1. (a) Find the directional derivative of the scalar function

\[ \phi(x, y, z) = 5x^2y - 5y^2z + \frac{5}{2}x^2z \]

at the point \( P(1, 1, 1) \) in the direction of the line

\[ \frac{x - 1}{2} = \frac{y - 3}{-2} = \frac{z}{1} \].

OR

(a') If \( \theta \) is the acute angle between the surfaces \( xy^2z = 3x + z^2 \) and \( 3x^2 - y^2 + 2z = 1 \)
at the point \((1, -2, 1)\), show that \( \cos \theta = \frac{3}{7\sqrt{6}} \).

(b) Show that \( \nabla || \vec{F} || = \frac{1}{|| \vec{F} ||} \vec{F} \) and hence evaluate \( \nabla \frac{1}{|| \vec{F} ||} \), where \( \vec{F} = xi + yj - zk \).

(c) Show the vector function \( \vec{F} = \frac{\vec{r}}{|| \vec{r} ||} \) is irrotational as well as solenoidal. Find its scalar potential \( \phi \) such that \( \vec{F} = \nabla \phi \).

2. (a) Verify Gauss divergence theorem for the function \( \vec{F} = 4xzi - y^2j + yzk \) taken over the cube bounded by the planes \( x = 0, x = 1, y = 0, y = 1, z = 0, z = 1 \).

OR

(a') Verify Stokes theorem for the function \( \vec{F} = y^2i + x^2j - (x + z)k \) over the triangle with the vertices at \((0, 0), (1, 0)\) and \((1, 1)\).

(b) By the use of Green's theorem in the plane, show that the area bounded by a simple closed curve is given by \( \frac{1}{2} \oint (ydx - xdy) \). Hence find the area of the ellipse \( \frac{x^2}{a^2} + \frac{y^2}{b^2} = 1 \).

Contd.....2
3. (a) Derive the Cauchy-Riemann equations in polar form. Show that the function \( w = \log z \) is analytic everywhere in the complex plane except at \( z = 0 \). Find also the derivative of \( \log z \).

(b) If \( f(z) = u + iv \) is an analytic function of \( z = x + iy \) and \( u - v = (x - y)(x^2 + 4xy + y^2) \), find \( f(z) \) in terms of \( z \).

(c) Let \( P(z) = az + bz + cz^2 \) and \( \int_C \frac{P(z)}{z} \, dz = \int_C \frac{P(z)}{z^2} \, dz = \int_C \frac{P(z)}{z^3} \, dz = 2\pi i \), where \( C \) is the circle \( |z| = 1 \). Evaluate \( P(z) \).

OR

(c') Use Cauchy's integral formula to evaluate

\[
\text{(i)} \quad \int_C \frac{3z^2 + z}{z^2 - 1} \, dz, \quad \text{C is } |z| = 2.
\]

\[
\text{(ii)} \quad \int_C \frac{e^{iz}}{(z+1)^3} \, dz, \quad \text{C is } |z| = 2.
\]

4. (a) Form a partial differential equation from

\[
\text{(i)} \quad z = y^2 + 2f \left( \frac{1}{x} + \log y \right)
\]

\[
\text{(ii)} \quad z = a (x + y) + b (x - y) + abt + c.
\]

(b) A tightly stretched string with fixed ends at \( x = 0 \) and \( x = \ell \) is initially in a position given by \( y = y_0 \sin \left( \frac{\pi x}{\ell} \right) \). If it is released from the rest from this position, find the displacement \( y(x, t) \).
2013 – 2014
B.TECH. (WINTER SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
MATHEMATICS – IV
(AM – 212)
Credits : 04

Maximum Marks: 60

Note: Answer all questions.
Programmable calculator is not allowed.
Assume suitable data if missing.

1. (a) Solve the following system of linear equations
   \[ x + 2y + 5z = 20, \quad 5x + 2y + z = 12, \quad x + 4y + 2z = 15 \]
   by Gauss-Seidal method. Perform three iterations.

