2012 – 2013

B.ARCH. / B.TECH. AUTUMN (V SEMESTER) EXAMINATION
(ARCHITECTURE / CIVIL ENGINEERING)
DESIGN OF CONCRETE STRUCTURES – I

(CE – 311)
Credits: 04

Duration : Three Hours

Maximum Marks : 60

Note: Answer all questions.
Assume suitable data, if required also list the relevant clauses of the IS 456-2000 while solving the problem.
Use of IS:456-2000 Code is allowed.

1. (a) How the following factors are incorporated in the design formulae for the limit state of design:
   Partial safety factor for load
   Partial safety factors for material strength
   Difference between cube strength and strength of concrete in structure

   [04]

   (b) Calculate the ultimate moment carrying capacity of a rectangular beam with
       \[ b=250\text{mm} \text{ and } D=400\text{mm}, \text{ and } A_{st} = 4 \times 16\text{mm} \text{ diameter bars.} \]
       Provide nominal clear cover to meet the requirement of the resistance rating of 2hrs and
durability requirements for “very severe” exposure. Assume concrete grade as
M30 and steel grade as Fe 415. Show the reinforcement details with neat sketches. List the relevant clauses of the IS456-2000 while solving the problem.

   [08]

OR

1'. (a) What are the basic assumptions in the design of a reinforced concrete section
for limit state of collapse in bending.

   [03]

   (b) Design a doubly reinforced section for a rectangular beam of effective span 4m.
The superimposed live load is 40kN/m and the size of the beam is limited to
250\times350\text{mm overall}. Take concrete grade M20 and steel grade Fe 415.

   [09]

2. (a) Deduce the formula for the calculation of development length in RC structure in
standard notations.

   [04]

   (b) An RC Beam of section 300\times400\text{mm} is reinforced with 3 bars of 20mm
diameter of Fe415 at support. The span of the beam is 5m and of UDL 36
kN/m. Design the shear reinforcement with vertical stirrups only.

   [08]

3. (a) Discuss in brief the various modes of failures in concrete columns.

   [04]

Contd…..2
(b) Design a square column for a residential building of ceiling height 3m subjected to a direct load of 200kN. Assume suitable end conditions. Use M20 and Fe 415. Show a neat sketch of reinforcement detail.

4. Design a slab of a multi penal floor system with all four edges continuous and centre to centre spans of 4m x 4m. Assume a live load of 4 kN/m² and a floor finish of 1 kN/m². Assume concrete grade as M20 and steel grade as Fe 415. Show a neat sketch of reinforcement details in the middle and edge strips.

OR

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

(b) Design an interior panel of a flat slab. The slab is supported on columns spaced at 6m in both the directions. The size of the column is 600mm x 600mm. Assume a live load of 3 kN/m² and a floor finish of 1 kN/m². Height of the column is 6m. Assume concrete grade as M20 and steel grade as Fe 415. Show a neat sketch of reinforcement details in the middle and column strips.

5. Design the footing of a square column of size 300x300mm with 8 # 16mm diameter to carry a working load of 900 kN for the following data Bearing Capacity of soil 100 kN/sq.m.

Concrete grade : M20
Steel grade : Fe415

Also show a neat reinforcement detail in the footing and column.
B.Arch. / B.Tech. Autumn (V Semester) Examination
(Architecture / Civil Engineering)
Soil Mechanics

(CE - 312)
Credits: 04

Maximum Marks: 60
Duration: Three Hours

Note: Answer all questions. Assume suitable data, if not given.

