentration.



Q. 4. (a).

Fig. 12.14. Chart for estimating time of concentration (Ref. 7).

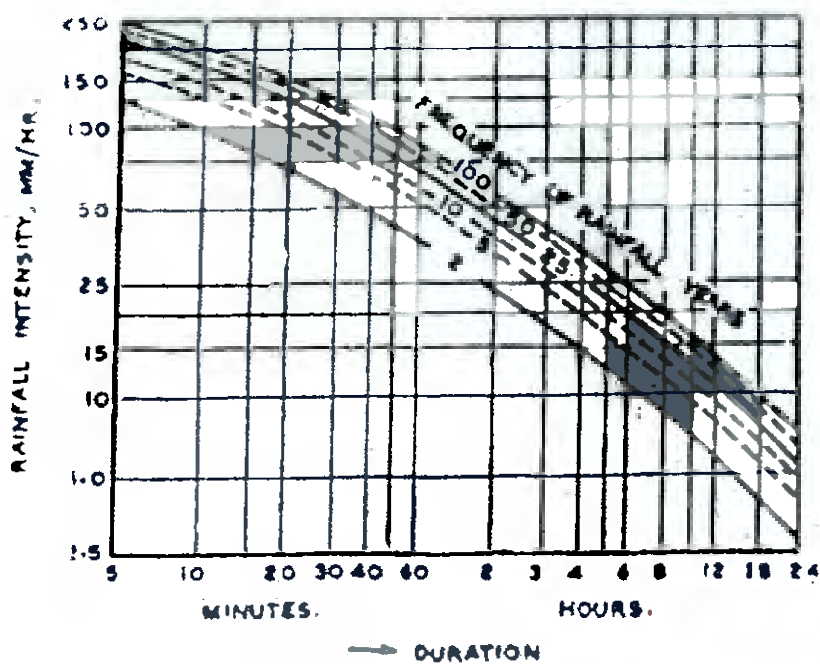


Fig. 11.4 Typical Rainfall Intensity Duration Curve



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END SEM EXAMINATION December 2023

Program: B.Tech Civil *Sem VII*

Duration: 3 Hrs

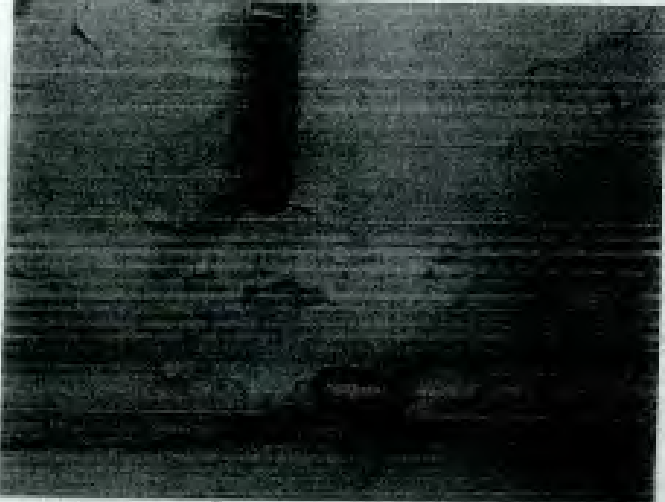
Course Code: PE-BTC723

Maximum Points: 100

Course Name: Maintenance, Repair and Rehabilitation of Structures

Semester: VII

*29/11/23*

| Q.No. | Questions  | Points | CO | BL  | Module No |
|-------|--|--------|----|-----|-----------|
|       |  |        |    |     |           |
| Q1 a  | Write a note on repair methodology of above cracked slab.                          | 15     | 1  | 2,3 | 5         |
| b     | What is difference between retrofitting and rehabilitation                         | 02     | 1  | 3,4 | 1         |
| c     | Define following terms-<br>a. Maintenance<br>b. Inspection<br>c. Durability        | 03     | 4  | 2,3 | 1         |





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**END SEM EXAMINATION December 2023**

|     |   |    |   |     |   |
|-----|---|----|---|-----|---|
|     |    |    |   |     |   |
| Q2a | Identify reason of the crack pattern and write detailed note on it                  | 10 | 1 | 2,3 | 2 |
| b   | Write note on structural cracks in hardened concrete                                | 10 | 1 | 2,3 | 3 |
|     |  |    |   |     |   |
| Q3  | Explain repair methodology for the above cracked column.                            | 20 | 1 | 2,3 | 6 |
| Q4a | What are objectives of maintenance ? Explain broad categories of maintenance        | 05 | 4 | 2,3 | 1 |




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**END SEM EXAMINATION December 2023**

|     |   |    |   |   |   |
|-----|---|----|---|---|---|
|     |                  |    |   |   |   |
| Q4b | For the beam shown above suggest corrosion protection methods for the exposed reinforcement bars. | 15 | 4 | 3 | 2 |
| Q5a | Write a detailed note on essential parameters for repair materials.                               | 10 | 1 | 3 | 5 |
| b   | What are various types of Non Destructive tests carried on concrete. Explain any two in detail.   | 10 | 3 | 4 | 4 |
| Q6  | Explain methodology for strengthening of RCC column using concrete jacketing.                     | 20 | 3 | 4 | 7 |
| Q7  | Write a detailed note on grouting of beams and columns.   | 20 | 3 | 4 | 6 |



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**End Semester Re-Examination February 2024**

Program: B. Tech. Civil Engineering *sem VII*

Duration: 3 hrs.

Course Code: PE-BTC742

Maximum Points: 100

Course Name: Sustainable Engineering & Technology

Semester: VII

Notes:

1. There are **TOTAL SEVEN MAIN** questions, each of **20 points**.
2. **QUESTION 1 & 2 is COMPULSORY. Solve any THREE from remaining FIVE QUESTIONS.**
3. Write **answer to each MAIN QUESTION on a new page.**
4. Answers to be accompanied with **appropriate sketches/facts & figures/table or chart/graph/diagram/flowchart** wherever necessary or required.
5. Assume suitable data wherever needed and state it clearly.

| Q. No. | Questions   | Points | CO      | BL    |
|--------|---|--------|---------|-------|
| 1      | <b>Answer the following:</b><br>Explain in short: (4 marks each)  | 20     | 1,2,3,4 | 1,2,3 |
|        | a) Sustainable Engineering and IPAT equation<br>b) Carbon Footprint and Ecological footprint<br>c) Elements of climate resilient pathway<br>d) Material flow analysis ISO definition of LCA<br>e) SDG 7 and SDG 13  |        |         |       |
| 2.     | Solve ANY TWO of the following activity based questions:  | 20     | 1,2     | 1,2,3 |
|        | a) Academic Visit was planned on 4 December 2023 to Centre for Technology Alternatives for Rural Areas (CTARA) at IIT Bombay. A lecture was delivered on developing bamboo concrete composite (bamcrete) arch and column as structural load-bearing elements toward a new technology "Bamcrete". Discuss how this technology contributes to sustainable rural development, addressing specific challenges and opportunities for positive socio-economic and environmental impacts. (10)   |        |         |       |
|        | a) Discuss the key components and objectives of the National Urban Policy Framework, highlighting its significance in the context of sustainable urban development. Analyze the policy's approach to addressing challenges such as urbanization, infrastructure development, housing, and social inclusivity and its potential future directions for the National Urban Policy Framework in promoting resilient and inclusive urban spaces. (10)<br><br>b) Write a detailed note reflecting on the insights shared by Ms. Preeti Chauhan during her guest session held on 8 December 2023 at our institute, highlighting various sustainable development strategies and programs implemented by her organization 'Little Green World' in Ladakh, India to address climate change issues. Discuss key initiatives, their impact on the local community, and the role of community engagement in implementing sustainable practices. (10) |        |         |       |



