

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination (Regular/ Backlog), Nov. 2017

B. Tech in Civil Engineering, Semester V

Roll No.....

CE 524: 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.

Q.1A	Objective type multiple choice questions (10 questions @ 1 mark)	10
i.	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	
ii.	A syphon spillway is one which surplus water flow through (a) a channel (b) a closed pipe (c) through a funnel (d) none of these	
iii.	Weir is a solid obstruction constructed across a (a) river (b) canal (c) level crossing (d) none of these	
iv.	In a dry area where water availability is limited which crop would you like to chose (a) cotton (b) groundnut (c) maize (d) sesame	
v.	On which of canal systems, R.G.Kennedy, executive engineer in the Punjab irrigation department made his observations for proposing his theory on stable channels? (a) Krishna Western Delta canals (b) lower Bari Doab canals (c) lower canab canals (d) upper Bari Doab canal	
vi	While designing a hydraulic structure the Piezometric head at bottom of the floor is computed as 10m. The datum is 3m below floor bottom. The assured standing water depth above the floor is 2m. The specific gravity of the floor material is 2.5. the floor thickness should be (a) 2.00 m (b) 3.33 m (c) 4.40 m (d) 6.00 m	
Vii	For weirs or low dams.....Spillway is suitable.	
viii	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	
ix	A rice crop is to be irrigated in a field covering an area of 2400 ha, the duty and base period of rice are given as 860 ha/cumec and 120 days respectively. The volume of water required in the field is nearly: (a) 500 h-m (b) 1400 h-m (c) 2000 h-m (d) 2880 h-m	

- x 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)

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

10

- i Draw a uplift pressure diagram for a dam with the following data
 (a) depth of water = 90 m
 Top width = 20 m
 Bottom width = 35 m
 Uplift may be considered to be acting on 45 % of the area of section. Tail water depth is 8m.
 (b) There is a drainage gallery at 15 m from the vertical face.
- ii What are the ill effects of the waterlogging? How will you overcome waterlogging effects in a dy region of Rajasthan?
- iii What are the various modes of failure of a gravity dam?
- iv Explain the method to be adopted to check the failure of barrage or weir.

Q.3A Discuss briefly with neat sketches the different forces that may act on a gravity dam.

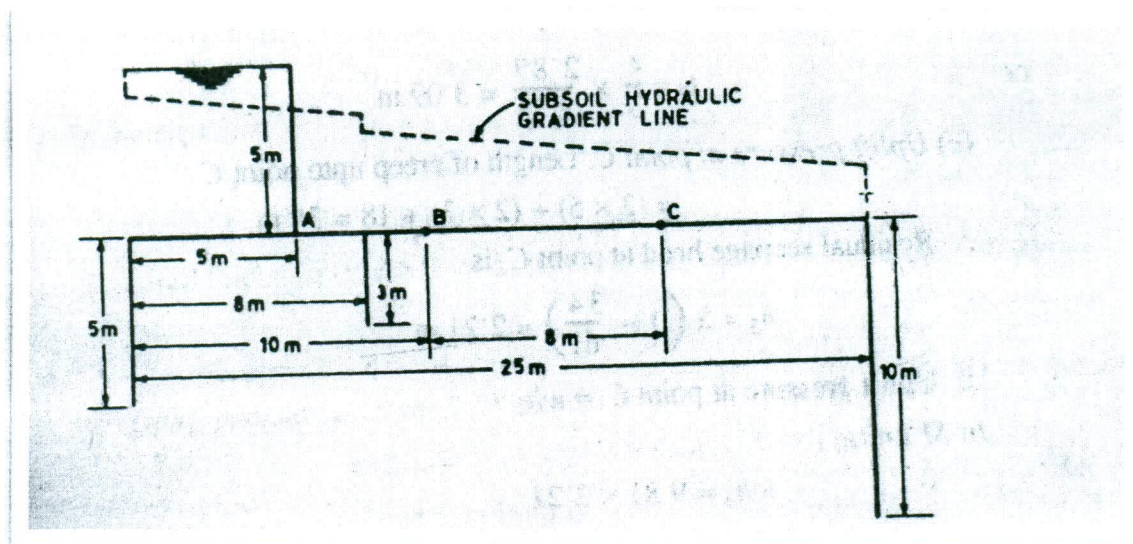
05

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

05

- Q.4A 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



Q.4B Write a Short note on :

