Note: Answer all the questions.
Assume suitable data, if required.
Notations used have their usual meaning.
Use of relevant IS codes and IRC loading charts are allowed.

Q.No.           Question                                                                                       M.M.
1               Design a continuous reinforced concrete beam of rectangular section to support a dead load of 10 kN/m and live load of 12 kN/m over 3 spans of 6 m each. All supports are simply supported. Use IS Code method. Adopt M-20 grade concrete and Fe-500 TMT bars. [12]

OR

1'(a) Irregularities of mass, stiffness, and strength are not desirable in buildings situated in earthquake prone areas. Describe using diagrams how these occur and affect the building. [4]

1'(b) A 5 storey OMRF building has plan dimensions as shown in Fig. 1. The storey height is 3.0 m. The dead load per unit area of the floor, consisting of the floor slab, finishes, etc is 4 kN/m². Weight of the partitions on the floor can be assumed to be 2kN/m². The intensity of live load on each floor is 3 kN/m² and on the roof is 1.5 kN/m². The soil below the foundation is hard and the building is located in Delhi. Determine the base shears and shears at different floors. [8]

2               Design the long wall of a RC tank 4.0 x 8.5 x 4.0 m deep resting on ground. Adopt M 25 and Fe 500 TMT bars. The design of tank should conform to the stresses specified in IS 3370: 2009 and IS 456: 2000. [12]

OR

Contd...2
Design top dome and top ring beam of an intz tank for the following data:

Central rise of top dome = 1.5 m  
Diameter of cylindrical vessel = 12.0 m  
Height of cylindrical vessel = 4.5 m  
Rise of bottom dome = 1.5 m  
Mean diameter of supporting tower = 9.0 m  


Design a reinforced concrete slab culvert for a state highway for IRC class AA tracked vehicle to conform the following data: Carriage way: 2 lane 7.5 m wide, Kerbs: 650 mm wide, Clear span = 6 m, wearing coat = 90 mm, width of bearing = 400 mm, Materials: M-25 grade concrete and Fe-500 TMT bars.

What is the need for high strength steel and high strength concrete in prestressed systems? Discuss.

A rectangular concrete beam, 300 mm deep and 200 mm wide, is pre-stressed by means of fifteen 5 mm diameter wires located 65 mm from the bottom of the beam and three 5 mm wires, located 25 mm from the top of the beam. If the wires are initially tensioned to a stress of 840 N/mm², calculate the percentage loss of stress in steel immediately after transfer, allowing for the loss of stress due to elastic deformation of concrete only.

The gravity loading on a ‘waist slab’ type flight can be resolved into components normal to the flight and tangential to the flight. Describe their load effects on the waist slab if it is (1) spanning transversely (2) spanning longitudinally.

Design one of the flights of dog-legged stairs spanning between landing beams using the following data.

Type of stair: Dog-legged with waist slab, treads and risers  
No of steps in the flight = 10  
Tread = 300 mm, Riser = 150 mm, width of landing beams = 300 mm  
Use M 20 concrete and Fe 500 TMT bars. Assume mild exposure conditions.  

Design the (section & reinforcement) of the vertical stem of the retaining wall of height 3 m above the ground level. The density of earth is 18 kN/m³ and its angle of repose is 30°. The embankment is horizontal at top. The safe bearing capacity of the soil may be taken as 200 kN/m² and the coefficient of friction between soil and
concrete is 0.5. Adopt M20 concrete and Fe 500 TMT bars.
1(a) What are the assumptions of Coulomb's theory of earth pressure? An excavation was made for a foundation trench in plastic clay having cohesion of 50 kN/m², unit weight of 21 kN/m³ and angle of shearing resistance, \( \phi = 0^\circ \). Find out the depth at which the active earth pressure is zero.

1(b) Determine the point of application of lateral active earth thrust acting on the vertical face of 7.5 m high retaining wall from the following data:
   (i) Surcharge over 1st layer: Intensity of surcharge, \( q = 10 \) kN/m²
   (ii) 1st Layer: Thickness = 3.0 m, \( \phi = 25^\circ \) and \( \gamma = 19 \) kN/m³
   (iii) 2nd Layer: Thickness = 4.5 m, \( \phi = 30^\circ \) and \( \gamma = 17 \) kN/m³

1'(a) Explain the design procedure of cantilever sheet pile wall and draw the pressure distribution diagrams for active and passive thrust on sheet pile wall.

