Maximum Marks: 60
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing. Notations used have their usual meaning.
Use of IS: 456-2000 Code is allowed and list the relevant clauses of the code while solving the problem.

Q. No. Question M.M.
1 (a) Explain flange action of a T beam? [03]
1 (b) Design a rectangular beam for an effective span of 4m which is subjected to a dead load of 15kN/m and a live load of 12 kN/m. Use M20 and Fe500 concrete and steel grade respectively. Provide nominal clear cover to meet the requirement of fire resistance rating of 2hrs and durability requirements for severe exposure. Assume the width of beam as 300mm. Show the reinforcement details with neat sketches. List the relevant clauses of the IS 456-2000 while solving the design problem. [09]

2 (a) Describe the modes of shear failure depending on the ratio of shear span to effective depth (a/d). [03]
(b) Design a beam 400 x 650mm subjected to a bending moment of 150 kNm, twisting moment of 20 kNm and a shear force of 100 kN at collapse. Use M20 concrete mix and Fe415 steel grade. [09]

OR

2′(a) Deduce the formula for the calculation of development length in R C structure with standard notations. [03]
2′(b) A R C beam of section 300 x 400 mm is reinforced with 3 bars of 20 mm diameter at support. The span of the beam is 5m and rate of UDL is 36 kN/m. Design the shear reinforcement with only vertical stirrups. Use M20 concrete mix and Fe415 steel grade. Also show a neat sketch of reinforcement detail. [09]
3(a) Draw the $P_n-M_n$ interaction curve for axially loaded column and describe its salient feature.

3(b) Design a circular short R.C. column to carry a working axial load of 1000kN and an ultimate bending moment of 60 kNm as effectively held in position at both ends and restrained against rotation at one end. The unsupported length of the column is 4m. Use M20 concrete mix and Fe415 steel grade. Assume clear cover as 40mm. Show a neat sketch of reinforcement detail.

4. Design a slab of a multi panel floor system with all four edges continuous and centre to centre spans of 4.2m x 4.2m. Assume a live load of 3.5 kN/m$^2$ and a floor finish of 1 kN/m$^2$. Assume concrete grade as M20 and steel grade as Fe415. Show a neat sketch of reinforcement details in the middle strips.

OR

4'(a) Explain punching shear failure in flat slabs.

4'(b) Design an interior panel of a flat slab. The slab is supported on columns spaced at 4m in both the directions. The size of the column is 550mm x 550mm. Assume a live load of 3.5 kN/m$^2$ and a floor finish of 1 kN/m$^2$. Height of the column is 6m. Assume concrete grade as M25 and steel grade as Fe415. Show a neat sketch of reinforcement details in the column strips only.

5. Design the footing of a square column of size 300 x 300 mm with 8# 16mm diameter to carry a working load of 600 kN for the following data

- Bearing capacity of soil: 100 kN/m$^2$
- Concrete grade: M20
- Steel grade: Fe415

Also show a neat reinforcement detail of the footing and column.
Chart 58 COMPRESSION WITH BENDING — Circular Section

\[ f_y = 415 \text{ N/mm}^2 \]

\[ d/D = 0.20 \]

\[ A_s = \pi D^2/400 \]

\[ \text{AXIS OF BENDING} \]
1(a) List the various methods of determining the moisture content of soil.

1(b) Explain the density bottle method of determining the specific gravity of soil solids.

1(c) A 1000 cubic centimetre core cutter weighing 946.80 gm was used to find out the in situ unit weight of an embankment. The weight of core cutter filled with soil was noted to be 2770.60 gm. Laboratory tests on the soil sample indicate a water content of 10.45% and specific gravity of solids 2.65. Determine the bulk unit weight, dry unit weight, void ratio and degree of saturation of the sample. If the embankment becomes saturated due to rains, calculate the water content and the saturated unit weight of the embankment soil. Assume there is no volume change due to saturation.

OR

1'(a) Define the following terms:
   (i) Shrinkage limit (ii) Plasticity Index (iii) Consistency Index (iv) Flow Index

1'(b) With the help of a neat sketch, describe Honey-Comb Structure and Flocculated Structure of soils.

