2017 – 2018
B. E (IV SEMESTER) EXAMINATION
CIVIL ENGINEERING
HIGHER MATHEMATICS – \( \sqrt{V} \)
(EAM-212)

Maximum Marks: 60

Answer all questions

1.(a) Apply general iteration method to find the root of the equation
\[ x + \log x = 2. \]

OR

\( (a') \) Establish an iterative formula for finding the cube root of natural number \( N \) and hence find the value of cube root of 12 correct to five decimal.

(b) Solve the following system of equations by Gauss-elimination method:
\[
2x + 2y + z + 2u = 7, \quad x - 2y - u = 2
\]
\[
3x - y - 2z - u = 3, \quad x - 2u = 0
\]

(7+8)

2.(a) (i) Find the cubic polynomial which takes the following values:
\[ y(1) = 1, \quad y(2) = -3, \quad y(3) = -1 \quad \text{and} \quad y(4) = 13. \]

Hence or otherwise, obtain \( y(5) \).

(ii) Prove the following identities:

\[ (A) \quad \mu = \sqrt{1 + \frac{\delta^2}{4}} \quad (B) \quad hD = \log(1 + \Delta) \]

where symbols have their usual meaning.

(b) Using Lagrange’s interpolation formula, find the polynomial \( y = f(x) \) which takes the following values:

<table>
<thead>
<tr>
<th>x</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>y</td>
<td>2</td>
<td>3</td>
<td>12</td>
<td>147</td>
</tr>
</tbody>
</table>

Hence obtain \( f(3) \) and \( f'(4) \).

OR

\( (b') \) Derive Simpson’s \( \frac{1}{3} \) rule from the general quadrature formula

and use it to evaluate the integral \( \int_0^1 \frac{dx}{(1+x)^2} \) with \( h = \frac{1}{8} \).

(8+7)
3.(a) Use Taylor’s series method upto \( x^4 \) term to find the solution of the initial value problem:
\[
\frac{dy}{dx} = -xy, \quad y(0) = 1. \quad \text{Also find } y(0.2)
\]
\[\text{OR}\]
(a') Apply fourth order Runge-Kutta method to find \( y(0.2) \), given that
\[
\frac{dy}{dx} = y - x, \quad y(0) = 2 \quad \text{and} \quad h = 0.1
\]

(b) Solve the boundary value problem
\[
y'' + y + 1 = 0
\]
with \( y(0) = y(1) = 0 \) and \( h = \frac{1}{4} \), by finite difference method. \(8+7\)

4.(a) Evaluate the following transforms:
(i) \( L \left[ te^{at} \sin bt + \left( \frac{e^{-at} - e^{-bt}}{t} \right) \right] \)
(ii) \( L^{-1} \left[ \frac{s}{(s^4 + s^2 + 1)} + \frac{1}{s(s+a)} \right] \)

(b) Apply convolution theorem to evaluate \( L^{-1} \left\{ \frac{s^2}{(s^2 + a^2)(s^2 + b^2)} \right\} \).

OR

(b') Using Laplace transform method, find the solution of the initial value problem
\[
\frac{d^2y}{dt^2} - 3 \frac{dy}{dt} + 2y = 1 - e^{2t} \quad ; \quad y(0) = 1, \quad y'(0) = 0.
\]
II YEAR B.E. EXAMINATION (CIVIL ENGINEERING) WATER SUPPLY AND TREATMENT (ECE - 214)

Maximum Marks = 60 Time = Two hours

Note: Attempt all questions
Assume Missing data suitably
The notations have their usual meanings.

Q.No. Question M.M. 60

1 (a) What are indicator organisms? Explain their significance as water quality parameter. [5]
1 (b) Balance the following redox reactions:
(i) Oxidation of ammonium to nitrate and reduction of oxygen to water [5]
(ii) Oxidation of acetate to carbon dioxide and reduction of Cr<sub>2</sub>O<sup>-7</sup> to Cr<sup>+++</sup>
1 (c) Find the solubility of fluoride in a saturated solution of CaF<sub>2</sub> at 25°C. Take Ksp for CaF<sub>2</sub> as 3 x 10<sup>-11</sup>. [5]

2 (a) Draw the sketch of a water supply connection for a house and briefly explain the various components [5]
2 (b) With the help of sketches explain the Grid iron and circular system of piping network used in water distribution system. [6]
2 (c) Briefly explain the Hardy Cross method used for solving water distribution networks. [4]

OR

2' Following table gives the hourly variations in water demand of a town. Estimate the capacity of the elevated reservoir required to meet out the variations in water demand. Take hours of pumping as 3.0 a.m. to 9.0 a.m. and 3.0 p.m. to 9.0 p.m. [15]

