

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

Time: 3 hours

Max. Marks: 75

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

- 1 a) Explain with the help of diagram a Reheat cycle. Derive an expression for its thermal efficiency. [8M]
b) A simple Rankine cycle works between 24 bar and 0.06 bar, the initial condition of steam being dry saturated. Calculate the cycle efficiency, work ratio and specific steam consumption. [7M]

Or

- 2 a) Describe briefly the Rankine cycle using superheated steam and show in what respect this cycle differs from Carnot cycle between the same temperatures. [8M]
b) Steam is supplied to a Rankine engine at 21 bar with 110°C of superheat. The back pressure is 0.20 bar. Find (1) Rankine efficiency (2) Percentage increase in efficiency if the steam has a temperature of 250°C before entering the cylinder. [7M]

- 3 a) Explain the feed check valve with the neat sketch. [8M]
b) In a chimney of height 50 meters, temperature of flue gases with natural draught is 367°C . The temperature of waste gases by using artificial draught is 127°C . The temperature of outside air is 27°C . If air supplied is 19 Kg/kg of fuel burnt, determine the efficiency of chimney. Assume $C_p = 1.005 \text{ KJ/kg K}$ for the gases. [7M]

Or

- 4 a) A boiler produces 9000 kg of steam while 1 tonne of coal is burnt. The steam is produced at 10 bar from water at 15°C . The dryness fraction of steam is 0.9. Determine the efficiency of the boiler when the calorific value of the coal is 32000 kJ/kg. [8M]
b) Explain the working of super heater with a neat sketch. [7M]

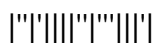
- 5 a) Explain the Pressure compounding of impulse turbine with the neat sketch. [8M]
b) Discuss the functions of the convergent portion, the throat and the divergent portion of a convergent-divergent nozzle with reference to flow of steam. [7M]

Or

- 6 In a stage of an impulse turbine provided with a single row wheel, the mean diameter of the blade ring is 800mm and the speed of revolution is 3000 rpm. The steam issues from the nozzles with a velocity of 300 m/s and the nozzle angle is 20° . The inlet and outlet blade angles are equal and the blade friction factor is 0.86. What is the power developed in the blading when the axial thrust on the blades is 140N. [15M]

- 7 In one stage of reaction turbine, both the fixed and moving blades have inlet and outlet blade tip angles of 35° and 20° respectively. The mean blade speed is 80 m/s and the steam consumption is 22550 kg per hour. Determine the power developed in the pair, if the isentropic heat drop for the pair is 23.5KJ per kg. [15M]

Or



- 8 a) Describe with a sketch a low level jet condenser of the counter flow type. [8M]
- b) The vacuum in a condenser dealing with 8100 kg of steam per hour is found to be 710mm of Hg when the barometer reads 750 mm of Hg. The temperature in the condenser is 20°C . The air leakage amounts to 8.1 kg per 1000kg of steam. Determine the capacity of a suitable dry air pump in m^3 per minute required for the condenser. Take volumetric efficiency of pump as 0.85. [7M]
- 9 A single-stage double acting air compressor is required to deliver 14 m^3 of air per minute measured at 1.013 bar and 15°C . The delivery pressure is 7 bar and the speed 300 rpm. Take clearance volume as 5% of the swept volume with the compression and compression index of $n=1.3$. Calculate (i) Swept volume of the cylinder (ii) The delivery temperature (iii) Indicated power. [15M]
- Or
- 10 a) Explain the working principle of vane sealed compressor with the neat sketch. [8M]
- b) Discuss the merits and demerits of centrifugal compressors over the reciprocating compressors. [7M]