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**End Semester Re-Examination February 2024**

|    |  |    |     |       |
|----|--|----|-----|-------|
| 3  | a) State and explain the need why sustainability assessment tool/method is a need in civil engineering sector. (10)<br>b) Define 'Risk Assessment' (3). State different methods / tools available for risk assessment (4). Explain any one method of risk assessment (3).              | 20 | 3,4 | 1,2,3 |
| 4. | a) 'Rural development is analogous to economic and social upliftment of the rural poor.' This statement was given by World Bank in 1992. Explain or justify this statement. (8)<br>b) Define Climate change (4), Climate variability (4) and Climate extreme (4) with proper examples. | 20 | 1,2 | 1,2,3 |
| 5. | a) Explain, in brief, the Indian Urban Trajectories (10).<br>b) Explain the difference between Smart cities and Sustainable cities (4).<br>c) Explain: Urban poor (2), Liveability and liveability index (4)   | 20 | 1,2 | 1,2,3 |
| 6. | a) Design a typical material flow analysis (MFA) system for a concrete production process. Explain in detail the input – system boundary – output.(10)<br>b) Explain the basic concept of life cycle assessment (LCA), different stages of LCA and its applications. (10)              | 20 | 3,4 | 1,2,3 |
| 7  | Write a detailed note on: (5 points each)<br>a) Human Interface with Climate<br>b) Bioclimatic design / Architecture and its benefits<br>c) Rural development scenario of India.<br>d) Role of SDG 11 towards building urban resilience  | 20 | 1,2 | 1,2,3 |

-----x---x---x-----





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**End Semester Examination December 2023**

Program: B. Tech. Civil Engineering *Sem VII*

Duration: 3 hrs.

Course Code: PE-BTC742

Maximum Points: 100

Course Name: Sustainable Engineering & Technology

Semester: VII

**Notes:**

1. There are **TOTAL SEVEN MAIN** questions, each of 20 points.
2. **QUESTION 1 & 2 is COMPULSORY.** Solve any **THREE** from remaining **FIVE QUESTIONS.**
3. Write answer to each **MAIN QUESTION** on a new page.
4. Answers to be accompanied with **appropriate sketches/facts & figures/table or chart/graph/diagram/flowchart** wherever necessary or required.
5. Assume suitable data wherever needed and state it clearly.

| Q. No. | Questions  | Points | CO      | BL    |
|--------|--|--------|---------|-------|
| 1      | <p><b>Answer the following:</b></p> <p>a) Define sustainable engineering and technology in a concise manner, highlighting the concept of sustainability and sustainable engineering. (4)</p> <p>b) State the six dimensions of 'Sustainable Development Analytical Grid' (SDAG) for a sustainability assessment. (2)</p> <p>c) State the SDAG assessment methodology. (2)</p> <p>d) Explain how World Bank has visualized rural development. (2)</p> <p>e) State few areas of rural development that demand more focused attention and new initiatives. (2)</p> <p>f) Discuss:<br/>1) tempo of urbanization for the period of 1901-2001 (2)<br/>2) Degree of Urbanization from 2011-2021. (2)</p> <p>g) Define 'Urban poor'. (2)</p> <p>h) State the Climate change mechanisms adopted globally. (2)</p>   | 20     | 1,2,3,4 | 1,2,3 |
| 2.     | <p>a) Academic Visit was planned on 4 December 2023 to Centre for Technology Alternatives for Rural Areas (CTARA) at IIT Bombay. The visit was learning on Technologies for sustainable rural development. Examine the role of innovative technologies showcased at the CTARA during our academic visit. Discuss how these technologies contribute to sustainable rural development, addressing specific challenges and opportunities for positive socio-economic and environmental impacts. Provide examples of the technologies observed and elaborate on their potential applications in the context of rural development. (10)</p> <p>b) Discuss the key components and objectives of the National Urban Policy Framework, highlighting its significance in the context of sustainable urban development. Analyze the policy's approach to addressing challenges such as urbanization, infrastructure development, housing, and social inclusivity and its potential future directions for the National Urban Policy Framework in promoting resilient and inclusive urban spaces. (10)</p> <p>Or</p> <p>b) Write a detailed note reflecting on the insights shared by Ms. Preeti Chauhan during her guest session held on 8 December 2023 at our institute, highlighting</p> | 20     | 1,2     | 1,2,3 |



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**End Semester Examination December 2023**

|    |  |    |     |       |
|----|--|----|-----|-------|
|    | various sustainable development strategies and programs implemented by her organization 'Little Green World' in Ladakh, India to address climate change issues. Discuss key initiatives, their impact on the local community, and the role of community engagement in implementing sustainable practices. (10)   |    |     |       |
| 3  | a) State and explain the basic requirements of any sustainability assessment tool/method. (10)<br>b) Explain the 'Meta principle' of sustainability assessment. (4)<br>c) For a risk assessment approach, explain, in short: (6 – 2 points each).<br>i) Applied dose ii) Absorbed dose iii) Reference Dose.  | 20 | 3,4 | 1,2,3 |
| 4. | a) Discuss the methodologies adopted for defining 'Rural'. (6)<br>b) Discuss the need of rural development in India. (4)<br>c) Give the definition of 'Climate change' as per UNFCCC. (2) State the objectives of SDG 13 – Climate change. (3)<br>d) Explain how IPCC (2014) has explained 'Climate variability' and 'Climate extreme'. (5)  | 20 | 1,2 | 1,2,3 |
| 5. | a) Explain, in brief, the pattern of urbanization in India'. (6)<br>b) Discuss in brief how the definition of 'Urban' has evolved from 1961 census till date. (8)<br>c) Define: (6)<br>1) Urban Agglomeration<br>2) Urban Outgrowth<br>3) Sustainable Smart Cities (as per UNECE & ITU)  | 20 | 1,2 | 1,2,3 |
| 6. | a) With a proper real world example, discuss the design principles of a material flow analysis (MFA) for Industrial Ecology (IE). (5)<br>b) Explain the concept of life cycle analysis (LCA) and its significance in evaluating the environmental impact of products or processes. (4)<br>c) Discuss the key stages involved in conducting a life cycle analysis, emphasizing how each stage contributes to a comprehensive assessment.(6)<br>d) Provide examples to illustrate how LCA can be applied to civil engineering product or process.(5) | 20 | 3,4 | 1,2,3 |
| 7  | a) State the primary objectives of planned (rural) development in India. (5)<br>b) State the rural development programmes in India. (3) Give atleast two structural development agencies for rural development. (2)<br>c) Write a note on 'Global Liveability Index (GLI) 2023'. (5)<br>d) Write a note on 'Transformational Change – a Climate resilient pathway'. (5)  | 20 | 1,2 | 1,2,3 |

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**RE EXAMINATION-FEB-2024**

Program: **Civil Engineering**

Duration: 3 hrs.

Course Code: PE-BTC-843

Maximum Points: 100

Course Name: Industrial Wastewater Treatment

Semester: VII

**Notes:**

1. Q.1 is compulsory and attempt any 4 out of remaining All questions are compulsory
2. Illustrate answer with neat sketches wherever required.
3. Make suitable assumptions where necessary and state them clearly.

