

Sample Question Paper – I

Course : Automobile Engineering Group

Course Code : AE

Semester : Fourth

Subject : Heat Power Engineering

Max Marks : 80

9058

Time: 3 Hour

Instructions:

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Use of non-programmable calculator is permissible.
4. Illustrate your answer with neat sketches wherever necessary.
5. Preferably, write the answers in sequential order.

Q1: A) Attempt Any Four Of the following:

08 Marks

- a) State Zeroth law of thermodynamics.
- b) Define the term free air delivery (F. A. D.).
- c) Enlist four non-conventional energy sources.
- d) Define thermal conductivity and give its unit.
- e) Identify types of calorimeters used for measuring calorific value of solids, liquids and gaseous fuels.

Q1: B) Attempt any Two of the following:

08 Marks

- a) Point out parameters involved in the site selection of thermal power plant.
- b) Explain with neat sketch working of Axial flow compressor
- c) Classify gas turbine on the basis of a) cycle of operation b) thermodynamic cycle
- c) Application d) fuels used.

Q.2: Attempt any three of the following:

12 Marks

- a) One kg of ideal gas is heated from 18°C to 98°C . Assuming $R = 0.264\text{ KJ / kg k}$ and $(c_p / c_v) = 1.18$ for the gas. Find 1) Specific heats 2) Change in internal energy 3) change in enthalpy.
- b) Draw a neat sketch of economizer and state its function.
- c) State four appliances based on solar energy sources and draw neat-labeled sketch for any one.
- d) Draw a neat block diagram of layout for thermal power plant Indicate flow direction.

Q.3: Attempt any three of following:

12 Marks

- a) Explain with neat sketch working principal of simple impulse turbine.
- b) Draw P-V diagram of Brayton cycle used in gas turbine and explain thermodynamic processes involved in it.
- c) Enlist modes of heat transfer. Explain the phenomenon of convection.
 - i. State Stefan-Boltzman's law
 - ii. Temperature of black surface is 650°C & surface area is 0.25 m^2 . Calculate total rate of energy emission.
Take $\sigma = 5.67 \times 10^{-8}\text{ W/m}^2\text{ K}$

Q4: Attempt any two of the following:

16 Marks

- a) Describe Otto Cycle with Thermodynamic Processes on P-V and T-S Diagram
- b) What are the requirements of good fuel? Calculate the higher calorific value of a fuel which contains carbon = 85%, Oxygen = 6%, Hydrogen = 6%, Sulphur = 1.5% and Ash = 1.5%
- c) Calculate Heat required to convert 50 Kg of Steam at 7 bar pressure with dryness fraction = 0.8; into, Steam at 10 bar pressure with temperature = 210°C . Take $C_p = 2.3\text{ KJ / Kg K}$. Refer Steam Table for necessary values.

Q5: Attempt any three of the following:

12 Marks

- a) Enlist non-conventional energy sources and state advantages of biodiesel as an alternative fuel.
- b)
 1. State Fourier's law.
 2. The glass window of a car have a total area 4 square meter and the Thickness of the glass is 0.4 cm. Calculate rate at which heat enters into the car by conduction when temperature inside surface of window area is at 25°C and outside surface at 40°C . Take $K = 0.837\text{ W / m K}$
- c) Illustrate with neat sketch working of turbo prop engine.
- d) Give four advantages of gas turbine over steam turbine.

Q.6: Attempt any three of the following:-

12 Marks

- a) Differentiate between Reciprocating Air Compressor and Centrifugal Air Compressor on the basis of – i) Delivery Pressure ii) Capacity iii) Speed iv) Lubrication
- b) Enlist the elements of steam condensing plant and mention the function of each element in one sentence
- c) State two advantages of multistage compression. Draw P-V diagram for two stage single acting reciprocating air compressor and show saving in work done due to multistaging.
- d) Write four advantages of gaseous fuels over solid fuels.