2015 – 2016
B.TECH. (WINTER SEMESTER) EXAMINATION
(CIVIL ENGINEERING)
MATHEMATICS – IV
(AM – 212)
CREDITS : 04

Maximum Marks: 60
Duration: Three Hours

Note: Answer all questions.

1. (a) Solve the following system of linear equations using Gauss – Seidal method by applying four iterations

\[\begin{align*}
5x + 2y + z &= 12 \\
x + 4y + 2z &= 15 \\
x + 2y + 5z &= 20
\end{align*}\]

(b) By using Newton Raphson’s method, find the root of \(x^3 - 2x - 5 = 0\), correct to three places of decimals.

(c) Find the missing values of in the following table

\[
\begin{array}{cccccc}
x : & 45 & 50 & 55 & 60 & 65 \\
y : & 3 & -2 & -2.4
\end{array}
\] [5,5,5]

2. (a) Find the interpolating polynomial for the following data and estimate \(f(0.2)\) and \(f(3.5)\) from the following table:

\[
\begin{array}{cccc}
x : & 0 & 1 & 2 & 3 & 4 \\
f(x) : & 1 & 1 & 7 & 25 & 61
\end{array}
\]

(b) Given the values

\[
\begin{array}{cccccccc}
x & 4 & 5 & 7 & 10 & 11 & 13 \\
f(x) & 48 & 100 & 294 & 900 & 1210 & 2028
\end{array}
\]

Evaluate \(f(8)\) using Lagrange’s formula

OR

(b') From the following table, evaluate \(f(3.8)\) using Newton; backward interpolation formula

\[
\begin{array}{cccc}
x : & 0 & 1 & 2 & 3 & 4 \\
f(x) & 1.00 & 1.50 & 2.20 & 3.10 & 4.60
\end{array}
\]

(c) Solve \(\int_0^\pi \sqrt{\cos \theta} \, d\theta\), using Simpson’s rule with eight equal sub-interval.

[5,5,5]

Contd…..2
3. (a) Use the Taylor Series method including term of maximum order \( x^4 \) to solve
\[
\frac{dy}{dx} = x^2 + y^2 \text{ with initial condition } y(1) = 1 \text{ and approximate } y(1.2).
\]
(b) Use Runge-Kutta method of fourth order, to find an approximate value of \( y \)
when \( x = 0.2 \), given that \( \frac{dy}{dx} = x + y^2 \) and \( y = 1 \) when \( x = 0 \).

OR

(b') Solve the boundary value problem by finite element method:
\[
\frac{d^2y}{dx^2} = -2, \quad 0 < x < 1, \quad y(0) = y'(1) = 0,
\]
Taking three elements.

4. (a) Find the Laplace transform.
(i) \[ L\left[ \frac{e^a - \cos bt}{t} \right] \]
(ii) \[ L\left[ t^2 e^t \sin 4t \right] \]

(b) Find the inverse Laplace transform of any two of the following:
(i) \[ \log \left( \frac{s + 1}{\sqrt{s - 1}} \right) \]
(ii) \[ \cot^{-1} \left( \frac{s + a}{b} \right) \]
(iii) \[ \frac{S}{S^4 + S^2 + 1} \]

(c) Solve the Differential equation by Laplace transform
\[
(D^3 - D^2 - D + 1) y = 8 t e^{-t}
\]
If \( y = D^2 y = 0, Dy = 1 \) when \( t = 0 \).