*Handwritten marks:*  
13/2/24  
13/2/24

| Q.No                             | Questions  | Points    | B<br>L        | C<br>O                 | Module<br>No             |                                  |                                 |         |        |          |          |       |   |     |     |
|----------------------------------|--|-----------|---------------|------------------------|--------------------------|----------------------------------|---------------------------------|---------|--------|----------|----------|-------|---|-----|-----|
| 1.                               | Write a short note on :<br>1. Treatability Study<br>2. Domestic Wastewater Vs Industrial wastewater<br>3. Treatment Flow sheet for Textile Industry<br>4. MBR  | 20        | 1             | 1-3                    | 1-7                      |                                  |                                 |         |        |          |          |       |   |     |     |
| 2                                | 1. Discuss effluent standards prescribed by MoEF.<br>2. What are the main contaminants that need to be removed from water during treatment?  | 10+10     | 2             | 1-3                    | 1                        |                                  |                                 |         |        |          |          |       |   |     |     |
| 3                                | 1. Write a short note on Neutralization, equalization and proportioning of Industrial Wastewater.<br>2. Derive streeter-phelps equation and Determine D.O. deficit profile for 80 km from the following data: Velocity of mix = 0.2 m/sec, R'=0.4, K' = 0.23.<br><table border="1" style="margin: 10px auto;"> <tr> <td>River</td> <td>Flow from STP</td> </tr> <tr> <td>Q=0.4m<sup>3</sup>/s</td> <td>Q=12000m<sup>3</sup>/d</td> </tr> <tr> <td>BOD<sub>5</sub>@20°C =2.5 mg/l</td> <td>BOD<sub>5</sub>@20°C =22 mg/l</td> </tr> <tr> <td>T=20 °C</td> <td>T=25°C</td> </tr> <tr> <td>DO=6mg/l</td> <td>DO=2mg/l</td> </tr> </table> | River     | Flow from STP | Q=0.4m <sup>3</sup> /s | Q=12000m <sup>3</sup> /d | BOD <sub>5</sub> @20°C =2.5 mg/l | BOD <sub>5</sub> @20°C =22 mg/l | T=20 °C | T=25°C | DO=6mg/l | DO=2mg/l | 10+10 | 3 | 1-3 | 2,3 |
| River                            | Flow from STP  |           |               |                        |                          |                                  |                                 |         |        |          |          |       |   |     |     |
| Q=0.4m <sup>3</sup> /s           | Q=12000m <sup>3</sup> /d   |           |               |                        |                          |                                  |                                 |         |        |          |          |       |   |     |     |
| BOD <sub>5</sub> @20°C =2.5 mg/l | BOD <sub>5</sub> @20°C =22 mg/l  |           |               |                        |                          |                                  |                                 |         |        |          |          |       |   |     |     |
| T=20 °C                          | T=25°C   |           |               |                        |                          |                                  |                                 |         |        |          |          |       |   |     |     |
| DO=6mg/l                         | DO=2mg/l   |           |               |                        |                          |                                  |                                 |         |        |          |          |       |   |     |     |
| 4                                | 1. Explain how to select technology for effluent treatment plant.<br>2. Write a short note on self-purification of river and how industrial waste affects the self-purification mechanism.   | 10<br>+10 | 2             | 1-3                    | 2,5                      |                                  |                                 |         |        |          |          |       |   |     |     |
| 5                                | 1. Write a short note on Conditioning and dewatering of sludge<br>2. Write a short note on RBC technologies for treatment  | 10<br>+10 | 3             | 1-3                    | 4                        |                                  |                                 |         |        |          |          |       |   |     |     |



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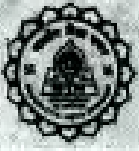
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| of Industrial wastewater. |   |           |   |     |   |
|---------------------------|---|-----------|---|-----|---|
| 6                         | Explain manufacturing processes, wastewater sources, and wastewater characteristics, Treatment used in following Industries,<br>1. Tannery Industry<br>2. Dyes Industry     | 10<br>+10 | 2 | 1-3 | 6 |
| 7                         | Explain manufacturing processes, wastewater sources, and wastewater characteristics, Treatment used in following Industries,<br>3. Sugar Industry<br>4. Distillery Industry | 10<br>+10 | 2 | 1-3 | 6 |



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## END SEMESTER EXAMINATION-DEC-2023

Program: Civil Engineering

Duration: 3 hrs.

Course Code: PE-BTC-843

Maximum Points: 100

Course Name: Industrial Wastewater Treatment

Semester: VII

### Notes:

1. Q.1 is compulsory and attempt any 4 out of remaining All questions are compulsory
2. Illustrate answer with neat sketches wherever required.
3. Make suitable assumptions where necessary and state them clearly.

| Q.No  | Questions   | Points       | B<br>L | C<br>O | Module<br>No |             |       |      |     |      |       |       |       |      |                               |      |      |      |      |      |      |      |      |
|---|---|--------------|--------|--------|--------------|-------------|-------|------|-----|------|-------|-------|-------|------|-------------------------------|------|------|------|------|------|------|------|------|
| 1.  | Write a short note on : (Any four)<br>1. Volume Reduction of Industrial waste.<br>2. Zones of self purification of river<br>3. Treatability Study<br>4. Neutralization Tank for industrial wastewater<br>5. Manufacturing process of Tannery Industry<br>6. Common effluent treatment plant.  | 20           | 1      | 1-3    | 1-7          |             |       |      |     |      |       |       |       |      |                               |      |      |      |      |      |      |      |      |
| 2   | A. "Untreated effluents discharged in the Ulhas river in Mumbai's Maharashtra Industrial Development Corporation (MIDC) area turned the water turquoise blue, according to a report submitted to the Supreme Court by non-profit Vanashakti on June 12, 2020. Discuss the above statement with impact of industrial effluent on stream & Municipal Sewage Treatment Plant.<br>B. What is Industrial waste? How is it different from domestic sewage?<br>C. Write a short note on: Eutrophication. | 08+08<br>+04 | 2      | 1-3    | 1            |             |       |      |     |      |       |       |       |      |                               |      |      |      |      |      |      |      |      |
| 3   | A. What do you mean by Equalization of industrial wastewater? What are the purposes of Equalization basin in effluent treatment plants? Determine the volume of equalization basin from the following data of time period and average flow.   | 10+10        | 3      | 1-3    | 2,3          |             |       |      |     |      |       |       |       |      |                               |      |      |      |      |      |      |      |      |
| <table border="1"> <thead> <tr> <th>Time period</th> <th>M-3</th> <th>3-6</th> <th>6-9</th> <th>9-12</th> <th>12-15</th> <th>15-18</th> <th>18-21</th> <th>21-M</th> </tr> </thead> <tbody> <tr> <td>Avg. Flow (m<sup>3</sup>/s)</td> <td>0.22</td> <td>0.37</td> <td>0.42</td> <td>0.32</td> <td>0.32</td> <td>0.27</td> <td>0.35</td> <td>0.25</td> </tr> </tbody> </table> |   |              |        |        |              | Time period | M-3   | 3-6  | 6-9 | 9-12 | 12-15 | 15-18 | 18-21 | 21-M | Avg. Flow (m <sup>3</sup> /s) | 0.22 | 0.37 | 0.42 | 0.32 | 0.32 | 0.27 | 0.35 | 0.25 |
| Time period   | M-3   | 3-6          | 6-9    | 9-12   | 12-15        | 15-18       | 18-21 | 21-M |     |      |       |       |       |      |                               |      |      |      |      |      |      |      |      |
| Avg. Flow (m <sup>3</sup> /s)   | 0.22  | 0.37         | 0.42   | 0.32   | 0.32         | 0.27        | 0.35  | 0.25 |     |      |       |       |       |      |                               |      |      |      |      |      |      |      |      |



