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06CV65

Sixth Semester B.E. Degree Examination, May/June 2010
Irrigation Engineering and Hydraulic Structures

Time: 3 hrs.

Max. Marks:100

- Note: 1. Answer any FIVE full questions, selecting at least TWO questions from each part.**
2. Any missing data may suitably be assumed.

PART – A

- 1 a. List the benefits and ill effects of irrigation. (06 Marks)
- b. What is Bhandara irrigation? What are its advantages and disadvantages? Explain Phad system of irrigation. (08 Marks)
- c. List the advantages of sprinkler irrigation, with its limitations. (06 Marks)
- 2 a. Define duty, delta and base period and establish the relationship between them. (08 Marks)
- b. The base period, duty at the field of difference crops, and area under each crop in the command area are given below. Find the required reservoir capacity to cater to the needs of the crops. (08 Marks)

Crops	Base period (days)	Duty @ field (Ha/cumec)	Area under the crop, (Ha)
Wheat	120	1800	4800
Sugar cane	360	800	5600
Cotton	200	1400	2400
Rice	120	900	3200

- c. After how many days will you supply water to soil in order to ensure sufficient irrigation of given crop, if

Field capacity of soil	= 28%
Optimum moisture content, when water is be supplied	= 16%
Dry density of soil	= 13 kN/m ³
Effective root zone depth	= 0.7 m
Daily consumptive use of water for given crop	= 12 mm

(04 Marks)

- 3 a. With a neat sketch, explain any one type in each of cross drainage work i) Carrying canal water over the drainage ; ii) Carrying drainage over the canal. (10 Marks)
 - b. An irrigation engineer has designed an irrigation canal using Kennedy's theory, for the following details. He had concluded that full supply depth of 1.8 m is sufficient for the canal. Check whether his design can be adopted. (10 Marks)
- | | |
|--------------------------------|-------------|
| Discharge | = 45 cumecs |
| Manning's Rugosity coefficient | = 0.0225 |
| Bed slope of channel | = 0.16 m/km |
| Critical velocity ratio | = 1 |

- 4 a. With a neat sketch, explain various storage zones of reservoir. (10 Marks)
- b. The amounts of water flowing form a certain catchment area of the proposad dam site are as tabulated below :

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Inflow Mm ³	2.83	4.25	5.66	18.40	22.64	22.64	19.81	8.49	7.10	7.10	5.66	5.66

Determine:

- i) The minimum capacity of reservoir if water is to be drawn off from the reservoir at uniform rate and no water to be spilled over
- ii) The initial storage required to maintain the uniform demand as above. Use mass curve analysis. (10 Marks)

PART – B

- 5 a. How does Khosla's theory differ from Bligh's theory with regard to the design of weir on permeable foundation? (08 Marks)
- b. Design the length of impervious and pervious aprons of a vertical drop weir with the following details, using Bligh's creep theory. (12 Marks)
- | | |
|-----------------------------------|--------------|
| Height of weir | 4.5 m |
| Height of crest shutter | 2m |
| Discharge per unit length of weir | 11.2 cumec/m |
| Top width of weir | 3m |
| Bottom width of weir | 8m |
| Depth of upstream cutoff | 2m |
| Depth of down stream cutoff | 7m |
| Coefficient of creep | 12 |
- 6 a. Derive an expression for base width of elementary profile of gravity dam for i) No tension condition ; ii) No sliding condition, when the reservoir is full. (08 Marks)
- b. A concrete gravity dam has the following features :
- | | |
|----------------------------|------------|
| Top of dam | - RL 200 m |
| Top width @ top | - 6 m |
| RL of bottom of dam | - 116 m |
| RL of tail water level | - 122 m |
| RL of full reservoir level | - 196 m |
- Upstream face is vertical. Down stream face is vertical up to RL 191 m and thereafter down stream face slopes 2 H : 3V. Drainage holes are located 8m away from upstream face, unit weight of concrete 23.5 kN/m^3 , calculate maximum vertical stress at the toe and heel. (12 Marks)
- 7 a. List the causes of failure of earth dam. What are the precautions to be taken to avoid each of the above mentioned failure during the design procedure? (10 Marks)
- b. In order to find the factor of safety of the down stream slope of 2:1 during steady seepage, the section of the earth dam was drawn. A possible slip circular arc passing through the toe of the dam was drawn. The soil mass was divided in to nine slices, each of 5m width. The end ordinates of the slices are 2.5, 4.5, 6, 7, 7.5, 7.5, 6 and 4.5 m respectively from toe towards upstream. Assuming all the slices are dry, find the factor of safety. Take
- Dry weight of soil of dam = 18 kN/m^3
 - Length of arc = 54 m
 - Cohesion of soil of dam = 24 kN/m^2
 - Angle of internal friction of soil in dam = 25° .
- (10 Marks)
- 8 a. What are spillways? Where are they provided? (06 Marks)
- b. Design a suitable section for the over flow section of a concrete gravity dam having the down stream face sloping at a slope of 0.7 H : 1V. The design discharge for the spillway is 8000 cumecs. The height of the spillway above the river bed is 104 m. The spillway length consists of 6 spans of clear width 10 m each. Take thickness of pier as 2.5 m. Assume contraction coefficient of pier = 0.01 and for abutment as 0.1. Design downstream profile assuming upstream face vertical. Use WES downstream profile formula. Use following formula for upstream profile with usual notation.

$$y = \frac{0.724(x + 0.27H_d)^{1.85}}{H_d^{0.85}} + 0.126H_d - 0.4315H_d^{0.375}(x + 0.27H_d). \quad (14 \text{ Marks})$$

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