Contd....
<table>
<thead>
<tr>
<th>Time</th>
<th>Water demand (L)</th>
<th>Time</th>
<th>Water demand (L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midnight to 1.0</td>
<td>45000</td>
<td>12 - 13</td>
<td>90000</td>
</tr>
<tr>
<td>1.0 - 2.0</td>
<td>45000</td>
<td>13 - 14</td>
<td>110000</td>
</tr>
<tr>
<td>2.0 - 3.0</td>
<td>65000</td>
<td>14 - 15</td>
<td>120000</td>
</tr>
<tr>
<td>3.0 - 4.0</td>
<td>75000</td>
<td>15 - 16</td>
<td>130000</td>
</tr>
<tr>
<td>4.0 - 5.0</td>
<td>85000</td>
<td>16 - 17</td>
<td>110000</td>
</tr>
<tr>
<td>5.0 - 6.0</td>
<td>110000</td>
<td>17 - 18</td>
<td>130000</td>
</tr>
<tr>
<td>6.0 - 7.0</td>
<td>130000</td>
<td>18 - 19</td>
<td>140000</td>
</tr>
<tr>
<td>7.0 - 8.0</td>
<td>150000</td>
<td>19 - 20</td>
<td>130000</td>
</tr>
<tr>
<td>8.0 - 9.0</td>
<td>180000</td>
<td>20 - 21</td>
<td>140000</td>
</tr>
<tr>
<td>9.0 - 10</td>
<td>150000</td>
<td>21 - 22</td>
<td>125000</td>
</tr>
<tr>
<td>10 - 11</td>
<td>120000</td>
<td>22 - 23</td>
<td>115000</td>
</tr>
<tr>
<td>11 - 12</td>
<td>100000</td>
<td>23 - 24</td>
<td>90000</td>
</tr>
</tbody>
</table>

3 (a) Briefly explain the impact of discharge of wastewater on streams. Write equations for D.O. deficit, Critical D.O. deficit and critical time.

3 (b) Design a sedimentation tank for the treatment of 20 MLD of water assume SOR as 30 m³/m².d. Design both rectangular and circular sections.

3 (c) Differentiate between coagulation and flocculation process. Calculate the amount of alum required for the treatment of 10 MLD of water consuming 20 mg/L of alum dose. Also calculate the amount of alkalinity required for the same.

OR

3' (c) Draw water treatment flowsheet for underground source of water supply and explain the purpose of aeration

4 (a) Describe the principle involved in Adsorption process. Write various adsorption isotherms.

4 (b) Write the different chemical equations used in Lime soda process of water softening. Briefly explain the importance of adding excess lime.

4 (c) Briefly describe Membrane Filtration process
1(a) Two 8cm × 16 cm rectangular section cast iron columns are each 4m long with one end fixed and the other end hinged. They share equally the total load carried by them. Find the diameter of single cast iron column of circular section of the same length and same end conditions to replace both of them. Also calculate percentage saving in material. Take $\sigma_c = 500$ MN/m$^2$ and $a = 1/1600$

1(b) A masonry retaining wall of trapezoidal cross section 2m at top and 3.5 m wide at base, having vertical face towards earth, is 12 m high and subjected to earth backfill inclined upward at 15° with the horizontal. Calculate extreme stresses developed at base of wall, assuming unit wt. of masonry as 19 kN/m$^2$, unit wt. of soil as 17 kN/m$^3$ and angle of repose for soil as 28°. Also check stability against overturning.

2(a) A simply supported beam AB, 5 m long carries two concentrated loads of 10 kN each. The loads are acting at points 1 m from the supports A and B. Calculate:
   (i) Maximum deflection of the beam
   (ii) Slope and deflection under each load
   Take $EI = 1.2 \times 10^4$ kNm$^2$
   Use moment area theorems

2(b) A compound beam ABCD is shown in Fig.1. Determine the slope just to the left and just to the right of the pin B. Also determine the displacement at the free end D. Assume the beam is fixed supported at A and C is a roller. Take $EI$ as constant. Use Conjugate beam method.
2'(a) A simply supported beam AB of span 8m, is subjected to a point load of 40 kN. The load is acting at a distance of 2 m from right support B. Find the slope at C which is at a distance of 2 m from left support A. Use moment area theorems. Take $E= 200$ GPa and $I = 360 \times 10^6 \text{mm}^4$.

2'(b) Using Conjugate beam method, determine the slope at B and the maximum deflection of the beam shown in Fig. 2. Assume A is a roller and B is a pin. Take $E= 200 \text{ GPa}$, $I = 195 \times 10^6 \text{mm}^4$.

