Code No: R1921025 **R19** SET - 1

**II B. Tech I Semester Supplementary Examinations, September - 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) | What are the requirements of an ignition system for an IC engine? | [6M] |
| | b) | A large diesel engine run on four-stroke cycle at 2000rpm. The engine has a displacement of 25litres and a brake mean effective pressure of 0.6MN/$m^2$. It consumes 0.018kg/s of fuel (calorific value=42000kJ/kg). Determine the brake power and brake thermal efficiency. | [9M] |
| | | Or | |
| 2 | a) | Discuss the functional requirements of an injection system? | [7M] |
| | b) | How are injection systems classified? Describe them briefly. Why the air injection system is not used now a days? | [8M] |
| 3 | a) | Reheating always improves specific work output but may not improve thermal efficiency of the plant. Discuss. | [6M] |
| | b) | In a single stage impulse turbine, the steam from the nozzle enters at 375 m/s when the nozzle angle is $20^o$. The mean blade speed is 165 m/s. Find out suitable blade angles to make the axial thrust to zero. The relative velocity of the steam is reduced by 15% as it flows over the blades. If the steam flow is 600 kg/min, find the power developed. | [9M] |
| | | Or | |
| 4 | a) | Explain with a neat sketch, a single stage impulse turbine. Also explain the pressure and velocity variations along the axial direction. | [7M] |
| | b) | Prove that the efficiency of a Rankine cycle using superheated steam is greater than the efficiency of the corresponding Rankine cycle using steam without superheat. Both the cycles operate between the same boiler and condenser pressure limits. | [8M] |
| 5 | a) | Describe the differences between an ideal gas turbine plant and an actual gas turbine plant. | [6M] |
| | b) | Derive an expression for the optimum pressure ratio giving maximum cycle thermal efficiency of gas turbine cycle, if the compressor efficiency is $\eta_c$ and turbine efficiency is $\eta_t$. The maximum cycle temperature is $T_3$ and minimum cycle temperature is $T_1$. | [9M] |
| | | Or | |
| 6 | a) | Explain Closed cycle gas turbine plant with the help of a neat sketch. | [6M] |
| | b) | 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. | [9M] |
| 7 | a) | Define velocity of flow and velocity of whirl and explain their significance. | [6M] |
| | b) | Prove that the force exerted by a jet of water on a fixed semicircular plate in the direction of the jet when the jet strikes at the center of the semicircular plate is two times the force exerted by the jet on a fixed vertical plate. | [9M] |
| | | Or | |
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8 a) Explain the working principles of a centrifugal pump with sketches. [7M]

b) A jet of water of 15cm diameter strikes at the centre of a smooth semi-spherical vane. The velocity of the jet is 15m/s. Find the thrust if the vane moves at a velocity of 5m/s. [8M]

9 a) Explain with the help of a diagram, the essential features of Kaplan turbine installation. [7M]

b) With the help of velocity diagrams, derive the equations of theoretical power developed by a Pelton wheel and its hydraulic efficiency. [8M]

Or

10 a) What do you understand by load duration curve? Explain. [6M]

b) Determine the speed and diameter of a Kaplan turbine to develop 5500kW of power under a head of 8m. Assume speed ratio=2.2, flow ratio=0.7, ratio of boss to runner diameters=0.34 and overall efficiency=85%. If the hydraulic efficiency=92%, determine the guide vane angle and runner vane angle at outer rim of runner wheel. [9M]