Instructions:  
(1) All questions are compulsory.
(2) Answer each next main question on a new page.
(3) Illustrate your answers with neat sketches wherever necessary.
(4) Figures to the right indicate full marks.
(5) Assume suitable data, if necessary.
(6) Use of Non-programmable Electronic Pocket Calculator is permissible.
(7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
(8) Use of Steam tables, logarithmic, Mollier’s chart is permitted.

1. A) Attempt any three: (3x4=12)
   a) State any four advantages and four ill effects of irrigation.
   b) Explain with neat label sketch Symon’s rain gauge.
   c) Calculate the maximum flood discharge for a catchment area 1500 km² using Dicken’s formula. Assume Dicken’s coefficient as 28.
   d) State the meaning of:
      i) GCA
      ii) Delta
      iii) Duty
      iv) Crop period.

   B) Attempt any one: (1x6=6)
   a) A tank has a catchment area of 120 km² out of which 20 km² is independent. The average annual rainfall of the catchment is 80 cm. The runoff of average bad year is 20% of the rainfall for an average bad year. The runoff from the intercepted catchment available for this tank is 20% of actual runoff. Calculate the assured yield.
b) Fix the FRL, FFL and HFL from the following data:
   1) DSL = 110.00 m
   2) Effective losses = 8000 m³
   3) Tank losses = 1500 m³
   4) Maximum flood discharge = 400 m³/sec
   5) Length of waste weir = 100 m
   6) Francis formula \( Q = 1.8 \, L\,H^{3/2} \)
   7) Free Board = 1.5 m.

<table>
<thead>
<tr>
<th>Contour RL</th>
<th>110</th>
<th>112</th>
<th>114</th>
<th>116</th>
<th>118</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity in m³</td>
<td>1000</td>
<td>3000</td>
<td>5000</td>
<td>6000</td>
<td>9000</td>
<td>12000</td>
</tr>
</tbody>
</table>

2. Attempt any four: (4×4=16)

   a) State the various cropping pattern seasons and crops in Maharashtra.
   b) Enlist any eight criteria for selection of site for a dam.
   c) Differentiate between earthen and gravity dam with respect to foundation, seepage, construction and maintenance.
   d) Write the functions of following components of earthen dam.
      i) Turfing
      ii) Berms
      iii) Heating
      iv) Rock toe.
   e) Draw a neat sketch of cross section of zoned type earthen dam and show all components of it.
   f) Differentiate between elementary profile and practical profile of gravity dam.

3. Attempt any four: (4×4=16)

   a) State and explain the different conditions of stability of a gravity dam.
   b) State importance of spillway in earthen dam and explain construction and working of ogee spillway with sketch.
   c) Draw a labeled sketch of vertical sliding gate. State where it is suitable?
   d) State advantages and disadvantages of Bandhara irrigation scheme.
   e) State the main features of lift irrigation scheme.
4. A) Attempt any three: 
   (3x4=12)
   a) Describe construction of percolation tank.
   b) Compare between drip irrigation and sprinkler irrigation on any four points.
   c) Write any eight component parts of diversion headwork.
   d) State different types of weir. Draw labeled sketch of any one type of weir.

B) Attempt any one: 
   (1x6=6)
   a) State the needs of sprinkler irrigation scheme. Draw layout of sprinkler irrigation scheme and show various components of it.
   b) Calculate the balancing depth for a section of a canal having the following data:
      \[ b = 10 \text{ m}, \text{FSD} = 1.5, \text{Bank width} = 2 \text{ m}, \text{Side slope} 1 : 1 \text{ in cutting}, 1.5 : 1 \text{ in filling free board 0.5 m}. \]

5. Attempt any two: 
   (2x8=16)
   a) Following table gives the necessary data about the crops, their duty and the area under each crop commanded by a canal taking off from storage reservoir. Find the reservoir capacity if the canal losses are 20% and reservoir losses are 12%.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Base period (days)</th>
<th>Area under the crop (Ha)</th>
<th>Duty at the field (Ha/cumec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheat</td>
<td>120</td>
<td>4800</td>
<td>1800</td>
</tr>
<tr>
<td>Sugar cane</td>
<td>360</td>
<td>5600</td>
<td>800</td>
</tr>
<tr>
<td>Cotton</td>
<td>200</td>
<td>2400</td>
<td>1400</td>
</tr>
<tr>
<td>Vegetables</td>
<td>120</td>
<td>1400</td>
<td>700</td>
</tr>
<tr>
<td>Rice</td>
<td>120</td>
<td>3000</td>
<td>800</td>
</tr>
</tbody>
</table>

   b) Explain the type of failure in earthen dam and its remedial measures.
   c) Suggest the suitable type of CD work and draw sketch of it under each of the following situations.
      i) Canal bed level and Nala bed level are same.
      ii) Canal bed level is above HFL of Nala.
      iii) Nala bed level is above FSL of Canal.
      iv) HFL of Nala is between FSL of Canal and bed level of Canal.
6. Attempt any four:
   a) Differentiate between weir and barrage w.r.t.:
      i) Cost
      ii) Silting
      iii) Flood control
      iv) Area of submergence.
   b) State four types of weir. Draw a sketch of any one and describe its purpose.
   c) Draw the cross section of canal in partial cutting and partial embankment.
   d) What do you mean by canal lining? State two purposes, advantages, disadvantages of canal lining.
   e) Differentiate between head regulator and cross regulator on any four points.