1 (a) Enumerate various methods for determining the specific gravity of soil. Describe a method for determination of the specific gravity of fine grained soil. 08
(b) A soil sample in its undisturbed state was found to have volume of 105 cm³ and weight 201 g. After oven drying the weight reduced to 168 g. Compute (i) water content (ii) voids ratio (iii) porosity (iv) degree of saturation. Take G = 2.7

OR

1' (a) Give the step by step procedure for classification of soil by Indian standard classification system. 08
(b) The natural density of sand is 17.5 kN/m³. Find the relative density if the maximum dry density is 18.5 kN/m³ and the minimum dry density is 16 kN/m³. Take G = 2.65

2 (a) What is Darcy's law of permeability? Discuss the factors affecting permeability of soil. 06
(b) A sand stratum 10 m thick. The water table is 2.5 m below ground level. The unit weights of sand above and below water table are 17 kN/m³ and 21 kN/m³ respectively. The capillary rise above water table is 1.5 m. Draw the distribution of effective pressure, pore water pressure and total pressure at the bottom of sandy stratum.

3 (a) Discuss the approximate methods for determining the vertical stress under surface footing. Also state the assumption made by Boussinesq for computing vertical stress under surface footing. 08
(b) A long strip footing of width 2.5 m carries a load of 600 kN/m. Determine the vertical stress at a depth of 4 m below the centre of the footing. 04

OR

3' (a) Derive an expression for the vertical stress under uniformly distributed circular area. Write down the expression for the vertical stress below the centre of the uniformly distributed rectangular area of length L and width B. 06
(b) A rectangular area 4 m x 2 m is uniformly loaded with a load intensity of 100 kN/m². Calculate the vertical stress at a point 3 m below one of its corners (i) by equivalent point load method (ii) Newmark’s influence chart method.

4 (a) Describe the laboratory consolidation test. Also discuss briefly that how the data obtained from laboratory consolidation test are used to determine the coefficient of consolidation. 08
(b) A clay layer whose settlement under a given loading is expected to be 12 cm, settles by 3.5 cm at the end of one month after the application of the load increment. How many months will be required to reach a settlement of 5 cm? How much settlement will occur in one year? Assume the layer to have double drainage.
5 (a) Describe in detail about the triaxial shear test. What are its merits and demerits?

(b) Vane shear test conducted in a soft clay deposit, failure occurred at a torque of 45 Nm. Afterwards the vane was allowed to rotate rapidly and the test was repeated in the remoulded soil. The torque at failure in the remoulded soil was 17 Nm. Calculate the sensitivity of soil. In both cases the vane was pushed completely inside the soil. The height of vane and diameter are 100 mm and 80 mm respectively.
2012 2013
B. Tech. Autumn (V Semester ) Examination
(CIVIL ENGINEERING)
ENVIRONMENTAL ENGINEERING
(CE -313 N)
CREDITS: 04

Maximum Marks: 60

Duration: Three Hours

Instructions to Examinees
1. Attempt all questions
2. Assume missing data suitably
3. Use of attached Nomograph permitted

Q. 1(a) Explain the different water demands for a town. Discuss the variation in water demand.
(b) Explain the various methods for the prediction of population. The following data shows the population of a city in three periods, each of ten years 30000 to 42000 to 55000
Find
(i) Saturation Population
(ii) Coefficient of Logistic equation.
(iii) Expected population in next ten years
OR

Q. 1'(a) Discuss the various methods of water distribution in a city
1'(b) Replace the pipe network shown in figure 1 by single diameter pipe. Make use of the attached nomograph.

Q. 2 (a) Draw water treatment flowsheets for a surface water source and a subsurface water source.
(b) Differentiate between coagulation and flocculation. Write down the equations for coagulation process with using Alum, Ferric chloride and Ferrous sulphate. Briefly explain the significance of presence of alkalinity in coagulation process using alum as a coagulant.
(c) Design a rectangular sedimentation tank for the treatment of 100 MLD of water. Assume a suitable value of surface overflow rate

Q. 3 (a) Discuss in detail the different pollutants present in a domestic wastewater.
(b) The BOD$_5$ at 20$^\circ$C of wastewater sample is 250 mg/L. Determine the ten day BOD if the temperature was 30$^\circ$C. Take $K_{20}$ as 0.23 d$^{-1}$.
(c) Briefly explain the working of a sequencing batch reactor.

