

# 17410

**21314**

**3 Hours / 100 Marks**

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
  - (8) Use of Steam tables, logarithmic, Mollier's chart is permitted.

**Marks**

1. a) Attempt any **SIX** of the following: **12**
- i) What is isolated system?
  - ii) Define point function and path function.
  - iii) State Charle's law.
  - iv) List any four boiler accessories.
  - v) On P-V and T-S chart draw Isobric and Isochoric system.

P.T.O.

- vi) State any four applications of steam nozzles.
- vii) State Dalton's law of partial pressure.
- viii) Define emissivity and transmissivity.

b) Attempt any **TWO** of the following: **08**

- i) Distinguish between open system and closed system and give their examples.
- ii) Write steady flow energy equation and apply it to turbine and nozzle.
- iii) Explain the terms 'Heat' and 'Work'. Also explain why work is called 'High grade energy'.

2. Attempt any **FOUR** of the following: **16**

- a) Differentiate between work and internal energy.
- b) Explain what is PMM-I and PMM-II.
- c) Prove that Kelvin Plank and Clausious statements are equivalent.
- d) Draw the following gas processes on P-V and T-S diagrams-
  - i) Isothermal
  - ii) Adiabatic
- e) Explain in brief Avogadro's law.
- f) A tank  $2.3 \text{ m}^3$  capacity contains air at  $270^\circ\text{C}$  and  $0.1 \text{ MPa}$ . Some air is drawn out of tank without changing the temperature, untill pressure becomes  $4\text{kPa}$ . Calculate mass of air left in the tank.

**3. Attempt any FOUR of the following:****16**

- a) Explain isothermal process.
- b) Define :
  - i) Dry saturated steam
  - ii) Wet steam.
- c) Draw a steam generation process at constant pressure on T-S and H-S charts.
- d) Three Kg. of steam at pressure of 3MPa exists in dry and saturated condition. Calculate following -
  - i) Enthaply
  - ii) Entropy
  - iii) Volume
  - iv) Internal Energy
- e) Explain constant Enthaply process.
- f) What is function of air pre-heater? State its advantages.

**4. Attempt any FOUR of the following:****16**

- a) Classify steam turbines.
- b) Explain what is Mach number.
- c) Explain working of Impulse turbine.
- d) With neat diagram, explain velocity compounding.
- e) Define terms related to condenser
  - i) Vacuum efficiency
  - ii) Condenser efficiency
- f) The vacuum in a surface condenser is 705 mm of Hg and barometer reading is 760 mm of Hg. The outlet and inlet temperature of cooling water to condenser is 38°C and 31°C respectively. Determine condenser efficiency.

- 5. Attempt any TWO of the following:** **16**
- a) i) With neat labelled diagram, explain construction and working of any one type of cooling tower.
  - ii) Give sources of air leakages in the condenser. What are the effects of air leakages?
  - b) With neat sketch explain construction and working of surface condenser.
  - c) Give complete classification of boilers.
- 6. Attempt any TWO of the following:** **16**
- a) i) Classify heat exchangers.
  - ii) Determine the rate of heat transfer through a composite wall made of 30 mm thick steel plate and covered with an insulated material of 8 mm thick on one side. Thermal conductivity of steel and insulating material is  $58 \text{ W/m}^\circ\text{k}$  and  $0.115 \text{ W/m}^\circ\text{k}$  respectively. The temperature at inner and outer surfaces of wall are  $280^\circ\text{C}$  and  $40^\circ\text{C}$  respectively.
  - b) i) State Fourier's law and Stefan-Boltzman law.
  - ii) State applications of heat exchangers.
  - c) Draw neat labelled sketch of pipe in pipe heat exchanger and explain its construction and working.
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