B. ELECTRICAL ENGINEERING (EVENING) 1ST YEAR 1ST SEMESTER
SUPPLEMENTARY EXAMINATION, 2017

Prime Movers for Electrical Systems

Time:-Three Hours Full Marks:-100

Answer Any Five Questions

Assume any data relevant to the questions if not provided

1. Writes short note on any four (5 X 4 =20)

a) Specific Speed of a Water Turbine b) Penstock c) Surge tank d) Octane number and Cetane number e) Degree of reaction and f) Cavitation

2. a) Deduce the Euler head developed by a water Turbine. (10)
   b) A plate having an area of 0.85 m^2 is sliding down the inclined plane at 45° to the horizontal with a velocity 0.75 m/s. There is a cushion of fluid 1.25 mm thick between the plane of the plate. Find the viscosity of the fluid if the weight of the plate is 400 Newton. (10)

3. a) Draw a Pelton Wheel and the efficiency versus blade speed curves. (10)
   b) A Pelton Wheel is required to develop 10 MW when working under a head of 340 m. It rotates with a speed of 500 R.P.M. Assuming jet ratio as 10 and overall efficiency as 90 %, Calculate i) The diameter of the Wheel, ii) The Number of Jets
   Assume velocity coefficient=0.98 and speed ratio=0.46 (10)

4. a) What is a reaction Turbine? What is its basic Principle? How does it differ from an Impulse Turbine? (10)

b) A Francis turbine has a wheel diameter 1.75 m at inlet and 0.875 at the exit. The blade angle at the entrance is 90° and the guide vane angle is 15°. The water at the exit leaves the blades without any tangential components. The available head is 50 m and the radial component of flow is constant. Draw the velocity diagram neatly. What would be the speed of wheel in R.P.M. and blade angle at exit? Neglect friction. (10)

5. a) Explain in brief with neat sketch the working principle of a 2-stroke I.C. engine. (8)

b) An engine working on the Otto cycle is supplied with air at 0.1 MPa, 35°C. The compression ratio is 8. Heat supplied is 2100 kJ/kg. Calculate the maximum pressure and

temperature of the cycle, network output, cycle efficiency and the mean effective pressure. (12)

6. a) Explain with neat sketch the principle of working of a reheat gas turbine cycle. Also state the advantages of reheat 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, 27^0C, the pressure ratio is 7, and the maximum cycle temperature is 977^0C. If the turbine and compressor have each an isentropic efficiency of 80%, find the cycle efficiency of the plant. (10)

7. a) Draw the velocity diagram for a simple impulse steam turbine and determine the expression of maximum blade efficiency with relevant parameters. (10)

b) The velocity of steam leaving the nozzle of an impulse turbine is 810 m/s and nozzle angle is 20^0. The blade velocity is 300 m/s and the blade friction factor is 0.85.Calculate for a steam flow rates of 1.5 kg/s and symmetric blades (a) the blade inlet angle and (b) the tangential thrust on the wheel. (10)