[This question paper contains 4 printed pages]

Roll No.	

ASME-23B-MENG-II

MECHANICAL ENGINEERING (PAPER-II)

Time Allowed: 3 Hours [Maximum Marks: 100

QUESTION PAPER SPECIFIC INSTRUCTIONS

Please read the following instructions carefully before attempting questions.

1. There are EIGHT questions printed in English.
2. Candidate has to attempt FIVE questions in all.
3. Question No.1 is compulsory. Out of the remaining SEVEN questions, FOUR are to be attempted.
4. All questions carry equal marks. The number of marks carried by a question / part are indicated against it.
5. Write answers in legible handwriting.
6. Wherever any assumptions are made for answering a question, they must be clearly indicated.
7. Diagrams / Figures, wherever required, shall be drawn neatly. Unless otherwise mentioned, symbols and notations carry their usual standard meanings.
8. Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question shall be counted even if attempted partly. Any page or portion of the page left blank in answer book must be clearly struck off.
9. Re-evaluation / Re-checking of answer book of the candidate is not allowed.
10. Use of calculators is allowed.

1. With the help of block diagrams, show that the COP of a heat pump is greater than the COP of a refrigerator by unity. Also discuss the concept of 'reversed heat engine'. A cyclic heat engine operates between a source temperature of $765\,^0$C and a sink temperature of $45\,^0$C. Determine the minimum rate of heat rejection per kW net output of the engine. 20

2. Using p-v and T-s diagrams. show that for the same maximum pressure and temperature of the cycle and the same heat rejection; 20

$$\eta_{\text{Diesal}} > \eta_{\text{Dual}} > \eta_{\text{Otto}}$$

Draw a comparison between Rankine cycle and Brayton cycle.

3. State and explain Archimedes principle. Also explain the conditions for stability of floating and submerged bodies. A hot air balloon has 12 meter diameter and contains hot air at a temperature of $78\,^0$C. Outside air temperature is $24\,^0$C, while the air pressure at the location is 0.8 bar. Taking R=285 J/kg. K; calculate the maximum load that the hot air balloon can support. 20

4. (a) Explain various minor losses occurring in a pipe flow. A horizontal pipe of 450 mm diameter is reduced suddenly to 225 mm diameter. Calculate loss of head and flow rate. Assume $P_1 = 15.12 \times 10^4$ N/m^2 ; $P_2 = 13.23 \times 10^4$ N/m^2 and coefficient of contraction = 0.64. 10

(b) Using a neat sketch; describe the working of 'Laser Doppler Anemometer' to measure the velocity of flow. Also compare the working of venturi, nozzle and orifice meters to measure the flow through pipes. 10

5. What is a fin and how are these classified? Discuss the concept of 'critical thickness' of insulation and derive an expression for critical radius of insulation. A pipe, covered with a layer of asbestos, is exposed to outside air having temperature of 25°C, with h = 3 W/m^2°C. Calculate the critical radius of insulation for asbestos; assuming k = 0.17 W/m°C. Also calculate the heat loss at 205°C from a 5 cm diameter pipe under both conditions i.e. when it is covered with the critical radius of insulation and it is without insulation. 20

6. (a) Describe the working, role and types of superheaters. How do these help in enhancing the overall efficiency of a boiler. 10

(b) Using a schematic diagram; describe the working and applications of a solar pond power plant. Also discuss the impact of 'Satellite Solar-Power Systems' on earth's environment. 10

7. (a) How does working of a reaction turbine differ from working of an impulse turbine? A Pelton turbine generates 16 MW at 420 rpm at an available head of 825 meters. What should be the diameter of the nozzle and diameter of the wheel. Assume: Overall Efficiency = 0.85; C_v = 0.98 and Blade Speed Ratio = 0.48. 10

(b) Discuss advantages of centrifugal pumps over reciprocating pumps. How are centrifugal pumps classified on the basis of direction of flow of fluid? Why and where does cavitation occur in a centrifugal pump? 10

8. (a) Describe the thermodynamic cycle of a supercharged IC engine. Discuss the impact of supercharging on power output, fuel consumption and mechanical efficiency. What modifications are needed to convert an engine to a supercharged engine. 10

(b) Discuss various chemical requirements and physical requirements of a good refrigerant. What are secondary refrigerants and discuss their role. 10

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