Code No: RT21022 **R13** SET - 1

II B. Tech I Semester Supplementary Examinations, Oct/Nov- 2017
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 **THREE** Questions from **Part-B**

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PART –A

1. a) Compare the relative advantages and disadvantages of four-stroke and two-stroke cycle engines (4M)
   b) Explain the difference between an impulse turbine and a reaction turbine (4M)
   c) Write a short on fuels used for gas trubines (4M)
   d) Define the terms: speed ratio, flow ratio and jet ratio. (4M)
   e) Define the terms 'unit power', 'unit speed' and 'unit discharge' with reference to a hydraulic turbine (3M)
   f) Define the terms firm power and load factor (3M)

PART –B

2. a) Describe the classification of IC Engines. What are its applications? (8M)
   b) A 4-cylinder four-stroke petrol engine develops 14.7 kW at 1000 r.p.m. The mean effective pressure is 5.5 bar. Calculate the bore and stroke of the engine, if the length of stroke is 1.5 times the bore (8M)

3. a) What are the advantages of Regenerative cycle over Simple Rankine cycle? (8M)
   b) In a steam power cycle, the steam supply is at 15 bar and dry and saturated. The condenser pressure is 0.4 bar. Calculate the Carnot and Rankine efficiencies of the cycle. Neglect pump work (8M)

4. a) Write the classification of gas turbines. Write its merits and demerits? (8M)
   b) In an air standard gas turbine, air at a temperature of 15°C and a pressure of 1.01 bar enters the compressor, where it is compressed through a pressure ratio of 5. Air enters the turbine at a temperature of 815°C and expands to original pressure of 1.01 bar. Determine the ratio of turbine work through compressor work and the thermal efficiency when the engine operates on ideal Brayton cycle. Take: $\gamma = 1.4$, $c_p = 1.005$ kJ/kg K (8M)
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5. a) A nozzle of 56 mm diameter delivers a stream of water at 30 m/sec perpendicular to a plate that moves away from the jet at 8 m/sec. Find the work done and efficiency of the jet. (8M)
   b) Prove that the force exerted by a jet of water on a fixed curved vane when the jet strikes at the center is $F = \rho a v^2 (1+\cos\theta)$ where (8M)
   ρ = Mass density of water
   a = Area of cross section of the jet
   v = Velocity of the jet
   θ = Angle of the curved plate at the out let.

6. a) Give the range of specific speed values of the Kaplan, Francis turbines and Pelton wheels. What factors decide whether Kaplan, Francis, or a Pelton type turbine would be used in a hydroelectric project? (8M)
   b) A Kaplan turbine working under a head of 25 m develops 16000 kW shaft power. The outer diameter of the runner is 4 m and hub diameter is 2 m. The guide blade angle is 35. The hydraulic and overall efficiency are 90% and 85% respectively. If the velocity of whirl is zero at outlet, determine: i) runner vane angles at inlet and outlet, and ii) speed of turbine (8M)

7. a) Explain the inherent advantages, which make Hydropower more attractive. (8M)
   b) A runoff stream with an installed capacity of 12000KW operates at 15% load factor when it serves as a peak load station. What should be the lowest discharge in the stream so that the station may serve as the base load station. It is given that plant efficiency is 70% when working under a head of 18m. Also calculate maximum load factor of the plant when the discharge in the stream rises to 18 cumecs. (8M)