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

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
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)	Explain the principle of carburetion.	(2M)
	b)	Discuss the advantages and disadvantages of reheat Rankine cycle.	(2M)
	c)	Write briefly the uses of closed cycle gas turbines?	(2M)
	d)	The work done by fluid on a curved vane per second is 1000 Joules. If the angular velocity is 20 radians per second, what is the torque?	(3M)
	e)	What is governing and how it is accomplished for different types of water turbines?	(3M)
	f)	Define Utilization factor.	(2M)

PART -B

2.	a)	In what respects four-stroke cycle CI engine differ from that of SI engine?	(5M)
	b)	Explain the two types of cooling systems and compare them.	(9M)
3.	a)	Describe the different operations of a Rankine cycle. Derive the expression for its thermal efficiency.	(7M)
	b)	Steam at a pressure of 5.4bar and dryness fraction 0.8 expands in a cylinder reversibly and isothermally to a pressure of 1bar. Find: i) Final condition of steam ii) Change in internal energy iii) Change in entropy iv) Heat transferred and v) Work done per kg of steam	(7M)
4.	a)	How gas turbines are classified? Explain with suitable sketches.	(5M)
	b)	In a gas turbine plant, operating on Brayton cycle, air enters the compressor at 1 bar and 27^0C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the power developed by the turbine. Assume the turbine work as 2.5 times the compressor work. Take Υ=1.4.	(9M)
5.	a)	List the main component parts of a centrifugal pump and explain them briefly.	(5M)
	b)	A jet of water having a velocity of 40m/s strikes a curved vane, which is moving with a velocity of 20m/s. The jet makes an angle of 30^0 with the direction of motion of vane at inlet and leaves at angle of 90^0 to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vane without shock.	(9M)

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6. a) Draw a neat diagram of the operating characteristic curves of Pelton, Francis and Kaplan turbines. Discuss the practical importance of these curves. (5M)

   b) 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 and ii) Diameter of the Pelton wheel. Take coefficient of velocity, C_v=0.98. (9M)

7. a) Distinguish between a base-load power plant and a peak-load power plant. (7M)

   b) Explain pumped storage systems in detail. (7M)

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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) Explain the reasons for cooling an engine. (3M)
   b) Discuss the classification of steam turbines. (2M)
   c) Discuss the limitations of open cycle gas turbine plants? (2M)
   d) Identify the two important functions of the volute casing of a centrifugal pump. (2M)
   e) State the advantages of a Kaplan turbine over Francis turbine. (3M)
   f) Define load factor. (2M)

PART -B

2. a) With neat sketches explain the working principle of four-stroke spark ignition engine. (7M)
   b) Explain the various mechanisms of lubrication and their functions. (7M)

3. a) Discuss the thermodynamic variables that affect the efficiency and output of a Rankine cycle. (7M)
   b) Steam at a pressure of 6 bar and dryness 0.8 is heated at a constant volume to a pressure of 7 bar. Determine the final dryness fraction and heat absorbed by 1 kg of steam. (7M)

4. a) Derive an expression for the thermal efficiency of a gas turbine plant, and show that it is independent of the mass of air circulated in it. (7M)
   b) A gas turbine consists of two stage compressor with perfect inter-cooler and a single stage turbine. If the plant works between the temperature limits of 300K and 1000K and 1bar and 16 bar; find the net power of the plant per kg of air. Take specific heat at constant pressure as 1 kJ/kg K. (7M)

5. a) Explain with the help of a neat diagram, the variable speed and constant speed performance curves of a centrifugal pump. (6M)
   b) A jet of water 100mm diameter and having a velocity of 30m/s strikes tangentially on a wheel which deflects the jet through an angle of 120^0. Calculate the thrust on the vane when (8M)
      i) The axis of symmetry of the vane is horizontal.
      ii) The tangent at inlet tip is horizontal

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6. a) What are the functions governing a hydraulic turbine? Explain with a sketch the governing mechanism of an impulse turbine. (6M)
   b) A pelton wheel having a mean bucket diameter of 1.0 m 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 the power available at the nozzle and the hydraulic efficiency of the turbine. (8M)

7. a) Differentiate between firm power and secondary power. (7M)
   b) Make a neat sketch of a hydro power plant and clearly explain the various elements. (7M)

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Code No: R1621025 **R16** SET - 3

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
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) What are the functional requirements of an injection system? (2M)
   b) Find the amount of heat required to convert 1kg of steam at a pressure of 0.5 bar and dryness fraction 0.9 to dry saturated steam. (3M)
   c) What are the advantages of closed cycle gas turbines over open cycle gas turbines? (2M)
   d) How does a volute casing differ from a vortex casing for the centrifugal pump? (2M)
   e) State the advantages and disadvantages of a Francis turbine over a Pelton wheel. (3M)
   f) Explain Capacity factor. (2M)

PART -B

2. a) Explain the working of four stroke C.I. Engine (6M)
   b) With a neat sketch explain the working principle of a simple carburetor. (8M)

