B.TECH. SEM -IV MECHANICAL 2014 COURSE (CBCS) :
SUMMER - 2018
SUBJECT: TURBOMACHINERY

Day: **Saturday** | **S-2018-2304** | Time: **10.00 AM TO 01.00 PM**
Date: **09/06/2018** | Max Marks: 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Use of steam table is allowed.
3) Assume suitable data, if necessary.

Q.1 A jet of water strikes tangentially a smooth curved vane moving in the same direction as the jet, and the jet get reversed in the direction. Show that the maximum efficiency is slightly less than 60%. **(10)**

OR

Q.2 The following data relate to a Pelton wheal: **(10)**

Head :	72 m
Speed of the wheel :	240 rpm
Shaft power of the wheel :	115 kW
Speed ratio:	0.45
Coefficient of velocity :	0.98
Overall efficiency :	85%

Design the Pelton wheel.

Q.3 **a)** With the help of a neat sketch, explain construction and working of Francis turbine. **(05)**

b) Explain the difference between inward and outward flow reaction turbines with respect to following aspects: **(05)**

i) Entry of water
ii) Centrifugal head imparted
iii) Discharge
iv) Speed control
v) Suitability

OR

Q.4 An inward flow reaction turbine has external diameter of 1 m and its breaths at inlet is 250 mm. If the velocity of flow at inlet is 2 m/s. Find weight of water passing through the turbine per second. Assume 10% of the area is blocked by the thickness. If the speed of runner is 210 rpm and guide blades make an angle of 10° to the wheel tangent, draw the inlet velocity triangle and find: **(10)**

i) Runner vane angle at inlet
ii) Velocity of wheel at inlet
iii) Absolute velocity of water leaving the guide vanes
iv) Relative velocity of water entering the runner blade

Q.5 **a)** With the help of a neat sketch, explain the construction and working of a simple impulse steam turbine. **(05)**

b) What is compounding? Which turbines need compounding? What are the different types of compounding methods? **(05)**

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OR

Q.6 **a)** Why governing of a steam turbine is done? What are the different methods of governing of steam turbines? Explain any one method. **(05)**

b) With the help of neat sketches, explain different types of nozzles. State applications of each type. **(05)**

Q.7 **a)** What is cavitation in centrifugal pumps? Explain Thoma's cavitation factor. **(05)**

b) What is specific speed of a centrifugal pump? Derive an expression for specific speed of a centrifugal pump. **(05)**

OR

Q.8 Find the power required to drive centrifugal pump which delivers 40 liters of water per second to a height of 20 m through a 150 mm diameter and 100 m long pipeline. The overall efficiency of a pump is 70% and the Darcy's friction factor $f = 0.06$ for the pipeline. Assume inlet losses in suction pipe = 0.33 m. **(10)**

Q.9 **a)** Give detailed classification of rotodynamic compressors. **(05)**

b) With the help of neat sketches, explain the concept of surging and stalling in the centrifugal compressor. **(05)**

OR

Q.10 Air enters the induced blades of a centrifugal compressor at a pressure of 1.02 bar and temperature of 335 K. The hub and tip diameters of the impeller eye are 10 cm and 20 cm respectively. If the compressor runs at 7200 rpm and delivers 5 kg/s of air, determine the air angle at the inducer blade entry and relative Mach number. **(10)**

Q.11 **a)** Explain the following performance characteristics for axial flow compressors: **(05)**

i) Pressure rise V/S flow rate

ii) Pressure ratio V/S Non-dimensional flow rate

iii) Loading coefficient V/S flow coefficient

b) Explain stage losses in axial flow compressor **(05)**

OR

Q.12 **a)** Derive an expression for stage efficiency of an axial flow air compressor. **(05)**

b) With the help of a neat sketch, explain stage velocity triangles for an axial flow air compressor. **(05)**

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