1'(b) The backside of a 10 m high retaining wall is inclined with vertical at an angle of 15°. The backfill has a unit weight of 18 kN/m³ and angle of shearing resistance of 24°. The angle of inclination of backfill with horizontal is 12° and angle of wall friction is 16°. Using Culmann’s graphical construction method, compute the maximum lateral active pressure on the wall and also show the location of failure plain.

2. A slope has to be made of a granular soil having \( \gamma_{sat} = 19 \) kN/m³, \( \phi' = 35^\circ \). If the factor of safety of 1.3 is needed against slope failure, determine the safe angle of the slope:
   (a) When the slope is dry without seepage.
   (b) If seepage occurs parallel to the slope with the water table at a depth of 1.5 m, What is the factor of safety available on a slip plane parallel to the ground surface at a depth of 4 m? Assume, \( \beta = 28^\circ \).

3(a) What do you understand by SPT N-Value? Explain various corrections which are applied to the observed N-Values obtained by standard penetration test.
3(b) A square footing of size $3m \times 3m$ is built on the homogenous bed of sand having the angle of shearing resistance of $36^\circ$ and unit weight of $20 \text{ kN/m}^3$. The depth of the base of footing is $1.5 \text{ m}$ below the ground surface. Calculate the safe load that is carried by footing with $\text{FOS} = 2.5$ against complete shear failure. Use Terzaghi’s analysis. Take values of bearing capacity factors, $N_c = 65.4$, $N_q = 49.4$ and $N_r = 54.0$

(OR)

3' (b) A footing $2.0 \text{ m}$ square carries a gross pressure of $350 \text{ kN/m}^2$ at a depth of $1.2 \text{ m}$ in sand. The saturated unit weight of sand is $20 \text{ kN/m}^3$ and the unit weight above the water table is $17 \text{ kN/m}^3$. The shear strength parameters are $c' = 0$ and $\phi' = 30^\circ$ [For $\phi' = 30^\circ$, $N_q = 22$, $N_r = 20$]. Determine the factor of safety with respect to shear failure when water table is $5.0 \text{ m}$ below the ground level.

4(a) Discuss the importance and uses of Pile foundations in Civil Engineering Constructions.
Classify various types of piles with the help of sketches.

4(b) A $40 \text{ cm}$ diameter concrete pile, $20 \text{ m}$ long was driven in a deposit of silty sand. The water table was close to the ground surface. The weight of the single acting hammer was $2 \text{ tons}$ which had a free fall of $100 \text{ cm}$. The final set was $5 \text{ mm}$ and the coefficient of restitution is $0.40$. Determine the allowable load as per IS code provisions.

(OR)

4'(b) A group of $9$ piles, $15 \text{ m}$ long is used as a foundation for a column. The piles used are $30 \text{ cm}$ in diameter with a centre to centre spacing of $0.9 \text{ m}$. The subsoil consists of clay with $q_u = 1.5 \text{ kg/cm}^2$. Calculate the load carrying capacity of pile group.

5(a) Define any three of the following:
(i) Dynamic magnification factor (ii) Vibration isolation technique (iii) Under damped case of free vibrations (iv) Logarithmic decrement

5(b) A spring mass system with viscous damping is displaced from its equilibrium position and released. The operating frequency is $60 \text{ rad/sec}$ and natural frequency is $35 \text{ rad/sec}$. If the amplitude of vibration of machine diminishes by $6\%$ each cycle, determine, (i) logarithmic decrement (ii) damping factor (iii) Check whether, the vibrating system is under damped, over damped or critically damped.
B.E. (AUTUMN SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
TRAFFIC ENGINEERING
(ECE-423)

Maximum Marks: 60
Credits: 04
Duration: Two Hours

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

1(a). The trip rate (y) and the corresponding household sizes (x) from a sample are shown in Table below. Compute the trip rate if the average household size is 2.5, by using regression method.

<table>
<thead>
<tr>
<th>Trips per day (y)</th>
<th>Household size (x)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

1(b). What are different methods of trip generation analysis? Discuss Regression method with suitable example.