1'(c) The in situ void ratio of a granular soil deposit is 0.50. The maximum and minimum void ratios of the soil were determined to be 0.75 and 0.35. Specific gravity of solids is 2.67. Determine the relative density and relative compaction of the deposit.

2(a) In a falling head permeameter, the sample used is 20cm long with a cross-sectional area of 24cm². Calculate the time required for the head to drop from 0.30m to 0.12m, if the cross sectional area of the stand pipe is 2cm². The soil sample is composed of three layers. The thickness of the first layer from the top is 10cm and has a value of coefficient of permeability \( k_1 = 2.1 \times 10^{-4} \) cm/sec, the second layer of thickness 6cm has \( k_2 = 4.5 \times 10^{-4} \) cm/sec and the bottom layer has \( k_3 = 6.0 \times 10^{-4} \) cm/sec. Assume that the flow is taking place perpendicular to the layers.

Contd.....2.
2(b) Define any three of the following:
   i) Darcy's Law
   ii) Seepage velocity
   iii) Critical hydraulic gradient
   iv) Validity of Darcy's Law

OR

2'(a) Derive the expression to determine vertical equivalent coefficient of permeability for a stratified soil deposit.

2'(b) Explain the procedure, importance and scope of constant head permeability experiment. Derive the relationship for the determination of coefficient of permeability.

3(a) A concentrated load of 60 kN acts on the surface of a soil. Determine and plot the variation of vertical stress due to the load on a horizontal plane at a depth of 2 m, up to a horizontal distance of 5 m on either side of centre at an interval of 1 m.

3(b) A raft foundation of the size given in the figure carries an uniformly distributed load of 120 kN/m². Estimate the vertical pressure at a depth of 4 m below the point P outside the raft.

4(a) Explain how consolidation is different from compaction? Explain the characteristic of all three stages of consolidation. Draw fictitious e-p and e-log p curves and explain their components.

4(b) Calculate the total settlement of a clay layer of thickness 7.6 cm, compression index 0.32, and initial void ratio 1.11 under a load increment of 120 kN/m². The effective stress at the centre of clay layer is given as 174.8 kN/m².

5(a) A saturated clay sample was tested using unconfined compression machine. The maximum load the sample sustained was 127 N and the vertical deformation was 0.8 mm. The height to diameter ratio of sample was kept at 2. Determine the undrained shear strength, if the sample was 38 mm in diameter. Draw Mohr's circle of stress for the test and locate $q_u$ and $s_u$.

5(b) Explain the working of triaxial shear test. Name three different types of tests that can be performed in a triaxial testing system?

Contd.....3.
Table: Newmark's Influence coefficients $I_N$ for rectangular/square area.

<table>
<thead>
<tr>
<th>$m$</th>
<th>0.2</th>
<th>0.4</th>
<th>0.6</th>
<th>0.8</th>
<th>1.0</th>
<th>2.0</th>
<th>3.0</th>
<th>5.0</th>
<th>10.0</th>
</tr>
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<tr>
<td>0.2</td>
<td>0.0179</td>
<td>0.0328</td>
<td>0.0435</td>
<td>0.0504</td>
<td>0.0547</td>
<td>0.0610</td>
<td>0.0619</td>
<td>0.0620</td>
<td>0.0620</td>
</tr>
<tr>
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<td>0.0602</td>
<td>0.0801</td>
<td>0.0931</td>
<td>0.1013</td>
<td>0.1134</td>
<td>0.1150</td>
<td>0.1154</td>
<td>0.1154</td>
</tr>
<tr>
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<td>0.0801</td>
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<td>0.1533</td>
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<td>0.1561</td>
<td>0.1562</td>
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<tr>
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<td>0.0931</td>
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<td>0.1850</td>
</tr>
<tr>
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<td>0.1361</td>
<td>0.1598</td>
<td>0.1752</td>
<td>0.1999</td>
<td>0.2034</td>
<td>0.2044</td>
<td>0.2046</td>
</tr>
<tr>
<td>2.0</td>
<td>0.0610</td>
<td>0.1134</td>
<td>0.1533</td>
<td>0.1812</td>
<td>0.1999</td>
<td>0.2325</td>
<td>0.2378</td>
<td>0.2395</td>
<td>0.2399</td>
</tr>
<tr>
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<td>0.0618</td>
<td>0.1150</td>
<td>0.1555</td>
<td>0.1841</td>
<td>0.2034</td>
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<td>0.2439</td>
<td>0.2461</td>
<td>0.2465</td>
</tr>
<tr>
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<td>0.0620</td>
<td>0.1154</td>
<td>0.1561</td>
<td>0.1849</td>
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<td>0.2486</td>
<td>0.2491</td>
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<td>0.1154</td>
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<td>0.2399</td>
<td>0.2465</td>
<td>0.2491</td>
<td>0.2498</td>
</tr>
</tbody>
</table>