3. a) Explain velocity compounding in steam turbines. (7M)
   b) A quantity of steam at 10 bar and 0.85 dryness occupies 0.15 m^3. The steam is heated at constant pressure to raise its temperature up to 300^0C. Determine: (7M)
      i) The work done
      ii) The change in internal energy
      iii) The heat supplied

4. a) Discuss the effect of inter-cooling on the thermal efficiency of a gas turbine. (6M)
   b) A gas turbine plant with a pressure ratio of 1:5 takes in air at 15^0C. The maximum temperature is 600^0C and develops 2200 kW. The turbine and compressor efficiencies are equal to 0.85. Taking C_p= 1 kJ/kg K and C_v=0.714 kJ/kg K; determine: (8M)
      i) Actual overall efficiency of the turbine
      ii) Mass of air circulated by the turbine

5. a) Explain the working of a single-stage centrifugal pump with a neat sketch. (6M)
   b) A jet of water moving with a velocity of 20m/s impinges on a curved vane, which is moving with a velocity of 10m/s. The jet makes an angle of 20^0 with the direction of motion of vane at inlet and leaves at angle of 130^0 to the direction of motion of vane at outlet. Determine: (8M)
      i)The angles of curved vane tips so that water enters and leaves without shock;
      ii)The work done per N of water entering the vane.

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6. a) What are the requirements of a good turbine governor? Explain with a sketch the governing mechanism of a reaction turbine. (7M)
   b) The following data pertain to a Kaplan turbine: shaft power= 13230 kW; speed= 75 rpm; head= 8m; diameter of boss of runner= 0.35 times the external diameter; speed ratio= 2; flow ratio= 0.6. Find the efficiency of the turbine. (7M)

7. a) What do you understand by load duration curve? How is it prepared? (7M)
   b) Explain briefly how the power available for a hydel project can be estimated. (7M)

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Code No: R1621025 **R16** SET - 4

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2019
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 PV and TS plots of Otto cycle and indicate all the processes. Write the expression for calculating the thermal efficiency in terms of compression ratio. (3M)
   b) Classify steam turbines. (2M)
   c) Write the advantages of gas turbine power plants. (2M)
   d) Derive the expressions for the force and work done per second by the jet when it strikes a stationary flat vertical plate. (3M)
   e) Write difference between Francis turbine and Kaplan turbine. (2M)
   f) Explain about load duration curve. (2M)

PART -B

2. a) Explain the working of Diesel cycle, indicate the processes involved using PV and TS diagram. (7M)
   b) What is the necessity cooling system in an IC engine? With a neat sketch explain the working of evaporative cooling system. (7M)

3. a) What is compounding? Explain about pressure compounding of a steam turbine. (6M)
   b) Steam at a pressure of 15 bar and 250°C is expanded through a turbine at first to a pressure of 4 bar. It is then reheated at constant pressure to the initial temperature of250°C and is finally expanded to 0.1 bar. Estimate the work done per kg of steam flowing through the turbine and amount of heat supplied during the process of reheat. Compare the work output when the expansion is direct from 15 bar to 0.1 bar without any reheat. Assume all expansion processes to be isentropic. (8M)

4. a) Explain the working of open cycle gas turbine plant with reheating system. Indicate the processes on T-S plot. (6M)
   b) Consider an air standard cycle in which the air enters the compressor at1.0 bar and 20°C. The pressure of air leaving the compressor is 3.5 bar and the temperature at turbine inlet is 600°C. Determine per kg of air: (i) Efficiency of the cycle, (ii) Heat supplied to air,(iii) Work available at the shaft, (iv) Heat rejected in the cooler, and(v) Temperature of air leaving the turbine. (8M)
   For air $\gamma = 1.4$ and $C_P = 1.005$ kJ/kg K.

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5. a) A jet of water 50 mm in diameter issues with a velocity of 10m/sec and impinges normally on a stationary flat plate which moves in forward motion. Determine the force exerted by the jet on the plate and the work done. Consider the same data and calculate force exerted by the jet on the plate and the work done when the plate is moving with a velocity of 3 m/s in the same direction. (8M)
   b) Give the classification of hydraulic pumps and write the advantages of centrifugal pump over reciprocating pump. (6M)

6. a) Discuss about characteristic curves of hydraulic turbines. (6M)
   b) A Pelton wheel is to be designed for the following specifications: (8M)
   Power (shaft or brake) = 9560 kW, Head = 350 meters, speed = 750 rpm, overall efficiency = 85%, jet diameter = not to exceed $1/6^{th}$ of the wheel diameter. Determine the following: i) The wheel diameter, ii) Diameter of the jet, iii) The number of jets required. Take $C_V = 0.985$, speed ratio = 0.45.

7. a) Discuss the factors to be considered in selecting site for a hydroelectric power plant. (7M)
   b) Discuss about load factor, Diversity factor, Utilization factor and capacity factor. (7M)

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