Hall Ticket No | | | | | | | | | | |

Question Paper Code: AMEC13

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.TECH IV SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - AUGUST 2023
Regulation: UG20

APPLIED THERMODYNAMICS

Time: 3 Hours **(MECHANICAL ENGINEERING)** **Max Marks: 70**

Answer ALL questions in Module I and II
Answer ONE out of two questions in Modules III, IV and V
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) With neat sketch describe the working of water cooling system used for multi cylinder engine. [BL: Understand| CO: 1|Marks: 7]

   (b) Compare the petrol and diesel engines with reference to the following:
   i) Power to weight ratio
   ii) Acceleration response
   iii) Economy on road transport
   iv) Maintenance and repair [BL: Understand| CO: 1|Marks: 7]

MODULE – II

2. (a) What is meant by abnormal combustion? Explain the phenomenon of knock in SI engines with suitable diagram. [BL: Understand| CO: 2|Marks: 7]

   (b) List the various effects of engine variables on SI engine knock. Discuss briefly the factors affecting delay period. [BL: Understand| CO: 2|Marks: 7]

MODULE – III

3. (a) Discuss the effect of clearance volume upon the performance of an air compressor. [BL: Understand| CO: 3|Marks: 7]

   (b) A four cylinder two stroke cycle petrol engine develops 30 KW at 2500RPM. The mean effective pressure on each piston is 8 bars and mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder with stroke to bore ratio 1.5. Also calculate the fuel consumption of the engine, if brake thermal efficiency is 28%. The calorific value of fuel is 43,900 kJ/ kg. [BL: Apply| CO: 3|Marks: 7]

4. (a) Describe the factors that affect the volumetric efficiency of a reciprocating compressor. [BL: Understand| CO: 4|Marks: 7]

   (b) A single cylinder 4-stroke engine using gas (heating value 11500 kJ/m^3) as a fuel has an air/fuel ratio of 10 : 1. The indicated power is 22.727 kW while running at 5500 RPM. The volumetric efficiency is 0.75 and indicated thermal efficiency is 0.3. What is the stroke volume? [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

5. (a) Obtain the condition of minimum work with complete inter cooling in a two stage compressor. [BL: Understand| CO: 5|Marks: 7]

   (b) A two stage single acting air compressor compresses $2m^3$ airs from 1 bar and 20° C to 15 bar. The air from the low pressure compressor is cooled to 25° C in the intercooler. Calculate the minimum power required to run the compressor. If the compression follows $PV^{1.25}$=C and the compressor runs at 400 RPM. [BL: Apply| CO: 5|Marks: 7]

6. (a) Outline the construction and working of sliding vane compressor. What are the advantages of multi stage compressors over single stage compressors? [BL: Understand| CO: 5|Marks: 7]

   (b) A centrifugal compressor delivers 16.5 kg/s of air with a total head pressure ratio of 4:1 .The speed of the compressor is 1500 RPM. Inlet total head temperature is 20^0C, slip factor 0.9 Power input factor 1.04 and 80 per isentropic efficiency. Calculate

   i) Overall diameter of the impeller

   ii) Power input [BL: Apply| CO: 5|Marks: 7]

MODULE – V

7. (a) With a neat sketch explain the working of a simple vapour compression refrigeration system. [BL: Understand| CO: 6|Marks: 7]

   (b) A vapour compression system produces ice of 30 tons from and at 0^0C in 24 hours. The temperature change in the compressor is from 25^0C to -16^0C. The vapour is bisaturated at the end of compression and the expansion valve is used. Calculate the coefficient of performance (COP) of the system. [BL: Apply| CO:6|Marks: 7]

8. (a) List different components of vapour compression system. Compare between vapour compression and vapour absorption systems. [BL: Understand| CO: 6|Marks: 7]

   (b) Freon-12 is compressed from 200 kPa to 1.0 MPa in an 80 percent efficient compressor. The condenser exiting temperature is 40^0 C. Calculate the COP and the refrigerant mass flux for 100 tons (352 kW) of refrigeration. [BL: Apply| CO: 6|Marks: 7]

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