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

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018
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**

~~~~~~

PART –A

1. a) In what respects CI engine differ from SI engine. (2M)
   b) Write about Rankine cycle? (2M)
   c) Write the work ratio and optimum pressure ratio for simple gas turbine cycle? (3M)
   d) Write the types of pumps? (3M)
   e) Classify turbines? (2M)
   f) Write the advantages of Hydro Power plants (2M)

PART -B

2. Explain about different types of ignition systems with neat sketches. (14M)

3. In an impulse turbine the steam issues from the nozzle with speed of 600 m/s and blade speed is 120 m/s. The velocity is compounded by passing the steam through a ring of moving blades, through a ring of fixed blades and finally through a ring of moving blades. The nozzle angle is 18^0 and the blade exit angles and relative velocity coefficients are (14M)
   1^{st} row moving : 20^0 and 0.8
   Fixed row : 25^0 and 0.85
   2^{nd} row moving : 30^0 and 0.9
   Find the diagram efficiency under these conditions and the power output for steam flow rate of 5 kg/sec.

4. A gas turbine cycle has a perfect heat exchanger in which air enters the compressor at a temperature and pressure of 300 K and 1 bar and discharges at 475K and 5 bar. After passing through the heat exchanger the air temperature increases to 655K.The temperature of air entering and leaving the turbine is 870^0 *C* and 450^0*C*. Assuming no pressure drop through the heat exchanger, compute the output per kg of air, the efficiency of the cycle and the work output to drive the compressor (14M)

5. a) A centrifugal pump has a 300 mm diameter impeller and an outlet width of 50 mm. It runs at 1000 rpm and delivers water against a head of 15 m. The vanes of the impeller are curved backwards at an angle of 30^0 with the periphery at outlet. The manometric efficiency of the pump is 92%. Calculate the discharge. (7M)
   b) A jet of water 50 mm in diameter has a velocity of 40 m/s. The jet strikes a vane which deflects it through 135^0. The vane moves through a velocity of 10 m/s in the direction of jet. Determine the force, work done per second and the efficiency of the vane. (7M)

|'''|'|'|''|''||'|||
~~~~~~

6. a) A reaction turbine produces a power of 5.9kw by consuming 125 kg\min super heated steam with 8 bar and 175^0C. The turbine runs at 2000 rpm and the exit velocity is equal to 0.75 times of the blade speed. Calculate the diameter and height of the blades if the exit angles are 20^0C for both fixed and moving blades. (8M)

   b) Differentiate between Francis turbine and Kaplan turbines? (6M)

7. a) Explain the components of hydro electric power plant? (7M)

   b) What are the different factors to be considered while selecting the site for hydroelectric power plant? (7M)

Code No: R1621025 **R16** SET - 2

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018
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**

~~~~~~

PART –A

1. a) Write the types of cooling systems? (2M)
   b) Write about Carnot cycle? (2M)
   c) Draw the closed cycle gas turbine plant? (3M)
   d) Write the impulse momentum equation? (2M)
   e) Write about the efficiency of Kaplan turbine? (3M)
   f) Write short notes on prediction of load (2M)

PART –B

2. Explain about air standard Otto cycle and Diesel cycles with neat diagrams? (14M)

3. At a stage in a reaction turbine, the mean blade ring diameter is 1 m and the turbine runs at a speed of 50 rps. The blades are designed for 50% reaction with exit angles 30^0 and inlet angles 50^0. The turbine is supplied with a steam at a rate of 6×10^5 kg/hr and stage efficiency is 85 %, determine the power output. (14M)

4. In a gas turbine unit air is taken in at 1 bar and 27^oC and is compressed to 4 bar with an adiabatic efficiency of 85%. Heat is added in the combustion chamber so that the temperature is raised to 500^oC. The overall efficiency of the nozzle and turbine is 85%. Determine the net power of the installation and over all thermal efficiency for the air flow of 135 kg/m. Neglect the mass of fuel added. Assume Cp = 1 kJ/kg-K and Cv = 0.714 kJ/kg-K for air and combustion products. (14M)

5. a) A centrifugal pump delivers water at the rate of 30 LPS against a head of 12 m and is running at 1450 rpm. It required 4.5 KW power. Determine the discharge, head of the pump and the power required if the pump runs at 1800 rpm. (7M)
   b) Obtain the expressions for components of the force exerted, due to the impact of jet of fluid on a stationary curved vane. (7M)
~~~~~~

6. a) A Hydraulic turbine is to develop 845.6 kW when running at 100 r.p.m. under a head of 10 m. Work out the maximum flow rate and specific speed for the turbine if the overall efficiency at the best operating point is 92 percent. In order to predict its performance, a 1:10 scale model is tested under a head of 6 m. What would be the speed, power output and water consumption of the model if it runs under the conditions similar to the prototype? (7M)

   b) Explain the differences between an impulse turbine and a reaction turbine. (7M)

7. a) Explain about pumped storage systems. (8M)

   b) Describe about load – duration curve, firm power and secondary power? (6M)