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|   |  |            |   |     |     |
|---|--|------------|---|-----|-----|
|   | <p>B. Draw &amp; discuss oxygen Sag curve and Determine D.O. deficit profile for 80 km from the following data: Velocity of mix = 0.2 m/sec, <math>R' = 0.4</math>, <math>K' = 0.23</math>.</p> <p>River<br/> <math>Q = 0.6 \text{ m}^3/\text{s}</math><br/> <math>\text{BOD}_5@20^\circ\text{C} = 3 \text{ mg/l}</math><br/> <math>T = 20^\circ\text{C}</math><br/> <math>\text{DO} = 8 \text{ mg/l}</math></p> <p>Flow from STP<br/> <math>Q = 20000 \text{ m}^3/\text{d}</math><br/> <math>\text{BOD}_5@20^\circ\text{C} = 40 \text{ mg/l}</math><br/> <math>T = 26^\circ\text{C}</math><br/> <math>\text{DO} = 2 \text{ mg/l}</math></p>   |            |   |     |     |
| 4 | <p>A. Write a short note on: Minimata Disease.</p> <p>B. A design wastewater flow of 1.5 MGD containing 175 mg/L BOD (in the primary effluent) is to be treated in an MBBR reactor.</p> <p>a) What is the BOD loading rate to the reactor in g/day?</p> <p>b) What would be a suitable design SALR to use for a target of 90-95% removal?</p> <p>c) If the MBBR carrier has a specific surface area of 600 <math>\text{m}^2/\text{m}^3</math> and design carrier fill % of 40%, what would be the required volume of carrier and required MBBR tank volume?</p> <p>d) If the design carrier % void space is 60%, what would be the volume of liquid in the MBBR reactor?</p> <p>e) If the design peak hour factor is 4, calculate the average hydraulic retention time at design average wastewater flow and at design peak hourly wastewater flow.</p> <p>C. Discuss the working principle of moving bed biofilm reactor with advantages and disadvantages.</p> | 10<br>+5+5 | 2 | 1-3 | 2,5 |
| 5 | <p>1. Write a short note on constructed wetland system for treatment of Industrial wastewater.</p> <p>2. Discuss the various membrane processes used in treatment of Industrial wastewater.</p>  | 10<br>+10  | 3 | 1-3 | 4   |
| 6 | <p>A. Discuss the process flow diagram of disposal of Industrial sludge.</p> <p>B. Explain flow sheet manufacturing process of Textile Industry with characteristics &amp; Treatment</p>   | 10<br>+10  | 2 | 1-3 | 6   |
| 7 | <p>A. "A distillery in Meerut district of Uttar Pradesh has been directed to pay environmental compensation of Rs. one crore for generating substantial quantity of effluent and discharging it into a drain which meets river Kali." – The Hindu. Discuss the above statement with manufacturing process, wastewater sources, wastewater characteristics, and Treatment flowsheet of distillery Industry.</p> <p>B. "Converting waste to energy: a sugar mill finds a new way" – The Indian Express dated 22 Dec, 2023. Support</p>   | 8+ 12      | 2 | 1-3 | 6   |



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the above statement with recycling potential of Sugar Industry.

## Typical Design Values for MBBR reactors at 15°C

| Purpose            | Treatment Target<br>% Removal | Design SALR<br>g/m <sup>2</sup> -d |
|--------------------|-------------------------------|------------------------------------|
| <b>BOD Removal</b> |                               |                                    |
| High Rate          | 75 - 80 (BOD <sub>7</sub> )   | 25 (BOD <sub>7</sub> )             |
| Normal Rate        | 85 - 90 (BOD <sub>7</sub> )   | 15 (BOD <sub>7</sub> )             |
| Low Rate           | 90 - 95 (BOD <sub>7</sub> )   | 7.5 (BOD <sub>7</sub> )            |



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Re-Examinations Feb 2024

Program: *B.Tech* Civil Engineering *Sem VII*

Duration: 3hr

Course Code: PE-BTC751

Maximum Points: 100

Course Name: Engineering Risk and Uncertainty

Semester: VII

## Instructions:

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

*13/2/24*

| Q.No. | Questions   | Points | CO  | BL  | PI             |
|-------|---|--------|-----|-----|----------------|
| 1(a)  | Discuss the need and importance integrated risk management.   | 6      | CO1 | BL2 | 1              |
| 1(b)  | Brief about the need for the development of risk register along with contents of risk register.                           | 5      | CO1 | BL2 | 2              |
| 1(c)  | Discuss the project risks that may emerge during the construction project life cycle and their direct consequences.       | 9      | CO1 | BL4 | 1              |
| 2(a)  | Discuss FMEA and FMECA  | 6      | CO1 | BL2 | 1.3.1          |
| 2(b)  | Explain in depth the process of risk assessment along with process flow chart as per IS 15883 (Part 8) : 2015             | 8      | CO1 | BL2 | 2.1.1          |
| 2(c)  | Brief about the steps in risk management with the help of flow chart.   | 6      | CO1 | BL3 | 1.3.1          |
| 3(a)  | Identify the risk in the following construction project and tabulate the risk and their mitigation measures.              | 10     | CO2 | BL3 | 2.3.1          |
|       | Laying of a drainage line in the area such as MCGM where some portion consists of rigid pavement road.                    |        |     |     |                |
| 3(b)  | Discuss various techniques that may be used for quantitative risk analysis as per IS 15883 (Part 8):2015.                 | 10     | CO3 | BL3 | 1.2.1<br>3.1.4 |
| 4(a)  | Hindustan Construction Company has 3 mutually exclusive project alternatives for expanding their Business.                | 9      | CO2 | BL4 | 2.1.1          |
|       | Each alternative has insignificant salvage value at the end of its life. The details are as given below. Life is 10 years |        |     |     |                |



| Project | Initial cost ₹ | Annual Maintenance cost ₹ |
|---------|----------------|---------------------------|
| A1      | 25,00,000      | 9,00,000                  |
| A2      | 20,00,000      | 7,00,000                  |
| A3      | 30,00,000      | 10,00,000                 |

Assuming an interest rate of 20% compounded annually, find the best project alternative for expanding the business operation of the company using annual equivalent method.

|       |   |    |     |     |                |
|-------|---|----|-----|-----|----------------|
| 4(b)  | Discuss process of Risk analysis and Management for projects (RAMP)   | 6  | CO1 | BL2 | 2.1.1          |
| 4(c)  | Discuss risk management plan as IS 15883 (Part 8) : 2015.   | 5  | CO3 | BL1 | 2.4.1<br>3.1.4 |
| 5(a)  | A steel manufacturing company is concerned with the possibility of a strike.  | 8  | CO2 | BL4 | 2.3.2          |
|       | <p>It will cost an extra Rs. 30,000/- to acquire an adequate stockpile. If there is a strike and company has not stockpiled management estimates an additional expenses of Rs. 70,000/- on account of lost sales. Should the company stockpile or not if it is to use following criteria.</p> <p>(i) Optimistic criteria<br/> (ii) Hurwicz criteria for <math>\alpha=0.5</math><br/> (iii) Regret criterion<br/> (iv) Laplace criterion</p> |    |     |     |                |
| 5(b)  | Brief about the need of development of Hybrid annuity model.  | 6  | CO1 | BL2 | 1.2.1          |
| 5 (c) | Discuss RPN and its significance in risk management process.  | 6  | CO1 | BL3 | 2.1.2          |
| 6(a)  | Discuss in detail management and mitigation of rare events.   | 8  | CO1 | BL3 | 3.1.1          |
| 6(b)  | Discuss in detail process of risk management and mitigation for the risk in PPP-highway projects.   | 8  | CO3 | BL2 | 1.2.1          |
| 6 (c) | Define HAM and differentiate NAHI HAM and Maharashtra PWD HAM.  | 4  | CO3 | BL1 | 1.2.1          |
| 7(a)  | Hari-Om plumbing and heating maintains a stock of 30 liter hot water heaters that it sells to and install for homeowners.   | 12 | CO2 | BL4 | 2.2.4          |
|       | Owner of Hari-Om plumbing likes the idea of having a large supply at hand   |    |     |     |                |

to meet customer demand, but he also recognizes that it is expensive to do so. He examines hot water heater sales over the past 50 weeks and notes the data given below

| Hot water heater sales per week | Number of weeks this number was sold |
|---------------------------------|--------------------------------------|
| 4                               | 6                                    |
| 5                               | 5                                    |
| 6                               | 9                                    |
| 7                               | 12                                   |
| 8                               | 8                                    |
| 9                               | 7                                    |
| 10                              | 3                                    |
| Total                           | 50                                   |

- a) If Hari-Om plumbing maintains a constant supply of 8 hot water heaters in any given week, how many times will he be out of stock during a 20 week simulation? Use random numbers as:10,24,03,32,23,59,95,34,34,51,08,48,66,97,03,96,46,74,77,44.
- b) What is the average number of sales per week (including stock outs) over the 20 weeks period?
- c) Using an analytic non simulation technique, what is expects number of sales per week? Also compare average number of sales per week for 20 weeks with answer from analytic non simulation technique.