OR

1'(b). A zone has 250 household with car and 250 household without car and the average trip generation rates for each groups is respectively 5.0 and 3.0 trips per day. Assuming that in the future, all household will have a car, find the growth factor and future trips generation from that zone, assuming that the population will increase 1.15 times and income remains constant.

2(a). Describe the various methods available for traffic count.

2(b). Describe the various causes of road accidents on highways.

3(a). Describe the various types of parking facilities designed for traffic needs.

3(b). What is an intersection? Differentiate between intersection at grade and grade separated intersections. Also write their advantages and disadvantages.

OR

3'(a). Write down the advantages and disadvantages of over-pass and under-pass.

3'(b). Four legs in a rotary intersection are designated as 1, 2, 3 and 4. The traffic volume in terms of PCU/hour are given as:

<table>
<thead>
<tr>
<th>Leg</th>
<th>Left Turning</th>
<th>Straight Ahead</th>
<th>Right Turning</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1080</td>
<td>1520</td>
<td>1090</td>
</tr>
<tr>
<td>2</td>
<td>150</td>
<td>200</td>
<td>240</td>
</tr>
<tr>
<td>3</td>
<td>300</td>
<td>450</td>
<td>600</td>
</tr>
<tr>
<td>4</td>
<td>570</td>
<td>310</td>
<td>412</td>
</tr>
</tbody>
</table>

Calculate the Practical Capacity of the rotary in PCU/hour. Take width of carriage way at entry and exit as 6m and length of weaving section as 45m respectively.

Contd...
4(a). Classify the road marking and discuss their individual benefits.

4(b). Draw the traffic signs for any four of the given commands. Colouring is not compulsory.
   (a) Vehicles prohibited in one direction
   (b) Compulsory ahead and turn right
   (c) Right reverse band
   (d) Parking both side
   (e) Vehicle width limit
   (f) Overtaking prohibited

29/12/17
Time: 03:00
05:00
Evening
2017-18
B.E (AUTUMN SEMESTER) EXAMINATION
CIVIL ENGINEERING
ECE429
INDUSTRIAL POLLUTION CONTROL
Credits: 04 Duration: Two Hours

Maximum Marks: 60

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

Q.No. Question MM
1(a) Discuss any two briefly
     a) Global warming
     b) Fumigation, Looping, Lofting, Conning plume behaviour
     c) Effects of SO$_x$ and NO$_x$ on human health, plants and material

OR
1'(a) What are the meteorological factors influencing air pollution? Briefly discuss the atmospheric cleansing process.

1(b) Discuss in brief about the different Pasquill stability classes. Differentiate between Ambient Lapse Rate (ALR) and Dry Adiabatic Lapse Rate (DALR).

2(a) Flow rate of an air stream Pass through a cyclone of standard proportion is 7.5 m$^3$/s. The diameter of a cyclone is 2.6 m and viscosity of air 2.07 x 10$^{-5}$ kg/ms
i. Workout other dimensions of this cyclone units
ii. Determine the size of the particles that can be removed with 50% efficiency
iii. Using the relative size efficiency curve determine the efficiency for removal of 10μm particle
iv. Determine collection efficiency for 10μm particles if 70 cyclones with 24 cm diameter are used instead of large unit
Assume Ne= 5, $\rho_f$= 1.5 g/cm$^3$

2(b) Briefly explain the working of Gravitational Settling Chamber and Baffled Gravitational Settling Chamber.

3(a) Explain the causes & effects of Industrial pollution. Discuss the step wise procedure of carrying out Industrial waste water survey & its significance.

3(b) Write a short note on coagulation & its mechanism for wastewater treatment. A treatment plant requires Ferrous Sulphate or copper as (FeSO$_4$.7 H$_2$O) with lime (CaO) as a coagulant. The ferrous sulphate is consumed at a rate of 12mg/l. Determine the quantities of Ferrous sulphate & lime required to treat 15 million litres of water.
4(a) The data of wastewater generated by a community on an hourly basis is recorded as shown in Table 1. Design a rectangular equalization tank for volume & dimensions.

Table 1.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>14</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>22</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative Flow (m³)</td>
<td>25</td>
<td>50</td>
<td>75</td>
<td>100</td>
<td>120</td>
<td>130</td>
<td>140</td>
<td>150</td>
<td>160</td>
<td>170</td>
<td>198</td>
<td>225</td>
</tr>
</tbody>
</table>

4(b) Write down the advantages & disadvantages of aerobic treatment methods over anaerobic methods of biological treatment. Discuss the treatment of industrial wastewater by activated sludge processes (ASP) & rotating biological contactor processes (RBC) in detail with flow sheet diagrams.

