1. Answer any three of the following:

(a) Solve the following system of linear equations by Gauss-Siedel method using three iterations. Rearrange equations if necessary:
   \[ 10x - y + 2z = 8; \quad 2x - y + 10z = -8; \quad x + 10y - z = 2. \]  

(b) Use two iterations of Newton–Raphson’s method to find a root of the equation \( \cos x - xe^x = 0 \) correct to four decimals. \[05\] 

(c) Given \( y_0 = -4, \ y_1 = -2, \ y_4 = 220, \ y_5 = 546, \ y_6 = 1148 \), find \( y_1 \) and \( y_2 \). \[05\] 

(d) Apply Newton’s formula to prove that the recurrence relation for finding the \( p^{th} \) root of \( k \) is:
   \[ x_{r+1} = \frac{(p-1)x_r^p + k}{px_r^{p-1}} \]
   Hence find the value of \( 30^{1/5} \). \[05\] 

2. Answer any three of the following:

(a) The following table gives the melting point \( \theta \) in °C of an alloy of Pb(X in %) and Zn:

<table>
<thead>
<tr>
<th>X</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \theta )</td>
<td>184</td>
<td>204</td>
<td>226</td>
<td>250</td>
<td>276</td>
</tr>
</tbody>
</table>

Find the melting point when (i) \( X = 85 \) and (ii) alloy has 55% Zn by suitable Newton’s interpolation formulae. \[05\] 

(b) Apply Lagrange’s formula to find a cubic polynomial which approximates the following data:

<table>
<thead>
<tr>
<th>X</th>
<th>150</th>
<th>152</th>
<th>154</th>
<th>156</th>
</tr>
</thead>
</table>

Contd.....2.
(c) Find $f''(5)$ from the following table:

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>7</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(x)</td>
<td>4</td>
<td>26</td>
<td>58</td>
<td>112</td>
<td>466</td>
<td>922</td>
</tr>
</tbody>
</table>

Dividing the range into 10 equal parts, find the value of the integral $\int_0^\pi \sin x \, dx$ by both Trapezoidal and Simpson's rules.

3(a) Derive the following formula:

$$\int_{-1}^{1} f(x) \, dx = A_0 f(-1) + A_1 f(-c) + A_1 f(c) + A_0 f(1).$$

Hence evaluate $\int_{-1}^{1} x^2 e^{-x} \, dx$.

OR

(a') Solve by Runge-Kutta of order four, the following differential equation

$$\frac{dy}{dx} = x + y, \quad y(0) = 1 \quad \text{for} \quad x = 0.2 \quad \text{with} \quad h = 0.1.$$  

(b) Solve the following BVP:  

$$y'' + y = -1; \quad y(0) = 0 = y(1).$$

By finite difference method for $h = \frac{1}{4}$.

4(a) Evaluate any two of the following:

(i) $L\{t^2 \sin at\}$  
(ii) $L\{e^{-at}(1 - at)\}$  
(iii) $L\{t^2 e^t \sin 4t\}$.

(b) Evaluate any two of the following:

(i) $L^{-1}\left\{ \frac{1}{s(s-1)} \right\}$  
(ii) $L^{-1}\left\{ \frac{a^2}{s(s+a)^2} \right\}$  
(iii) $L^{-1}\left\{ \frac{\cos at - \cos bt}{t} \right\}$.

(c) Use Laplace Transform method to solve the following initial value problem:

$$\frac{d^2 x}{dt^2} + 5 \frac{dx}{dt} + x = 5e^t, \quad x_0 = 2, \quad x_1 = 1.$$
2015-16
B. E. CIVIL ENGINEERING (WINTER SEMESTER) EXAMINATION
ECE 216
STRUCTURAL MECHANICS

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)    Analyse the following truss to calculate forces in members BD, BE and ED.  [06]

![Fig. 1]

1(b)    A cylindrical shell is 1.5 m in diameter and 4 m long. It is subjected to 3 \( \text{N/mm}^2 \) internal pressure. If the maximum principal stress is not to exceed 150 MPa, find the thickness of the shell. Assume \( E = 2 \times 10^5 \) MPa and Poisson’s ratio as 0.25. Find the changes in the diameter, length and volume of the shell.