OR

Q. 3'. Briefly explain the BOD removal mechanism in a trickling filter. Design a two stage high rate trickling filter for the treatment of 40 MLD of domestic wastewater. The BOD of wastewater may be taken as 250 mg/L. It is assumed that 30% of the BOD has been removed in primary treatment. It is desirable to have 30 mg/L of BOD in the treated effluent. Take $R = 1$.  

...2
Q. 4 (a) Design a septic tank for 50 users. Assume an appropriate value of sewage contribution per person and frequency of cleaning as one year. (6)
(b) Briefly explain the working of an oxidation pond. Design an oxidation pond for the post treatment of 10 MLD of industrial wastewater. The BOD loading may be taken as 150 Kg BOD ha\(^{-1}\).d\(^{-1}\). The influent BOD may be taken as 200 mg/L. (6)

Q. 5. Briefly explain any four of the following (4 x 3)
(i) Municipal Solid Waste Management
(ii) Breakpoint Chlorination
(iii) Wetlands
(iv) Working of activated sludge process
(v) Primary treatment of wastewater

![Figure 1](image-url)
Diagram for Hazen-Williams Formula.

*Based on C = 100.*
1(a) What are different types of arrangements used in Triangulation? What are their relative advantages and disadvantages? (4)

1(b) Two proposed triangulation stations A and D are 120 km apart and their respective elevations above mean sea level are 282m and 1105m. The altitude of two peaks B and C on the profile between them are respectively 375m and 640m 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 the line of sight may clear the obstacle by 3m taking A as a ground station. (8)

1'(a) Correct the observed altitude for the height of signal, refraction and curvature from the following data:
- Observed altitude = 02° 48' 39"
- Height of instrument = 1.12m
- Height of signal = 4.87m
- Horizontal distance = 5112m
- Co-efficient of refraction = 0.07
- Mean radius of earth = 6400km (4)

1'(b) In measuring angles from a triangulation station B it was found necessary to set the instrument at a satellite station S, due south of the main station B and at a distance of 12.2m from it. The line BS approximately bisects the exterior angle ABC. The angles ASB and BSC were observed to be 30° 20' 30" and 29° 45' 06" respectively. When the station B was observed, the angles CAB and ACB were observed to be 59° 18' 26" and 60° 26' 12" respectively. The side AC was computed to be 4248.5m from the adjacent triangle. Determine the correct value of the angle ABC. (8)

2(a) Derive the relation for setting out the simple circular curve by linear method (offset from tangent) (4)

2(b) Two tangents AB and BC are to be connected by a right hand circular curve. The bearing of AB and BC are 70° and 140° respectively. The curve is to pass through a given point P which is at a distance of 120m from B and the angle ABP is 40°. Determine (i) radius of the curve (ii) chainage of tangent points (iii) total deflection angle for the first, last, and unit pegs. The peg interval and the length of a normal chord is 30m. the chainage of the point of intersection is 3000m. (8)

OR

2'(a) Derive the relation for shift of the curve in the transition curve. (4)

2'(b) Two straights AB and BC intersect at chainage 1642.5m. the deflection angle being 48° 24'. It is proposed to insert a circular curve of 300m radius with a transition curve at each end. The maximum speed is 72km/hr, rate of change of centrifugal acceleration is 0.3m/sec². Find the chainage at all important points. Make all necessary data for setting out transition curve using peg interval as 15m. (8)
3(a) The following are the observed value of an angle:
30° 20' 30" w=2; 30° 20' 32" w=3; 30° 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.  

Find the most probable values of the following station observation forming normal equation in correction (Method of differences)

\[
\begin{align*}
A &= 20° 10' 14" & w=2 \\
B &= 30° 15' 20" & w=2 \\
C &= 42° 02' 16" & w=3 \\
A+B &= 50° 25' 37" & w=3 \\
B+C &= 70° 17' 34" & w=3 \\
A+B+C &= 92° 27' 52" & w=1 \\
\end{align*}
\]

4(a) Using Napier’s rule, derive the relation between astronomical terms α, δ, θ and H when the star is at prime vertical.  