   (b) Find an approximate value of a root of \( x^4 - x - 10 = 0 \) by applying four iterations of Newton-Raphson method, starting with \( x_0 = 2 \).

   OR

   (b') Applying the general iterative method, find the real root of \( x^3 - 5x - 11 = 0 \), correct to three decimal places. Assume that the initial approximation is \( x_0 = 3 \).

   (c) Find the order of convergence of the iterative scheme
   \[ x_{n+1} = \frac{1}{8} x_n \left( 6 + \frac{3a}{x_n^2} - \frac{x_n^2}{a} \right) \]
   with limit \( \sqrt{a} \).

2. (a) Given the data
   \[
   \begin{array}{c|c|c|c|c|c|}
   x & 0 & 2 & 3 & 6 \\
   f(x) & -4 & 2 & 14 & 158 \\
   \end{array}
   \]

   find the value of \( f(4) \) using Lagrange's formula or Newton's divided difference formula.

   (b) (i) Prove with the usual notations that
   \[
   \left( E^{-\frac{1}{2}} + E^{\frac{1}{2}} \right) (1 + \Delta) = 2 + \lambda
   \]

   (ii) \( \mu \delta = \frac{1}{2} (\Delta + \nabla) \)

   (c) Calculate \( \int_0^\frac{\pi}{2} \sin x \, dx \), dividing the interval into ten equal parts by Trapezoidal rule.

   Contd.....2
3. (a) Use Modified Euler's method to compute $y$ for $x = 1.05$, given that $\frac{dy}{dx} = x + y$ with initial conditions $x(1) = 1$ correct up to three decimal places.

(b) Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at $x = 0.2$ considering $h = 0.2$.

OR

(b') Solve the boundary value problem:

$$\frac{d^2 y}{dx^2} = x + \frac{dy}{dx}; \ y(0) = y(1) = 0,$$

With $h = 0.25$ by finite difference method.

4. (a) Find the Laplace transform of the following:

(i) $L [e^t \cdot \sin^2 t]$  

OR

(i') $L [\cos at \cdot \sin bt]$  

(ii) $L \left[ \frac{1 - \cos t}{t} \right]$

(b) (i) Find $L^{-1} \left[ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right]$, using convolution theorem.

(ii) Find the inverse Laplace transform of $\log \left[ \frac{s^2 - 1}{s^2} \right]$.

(c) Using Laplace transform method, solve the following differential equation

$$(D^2 - 2D + 1) x - e^t, \ x_0 = 2, \ x_1 = 1.$$  

OR

(c') Solve by Laplace transform method

$Dx - y = e^t$

$Dy + x = \sin t, \ x_0 = 1, \ y_0 = 0.$

Where $D = \frac{d}{dt}$.  

__________________________
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
Environmental Science
CE 214 N

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) Describe the effects of various chemical water quality parameters on human health [06]
1 (b) The 3 day 2°C BOD of wastewater sample was 450 mg/L. Find 5 day BOD if the temperature was maintained as 20°C [03]
1 (c) Briefly describe the effects of presence of nutrients in wastewater. What happens if a nitrogen rich wastewater enters a river? [03]

OR

1' (a) What are water borne diseases? Name different common water borne diseases [04]
1' (b) Briefly explain the impact of discharge of wastewater on rivers. Draw and explain D.O. sag curve. [04]
1' (c) Give in a tabular form the permissible limits of various drinking water quality parameters [04]

2 (a) What is the significance of solubility concepts in water treatment? Find the solubility of fluoride in a saturated solution of CaF₂. Take kₚ for CaF₂ = 3.0 x 10⁻¹¹. [04]
2 (b) Balance the following oxidation reduction reactions
   Oxidation of acetate to carbon dioxide and reduction of chloride to chlorine gas
   Oxidation of glucose to carbon dioxide and reduction of oxygen to water [04]
2 (c) Draw microbial growth curve and explain its different phases. [04]

3 (a) Describe the different sources of air pollution [02]
3 (b) Briefly explain the health effects of carbon monoxide and particulates on human...
3 (c) Briefly explain the effects of noise pollution on human health

4 (a) Draw a water treatment flow sheet for a surface water source and briefly explain the significance of each unit.