|       |   |   |     |     |       |
|-------|---|---|-----|-----|-------|
| 7 (b) | Discuss in brief about advantages of HAM compared to BOT PPP Model in the context of risk management. | 8 | CO3 | BL2 | 2.4.1 |
|-------|---|---|-----|-----|-------|



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**END SEMESTER EXAMINATION DECEMBER 2023**

Program: **Civil Engineering** *SEM VII*

Duration: 3hr

Course Code: PE-BTC751

Maximum Points: 100

Course Name: Engineering Risk and Uncertainty

Semester: VII

**Instructions:**

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

*M/M*

| Q.No. | Questions   | Points | CO         | BL  | Module No. |
|-------|---|--------|------------|-----|------------|
| 1a    | You are laying water supply pipeline in a corporation area, which passes through underground. Discuss the above construction work in the context of systematic risk management.   | 8      | CO1<br>CO3 | BL5 | 1          |
| 1b    | Describe risk priority number and risk register.  | 5      | CO1        | BL2 | 3          |
| 1c    | Carry out identification and risk analysis in case of flyover construction at place like Eastern Express highway in Mumbai.   | 7      | CO1<br>CO3 | BL5 | 3          |
| 2a    | An alternative, A requires an initial investment of Rs. 5,00,000 and an annual expense of Rs 2,50,000 for the next 10 years. Alternative B, on the other hand, requires an initial investment of Rs. 7,50,000 and an annual expense of Rs 2,00,000 for the next 10 years. Which alternative would you prefer if interest rate were 10%. | 5      | CO2        | BL2 | 5          |
| 2b    | Discuss the role of insurance in risk management and areas in construction project risk where insurance is possible.  | 5      | CO1        | BL3 | 2          |
| 2c    | Define PPP and discuss the typical risk in the context of Road project.   | 6      | CO1        | BL2 | 7          |

**END SEMESTER EXAMINATION DECEMBER 2023**

| 2d | Discuss about Break Even Analysis and its importance.   | 4         | CO1        | BL2       | 5         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
|----|---|-----------|------------|-----------|-----------|-----------|----|-------|------|-------|--------|----|--------|-------|-----|---|----|--------|--------|-------|-------|---|-----|-----|---|
| 3a | Discuss in detail management and mitigation of rare events.   | 6         | CO1        | BL3       | 2         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 3b | Describe risk response planning.  | 4         | CO1        | BL2       | 2         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 3c | Discuss FMEA and FMECA.   | 5         | CO1        | BL2       | 3         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 3d | Discuss in detail HAM with suitable case study.   | 5         | CO2        | BL2       | 7         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 4a | Carry out identification and risk analysis and its management in case of Commercial building construction in Mumbai where restriction of space for storage of material and other activities.  | 6         | CO1<br>CO3 | BL2       | 3         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 4b | Differentiate between Risk and Uncertainty.   | 6         | CO1        | BL2       | 1         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 4C | The following matrix gives the payoff of different strategies S1, S2,S3 against the events N1,N2, N3, and N4 in rupees<br><table border="1" data-bbox="338 1288 933 1621"><thead><tr><th></th><th>N1 in Rs.</th><th>N2 in Rs.</th><th>N3 in Rs.</th><th>N4 in Rs.</th></tr></thead><tbody><tr><td>S1</td><td>4,000</td><td>-100</td><td>6,000</td><td>18,000</td></tr><tr><td>S2</td><td>20,000</td><td>5,000</td><td>400</td><td>0</td></tr><tr><td>S3</td><td>20,000</td><td>15,000</td><td>-2000</td><td>1,000</td></tr></tbody></table> <p>Indicate the decision taken under the following approach<br/>Pessimistic<br/>Optimistic<br/>Regret<br/>Equal probability</p> |           | N1 in Rs.  | N2 in Rs. | N3 in Rs. | N4 in Rs. | S1 | 4,000 | -100 | 6,000 | 18,000 | S2 | 20,000 | 5,000 | 400 | 0 | S3 | 20,000 | 15,000 | -2000 | 1,000 | 8 | CO2 | BL5 | 5 |
|    | N1 in Rs.   | N2 in Rs. | N3 in Rs.  | N4 in Rs. |           |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| S1 | 4,000   | -100      | 6,000      | 18,000    |           |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| S2 | 20,000  | 5,000     | 400        | 0         |           |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| S3 | 20,000  | 15,000    | -2000      | 1,000     |           |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |
| 5a | Discuss process of Risk analysis and Management for projects (RAMP).  | 6         | CO1        | BL2       | 3         |           |    |       |      |       |        |    |        |       |     |   |    |        |        |       |       |   |     |     |   |

**END SEMESTER EXAMINATION DECEMBER 2023**

|    |   |   |     |     |   |
|----|---|---|-----|-----|---|
| 5b | Discuss risk management plan as IS 15883 (Part 8) : 2015.   | 6 | CO3 | BL1 | 3 |
| 5c | The Indian Yatch company has developed a new cabin cruiser which they have earmarked for the medium to large boat market. A market analysis has a 30% probability of annual sales being 5,000 boats, a 40% probability of 4000 annual sales and a 30% probability of 3000 annual sales. The company can go into limited production, where variable costs are Rs 10,000 per boat and fixed cost are 8,00,000 annually. Alternatively they can go into full scale production, where variable costs are rs.9,000 per boat and fixed cost are 50,00,000 annually. If the new boat is to be sold for Rs.11,000 should the company go into limited or full scale production when the objective is to maximize the expected profits? Draw decision tree. | 8 | CO1 | BL4 | 5 |
| 6a | Discuss RPN and its significance in risk management process.  | 6 | CO1 | BL3 | 3 |
| 6b | Discuss in brief about advantages of HAM compared to BOT PPP Model in the context of risk management.   | 6 | CO3 | BL2 | 7 |
| 6C | A steel manufacturing company is concerned with the possibility of a strike. It will cost an extra Rs. 20,000/- to acquire an adequate stockpile. If there is a strike and company has not stockpiled management estimates an additional expenses of Rs. 60,000/- on account of lost sales. Should the company stockpile or not if it is to use following criteria.<br>(i) Optimistic criteria<br>(ii) Hurwicz criteria for $\alpha=0.4$<br>(iii) Regret criterion<br>(iv) Laplace criterion  | 8 | CO2 | BL4 | 5 |



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## END SEMESTER EXAMINATION DECEMBER 2023

|    |   |   |     |     |   |
|----|---|---|-----|-----|---|
| 7a | Discuss various techniques that may be used for quantitative risk analysis as per IS 15883 (Part 8):2015. | 8 | CO3 | BL3 | 4 |
| 7b | Brief about the need of development of Hybrid annuity model.  | 4 | CO1 | BL2 | 7 |
| 7c | Describe following with suitable example:<br>i) Scenario analysis<br>ii) Certainty index method           | 8 | CO2 | BL2 | 6 |



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Re-Exam - Feb 2024

Program: B.Tech Civil Engineering *Sem VII*

Duration: 3 Hours

Course Code: PE-BTC726

Maximum Points: 100

Course Name: Prestressed Concrete

Semester: VII

Notes:

- Attempt any 5 main questions.
- Answers to all sub-questions should be grouped together
- Draw neat sketches wherever possible
- Assume suitable data if missing and state the same clearly.
- Use of IS 1343 is allowed