OR

(c') Solve the following Simultaneous differential equation by Laplace transform
\[
\frac{dx}{dt} + 4 \frac{dy}{dt} - y = 0
\]
\[
\frac{dx}{dt} + 2y = e^{-t} \text{ with }
\]
Condition \( x(0) = y(0) = 0 \).
<table>
<thead>
<tr>
<th>Q. No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>With the help of flow chart diagram, describe the manufacture of Portland cement by wet process. Also write the advantages of wet process.</td>
<td>[08]</td>
</tr>
<tr>
<td>1(b)</td>
<td>Describe the characteristics of any two of the following:</td>
<td>[04]</td>
</tr>
<tr>
<td></td>
<td>(i) Low heat cement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ii) Portland Pozzolana cement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iii) Hydrophobic cement</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(iv) Portland slag cement</td>
<td></td>
</tr>
<tr>
<td>2(a)</td>
<td>What is meant by workability of concrete? Describe the factors affecting the workability of concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Differentiate between segregation and bleeding of concrete. Write the circumstances in which the segregation and bleeding take place.</td>
<td>[06]</td>
</tr>
<tr>
<td>2'(a)</td>
<td>What is meant by curing of concrete? Differentiate between water curing and membrane curing of concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td>2'(b)</td>
<td>What do you mean by creep of concrete? Discuss the factors affecting creep of concrete.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(a)</td>
<td>Write the composition of good brick-earth and describe the chemical changes in burning of bricks.</td>
<td>[06]</td>
</tr>
<tr>
<td>3(b)</td>
<td>What are the classifications of bricks? Discuss their characteristics and uses.</td>
<td>[06]</td>
</tr>
<tr>
<td>3'(a)</td>
<td>Describe the various tests to be made on bricks.</td>
<td>[06]</td>
</tr>
<tr>
<td>3'(b)</td>
<td>What is lime? Explain the cementing action of lime and compare it with Portland cement.</td>
<td>[06]</td>
</tr>
<tr>
<td>4(a)</td>
<td>With the help of neat sketches, discuss the various defects of timber.</td>
<td>[06]</td>
</tr>
<tr>
<td>4(b)</td>
<td>What is seasoning of timber? Describe the artificial method of seasoning of timber.</td>
<td>[06]</td>
</tr>
<tr>
<td>4'(a)</td>
<td>What is meant by preservation of timber? Describe any two methods of preservation of timber.</td>
<td>[06]</td>
</tr>
<tr>
<td>4'(b)</td>
<td>Describe the characteristics of mild steel and HYSD steel bars used in civil engineering structures.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(a)</td>
<td>Discuss the functions of various constituents of glass.</td>
<td>[06]</td>
</tr>
<tr>
<td>5(b)</td>
<td>Describe the properties and uses of various kinds of bitumen.</td>
<td>[06]</td>
</tr>
</tbody>
</table>
2015-2016
B.TECH. (WINTER SEMESTER) EXAMINATION
IVTH SEMESTER
CIVIL ENGINEERING
STRUCTURAL MECHANICS
CE-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 M.M.

1(a) Differentiate between thin and thick cylindrical shells. [04]

1(b) A cylindrical vessel whose ends are closed by means of rigid flange plates is made of steel plate 5 mm thick. The internal length and internal diameter of vessel are 75 cm and 25 cm respectively. Determine the longitudinal and circumferential stresses in the cylindrical shell due to an internal fluid pressure of 5 MN/m². Also calculate increase in length, diameter and volume of the vessel. Take \( E = 200 \, \text{GN/m}^2 \) and Poisson’s ratio \( 1/m = 0.3 \) [08]

OR

1'(a) A masonry retaining wall of trapezoidal section with 1.5m wide at top and 6m wide at bottom and left face vertical 10 m high, is completely filled with earth on this left side and levelled at top. Calculate extreme stresses at base of the wall. Assume unit weight of masonry and earth as 20 kN/m³ and 17 kN/m³ respectively, and angle of repose for soil as 28°. [4]

1'(b) Calculate force in members BD, BC and ED of the pin jointed frame shown in Fig.1. [8]

![Fig. 1](image)

Contd......2.
2(a) Determine the slope at A and the deflection at C of the following beam. \( EI \) is constant. [06]

Use Conjugate beam method.

2(b) Determine the displacement at B and the slope at C of the cantilever beam shown below. \( EI \) is constant. Use moment area theorems.

