Model Question Paper-1

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Fourth Semester B.E. Degree Examination

Subject Title: TURBOMACHINES

TIME: 03 Hours **Max. Marks: 100**

Note: 01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. Assume missing data's

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	Differentiate between a turbomachine and positive displacement machine	L1	08
	b	Obtain an expression for (i) flow coefficient (ii) head coefficient (iii) power coefficient of a turbomachine using Buckingham pi theorem.	L3	12
		OR		
Q.02	a	Derive an alternate form of euler's turbine equation and explain significance of each component	L2	08
	b	Obtain an expression for T using Buckingham - π theorem. Where T is the frictional torque of a disc of diameter D, rotating at a speed N, in a fluid of viscosity μ and density ρ in turbulent flow	L3	08
	c	A blower develops 750mm of water at a speed of 1480 rpm and a flow rate of $38m^3/s$. determine the specific speed of blower.	L3	04
		Module-2		
Q. 03	a	Define the polytrophic efficiency of a turbine. Draw the T-S diagram and show that polytrophic efficiency is given by $\eta_p = \frac{n-1}{n}\frac{\gamma}{\gamma-1}$	L2	10
	b	What is reheat factor? Show that the reheat factor is greater than unity in multistage	L2	10
		OR		
Q.04	a	Derive an expression for overall isentropic efficiency for finite number of stages of compression in terms of pressure ratio, stage efficiency, number of stages and ratio of specific heats for a compressor.	L2	14
	b	A 16 stage axial flow compressor is to have a pressure ratio of 6.3 and tests have shown that a stage Efficiency of 89.5% can be obtained. The intake conditions are 288K, 1bar. Find the i. overall efficiency. ii. polytrophic efficiency. iii. Preheat factor.	L3	06
		Module-3		
Q. 05	a.	With velocity triangles for an axial flow compressor, show that $E = V_f u [\tan\beta_2 - \tan\beta_1] / [\tan\beta_1 \tan\beta_2]$	L2	10
	b.	Derive an expression for overall pressure ratio developed by centrifugal compressor.	L2	10
		OR		
Q. 06		With mathematical expression, define the following: i. Slip input factor ii. Power factor iii. Pressure coefficient iv. Work done factor v. Reaction ratio vi. blade efficiency vii. Nozzle efficiency viii. Stage efficiency ix. Surging x. Choking	L1,2	20
		Module-4		

Q. 07	a	Mention different type of losses in radial flow turbine and define nozzle loss coefficient.	L2	10
	b	An inward flow reaction turbine has outer and inner diameter of the wheel as 1m and 0.5m respectively, the vanes are radial at inlet and discharge is radial at outlet. Water enters the vanes at an angle of 10^0. Assuming velocity of flow to be constant and equal to 3m/s. Find i) speed if the wheel ii)vane angle at outlet iii) degree of reaction	L3	10
		OR		
Q. 08	a	With reference to flow passage write brief description of subsonic, transonic and supersonic turbines	L2	10
	b	At a stage in a 50% reaction axial flow turbine the rotor speed is 210m/s. Steam emerges from the nozzle inclined at 28^0 to the wheel plane with axial component equal to blade speed. Determine the rotor blade angles and utilization factor.	L2	10
		Module-5		
Q. 09	a	Show that in a pelton wheel, for max efficiency utilization $u/v_1 = 0.5$, energy transfer , $E = V_1^2(1+\cos\beta_2)/4$	L3	05
	b	The following data is given for a francis turbine, net head H = 70m, speed = 600rpm, power at shaft = 367.5KW, overall efficiency = 85%, hydraulic efficiency = 95%, flow ratio = 0.25, width ratio = 0.1, outer diameter to inner diameter ratio = 2. The thickness of vanes occupies 10% of the circumferential area of runner, velocity of flow is constant at inlet & outlet & discharge is radial at outlet, Determine a) guide blade angle, b) runner vane angle at inlet & outlet, c) width of wheel at inlet d) diameter of runner at inlet & outlet.	L3	10
	c	Write a short note on draft tube.	L1	05
		OR		
Q. 10	a	Explain the following with diagram. a) pumps in series b) pumps in parallel	L2	10
	b	Show that the pressure rise in the impeller of a centrifugal pump when the frictional & other losses in the impeller are neglected is given by $\frac{1}{2g}[V_{f1}^2 + u_2^2 - V_{f2}^2 \text{cosec}^2\beta_2]$.	L3	10

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.