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

II B. Tech I Semester Regular Examinations, Jan - 2015
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) How heat engines are classified. Explain the principle of working of heat engine
b) Explain various operation of a Carnot cycle. Also represent it on T-s and P-V diagrams
c) What are the merits of Gas turbines over the IC engines
d) What are the applications of impulse-momentum equation?
e) Classify the hydraulic turbines
f) Explain about the load curve (3M+4M+4M+4M+4M+3M)

PART –B

2. a) With a neat sketch explain the working principle of a simple carburetor
b) Briefly discuss the air-fuel ratio requirements of a petrol engine from no load to full load. [8+8]

3. a) Explain about pressure compounding of impulse steam turbine with a neat sketch.
b) A simple Rankine cycle works between pressures 28 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. [8+8]

4. a) Explain the Inter cooling method applied to the gas turbine plant for improvement of the performance of plant with the help of P-V diagram and H-S diagram.
b) In an air standard gas turbine engine, air at a temperature of 15^0C 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 815^0C and expands to original pressure of 1.01 bar. Determine the ratio of turbine work to compressor work and the thermal efficiency when the engine operates on ideal Brayton cycle. Take γ=1.4 and C_p=1.005kJ/kgK. [8+8]

5. a) Derive an expression for force exerted by a jet on a stationary flat plate held normal to the jet
b) Discuss the influence of exit blade angle on the performance and efficiency of a centrifugal pump. Assume radial flow at entrance. [8+8]

6. A pelton wheel is to be designed to the following specifications:
Power 11948 kW, Head 381m,Speed 750 rpm, overall efficiency 86% Jet diameter not to exceed 1/8 times the wheel diameter. Determine i) The wheel diameter ii) the number of jets required iii) The diameter of the jet. [8+8]

7. a) With a neat sketch explain the working of a simple hydro electric power plant identify all the components and explain their functionality
b) Explain the following: i) load factor ii) utilization factor iii) capacity factor [8+8]
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Code No: RT21022 **R13** SET - 2

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THERMAL AND HYDRO PRIME MOVERS
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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) Compare External combustion engine and Internal combustion engines
   b) Explain the various operation of a Rankine cycle. Also represent it on T-s and P-V Diagrams
   c) What are the merits of Gas turbines over the IC engines
   d) Mention the parts of centrifugal pump. Explain the function of impeller
   e) What are the parameters to be considered while designing the Pelton Wheel?
   f) Explain the term diversity factor (4M+4M+4M+4M+3M+3M)

PART –B

2. a) What are the various components to be lubricated in an engine and explain how it is accomplished
   b) Compare the wet sump and dry sump lubrication systems [8+8]

3. a) Explain about the Re-heat cycle with the neat sketch
   b) In a steam turbine steam at 20 bar, 360^0C is expanded to 0.08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assume ideal processes; find per kg of steam the net work and the cycle efficiency. [8+8]

4. a) Explain the Re-heat method applied to the gas turbine plant for improvement of the performance of plant with the help of P-V diagram and H-S diagram
   b) In an open cycle constant pressure gas turbine air enters the compressor at 1 bar and 300K.The pressure of air after the compression is 4 bar. The isentropic efficiencies of compressor and turbine are 78% and 85% respectively. The air fuel ratio is 80:1.Calculate the power developed and thermal efficiency of the cycle if the flow rate of air is 2.5 kg/s. Take C_p=1.005KJ/ KgK and □=1.4 and C_{pg}=1.147 KJ/KgK and □=1.33 for gases. R=0.287KJ/KgK Calorific value of fuel=42000KJ/Kg [8+8]

5. a) Derive an expression of the force exerted by a jet on a stationary flat plate held inclined to the jet
   b) Explain briefly the effect of variation of discharge on the efficiency [8+8]

6. A Pelton wheel having a mean bucket diameter of 1m is running at 1000 rpm. The net head on the Pelton wheel is 700m.If the side clearance angle is 15^0 and discharge through the nozzle is $0.1m^3/s$, determine power available at the nozzle and hydraulic efficiency of the turbine. [8+8]

7. a) Explain about the pumped storage systems in detailed
   b) Distinguish between a base load power plant and a peak load power plant [8+8]