Figure for Q 3(b)
1(a) Briefly describe the parameters analysed in the characterization of wastewaters. [04]

1(b) Briefly explain what happens when a wastewater is discharged in a stream. A treated effluent for a municipal wastewater treatment plant is discharged to a stream. The characteristics of effluent and the stream just ahead of the discharge point are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Effluent</th>
<th>Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>10 MLD</td>
<td>0.8 m³/s</td>
</tr>
<tr>
<td>BOD₅&lt;sup&gt;20&lt;/sup&gt;</td>
<td>40 mg/L</td>
<td>5.0 mg/L</td>
</tr>
<tr>
<td>D.O.</td>
<td>1.3 mg/L</td>
<td>8.5 mg/L</td>
</tr>
<tr>
<td>Temperature</td>
<td>22°C</td>
<td>19°C</td>
</tr>
</tbody>
</table>

K<sub>1</sub> at 20°C = 0.23 d<sup>-1</sup>  \ K<sub>2</sub> at 20°C = 0.4 d<sup>-1</sup>

Assume instantaneous mixing of effluent and stream water and the velocity of mixture as 0.2 m/s, find the critical value of dissolved oxygen and the distance at which it occurs. Assume a suitable value of C₅.

2 Explain the graphical method used for the determination of capacity of overhead tanks. Following table gives the variations in water demand. Using any one of the methods calculate the capacity of storage tank to meet out the variations in water demand if the pumps are operated from 4.0 a.m. to 10.0 a.m. and from 3.0 p.m. to 9.0 p.m.
<table>
<thead>
<tr>
<th>Time (hours)</th>
<th>Water demand $(10^3 \text{ L})$</th>
<th>Time (hours)</th>
<th>Water demand $(10^3 \text{ L})$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight to 1.0 a.m.</td>
<td>15</td>
<td>12.0 - 13.0</td>
<td>95</td>
</tr>
<tr>
<td>1.0 - 2.0</td>
<td>15</td>
<td>13.0 - 14.0</td>
<td>110</td>
</tr>
<tr>
<td>2.0 - 3.0</td>
<td>20</td>
<td>14.0 - 15.0</td>
<td>105</td>
</tr>
<tr>
<td>3.0 - 4.0</td>
<td>40</td>
<td>15.0 - 16.0</td>
<td>100</td>
</tr>
<tr>
<td>4.0 - 5.0</td>
<td>60</td>
<td>16.0 - 17.0</td>
<td>110</td>
</tr>
<tr>
<td>5.0 - 6.0</td>
<td>80</td>
<td>17.0 - 18.0</td>
<td>100</td>
</tr>
<tr>
<td>6.0 - 7.0</td>
<td>90</td>
<td>18.0 - 19.0</td>
<td>90</td>
</tr>
<tr>
<td>7.0 - 8.0</td>
<td>100</td>
<td>19.0 - 20.0</td>
<td>100</td>
</tr>
<tr>
<td>8.0 - 9.0</td>
<td>130</td>
<td>20.0 - 21.0</td>
<td>110</td>
</tr>
<tr>
<td>9.0 - 10.0</td>
<td>110</td>
<td>21.0 - 22.0</td>
<td>80</td>
</tr>
<tr>
<td>10.0 - 11.0</td>
<td>100</td>
<td>22.0 - 23.0</td>
<td>60</td>
</tr>
<tr>
<td>11.0 - 12.0</td>
<td>90</td>
<td>23.0 - Midnight</td>
<td>40</td>
</tr>
</tbody>
</table>

