Code No: R1621025 **R16** SET - 1

II B. Tech I Semester Supplementary Examinations, October/November - 2020
THERMAL AND HYDRO PRIME MOVERS
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Draw the valve timing diagram of four stroke SI engine and indicate the important points. (2M)
   b) Draw the velocity diagram of a simple impulse turbine. (3M)
   c) Differentiate between gas turbines and internal combustion engines. (3M)
   d) Write a short note on pumps connected in series and in parallel. (2M)
   e) Discuss about Kaplan turbine and write its advantages. (2M)
   f) Discuss about diversity factor. (2M)

PART -B

2. a) Classify internal combustion engines. (5M)
   b) Explain the working of Otto cycle, indicate the processes involved using PV and TS diagram and derive the expression for its thermal efficiency. (9M)

3. a) What is compounding? Explain about pressure velocity compounding of a steam turbine. (7M)
   b) The velocity of steam entering the nozzle of the impulse stage of a turbine is 400 m/s. The blades operate close to maximum blading efficiency. The nozzle angle is 20^0. Consider equiangular blades and neglecting blade friction, calculate for a steam flow of 0.6 kg/s, the diagram power and diagram efficiency. (7M)

4. a) Explain the working of gas turbine plant with inter cooler and reheating system. Indicate the processes on T-S plot. (7M)
   b) In a gas turbine plant working on Brayton cycle, the air at inlet is 27°C,0.1 MPa. The pressure ratio is 6.25 and the maximum temperature is 800°C. The turbine and compressor efficiencies are each 80%. Find compressor work, turbine work, heat supplied, cycle efficiency and turbine exhaust temperature. Mass of air may be considered as 1 kg. Draw T-s diagram. (7M)

5. a) Derive the expressions for the force and work done per second by the jet when it strikes a curved plate moving in the direction of the jet. (7M)
   b) The impeller of a centrifugal pump has an external diameter of 450 mm and internal diameter of 200 mm and it runs at 1440 rpm. Assuming a constant radial flow through the impeller at 2.5 m/s and the vanes at exit are set back at an angle of 25^0.Determine i) inlet angle, ii) the angle, absolute velocity of water at exit makes with the tangent. (7M)

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6. a) What is governing? With a neat sketch explain the governing mechanism of impulse turbine. (7M)
   b) A Kaplan turbine working under a head of 20 m develops 7357.5 kW shaft power. The outer diameter of the runner is 4 m and hub diameter 2 m. The guide blade angle at the extreme edge of the runner is 30°. The hydraulic and overall efficiencies of the turbine are 95% and 90% respectively. If the velocity of whirl is zero at outlet, determine: (i) runner vane angles at inlet and outlet at the extreme edge of the runner and (ii) speed of the turbine. (7M)

7. a) With a neat sketch explain the working of pumped storage hydro electric power plant. (7M)
   b) The peak load on a power plant is 30 MW. The loads having maximum demands of 25 MW, 10 MW, 5 MW and 7 MW are connected to the power plant. The capacity of the power plant is 40 MW and the annual load factor is 50%. Find i) Average load on the power plant, ii) Energy supplied per year, iii) Demand factor, iv) Diversity factor. (7M)

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