Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 50865

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Fourth/Sixth Semester
Mechanical Engineering
ME 6404 – THERMAL ENGINEERING
Common to : Mechanical Engineering (Sandwich)
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

(Use of Steam table, Refrigeration table, Mollier Chart and Psychometric Charts are permitted)

Answer ALL questions.

PART – A (10×2=20 Marks)

1. Define mean effective pressure.
2. Write down the air standard efficiency for Otto and Diesel Cycle.
3. State the function of engine flywheel.
4. Draw the actual PV diagram of a four-stroke diesel engine and indicate all the processes.
5. Define the term compounding in turbines.
6. What do you understand by the term critical pressure ratio ?
7. What is purpose of intercooler in a compressor ?
8. What is the effect of clearance volume on work of compression ?
9. Define RSHF and GSHF.
10. What are the requirement of a Refrigerant ?

PART – B (5×13=65 Marks)

11. a) An Oil engine works on the Dual Cycle, the heat liberated at constant pressure being twice that liberated at constant volume. The compression ratio of the engine is 8 and the expansion ratio is 5.3. But the Compression and expansion processes follow the law $pV^{1.3} = C$. The pressure and temperature at beginning of compression are 1 bar and 27°C respectively. Assuming $C_p = 1.004$ kJ/kg K and $C_v = 0.717$ kJ/kg K for air, find the air standard efficiency and the mean effective pressure.

(OR)

b) A gas engine operating on the ideal Otto Cycle has a compression ratio of 6 : 1. The pressure and temperature of the commencement of compression are 1 bar and 27°C. Heat added during the constant volume combustion process is 1170 kJ/kg. Determine the peak pressure and temperature, work output per kg of air and air standard efficiency. Assume $C_p = 1.004$ kJ/kg K and $C_v = 0.717$ kJ/kg K, Y = 1.4 for air.

12. a) Explain the working of magneto ignition system with neat sketch.

(OR)

b) Explain the construction and working principle of Diesel reciprocating pump and Fuel injector with neat sketch.

13. a) Derive the equation for critical pressure ratio in steam nozzle.

(OR)

b) In a single stage impulse turbine the blade angles are equal and nozzle angle is 20°. The velocity coefficient for the blade is 0.83. Find the maximum blade efficiency possible. If the actual blade efficiency is 90% of maximum blade efficiency, find the possible ratio of blade speed to steam speed.

14. a) Derive the work done equation for multistage compressor with Intercooler.

(OR)

b) A single stage, Single acting air compressor 30 cm bore and 40 cm stroke runs at 200 rpm. The suction pressure is 1 bar at 15°C and the delivery pressure 5 bar. Determine the indicated mean effective pressure and ideal power required to run it, when :

i) Compression is isothermal

ii) Compression follows the law $pv^{1.25} = C$

iii) Compression is reversible Adiabatic (Y = 1.4)

Determine the isothermal efficiency for ii, iii. Assume isentropic or reversible adiabatic index as Y = 1.4 and R = 0.287 kJ/Kg K.

15. a) Explain the working of Vapor – Compression Refrigeration system with Neat sketch.

(OR)

b) Air at dry bulb temperature of 5°C and relative humidity of 80% is to be heated and humidified to 24.5°C and 45% relative humidity, (i) by passing the air through heated water spray washer, (ii) by pre heating sensibly, and then passing through water spray washer with recirculated water till relative humidity rises to 95% and then again heated sensibly to final required state. Determine for (i) and (ii) the total heating required. The makeup water required in water spray air washer and humidifying efficiency of the recirculated spray washer.

PART – C (1×15=15 Marks)

16. a) Discuss the convergence of state of art of fuel supply system of spark ignited a engine from carburetor to MPFI Fuel Supply System.

(OR)

b) Draw a schematic of gas turbine closed-cycle arrangement and explain in detail. Also list the merits and demerits of this cycle arrangement.