05

- (a) Kor Period and Kor depth , (b) Aqueduct and Syphon (c) Practical profile of

gravity dam ,(d)Gross command area and Culturable command area ,

Q.5A What preliminary investigation are necessary for selecting a site for the dam? 05
How will you optimize size and type of a dam considering the preliminary investigation? You may consider catchment area of Banas river (Rajasthan) to answer your query.

Q.5B Design a concrete lined channel of trapezoidal section to carry a discharge of 250 05
cumec at a longitudinal slope of 1 in 6000.
Take manning's Rugosity coefficient for the lining material as 0.015.

Q.6A What do you understand by delta of crop? How is it different from delta on 05
field?

Consider 3- cases of irrigation distributaries with the following data:

	Distributary 1	Distributary 2	Distributary 3
Discharge	150 m ³ /s	20 m ³ /s	5 m ³ /s
C.C.A.	15000 ha	25000 ha	30000 ha
Intensity of irrigation	60 %	80%	50%
Base period	200 days (cotton crop)	120 days (Wheat crop)	360 days (sugarcane)

Which one is more efficient? Argue.

Q.6B Following data were obtained from the stability analysis of a gravity dam. 05

(i)total overturning moment about toe = 1×10^6 kN-m

(ii) total resisting moment about toe = 2×10^6 kN-m

(iii)total vertical force above base = 5000 kN

(iv)base width of the dam = 50 m

(v) slope of the d/s face = 0.8(H): 1 (V)

Calculate the maximum and minimum vertical stress to which the foundation will be subjected to. What is the maximum principal stress at toe?

Assume there is no tail water.

OR

Q.6B For an elementary profile of a dam ,the following data are available 05

Limiting height of a masonry dam =90 m

Weight of masonry dam =2400 Kg/m³

Uplift intensity factor =0.67

Factor of safety =2.0

specific weight of water =9810N/m³

(i)determine safe limiting stress ignoring uplift

(ii) Also determine H (limiting height) and bottom width when uplift intensity factor and factor of safety are given.

Q.7A A rectangular dam has constant width b and height H with reservoir full upto 05
its top. Analyse the dam completely

Q.7B Given Q =50 m³/s, silt factor =1.1 side slope = $\frac{1}{2}$:1, using Lacey's theory 05
determine (i)velocity ,(ii)Area of cross section, (iii)Hydraulic radius
(iv)Perimeter (v) longitudinal slope.

OR

Q.7B Design a channel by Lacey's theory for $40 \text{ m}^3/\text{s}$ capacity. The side slope may be assumed to be 1:1. The average size of the bed material may be taken as 0.8 mm. 05

Q.8A Derive the relationship between the 'duty' and 'delta'. A stream of 150 liter per second was delivered from a canal and 110 liter per second were delivered to the field. An area of 2.2 hectare was irrigated in eight hours. The effective depth of zone was 1.5 m. the runoff loss in the field was 445 m^3 . The depth of water penetration varied linearly from 1.5 m at the head end of the field to 1.1 m at the tail end. Available moisture holding capacity of the soil is 200 mm per meter depth of soil. Determine the water conveyance efficiency, water application efficiency, water storage efficiency and water distribution efficiency. Irrigation was started as a moisture extraction level of 50%. 03+07

Q.9A An irrigation channel carries a discharge of $40 \text{ m}^3/\text{s}$ and is laid on a slope of 1 in 2500. If C.V.R. = 1.2 and $n = 0.025$, design the channel. 10

Q.9B The gross command area of distributory 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.

OR

Q.9B What is a spillway? Enumerate various type of spillways with neat sketch. 04+06

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, $H_d = 3 \text{ m}$. The discharge coefficient for design head $C_o = 2.1$.

Also compute the passing discharge over the spillway for head over the crest $H = 3.45 \text{ m}$. 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