*12/2/24*

| Q.No. | Questions   | Points | CO | BL  | PI             |
|-------|---|--------|----|-----|----------------|
| 1.a)  | A simply supported prestressed I girder has flange dimensions as 2100x350mm and web dimensions as 300x1800mm. It is prestressed using a cable with parabolic profile, such that effective prestressing force is 1900kN. The cable is concentric at supports and has an eccentricity of 400mm at midspan. The girder supports a live load UDL of 10kN/m. Calculate the total stresses induced in the girder at midspan and supports. | 10     | 1  | 3   | 1.4.1<br>2.3.2 |
| 1.b)  | Explain in detail the difference between pre-tensioned and post-tensioned structures  | 05     | 1  | 1,2 | 2.2.4          |
| 1.c)  | Explain the need of high strength materials in prestressed concrete structures  | 05     | 1  | 1,2 | 2.2.4          |
| 2.a)  | Calculate the flexural capacity of a post-tensioned (bonded) I girder having the following properties:<br>Flange = (1400x250)mm<br>Web = (350x2000)mm<br>Area of cables = 3000mm <sup>2</sup><br>f <sub>p</sub> = 1650MPa<br>Effective depth = 2250mm<br>f <sub>ck</sub> = 40MPa  | 10     | 1  | 3   | 3.1.4          |
| 2.b)  | Design the shear reinforcement <i>at quarter span</i> for a simply supported beam of rectangular cross section 300mmx800mm and span 12m. It carries a live load UDL of 7kN/m(unfactored). It is prestressed by a straight cable that is having eccentricity of 200mm<br>f <sub>ck</sub> = 40MPa   | 10     | 2  | 4   | 3.1.4          |



|         | Effective prestress in cable = 1200MPa<br>Characteristic strength of PT steel = 1600MPa<br>Use Fe415 grade steel for reinforcement.  |                         |                         |                         |                         |         |           |                       |                       |         |          |                 |                 |    |   |   |       |
|---------|--|-------------------------|-------------------------|-------------------------|-------------------------|---------|-----------|-----------------------|-----------------------|---------|----------|-----------------|-----------------|----|---|---|-------|
| 3.a)    | <p>A simply supported post tensioned beam of span 18m with 2 cables having a cross section of 300mmX 900mm is successively tensioned from a single end in the order of cables 1-2.</p> <table border="1"> <thead> <tr> <th></th> <th>Profile</th> <th>Eccentricity at midspan</th> <th>Eccentricity at support</th> </tr> </thead> <tbody> <tr> <td>Cable 1</td> <td>Parabolic</td> <td>200mm<br/>(below N.A.)</td> <td>150mm<br/>(above N.A.)</td> </tr> <tr> <td>Cable 2</td> <td>Straight</td> <td>350mm(below NA)</td> <td>350mm(below NA)</td> </tr> </tbody> </table> <p>Each cable has a cross section area of 300mm<sup>2</sup> and an initial tension of 1200MPa. Co-efficient for friction = 0.5; co-efficient for wave effect = 0.0015/m. Age of concrete at transfer of prestress = 28days. Anchorage slip = 4mm. <math>E_s = 210\text{kN/mm}^2</math>, <math>E_c = 30\text{kN/mm}^2</math>.<br/>Calculate the % losses due to elastic shortening, shrinkage (at 100days), friction and anchorage slip</p> |                         | Profile                 | Eccentricity at midspan | Eccentricity at support | Cable 1 | Parabolic | 200mm<br>(below N.A.) | 150mm<br>(above N.A.) | Cable 2 | Straight | 350mm(below NA) | 350mm(below NA) | 15 | 1 | 3 | 2.2.1 |
|         | Profile  | Eccentricity at midspan | Eccentricity at support |                         |                         |         |           |                       |                       |         |          |                 |                 |    |   |   |       |
| Cable 1 | Parabolic  | 200mm<br>(below N.A.)   | 150mm<br>(above N.A.)   |                         |                         |         |           |                       |                       |         |          |                 |                 |    |   |   |       |
| Cable 2 | Straight   | 350mm(below NA)         | 350mm(below NA)         |                         |                         |         |           |                       |                       |         |          |                 |                 |    |   |   |       |
| 3.b)    | Explain the concept of debonding of cables.  | 5                       | 1,3                     | 2                       | 1.4.1                   |         |           |                       |                       |         |          |                 |                 |    |   |   |       |
| 4       | <p>Design a Type 1 post tensioned bonded girder (simply supported) for the following data :</p> <p>Effective span = 20m<br/>Live load = 18kN/m<br/><math>f_{ck} = 40\text{MPa}</math><br/><math>f_{ci} = 30\text{MPa}</math><br/><math>E_s = 210\text{kN/mm}^2</math><br/><math>E_c = 31.6\text{ kN/mm}^2</math><br/>Assumed loss % = 30%</p> <p>Use 8mm<math>\phi</math> strands for cables. The characteristic strength of cables is 1500MPa. Calculate the size of section required, prestressing force, eccentricity with safe cable zone. Draw neat sketch of the cable profile</p>   | 20                      | 2                       | 4                       | 3.1.4<br>3.2.1          |         |           |                       |                       |         |          |                 |                 |    |   |   |       |
| 5.a)    | <p>A 14m span simply supported composite beam consists of 300mmX700mm precast stem and a cast-in-situ flange of 600mmX400mm. The stem is a post tensioned unit subjected to an initial prestressing force of 900kN. The tendons are provided at 150mm from the soffit of stem. The beam has to support a live load of 10kN/m. Determine the resultant stress distribution in the beam if</p>   | 15                      | 1                       | 3                       | 2.2.1<br>1.4.1          |         |           |                       |                       |         |          |                 |                 |    |   |   |       |





Bharatiya Vidya Bhavan's

# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058



End Semester Examination - December 2023

Program: B.Tech Civil Engineering *sem VII*

Duration: 3 Hours

Course Code: PE-BTC726

Maximum Points: 100

Course Name: Prestressed Concrete

Semester: VII

Notes:

- Attempt any 5 main questions.
- Answers to all sub-questions should be grouped together
- Draw neat sketches wherever possible
- Assume suitable data if missing and state the same clearly.
- Use of IS 1343-2012 is allowed

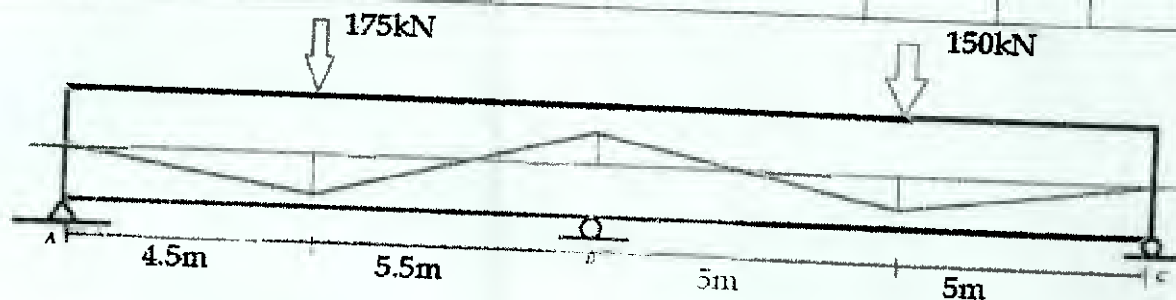
| Q.No. | Questions   | Points | CO | BL  | Module no. |
|-------|---|--------|----|-----|------------|
| 1.a)  | A rectangular concrete beam of cross-section 250x450mm is prestressed by means of 15 wires of 5 mm diameter located 65 mm from the bottom of the beam and 3 wires of diameter of 5 mm, 25 mm from the top. The effective prestress in the steel is 750 N/mm <sup>2</sup> , calculate the stresses at the extreme fibres of the mid-span section when the beam is supporting only its own weight over a span of 6 m.<br>Also, calculate the extreme fibre stress at midspan if a uniformly distributed live load of 6 kN/m is imposed. | 10     | 1  | 3   | 02         |
| 1.b)  | Explain in detail the difference between pre-tensioned and post-tensioned structures  | 05     | 1  | 1,2 | 01         |
| 1.c)  | Explain the concept of de-bonding of cables   | 05     | 1  | 1,2 | 02         |
| 2.a)  | An unsymmetrical I-section has an overall depth of 2000 mm. The top flange width and depth are equal to 1200 and 300 mm, respectively, and the bottom flange width and depth are equal to 750 and 200 mm, respectively. The thickness of the web is 300 mm. The tendons having a cross-sectional area of 7000 mm <sup>2</sup> are located 200 mm from the soffit.<br>$f_{ck} = 45\text{MPa}$ , $f_{pu} = 1750\text{N/mm}^2$<br>Calculate the flexural strength of the section.  | 10     | 1  | 3   | 03         |
| 2.b)  | Design the shear reinforcement <i>at quarter span</i> for a simply supported beam of rectangular cross section 300mmx800mm and span 10m. It carries a live load UDL of 8.5kN/m. It is prestressed by a straight cable that is   | 10     | 2  | 4   | 03         |

