Instructions: (1) All questions are compulsory.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data, if necessary.
(5) Use of Non-programmable Electronic Pocket Calculator is permissible.
(6) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. A) Attempt any three:
   a) An engine of diameter 250 mm and 375 mm stroke works on otto cycle. The clearance volume is 0.00263 m³, find the air standard efficiency of cycle also sketch the cycle on P-V plane.
   b) State any four industrial uses of compressed air.
   c) Define the following terms related to compressor.
      i) Compressor capacity
      ii) Free air delivered
      iii) Volumetric efficiency
      iv) Mechanical efficiency.
   d) What is pre-ignition? State any two factors responsible for pre-ignition.

B) Attempt any one:
   a) A petrol engine working on otto cycle has compression ratio 8 and consumes 1 kg of air per minute. If maximum temperature during the cycle is 2001 k and minimum temperature is 299 k. Find power developed by engine.
   b) Write any three pollutants in exhaust gasses of petrol and diesel engine with their effects on environment.

2. Attempt any two:
   a) Compare Reciprocating air compressor and Rotary air compressor mentioning the basis of comparison (any 8 points)
   b) Explain sensible heating and cooling with dehumidification by sketching it on outline diagram of psychrometric chart.

P.T.O.
The following observations were made during the test on an oil engine BP of engine = 31.5 kW, fuel used = 10.5 kg/hr, C.V. of fuel = 43,000 kJ/kg, jacket circulating water = 540 kg/hr, rise in temperature of cooling water = 56°C, water circulated through exhaust gas calorimeter = 545 kg/hr, rise in temperature of water passing through exhaust gas calorimeter = 36°C, temperature of exhaust gas leaving the exhaust gas calorimeter = 82°C, A : F ratio = 19:1, ambient temperature = 17°C, Cp for exhaust gases = 1 kJ/kg°k. Draw up the heat balance sheet on minute basis.

3. Attempt any Four:
   a) What is catalytic convertor? Explain two way catalytic convertor with neat sketch.
   b) Draw constant pressure closed cycle gas turbine on P.V and T-S planes. Name the various processes involved and give its efficiency equation with meaning of each term.
   c) Draw and explain simple vapour absorption refrigeration system.
   d) Name the different sensors used in ECU of modern automobile with their application. (minimum 4)
   e) Explain different stages of combustion in C.I. engine with sketch.

4. A) Attempt any three:
   a) Explain MPFI system with sketch.
   b) Define the following related I.C. engine.
      i) Indicated power
      ii) Brake power
      iii) Brake specific fuel consumption
      iv) Relative efficiency.
   c) Draw and explain Battery ignition system.
   d) Describe the method to measure indicated power of I.C. engine.

4. B) Attempt any one:
   a) List the additives of Lubricant used in S.I. engine and state their advantages.
   b) Explain working of 4 stroke S.I. engine with neat sketch.

5. Attempt any two:
   a) Explain construction and working of ice plant with neat sketch.
   b) A pneumatic rock drill requires 10 kg/min of air at 6 bar pressure. Find the power required to drive the single acting single stage reciprocating compressor receiving air at 1 bar and 27°C. Assume mechanical efficiency as 80% and value of index, n as 1.25. Take Cp = 1.005 kJ/kgk and Cv = 0.718 kJ/kgk for air. Also estimate isothermal efficiency of compression.
   c) Explain construction and working of turbojet with neat labelled sketch.

6. Attempt any four:
   a) Represent subcooling and superheating on P-h and T-S diagram in refrigeration also give its effect on C.O.P. of refrigeration.
   b) Define perfect and imperfect inter-cooling in air compressor and show it by graph also.
   c) Draw P-V and T-S diagram for dual cycle. Name the processes involved in it.
   d) Give classification of air conditioning system.
   e) Compare, closed cycle and open cycle gas turbine (any four point).
   f) State the different methods used to improve thermal efficiency of gas turbine. Explain any one in brief.