

**B. ELE. ENG. 2<sup>ND</sup> YEAR 1<sup>ST</sup> SEM. SUPPLE EXAM. - 2017****Sub: Prime Movers for Electrical Systems**

TIME: 3 HRS

FULL MARKS: 100

**Part-1**

(Full Marks for Part-1: 50)

Use of Steam Table and Mollier Chart is permissible.

**Answer Question No. 1 and any two from the rest**

1. (a) What are the performance indicators used to know the engine performance of SI engines? **3**  
 (b) Why convergent nozzles are rarely found in a steam turbine plant? **3**  
 (c) Write some main reasons to use the Person's turbine in the industry **4**
  
2. (a) What do you understand the choked flow in nozzles? For any steam nozzle design, critical pressure ratio evaluation is necessary – Explain. For voiding shock waves in nozzles, what design aspects should be maintained? **4+3+3**  
 (b) The inlet condition of steam at 15 bar and dry saturated which passes through a nozzle in a simple impulse turbine to an exhaust pressure of 0.5 bar. Steam flows from a nozzle at a direction  $18^\circ$  to the peripheral velocity. The expansion efficiency of steam is 90%. The mean velocity of blades is 290 m/s. The blades are equiangular and the blade velocity coefficient is 0.85. Determine the gross stage efficiency. **10**
  
3. (a) Deduce a general expression for the blade efficiency of a multi-stage impulse turbine with the single raw wheel. Then derive an expression for the maximum blade efficiency of such turbine with the consideration of the negligible blade friction. **10**  
 (b) In a Parson's turbine running at 1800 rpm, the total isentropic enthalpy drop for an expansion is 55.0 kJ/kg. If the mean diameter of the rotor in the expansion is 18 cm, calculate the number of rows of moving blades necessary in the expansion given that the gross stage efficiency =0.8, blade outlet angle =  $20^\circ$  and speed ratio =0.7. **10**
  
4. (a) When the compounding of steam turbine is necessary? What are the advantages of pressure compounding impulse turbines in comparison to that of the velocity compounding? **8**  
 (b) The air flow to a four cylinder four stroke petrol engine is measured by means of a 7.5 cm diameter sharp-edged orifice,  $C_d=0.6$ . During a test on the engine following data were recorded: Bore=11 cm, stroke=13 cm, engine speed=2250 rev/min, brake power=36 kW, fuel consumption=10.5 kg/h, calorific value of fuel=42000 kJ/kg, pressure drop across the orifice=4.1 cm of water. Atmospheric temperature and pressure are  $30^\circ\text{C}$  and 1.01325 bar, respectively. Calculate: (a) Brake thermal efficiency, and (b) brake mean effective pressure **12**

[ Turn over

Bachelor of Electrical Engineering 2<sup>nd</sup> Year 1<sup>st</sup> Semester Supplementary Examination 2017

Subject : Prime Movers for Electrical Systems

Time: One and half hours for each part.

Assume suitable data, if necessary

*Use Separate Answer scripts for Part I and Part II. Maximum Marks for each part is 50.*

### Part II

Answer **question no- 1** and any **two** from the rest.

1. Answer any **two** of the followings: [2X5]
- a) Explain the stability of a floating body.
  - b) What is friction factor? What are minor losses in a pipeline?
  - c) Define Streamline, Pathline and Streakline.
  - d) What do you mean by laminar and turbulent flow? What is lower and upper critical Reynolds' number?
- 2.a) State and explain Newton's law of viscosity. What are Dynamic and Kinematic viscosities? What are their units in SI system?
- b) Two square flat plates with each side 60 cm are spaced 12.5 mm apart. The lower plate is stationary and upper plate requires a force of 100 N to keep it moving with a velocity of 2.5 m/s. The oil film between the plates has the same velocity as that of plates at the surface of contact. Assuming a linear velocity distribution, determine:
- i. the dynamic viscosity of the oil , and
  - ii. the kinematic viscosity of the oil if the specific gravity of the oil is 0.95. [8+12]
- 3.a) Derive Bernoulli's Equation of motion from Euler's equation of motion along a streamline. State all the assumptions for Bernoulli's Equation.
- b) Water is flowing upwards through a pipeline having diameters of 15 cm and 30 cm at the bottom and upper ends respectively. When a discharge of 50 litres/sec is passed through the pipeline, the pressure gauges at the bottom and upper section read 30 kPa and -54 kPa respectively. If the friction loss in the pipe is 2m, determine the difference in elevation head. Take specific weight of water 10 kN/m<sup>3</sup>. [12+8]
- 4.a) Show that for a Pelton Turbine the wheel efficiency is maximum when the speed ratio is 0.5.
- b) Draw the two views of a set- up of Francis turbine and indicate the main components along with their functioning in brief. [10+10]