Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Use of IS: 456-2000 is allowed

Q.No. Question M.M.
1(a) Give causes of the following types of cracks in RC beam [03]
   (i) Vertical cracks (ii) Inclined cracks (iii) Horizontal cracks along reinforcement.
1(b) Design a doubly reinforced section for a rectangular beam of effective span 4m. [09]
The superimposed live load is 40kN/m and the size of the beam is limited to
250×400 mm overall. Take concrete grade M20 and steel grade Fe 415. Provide
nominal clear cover to meet the requirement of fire resistance rating of 2hrs and
durability requirements for “very severe” exposure. List the relevant clauses of the
IS 456-2000 while solving the problem.

OR

2(a) Explain anchorage bond and flexural bond. [02]
2(b) A RC beam has an effective depth of 450 mm and breadth of 300 mm. It contains
3-25 mm diameter bar of Fe-415 steel grade in tension. Determine the shear
reinforcement with bent up bar and 2 legged shear stirrups needed for a factored
shear force of 250 kN. Use M20 concrete mix. Also show the reinforcement
details. [10]

3(a) Define the following terms for compression members [3]
   i) Failure modes of short and long column
   ii) Criteria of minimum eccentricity of loading given below

Contd......2
3 (b) Design a column 4 m high effectively held in position at both ends and restrained against rotation at one end to carry an axial load of 2000 kN using lateral ties. Use M20 concrete mix and Fe415 steel grade.

OR

3' Discuss interaction curve (P_u-M_u) for the column carrying axial load and uniaxial bending moment.

4. Design a slab of a multi panel floor system with all four edges continuous and centre to centre spans of 3.75m×3.75m. Assume a live load of 3.5 kN/m², a floor finish of 1.5 kN/m² and load of unknown partitions on slab as 1 kN/m². Assume concrete grade as M20 and steel grade as Fe500. Show a neat sketch of reinforcement details in the middle strips.

OR

4' Design an interior panel of a flat slab. The slab is supported on columns spaced at 5m in both the directions. The size of the column is 550mm×550mm. Assume a live load of 2kN/m² and a floor finish of 1kN/m². Height of the column is 5m. Assume concrete grade as M25 and steel grade as Fe415. Show a neat sketch of reinforcement details in the middle and column strips.

5 Show the diagram of failure modes of reinforced concrete column footings in shear and bending and their critical sections

A square column 300mm×300mm in cross section carries a working load of 600kN. If the safe bearing capacity of soil is 120kN/m², Calculate

(i) Footing size

(ii) Thickness of the footing and the area of reinforcement for concrete grade M20 and steel grade of Fe415

Show a neat sketch of reinforcement detail.
2013-14
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL
SOIL MECHANICS
CE-312

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)  Explain in detail about heavy compaction test as per IS: 2720 Part-8. Also enumerate the factors affecting compaction of soil.  [06]
1(b)  A sand deposit was compacted dry to an in place voids ratio of 0.45. For this sand \( e_{max} = 0.7 \) and \( e_{min} = 0.3 \). Determine relative density and relative compaction of the sand deposit, take \( G=2.65 \).  [06]

OR

1'(a)  Enumerate various classifications systems of soil. Discuss IS: 1498-1970 classification system.  [06]
1'(b)  A soil in its natural state has a voids ratio of 0.65 and a water content of 21\%. Specific gravity of soil is 2.65. How many additional litres of water per cubic metre of soil is needed to make it a saturated soil with no change in voids ratio?  [06]

2(a)  Discuss the quick sand condition in detail. What are the harmful effects of liquefaction of soil on foundations?  [06]
2(b)  In a sandy stratum 20 m thick, the water table is 5.5 m below ground level. The unit weights of sand above and below water table are 17 kN/m\(^3\) and 20 kN/m\(^3\) respectively. The capillary rise above water table is 3.5 m. Draw the distribution of effective pressure, pore water pressure and total pressure at the bottom of sandy stratum.  [06]

3(a)  Discuss in detail about uniformly distributed rectangular area.  [06]

Contd......2
3(b) With the help of Newmark’s influence chart determine the vertical stresses at 7 m and 8 m depths below corner and centre of 150 kN/m² uniformly distributed rectangular area of size 4 x 5 m.

4(a) Discuss in detail about Terzaghi's one dimensional consolidation theory.

