GALGOTIAS UNIVERSITY

ADMISSION NUMBER

School of Engineering

B.TECH Mechanical Engineering
Semester End Examination - Jun 2024

Duration : 180 Minutes
Max Marks : 100

Sem IV - G3UB404B- G3UB401T - BTME3021 - Applied Thermodynamics

General Instructions
Answer to the specific question asked
Draw neat, labelled diagrams wherever necessary
Approved data hand books are allowed subject to verification by the Invigilator

1)	Define heat engine.	K1(2)
2)	Derive 1st and 2nd TDS quuation usning maxwell relaions	K2(4)
3)	Explain why carnot cycle is not used in power plant	K2(6)
4)	A spark ignition engine working on the ideal Otto cycle has a compression ratio of 6. The initial pressure and temperature of air are 1 bar and 37°C. The maximum pressure in the cycle is 30 bar. For unit mass flow, Calculate 1. Pressure and temperatures at all salient points. 2. The ratio of heat supplied to the heat rejected.	K3(9)
5)	List the four thermodynamic processes involved in the Otto cycle and diesel cycle	K3(9)
6)	Prove ulilizing maxwell equations that specific heat at constant pressure is the fuction of temperture only	K5(10)
7)	Consider a regenerative cycle using steam as the working fluid. Steam leaves the boiler and enters the turbine at 4 MPa, 400°C. After expansion to 400 kPa, some of the steam is extracted from the turbine to heat the feedwater in an open feedwater heater. The pressure in the feedwater heater is 400 kPa, and the water leaving it is saturated liquid at 400 kPa. The steam not extracted expands to 10 kPa. Determine the cycle efficiency. Solve the problem with same operating conditions in case of a simple Rankine cycle without regeneration. Compare and conclude on the results thus obtained	K4(12)
8)	The stroke and cylinder diameter of the compression ignition engine are 250 mm and 150 mm respectively. If the clearance volume is 0.0004 m3 and fuel injection takes place at constant pressure for 5 % of the stroke. Determine the efficiency of the engine. Assume the engine working on the diesel cycle.	K5(15)
9)	The compression ratio for a single–cylinder engine operating on	K5(15)

dual cycle is 8. The maximum pressure in the cylinder is limited to 60 bar. The pressure and temperature of the air at the beginning of the cycle is 1 bar and 27°C. heat is added during constant pressure process up to 5 percent of the stroke. Assuming the cylinder diameter and stroke length as 240 and 310 mm respectively, evaluate : The air standard efficiency of the cycle.

10) Steam at 50 bar, 3500C expands to 12 bar in a HP stage, and is dry saturated at the stage exit. This is now reheated to 2800C without any pressure drop. The reheat steam expands in an intermediate stage and again emerges dry and saturated at a low pressure, to be reheated a second time to 2800C. Finally, the steam expands in a LP stage to 0.05 bar. Assuming the work output is the same for the high and intermediate stages, and the efficiencies of the high and low pressure stages are equal, Estimate: (a) efficency of the HP stage (b) Pressure of steam at the exit of the intermediate stage, (c) Total power output from the three stages for a flow of 1kg/s of steam, (d) Condition of steam at exit of LP stage and (e) Then □ of the reheat cycle. Also calculate the thermodynamic mean temperature of energy addition for the cycle. K6(18)