

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

Term-End Examination

00383

December, 2018

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, if any, suitably.

1. Define and explain the terms Reynolds number, Froude number and Mach number. Derive expressions for any two numbers. 10

2. Show by using dimensional analysis, the resistance R to the motion of a sphere of diameter D as it moves at a velocity V in a fluid of density ρ and viscosity μ is given by 10

$$R = \rho D^2 V^2 \phi \left(\frac{DV\rho}{\mu} \right).$$

3. Define the specific speed of a turbine. Derive an expression for the specific speed. What is the significance of the specific speed? 10

4. A Kaplan turbine develops 24647.60 kW power at an average head of 39 metres. Assuming a speed ratio of 2, flow ratio of 0.6 and diameter of the boss equal to 0.35 times the diameter of the runner and an overall efficiency of 90%, calculate the diameter, speed and specific speed of the turbine. 10
5. Why are centrifugal pumps used sometimes in series and sometimes in parallel ? Draw the following characteristics curves for a centrifugal pump :
Head, power and efficiency versus discharge with constant speed. 10
6. A centrifugal pump delivers water against a net head of 14.5 m and a design speed of 1000 rpm. The vanes are curved back to an angle of 30° with the periphery. The impeller diameter is 300 mm and outlet width 50 mm. Determine the discharge of the pump if manometric efficiency is 95%. 10.

7. Briefly explain the phenomena of surge and choking in centrifugal compressor. 10

8. A centrifugal compressor under test gave the following data :

Speed : 11500 rpm

Inlet total head temperature : 21°C

Outlet and inlet total head pressure : 4 bar, 1 bar

Impeller dia : 75 cm

If the slip factor is 0.92, what is the compressor efficiency? 10

9. Explain with the help of neat sketch, a single-stage impulse turbine. 10

10. What do you mean by the term "gas turbine"? How are gas turbines classified? Compare the steam and gas turbine power plants. 10