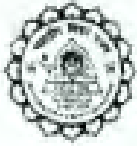


|         | <p>having eccentricity of 200mm<br/> <math>f_{ck} = 40\text{MPa}</math><br/>           Effective prestress in cable = 1100MPa<br/>           Characteristic strength of PT steel = 1600MPa<br/>           Use Fe415 grade steel for reinforcement.</p>   |                         |                         |                         |                         |         |           |                       |     |         |          |                 |                 |    |   |   |    |
|---------|--|-------------------------|-------------------------|-------------------------|-------------------------|---------|-----------|-----------------------|-----|---------|----------|-----------------|-----------------|----|---|---|----|
| 3.a)    | <p>A simply supported post tensioned beam of span 18m with 2 cables having a cross section of 300mmX 900mm is successively tensioned from a single end in the order of cables 1-2.</p> <table border="1"> <thead> <tr> <th></th> <th>Profile</th> <th>Eccentricity at midspan</th> <th>Eccentricity at support</th> </tr> </thead> <tbody> <tr> <td>Cable 1</td> <td>Parabolic</td> <td>250mm<br/>(below N.A.)</td> <td>0mm</td> </tr> <tr> <td>Cable 2</td> <td>Straight</td> <td>350mm(below NA)</td> <td>350mm(below NA)</td> </tr> </tbody> </table> <p>Each cable has a cross section area of 350mm<sup>2</sup> and an initial tension of 1200MPa. Co-efficient for friction = 0.45; co-efficient for wave effect = 0.0015/m. Anchorage slip = 4mm. <math>E_s = 210\text{kN/mm}^2</math>, <math>E_c = 30\text{kN/mm}^2</math>.<br/>           Calculate the % losses due to elastic shortening, friction and anchorage slip</p> |                         | Profile                 | Eccentricity at midspan | Eccentricity at support | Cable 1 | Parabolic | 250mm<br>(below N.A.) | 0mm | Cable 2 | Straight | 350mm(below NA) | 350mm(below NA) | 12 | 1 | 3 | 02 |
|         | Profile  | Eccentricity at midspan | Eccentricity at support |                         |                         |         |           |                       |     |         |          |                 |                 |    |   |   |    |
| Cable 1 | Parabolic  | 250mm<br>(below N.A.)   | 0mm                     |                         |                         |         |           |                       |     |         |          |                 |                 |    |   |   |    |
| Cable 2 | Straight   | 350mm(below NA)         | 350mm(below NA)         |                         |                         |         |           |                       |     |         |          |                 |                 |    |   |   |    |
| 3.b)    | <p>Explain the advantages and disadvantages of using prestressed concrete sections instead of RCC</p>  | 08                      | 1,3                     | 2                       | 01                      |         |           |                       |     |         |          |                 |                 |    |   |   |    |
| 4.      | <p>Design a Type 1 pretensioned girder (simply supported) for the following data :<br/>           Effective span = 12m<br/>           Live load = 18kN/m<br/> <math>f_{ck} = 40\text{MPa}</math><br/> <math>f_{ci} = 30\text{MPa}</math><br/> <math>E_s = 210\text{kN/mm}^2</math><br/> <math>E_c = 31.6\text{ kN/mm}^2</math><br/>           Assumed loss % = 30%<br/>           Use 8mm<math>\phi</math> strands for cables. The characteristic strength of cables is 1200MPa. Calculate the size of section required, prestressing force, eccentricity. Draw neat sketch of the cable profile</p>   | 20                      | 2                       | 4                       | 05                      |         |           |                       |     |         |          |                 |                 |    |   |   |    |
| 5.      | <p>A 15m span simply supported composite beam consists of 300mmX900mm precast stem and a cast-in-situ flange of 600mmX250mm. The stem is a post tensioned unit subjected to a prestressing force of 1000kN. The tendons are provided at 150mm from the soffit of stem. The beam has to support a live load of 10kN/m.<br/>           Determine the resultant stress distribution in the beam if</p>  | 20                      | 1                       | 3                       | 06                      |         |           |                       |     |         |          |                 |                 |    |   |   |    |



|           | the beam is a) unpropped; b) propped   |                         |                         |                         |           |                    |                   |    |   |   |    |
|-----------|--|-------------------------|-------------------------|-------------------------|-----------|--------------------|-------------------|----|---|---|----|
|           | Draw the stress variation diagram due to each load for both the cases  |                         |                         |                         |           |                    |                   |    |   |   |    |
| 6.a)      | <p>a) Derive the expression for deflection in a simply supported beam due to parabolic prestressing profile having eccentricities at end = <math>e_1</math> (Above CG) and at midspan = <math>e_2</math> (Below CG)</p> <p>b) A simply supported prestressed beam of cross section 450mmX900mm and span 12m has the following cable profile:</p> <table border="1"> <thead> <tr> <th>Profile</th> <th>Eccentricity at midspan</th> <th>Eccentricity at support</th> </tr> </thead> <tbody> <tr> <td>Parabolic</td> <td>250mm (below N.A.)</td> <td>50mm (above N.A.)</td> </tr> </tbody> </table> <p>It carries a live load of 12kN/m. The area of each cable is 600mm<sup>2</sup> and it is initially tensioned to 1250N/mm<sup>2</sup>. Losses = 25%<br/>Calculate the :</p> <ol style="list-style-type: none"> <li>Instantaneous deflection due to dead load + prestressing force</li> <li>Long term deflection if the creep coefficient is 1.6</li> </ol> <p><math>E_s = 210 \text{ kN/mm}^2</math>; <math>E_c = 35 \text{ kN/mm}^2</math></p> | Profile                 | Eccentricity at midspan | Eccentricity at support | Parabolic | 250mm (below N.A.) | 50mm (above N.A.) | 12 | 1 | 3 | 03 |
| Profile   | Eccentricity at midspan  | Eccentricity at support |                         |                         |           |                    |                   |    |   |   |    |
| Parabolic | 250mm (below N.A.)   | 50mm (above N.A.)       |                         |                         |           |                    |                   |    |   |   |    |
| 6.b)      | The end block of a post-tensioned beam is 600 mm wide and 1200 mm deep. Two cables, each carrying a force of 2000 kN, are anchored using square anchor-plates of side 300 mm. The anchor-plate centres are located symmetrically at 300 mm from the top and bottom edges of the beam. Using Fe-415 reinforcement, design suitable reinforcements in the end block.   | 08                      | 2                       | 4                       | 04        |                    |                   |    |   |   |    |
| 7.a)      | The cable profile for a two span continuous beam is as shown in figure below. The prestressing force is 1800kN. Locate the pressure line eccentricity due to prestressing force and the shown loads only.  | 20                      | 3                       | 4                       | 07        |                    |                   |    |   |   |    |



**End Semester Examination December 2023**Program: B. Tech. Civil Engineering *Sem VII*

Duration: 3 hrs.

