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

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
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) Write the primary requirements of a cooling and lubrication system. (4M)
   b) Find the saturation temperature, change in specific volume and entropy during evaporation, and the latent heat of vaporization of steam at 2.5 MPa. (4M)
   c) Define work ratio and efficiency of a gas turbine. (4M)
   d) Differentiate between turbine and pump. (4M)
   e) What is governing? Why is it required? (3M)
   f) List out the components of hydro electric power plant. (3M)

PART -B

2. a) How are IC engines classified? (4M)
   b) Explain Air standard Otto cycle and derive the expression for its thermal efficiency. (12M)

3. a) Explain pressure compounding in steam turbine. (8M)
   b) In a single stage reaction turbine, both the fixed and moving blades have the same tip angles of 35º and 20º for inlet and outlet respectively. Determine the power required if the isentropic heat drop in both fixed and moving rows is 24.5 kJ/kg. The mean blade speed is 70 m/s and the steam consumption is 22,000 kg/h. (8M)

4. a) Explain the working of open cycle gas turbine system with inter cooler. (8M)
   b) A gas turbine unit has a pressure ratio of 6:1 and the maximum cycle temperature is 610^0C. Calculate the power output of the turbine when the air enters the compressor at 15^0C at a rate of 16 kg/s. (8M)
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5. a) A jet of water of diameter 40 mm moving with a velocity of 25 m/s strikes a fixed flat plate in such a way that the angle between the jet and the plate is 60°. Find the force exerted by the jet on the plate (10M)
   (i) in the direction normal to the plate, and (ii) in the direction of the jet.
   b) Explain the working of single stage reciprocating pump. (6M)

6. a) What are the operating characteristics curves of hydraulic turbine? Sketch them and explain their features and applications (8M)
   b) A Pelton wheel has mean bucket speed of 30 m/s with a jet of water flowing at the rate of 1 cubic meter per sec under a head of 250m. The bucket deflect jet through angle of 170 degree. Calculate power developed and the efficiency of the turbine. Assume Coefficient of velocity= 0.98 (8M)

7. A common load is shared by two stations, one being a base load plant with 25 MW installed capacity and the other being a standby with 30 MW capacity. The yearly output of standby is 10.5 X 10^6 kWh. The peak load taken by the standby is 15 MW working for 2500 hours during the year. The base load station takes a peak of 22.5 MW. Find (16M)
   a) Annual load factor for both stations,
   b) plant use factor for both stations,
   c) capacity factor for both stations.

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Code No: RT21022 **R13** SET - 2

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
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(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 70

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Explain how fuel is ignited in SI and CI engines. (4M)
   b) Find the saturation temperature, change in specific volume and entropy during evaporation, and the latent heat of vaporization of steam at 5 MPa. (4M)
   c) Write the advantages and limitations of gas turbines. (3M)
   d) Obtain an expression for the force exerted by a jet of water on a stationary inclined flat plate. (4M)
   e) Draw constant head curve of a hydraulic turbine. (3M)
   f) How do you estimate water power potential? (4M)

PART –B

2. a) Explain the working of 4 stroke Diesel engine. (10M)
   b) With a neat sketch explain the working of splash lubrication system. (6M)

3. a) Explain velocity compounding in steam turbine. (8M)
   b) The velocity of steam at inlet to simple impulse turbine is 1100 m/s and the nozzle angle is 20º. Mean blade speed is 420 m/s and the blades are symmetrical. The mass flow rate of steam is 0.75 kg/s. Calculate the blade angles, axial thrust and diagram efficiency. (8M)

4. a) Explain the working of open cycle gas turbine with reheating system. (8M)
   b) A gas turbine unit has a pressure ratio of 6:1 and the maximum cycle temperature is 610^0C. The isentropic efficiencies of compressor and turbine are 0.80 and 0.82 respectively. Calculate the power output of the turbine when the air enters the compressor at 15^0C at a rate of 16 kg/s. (8M)
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5. a) Explain the working of a centrifugal pump with a neat schematic layout. (6M)

   b) A jet of water of diameter 15 cm moving with a velocity of 30 m/s strikes a curved fixed symmetrical plate at the center. Find the force exerted by the jet of water in the direction of the jet if the jet is deflected through an angle of 120^0 at the outlet of the curved plate. (10M)

6. a) Differentiate impulse turbine with reaction turbine. (6M)

   b) A pelton wheel is receiving water from a penstock with a gross head of 510m.one third of gross head is lost in friction in the penstock. The rate of flow through the nozzle fitted at the end of the penstock is 2.2 m^3 /sec. The angle of deflection of the jet is 160^0. Determine (10M)

   i) the power given by water to the runner,

   ii) hydraulic efficiency of the pelton wheel.

