Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: ME206

Course Name: FLUID MACHINERY

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks Marks

1	a)	Estimate the force exerted by a jet of water on an unsymmetrical moving curved plate when jet strikes tangentially at one of the tips. Also obtain the expression for work done. Assume, blade angles at inlet and exit are θ and φ and the blade is moving with a velocity $\boldsymbol{u}$.	6
	b)	Differentiate the construction and working of an impulse and a reaction turbine.	4
2		The water fed from Idukki reservoir to Moolamattam power house is 6 m^3/s at a total head of 250 m through a single penstock of 500 m long. The turbine has four Pelton wheels with two nozzles each. The efficiency of power transmission through the penstock is 90% and overall efficiency is 85%. The coefficient of velocity for each nozzle may be assumed as 0.95 and the friction factor as 0.02. Determine the (a) power output of the plant (b) diameter of each nozzle (c) penstock diameter. Assume that all the nozzles have same diameter. Assume radial outlet.	10
3		An outward flow reaction turbine has the inner and outer diameters as 1.50m and 2.0 m, respectively, and is rotating at 300 rpm operating under an effective head of 60 m. The runner has 30 vanes 10 mm thick at inlet and at the outlet. The width of the passage is 30 cm throughout. The discharge through the turbine is 10 m^3/s. Determine (a) the blade angles at inlet and outlet and (b) power developed by the runner.	10
4	a)	Define the specific speed of a turbine and derive the expression for it. Explain the significance of specific speed in the selection of a turbine.	6
	b)	Explain the working of a draft tube in a axial reaction turbine with neat sketch. What is the reason for the absence of draft tube in an impulse turbine?	4

PART B

Answer any three questions, each carries 10 marks

5	a)	The construction details of a centrifugal pump is a follows Impeller diameter = 50 cm Impeller width = 2.5 cm Speed = 1200 rpm Suction head = 6 m Delivery head = 40 m Outlet blade angle = 30°. Manometric efficiency = 80% Overall efficiency = 75%. Determine the power required to drive the pump. Also calculate the pressures at the suction and delivery side of the pump. Assume the frictional drop in suction is 2 m and in the delivery 8m and inlet swirl as zero.	6
	b)	Classify different types of vortex fluid flows and write down the relevant governing equations.	4
6	a)	Draw the performance curves of a centrifugal pump. Also discuss the effect of	6

		blade outlet angles	
	b)	Explain the significance of NPSH in the installation of a centrifugal pump	4
7	a)	Determine the maximum speed of a single-acting reciprocating pump if separation head is 3 m of water (abs). The pump is placed 3 m above the sump level and it delivers water to a tank placed 15 m above its centre line. The pump has 100 mm bore and 180 mm stroke. The diameter of suction and deliver pipe is 40 mm whereas the length of suction pipe is 4 m and that of delivery pipe 18 m.	5
	b)	How does the slip phenomenon occur in a reciprocating pump? Quantify the slip factor and comment whether the negative slip-factor is possible.	5
8		A single acting reciprocating pump of 200 mm bore and 300 mm stroke runs at 30 rpm. The suction head is 4 m and the delivery head is 15 m. Considering acceleration determine the pressure in the cylinder at the beginning and end of suction and delivery strokes. Take the value of atmospheric pressure as 10.3 m of water head. The length of suction pipe is 8 m and that of delivery pipe is 20 m. The pipe diameters are 120 mm each.	10

PART C

Answer any four questions, each carries 10 marks

9		Draw the indicator diagram of a single acting reciprocating compressor with clearance volume and explain the working. Also derive the expression for work done in terms of pressure ratio and effective swept volume.	10
10		A double acting single-stage reciprocating compressor delivers air at the rate of 15 m^3/min. (at 1 bar and 15^0C). The suction pressure and temperature in the cylinder are 1 bar and 32^0C. The delivery pressure is 7 bar and compression and expansion index is 1.3. The clearance volume is 5% of the swept volume. Calculate indicated power and volumetric efficiency.	10
11		Write short notes on (i) FAD (ii) isothermal efficiency (iii) intercooler (iv) clearance-ratio in connection with a reciprocating compressor.	10
12		With a neat sketch elaborate the working of a centrifugal compressor and derive the Euler's equation.	10
13		A centrifugal compressor running at 1440 rpm handles air at 101kPa and 21^0C and isentropically compresses it to a pressure 6 bar. The inner and outer diameters of impeller are 14cm and 28cm respectively. The width of the blade at the inlet is 250 mm. The blade angles are 16^0 and 40^0 at entry and exit. Calculate the mass flow rate of air, degree of reaction, power input and width of blades at outlet.	10
14	a)	Derive the expression of degree of reaction of an axial flow air compressor in terms of blade angles and blade velocity.	6
	b)	Explain the working of (i) vane compressor and (ii) screw compressor	4

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