Course Code: OE-BTC713

Maximum Points: 100

Course Name: Disaster Management &amp; Preparedness

Semester: VII

**Notes:**

1. There are **TOTAL SEVEN MAIN** questions, each of **20 points**.
2. **QUESTION 1 & 2 is COMPULSORY**. Solve any **THREE** from remaining **FIVE QUESTIONS**.
3. Write **answer to each MAIN QUESTION on a new page**.
4. Answers to be accompanied with **appropriate sketches/facts & figures/table or chart/graph/diagram/flowchart** wherever necessary or required.
5. Assume suitable data wherever needed and state it clearly.

*26/12/23*

| Q. No.   | Questions   | Points | CO      | BL    |
|--|---|--------|---------|-------|
| 1  | <b>Answer the following:</b>  | 20     | 1,2,3,4 | 1,2,3 |
|  | 1. Define (4)   |        |         |       |
|  | a) Disaster risk  |        |         |       |
|  | b) Vulnerability  |        |         |       |
|  | c) Disaster management  |        |         |       |
| d) Disaster Impact   |   |        |         |       |
| 2. Give the full forms of: (4)   |   |        |         |       |
| a) NDMA  |   |        |         |       |
| b) IAIA  |   |        |         |       |
| c) DALYs   |   |        |         |       |
| d) NERP  |   |        |         |       |
| 3. State the period (from year - to year) of the frameworks: (3)                       |   |        |         |       |
| a) Yokohoma Strategy   |   |        |         |       |
| b) Hyogo Framework   |   |        |         |       |
| c) Sendai Framwork   |   |        |         |       |
| 4. Draw a neatly labelled schematic diagram showing the disaster management cycle. (5) |   |        |         |       |
| 5. List the disaster sub-types of the following main types of disasters: (4)           |   |        |         |       |
| a) Mass movement (dry) (2)   |   |        |         |       |
| b) Storms (2)  |   |        |         |       |
| 2.A  | State the key factors influencing the impact of Cyclone Michaung on the affected regions, and explain how the local communities, governments, and international organizations respond to mitigate the disaster's effects and enhance resilience. Provide a comprehensive analysis of the cyclone's path, intensity, the vulnerability of the affected areas, and the effectiveness of preparedness and response measures implemented. (10)  | 10     | 1,2,3   | 1,2,3 |
| 2.B  | During the guest session that was arranged in our college on 8 December 2023 on disaster management and preparedness delivered by the MCGM (Municipal Corporation of Greater Mumbai) officer, Mr. Nikhil Mene, discuss the key insights and recommendations provided for enhancing the preparedness to disasters. Outline the main strategies highlighted by the officer, and critically assess their feasibility and potential impact on minimizing risks and improving response capabilities. | 10     | 3       | 1,2,3 |



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**SARDAR PATEL COLLEGE OF ENGINEERING**



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**End Semester Examination December 2023**

|     |  |    |       |       |
|-----|--|----|-------|-------|
|     | Additionally, elaborate on any specific case studies or examples shared during the session to illustrate successful disaster management practices. (10)  |    |       |       |
| 3   | i. State the strategic Goals (3), Outcomes (2) and five Objectives of Hyogo Framework. (5)<br>ii. State the Goal (2), Expected Outcome (1) and seven Global Targets of Sendai Framework. (7)   | 20 | 1,2,3 | 1,2,3 |
| 4.A | i. Explain in short: (6 – 2 points each)<br>a) Hazard Identification b) Risk Analysis c) Risk Evaluation and Risk Control<br>ii. Give the sequential steps of Risk Analysis as per IS 15656: 2006. (4)   | 10 | 4,5   | 1,2,3 |
| 4.B | i. State the commonly used HVRA tools. (4)<br>ii. State various Vulnerability analysis tools. (2).<br>iii. Explain any one vulnerability analysis tool with a proper example. (4)  | 10 | 4,5   | 1,2,3 |
| 5.A | i. Define 'Disaster Deficit Index' and 'Disaster Impact Analysis'. (4)<br>ii. State the steps of Impact assessment. (3)<br>iii. State the Economic Commission for Latin America and the Caribbean (ECLAC) 2003 system for measuring the disaster related damages. (3)  | 10 | 4,5   | 1,2,3 |
| 5.B | Describe the DALYs method of disaster impact measurement. (10)   | 10 | 4,5   |       |
| 6.A | Explain with a proper example the event tree or fault tree analysis method of risk assessment (10)<br>Or<br>Explain with a proper example the indicator based approach of qualitative risk assessment (10)   | 10 | 4,5   | 1,2,3 |
| 6.B | i. State different types of Natural Disaster Impacts. (5)<br>ii. Describe a typical Natural Disaster Impact Mechanism. (5)   | 10 | 3,4,5 | 1,2,3 |
| 7   | Write note on:<br>1. Measures taken by India for Disaster risk reduction. (5)<br>2. India Disaster Resource Network (IDRN) and India Disaster Knowledge Network (IDKN). (5)<br>3. Moving agenda (UN) of Disaster Risk Reduction. (5)<br>4. Structural and Non-Structural Mitigation measures for any natural disaster. (5) | 20 | 3,4,5 | 1,2,3 |

-----X--X--X-----



Bharatiya Vidya Bhavan's

# SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai - 400058



End Semester Examinations December 2023

(2023-24)

Program: B.Tech. Civil/Mechanical/Electrical Engineering (UG)

Duration: 03 Hrs.

Course Code: OE-BTC-714

Maximum Points: 100

Course Name: Engineering System and Development

Semester: VII

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.

26/12/23

| Q. No. | Questions   | Points | CO | BL | PI     |
|--------|---|--------|----|----|--------|
| 1      | (a) Explain the basic principles of engineering profession for a developing society.  | 10     | 1  | 2  | 4.1.1  |
|        | (b) You are one of the team members of an engineering team for commissioning of a new nuclear power plant. Discuss the engineering functions and expected essential roles of the all team members.                    | 10     | 2  | 3  | 9.1.1  |
| 2      | (a) Define sustainability and discuss sustainable development matrix with suitable example in your domain area.   | 10     | 1  | 2  | 7.1.1  |
|        | (b) What is your opinion on economic growth and limitations imposed by environment, technology, or society with respect to dematerialization of the economy, less energy intensive and more equitable in its impacts? | 10     | 3  | 4  | 9.2.1  |
| 3      | (a) What is HDI? Suggest suitable measure to improve it w.r.t. life expectancy, years of schooling and the Gross National Income (GNI) per capita of the country.   | 10     | 1  | 2  | 11.3.2 |
|        | (b) What does the Organization for Economic Co-operation and Development (OECD) do? Discuss the structural reform priorities with respect to labour market.   | 10     | 2  | 3  | 11.1.1 |
| 4      | (a) Discuss the role of National Institution for Transforming India (NITI Aayog) in development and state its different verticals.  | 10     | 1  | 2  | 12.1.1 |
|        | (b) What is development engineering? Discuss its role in development of drinking water, electricity and small scale industries sectors.   | 10     | 2  | 4  | 12.1.1 |
| 5      | (a) Discuss (i) The effect of seasonal variation on development; and (ii) Importance of service and manufacturing sector  | 10     | 2  | 2  | 11.3.2 |
|        | (b) What is your opinion on multidimensional perspective of the changing dynamics of industry/system due to digitization and communication?   | 10     | 3  | 5  | 11.3.2 |



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Munshi Nagar, Andheri (W) Mumbai - 400058



**End Semester Examinations December 2023**

**(2023-24)**

|   |  |    |   |   |        |
|---|--|----|---|---|--------|
| 6 | (a) What the word paradigm indicates? Does everyone use same paradigm? Discuss w.r.t. goals of development and development thoughts. | 10 | 2 | 4 | 9.2.1  |
|   | (b) Explain classical model of development and growth stage theory.  | 10 | 1 | 2 | 4.1.1  |
| 7 | (a) Discuss the role of natural resources in economy and development.  | 10 | 2 | 3 | 4.1.1  |
|   | (b) Discuss the role of human capital in system and business development.  | 10 | 3 | 5 | 11.1.3 |

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