![Fig. 2]

3(a) The planer stresses at a point are given as; $\sigma_{xx} = 50 \text{ N/mm}^2$, $\sigma_{yy} = -10 \text{ N/mm}^2$, $\tau_{xy} = 5 \text{ N/mm}^2$. Find the orientation of planes on which direct stress is zero. Also calculate shear stresses on these planes.

3(b) A hollow steel shaft of solid circular section of 10 cm diameter is fixed at one end and subjected to a torque of 10 kNm and an axial load of 50 kN at free end. Calculate maximum principal stresses developed and also check safety against each of the following failure theories, if yield stress of material is 150 N/mm$^2$, and Poisson’s ratio is 0.3.

(i) Maximum strain energy theory
(ii) Maximum principal strain theory
(iii) Maximum shear stress theory

4. A simply supported beam AB of uniform rectangular section, 250 mm wide and 400 mm deep, is 6 m long, and is loaded as shown in Fig.3. Using Castigliano’s theorem, determine the slope at end support A and deflection at mid span C. Take $E= 200 \text{ GPa}$ and Poisson’s ratio $\nu$ as 0.3.
30 kN/m   10 kN/m

A   C   B

3 m   3 m

Fig. 3

4'(a) Calculate strain energy due to self weight for a freely held vertical column of uniform rectangular section 300mm x 400mm and 2m long. The unit weight of material may be assumed as 25 kN/m³ and E=20 GPa.

4'(b) Calculate strain energy due to bending and shear separately for a cantilever beam of uniform cross section 250mm x 400mm and 2m span subjected to udl. of 15 kN/m over its half span from fixed end and a load of 20 kN at free end. Assume E=20 GPa and Poisson’s ratio ν as 0.2.
Maximum Marks: 60
Duration: Two hours

Answer all the questions.
Assume suitable data, if required.

Q.No. Question MM

1(a) What is the purpose of orientation in plane table surveying? Discuss trial and [05]
error method for solution of three point problem.

1(b) A 2 km long line is measured with a tape of length 50m which is standardized [10]
under no pull at 15°C. The tape has cross-sectional area of 3.75 mm². If one
half of line is measured at temperature of 20°C and the other half at 26°C and
the tape is stretched with a pull of 22kg. Find the corrected total length of line.
Take coefficient of thermal expansion as 12×10⁻⁶ /°C, weight of 1 cm³ of tape
= 7.7504g and E= 2.11×10⁶ kg/cm².

OR

1'(b) The bearings observed in traversing with a compass at a place where local [10]
attraction was suspected are given below:

<table>
<thead>
<tr>
<th>Line</th>
<th>Fore Bearing</th>
<th>Back Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB</td>
<td>N62°45'E</td>
<td>S62°15'E</td>
</tr>
<tr>
<td>BC</td>
<td>N21°00'W</td>
<td>S20°45'E</td>
</tr>
<tr>
<td>CD</td>
<td>N71°30'W</td>
<td>S71°30'E</td>
</tr>
<tr>
<td>DE</td>
<td>S39°00'W</td>
<td>N38°00'E</td>
</tr>
<tr>
<td>EA</td>
<td>S54°30'E</td>
<td>N53°15'W</td>
</tr>
</tbody>
</table>

At what stations do you suspect local attraction? Find the corrected bearings
of all the lines. Also find included angles at station A and B.

2(a) What are the factors which should be considered while selecting the [05]
triangulation stations?

OR

2'(a) With the help of neat sketches, describe the various triangulation systems. [05]

2(b) The following observations were made in running fly levels from a bench
mark of R.L. 60.65 m. [10]

<table>
<thead>
<tr>
<th>Back Sight(m)</th>
<th>0.964</th>
<th>1.632</th>
<th>1.105</th>
<th>0.850</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fore Sight(m)</td>
<td>0.948</td>
<td>1.153</td>
<td>1.984</td>
<td></td>
</tr>
</tbody>
</table>

Five pegs at 20 m interval are to be set on a falling gradient of 1 in 100 from
the last position of the instrument. The first peg is to be at R.L. 60 m. Work
out the staff readings required for setting the pegs and prepare the page of the
level book.

3(a) What is the transition curve? Explain the methods used for determining the [05]
length of a transition curve.

contd.....2
3(b) Two straights A1 and B1 meet at a chainage of 3450 m. A right handed simple circular curve of radius 250 m joins them. The deflection angle between the two straights is 50°. Tabulate the necessary data to layout the curve by Rankine’s method of deflection angles. Take the chord interval as 20 m.

4(a) What is meant by a satellite station? How are the observed angles to and from a satellite station reduced to their true value?

4(b) Determine the gradient from a point A to B from the following observations made with a fixed hair tacheometer fitted with an anallactic lens. The constant of the instrument was 100 and the staff was held vertical.

