Reg. No. : ....

Name : ....

Fourth Semester B.Tech. Degree Examination, June 2016
(2013 Scheme)
13.405 : Fluid Machinery (M)

Time : 3 Hours   Max. Marks : 100

Instruction : Answer **all** questions in Part **A** and **one full** question from **each** Module in Part **B**.

PART – A

1. Define jet propulsion.   (10×2=20 Marks)
2. Explain specific speed of a turbine.
3. Differentiate between inward and outward flow reaction turbines.
4. Explain the difference between volute and vortex casing in centrifugal pumps.
5. Why priming is necessary in centrifugal pumps ?
6. Why reciprocating pumps are not coupled directly to a motor ?
7. Why air vessels are used in reciprocating pumps ?
8. What is the function of an intercooler in an air compressor ?
9. What is surging in compressors ?
10. What is slip factor in rotory compressors ?

PART – B

Each question carries **20** marks.

Module – I

11. a) A jet of water moving at 20 m/sec impinges on a symmetrical curved vane shaped to deflect the jet through 120° (i.e. vanes angles θ and φ are equal to 30°). If the vane is moving at 5m/sec., find the angle of the jet so that there is no shock at inlet. Also determine the absolute velocity of exit in magnitude and direction and the work done.   10

b) A pelton wheel has to be designed for the following data: power to be developed = 6000 kW. Net head available = 300 m; speed = 550 rpm; Ratio of jet diameter to wheel diameter = $\frac{1}{10}$ and the overall efficiency = 85%. Find the number of jets; diameter of the jet; diameter of the wheel; and the quantity of water required.   10

OR

12. a) A jet of water of diameter 150 mm strikes a flat plate in such a way that the normal of the plate makes an angle 30° to the axis of the jet. Find (1) the normal force exerted on the plate (2) power (3) efficiency of the jet. 10

b) Explain the following in detail (1) specific speed of a turbine (2) unit speed (3) unit discharge (4) unit power. 10

Module – II

13. a) What is the significance of characteristics curves of centrifugal pumps ? Explain in detail. 10

b) A centrifugal pump is to discharge 0.12 m^3 at a speed of 1400 rpm against a head of 30 m. The diameter and width of the impeller at outlet are 25 cm and 5 cm respectively. If the manometric efficiency is 75%, determine the vane angle at outlet. 10

OR

14. a) Explain in detail on (1) manometric efficiency (2) mechanical efficiency (3) overall efficiency of a centrifugal pump with its significance. 10

b) 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 3m/sec. The pump is working against a total head of 30 m and the discharge through the pump is 0.3 m^3/sec. If the manometric efficiency of the pump is 75%, determine (1) the diameter of the impeller (2) width of the impeller at outlet. 10

Module – III

15. a) Derive an expression for the head lost due to friction in the delivery pipe of a reciprocating pump with and without an air vessel.

b) The cylinder of a single acting reciprocating pump is 125 mm in diameter and 250 mm in stroke. The pump is running at 40 rpm and discharge water to a height of 15 m. The diameter and length of the delivery pipe are 100 mm and 30 m respectively. If a large air vessel is fitted in the delivery pipe at a distance of 1.5 m from the centre of the pump, find the pressure head in the cylinder (1) at the beginning of the delivery stroke (2) in the middle of the delivery stroke. Take the efficiency of friction as 0.01.

OR

16. a) Draw an indicator diagram, considering the effect of acceleration and friction in suction and delivery pipes. Find an expression for the workdone per second in case of single-acting reciprocating pump.

b) Discuss in detail on slip, percentage slip and negative slip of a reciprocating pump. Explain its significance.

Module – IV

17. a) Explain the working of a vane compressor and screw compressor with a neat sketch. **10**

b) A small single acting compressor has a bore and stroke both of 10 cm and is driven at 350 rpm. The clearance volume is 75 cm^2 and the index of compression and expansion is 1.23. The suction pressure is 0.95 bar and the delivery is 7 bar. Calculate (i) the volume of free air at 1 bar and 20° C dealt with per minute, if the temperature at the start of compression is 30°C and (ii) the mean effective pressure of the indicator diagram, assuming constant suction and delivery pressure. **10**

OR

18. a) Detail an classification of air compressors with neat sketch. **10**

b) Write detailed notes on :

1) Workdone by a single stage compressor with and without clearance volume.

2) Significance of multistage compressors.

3) Degree of reaction in axial flow compressors. **10**