OR

(b')    A masonry chimney of uniform hollow circular section 2m outer dia. and 1m inner dia. is to carry a wind pressure of 1.5 kN/m². Calculate the maximum height allowed so that there is no tension on the base and maximum compressive permissible stress is 3 N/mm². Assume unit weight of masonry as 19 kN/m³.

2(a)    The planer stresses at a point are given as; \( \sigma_{xx} = -50 \ \text{N/mm}^2 \), \( \sigma_{yy} = 10 \ \text{N/mm}^2 \), \( \tau_{xy} = 8 \ \text{N/mm}^2 \). Calculate stresses on a plane inclined to X-axis by 30° in clockwise direction and calculate principal stresses. Also locate the position of principal planes with respect to X axis.

2(b)    Generalised stresses at a point are given with respect to x-y-z axes as;

\[
[\sigma] = \begin{bmatrix}
50 & -20 & 0 \\
-20 & 50 & 5 \\
0 & 5 & -30
\end{bmatrix}
\]

Contd.....2.
Transform the stress tensor if y-z axes are rotated in their own plane about x-axis in anti-clock wise direction by 30°.

OR

2'(a) Describe Total Strain Energy theory of failure and its Two-dimensional form. [06]

2'(b) A shaft of steel of solid circular cross section, 2m long is fixed at one end and subjected to an axial load of 40 kN and a torque of 10 kNm at its free end. Calculate the minimum diameter required so that the material is safe against 'distortional strain energy theory' with a factor of safety of 1.5. The yield stress for steel is 250 N/mm². [06]

3(a) A beam of uniform cross section and length 2L is simply supported at its ends and carries two point loads each of magnitude $W$ at equal distance 'a' on either side of the mid span. Show that the maximum deflection in the beam is given by

$$y'_{max} = \frac{W(2L^3 - 3L a^2 + a^4)}{6EI}$$

where $EI$ is the flexural rigidity. [04]

3(b) Find the slope at the support A and the deflection at the sections D and C for the simply supported beam loaded as shown in Fig. 2. [08]

![Fig. 2]

3' A simply supported beam AB 6 m long is loaded as shown in Fig. 3. Determine the slope at ends A and B and the maximum deflection in the beam. Take $EI$ as constant. [12]

![Fig. 3]

Contd....3.
4. Using Castigliano's theorem, calculate deflection at mid span and slope at right support for simply supported beam shown in Fig. 4. Assume $EI=5 \times 10^4$ kNm$^2$.

![Fig.4](image)

5(a) A bar of length 4 m when used as a simply supported beam and subjected to a uniformly distributed load of 30 kN/m over the whole span, deflects by 15 mm at the centre. Determine the crippling loads when it is used as a column with the following end conditions:
   (i) Both ends pinned
   (ii) One end fixed and the other end pinned, and
   (iii) Both ends fixed

5(b) A steel strut of hollow circular section with external diameter of 80 mm and internal diameter of 50 mm is 3.5 m long and hinged at both ends. Determine the maximum eccentricity for a crippling load (the line of action of which is parallel to the axis of the strut) of value equal to 80% of that of Euler's load. The yield stress is 300 MPa and $E=2 \times 10^5$ MPa.
### Note:
Answer all questions, assume any missing data suitably.

<table>
<thead>
<tr>
<th>1. (a)</th>
<th>Write down the basic principles of building planning.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Write down the requirements of the following elements of a residential building:</td>
</tr>
<tr>
<td>(i)</td>
<td>Kitchen</td>
</tr>
<tr>
<td>(ii)</td>
<td>Drawing cum Dinning Room</td>
</tr>
<tr>
<td>(iii)</td>
<td>Bathroom and W/C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. (a)</th>
<th>Briefly explain how depth and width of foundation are fixed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Distinguish between load bearing wall and partition wall.</td>
</tr>
<tr>
<td>(c)</td>
<td>Explain English and Flemish bonds used in brick masonry with neat sketches.</td>
</tr>
<tr>
<td></td>
<td>OR</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2'.(a)</th>
<th>Explain different types of bands. Write its importance in brick masonry building.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>What is the object of plastering? State in brief the different types of plasters.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. (a)</th>
<th>Explain Dead shores and flying shores with neat sketches.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>Describe the process well point system of dewatering the foundation trenches with the help of neat sketch.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3'.(a)</th>
<th>What is scaffolding? Explain Brick-layer’s scaffold with a neat sketch.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>What are the various types of cofferdams based on the materials used in their construction? Explain Single walled cofferdam with a neat sketch.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4. (a)</th>
<th>What are the important sources of dampness?</th>
</tr>
</thead>
<tbody>
<tr>
<td>(b)</td>
<td>What are the methods of dam-proofing? Describe any one method of damp-proofing.</td>
</tr>
</tbody>
</table>

