MANIPAL INSTITUTE OF TECHNOLOGY
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MANIPAL INSTITUTE OF TECHNOLOGY

FOURTH SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATION, MAY 2023

WATER RESOURCES ENGINEERING (CIE 2255)

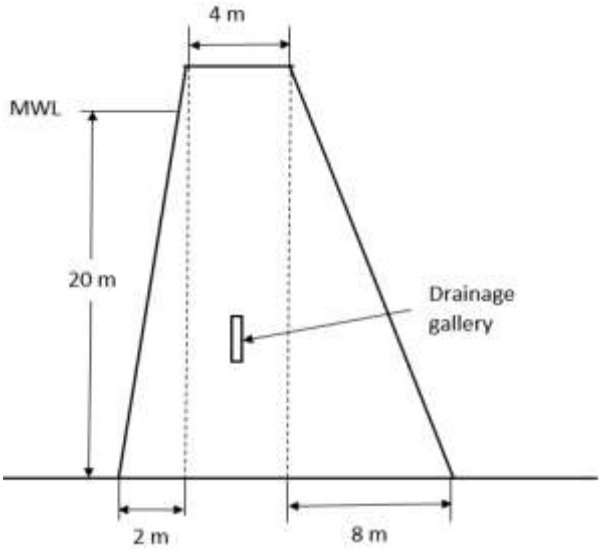
(– 05 - 2023)

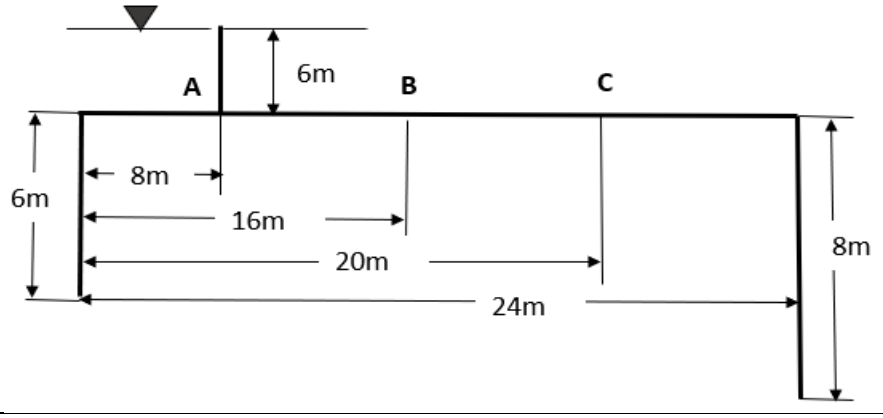
TIME: 3 HRS. **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. Any missing data may be suitably assumed.

Q. NO	QUESTION	MARKS	CO	BL
1A	With a neat sketch illustrate the working principle of the following: a) Natural Syphon type raingauge b) IS Evaporation Pan	**3**	**1**	**3**
1B	The hyetograph of a storm of 2 hrs is constructed at 15 minute interval for the first hour and at 30 minute interval for the next hour. The successive ordinates in mm/hr are 58, 56, 46, 54, 36 and 32. Compute the total rainfall	**2**	**1**	**4**
1C	A 4-hr rainfall event delivers 2.0, 3.2, 2.2 and 1.6 cm of hourly rainfall on a catchment. The Ø-index of the catchment area are 25 mm/hr for the first 30% of the area, 30 mm/hr for another 30% and 15 mm/hr for the rest of the area. Calculate the total runoff from the catchment.	**5**	**2**	**4**
2A	The ordinates of storm hydrograph measured at an interval of 2 hours and base flow ordinates are given in the table. Effective duration of storm was 4 hours. The catchment area is estimated to be 80 sq.km. Calculate the ordinates of 4-hour unit hydrograph.	**5**	**3**	**4**
2B	Illustrate with sketches the three types of conceptual hydrographs	**3**	**3**	**3**
2C	List the various factors effecting the hydrographs?	**2**	**3**	**3**
3A	Determine the safety against overturning, sliding, and development of tension for the gravity dam section with the following data: Total height of dam - 55 m Top width of the dam - 10 m u/s Water Depth - 52 m	**4**	**4**	**4**

Time(hrs)	0	2	4	6	8	10	12	14
Stream flow (m^3/ sec)	40	75	120	130	100	93	70	40
Base flow ordinates(m^3/ sec)	40	42	45	46	46	46	40	40

	Coefficient of friction - 0.8 Safe shear stress - 1400 kN/m^2 Unit weight of dam material - 24 kN/m^2 Net Horizontal Forces - 13263.12 kN Net Vertical Forces - 26425.84 kN Net Overturning Moment - 405730.724 kN-m Net Resisting Moment -916833.3 kN-m Upstream face of the dam is vertical Downstream side is inclined with a slope of 0.7 H: 1vertical for a height 44 m from bottom.			
3B	Illustrate the importance of Energy dissipator in a reservoir project. What are its types?	**3**	**4**	**3**
3C	Classify various types of dams and distinguish clearly between rigid and non-rigid dams.	**3**	**4**	**3**
4A	A cross section of concrete gravity dam of height 22m is shown in figure. Drainage gallery is located at 4m from the heel. Calculate the magnitude of 3 primary forces acting on the dam and their location with respect to the toe. Represent with a neat sketch. Take uplift intensity factor as 0.85 and uplift area factor as 95%. Unit weight of concrete = 24 kN/m^3 	**5**	**4**	**4**
4B	Name the type of canal constructed as per the following alignment and discuss their merits. i. Canal is aligned along the watershed. ii. Canal is aligned nearly parallel to the contour of the area.	**2**	**5**	**3**
4C	Name and illustrate with neat sketch, the type of cross drainage work adopted for the following two cases. i. HFL of drain is much below the bed level of the canal trough ii. FSL of canal is much below the bed level of natural drain.	**3**	**5**	**3**
5A	Where is diversion head work located in a direct irrigation project? Explain its functions.	**2**	**5**	**3**

5B	Discuss the causes of failure of weir on a permeable foundation due to surface flow. Also identify suitable methods of preventing it.	**4**	**5**	**3**
5C	The figure shows the section of a barrage founded on sand. Calculate the average hydraulic gradient. Calculate uplift pressures below the foundation specifying the floor thicknesses at points 8, 16 and 20m from the upstream end of the floor. Assume specific gravity=2.4 and factor of safety = 4/3. 	**4**	**5**	**4**