Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VI SEMESTER B.TECH (CIVIL) END SEMESTER EXAMINATIONS

APRIL/MAY 2019

SUBJECT: HYDRAULICS AND HYDRAULIC MACHINES (CIE 4007)

Date of Exam: **30/04/2018** Time of Exam: **2:00 PM to 5.00 PM** Max. Marks: **50**

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed

Q.No	Questions	Marks	CO
1A.	Water flows at a steady and uniform depth of 2m in an open channel of rectangular cross section having base width equal to 5m and laid at a slope of 1 in 1000. It is desired to obtain critical flow in the channel by providing a hump in the bed. Calculate the height of hump and sketch the flow profile. Consider the value of Manning's rugosity co-efficient, n = 0.02.	**03**	**CO1**
1B.	Explain the velocity distribution profile in open channel flow with neat sketch.	**02**	**CO1**
1C.	A rectangular channel 4m wide carries a discharge of 6 m^3/s. The bed slope of the channel is 0.0004 and Manning's constant n =0.025. At a certain section, the depth of flow is 1.5m. What is the water surface slope? Determine the distance (by single step method) to the section where the depth of flow is 1m. Name the slope of the channel and classify the water surface profile.	**05**	**CO2**
2A.	List the applications of hydraulic jump (6 points)	**03**	**CO2**
2B.	With the help of a neat sketch derive the Chezy's formula for velocity under uniform flow conditions and state the assumptions.	**03**	**CO2**
2C.	Derive the general differential equation of gradually varied flow. State the assumptions (any 4 points) made and draw the required sketch	**04**	**CO2**
3A.	The bed slope of a regime channel is 1 in 6000, determine the channel section and discharge. Assume particle size as 0.323mm.	**03**	**CO3**
3B.	List the drawbacks in Kennedy's theory of unlined canal design on alluvial soil. (4 points)	**02**	**CO3**
3C.	Show that; i. The maximum efficiency of jet impacting upon a series of flat plate mounted on the periphery of the wheel is 50%. ii. The maximum efficiency of jet impacting upon a series of semicircular vane mounted on the periphery of the wheel is 100%.	**05**	**CO4**
4A.	Define specific speed of a centrifugal pump and derive the mathematical formula to calculate the specific speed of a centrifugal pump.	**03**	**CO5**
4B.	A conical draft tube having inlet and outlet diameters 1m and 1.5m discharges water at outlet with a velocity of 2.5m/s. The total length of the draft tube is 6m	**03**	**CO5**

	and 1.20m of the length of the draft tube is immersed in water. If the atmospheric pressure head is 10.3m of water and loss of head due to friction in draft tube is equal to 0.2× velocity head at outlet of the tube, find the pressure head at inlet and efficiency of the draft tube.		
4C.	A centrifugal pump running at an overall efficiency of 80% delivers 25 lt/sec of water at a height of 20m through pipe of length 100m and 100mm diameter having a friction factor of 0.04. Calculate the power required to operate the pump.	**04**	**CO5**
5 A.	Pelton turbine is supplied with water at the rate of 10,000 lpm under a head of 125m. The buckets deflect the jet through an angle of 160˚. The speed ratio is 0.465 and the nozzle co-efficient is 0.982. Sketchy the velocity triangles, and estimate the hydrodynamic force on the buckets, the power developed and the efficiency of the turbine. Allow for 10% friction loss in relative velocity due to surface roughness of the buckets.	**05**	**CO5**
5B.	A Kaplan turbine has the following details; Runner diameter = 4m Boss diameter = 2m Net head =22m Shaft power = 14250 kW Overall efficiency =85% Hydraulic efficiency = 90% Guide vane angle at inlet = 40˚ Assume that discharge is radial at outlet Find (i) the runner vane angle at inlet and outlet and (ii) the speed of the turbine.	**05**	**CO5**