B.E (III YEAR) EXAMINATION
CIVIL ENGINEERING
DESIGN OF CONCRETE STRUCTURE-I
ECE-311

Maximum Marks: 60
Duration: Two 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. Only the design charts of SP16 attached are allowed.

Q.No. | Question | M.M.
--- | --- | ---
1 (a) | Give three reasons for providing cover to tension steel in a R.C beam | [3]
1 (b) | Design a doubly reinforced section for a rectangular beam of effective span 3.75 m. The superimposed live load is 40 kN/m and the size of the beam is limited to 250×400 mm overall. Provide nominal clear cover to meet the requirement of fire resistance rating of 2 hrs and durability requirements for “very severe” exposure. Assume concrete grade as M25 and steel grade as Fe 415. Show the reinforcement details with neat sketches. | [12]
2 (a) | Prove the following expression, \( L_d = \frac{0.87\sigma_y\phi}{4\tau_{bd}} \) where, \( L_d \) = development length; \( \sigma_y \) = stress in steel; \( \phi \) = diameter of bar and \( \tau_{bd} \) is bond stress | [05]
2 (b) | A R.C. beam has an effective depth of 450 mm and width of 300 mm. It contains 2-25 mm Fe 415 grade bars in tension and M20 mix. Design the shear reinforcement needed for a factored shear force of 250 kN. Also show the details of shear reinforcement in a section. | [10]

OR

2'(b) | Determine the depth of a RC slab 6.3 m×4.5 m effective span with all four edges continuous over support using Limit State of Serviceability and Collapse criteria and determine the area of steel in shorter direction. The design LL is 2.5 kN/m². A 37.5 mm thick floor finish is provided on the slab. Exposure condition of slab to environment can be classified as mild. Assume M20 concrete mix and Fe415 grade steel. Checks are not required. | [10]

3 (a) | Explain the modes of failure of column. | [3+12]
3 (b) | Design the reinforcement in a circular column of diameter 300 mm pinned at both ends to support a service axial load of 800 kN. The column has an unsupported...
length of 3m. Assume M20 mix concrete and Fe415 grade steel. Check the slenderness ratio and design the column accordingly with helical ties as transverse reinforcement. Also detail the column

OR

3'(a)
Explain the function of transverse ties in a RC column? What happens when ties are not provided?

3'(b)
A reinforced concrete column of circular cross section with unsupported length of 5.5 m is to support an axial load of 1800 kN (working) along with a factored bending moment of 150 kNm. Design a suitable cross section of column with longitudinal and transverse steel. Use the chart as attached herewith. Assume M25 mix concrete and Fe415 grade steel.

4
Determine only the depth of the footing of a square column of size 300 x 300 mm with 8# 16mm diameter to carry a working load of 900 kN such that it is safe in punching shear also, for the following data:
Bearing capacity of soil: 100 kN/m², concrete grade: M20 and steel grade Fe415. Without calculating the steel in footing give a neat sketch of reinforcement detail of the footing and column

contd...
\[ f_y = 415 \text{ N/mm}^2 \quad \frac{d}{D} = 0.15 \]

\[ A_s = \frac{p
\text{A}}{400} \]

\[ \text{Axis of Bending} \]

\[ \frac{P}{f_{y}D^2} \]

\[ \frac{M}{f_{y}D^3} \]

Contd... 5.
2018-19  
B.E. (Civil) V SEMESTER EXAMINATION  
SOIL MECHANICS  
ECE-312

Maximum Marks: 60  
Duration: Two Hours

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

Q.No.  

1(a) What are the Index properties of soil?  
A soil has a plastic limit of 30% and a plasticity index of 9%. When the soil is dried from its state at plastic limit, the volume change is 25% of its volume at plastic limit. Similarly, the corresponding volume change from the liquid limit to the dry state is 32% of its volume at liquid limit. Determine the shrinkage limit of soil.  
[7.5]

1(b) What were the assumptions considered by Boussinesq for determining the soil stresses? A concentrated load of 45kN is applied vertically on a horizontal ground surface. Determine the vertical stresses:  
(i) At 3m below the point of application of load.  
(ii) At 1m below and at a radial distance of 4m from the line of action of the load.  
[7.5]

OR

1'(a) Explain any THREE of the following:  
i) Grain size distribution curve  
ii) Sedimentation analysis of soil  
iii) Indian Standard Classification System (ISCS)  
iv) Standard Proctor's Compaction test  
[7.5]

1'(b) A T-shaped foundation is loaded with a uniform load of 150 kN/m². Determine the vertical stress at point P at a depth of 5m.  
[7.5]
2(a) Enumerate various methods to compute coefficient of permeability. Derive the relationship to determine the average permeability parallel to bedding plane. Explain falling head permeability test with the help of diagram.