4(b) The altitudes of a star at upper and lower transits of a star are 70° 20' 30" and 20° 40' 10" both the transits being North side of zenith of the place. Find the declination of star and the latitude of place of observation. 

4(c) Calculate the sun’s azimuth and hour angle at sunset at a place in latitude 50° 40' 30"N when its declination is 16° 30' 40"S.

**OR**

4'(a) Define the following terms with the help of sketches:
The declination; Celestial Horizon; The prime vertical and celestial poles of a heavenly body.

4'(b) Find the local apparent time of an observation at a place in longitude 60° 18'E, corresponding to local mean time 10h 20m 30s, the equation of time at GMN being 5m 4.35s additive to the mean time, and decreasing at the rate of 0.32s per hour.

5(a) Enumeration the different methods of locating soundings. Derive the relation for analytical solution of three point problem.

5(b) 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.
2012 – 2013
B.TECH. AUTUMN (V SEMESTER) EXAMINATION
CIVIL ENGINEERING
CONCRETE TECHNOLOGY
(CE-421)
Credits: 04

Maximum Marks : 60

Note: Answer all questions.

1. (a) Discuss the role of C3S and C2S on the early strength of concrete.
(b) Discuss the steps required to reduce the alkali aggregate reaction.

2. (a) Discuss the various factors affecting the shrinkage of concrete.
(b) Discuss the harmful effect of creep of concrete.

OR

2'. (a) Describe the role of aggregates in creep as well as shrinkage of concrete.
(b) Explain the relation between the modulus of elasticity of concrete and its strength.

3. (a) Briefly explain the steps that are adopted while concreting in hot weather.
(b) Discuss the effects of seawater on the durability of concrete.

4. (a) Discuss in brief the various types of tests that are conducted for determining the tensile strength of concrete.
(b) Discuss the difference in strength of concrete obtained from cube test and a standard cylinder test.

OR

4'. (a) Describe the advantages of non-destructive testing of concrete over standard testing of concrete.
(b) Discuss any one test for non-destructive testing of concrete.

5. (a) What is meant by self compacting concrete? What are the advantages of this type of concrete?
(b) What are the advantages and disadvantages of Light Weight Concrete?
B.TECH.AUTUMN (V SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
DAM ENGINEERING
(CE-428)

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all questions.
Assume missing data suitably, if not given.
Notations used have their usual meanings.

1.(a) Write a note on selection of dam site.

(b) Derive an expression for the principal and shear stresses developed in the body of a gravity dam.

OR

1′(a) Explain the procedure of designing zone I and II of a gravity dam by the method of zoning.

(b) Calculate factor of safety against overturning and sliding for a gravity dam 45 m high. It has top width of 8.0 m. The u/s face is vertical and d/s is vertical from top up to 9.0 m depth and then has a constant slope of 0.75 horizontal to 1 vertical to the base. Assuming unit weight of dam material as 24 KN/m³, reservoir full condition with a free board of 3.0 m. Consider weight of dam, water pressure and uplift pressure. Take μ = 0.65 and uplift pressure coefficient C = 1/3.

2(a) Calculate the total overturning force and overturning moment for a gravity dam profile as shown in Fig.1, under the influence of following forces:

Weight of dam (γm = 24 KN/m³); Water pressure (γw = 10 KN/m³);
Wave pressure (T = 20 Km. V = 82Kmph); Uplift force (C = 1)
Horizontal acceleration of earth quake (ω = 0.05)

(b) Write short note on temperature control in mass concreting in case of a gravity dam.

OR
(b') Derive a relation for the base width of an elementary profile of a gravity dam based on sliding criteria.

