

II B. Tech I Semester Regular Examinations, March - 2021
THERMAL AND HYDRO PRIME MOVERS
 (Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 75

Answer any **FIVE** Questions each Question from each unit
 All Questions carry **Equal** Marks

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- 1 a) Compare the relative advantages and disadvantages of four-stroke and two-stroke cycle engines. [8M]
 b) Discuss with suitable sketch the magneto-ignition system used in petrol engines. [7M]
- Or
- 2 a) Draw and explain valve timing diagram of CI Engine. [8M]
 b) Explain working principal of Otto cycle? [7M]
- 3 a) Explain with the help of neat sketch a single-stage impulse turbine. Explain the pressure and velocity variations along the axial direction. [7M]
 b) Explain with the help of a neat sketch, Reheat-Rankine cycle. Derive its expression for the thermal efficiency [8M]
- Or
- 4 a) Explain working principal of impulse turbine with a neat sketch?
 b) What is compounding? Explain velocity compounding? [8M]
- 5 a) Describe with neat sketches the working of a simple constant pressure open cycle gas turbine. [7M]
 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 is 240 m³/s, compute the power output and thermal efficiency. [8M]
- Or
- 6 a) Derive an expression for thermal efficiency in open cycle gas turbine plant? [8M]
 b) Compare open cycle gas turbine and closed cycle gas turbine? [7M]
- 7 a) Why multi stage pumps are used? Explain the advantages and limitations. [7M]
 b) A jet of water moves smoothly over the surface of a curved vane. Analyze the forces acting on the vane and determine the resultant force in magnitude and direction. Assume shockless flow at entry and exit. [8M]
- Or
- 8 a) Draw a neat sketch of centrifugal pump explain its working principle? [8M]
 b) Determine the performance characteristics of centrifugal pumps? [7M]

- 9 a) Draw a net sketch of a Pelton wheel installation and briefly indicate the functions of each component? [8M]
b) Distinguish in detail between impulse and reaction turbines. [7M]
- Or
- 10 a) Explain in detail about pumped storage system. [10M]
b) Explain the working of kaplan turbine. [5M]

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- 1 a) Explain about different types of ignition systems with neat sketches. [8M]
 b) Explain briefly the methods of cooling IC engines? [7M]
- Or
- 2 Explain about air standard Otto cycle and Diesel cycles with neat diagrams? [15M]
- 3 a) Define steam turbine? Classify it? Explain working of impulse turbine? [8M]
 b) Sketch the schematic-layout of steam power plant explain its functioning. [7M]
- Or
- 4 a) Explain the working of steam power plant with reheating system. [7M]
 b) The nozzles of a Delaval steam turbine are supplied with dry saturated steam at a pressure of 9 bar. The pressure at the outlet is 1 bar. The turbine has two nozzles with a throat diameter of 2.5 mm. Assuming nozzle efficiency as 90% and that of turbine rotor 35%, find the quality of steam used per hour and the power developed. [8M]
- 5 a) Explain the factor effecting the performance of gas turbine. [7M]
 b) A Gas turbine plant works between the temperature limits of 11520K and 2880 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. [8M]
- Or
- 6 a) 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^o C and 450^o 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? [10M]
 b) Define work-ratio and pressure-ratio of gas turbine? [5M]
- 7 a) Using impulse momentum principle derive the [8M]
 b) List the main component parts of a centrifugal pump and explain them briefly. [7M]
- Or
- 8 a) Describe with a neat sketch, the operation of multi-stage pump. [8M]
 b) Differentiate between reciprocating and centrifugal pumps. [7M]



- 9 a) Differentiate between firm power and secondary power. [7M]
b) Make a neat sketch of a hydro power plant and clearly explain various elements of it. [8M]

Or

- 10 a) What are the necessities of governing a hydraulic turbine? Explain with a sketch the governing mechanism of an impulse turbine. [7M]
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° and discharge through the nozzle is $0.1\text{m}^3/\text{s}$, determine the power available at the nozzle and the hydraulic efficiency of the turbine. [8M]

