BACHELOR OF ENGINEERING (ELECTRICAL ENGINEERING)
FIRST YEAR FIRST SEMESTER SUPPLEMENTARY EXAM 2018

PRIME MOVERS FOR ELECTRICAL SYSTEMS

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) Classify steam turbine based on the principle of working.
   b) How do you improve the cycle efficiency of a simple Brayton cycle?
   c) What do you mean by the following terms related to an IC engine?
   (i)Clearance volume, (ii) Stroke volume, (iii) IP (iv) Mechanical efficiency 10

2. a) Derive an expression of optimum pressure ratio for an ideal simple Brayton cycle. 10
   b) In a gas turbine plant working on Brayton cycle, air is drawn in at 1 bar and 25^0C and is compressed to 8bar. Calculate the thermal efficiency and the back work ratio of the ideal pressure cycle when the maximum cycle temperature is limited to 850^0C. 10

3. a) Explain if brief working principle of a 4-stroke SI engine. 10
   b) A four-stroke engine delivers 35 kW with a mechanical efficiency of 80%. The fuel consumption of the engine is 0.4 kg/kW-hr and the air-fuel ratio is 14:1. The heating value of the fuel is 42000kJ/kg. Find (i) the indicated power, (ii) the friction power, (iii) the brake thermal efficiency, and (iv) the fuel consumption per hour. 10

4. a) Draw the longitudinal sectional view of a simple impulse turbine with development of nozzles and blades. Also show pressure and velocity distributions. 8
   b) An impulse steam turbine has nozzles inclined at 20^0 to the plane of rotation. The inlet and outlet angles of the moving blades are equal, the blades friction factor is 0.8 and the mean diameter of the blades is 0.6 m. The steam leaves the nozzle with a velocity of 700 m/s. Determine (a) the optimum value of the blade angles, (b) the steam flow rate required to produce 20kW and (c) the blade efficiency. Assume the rotational speed of the wheel 3000rpm 12

[Turn over

Group B

(Answer Any THREE and Question 5 is compulsory)

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

   a) Classification of Wind Turbine

   b) Pelton Wheel

   c) Moody's diagram

6. a) State and explain the Newton's Law of viscosity. — 6

   b) A 90 mm diameter cylinder moves at 2 m/s through a cylinder of 90.5 mm internal diameter. The annular space between the cylinder is filled with oil having a dynamic viscosity of 0.1 Pa.s. Determine the power required in overcoming viscous friction. — 8

   c) The velocity vector in a fluid flow is given by $V = 2x^2\hat{i} - 5x^2y\hat{j} + 4zt\hat{k}$. Find the velocity and acceleration of a fluid particle at (1,2,1) at time t=1 — 6

7. a) Derive the Euler equation of motion. — 8

   b) An orifice meter of 10 cm diameter is used to measure the flow of water through a pipe of diameter 20 cm. If mercury monometer shows a reading of 20 cm, determine the rate of flow. Assume Cd = 0.96, Cc =0.8. — 6

   c) Determine the pressure drop and the wall shear stress at the pipe of length 200m filled with oil of viscosity 0.1 Pa.s. and density 700 kg/m^3 flowing through a circular pipe of diameter 60 mm. The discharge through the pipe is 10 litres/s. — 6

8. a) What do you mean by reaction turbine? Draw a schematic layout of hydroelectric power plant with its major components. — 10

   b) An impulse turbine rotates at 1000 rpm under a head of 300 m. Calculate the power available at the inlet and the hydraulic efficiency when discharge through the turbine is 600 litre per second and jet deflected at 170 degree. Assume speed ratio =0.45, Cv= 0.96 and K=0.9 — 10