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

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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) Give examples of External combustion engines and internal combustion engines
   b) Draw the combined velocity triangle for the single stage impulse turbine. Explain the notations used in the velocity triangles
   c) What are the merits of Gas turbines over the steam turbines?
   d) Draw the operating characteristic curves of centrifugal pump and explain then in brief
   e) Draw the main characteristics of Pelton wheel and explain them in brief
   f) Explain about the duration curve (4M+4M+4M+3M+4M+3M)

Part –B

2. a) With a neat sketch explain Battery ignition system.
   b) A four-stroke gas engine has a bore of 20cm and stroke of 30 cm and runs at 300 rpm firing every cycle. If air-fuel ratio is 4:1 by volume and volumetric efficiency on NTP basis is 80%, determine the volume of gas used per minute. If the calorific value of gas is 8MJ/m^3 at NTP and the brake thermal efficiency is 25% determine brake power of the engine. [8+8]

3. Derive expression for maximum blade efficiency in a single-stage impulse turbine [16]

4. a) Explain the Regenerative method applied to the gas turbine plant for improvement of the performance of plant with the help of P-V diagram and H-s diagram
   b) Describe with neat diagram a closed cycle gas turbine and also derive the expression of thermal efficiency of the closed cycle. State also its merits and demerits over open cycle gas turbine. [8+8]

5. a) Derive an expression of force exerted on a stationary curved plate when jet strikes the curved plate at the centre.
   b) Explain the working of volute casing of centrifugal pump with the help of neat sketch [8+8]

6. The jet of water coming out of nozzle strikes the buckets of a Pelton wheel which when stationary would deflect the jet through 165^0.The velocity of water at exit is 0.9 times at the inlet and the bucket speed is 0.45 times the jet speed. If the speed of the Pelton wheel is 300 rpm and the effective head is 150m, determine (i) Hydraulic efficiency (ii) Diameter of the Pelton wheel. Take coefficient of velocity C_v=0.98 [16]

7. a) Make a neat sketch of hydropower plant and explain working of each element in the plant.
   b) Differentiate between firm power and secondary power [8+8]
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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) Define the following: i) bore ii) stroke iii) clearance volume iv) cubic capacity
   b) Give the differences of Rankine cycle and Carnot cycle
   c) List out the applications of the gas turbines
   d) Explain about the multistage centrifugal pumps
   e) Draw the main characteristic curves of Francis turbine and explain them in brief
   f) Explain about the Utilization factor (4M+4M+3M+4M+4M+3M)

PART-B

2. a) With a neat sketch explain the magneto ignition system
   b) A four-stroke, four cylinder gasoline engine has a bore of 60mm and a stroke of 100 mm. On test it develops a torque of 66.5 Nm when running at 3000 rpm. If the Clear acne volume in each cylinder is 60cc the relative efficiency with respect to brake Thermal efficiency is 0.5 and the calorific value of the fuel is 42MJ/kg, determine the fuel consumption in kg/h and the brake mean effective pressure. [8+8]

3. A single stage steam turbine is supplied with steam at 5 bar, 200^0C at the rate of 50 kg/min. It expands into condenser at a pressure of 0.2 bar. The blade speed is 400 m/s. The nozzles are inclined at an angle of 20^0 to the plane of wheel and the outlet blade angle is 30^0.Neglecting friction losses, determine the power developed, blade efficiency and stage efficiency. [8+8]

4. a) List out the differences between the open cycle gas turbine and closed cycle cycle gas Turbine
   b) Derive an expression of air standard efficiency for the open cycle gas turbine with the neat Sketch and indicate the operations on P-V and T-s diagram [8+8]

5. a) Derive an expression of force exerted on a stationary curved plate when jet strikes the curved plate at one end tangentially when the plate is unsymmetrical.
   b) Explain the working of single stage centrifugal pump with a neat sketch [8+8]

6. A pelton wheel has a mean bucket speed of 12m/s diameter and is supplied with water at the rate of 0.7m^3/s under a head of 30m.If the buckets deflect the jet through an angle of 160^0,find the power and the efficiency of the turbine. [8+8]

7. a) Show that capacity factor is equal to the product of the load factor and the utilization factor
   b) Differentiate between storage and pondage. Support your answer with a neat sketch [8+8]
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