OR

2' (a) Define self cleaning and scouring velocities in sewers. A 300 mm sewer is laid at a slope of 0.006. Find out the depth of flow when the sewer is flowing at 40% of its capacity. Also find the velocity of flow. Use the attached nomograph.

2' (b) With the help of sketches describe the different water distribution piping network systems.

3 (a) Draw the water treatment flowsheets for surface and sub surface sources of water supply.

3 (b) Derive the equations used for the determination of terminal settling velocities. Find the terminal settling velocity of a particle of diameter 0.4 mm and specific gravity 2.65 settling in water. Assume dynamic viscosity of water as $1.002 \times 10^{-3} \text{ N s/m}^2$.

3 (c) Differentiate between coagulation and flocculation process. Write the chemical equations for coagulation with alum, ferric chloride and ferrous sulphate as coagulants. Find the alkalinity requirement during coagulation process using 30 mg/L of Alum.

4 (a) Design an activated sludge process for the treatment of 20 MLD of wastewater using the following data. Take influent BOD = 180 mg/L. It is desired to have effluent BOD as 30 mg/L.

Contd.....3.
4 (b) Briefly describe the different treatment units used for secondary treatment of sewage.

OR

4' (a) What is the purpose of sludge digestion? Describe standard rate and high rate sludge digesters.

4' (b) Describe the functioning of trickling filters and write the formula used for the design of two stage high rate trickling filters.

4' (c) Define mean cells residence time. Design a circular clarifier for the treatment of 12 MLD of sewage. Assume SOR as 25 m³/m².d.

5 (a) Briefly describe the functioning of a septic tank. Design a septic tank for 80 users assuming wastewater contribution per person as 45 L/d and period of cleaning as 2 years.

5 (b) Differentiate between a wetland and a pond. Describe the BOD removal mechanism in a pond.

5 (c) Describe the working of a secured landfill. What are the objectives of providing covers and liners in a secured landfill.
Maximum Marks: 60

Credits: 04

Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question | M.M.
--- | --- | ---
1(a) | What is slump test for concrete? Discuss procedure, types and standard values. | [07]
1(b) | What are the field tests to check the quality of cement? | [03]
2(a) | What do you understand by the creep in concrete? Discuss factors affecting the creep. | [05]
2(b) | Discuss in brief the effect of w/c ratio on concrete and show the relation between compressive strength and w/c of concrete. | [05]
3 | Discuss the behaviour of concrete under the given extreme conditions:
   (a) Sulphate attack and Saline Environment, | [10]

OR

(a') Acid attack and Fire.

4 | What are Non-Destructive Tests on concrete? Describe its importance and any of the tests in detail. | [10]
4' | What do you mean by admixture in concrete? Describe its type and their effects. | [10]
5 | Write down short notes on any FOUR.
   (a) Workability of concrete
   (b) Lightweight Concrete
   (c) Ferro cement
   (d) Bleeding and segregation in concrete
   (e) Pre-placed Concrete
   (f) Compressive strength of concrete and factors affecting it. | [20]
2015-16
B. E (Evening) (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
TRAFFIC ENGINEERING
ECE-423

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. | Question | M.M.
--- | --- | ---
1(a) | What are the different steps in traffic forecast modelling? Draw trip distribution table and explain the parameters entered in its rows and columns. | [09]
1(b) | Explain the purpose of trip generation modelling, factors governing trip generation, and classification of trips. Derive an expression to predict the number of trips generated in future using Growth Factor modelling approach. | [06]
2(a) | Explain how the speed and delay studies are carried out. What are the various uses of speed and delay studies? | [07]
2(b) | The consolidated data collected from speed and delay studies on a stretch of urban road of length 4.5 km, running N-S is given in Table below. Determine the average values of volume, journey speed and running speed of the traffic stream along either direction. | [08]

