

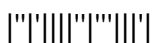
II B. Tech II Semester Supplementary Examinations, February - 2022
APPLIED THERMODYNAMICS
 (Automobile Engineering)

Time: 3 hours

Max. Marks: 75

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

- 1 a) What is reheating? Write the advantages of reheat Rankine cycle. [8M]
 b) A steam plant working on a simple Rankine cycle operated between the temperature of 260°C and 95°C . the steam is dry and saturated when it enters the turbine and expanded isentropic ally. Find Rankine efficiency. [7M]
- Or
- 2 a) Show Rankine cycle on P-V and T-S diagram using dry saturated steam and obtain an expression for the Rankine cycle efficiency. [8M]
 b) A power generating plant uses steam as working fluid and operates at boiler pressure of 50 bar, dry saturated and condenser pressure of 0.5 bar. Calculate for these limits i) the cycle efficiency and ii) the work ratio and iii) specific steam consumption for Carnot cycle and Rankine cycle. [7M]
- 3 a) Calculate the height of a chimney required to produce a draught equivalent to 1.7cm of water if the flue gas temperature is 270°C and ambient temperature is 22°C and minimum amount of air per kg of fuel is 17kg. [8M]
 b) Derive an expression for maximum discharge rate of gases through the chimney for a given height of the chimney. [7M]
- Or
- 4 a) Why boiler accessories are installed. Explain the operation of economiser with the help of simple diagram. [8M]
 b) What is stoichiometry? Discuss in detail about combustion stoichiometry with a example. [7M]
- 5 a) Dry saturated steam at a pressure of 8bar enters a convergent divergent nozzle and leaves it at a pressure of 1.5 bar. If the flow is isentropic and the corresponding expansion index is 1.135. Find the ratio of cross sectional area at exit and throat for maximum discharge. [8M]
 b) Derive the expression for maximum blade efficiency of a single stage impulse turbine. [7M]
- Or
- 6 a) Derive the equation for maximum discharge in nozzles. [7M]
 b) In a single stage impulse turbine the isentropic enthalpy drop of 200 kJ/kg occurs in the nozzle having efficiency of 96% and nozzle angle of 15° . The blade velocity co efficiency is 0.96 and ratio of blade speed to steam velocity is 0.5. The steam mass flow rate 20 kg/s and velocity of steam entering is 50 m/s. determine i) The blade angles at inlet and outlet if the steam enters blades smoothly and leaves axially. ii) The blade efficiency iii) The power developed in Kw iv) The axial thrust. Solve using velocity diagram. [8M]



- 7 a) Define the term Degree of Reaction used in Reaction Turbines. Prove that moving and fixed blades should have the same shape for 50% reaction. [8M]
b) A surface condenser is designed to handle 10000 kg of steam per hour. The steam enters at 0.08 bar abs. and 0.9 dryness and the condensate leaves at the corresponding saturation temperature. The pressure is constant throughout the condenser. Estimate the cooling water flow per hour, If the cooling water temperature rise is limited to 10°C. [7M]

Or

- 8 a) Define the following terms for reaction turbines: [8M]
(i) Diagram efficiency and (ii) Stage efficiency.
b) Cooling water leaves the condenser of a power plant and enters a wet cooling tower at 35°C at a rate of 100 kg/s. Water is cooled to 22°C in the cooling tower by air that enters the tower at 1 atm, 20°C, and 60 percent relative humidity and leaves saturated at 30°C. Neglecting the power input to the fan, determine (a) the volume flow rate of air into the cooling tower and (b) the mass flow rate of the required makeup water. [7M]
- 9 a) An air compressor takes in air at 1 bar and 20°C and compresses it according to law $p v^{1.2} = \text{constant}$. It is then delivered to a receiver at a constant pressure of 10 bar. $R = 0.287 \text{ KJ/Kg K}$. Determine: (i) Temperature at the end of compression (ii) Work done and heat transferred during compression per kg of air. [8M]
b) Compare between reciprocating and rotary compressors? Define the terms i) Volumetric efficiency ii) mechanical efficiency iii) clearance ratio [7M]

Or

- 10 a) Draw the velocity diagram of an axial flow compressor? What do you mean by multistage compression? And state its advantages. [8M]
b) State how the air compressors are classified? Explain the working of roots blower. Write the applications of compressed air. [7M]