4 (b) Design a sedimentation tank for the treatment of 10 MLD of water. Assume SOR as 25 m³/m²·d. Your design should include both rectangular as well as circular sections.

4 (c) Draw a flow sheet for the treatment of sewage and explain the purpose of each unit OR

4. Discuss in detail the different methods of disposal of solid waste

5 Answer any four of the following

(i) Breakpoint Chlorination
(ii) Application of microbiology in wastewater treatment
(iii) Plume behaviour
(iv) Nitrogen Cycle
(v) BOD and COD
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
STRUCTURAL MECHANICS
CF. 216

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) A masonry retaining wall as shown in Fig. 1, retains earth on one face. Calculate extreme stresses at base and check stability of the wall against sliding and overturning. Assume following data:

- Angle of repose for soil = 28°
- Coefficient of friction at base = 0.6
- Unit wt. of soil = 18 kN/m³
- Unit wt. of masonry = 22 kN/m³

Fig. 1

1(b) A cylindrical shell 3.25 m long, 1 m in diameter, thickness of metal 10 mm is subjected to an internal pressure of 1 N/mm². Calculate the longitudinal and circumferential stress, change in the length, change in diameter assuming Young’s modulus of elasticity $E = 2 \times 10^5$ N/mm² and Poisson’s ratio $\nu = 0.3$.

CR

1. Calculate forces in members BC, CD, GH, BI and IH for the truss shown in Fig. 2.

Fig. 2

2(a) 3D-stresses at a point in some material are given with respect to (X,Y,Z) axes as given below. Transform these stresses with respect to (X', Y', Z') axes obtained by...
rotating X and Z axes clockwise by 30° in their own plane, keeping X and Y' axes overlapping.

\[
\sigma = \begin{bmatrix}
20 & 0 & 9 \\
0 & -15 & 3 \\
9 & 3 & 10
\end{bmatrix}
\]

2(b) A steel shaft of 10 cm dia. and 1.5 m long is fixed at one end, and subjected to an axial load of 150 kN and a torque of 15 kNm at free end. Calculate maximum principal stresses and check the safety of the material against the following failure theories, if uni-axial yield stress for steel is 150 MPa and Poisson's ratio \( = 0.3 \).

(i) Maximum principal strain theory
(ii) Maximum Distortional energy theory

3(a) A 6 m long simply supported beam carries 450 kN-m clockwise couple acting at 2 m from the right support. Taking \( EI = 8 \times 10^6 \) kNm², calculate

(i) the deflection at the point of application of couple
(ii) the maximum deflection in the beam

3(b) The middle half of a simply supported beam has a moment of inertia twice that of the rest of the beam and is loaded as shown in Fig. 3. Determine the slope at the supports and the mid span deflection in the beam.

3' A simply supported prismatic beam is loaded as shown in Fig. 4. Find the slope at the supports. Also find the intensity of maximum deflection in the beam. Take \( EI \) as constant.
4(a) Calculate strain energy due to self weight in a vertically fixed bar of uniformly varying dia., 20cm at fixed end and 10cm at free end, and 1m long. Assume the elastic modulus as 200 GPa.

4(b) Calculate strain energy due to bending in a cantilever beam of uniform rectangular cross section 200mmx300mm, and 2m, subjected to a u.d.l. of 20kN/m over complete span and a point load of 30 kN at free end. Assume elastic modulus as 20 GPa and $v=0.2$.

OR

4' (a) A cantilever frame ABCD of uniform cross section is loaded as shown in Fig. 5. Using Castigliano's theorem, determine vertical deflection and slope at free end A.

Assume $E=2\times10^5$ MPa and $I=2.0\times10^6$ mm$^4$.