2(a)* Discuss Flow-net filters and their significance.

A Falling Head Permeability test was carried out on a 12 cm long sample of silty clay. The diameter of sample & stand pipe was 6 cm & 1.2 cm respectively. The water level in the stand pipe was observed to fall from 50 cm to 35 cm in 6 min. Determine:
   a) The coefficient of permeability in meter per day.
   b) Height of water level in stand pipe after 20 min.

2(b) A layer of saturated clay 6.5 m thick is overlain by sand 4.5 m deep, the water table is 2.5 m below the ground level. Calculate & plot the total, effective & pore water pressure at various depths of soil if sand above water table is saturated by capillary action upto the ground level. The unit weight is as follows: \( \gamma_{sat} \) of clay = 18.5 KN/m³, \( \gamma_{sat} \) of sand = 19.5 KN/m³.

3(a) Discuss the following terms in detail:
   i) coefficient of volume compressibility
   ii) coefficient of compressibility
   iii) Time factor

3(b) A single-storeyed building construction started in January 1989 and was completed in June 1990. The total consolidation settlement was estimated to be 8 cm. The average settlement of building was measured in December 1991 and was found to be 2.2 cm. Compute the probable settlement of the building in Jan 2001.

OR

3(b)* In a laboratory consolidation test, a 3.5 cm thick sample of clay reached 50% consolidation in 12 minutes under double drainage condition. Determine the time required for 50% consolidation of a layer of this soil in the field under the following conditions:
   (i) When a 2.5 m thick layer of the given soil is sandwiched between two sand layers
   (ii) When a 4 m thick layer of the soil is overlain by a sand layer and underlain by a deep layer of intact shale

4(a) Explain the Vane shear shear test with diagram. In an in-situ vane shear test on a saturated clay, a torque of 30 Nm was required to shear the soil. The diameter of the vane was 60 mm and length 120 mm. Calculate the undrained shear strength of the clay. The vane was then rotated rapidly to cause remoulding of the soil. The torque required to shear the soil in the remoulded state was 6 Nm. Determine the sensitivity of the clay.

4(b) Describe the Mohr-Coulomb theory with neat sketches.
2018-19
B.E. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
WASTE MANAGEMENT
ECE 313
Credits: 04

Duration: Two Hours

Maximum Marks: 60

Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning. Use of Nomograph and partially flow diagram permitted.

Q.No. 1
(a) Briefly explain the components of wastewater collection system. [05]
(b) A 400 mm sewer is flowing at a depth of 180 mm. Find the slope at which it should be laid so that a velocity of 1.0 m/s is maintained in the sewer. [05]
(c) Differentiate between separate and combined sewerage systems. Also comment on their suitability and economics. [05]

2 (a) Briefly explain the parameters involved in the characterization of municipal wastewater. [05]
(b) Define type 1 settling. Find the terminal velocity of a 0.2 mm diameter spherical grit particle settling in water having a dynamic viscosity of $1.002 \times 10^{-3} \text{ Ns/m}^2$. Take specific gravity of grit particle as 2.65 [05]
(c) Differentiate between the working of a CSTR and a PFTR. Also draw their hydraulic profiles. [05]

OR

2* (c) Derive the equation of effluent concentration for a continuous input of tracer undergoing decay in a CSTR operating under Non Steady state conditions [05]

3 (a) Differentiate between aerobic and anaerobic processes of wastewater treatment. Name different types of aerobic and anaerobic processes used for wastewater treatment. [05]

(b) Design a two stage high rate trickling filter for the treatment of 5 MLD of sewage having a BOD of 180 mg/L. It is desired that the effluent BOD from the filter
should not exceed 30 mg/L. Assume recirculation ratio as 1

OR

3'(a) Draw a neat sketch of UASB reactor and explain its functioning [05]

3'(b) Differentiate between Activates Sludge Process and Sequencing Batch Reactor systems. Derive equations for the determination of oxygen requirement, recirculation ratio and nutrient requirements. [06]

3'(c) Define kinetic constants $K_s$, $k$, $Y$ and $k_d$ and briefly explain their significance [04]

4(a) Briefly explain the typical composition of municipal solid waste. Find out the moisture content and density of a municipal solid waste sample describe by the following composition

