

**B.Tech. - VIEP - MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

June, 2017

00898

BIME-013 : TURBO MACHINES

Time : 3 hours

Maximum Marks : 70

Note : Answer any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume missing data suitably.

1. Why are centrifugal pumps used sometimes in series and sometimes in parallel ? Draw the following characteristic curves for a centrifugal pump : 10
Head, power and efficiency versus discharge with constant speed.
2. A Kaplan turbine develops 9000 kW under a net head of 7.5 m. Overall efficiency of the wheel is 86%. The speed ratio based on the outer diameter is 2.2 and the flow ratio is 0.66. Diameter of the boss is 0.35 times the external diameter of the wheel. Determine the diameter of the runner and the specific speed of the runner. 10

3. What is meant by 'priming' of a pump ? What are the different priming arrangements employed for small and big pumping units ? 10
4. Differentiate between an impulse and a reaction turbine. With a neat sketch, explain the working of any turbine. 10
5. With the help of a neat sketch, explain the working of an axial flow compressor. 10
6. (a) What is a centrifugal compressor and what are its advantages ?
- (b) With a neat sketch, explain the essential parts of a centrifugal compressor. 5+5
7. A centrifugal compressor has to deliver 35 kg of air per second. The impeller is 76 cm in diameter revolving at 11,500 rpm with an adiabatic efficiency of 80%. If the pressure ratio is 4.2 : 1, estimate the probable axial width of the impeller at the impeller tip, if the radial velocity is 120 m/s. The inlet conditions are 1 bar and 47°C. 10
8. The impeller of a centrifugal pump is 30 cm in diameter and 5 cm in width at the periphery and has a blade whose tip is angled inclined backwards 60° from the radius. The pump delivers 17 m³/min and the impeller rotates at 1000 rpm. Assuming the pump to admit fluid radially, determine the whirl velocity of the blade outlet. 10

9. A centrifugal pump with 1.2 m diameter runs at 200 rpm. The angle which the vanes make at exit with the tangent to the impeller is 26° and the radial velocity of flow is 2.5 m/s. Determine the manometric efficiency of the pump. 10

10. The variables controlling the motion of a floating vessel through water are the drag force, the speed V , the length L , the density ρ and the dynamic viscosity μ of water and acceleration due to gravity 'g'. By using dimensional analysis, prove that $F = \rho L^2 V^2 \phi \left[\frac{\mu}{\rho V L}, \frac{Lg}{V^2} \right]$. 10