| 4'(b)  | Describe treatment to foundation on Damp Soil with a neat sketch. |

<table>
<thead>
<tr>
<th>5</th>
<th>Describe any two of the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i)</td>
<td>Danger to life of occupants caused by fire.</td>
</tr>
<tr>
<td>(ii)</td>
<td>Danger of damage to property caused by fire.</td>
</tr>
<tr>
<td>(iii)</td>
<td>Fire resisting properties of timber and concrete</td>
</tr>
</tbody>
</table>
2015-16
B.E (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
SURVEYING - ECE 218R

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

1 (a) What do you mean by reciprocal ranging? Explain in detail.

OR

1 (b) Explain how three-point problem is solved by graphical method?

The paper of an old map drawn to a scale of 100 m to 1 cm has shrunk, so that a line originally 10 cm has now become 9.6 cm. The survey was done with a 20 m chain 10 cm too short. If the area measured now is 71 sq. cm, find the correct area on the ground.

OR

The following angles were observed in clockwise direction in an open traverse.
\( \angle ABC = 124^\circ 15', \angle BCD = 150^\circ 30', \angle CDE = 104^\circ 00', \angle DEF = 98^\circ 15' \) and \( \angle EFG = 210^\circ 45' \). Magnetic bearing of the line AB was 141° 30'. What would be the bearing of the line FG?

2 The followings' consecutive readings were taken with a level and a 4m levelling staff on a continuously sloping ground at a common interval of 30m.

0.855(on A), 1.545, 2.335, 3.115, 3.825, 0.455, 1.380, 2.055, 3.455, 0.585, 1.015, 3.845(on B). The RL of point A was 380.500m. Make a level book and apply usual checks. Determine the gradient of line AB.

OR

2'(a) Differentiate Reciprocal levelling with Differential levelling.

2'(b) Find the distance to the visible horizon from the top of a Light House 60m high. Also find the dip of Horizon if the radius of the earth is 6371 Km.

3(a) What are the requirements of an ideal Signal and Name various types of Signals.

OR

3 (b) Directions observed from a satellite station S, 5.80 m from the main triangulation station A, are tabulated as shown:
<table>
<thead>
<tr>
<th>Observed station</th>
<th>Bearings</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0° 00' 00&quot;</td>
</tr>
<tr>
<td>B</td>
<td>132° 18' 30&quot;</td>
</tr>
<tr>
<td>C</td>
<td>232° 24' 06&quot;</td>
</tr>
<tr>
<td>D</td>
<td>296° 06' 11&quot;</td>
</tr>
</tbody>
</table>

The lengths of AB, AC and AD were computed to be 3265.5 m, 4022.2 m and 3086.4 m respectively. Determine the directions of AB, AC and AD.

4(a) What is meant by transition curve? Give reasons for introducing a transition curve between a straight and the circular curve on a road or railway.

4(b) Two straights intersect at a chainage of 425.8m having an angle of deflection 40°. The two straights are to be connected by a circular curve of radius 220m and two transition curves, the length of each being 50m. Calculate the shift of the main curve, the spiral angle of the transition curve and the chainage of point of commencement.

OR

4' Two tangents intersect at chainage 1190m, the deflection angle being 36°. Calculate all the data necessary for setting out a curve with a radius of 300m by deflection angle method. The peg interval is 30m.

5 (a) Differentiate between stadia and tangential method of tacheometric survey.

5 (b) Following are the observations of a closed traverse. Calculate the omitted data.