<table>
<thead>
<tr>
<th>Trip No.</th>
<th>Direction of Trip</th>
<th>Journey Time (Min. Sec.)</th>
<th>Total stopped delay (Min. Sec.)</th>
<th>No. of vehicles overtaking</th>
<th>No. of vehicles overtaken</th>
<th>No. of vehicles from opp. direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>N-S</td>
<td>7-14</td>
<td>1-50</td>
<td>6</td>
<td>4</td>
<td>264</td>
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<tr>
<td>2</td>
<td>S-N</td>
<td>6-32</td>
<td>1-40</td>
<td>4</td>
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<td>194</td>
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<tr>
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<td>N-S</td>
<td>7-40</td>
<td>2-00</td>
<td>2</td>
<td>5</td>
<td>287</td>
</tr>
<tr>
<td>4</td>
<td>S-N</td>
<td>6-50</td>
<td>1-30</td>
<td>5</td>
<td>3</td>
<td>210</td>
</tr>
<tr>
<td>5</td>
<td>N-S</td>
<td>8-00</td>
<td>2-22</td>
<td>4</td>
<td>5</td>
<td>278</td>
</tr>
<tr>
<td>6</td>
<td>S-N</td>
<td>6-10</td>
<td>1-10</td>
<td>2</td>
<td>2</td>
<td>180</td>
</tr>
<tr>
<td>7</td>
<td>N-S</td>
<td>7-30</td>
<td>1-40</td>
<td>5</td>
<td>2</td>
<td>294</td>
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<td>S-N</td>
<td>6-28</td>
<td>1-40</td>
<td>3</td>
<td>4</td>
<td>170</td>
</tr>
</tbody>
</table>

3(a) | Draw neat sketches of un-channelized and channelized intersections. What are the advantages and limitations of un-channelized and channelized intersections? | [07]
3(b) | What do you understand by rotary intersection? With reference to Indian traffic conditions, what are its advantages and limitations? A rotary intersection is provided with an average entry width of 8.4m, width of weaving section as 14m and length of the weaving section between the channelizing |

Contd....2.
islands is 35 m. The left turning traffic, right turning traffic, crossing traffic turning left and right while entering the rotary are 420, 580, 515 and 485 pcu per hour respectively. Calculate the capacity of the rotary.

OR

3'(a) With the help of a neat sketch briefly describe grade-separated intersection. Also write its advantages and limitations.

3'(b) Illustrate with sketches recommended types of lights and luminaire distribution. Calculate the spacing between the lighting units to produce a lux equal to 7.0 from the following data:

- Width of the road = 14 m
- Mounting Height = 8 m
- Lamp size = 70W3) lamph
- Luminaire type II

4(a) Define any three from the following:
   i) Effective green time
   ii) Lane capacity
   iii) Saturation headway (Draw figure)
   iv) Start-up-lost time

4(b) During the design hour the saturation flow values on Road A and B are estimated as 1400 and 1200 pcu per hour and the average normal flow of traffic are 450 and 300 pcu per hour, respectively. The all-red time required for pedestrian is 12secs. Design two phase traffic signal by Webster's method. Assume amber time appropriately.

OR

4'(a) Define any three from the following:
   i) Clearance interval
   ii) Cycle length
   iii) Saturation flow rate
   iv) Green ratio

4'(b) Discuss different traffic control devices. Write down the classification of traffic signs and mention the size and color-scheme of regulatory traffic signs.
Question

1(a) Discuss various cases of uplift pressure diagram and in each case write the equation for total uplift force.

