

Question Paper Code : 21037

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2012.

Fifth Semester

Mechanical Engineering

080120023 — THERMAL ENGINEERING

(Regulation 2008)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain the term Knocking.
2. What is meant by lean and rich mixture?
3. Draw the P-V and T-s diagrams for dual cycle and name the processes.
4. Draw the actual P-V diagram of two stroke engine.
5. What is meant by critical pressure ratio?
6. Write the disadvantages of pressure and velocity compounding.
7. Broadly classify the types of air-compressors.
8. Write the advantage of multi stage air-compressors over equivalent single stage air compressor.
9. List few VAR systems and name the absorbent in them.
10. Give the advantages of VAR over VCR.

PART B — (5 × 16 = 80 marks)

11. (a) The following data were given for an oil engine working with Otto cycle.
- | | | |
|----------------------------|---|------------|
| Brake power | = | 14.7 kW |
| Suction Pressure | = | 0.9 bar |
| Mechanical Efficiency | = | 80% |
| Ratio of compression | = | 5 |
| Index of compression curve | = | 1.35 |
| Index of expansion curve | = | 1.3 |
| Maximum explosion pressure | = | 24 bar |
| Engine speed | = | 1000 r.p.m |
| Ratio of stroke : bore | = | 1.5 |
- Find the dia and stroke of piston. (16)
- Or
- (b) (i) Explain the method of air cooling in IC engines. (8)
- (ii) Explain any one type of lubrication method for IC engines. (8)
12. (a) An engine working on Otto cycle has a volume of 0.50 m³, pressure 1 bar and temperature 30°C at the beginning of the compression stroke. At the end of the stroke the pressure is 11.5 bar. 270 kJ of heat is then added at constant volume. Determine
- (i) Pressure, Temperature and volumes at salient points in the cycle.
- (ii) Percentage clearance.
- (iii) Efficiency. (16)
- Or
- (b) In a gas turbine power plant, the air at inlet is at 35°C, 0.1 MPa. The pressure ratio is 8 and the maximum temperature is 1050° C. The turbine and compressor efficiencies are each 80%. Find compressor work, turbine work, heat supplied, cycle efficiency and turbine exhaust temperature. Mass of air may be considered 1 kg. Draw the T-s diagram. (16)
13. (a) Discuss the various methods of compounding and list their demerits. (16)
- Or
- (b) A single stage steam turbine is supplied with steam at 10 bar and 400°C at 50 kg/s. It expands to a condenser pressure of 0.4 bar, the blade velocity is 8000 m/s. The nozzles are inclined at an angle of 20° to the plane of the wheel and the outlet blade angle is 30°. Neglecting the frictional losses determine the power developed, blade efficiency and the stage efficiency. (16)

14. (a) A two stage single acting reciprocating compressor takes in air at the rate of $0.5 \text{ m}^3/\text{s}$. The intake pressure and temperature of air are 0.1 MPa and $25 \text{ }^\circ\text{C}$. The air is compressed to a final pressure of 1.1 MPa . The intermediate pressure is ideal and inter-cooling is perfect. The compression index in both stages is 1.5 and the compressor runs at 450 rpm , neglecting clearance determine : (16)

- (i) The intermediate pressure.
- (ii) The total volume of each cylinder
- (iii) The power required to drive the compressor
- (iv) The rate of heat rejection in the intercooler.

Or

- (b) (i) Derive an equation to explain the effect of clearance volume on compressor work. (8)
- (ii) Explain the methods of increasing the isothermal efficiency of a reciprocating compressor. (8)

15. (a) (i) Draw the VCR cycle and explain its working with necessary plots. (12)
- (ii) Name four alternative refrigerants used instead of CFCs. (4)

Or

- (b) (i) Explain the working of Water-Ammonia VAR system. (10)
- (ii) List the advantages and disadvantages of VAR system. (6)