![Fig. 5](image)

5(a) Determine the ratio of the buckling strengths of a solid steel column to that of a hollow column of the same material and having the same cross sectional area. The internal diameter of the hollow column is $1/4$ of its external diameter. Both the columns are of same length and are pinned at both ends.

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 $E=2\times10^5$ MPa.
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
CONSTRUCTION PRACTICE
CE - 217

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions:

Q.No. Question
1 Write down the requirements of the following elements of a residential house:
   (a) Plinth  (b) Habitable Rooms  (c) Kitchen  (d) Bathrooms
   OR
1' What are the various principles of planning? Explain the following in detail:
   (a) Aspect  (b) Grouping  (c) Privacy  (d) Circulation
2(a) Enumerate different types of windows and explain any two of them with the help of neat sketches.
2(b) Explain with the help of neat sketches the following shallow foundations.
   (i) Trapezoidal combined footing  (ii) Grillage foundation  (iii) Strap footing
   OR
2'(a) Explain different types of timber floors with the help of neat sketches.
2'(b) Explain with the help of neat sketches the following deep foundations.
   (i) Sand pile  (ii) Under reamed pile  (iii) Well Foundation
3(a) What is a Formwork and why is it necessary? What are the essential requirements of the Formwork?
3(b) What do you understand by Shoring? Mention the situations where shoring is required and giving a neat sketch describe the dead shore.
4(a) Describe various methods of damp proofing in buildings.
4(b) Explain how pre and post construction anti-termite treatment is carried out.
5(a) What is meant fire resisting material? Enumerate the characteristics of a fire resisting material.
5(b) Explain causes and repair measures of vertical cracks in the walls of a building with the help of neat sketches.
1(a) Differentiate between Gunter's chain and Revenue chain.

1(b) A 20 m chain was found to be 15 cm too long after chaining a distance of 1600 m. It was found to be 30 cm too long after chaining a distance of 3000 m. Determine the correct distance if the chain was correct before the commencement of the work.

1(e) To continue a chain line OA across a lake and find the intervening distance, two lines AC and AD were set at convenient angles so that C and D are past the obstacles and in line with B, a point on the other side and on the line OA. The distance CB could also not be measured due to an intervening pond. Lines BE and EC were laid with right angles at E. The following are the lengths measured: BE = 100 m, EC = 75 m, AC = 318 m, AD = 225 m, BD = 142 m. Find the distance AB.

OR

1′(a) A 30 m steel tape was standardized on the flat and was found to be exactly 30 m under no pull at 65°F. It was used in a catenary to measure a base of 5 bays. The temperature during measurement was 92°F and the pull exerted during measurement was 10 kg. The area of cross section of the tape was 0.08 sq. cm. The specific weight of the steel is 7.86 g/cm³. Take α = 6.3 × 10⁻⁶ per °F and k = 2.1 × 10⁹ kg/cm². Find the true length of the line.

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

1′(c) Differentiate between an optical square and a cross staff.
1' (d) Explain the method of testing and adjustment of a chain.
2 (a) Differentiate between true meridian and magnetic meridian.
2 (b) The following angles were observed in clockwise direction in an open traverse: 
\[ \angle ABC = 124^\circ 15', \quad \angle BCD = 150^\circ 30', \quad \angle CDE = 104^\circ 00' \quad \text{and} \quad \angle DEF = 98^\circ 15' \quad \text{and} \quad \angle EFG = 210^\circ 45'. \] Magnetic bearing of the line AB was 141\(^\circ\) 30'. What would be the bearing of the line FG?
2 (c) What is the purpose of orientation in Plane table survey? Briefly describe the method of orientation by backsighting.
3 (a) The following readings were taken with a staff and a level, the level having been shifted after 3\(^{rd}\), 6\(^{th}\), 9\(^{th}\) and 12\(^{th}\) reading. Enter the reading on a level page and determine the R.L.s of various stations and apply usual checks. The first reading was taken on a bench mark of R.L. 183.875m.
0.785, 1.245, 2.565, 1.115, 0.875, 2.555, 3.125, 0.985, 3.255, 1.453, 2.335, 1.115, 3.235, 0.985
3 (b) The following observations were taken with a level in reciprocal levelling.