<table>
<thead>
<tr>
<th>Composition</th>
<th>Per cent by Mass</th>
<th>Typical Density (Kg/m$^3$)</th>
<th>Moisture Content %</th>
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<tr>
<td>Food Waste</td>
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<td>70</td>
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<tr>
<td>Cardboard</td>
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<tr>
<td>Plastics</td>
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<td>65</td>
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</tr>
<tr>
<td>Garden Trimmings</td>
<td>10</td>
<td>105</td>
<td>60</td>
</tr>
<tr>
<td>Wood</td>
<td>10</td>
<td>240</td>
<td>20</td>
</tr>
<tr>
<td>Dirt, ash, bricks, etc</td>
<td>15</td>
<td>480</td>
<td>8</td>
</tr>
</tbody>
</table>

4(b) Explain the effects of carbon monoxide and particulate matter on human health. [07]
<table>
<thead>
<tr>
<th>Flow, gpm</th>
<th>Flow, m³/s</th>
<th>Pipe Diameter, in.</th>
<th>Pipe Diameter, cm</th>
<th>Slope of pipe, ft/ft</th>
<th>Slope of pipe, m/m</th>
<th>Slope, percent</th>
<th>Velocity, ft/sec</th>
<th>Velocity, m/s</th>
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<td>1.5</td>
<td>4.5</td>
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<td>0.00110</td>
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</table>

The graph shows the relationship between the ratio of hydraulic elements and the velocity.
Maximum Marks: 60

Answer all the questions. Assume suitable data, if required.

Question                                                                 MM
1(a) Enumerate various tests conducted on hardened concrete and explain in detail flexural strength test on concrete.  [7.5]
1(b) Briefly describe the various factors affecting the strength of hardened concrete. [7.5]

OR

1'(b) Discuss in detail the various stages involved in the production of concrete. [7.5]
2 Design a concrete mix of M30 grade to be used in structural elements by IS code method for following requirements:
   (a) Type of cement : OPC 43 grade
   (b) Max size of aggregate : 20 mm
   (c) Shape of the aggregates : angular
   (d) Max w/c ratio : 0.45
   (e) Workability : 100mm (slump)
   (f) Exposure condition : severe
   (g) Specific gravity of cement : 3.15
   (h) Specific gravity of coarse aggregate : 2.78
   (i) Specific gravity of fine aggregate : 2.60
   (j) Water absorption of coarse aggregate : 0.5 percent
   (k) Water absorption of fine aggregate : nil
3(a) Discuss the effect of hot weather on different properties of the concrete. [7.5]
3(b) Briefly discuss the role of different types of admixtures in concrete. [7.5]

OR

3'(a) What is the mechanism of sulphate attack in the concrete? Suggest the techniques to control the sulphate attack. [7.5]
3'(b) Discuss in detail about the factors affecting the durability of concrete. [7.5]
4(a) What is Fibre Reinforced Concrete? Discuss the factors affecting the properties of Fibre Reinforced Concrete. [7.5]
4(b) What is meant by Ferro-cement? List the advantages and disadvantages of Ferro-cement. [7.5]
2018-19
B.E.AUTUMN (V SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
DAM ENGINEERING
(ECE-428)
Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

Q.No. | Question | M.M.
------|----------|-----
1(a)  | Discuss site selection criteria for a gravity dam. | [05]
1(b)  | Check the stability 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 ($\gamma_m = 24$ kN/m$^3$); Water pressure ($\gamma_w = 10$ kN/m$^3$); Wave pressure ($F = 14$ Km, $V = 92$ Km/h); Uplift force ($C = 0.7$); Coefficient of friction ($\mu = 0.6$) | [10]

[Diagram of a gravity dam profile]

All dimensions and levels are in meter

Fig. 1

OR

1'(b) Discuss various modes of stability. Derive an expression for principal and shear stress in case of gravity dam.

[Diagram of a gravity dam profile]
2(a) Give step-wise procedure to calculate horizontal seismic coefficient by response spectrum method.

2(b) Discuss Zainger's approach for determining hydrodynamic pressure of water in case of gravity dam.

OR

2'(b) Discuss the significance of a gravity dam elementary profile. Based on stress criteria, derive expressions for its base width.

2(c) Briefly explain the role of galleries in dams.

3(a) Prove that the most economical central angle for a constant radius arch dam is $133^034'$.

3(b) Discuss advantages and disadvantage of buttress dam.

OR

3'(b) Discuss various forces acting on an arch dam.

4(a) For the earth dam of homogeneous section with a horizontal filter as shown in Fig 2, find out the equation of phreatic line using Casagrande method. If the coefficient of permeability of the soil material used in the dam is $5 \times 10^{-4}$ cm/sec, find the seepage flow per unit length of the dam.

4(b) Derive the Laplace equation for seepage through the homogeneous and isotropic mass of an earth dam.

OR

4'(b) Discuss the causes of structural failure of earth dams.