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

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018
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**

~~~~~~

PART –A

1.	a)	Write the types of lubrication systems?	(2M)
	b)	Write the properties of steam?	(2M)
	c)	What are the factors to be considered for improving the performance of the gas Turbine?	(3M)
	d)	Write the working principle of centrifugal pumps?	(3M)
	e)	Write about the efficiency of Francis turbine?	(2M)
	f)	Write the importance of draft tube in Hydro power plant	(2M)

PART –B

2.	a)	What are the factors to be considered in evaluating the performance of an engine?	(5M)
	b)	Explain about valve and port timing diagrams?	(9M)
3.		One stage of an impulse turbine consists of a row of nozzles and one row of moving blades. The steam enters the nozzles at a pressure of 15 bar, dry saturated with a velocity of 130 m/s. The pressure drops along the nozzles to 9 bar. The nozzles have discharge angle of 20^0 and the steam passes into the blades without shock. If the velocity coefficient for nozzles is 0.9, determine for maximum efficiency conditions (i) the blade angles for equiangular blades (ii) the blade efficiency (iii) stage efficiency	(14M)
4.	a)	How are gas turbines cycles classified .Explain in detail	(5M)
	b)	A Gas turbine plant works between the temperature limits of 1152^0K and 288^0 K Isentropic efficiency for compressor and turbines are 0.85 and 0.8 respectively. Determine the optimum pressure ratio for maximum work output and also for maximum cycle thermal efficiency.	(9M)
5.	a)	A centrifugal pump is discharging water at the rate of 500 lt/min at 1200 RPM. The internal and external diameters and width of impellers are 12 cm and 24 cm and 16 mm and 8 mm respectively. The vanes are curved back 25^0 to the tangent at outlet. Find the increase in pressure, as water passes through the impeller.	(8M)
	b)	What are characteristic curves of a centrifugal pump? What is the use of these curves?	(6M)

|'''|'|'|''|''||'|||
~~~~~~

6. a) A pelton wheel is required to develop 1800 kW under a net head of 200 m at a speed of 480 rpm. Calculate: (9M)
   (i) the mean diameter of the wheel.
   (ii) the diameter of the jet.
   (iii) the number of jets required, assuming the data.
   Given below : Coefficient of velocity jet, $C_v = 0.98$, Speed ratio $\phi = 0.48$
   The jet diameter d to be 1/12 of the mean diameter of the wheel D.
   b) Write about governing of turbines? (5M)

7. a) Explain about the estimation of water power potential at Hydro electric power plant. (8M)
   b) Write about prediction of load in Hydro electric power plant? (6M)

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

II B. Tech I Semester Regular/Supplementary Examinations, October/November - 2018
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**

~~~~~~

PART –A

1. a) Classify IC engines? (2M)
   b) Draw the schematic layout of steam power plant? (2M)
   c) Draw the open cycle gas turbine plant? (3M)
   d) Write about the components of centrifugal pumps? (3M)
   e) Write about the efficiency of pelton wheel? (2M)
   f) Define diversity factor? (2M)

PART –B

2. a) Why lubrication system is required in I. C. Engines? Explain any one of the lubrication systems. (7M)
   b) What are the limitations of simple carburetor? How to avoid those limitations. (7M)

3. In a steam turbine, steam expands from an inlet condition of 7 bar and 300^0C with an isentropic efficiency of 90%. The nozzle angle is 20^0. The stage operates at optimum blade speed ratio. The blade inlet angle is equal to the outlet angle. Determine the blade angle. Determine the power output for a flow rate of 0.472 kg/sec. (14M)

4. A closed cycle gas turbine using Argon as the working fluid has two compressions with perfect inter cooling. The overall pressure ratio is 9 and pressure ratio in each stage is equal. Each stage has an isentropic efficiency of 85%. The turbine is also two stage with equal pressure ratio with inter change reheat to original temperature. Each turbine stage has an isentropic efficiency of 90%. The turbine inlet temperature is 1100K and the compressor inlet is 303K. Find (i) work done per kg of fluid flow (ii) work ratio (iii) The overall cycle efficiency. The properties of argon are Cp= 0.5207 kJ/kg K, γ =1.667 and R=0.20813 kJ/kgK. (14M)

5. a) Explain about multi stage pumps? (6M)
   b) A jet of water strikes a flat plate normally at 30 m/s at a point 150 mm below the top- of the plate. If diameter of the jet is 25 mm, what force should be applied at 100 mm below the axis of the jet, in order to keep the plate vertical. (8M)
~~~~~~

6. a) Derive an expression for maximum efficiency of pelton wheel in terms of jet deflection angle. (6M)

   b) A Francis turbine working under a head of 14 m, has guide blade angle of 20^0 and radial vanes at inlet. The ratio of inlet and outlet diameters is 1.5. The velocity of flow of water at exit is 4 m/s. Assuming the velocity of flow to be constant, determine the peripheral velocity of water at inlet and the vane angle at outlet. (8M)

7. a) Explain the working principle of hydro electric power plants. (7M)

   b) Explain the estimation of load on turbines. (7M)