OR

4'(a) Discuss in detail the manufacturing process along with various wastewater streams generated, its characteristic for brewery or tannery industry

4'(b) Discuss any two chemical methods of treating the industrial wastewater streams. A dairy is involved in operations of bottling of milk. How much BOD will be produced of total wastewater production & its population equivalent for the given data:

i. Quantity of milk processed daily 2,50,000 kg

ii. Waste water produced daily 250 m³

iii. BOD of waste water 1200 mg/l

Figure: Empirical efficiency for standard dimension cyclone collector as a function of relative particle size
2017-18
B. E. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
STRUCTURAL ANALYSIS II
ECE 430

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.

1. Analyze the frame shown in Fig. 1 using Kani's method taking advantage of the symmetry of frame geometry and loading. Also draw the BMD for the frame.

![Frame Diagram](image)

Fig. 1

OR

1'. Analyze the continuous beam shown in Fig. 2 using Kani's method. Also draw the BMD for the beam.

![Beam Diagram](image)

Fig. 2

contd.....2.
2. Compare stiffness and flexibility method. Develop stiffness matrix for a three span continuous beam ABCD with support A fixed and B, C and D as rollers. [12]

3. Use flexibility method to analyse the beam shown in Fig. 3. Flexural rigidity, EI, of the members is constant throughout. Also draw SFD and BMD.

4. For the continuous beam with internal hinges at C and D as shown in Fig. 4, draw the influence line diagram (I.L.D.) for reactions at the supports A and B; shear force and bending moment at both the sections G and H. [12]

**OR**

4' (a). For the simply supported beam shown in Fig. 5, find the shear force and bending moment at section X using the influence line diagrams. [06]

---

Fig. 3

Fig. 4

Fig. 5

---
4. (b). Find the maximum values of shear force and bending moment at a section 6 m from the left end in a simply supported beam of span 16 m when a load system as shown in Fig. 6 crosses the beam from right to left.

![Diagram of a beam with loads](image)

Fig. 6

5. Calculate maximum shear force and bending moment at a section 8 m from the left hand hinge support of a three hinged parabolic arch whose span is 20 m with a central rise of 5 m, due to a 200 kN point load rolling over the arch from left to right.
1(a) What is an earthquake? Discuss body waves and surface waves with sketches. How can we find surface wave and body wave magnitude of an earthquake? [04]

1(b) How the epicentre of an earthquake is located? Discuss briefly the need of seismic zoning. How moment magnitude a better measure of earthquake size than other magnitude? [04]

1(c) Find the natural period for the system shown below assume that the beam and spring are mass less. Take $L = 1m$, $EI = \text{unity}$

\[ K_2 = 6kN/m \]

\[ K_1 = 3kN/m \]

OR

1'(a) Derive the relation for response of a single degree damped free vibration system. [04]

1'(b) A platform of weight 25,000N is supported on three columns which are fixed to the foundation as well as to the platform. Experimentally it is found that a force of 6000N applied horizontally to the platform produces a displacement of 0.3cm. It is estimated that damping in the structures is of the order of 5% of the critical damping. Determine (i) undamped natural frequency (ii) Absolute damping coefficient (iii) Logarithmic decrement (iv) the number of cycles and time required for the amplitude of motion to be reduced from an initial value of 0.3cm to 0.03cm. [04]

1'(c) A mass of 0.07kg is suspended from a spring of stiffness 45N/m, the mass is pulled downwards by 15mm from its equilibrium position and then released. The upward velocity observed were 25mm/s. Determine the maximum velocity, maximum acceleration and the phase angle. [04]

2 Answer any three of the followings: [6x3]

(a) Find out storey lateral force in a three storey RCC school building situated...
in seismic zone V as shown below using equivalent lateral force procedure as per IS 1893:2002. Zone Factor = 0.36; Importance Factor = 1.5; Response Reduction Factor = 5

(b) For the purpose of earthquake resistant structures, what type of desirable properties the construction materials should have? Give the measures and provisions as per IS1893:2002 and IS 13920 to make a building resistant in earthquake prone regions.

