

**3rd Sem./MECH/AUTO/AERO/DIP IN MECH/ MECH(PROD)/
MECH(MAINT)/ MECH(IND INTG)/ MECH(SWITCH)/ 2021(W)**
Th4 Thermal Engg.-1

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10
 - a. Define Point function and Path function.
 - b. What is mechanical equivalent of heat?
 - c. Define the Zeroth law of thermodynamics.
 - d. Explain the Clausius statement of 2nd law of thermodynamics.
 - e. State the Boyle's law and Charles's law.
 - f. Define enthalpy.
 - g. Define Piston speed and state its formula.
 - h. Draw the P-V and T-S diagram of Otto cycle.
 - i. Define Cetane number and Octane number.
 - j. What is meant by Free Expansion?

2. Answer **Any Six** Questions 5X6
 - a. Explain the Thermodynamic systems.
 - b. Derive the steady flow energy equation.
 - c. Differentiate between SI and CI engine.
 - d. Classify and explain the different types of fuel.
 - e. Derive the relationship between C_p , C_v and R .
 - f. Define COP. Derive the relation between COP of Refrigerator and COP of Heat Pump.
 - g. An ideal gas at 30°C and 1bar is compressed adiabatically from 5m³ to 1m³. Find the temperature, pressure and work done. Take $\gamma=1.4$

- 3 Derive the efficiency of Otto cycle with P-V and T-S diagram. 10
- An ideal diesel cycle operates within the temperature limits of 1700K and 300K and with a compression ratio of 16. Determine the
- 4 (a) pressure and temperature at each point in the cycle 10
 (b) thermal efficiency of the engine
 (c) mean effective pressure
- Air flows steadily at the rate of 1kg/s through an air compressor entering at 7m/s velocity, 100kPa pressure and specific volume of 0.95m³/kg and leaving at 5m/s, 700kPa and 0.19m³/kg. The difference in internal energy between outlet and inlet is 90kJ/kg. Cooling water absorbs heat from the air at the rate of 60kW. Calculate
- 5 (a) rate of work input 10
 (b) ratio of inlet and outlet pipe diameter
- 6 (a) What is the first law of thermodynamics? 10
 (b) Derive the expression for the work done for an Isothermal process.
- 7 Explain the working principle of 2 Stroke and 4 Stroke SI engine with neat sketch. 10