



APJ Abdul Kalam Technological University

MODEL QUESTION PAPER

FOURTH SEMESTER B.TECH. MECHANICAL ENGINEERING

ME 206 FLUID MACHINERY

Time: 3 hours

Total marks:100

This question paper consists of three parts

All full questions carry 10 marks

Part A

Answer any *three* full questions

1	Find the force, work done per second and efficiency of a fluid jet exerted on a series of moving plate placed on the periphery of a wheel also find the maximum efficiency?	10marks
2a	Write the Euler's equation of energy transfer in rotodynamic machines in terms of absolute velocity, velocity of vane and relative velocity?	4marks
2b	Explain the classification of rotodynamic machines based on components of energy transfer?	6marks
3	An inward flow reaction turbine has external and internal diameters as 1 m and 0.5 m respectively. The turbine is running at 200 rpm and width of turbine at inlet is 200 mm. The velocity of flow through the runner is constant and is equal to 1.8 m/s. The guide blades makes an angle of 10° to the tangent of the wheel and the discharge at the outlet of the turbine is radial. Calculate all velocity vectors and Draw the inlet and outlet velocity triangle? (6Marks)Also calculate mass flow through the runner/second, Power developed and Hydraulic efficiency?	10marks
4a	Differentiate the phenomenon of cavitation and boiling?	4marks
4b	A turbine develops 500 kW power under a head of 100 m at 200 rpm. What would be its normal speed and output under a head of 81 m?	6marks
Part B Answer any <i>three</i> full questions		
5a	Define manometric head and static head of the Centrifugal pump?	4marks
5b	A centrifugal pump is running at 1000 rpm. The outlet vane angle of the impeller is 30° and the velocity of flow at outlet is 3 m/s. The pump is working against a total head of 30 m and the discharge through the pump is $0.3 \text{ m}^3/\text{s}$. If the manometric efficiency of the pump is 75%, determine (1) the diameter of the impeller; (2) width of the impeller at the outlet.	6marks



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6a	Draw the performance characteristics curve for two dissimilar centrifugal pumps when connected in series? Show the system characteristics curve and operating conditions of pump 1 and pump 2 for any two discharges?	5marks
6b	What is negative slip in a reciprocating pump? Explain with neat sketches the functions of air vessels in a reciprocating pump?	5marks
7	A single acting reciprocating pump has a cylinder bore 90 mm and a stroke of 180 mm. Water is to be drawn from a sump 3 m below the axis of the cylinder, through a 50 mm diameter and 6 m long pipe. The pump delivers the water to a tank at a height of 8 m through a 25 m long, 50 mm diameter pipe. If separation occurs at 0.0765 N/mm ² below the atmospheric pressure and the barometer reads 760 mm of mercury, find the maximum speed at which the pump can run?	10marks
8a	With the aid of a neat sketch explain the working of a Hydraulic Ram?	5marks
8b	With the aid of a sketch explain the working of a Hydraulic Accumulator?	5marks
Part C Answer any <i>four full</i> questions		
9	A single stage double acting air compressor handles 17 m ³ of air per minute, measured at 1 bar and 15°C. The pressure and temperature at the end of suction are 0.98 bar and 32°C. The air is delivered at 6.325 bar. Assuming a clearance factor of 5% and the compression and expansion processes to follow the polytropic law $pV^{1.32} = \text{constant}$, determine the stroke volume of the compressor running at 500 r.p.m. Also calculate the indicated power in kW of the compressor. $R=287 \text{ J/kgK}$. Neglect the effect of piston rod.	10marks
10	Derive the equation of shaft work for a single stage reciprocating compressor?	10marks
11	With the help of a neat sketch explain the parts and functions of centrifugal compressor?	10marks
12a	Explain the ideal and actual performance curves for an axial flow compressor?	5marks
12b	Distinguish surging and stalling phenomenon happens at off design condition in axial flow compressor?	5marks
13a	Draw the exit velocity triangle for backward curved, radial and forward curved vane impeller of a centrifugal compressor?	6marks
13b	Draw the performance characteristics, pressure coefficient and flow coefficient for backward curved, radial and forward curved vane impeller of a centrifugal compressor?	4mars
14a	Draw the stage velocity triangles for an axial compressor with upstream guide vanes, rotor blades and diffuser blades.	5marks
14b	Find the specific work of the compressor stage?	5marks