

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, April-May 2016

B. Tech in Civil Engineering, Semester VI



Roll No.....

CE 610: Irrigation Engineering

Time: 3 hours

Max. Marks: 100

Instructions to students:

1. Do not write anything other than your roll number on question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.
4. Answer should be precise and to the point only.

Q.1A Objective type multiple choice questions & Fill the blanks (10 questions @ 1 mark) 10

- i. The Sodium Absorption Ratio (SAR) of an irrigation water is 8. This water will be Called
- ii. Crops grown during Winter months and harvested in March-April are called Crops.
- iii. When the total horizontal forces acting on a dam is grater then the total vertical forces, then the dam may fail.....
- iv. The forces, which are considered for the analysis of an elementary profile of a gravity dam under empty reservoir condition, are i) Water pressure ii) Self weight iii) Uplift iv) Pressure due to earthquake The correct answer is
(a) Only (ii)
(b) (i), (ii) and (iii)
(c) (i), (ii) and (iv)
(d) (i), (ii), (iii) and (iv)
- v. Base period is then the crop period.
- vi. A channel is designed by Lacey's theory has mean velocity of one m/s. The slit factor is unity. The hydraulic mean radius will be
- vii. Horizontal acceleration due to earthquake results in
(a) hydrodynamic pressure (b) inertia force into the body of the dam
(c) both (a) and (b) (d) none of the above
Silt excluders are constructed on the
- viii. (a) river bed upstream of head regulator
(b) river bed downstream of head regulator
(c) canal bed upstream of head regulator
(d) none of the above
- ix. If there are two canals taking off from each flank of a river, then there will be
(a) one divide wall and one undersluice
(b) one divide wall and two undersluices
(c) two divide walls and one undersluice
(d) two divide walls and two undersluices
- x For weirs or low dams.....Spillway is suitable.

Q.2 Short answer type questions (4 questions @ 2.5 marks) 10

- Explain the economics of canal lining.
- Sketch the plot of moisture content of soil Vs. stage of crop growth, which is helpful in understanding the irrigation needs of crops.
Draw uplift pressure diagram for dam with the following data
- (i) depth of water = 90 m
(ii) top width = 20 m
(iii) bottom width = 35 m
Uplift may be considered to be acting on 45 % of the area of section. tail water depth is 8 m.
- Explain the method to be adopted to check the failure of barrage or weir.

Q.3A Define base period, duty and delta. Establish a relation between them. A 05
channel is to be designed for irrigating 5000 hectares in Kharif crop and 4000 hectare in rabi crop. The water requirement for kharif and rabi are 60 cm and 25 cm respectively. The Kor period for Kharif is 3 weeks and for Rabi is 4 weeks. Determine the discharge of the channel for which is to be designed.

Q.3B Draw a neat sketch of the layout of the diversion headwork works, indicating 05
-the components and their functions of each.

Q.4A Explain the necessity of cross drainage works and also explain the super 05
passage and syphon super passage, aqueduct and siphon aqueduct with sketches.

Q.4B Name the methods of distribution of water adopted for the following crops 05
and describe the methods with sketch.
(a) potato (b) orchard (c) paddy (in plain terrain)

Q.5A A farmer wishes to have his own pump set for the following cropping pattern 05
to be followed in five hectares of his land. Calculate the right size of the centrifugal pump he should have, litres/sec.

Season	Crop	Area to be irrigated	Intensity of irrigation, cm	Rotation period, days
Rabi	Wheat	2.0	7.5	12
	Cotton	0.4	7.5	20
	Vegetables	0.4	7.5	10
	Mustard	2.2	5.0	40

For each crop, duration of pumping hours per day is 10.

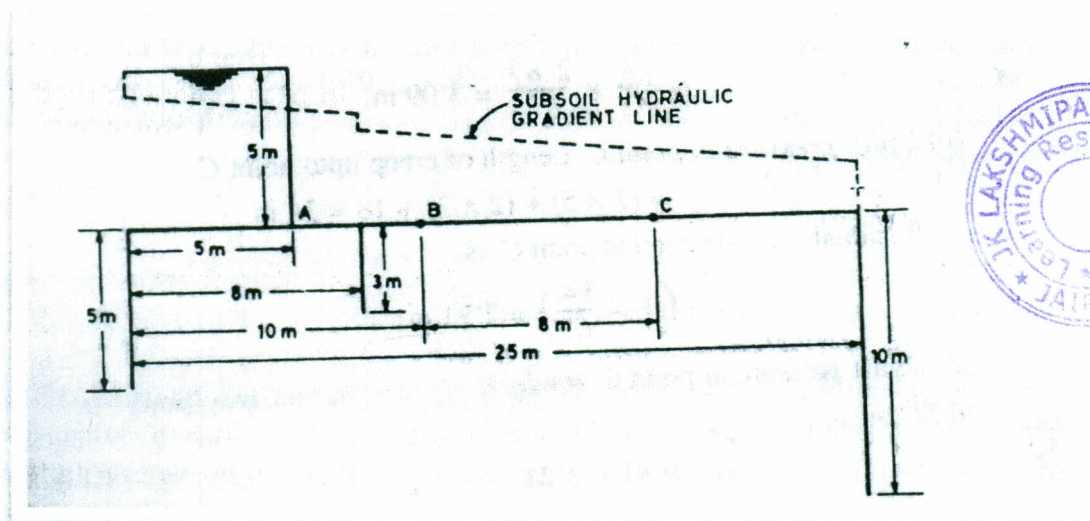
Q.5B What is meant by the elementary profile of a gravity dam, and how is it 05
deduced?