<table>
<thead>
<tr>
<th>Inst. station</th>
<th>Staff station</th>
<th>Bearing</th>
<th>Vertical angle</th>
<th>Staff readings (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>A</td>
<td>345°</td>
<td>+15°</td>
<td>0.750, 1.435, 2.120</td>
</tr>
<tr>
<td>P</td>
<td>B</td>
<td>75°</td>
<td>+10°</td>
<td>0.625, 1.835, 3.050</td>
</tr>
</tbody>
</table>

OR

4'(a) How is the closing error of a traverse adjusted graphically?

4'(b) The following observations were made on a satellite station S to determine angle BAC. Calculate the angle BAC.

<table>
<thead>
<tr>
<th>Line</th>
<th>Length(m)</th>
<th>Line</th>
<th>Bearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA</td>
<td>9.43</td>
<td>SA</td>
<td>0°00'</td>
</tr>
<tr>
<td>AB</td>
<td>2925</td>
<td>SB</td>
<td>78°46'</td>
</tr>
<tr>
<td>AC</td>
<td>3426</td>
<td>SC</td>
<td>100°12'</td>
</tr>
</tbody>
</table>
2017-18
II YEAR B.E. IV- SEMESTER EXAMINATION
CIVIL ENGINEERING
HYDROLOGY
(ECE-219)

Maximum Marks: 60
Duration: Two Hours

Answer all the questions. Assume suitable data if missing.

Q. No.  

1(a)  
Describe the technique that is used for checking the consistency of rainfall data.

The network of 10 station in and around a river basin have the Thiessen weight of 0.10, 0.06, 0.11, 0.07, 0.08, 0.09, 0.11, 0.12, 0.16 and 0.10 respectively. Stations 2, 4 and 5 lie outside the basin while the remaining are inside. If the rainfalls recorded at these gauges during a storm are 150, 168, 158, 135, 156, 207, 138, 162, 114 and 132 mm respectively. Determine the average depth of rainfall over the basin by arithmetic and Thiessen mean method.

OR

1'(a)  
Differentiate between normal annual rainfall and annual rainfall. A storm commenced at 7.00 hours. The ordinates of the rainfall mass curve of this storm in mm as recorded by a recording rain gauge at 15 minutes intervals are 0, 9.5, 17.0, 27.0, 40.5, 49.0, 63.0, 84.0, 95.0, 102.0, 110.0, 112.0, and 112.0. Construct the hyetograph of this storm for a uniform interval of 15 minutes.

1(b)  
Enumerate various raingauges. Discuss with the help of neat sketch the various components of hydrologic cycle.

2(a)  
Enumerate various methods of determining PET. Describe briefly any one of them.

2(b)  
Explain the working of Single tube flooding infiltrometer. A reservoir with an average surface spread of 5 Km² had the following average values of parameters during a week: water temperature = 25ºC, relative humidity = 30% & wind velocity at 3 m above the ground = 19 Km/hr. Estimate the average daily evaporation from the lake and the volume of

cont'd...
water evaporated from the lake during that week.

3(a) Briefly explain the concept of unit hydrograph. Also discuss the assumptions made in the theory of unit hydrograph.

3(b) Enumerate various factors affecting the recession limb of hydrograph. Following are the ordinates of a 2-h unit hydrograph. Two storms each of 4-h duration and having excess rainfall of 2.5 and 3.5 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>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>
</tr>
</thead>
<tbody>
<tr>
<td>Ordinates m³/s</td>
<td>0</td>
<td>15</td>
<td>65</td>
<td>110</td>
<td>95</td>
<td>75</td>
<td>50</td>
<td>35</td>
<td>20</td>
<td>15</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

OR

3'(b) What is the significance of flow mass curve and flow duration curve? Give step-wise procedure for drawing a flow duration curve.

4(a) Show that average permeability in parallel to a bedding plane through any stratified soil is always greater than in perpendicular direction. Calculate hydraulic conductivity and transmissivity of a confined aquifer having thickness of 8 m from which a 16 cm diameter well is pumping water at a constant rate of 160 L/min. The steady state drawdown observed in two wells located at 25m & 10m distances from the centre of well are 0.55 m & 6 m respectively.

OR

4'(a) What is Darcy's law of permeability? A Falling Head Permeability test was carried out on a 15 cm long sample of silty clay. The diameter of sample and stand pipe were 9.5 cm and 0.45 cm respectively. The water level in the stand pipe was observed to fall from 75 cm to 55 cm in 12 min. Determine coefficient of permeability in meter per day and height of water level in stand pipe after 10 min

4(b) Write short note on the following:

(i) Specific Yield and Unconfined Aquifer (ii) Storage coefficient and transmissivity