1(b) Calculate the factor of safety against sliding and overturning for a gravity dam profile as shown in Fig.1. Analysis is to be carried out under the influence of following forces:

- Weight of dam ($\gamma_m = 24 \text{ kN/m}^3$);
- Water pressure ($\gamma_w = 10 \text{ kN/m}^3$);
- Wave pressure ($F = 14 \text{Km.}, V = 86 \text{Kmph}$);
- Uplift force ($C = 0.6$);
- Coefficient of friction ($\mu = 0.6$)

![Diagram of dam profile]

**Fig. 1**

All R.L. are in meter

**OR**

1'(b) Why do we need dams? Discuss merits and demerits of various types of dams.
2(a) How the effect of earthquake is considered in the design of low gravity dam? Give step-wise procedure to calculate earthquake forces as per response spectrum method.

2(b) Discuss the role of galleries in gravity dams.

OR

2'(b) Give the significance of elementary profile of a gravity dam. Derive an expression for principal stress.

3(a) Differentiate between arch and buttress dams. Design a constant radius arch dam using following data:
Bottom width of the valley = 100 m
Top width of the valley = 150 m at a height of 100 m
Overall height of the dam = 100 m
Allowable stress in concrete = 400 t/m²
The top arch angle = 140°
Unit weight of water = 10 kN/m²

3(b) Draw the neat sketch of a buttress dam. Explain the function of all its components.

OR

3'(a) A 60 m high buttress dam of the deck type has a buttress spacing of 10 m and inclination of the upstream face is 45°. Determine the shape of the buttress and the required thickness. Assume that there is no free board and the joints between the deck and buttress are frictionless. Take the allowable stress in concrete as 4.5 MPa and unit weight of the concrete as 24 kN/M³. Minimum thickness of buttress is 1.5 m

3'(b) What are the assumptions of thin cylinder theory?

4(a) Draw the neat sketch of cross section of an earthen dam and show all its components. Name any three earth dams of India and give their details.

OR

4'(a) Briefly discuss how rolled fill dams are classified.

4(b) Discuss various causes of failure of earth dams.

4(c) Discuss any three devices used in the construction of an earth dam.
Q.No. | Question                                                                                   | M.M. |
---   |-------------------------------------------------------------------------------------------|------|
1(a)  | How industrial wastewater survey/implant survey is performed?                            | [04] |
1(b)  | What is the importance of Equalization and Neutralization in industrial wastewater treatment? | [04] |
1(c)  | Design an Equalization tank for Dairy industry for the following data                     | [04] |
|      | Time (Hours)                             | 4  | 8  | 12 | 16 | 20 | 24 |
|      | Flow( m³/hour)                           | 15 | 25 | 50 | 30 | 10 | 5 |
2(a)  | Discuss the effect of oxides of sulphur and nitrogen on air quality.                      | [06] |
OR    |                                                                                          |      |
2'(a) | How air pollutants are classified? What are particulate matter?                          | [06] |
2(b)  | What is the concept of atmospheric cleansing? Discuss the plume behaviour in Fanning, Looping and Trapping in context with change in lapse rate. | [06] |
3(a)  | It is desired to construct a settling chamber to remove a particles from air stream of 120 m³/minutes. The specific gravity of particle is 2.5. The chamber is strapped to the ceiling of an industrial building and the space is limited vertically to 2 m and horizontally 1.5 m. Determine the length require to remove 100% of 50 microns particle. | [06] |
3(b)  | What are centrifugal collectors? Briefly explain different types of centrifugal collector with diagram. | [06] |
OR    |                                                                                          |      |
Contd....2.
3’(b) Discuss the working of gravitational settling chamber and its design criteria. [06]

4 (a) Explain the working of aerobic sequencing batch reactor (SBR). What are the advantages disadvantages of anaerobic process compared to aerobic process? [06]

4(b) Design high rate trickling filter for wastewater treatment plant for a flow of 10,000 m³/day, Influent BOD of 250 mg/L. It is desired to have effluent BOD of 30 mg/L. Assume value R=1. [06]

5(a) Explain the sugar industry manufacturing process in detail. What is its wastewater characteristics? Suggest a treatment scheme for medium scale sugar production industry. [08]

OR

5’(b) How beer is produced in breweries? What are its input and output material balance? Suggest a treatment scheme for breweries industry wastewater. [08]

5(b) What are the two methods for measurement of discharge for industrial wastewater? [04]