4(b) In a laboratory consolidometer test on a 20 mm thick sample of clay taken from a site, 75% consolidation was reached in 15 minutes. Estimate the time required for the clay layer of 5 m thickness at the site for 75% compression if there is drainage only at top. How much time is required for the clay layer to reach 90% consolidation in the field? What is the time required for the clay layer to reach 75% consolidation if the layer has double drainage instead of single drainage in the field?

OR

4'(a) Discuss in detail about square root of time fitting and log of time fitting methods to determine the coefficient of consolidation.

4'(b) The voids ratio after complete consolidation had occurred at various effective stresses in a laboratory consolidation test were determined and given below:

<table>
<thead>
<tr>
<th>Effective Stress (kN/m²)</th>
<th>50</th>
<th>100</th>
<th>200</th>
<th>400</th>
<th>800</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voids Ratio</td>
<td>1.82</td>
<td>1.77</td>
<td>1.68</td>
<td>1.56</td>
<td>1.39</td>
</tr>
</tbody>
</table>

Determine the coefficient of volume compressibility for the effective stress range of 300 to 600 kN/m².

5(a) How do you define shear strength of soil? Discuss the significance of shear strength in Geotechnical Engineering. Explain briefly how the sensitivity of soil can be determined by Vane Shear test.

5(b) Determine the shear strength in terms of effective stress on a plane within a saturated soil mass at a point the total normal stress is 250 kN/m² and the pore water pressure is 70 kN/m². The effective shear strength parameters for the soil are $C' = 20$ kN/m² and $\phi' = 30^\circ$. 
Q.No.  Question                                      M.M.
1(a) Explain various water demands for a town. Discuss the variations in water demand. [06]
1(b) Describe the various sources of water. Explain the permissible limits of chlorides, TDS, Fluoride in drinking water. [06]

OR

1'(a) What are the various methods of calculation of water requirement for fire demand. [06]
Explain each method in detail

1'(b) Calculate fire demand for a population of 12.5 lacs people by various methods. [06]

2(a) Draw a milliequivalent per liter bar diagram and list the hypothetical compositions of the compounds formed. Calculate the quantities of lime and soda required for the treatment of 20 MLD of water. Take the purity of lime and soda as 70 % and 80% respectively.

\[ \text{Ca}^{++} = 94 \text{ mg/L}, \quad \text{HCO}_3^- = 317 \text{ mg/L} \]
\[ \text{Mg}^{++} = 24 \text{ mg/L}, \quad \text{SO}_4^{--} = 67 \text{ mg/L} \]
\[ \text{Na}^+ = 14 \text{ mg/L}, \quad \text{Cl}^- = 24 \text{ mg/L}. \]

2(b) Describe the disinfection process using chlorine as a disinfectant. Draw the breakpoint curve and explain each phase. [04]

2(c) What are indicator organisms? [02]
3 (a) Compute $L_0$ and $K$ values using Thomas slope method for the following data.  

<table>
<thead>
<tr>
<th>Time (days)</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>$y$ (mg/L)</td>
<td>11</td>
<td>18</td>
<td>24</td>
<td>26</td>
<td>28</td>
</tr>
</tbody>
</table>

3 (b) Briefly describe the method of grit removal from wastewater.

3 (c) Draw the sewage treatment flowsheet using activated sludge process as a secondary treatment.

OR

3'(a) 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.

3'(b) Design an activated sludge process for the treatment of 18 MLD of wastewater. The BOD$_5$ of raw wastewater may be taken as 220 mg/L. Assume $Y=0.5$, mean cells residence time as 10 days, $K_c = 125$ mg/L, $X_c = 10,000$ mg/L, $k = 4.0$ d$^{-1}$, $X = 2000$ mg/L, $k_d = 0.06$ d$^{-1}$

Take Effluent BOD as 30 mg/L. Your design should include volume of aeration tank, oxygen requirement, Nutrient requirement and recirculation ratio.

4 (a) Discuss in detail the composting method of solid waste disposal

4 (b) Briefly describe wastewater irrigation.

4 (c) Briefly describe the BOD removal mechanism in an stabilization pond

5 (a) What arc landfills? Describe the functioning of landfills for the treatment of solid waste

5 (b) Differentiate between coagulation and flocculation process. An alum dose of 50 mg/L is required for the treatment of 20 MLD of water. Calculate the theoretical alkalinity requirement for the same.

5 (c) Briefly describe the anaerobic sludge digestion process. Differentiate between standard rate and high rate sludge digesters.