<table>
<thead>
<tr>
<th>Instrument near</th>
<th>Staff reading at</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>A</td>
<td>1.625</td>
</tr>
<tr>
<td>B</td>
<td>0.725</td>
</tr>
</tbody>
</table>

Determine the R.L. of B if that of A = 100.105. Also calculate the angular error in collimation if the distance between A and B is 1000 m.
3 (c) What do you understand by Barometric levelling?
4 (a) The following lengths and bearings were recorded in running a theodolite traverse in a counter clockwise direction, the bearing of DE and EA having being omitted.

<table>
<thead>
<tr>
<th>Line</th>
<th>Length (m)</th>
<th>Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>281.4</td>
<td>S 69(^\circ) 11' E</td>
</tr>
<tr>
<td>BC</td>
<td>129.4</td>
<td>N 21(^\circ) 49' E</td>
</tr>
<tr>
<td>CD</td>
<td>141.5</td>
<td>N 19(^\circ) 34' W</td>
</tr>
<tr>
<td>DE</td>
<td>144.5</td>
<td>?</td>
</tr>
<tr>
<td>EA</td>
<td>168.7</td>
<td>?</td>
</tr>
</tbody>
</table>

Determine the bearings of DE and EA.
4 (b) Describe the different methods of theodolite traversing by fast needle method. [04]

OR

4' (a) Differentiate between stadia and tangential method of tacheometric survey. [04]

4' (b) Determine the gradient of the line AB from the following observations [08]

<table>
<thead>
<tr>
<th>Instrument station</th>
<th>Point sighted</th>
<th>Horizontal Angle</th>
<th>Vertical Angle</th>
<th>Staff Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Upper</td>
</tr>
<tr>
<td>O</td>
<td>A</td>
<td>0° 0' 0&quot;</td>
<td>10° 05' 20&quot;</td>
<td>2.585</td>
</tr>
<tr>
<td>C</td>
<td>B</td>
<td>40° 10' 30&quot;</td>
<td>0° 0' 0&quot;</td>
<td>3.100</td>
</tr>
</tbody>
</table>

Take constants of tacheometer as 100 and 0.

5. Following gives the latitudes and departures of lines of a closed traverse. Calculate the area of the traverse by all four methods [12]

<table>
<thead>
<tr>
<th>Line</th>
<th>Latitude</th>
<th>Departures</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>+121</td>
<td>+95</td>
</tr>
<tr>
<td>BC</td>
<td>-231</td>
<td>+131</td>
</tr>
<tr>
<td>CD</td>
<td>-56</td>
<td>-100</td>
</tr>
<tr>
<td>DA</td>
<td>+166</td>
<td>-126</td>
</tr>
</tbody>
</table>
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
SURVEYING
CE 218 R

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 Gunter’s chain and Revenue chain [02]
1 (b) The distance of a line AB was found out to be 1200 when measured with a 20 m chain.
      The same distance was measured with a 30 m chain and was out to be 1206 m. If the
      30 m chain was found 5 cm too short. What was the error in the length of 20 m chain? [04]
1(b) Differentiate between the following:
      (i) True meridian and true bearing,
      (ii) Declination and angle of dip
      (iii) Resection and Intersection method of Plane Table Survey [06]

OR

1' (a) The following angles were observed in clockwise direction in an open traverse.
      ∠ABC=124° 15', ∠BCD=150° 30', ∠CDE=104° 0' and ∠DEF=98° 15' and
      ∠EFG=210° 45'. Magnetic bearing of the line AB was 141° 30'. What would be the
      bearing of the line FG? [06]
1' (b) To continue a chain line OA across a lake and find the intervening distance, two lines
      AC and AD were set at convenient angles so that C and D are past the obstacles and in
      line with B, a point on the other side and on the line OA. The distance CB could also
      not be measured due to an intervening pond. Lines BE and EC were laid with right
      angles at E. The following are the length measured: BE = 100m, EC = 75m, AC =
      318m, AD = 225m, BD = 142m. Find the distance AB.

contd...
2 (a) The following readings were taken with a staff and a level, the level having being shifted after 3rd, 6th, 9th and 12th reading. Enter the reading on a level book and determine the R.L.s of various stations and apply usual checks. The first reading was taken on a bench mark of R.L. 183.875m.

