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.

1. A) Attempt any three:
   a) Write the equations for air standard efficiency of otto cycle and diesel cycle and state various terms involved in it.
   b) Define:
      i) Compression ratio ($R_c$) ii) Swept volume ($v_s$)
      iii) Cut off ratio iv) Clearance volume ($v_c$)
   c) Write uses of compressed air.
   d) Draw a neat sketch of vane compressor and label the different parts.

B) Attempt any one:
   a) What is the necessity of I.C. Engine Testing? What are the different test carried out on I.C. Engines?
   b) Explain the procedure for conducting Morse test.

2. Attempt any two:
   a) An I.C. Engine uses 6 kg of fuel having calorific value 44000 kJ/kg in one hour. The IP developed is 18 kW. The temperature of 11.5 kg of cooling water was found to rise through 25°C per minute. The temperature of 42 kg of exhaust gas with specific heat 1 kJ/kg°C was found to rise through 220°C. Draw the heat balance sheet for the engine.
   b) What is the necessity of multistage compression? Explain the working of two stage reciprocating air compressor with intercooler, with the help of p-v diagram.
   c) Explain vapour compression refrigeration (for dry saturated state of refrigerant) cycle with the help of P-h and T-s charts.

P.T.O.
3. Attempt any four:
   a) Draw actual valve timing diagram for 4-stroke petrol engine.
   b) Explain turb charging with a neat sketch.
   c) Explain three way catalytic convertor.
   d) Explain with a neat sketch turbo propeller w.r.to Jet propulsion.
   e) Explain the concept of super heating and sub cooling with the help of P-h and T-s charts.

4. A) Attempt any three:
   a) What are the causes of detonation in I.C. engine?
   b) What are the effects of pollutants on environment?
   c) What are the methods to improve thermal efficiency of gas turbine?
      Explain any one method.
   d) What is jet propulsion? Give the classification of jet propulsion system.

B) Attempt any one:
   a) Explain with neat sketch turning moment diagram for a four-stroke engine.
   b) The following results were obtained during Morse test on 4-stroke petrol engine.
      B.P. developed when all cylinders are working = 16.2 kW.
      B.P. developed when cylinder No. 1 cut off = 11.55 kW.
      B.P. developed when cylinder No. 2 cut off = 11.63 kW
      B.P. developed when cylinder No. 3 cut off = 11.68 kW
      B.P. developed when cylinder No. 4 cut off = 11.51 kW
      Calculate mechanical efficiency of engine.

5. Attempt any two:
   a) Differentiate between reciprocating and rotary compressors.
   b) Explain intercooling and reheating in gas turbine with the help of T-S diagram.
   c) Draw a neat sketch of vapour compression refrigeration cycle. Describe its working.

6. Attempt any four:
   a) What is MPFI? Explain any one MPFI system with neat sketch.
   b) Define:
      i) Free air delivered
      ii) Compressor capacity
      iii) Swept volume
      iv) Pressure ratio, w.r.to compressor.
   c) Explain the working principle of jet propulsion with a neat sketch.
   d) Differentiate between heat pump and refrigerator.
   e) Explain the working of window air conditioner with neat sketch.

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