OR

2'(b) A rectangular beam 150 mm \( \times \) 240 mm deep is simply supported at the ends. The span of the beam is 4 m. The beam is subjected to a uniformly distributed load of 4kN/m throughout its length. What point load at the centre be applied so that the maximum deflection is doubled? [06]

3 (a) Describe Generalized Hooke's Law and its modified form for homogeneous and isotropic materials. [06]

3(b) The planer stresses at a point are given as: \( \sigma_{xx} = 50 \text{ N/mm}^2, \sigma_{yy} = -20 \text{ N/mm}^2 \), \( \tau_{xy} = 8 \text{ N/mm}^2 \). Calculate stresses on a plane inclined to X-axis by 30° in clockwise direction and calculate principal stresses. Also locate the position of planes with maximum shear with respect to X axis.

OR

3' A steel shaft of hollow uniform circular cross section with outer dia. 80 mm, 20mm thick and 2m long is fixed at one end and subjected to an axial load of 400 kN and a torque of 10 kNm at its free end. Check the safety of material against following failure theories.

(i) Maximum shear stress theory

Contd....3.
(ii) Total Strain Energy theory

(iii) Distortional Strain Energy theory

Also calculate factor of safety in each case. Assume yield stress for steel as 250 N/mm² and Poisson’ ratio 0.3.

4(a) A steel rod of 25 cm dia. and 1 m long is freely held with top end fixed and subjected to an axial load of 20 kN at free end. Calculate total strain energy absorbed due axial load including self weight. Assume unit weight of steel as 78 kN/m³ and E=200GPa.

4(b) Using Castigliano’s theorem, calculate vertical deflection at free end for the cantilever frame as shown below. Assume I=3x10⁹ mm⁴ and E= 2.5x10⁴ N/mm².

\[
\begin{align*}
&7kN \\
&1.5m \\
&21 \\
&5kN \\
&3m
\end{align*}
\]

5(a) A bar of length 4 m when used as a simply supported beam and subjected to a point load of 30 kN at the mid-span, deflects 15 mm at the centre. Determine the crippling loads when it is used as a column with the following end conditions:

(i) One end fixed and the other end hinged
(ii) Both ends fixed

5(b) A hollow cylindrical cast iron column is 4 m long with both ends fixed. Determine the minimum diameter of the column, if it has to carry a safe load of 300 kN with a factor of safety of 5. Take the internal diameter as 0.75 times the external diameter. Take \( \sigma_c = 500 \text{ MN/m}^2 \) and \( a = 1/1600 \) in Rankine’s formula.
2015-16
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  M.M.
1(a)  What are the various principles of planning? Explain any two of the following in detail:
      (a) Aspect  (b) Grouping  (c) Privacy  (d) Circulation  [06]
1(b)  What points should be considered while selecting suitable site for a building?  [06]
2(a)  What are the advantages and disadvantages of pre-cast concrete piles?  [04]
2(b)  Explain the following with the help of neat sketches.
      (i) Grillage Foundation  (ii) Strap Foundation
      (iii) Under reamed Pile  (iv) Well Foundation  [08]

OR

2'(a)  Write the basic requirements of a floor.  [04]
2'(b)  Explain the following with the help of neat sketches.
      (i) Framed and Panelled Door  (ii) Collapsible Steel Door
      (iii) Dormer Window  (iv) Bay Window  [08]
3(a)  Describe the process Well Point System of dewatering the foundation trenches with the help of neat sketches  [06]
3(b)  What is a Formwork and why is it necessary? What are the essential requirements of the Formwork?  [06]

OR

3'(a)  What is scaffolding? Mention its various components.  [06]
3'(b)  What do you understand by Shoring? Giving a neat sketch describe the dead shore.  [06]
4(a)  What are the ill effects of dampness in building?  [04]
4(b)  Explain how pre and post construction anti-termite treatment is carried out.  [08]
5(a)  What are the important considerations in fire protection of a building?  [06]
5(b)  Explain causes and remedial measures of horizontal cracks in the wall of a building with the help of neat sketches.  [06]
2015-16
B TECH (WINTER SEMESTER) EXAMINATION
CIVIL ENGINEERING
SURVEYING - CE 218R

Maximum Marks: 60 Credits: 04 Duration: Three Hours

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

1 (a). Explain, in brief, the classification of survey?