(c) Describe the advantages of using concrete over brick masonry for buildings in seismic areas. What are the possible damages to masonry building in earthquake prone areas?

(d) Answer the following:
   (i) Different Terrain Category, (ii) Design wind force for individual panel and (iii) design wind velocity in different terrain category

(e) Discuss with the help of sketches, the Do’s and Don’ts, in cyclone prone areas for disaster mitigation.

3 (a) List the factors affecting a flood hydrograph. Discuss the role of these factors. [04]

(b) How are river training works classified? Write a brief note on guide banks used for river training works. [04]

(c) Discuss the runoff coefficient C used in the rational formula for flood discharge. Estimate the maximum flood for the following catchments by using an appropriate empirical formula: (i) Area ‘A1’ = 65 sq. km for Western Ghats area, Maharashtra (ii) Area ‘A2’ = 48 sq. km for Gangetic plain and (iii) Area ‘A3’ = 54 sq. km for Tamil Nadu region. [07]

4 (a) Give a brief classification of Natural Hazards. Discuss initiatives taken in India for minimizing the effects of these hazards. [07]

(b) Briefly discuss the factors taken into consideration for IS Code 14496 and Landslide Susceptibility Scores. What are the major differences in the two schemes of landslide hazard zonation? [08]
<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>What are seismic waves? Explain different types of seismic waves with the help of a diagram.</td>
<td>05</td>
</tr>
<tr>
<td>1(b)</td>
<td>Explain the term seismic zoning. Discuss the use of seismic zoning maps.</td>
<td>05</td>
</tr>
<tr>
<td>1(c)</td>
<td>The Moment Magnitude of an earthquake that occurred in 1960 is estimated to be 8.1. Calculate the Rupture Area, if average slip was 1.5m. Take Modulus of rigidity as $3.0 \times 10^{10}$ N/m².</td>
<td>05</td>
</tr>
<tr>
<td>1'(a)</td>
<td>Discuss the effect of soil cover on different earthquake parameters.</td>
<td>05</td>
</tr>
<tr>
<td>1'(b)</td>
<td>What is seismic hazard analysis? Explain deterministic approach of seismic hazard analysis.</td>
<td>05</td>
</tr>
<tr>
<td>1'(c)</td>
<td>During an earthquake the maximum amplitude recorded at a site by seismograph is 30 cm. The maximum ground velocity recorded was 20cm/s. The site was found to be 75 km away from the epicenter. Determine the magnitude and intensity of earthquake.</td>
<td>05</td>
</tr>
<tr>
<td>2(a)</td>
<td>Derive the equation of dynamic equilibrium for a building subjected to earthquake motion.</td>
<td>03</td>
</tr>
<tr>
<td>2(b)</td>
<td>A two degree of freedom system is subjected to horizontal earthquake excitation. Each lumped mass is 100kg. Take length of columns on each storey as 3m and $EI = 106$ Nm². Find the natural frequencies and mode shapes for the system.</td>
<td>12</td>
</tr>
<tr>
<td>3(a)</td>
<td>The plan and elevation of a three storey hospital building is shown in Fig.1(a-b). The building is located in seismic zone IV. The type of soil encountered is soft and it is proposed to design the building with a special moment resisting frame. The intensity of dead load is 12.0 kN/m² and floors are to cater to an imposed load 4.0 kN/m². Determine the earthquake forces at different floor levels.</td>
<td>09</td>
</tr>
<tr>
<td>3(b)</td>
<td>Discuss theory of Plate Tectonic and different types of plate boundaries.</td>
<td>06</td>
</tr>
</tbody>
</table>

Contd...
3’(b) Describe the various Earthquake resistant features that can be introduced in a masonry building to make it Earthquake resistant.

4(a) A multi-storeyed building shown in Fig.2(a-b) having 20m x 30m plan dimensions and an overall height of 30m is to be designed at Roorkee in developed out-skirt area with scattered buildings of its height. Determine the design wind pressures acting on the building and draw the pressure diagram.

4(b) Define bands with neat sketches. At what levels in a masonry building would you provide them? Give justifications for each of them.

OR

4’(b) Discuss the causes of failure of the RC structures under past Earthquakes.

FIGURES

Fig1(a): Plan

Fig1(b): Elevation

Fig2(a): Plan

Fig.2(b): Section X-X