What should be the maximum depth of elementary profile of a gravity dam if the safe limit stress on the masonry should not exceed 1500 kN per m².

(Assume unit weight of masonry = 24 kN/m³.)

Q.6A A lined irrigation canal with trapezoidal cross section has 5 m bed width, 2.5 m 05
depth and 1.5(H): 1(V) side slope, longitudinal bed slope of the canal is 1 in 1000 and Manning's n = 0.016. What is the maximum carrying capacity of the canal? What area of land in hectares the canal can irrigate if the crop has 150 mm field irrigation requirement in core period of 10 days.

- Q.6B The accompanying figure show the section of a hydraulic structure on permeable foundation. Calculate the average hydraulic gradient according to (i)Bligh's Creep theory (ii) Lane's weighted creep theory. Also find the uplift pressure at points A, B, C as shown in the figure and the floor thickness required at these points. 05

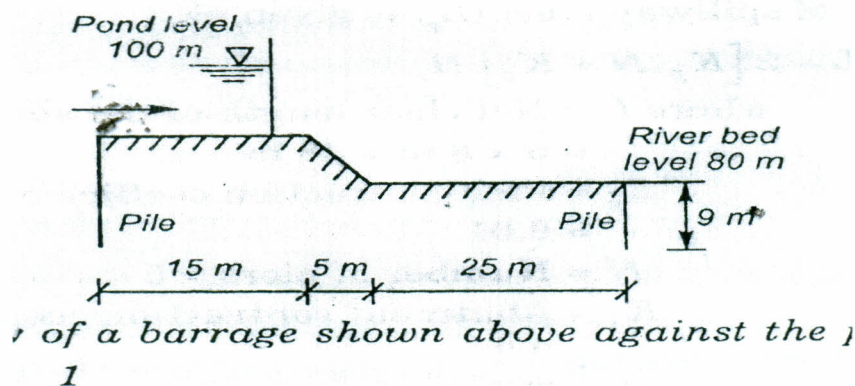


OR

- Q.6B What is a canal fall? Enumerate types of canal fall and explain any Two types of Fall in detail with neat sketch. 05
- Q.7A What is Evapotranspiration? Determine the discharge of distributary at the tail end from the following data : 05
- Gross command Area (GCA) = 20000 ha
Cultivated command Area(CCA) = 70%
Losses beyond the tail end = $1 \text{ m}^3 \text{ s}^{-1}$

Crop Season	Crop	Irrigation intensity	Kor depth	Kor period
Kharif	Rice	15 %	19 cm	2.5 weeks
Rabi	Wheat	30%	13.5 cm	4 weeks
Perennial	Sugarcane	10%	16.5cm	4 weeks

- Q.7B Check the safety of a barrage shown in figure against piping action. The safe exit gradient is $1/5$. 05



OR

- Q.7B A triangular channel of apex angle 90° and a rectangular channel of the same material have the same bed slope. If the rectangular channel has the depth of flow equal to width of channel and flow areas in both channels are the same, find the ratio of discharges in rectangular and triangular channels respectively. Use Manning's Roughness equation for estimation of velocity. 05

- Q.8A What is a spillway? Enumerate various type of spillways with neat sketch. 10
An overflow ogee spillway has Six bays each of 8 m clear length and five rounded nose piers ($K_P=0.01$) each of 2.5 m thick. Both the abutments are sharp edged ($K_a = 0.2$). The upstream face of the spillway is vertical. Compute the discharge that will pass over the spillway at the design head, $H_d = 3$ m. The discharge coefficient for design head $C_o = 2.1$.
Also compute the passing discharge over the spillway for head over the crest $H = 3.45$ m. Neglect the approach velocity to the spillway. Discharge coefficients for head other than design head are given below :

H/H _d	C/C _o
0.6	0.94
0.85	0.98
1.15	1.02
1.50	1.06

- Q.9A The gross command area of distributary is 25000 hectare. It is reducing by 5000 hectare after every kilometer. The culturable command is only 70 % of gross command. The intensities of irrigation are 30 % and 12 % for Rabi and kharif respectively. The Kor periods are 4 weeks and 3 weeks for Rabi and Kharif respectively. The Kor depths are 15 cm and 25 cm for Rabi kharif respectively. The details of canal sections are as under: 10

Km	Bed width (m)	Depth (m)	Side slope
0-1	6	1.2	0.5:1
1-2	6	1.1	0.5:1
2-3	4.5	1.1	0.5:1

The conveyance losses occur at a rate of 2.2 cumec per million square meter of wetted area. Total losses below km 3 are 0.6 cumec.

Determine the design canal discharge required at km 1.

- Q.9B During a particular stage of growth of a crop, consumptive use of water is 3.2mm/day. Determine the interval between irrigation and depth of water applied when the amount of water available in the soil is (i) 35 % (ii) 75 % and (iii) 0 % of the maximum depth of available water in the root zone which is 100 mm. Assume irrigation efficiency to be 60%. 10

OR

- Q.9B A distributary is to be designed to irrigate 3600 ha in Rabi and 1400 ha in kharif. Kor depth (critical stage watering depth) and kor period (critical stage watering period) for Rabi and Kharif are 13.5 cm and 4 Weeks, 19.00 cm and 2.5 weeks, respectively. Design the distributary by Lacey's Theory with silt Factor 0.85. 10