7. A common load is shared by two stations, one being a base load plant with 25 MW installed capacity and the other being a standby with 30 MW capacity. The yearly output of standby is 10.5 X 10^6 kWh. The peak load taken by the standby is 15 MW working for 2500 hours during the year. The base load station takes a peak of 22.5 MW. (16M)

   Find

   a) Annual load factor for both stations,

   b) plant use factor for both stations,

   c) capacity factor for both stations.

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Code No: RT21022 **R13** SET - 3

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
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) Draw the T-s and p-v diagrams of a diesel cycle and indicate all the processes in it. Write its expression for thermal efficiency. (4M)
   b) Discuss about intercooling and indicate it on T-s diagram. (4M)
   c) Write the applications of gas turbines. (3M)
   d) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate. (4M)
   e) Classify different hydraulic turbines. (3M)
   f) Define utilization factor and diversity factor. (4M)

PART –B

2. a) With the help of a neat sketch explain the valve timing diagram of 4 stroke petrol engine. (8M)
   b) Explain the working of Battery ignition system. (8M)

3. a) Explain the working of Rankine cycle with reheating system. (8M)
   b) Steam initially at 1.5 MPa, 300^0C expands reversibly and adiabatically in a steam turbine to 40^0C. Determine the ideal work output of the turbine per kg of steam. indicate the process on T-s and h-s plots. (8M)

4. a) Explain the working of open cycle gas turbine system with regeneration system. (8M)
   b) A simple gas turbine cycle works with a pressure ratio of 6. The compressor and turbine inlet temperatures are 300 K and 800 K respectively. If the volume flow rate of air is240 m^3/s, compute the power output and thermal efficiency. (8M)

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5. a) A jet of water having a velocity of 30 m/s strikes a curved vane which is moving with a velocity of 15 m/s. The jet makes an angle of 30^0 with the direction of motion of vane at inlet and leaves at an angle of 120^0 to the direction of motion of vane at outlet. Calculate vane angles if the water enters and leaves the vane without shock and work done per second per unit weight of water striking the vanes per second. (10M)

   b) Differentiate between centrifugal and reciprocating pumps. Write their applications. (6M)

6. a) What is Governing of turbine? Explain how it is accomplished for impulse and reaction turbines. (8M)

   b) In a Pelton wheel the diameter of the wheel is 2 m and angle of deflection is 162^0. The jet diameter is 165 mm and pressure behind the nozzle is 1000 kN/m^2 and wheel rotates at 320.rev/min. Find the hydraulic power developed and hydraulic efficiency (8M)

7. a) Discuss about load curve and load factor and load duration curve. (8M)

   b) Discuss about pumped storage system. (8M)

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Code No: RT21022 **R13** SET - 4

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(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) Draw the T-s and p-v diagrams of a Otto cycle and indicate all the processes in it. Write its expression for thermal efficiency. (4M)
   b) Classify steam turbines. (3M)
   c) Differentiate between open cycle and closed cycle gas turbine system. (4M)
   d) What is priming? Why it is required? (3M)
   e) Differentiate between Pelton wheel and Francis turbine. (4M)
   f) Define load factor and capacity factor. (4M)

PART –B

2. a) With the help of a neat sketch explain the port timing diagram of 2 stroke petrol engine. (8M)
   b) What is the necessity of cooling system in an IC engine? Explain the working Thermosyphon cooling system. (8M)

3. a) Explain the working of simple Rankine cycle and derive the expression for its thermal efficiency. (10M)
   b) Dry saturated steam at a pressure of 12 bar with negligible velocity expands in Convergent Divergent nozzle to 1.5 Bar and Dryness fraction 0.95.Determine the velocity of steam leaving the nozzle. (6M)
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4. a) Explain the working of closed cycle gas turbine plant with intercooler and reheater. (8M)

   b) A gas turbine plant is supplied with air at a pressure of 2 bar and 300 K. The air is then compressed to a pressure of 6 bar and then heated to 800^0C in the combustion chamber. Calculate the thermal efficiency of the cycle. (8M)

5. a) Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet when the plate is moving in the same direction. (6M)

   b) A nozzle of 50mm diameter delivers a stream of water at 20 m/s perpendicular to a plate that moves away from the jet at 5 m/s. (10M)

   Find i) The force on the plate ii)Work done iii)The efficiency of the jet

6. a) With a neat sketch explain the working of pelton wheel. (8M)

   b) A Pelton wheel develops 67.5 kw under a head of 60 m of water. It rotates at 400 rev/min. The diameter of penstock is 200 mm. The ratio of bucket speed of jet velocity is 0.46 and overall efficiency of the installation is 83%. Calculate. (8M)

   (i) Volumetic flow rate (ii) Diameter of the jet (iii) Wheel diameter

7. a) Draw the schematic layout of a hydro electric power plant and explain its working. (10M)

   b) Discuss about the significance of load prediction. (6M)

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