Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S,FE) Examination August 2021 (2015 Scheme)

Course Code: ME206

Course Name: FLUID MACHINERY (ME)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three questions, each carries 10 marks Marks

1 a) Prove that for a fluid jet striking normal to flat plate moving in series maximum efficiency is 50 % 5

b) A jet of water of diameter 70 mm strikes a curved vane at its centre with a velocity of 15 m/s. The vane is moving with a velocity of 6 m/s in the direction of the jet. The jet is deflected through an angle of 165^0. Assuming the vane is smooth find the force exerted on the vane in the direction of the jet, power and efficiency of the jet. 5

2 a) Distinguish between impulse and reaction turbines 4

b) A Pelton turbine develops 10 MW under a head of 500m.Taking the overall efficiency of the turbine as 90%, jet ratio as 12 and speed ratio as 0.45 find the nozzle diameter, wheel diameter and speed. 6

3 a) Differentiate between Francis and Kaplan turbines 3

b) A propeller turbine operates a 23 MW generator under an effective head of 39 m. Assuming generator efficiency of 93%, speed ratio as 2,flow ratio as 0.6, diameter of boss as 0.35 times the external diameter of runner, overall efficiency of 90% and hydraulic efficiency of 94% determine the tip diameter of runner, speed of runner, guide vane angle at inlet and runner vane angle at outlet assuming zero swirl at the runner exit 7

4 a) Define specific speed of a turbine and derive an expression for the same 4

b) Illustrate the term 'governing of turbines' 6

PART B

Answer any three questions, each carries 10 marks

5 a) Illustrate about various types of vanes used in centrifugal pumps 3

	b)	Differentiate suction head, delivery head, static head and manometric head of a centrifugal pump	4
	c)	Illustrate various efficiencies of a centrifugal pump	3
6	a)	With neat sketches illustrate the operating characteristics of a centrifugal pump	4
	b)	During a test on a centrifugal pump the following readings were obtained pressure gauge reading -1.32 bar, vacuum gauge reading- 300 mm of mercury, effective height between gauges- 45 cm, power of electric motor – 22kW, discharge of pump – 85 lps, diameter of delivery pipe – 150 mm, diameter of suction pipe – 200 mm. Determine the overall efficiency of the pump.	6
7	a)	Give an overview on the functions and advantages of air vessels	5
	b)	A single acting reciprocating pump running at 60 rpm delivers 0.53 m^3 of water per minute. The diameter of the piston is 200 mm and stroke length is 300 mm. The suction and delivery heads are 4 m and 12 m respectively. Determine the theoretical discharge, coefficient of discharge, percentage slip and power required to run the pump.	5
8	a)	With a neats ketches explain the working of a hydraulic ram	6
	b)	Illustrate the working of a gear pump	4

PART C

Answer any four questions, each carries 10 marks

9		The free air delivered by a single stage double acting reciprocating compressor measured at 1 bar and 15^0C is 16 m^3/min. the pressure and temperature of air inside the cylinder during suction are 0.96 bar and 30^0C respectively. If the delivery pressure is 6 bar and the compressor has clearance of 4% of the swept volume and the mean piston speed is limited to 300 m/min. Determine power input to the compressor if mechanical efficiency is 90% and compression efficiency is 85%, stroke and bore if the compressor runs at 500 rpm. Take the index of compression and expansion as 1.3	10
10	a)	Define isothermal efficiency of a reciprocating compressor. Illustrate various methods employed to improve it	5
	b)	Illustrate the necessity of intercooling in multistage reciprocating compressors with special reference on perfect inter cooling	5
11		Derive the expression for work done in a two stage reciprocating air compressor with perfect intercooling	10

12	a)	Discuss the effect of impeller blade shape on the performance of a centrifugal compressor	5
	b)	Illustrate the significance of slip factor and pressure coefficient in centrifugal compressors	5
13		A centrifugal compressor running at 10000 rpm delivers 660 m^3/min of free air. The air is compressed from 1 bar and 20^0C to a pressure ratio of 4 with an isentropic efficiency of 82%. Blades are radial at outlet of impeller and flow velocity of 62 m/s may be assumed constant throughout. The outer radius of the impeller is twice the inner and the slip factor may be assumed as 0.9, The blade area coefficient may be assumed as 0.9 at inlet. Calculate final temperature of air, theoretical power, impeller diameters at inlet and outlet, breadth of impeller at inlet, impeller and diffuser blade angles at inlet	10
14	a)	An axial flow compressor with an overall isentropic efficiency of 85% draws air at 20^0C and compresses it in the pressure ratio 4:1. The mean blade speed and flow velocity are constant throughout the compressor. Assuming 50% reaction blading and taking blade velocity as 180 m/s and work input factor as 0.82, calculate the flow velocity and number of stages. Take relative air angle at rotor inlet as 12^0 and inlet blade angle as 42^0.	6
	b)	Explain the working of a screw compressor	4

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