3(a) A V-shaped valley is approximated by a trapezium of dimensions top width 250m, bottom width 80m and depth 100m. Design a constant angle arch dam for the valley and tabulate design calculations in tabular form on the basis of thin cylinder theory. Take $\theta = 140^0$ and $f_c = 350t/m^2$.

(b) What are the assumptions of thin cylinder theory? Also mention the limitations.

OR

(b') Explain various components of a Buttress dam by giving a neat sketch.

4(a) Write short notes on any one of the following:
(i) Design criteria for an earthen dam.
(ii) Various components of earth dam.

(b) Discuss various causes of earth dam failures.
Maximum Marks: 60
Duration: Three Hours

Attempt all questions.
Assume any information if required.

Q1 (a) What are the main parameters in wastewater characterization? List tolerance limits of various parameters to discharge wastewater effluents
(i) in water bodies
(ii) on land for irrigation

Q1 (b) For a 150 mg/L solution of glucose
(i) Determine the ultimate BOD if glucose is oxidized completely to carbon dioxide and water.
(ii) If the BOD rate constant is 0.3 d⁻¹, calculate the 5 day BOD for the solution.
(iii) What will be the TOC value for the solution?

Q1 (c) A lake with surface area of 100 x 10⁶ m² has the only source of phosphorus from the effluent of a wastewater treatment plant. The effluent flowrate is 0.4 m³/s and its phosphorus concentration is 10 mg/L. The lake is also fed by a stream having 20 m³/s of flow with no phosphorus. If the phosphorus settling rate is estimated to be 10 m/year, estimate the average phosphorus concentration in the lake. What level of phosphorus removal at the treatment plant would be required to keep the average lake concentration below 0.01 mg/L?

Q1 (d) An industrial wastewater treatment plant disposes of its effluent in a surface stream. Characteristics of the stream and effluent are shown below.

<table>
<thead>
<tr>
<th></th>
<th>Wastewater</th>
<th>Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow, m³/s</td>
<td>0.2</td>
<td>5.0</td>
</tr>
<tr>
<td>Dissolved oxygen, mg/L</td>
<td>1.0</td>
<td>8.0</td>
</tr>
<tr>
<td>Temperature, °C</td>
<td>15</td>
<td>20.2</td>
</tr>
<tr>
<td>BOD₅ at 20°C, mg/L</td>
<td>100</td>
<td>2.0</td>
</tr>
<tr>
<td>k₁ at 20°C, d⁻¹</td>
<td>0.2</td>
<td>---</td>
</tr>
<tr>
<td>k₂ at 20°C, d⁻¹</td>
<td>---</td>
<td>0.3</td>
</tr>
</tbody>
</table>

(i) What will be the dissolved oxygen in the stream after 2 days?
(ii) What will be the lowest dissolved oxygen concentration as a result of the waste discharge?

OR

Q1 (d') A completely mixed activated sludge plant is to treat 10,000 m³/d of industrial wastewater. The wastewater has a BOD of 500 mg/L which is to be reduced to 30 mg/L before it can be
discharged into a river. Assuming $\theta = 5 \text{ d}$, $X = 3000 \text{ mg/L}$, $Y = 0.5$, $k_d = 0.05 \text{ d}^{-1}$ and $X_s = 10000 \text{ mg/L}$, determine:

(i) volume of reactor
(ii) mass and volume of solids wasted daily
(iii) sludge recirculation ratio

Q2(a) An industrial plant discharges 250 m$^3$/d of waste which has a BOD of 1000 mg/L. If each person contributes 0.05 kg/d BOD load, what is the population equivalent of the waste?

OR

Q2(a') A wastewater sample has a a BOD$_5$ of 500 mg/L. The initial dissolved oxygen in the BOD bottle was 8 mg/L and the dilution was 1 to 100. What was the final dissolved oxygen in the BOD bottle?

Q2(b) Calculate the volume of sludge from a sedimentation tank treating 1000 m$^3$/d if incoming wastewater has 1200 mg/L suspended solids and removal efficiency is 95%. Assume sludge moisture of 99% and density as 1000 kg/m$^3$.