OR

1' (a) Explain the purpose of orientation in plane table survey?

[04]

1 (b). A 30 m steel tape was standardized on the flat and was found to be exactly 30 m under no pull at 66° F. It was used in 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 x 10⁻⁶ per °F and E = 2.1 x 10⁶ kg/cm². Find the true length of the line.

OR

The following bearings were observed in running a closed traverse.

<table>
<thead>
<tr>
<th>Line</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fore bearing</td>
</tr>
<tr>
<td>AB</td>
<td>N 75° 05' E</td>
</tr>
<tr>
<td>BC</td>
<td>S 64° 40' E</td>
</tr>
<tr>
<td>CD</td>
<td>S 14° 25' E</td>
</tr>
<tr>
<td>DE</td>
<td>S 44° 50' W</td>
</tr>
<tr>
<td>EA</td>
<td>N 55° 10' W</td>
</tr>
</tbody>
</table>

At what station do you suspect local attraction? Determine the true bearings of the lines if the magnetic declination was 5° 10' east.

2(a). Define the following terms:
(i) Datum (ii) Bench Mark (iii) Line of Collimation (iv) Height of Instrument

2(b). The following consecutive readings were taken with a dumpy level, the instrument was shifted after fourth, seventh and tenth readings:
2.650, 3.745, 3.835, 5.270, 4.645, 0.385, 0.960, 1.645, 2.840, 3.485, 4.680 and 5.265 m.
The first reading was taken with the staff held upon a bench mark of elevation 132.135 m.
Enter the readings in the level book form and reduce the levels by using height of instrument or rise and fall method. Also apply the usual arithmetical checks.

3(a). What is the advantage of braced quadrilaterals over single and double chain of triangles?
Justify your answer with neat sketches.

3(b). What points will you keep in mind while selecting the site for base line of a triangulation system?

3(c). List the various types of signals used in triangulation and describe any one of these.

OR

3'(a). What is meant by reduction to centre?
3(b). From an eccentric station S, 12.25 m to the east of the main station B, the following angles were measured: \( \angle \text{BSC} = 76^\circ 25' 32'' \) and \( \angle \text{CSA} = 54^\circ 32' 20'' \). The stations S and C are to the opposite sides of the line AB. Calculate the true angle ABC, if the lengths AB and BC are 5286.50 m and 4932.20 m respectively.

4(a). What are different types of curves used in highways and railways? Describe each with neat sketches.

4(b). Two tangents intersect at a chainage of 2032 m. Calculate the necessary data for setting out a circular curve of 50 m radius to connect the two tangents if the deflection angle is 86°30'. Take the peg interval as 5 m. Use the method of radial offsets from the tangent.

OR

4'(a). What is transition curve? When and why it is provided? Also write the advantages and conditions to be fulfilled by a transition curve.

4'(b). A compound railway curve ABC is to have the radius of arc AB 500 m and that of BC 350 m. The intersection point V of the straights is located at a chainage of 1385.48 m and the deflection angle is observed to be 45°30'. If the arc AB is to have a length of 250 m, find the chainages of tangent points and point of compound curvature.

5 (a) Differentiate between loose and fast needle methods of theodolite traversing.

5 (b) Determine the gradient of the line AB from the following observations:

<table>
<thead>
<tr>
<th>Instrument Station</th>
<th>Point sighted</th>
<th>Horizontal angle</th>
<th>Vertical angle</th>
<th>Staff reading (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>upper</td>
<td>middle</td>
</tr>
<tr>
<td>O</td>
<td>A</td>
<td>00° 00' 00''</td>
<td>10° 05' 20''</td>
<td>2.585</td>
</tr>
<tr>
<td>O</td>
<td>B</td>
<td>40° 10' 30''</td>
<td>00° 00' 00''</td>
<td>3.100</td>
</tr>
</tbody>
</table>

Take tacheometric constants K and C as 100 and 0 respectively.
2015-16.  
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.  