FIGURE ENCLOSED

Contd......3
2013-14
B.TECH. (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
Surveying II
CE 314

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)  Differentiate between various orders of triangulation. Write down the specifications of each order.  [04]

1(b)  What is meant by reduction to centre? On occupying a ground station A of a Triangulation survey, it was evident that some elevation of the theodolite would be necessary, in order to sight the signals at adjacent stations, P on the left and Q on the right. It was found however, that these stations could be seen from a ground station B, South West of A, so that AB approximately bisected the angle PBQ.

Whereupon, B was adopted as a false station and the distance AB was carefully measured, being 2.835m, while the angles PBA and ABQ were observed to be 28° 16' 35" and 31° 22' 20" respectively. The side PQ was computed to be 994.87m in the adjacent triangle, and when A was under observation, the interior angles at P and Q were found to have mean value of 62° 34' 15" and 57° 39' 20" respectively. Determine accurately the magnitude of the angle PAQ.

OR

1'(a)  What is meant by axis signal correction? Derive the formula used for the same.  [04]

1'(b)  Two proposed triangulation stations A and D are 120 km apart and their respective elevations above mean sea level are 282 m and 1105 m. the altitude of two peaks B and C on the profile between them are respectively 378m and 646 m and the distances AB and AC are 47km and 83km respectively. Find whether the station A and D are intervisible. If, not, compute the height of the scaffold at D in order that

Contd……2
the line of sight may clear the obstacle by 3m taking A as a ground station.

2 (a) Enumerate various linear methods of layout of simple circular curve. Derive the equations required for setting out the curve by offsets from long chord.

2 (b) Two straights $T_1V$ and $V T_2$, having bearings of $45^\circ$ and $110^\circ$ respectively are to be connected by a $4^\circ$ curve (based on chord of 30m), due to inaccessible intersection point, the following traverse is run from a point $P$ on the rear tangent to the point $S$ on the forward tangent:

<table>
<thead>
<tr>
<th>Line</th>
<th>Length (m)</th>
<th>Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>PQ</td>
<td>110.20</td>
<td>$60^\circ 30'$</td>
</tr>
<tr>
<td>QR</td>
<td>90.50</td>
<td>$130^\circ 20'$</td>
</tr>
<tr>
<td>RS</td>
<td>180.70</td>
<td>$30^\circ 40'$</td>
</tr>
</tbody>
</table>

compute the chainage of Point of curve, Point of Intersection and Point of Tangency.

OR

2'(a) A parabolic vertical curve is to be set out connecting two uniform grades $+2\%$ and $-1.5\%$. The chainage and reduced level of point of intersection are 850.0m and 70.50m respectively. The rate of change of grade is 0.05\% per chain of 20m. Calculate the reduced levels of the highest point, point of beginning and point of end of the curve.

2'(b) Describe the procedure adopted for the calculation of length of transition curves.

2'(c) Differentiate between compound curve and reverse curve

3 (a) The observations closing the horizon at a station are

- $A = 24^\circ 22'18.2''$ weight = 1
- $B = 30^\circ 12'24.4''$ weight = 2
- $A + B = 54^\circ 34'48.6''$ weight = 3
- $C = 305^\circ 25'13.9''$ weight = 2
- $B + C = 335^\circ 37'38.0''$ weight = 3

Find the most probable values of the angles $A$, $B$ and $C$
3(b) The following are the observed value of an angle:
   $30^\circ 20' 30''$ w=2; $30^\circ 20' 32''$ w=3; $30^\circ 20' 35''$ w=4

Find
(i) probable error of single observation of unit weight
(ii) probable error of weighted arithmetic mean
(iii) probable error of observation of weight 3.

4(a) Define the following terms:
Vertical, Declination, Celestial Horizon, Zenith Distance and Azimuth of the heavenly body. Illustrate your answer with sketches.

4(b) Find the LMT of observation at a place from the following data:
LAT of observation = $16^h 20^m 40^s$
ET at GMN = $5^m 10.75^s$ additive to apparent time and increasing $0.32^s$/hr. longitude of the place = $25^\circ 30' W$

5(a) A vertical photograph of a flat area having an average elevation of 300m above mean sea level was taken with a camera having a focal length of 20cm. A section line AB, 250m long in the area, measures 8.50cm on the photograph. A tower TB in the area also appears on the photograph. The distance between the images of top and bottom of the tower measures 0.46cm on the photograph. The distance of image of top of the tower is 6.46cm. Determine the height of the tower.

5(b) Briefly describe the applications of hydrographic survey

5(c) Briefly describe the various equipments used for taking soundings