Q2(c) Discuss the importance of equalization and neutralization in industrial wastewater treatment.

OR

Q2(c') Explain the difference between a grab sample and composite sample. List the different methods used for measurement of waste flow in an open channel.

Q2(d) For an industry of your choice explain the manufacturing process, raw materials and chemicals used, various wastewater streams generated and the proposed treatment scheme.

Q3 (a) Explain why air pollution is a growing problem in India.

Q3 (b) One cubic meter sample of air was found to contain 80 $\mu$g/m$^3$ of SO$_2$. The temperature and pressure were 25° C and 103.193 kPa when the air sample was taken. What was the SO$_2$ concentration in ppm.

OR

Q3' (a) From which natural sources might the following pollutants arise: Hydrocarbons, CO, H$_2$S, CH$_4$ and particulate matters?

Q3' (b) What is meant by global warming? State any two effects.

Q3' (c) What can you do to reduce air pollution as a result of industrial activities in our country?

Q4 (a) Explain the influence of moisture, temperature, and sunlight on the severity of air pollution effects on materials.

Q4 (b) Estimate the plume rise for a 3.6 m diameter stack whose exit gas has a velocity of 25 m/sec. When the wind velocity is 2.3 m/s. The pressure is 1.0 atmosphere and the stack and surrounding temperature are 125° C and 20° C respectively.
Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer ALL the questions. Notations used have their usual meaning.

1(a) Explain the difference between orientational, electronic and ionic polarizations in brief. [05]

(b) Define static dielectric constant and obtain the relation \( P = \varepsilon_0(\varepsilon_r - 1) E \). [05]

(c) What is piezoelectricity? Give two examples of piezoelectric materials. Draw hysteresis curve for ferroelectric material and discuss it briefly. [05]

OR

(c') The electronic polarizability of the Ar atom is \( 1.8 \times 10^{-39} \text{ F.m}^2 \). What is the static dielectric constant of Ar gas at 1 atmospheric pressure at room temperature (300K)? [Given: \( k_B = 1.38 \times 10^{-23} \text{ J/K} \) and \( \varepsilon_0 = 8.854 \times 10^{-12} \text{ F/m} \)]. [05]

2(a) What is dipolar relaxation? Obtain the relation for orientational polarization in alternating fields. [07]

(b) Explain the diffusion process in semiconductors and find a relation for diffusion current per unit area for \( n \) and \( p \) type semiconductors. [05]

(c) An intrinsic Si sample is doped with donors from one side such that \( N_d = N_0 \exp(-ax) \). [03]
   
   (i) Find an expression for \( E(x) \) at equilibrium over the range for which \( N_d > n_i \).
   
   (ii) Evaluate \( E(x) \) when \( a = 4 \text{ (\mu m)}^{-1} \).

3(a) How ferromagnetism is explained on the basis of exchange interaction? Give a brief account of Weiss theory of ferromagnetism. [07]

(b) The magnetic field in a diamagnetic material is 1000 Am\(^{-1}\). Calculate the magnetization and flux density of the material if its susceptibility is \(-0.4 \times 10^{-5}\). [04]

(c) Distinguish between hard and soft magnetic materials. Give two examples for each. [04]
4(a) Derive the London’s equations and explain the term coherence length.

(b) A d.c. voltage of 1μV is applied across a Josephson junction. Calculate the frequency of the Josephson current generated. [Given: \( h = 6.63 \times 10^{-34} \text{ J.s} \)]

(c) Discuss briefly the potential applications of superconductors.

OR

4(a') Explain d.c. Josephson effect. Show that the super current of superconducting pairs across the junction depends on the phase difference.

(b') A superconductor sample has a critical temperature of 3.722 K in zero magnetic field of 0.0305 T at 0 K. Evaluate the critical field at 2 K

(c') Discuss the thermodynamics of superconducting transition in detail.