0.785, 1.245, 2.565, 1.115, 0.875, 2.555, 3.125, 6.985, 3.255, 1.455, 2.335, 1.115, 3.235, 0.985

2 (b) Following is the page of a level book. Some of the readings were erased and are missing. Calculate the missing readings and apply usual checks.

<table>
<thead>
<tr>
<th>Station</th>
<th>B.S.</th>
<th>I.S.</th>
<th>F.S.</th>
<th>Rise</th>
<th>Fall</th>
<th>R.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150.000</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>2.457</td>
<td></td>
<td>0.827</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>2.400</td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2.697</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td>148.070</td>
</tr>
<tr>
<td>5</td>
<td>X</td>
<td>2.051</td>
<td></td>
<td></td>
<td></td>
<td>148.716</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>2.500</td>
<td></td>
<td></td>
<td></td>
<td>149.784</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>2.896</td>
<td></td>
<td></td>
<td></td>
<td>149.388</td>
</tr>
<tr>
<td>8</td>
<td>X</td>
<td></td>
<td></td>
<td>0.124</td>
<td>X</td>
<td>149.612</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>2.672</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2 (c) Briefly explain the different types of bench marks

3 (a) Two stations A and B are 100 km apart. The elevation of A is 185 m and that of B is 885 m. In the line of sight between A and B, there are two intervening high points C and D. C is 42 km from A and D is 81 km from A. The elevations of peaks C and D are 310 m and 655 m respectively. Check whether the line of sight from A to B clears the peaks with a minimum clearance of 3 m above ground level. Determine the height of the signal at B for intervisibility.

3 (b) Briefly describe the various orders of triangulation survey. Mention the various specifications

OR

3' (a) Briefly describe the necessity of satellite station in triangulation survey.

3' (b) 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 would be visible from a ground station B, south west of A, so that AB approximately bisects the angle PBQ.

Whereupon B was adopted as a satellite station and the distance AB was carefully measured being 2.835 m, 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 994.87 m from 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.

4 (a) Differentiate between loose needle and fast needle method of theodolite traversing. Explain any one method of fast needle method.

4 (b) The following lengths and bearings were recorded in running a theodolite traverse in a counter clockwise direction, the length of CD and bearing of DE having being omitted.

<table>
<thead>
<tr>
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<td>BC</td>
<td>129.4</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>144.5</td>
<td>?</td>
</tr>
<tr>
<td>EA</td>
<td>168.7</td>
<td>S 74°24' W</td>
</tr>
</tbody>
</table>

Determine the length of CD and bearing of DE.

5 (a) Two straight lines AB and BC meet at an inaccessible point B and are to be connected by a simple circular curve of 600 m radius. Two points P and Q were selected in AB and BC respectively, and the following data were obtained:

Angle APQ = 150°, Angle CQP = 160° and PQ = 150 m. Make necessary calculations for setting out the curve by the method of deflection angles with pegs at every 30 m through chainage. The chainage of P is given as 1600.00.

5 (b) Describe the different methods used for calculating the length of a transition curve

5 (c) Briefly explain why a parabola is preferred for vertical curves
2013-14
B.TECH. (WINTER SEMESTER) EXAMINATION
CIVIL
HYDROLOGY
CE-219

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)  Discuss the Hydrologic Cycle with aid of neat sketch.  [07]
1(b)  Differentiate between:
      (i) Annual and normal annual rainfall
      (ii) Water surplus year and water deficient year
      (iii) Arid, semi-arid and humid climate

1(c)  The annual rainfalls at seven rain gauge stations in a basin are 55, 90, 60, 45, 20, 88, and 69 cm respectively. How many additional rain gauges are required if it is desired to limit the error to only 5% in the measurement of average rainfall?