1(a) Describe different components of hydrologic cycle with a suitable sketch.  

1(b) 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), (10,0), (0,10), (-10,0), and (0,-10) km respectively. If the rainfall recorded at these rain gauges are 34,40,45,20 and 25 cm respectively, determine the average depth of rainfall using Arithmetic mean method and Thiessen polygon method.

OR

1'(a) Enumerate various types of rain gauges. Discuss the working and construction of weighing bucket rain gauge by giving a neat sketch.

1'(b) The cumulative rainfall depth with time during a storm as obtained from a recording rain gauge at a station is given below:

<table>
<thead>
<tr>
<th>Time in hours</th>
<th>Rainfall in mm</th>
<th>Time in hours</th>
<th>Rainfall in mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.00</td>
<td>0</td>
<td>13.30</td>
<td>51</td>
</tr>
<tr>
<td>10.30</td>
<td>6</td>
<td>14.00</td>
<td>57</td>
</tr>
<tr>
<td>11.00</td>
<td>11</td>
<td>14.30</td>
<td>61</td>
</tr>
<tr>
<td>11.30</td>
<td>16</td>
<td>15.00</td>
<td>66</td>
</tr>
<tr>
<td>12.00</td>
<td>24</td>
<td>15.30</td>
<td>67</td>
</tr>
<tr>
<td>12.30</td>
<td>29</td>
<td>16.00</td>
<td>67</td>
</tr>
<tr>
<td>13.00</td>
<td>38</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contd.....2.
Construct the hyetograph of this storm using uniform time interval of 30 and 60 minutes

2(a) An infiltrometer test on a ring with 35 cm diameter yielded the following data:

<table>
<thead>
<tr>
<th>Time since start (minutes)</th>
<th>0</th>
<th>3</th>
<th>5</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>60</th>
<th>90</th>
<th>150</th>
<th>210</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume of water added since start of test (cm³)</td>
<td>0</td>
<td>250</td>
<td>600</td>
<td>1180</td>
<td>2000</td>
<td>2500</td>
<td>3350</td>
<td>3990</td>
<td>4580</td>
<td>5300</td>
</tr>
</tbody>
</table>

(a) Determine the infiltration capacity for the time intervals in the experiment.
(b) What is the average infiltration capacity of first 20 minute?

2(b) Discuss various factors affecting evaporation.
2(c) Differentiate between Potential evapotranspiration and Consumptive use. Give the step-wise procedure to calculate annual P.E.T. by Thornthwaite method.

OR

2'(c) Describe the working and installation of Lysimeter used to estimate evapotranspiration.
3(a) Give step-wise procedure of drawing Irrigated Flow duration curve and also give its significance.
3(b) The ordinates of a 4-h unit hydrograph are given below:

<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>4-h UH ordinates (m³/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>4</th>
<th>8</th>
<th>12</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 0.2 cm/h. Assume the base flow to be 10 m³/s

OR

3'(a) Discuss various factors affecting runoff.
3'(b) Draw a single peaked hydrograph and discuss its various components.
3'(c) Following are the ordinates of a 2-h unit hydrograph.

<table>
<thead>
<tr>
<th>Time in Hours</th>
<th>0</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>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinates (m³/s)</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>20</td>
<td>18</td>
<td>15</td>
<td>12</td>
<td>09</td>
<td>05</td>
<td>02</td>
<td>0</td>
</tr>
</tbody>
</table>

Derive the ordinates of 6-h unit hydrograph for the same catchment. [05]

4(a) Differentiate between [05]
(i) Specific yield and Specific retention
(ii) Aquitard and Aquifuge

4(b) Develop the equation for steady state discharge through a well in an unconfined aquifer and also mention the assumptions made. [05]

4(c) A gravity well has a diameter of 40 cm. The depth of water in the well is 10 m before pumping is started. When pumping is being done at the constant rate of 0.035 m³/s, the drawdown in a well 10 m away is 4.0 m and in another well 20 m away is 2.0 m. Determine hydraulic conductivity of the aquifer. [05]