# BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
# FIRST YEAR FIRST SEMESTER EXAM 2019 (Old)

## PRIME MOVERS FOR ELECTRICALSYSTEMS

Time: Three hours **Use Separate answer script for *Group A* and *Group B*** Marks: 100

*Different parts of the same question should be answered together. All symbols carry their usual meanings unless otherwise mentioned. Assume any relevant data if necessary.*

**Group A**

***(Answer Any THREE and Question 1 is compulsory)***

1. Answer the following questions (*any **two***) 5 X 2 = 10
   a) Define and classify steam turbine.
   b) State advantages of gas turbine cycle with regeneration.
   c) What do you mean by the following terms related to an IC engine?
   (i)BDC, (ii) Swept volume, (iii) indicated thermal efficiency,
   (iv) mechanical efficiency. 10

2. a) Explain with neat sketch working of an ideal gas turbine cycle. 10
   b) In a gas turbine plant, working on the simple Brayton cycle, the air at the inlet to the compressor is at 0.15 MPa, $27^0$C, the pressure ratio is 7, and the maximum cycle temperature is $977^0$C. If the turbine and compressor have each an isentropic efficiency of 80%, find the cycle efficiency of the plant. 10

3. a) Explain with neat sketch working of 4-stroke petrol engine. 8
   b) A four stroke SI engine at full load delivers 50 kW. It requires 8.5 kW to rotate it without load at the same speed. Find its mechanical efficiency at full load, half load and quarter load. Also find out the volume of the fuel consumed per second at full load if the brake thermal efficiency is 25%, given that calorific value of the fuel is 42 MJ/kg and specific gravity of fuel 0.75. Estimate the indicated thermal efficiency. 12

4. a) Draw velocity diagrams and derive an expression of blade efficiency for a simple impulse turbine with relevant parameters. 8
   b) A simple impulse turbine has one ring of moving blades running at 150 m/s. The absolute velocity of steam at exit from the stage is 85 m/s at an angle of $80^0$ from the tangential direction. Blade friction co-efficient is 0.82 and the rate of steam flowing through the stage is 2.5 kg/s. If the blades are equiangular, determine: (i) Blade angles; (ii) Nozzle angle; (iii) Absolute velocity of steam issuing from the nozzle; (iv)Axial thrust. 12

## Group B

***(Answer Any THREE and Question 5 is compulsory)***

5. Write short note on (any TWO) 5 X 2 = 10 — 10

   a) Horizontal Axis Wind Turbine

   b) Non-Newtonian Fluid

   c) Draft Tube

   d) Moody's diagram

6. a) What is viscosity of fluid? Explain the causes of viscosity of fluid. — 10

   b) The space between two parallel plates 5mm apart is filled with oil. A force of 2 N is required to drag the upper plate at a constant velocity of 0.8m/s. The lower plate is stationary. The area of the upper plate is $0.09m^2$. Determine the dynamic viscosity and kinematic viscosity of the oil, if specific gravity of the oil is 0.9. — 10

7. a) Derive the equation of velocity distribution of viscous fluid through a circular pipe. — 10

   b) An oil of viscosity 10 poise and sp. gravity 0.7 is flowing through a circular pipe of diameter 30 mm and length 200 m. If the pressure drop in a length of 200m is $3000kN/m^2$, determine the rate of flow and power required to maintain the flow. — 10

8. a) Draw a schematic layout of hydroelectric power plant with its major components. — 10

   b) A Pelton turbine works under a head of 400 m, rotating at 400 rpm and produces 12000kW power. If the overall efficiency of the turbine is 80%, calculate the discharge through the turbine and diameter of the wheel. — 10