OR

1’(a)  Enumerate various types of rain gauges. Discuss the working and construction of Float type rain gauge.

(b)  List various methods of mean rainfall measurement. A circle of diameter 40 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 (10,10), (-10,10), (-10,-10), (10,-10), and (0,0) km respectively. If the rainfall recorded at these rain gauges are 90, 99, 84, 87 and 112 mm respectively, determine the average depth of rainfall using Thiessen polygon method.
2(a) Differentiate between Potential Evapotranspiration (P.E.T.) and Consumptive use.

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 correction 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 P.E.T. using Thornthwaite method.

2(b) What do you mean by ultimate infiltration capacity? A test is conducted on an automatic adjustable depth of Flooding Type Double Ring Infiltrometer with a constant depth of flooding of 1.5 cm. The diameter of the inner ring and the tank feeding water to it are 30 cm and 20 cm, respectively. The observation of water level in the tank are as given below:

<table>
<thead>
<tr>
<th>Time in minutes since start</th>
<th>Water level in the feeder tank (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>53</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>45</td>
</tr>
<tr>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>90</td>
<td>38</td>
</tr>
<tr>
<td>120</td>
<td>36</td>
</tr>
<tr>
<td>240</td>
<td>32</td>
</tr>
</tbody>
</table>

Determine the infiltration capacity for the time intervals in the test.

3(a) What is the an unit hydrograph? Discuss its practical utilities.

3(b) The ordinates of a 6-h unit hydrograph are given below.

<table>
<thead>
<tr>
<th>Time (h)</th>
<th>0</th>
<th>6</th>
<th>12</th>
<th>18</th>
<th>24</th>
<th>30</th>
<th>36</th>
<th>42</th>
<th>48</th>
<th>54</th>
<th>60</th>
<th>66</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-h UH ordinate ($m^3/s$)</td>
<td>0</td>
<td>20</td>
<td>60</td>
<td>150</td>
<td>120</td>
<td>90</td>
<td>66</td>
<td>50</td>
<td>32</td>
<td>20</td>
<td>10</td>
<td>0</td>
</tr>
</tbody>
</table>

Using the above unit hydrograph derive the flood hydrograph due to the storm given below.
<table>
<thead>
<tr>
<th>Time from beginning of the storm (h)</th>
<th>0</th>
<th>6</th>
<th>12</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accumulated rainfall (cm)</td>
<td>0</td>
<td>4</td>
<td>6</td>
<td>10</td>
</tr>
</tbody>
</table>

The φ - index for the storm can be assumed to be 0.167 cm/h. Assume the base flow to be 25 m³/s

**OR**

3'(a) Describe briefly the procedure of preparing a D-hour unit hydrograph for a catchment.

3'(b) Define hydrograph. Draw a single peaked hydrograph and indicate its various components.

3'(c) The peak of flood hydrograph due to a 3-h duration isolated storm in a catchment is 270 m³/s. The total depth of rainfall is 5.9 cm. Assuming an average infiltration loss of 0.3 cm/h and a constant base flow of 20 m³/s, estimate the peak of the 3-h unit hydrograph (UH) of this catchment. If the area of this catchment is 567 km², determine the base width of the 3-h unit hydrograph by assuming it to be triangular in shape.

4'(a) Explain the following

(i) Well loss

(ii) Perched aquifer

(iii) Intrinsic permeability

4'(b) Develop the equation for steady state discharge through a well in an unconfined aquifer taking suitable physical variables.

4'(c) A gravity well has a diameter of 60 cm. The depth of water in the well is 40 m before pumping is started. When pumping is being done at the constant rate of 0.033 m²/s, the draw down in a well 10 m away is 4.0 m and in another well 20 m away is 2.0 m. Determine:

(i) Radius of zero draw down.

(ii) Coefficient of permeability.

(iii) Draw down in the well.