B. Tech
(SEM. V) (ODD SEM.) EXAMINATION, 2011-12
HYDROLOGY

Time: 3 Hours

Total Marks: 100

Note: Attempt any 5 questions. Each question carries equal marks.

1. (a) Differentiate between: (any five) 3×5=15

(i) Hydrograph and Hyetograph

(ii) Runoff and Base flow

(iii) Precipitation and Rainfall excess

(iv) Hydraulic and Hydrologic routing

(v) Aquifer and Aquitard

(vi) Confined and Unconfined aquifer

(b) Station X remained inoperative for a certain period during which the storm has occurred. The storm rainfall at the three surrounding stations A, B, C, was recorded as 155 mm, 135mm, and 170mm respectively. The normal precipitation at stations X, A, B, and C was observed as 1200mm, 1400mm, 1550mm, and 1500mm respectively. Find the storm precipitation at station X.
2. (a) Explain the factors affecting flood hydrograph.
   (b) A watershed has a network of five rain gauges. Annual rainfall recorded by these gauges is given for a year as:

<table>
<thead>
<tr>
<th>Rain gauge</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual rain fall (mm)</td>
<td>500</td>
<td>820</td>
<td>730</td>
<td>640</td>
<td>1050</td>
</tr>
</tbody>
</table>

Calculate the optimum rain gauge for this watershed for a 10% error in estimation of mean areal rainfall.
(c) Explain the procedure to estimate the parameters $K$ and $x$ in Muskingum equation of flood routing.

3. (a) Define the following terms: (any five) 3x5=15
   (i) Time of concentration
   (ii) Return period
   (iii) Storage coefficient
   (iv) Instantaneous unit hydrograph
   (v) Isohypses
   (vi) Probable maximum precipitation

(b) A confined aquifer has a thickness of 25m and a porosity of 30%. If the bulk modulus of elasticity of water and the formation material are $2.12 \times 10^5$ N/cm$^2$ and 5000 N/cm$^2$, respectively. Calculate the storage coefficient.

4. (a) Three rain gauge stations 1, 2, 3 are located at the midpoint of the vertex of an isosceles triangle as shown in the figure below. The rain fall values at stations 1, 2 and 3 are 20mm, 20mm and 15mm.
respectively. Using Thiessen polygon method, calculate the mean precipitation over the area.

(b) What do you mean by a D-hr duration unit hydrograph? Write down the assumptions and limitations of unit hydrograph theory.

(a) For a catchment having an area of 100 sq km, derive a 12 hr unit hydrograph from a 6-hr unit hydrograph (assuming 1 cm rainfall excess) as given below.

<table>
<thead>
<tr>
<th>Time (hr)</th>
<th>0</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
<th>18</th>
<th>21</th>
<th>24</th>
<th>27</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-hr UH (cumec)</td>
<td>0</td>
<td>20</td>
<td>50</td>
<td>100</td>
<td>160</td>
<td>240</td>
<td>350</td>
<td>420</td>
<td>520</td>
<td>440</td>
<td>310</td>
</tr>
<tr>
<td>Time (hr)</td>
<td>33</td>
<td>36</td>
<td>39</td>
<td>42</td>
<td>45</td>
<td>48</td>
<td>51</td>
<td>54</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6-hr UH (cumec)</td>
<td>230</td>
<td>150</td>
<td>100</td>
<td>65</td>
<td>40</td>
<td>25</td>
<td>15</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(b) For the same catchment, derive the discharge hydrograph using unit hydrograph theory, for the rainfall event as given below. Take base flow as 10 cusec.

<table>
<thead>
<tr>
<th>Time</th>
<th>0-6 hr</th>
<th>6-12 hr</th>
<th>12-18 hr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfall excess (mm)</td>
<td>10</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>

6. Write short notes on (any five)
(a) Area velocity method
(b) Infiltration and its measurement
(c) Depth area duration curve
(d) Flood Routing
(e) Hydrological cycle
(f) Continuous probability distributions
(g) Application of regression analysis in hydrology

4 × 5 = 20