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- 1 a) Explain in detail the valve timing diagram of four stroke SI engine. [8M]
 b) What is the necessity of a carburetor in a petrol engine? With a neat sketch explain the working of a simple carburetor and write its limitations. [7M]
- Or
- 2 a) Explain the working of four stroke C.I. Engine [8M]
 b) Explain working principle of Otto cycle? [7M]
- 3 a) Explain the working of Carnot cycle and derive the expression for its thermal efficiency. [10M]
 b) Write the working principle of reaction turbine? [5M]
- Or
- 4 a) The velocity of steam at inlet to simple impulse turbine is 1100 m/s and the nozzle angle is 20° . 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]
 b) Explain pressure compounding in steam turbine? [7M]
- 5 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 is $240 \text{ m}^3/\text{s}$, compute the power output and thermal efficiency. [7M]
- Or
- 6 a) Explain ideal and actual gas turbine cycles. [8M]
 b) A Gas turbine plant works between the temperature limits of 11520K and 2880 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. [7M]
- 7 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° with the periphery at outlet. The manometric efficiency of the pump is 92%. Calculate the discharge. [8M]
 b) Differentiate between centrifugal and reciprocating pumps. Write their applications. [7M]

Or

- 8 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. [8M]
- b) Obtain the expressions for components of the force exerted, due to the impact of jet of fluid on a stationary flate plate. Which is incitred at an angle with the horizontal. [7M]
- 9 a) Explain with the help of a diagram, the essential features of a Kaplan turbine installation. [7M]
- b) What are the functions governing a hydraulic turbine? Explain with a sketch the governing mechanism of an impulse turbine. [8M]
- Or
- 10 a) What are the different types of hydropower plants? Describe each one briefly? [7M]
- b) Describe about load – duration curve, firm power and secondary power? [8M]

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- 1 a) Explain the various mechanisms of lubrication and their function. [8M]
 b) Explain the working of fuel injection system with a neat sketch. [7M]

Or

- 2 a) What is the necessity of cooling system in an IC engine? Explain the working of Thermosyphon cooling system. [8M]
 b) Draw and explain port timing diagram? [7M]
 3 a) Explain with the help of neat sketch a single-stage impulse turbine. Explain the pressure and velocity variations along the axial direction. [10M]
 b) Explain the classification of steam turbines? [5M]

Or

- 4 a) Explain repeat cycle? Discuss its Merit and demerits? [7M]
 b) Discuss about thermodynamic variables effecting efficiency and out-put in Rankine cycle? [8M]
 5 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 [15M]
 (i) work done per kg of fluid flow
 (ii) work ratio
 (iii) The overall cycle efficiency. The properties of argon are $C_p = 0.5207$ kJ/kg K, $\gamma = 1.667$ and $R = 0.20813$ kJ/kgK.

Or

- 6 a) Explain the importance of inter cooling and regeneration in gas turbine plant. [8M]
 b) What are the factors to be considered for improving the performance of the gas Turbine? [7M]
 7 a) Derive equations for the force of impact of a fluid jet on a series of normal flat vanes mounted on a wheel. Consider that the vane velocity is less than the jet velocity. [7M]
 b) How are centrifugal pumps classified? Describe with sketches the operation of a i) Multi-stage pump ii) single stage. [8M]

Or

- 8 a) Explain with the help of a neat diagram, the variable speed and constant speed performance curves of a centrifugal pump. [8M]
- 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° . Calculate the thrust on the vane when.
- i) The axis of symmetry of the vane is horizontal.
 - ii) The tangent at inlet tip is horizontal
- 9 a) Draw the schematic layout of a hydro electric power plant and explain its working. [7M]
- b) Write about governing of turbines? [8M]
- Or
- 10 a) Explain about the estimation of water power potential at Hydro electric power plant. [7M]
- b) Write about prediction of load in Hydro electric power plant? [8M]

