Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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V SEMESTER B.TECH. (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: HYDRAULICS AND HYDRAULIC MACHINES [CIE 4007]

REVISED CREDIT SYSTEM
(01/12/2016)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed

1A.	A 3m wide rectangular channel carries 2.4 cumec at a depth of 0.7m at the entrance. Determine (i) Specific energy, (ii) Critical depth (iii) Is the flow sub-critical or supercritical (iv) Determine the depth alternate to 0.7m. If Manning's n=0.015, determine the critical slope.	**03**
1B.	What is Froude number? Show that in an open channel minimum specific energy at a given flow and maximum flow at a given specific energy occurs when Froude's number is unity.	**02**
1C.	State all the assumptions made in the derivation of the dynamic equation for gradually varied flow. Starting from the first principles derive the equation for the slope of the water surface in gradually varied flow with respect to the canal bed.	**05**
2A.	Illustrate the application of hydraulic jump as energy dissipaters. Explain anyone auxiliary device used in stilling basin	**02**
2B.	Distinguish between Lacey's and Kennedy's silt theory (4 points)	**02**
2C.	A dam is built across a stream of rectangular cross section which carries water the rate of $5m^3$/sec. As a result the depth of flow just upstream of the dam is increased to 2.5m. The stream is 3m wide and has a bed slope of 1 in 4900. Take n=0.015. Compute the backwater profile using the direct step method. How far upstream is the depth within 10cm of the normal depth? Let the normal depth = 1.95m.	**06**
3A.	A 4m wide rectangular channel conveys $10m^3$/sec of water with a velocity of 5m/sec. Is there a condition for hydraulic jump to occur? If so calculate the depth after the jump, height of the jump, length of the jump and loss of energy due to the jump.	**03**
3B.	Classify hydraulic turbines under various headings	**04**
3C.	Design an irrigation channel by Kennedy's theory to carry a discharge of 50 cumec with critical velocity ratio =1, Manning's n=0.03 and B/D ratio=8.0	**03**
4A.	Show that for a series of curved vanes mounted on the periphery of a wheel and jet striking at the centre, the maximum efficiency is obtained when the vanes are semicircular in shape	**03**

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4B.	A jet of water having a velocity of 45m/s impinges without shock on a series of vanes moving at 15m/sec. The direction of motion of the vanes is inclined at 20° to that of the jet, the relative velocity at the outlet is 0.9 of that at the inlet and the absolute velocity of water at the exit is to be normal to the motion of the vanes, find (i). Vane angles at the entrance and exit. (ii).Work done on vanes. (iii).Hydraulic efficiency.	**04**
4C.	A Pelton wheel has a mean bucket speed of 10m/sec with a jet of water flowing at the rate of 0.7 m^3/sec under a head of 30m. The bucket deflects the jet through an angle of 160°. Calculate efficiency of the turbine. Assume the co-efficient of velocity as 0.98.	**04**
5A.	What is a draft tube? What are the uses of draft tubes? Describe with the sketches SA. I different types of draft tubes.	**03**
5B.	A centrifugal pump discharges 2 m^3/sec of water developing a head of 20m when running at 300 rpm. The impeller diameter at the outlet and outflow velocity there are 1.5m and 3.0 m/sec respectively. If vanes are set back at the angle 30° at the outlet, determine (i). Manometric efficiency. (ii).Power required by the pump. If the inner diameter is 750mm, find the minimum speed to start the pump.	**05**
5C.	Define suction head, delivery head, static head and manometric head of a centrifugal pump?	**02**