<table>
<thead>
<tr>
<th>Line</th>
<th>Length (m)</th>
<th>Reduced bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>281.40</td>
<td>S 69° 11' E</td>
</tr>
<tr>
<td>BC</td>
<td>129.40</td>
<td>N 21° 49' E</td>
</tr>
<tr>
<td>CD</td>
<td>?</td>
<td>N 19° 34' W</td>
</tr>
<tr>
<td>DE</td>
<td>144.50</td>
<td>?</td>
</tr>
<tr>
<td>EA</td>
<td>168.70</td>
<td>S 74° 24' W</td>
</tr>
</tbody>
</table>
2015-16
II YEAR B.E. IV- SEMESTER EXAMINATION
CIVIL ENGINEERING
HYDROLOGY.
(ECE-219)

Maximum Marks: 60
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.

Question M.M.

Q. No. 1(a) List out various types of rain gauges. Describe Floating type of raingauge with the help of a neat sketch. [7]

1(b) Enumerate various forms of precipitation. The annual rainfalls at seven rain gauge stations in a basin are 52, 94, 65, 45, 20, 80 and 69cm respectively. What is the percentage error of the existing network in the estimation of the average depth of rainfall over the basin? How many additional gauges are required if it is desired to limit the error to only 11%? [8]

OR

1'(a) A circle of diameter 50 km is a close approximation to a river basin. The position coordinates of five rain gauge stations A, B, C, D and E located within the basin with respect to coordinate axes system whose x- axis and origin are coincident with diameter and centre of the circle are (0,0), (15,0), (0,15), (-15,0), and (0,-15) km respectively. If the rainfall recorded at these rain gauges are 20, 25, 35, 22 and 30 cm respectively, determine the average depth of rainfall using Arithmetic mean method and Thiessen polygon method. [7]

1'(b) Discuss Hydrologic cycle with the help of a neat sketch. [8]

2(a) What do you mean by Infiltration? Discuss various factors affecting infiltration [7]

2(b) The mean monthly temperature in degree centigrade at a place from January to December in a year are 16.6, 18.5, 23.3, 27.5, 28.4, 25.5, 24.4, 23.8, 23.5, 23.6 20.00 and 17.50 respectively. The reduction factor for unequal day lights for the same months are 0.96, 0.91, 1.03, 1.04, 1.12, 1.09, 1.13, 1.09, 1.02, 1.01, 0.94 and 0.96 respectively. Compute the annual PET using Thornthwaite method. [8]

3(a) Explain flood hydrograph. Describe various methods of base flow separation. [8]

3(b) What is the significance of Flow duration curve? The observed mean monthly flows of a stream for a year from June to May in m³/s are 25, 27, 46, 42, 35, 30, 28, 23, 26, 21, 18 and 9. Draw a flow duration curve and:
(i) Determine the flow which can be expected 50% of time.
(ii) What is the dependability of flow of magnitude 30 m³/s. [7]

Contd.....2.
3'(a) What do you mean by Flow mass curve? Discuss various factors affecting runoff.

3'(b) Following are the ordinates of a 4-h unit hydrograph. Two storms each of 4-h duration and having excess rainfall of 2 and 3 cm occur successively over a catchment. Calculate the ordinates of resulting direct runoff hydrograph (DRH).

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>0</th>
<th>4</th>
<th>8</th>
<th>12</th>
<th>16</th>
<th>20</th>
<th>24</th>
<th>28</th>
<th>32</th>
<th>36</th>
<th>40</th>
<th>44</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinates (m³/s)</td>
<td>0</td>
<td>20</td>
<td>80</td>
<td>135</td>
<td>130</td>
<td>120</td>
<td>90</td>
<td>52</td>
<td>25</td>
<td>15</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

4(a) In an artesian aquifer of 10 m thickness, a 20cm diameter well is pumped at a constant rate of 100 lit/minute. The steady state drawdown observed in two wells located at 10 m and 50 m distances from the centre of the well are 3 m and 0.05 m respectively, compute the transmissibility and the hydraulic conductivity of the aquifer.

4(b) Explain the following:
(i) Radius of influence
(ii) Artesian well and flowing well
(iii) Aquitard and aquifuge
(iv) Influent and effluent streams