Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 20862

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2022.

Fifth/Seventh Semester

Mechanical Engineering

ME 8595 – THERMAL ENGINEERING – II

(Common to : Mechanical Engineering (Sandwich))

(Regulations 2017)

Time : Three hours | Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the expression for velocity of steam at the nozzle throat. Also write velocity of steam at the nozzle throat if the discharge is maximum.
2. Define nozzle efficiency and velocity coefficient.
3. What are boiler mountings?
4. When a boiler is called high pressure boiler? Mention any two high pressure boiler.
5. How turbine with throttle governing is different from nozzle governing?
6. Write any four advantages of steam turbine over steam engines.
7. List the advantages of heat pipe heat exchanger (HPHE).
8. When the concept of cogeneration is to be more attractive?
9. What are the advantages of using an expansion valve instead of an expander in a vapour compression refrigeration cycle?
10. In an absorption type refrigeration system, heating in generator, refrigeration in evaporator and cooling by cooling water in condenser, take place at 95°C, –5°C and 27°C respectively. Determine the maximum COP of the system.

PART B — (5 × 13 = 65 marks)

11. (a) Dry saturated steam at a pressure of 15 bar enters in a nozzle and discharged with a pressure of 1.5 bar. Find the final velocity of the steam, when the initial velocity of the steam is negligible. If 10% of the heat drop is lost in friction, find the percentage reduction in the final velocity. (13)

Or

(b) (i) With the help of h-s diagram explain the metastable state of steam in nozzle. (8)

(ii) List the effects of supersaturation in steam nozzle. (5)

12. (a) (i) What are essentials for a good steam generator? (8)

(ii) List the factors that are considered for selection of boiler. (5)

Or

(b) Discuss in detail about the differences between fire tube and water tube boilers. (13)

13. (a) Steam at 5 bar and 200°C is first made to pass through nozzles. It is then supplied to an impulse turbine at the rate of 30 kg/min. The steam is finally exhausted to a condenser at 0.2 bar. The blade speed is 300 m/s. The nozzles are inclined at 25° with the direction of motion of the blades and the outlet blade angle is 35°. Neglecting friction, find the theoretical power developed by the turbine. (13)

Or

(b) With a neat diagram explain the working of impulse and reaction turbine. (13)

14. (a) Using a relevant sketch explain the working method of any two recuperative type waste heat recovery device. (13)

Or

(b) With a valid reason and sketch discuss the technical option for gas turbine cogeneration system. (13)

15. (a) A reversed carnot cycle is used for making ice at –5°C from water at 25°C. The temperature of the brine is –10°C. Calculate the quantity of ice formed per kWh of work input. Assume the specific heat of ice as 2 kJ/kg.K, latent heat of ice as335 kJ/kg and specific heat of water as 4.18 kJ/kg.K (13)

Or

(b) (i) What is Room sensible heat factor, Grand sensible heat factor, Effective room sensible heat factor and By pass factor? (8)

(ii) List out the desirable properties of refrigerant. (5)

PART C — (1 × 15 = 15 marks)

16. (a) In a boiler, the following observations were made :

Pressure of steam = 10 bar; Steam condensed = 540 kg/h; Fuel used = 65 kg/h; Moisture in fuel = 2% by mass; Mass of dry flue gases = 9 kg/kg of fuel; Lower calorific value of fuel = 32 MJ/kg; Temperature of the flue gases = 325°C; Temperature of boiler house = 28°C; Feed water temperature = 50°C; Mean specific heat of flue gases = 1 kJ/kg.K; Dryness fraction of steam = 0.95. Draw up a heat balance sheet for the boiler. (15)

Or

(b) (i) In a steam nozzle, the steam expands from 4 bar to 1 bar. The initial velocity is 60 m/s and the initial temperature is 200°C. Determine the exit velocity if the nozzle efficiency is 92%. (10)

(ii) Show that for Parson's reaction turbine the degree of reaction is 50%. (5)

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