Printed Page:- 04 **Subject Code**:- **AME0404**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM : IV CARRY OVER THEORY EXAMINATION - AUGUST 2023

Subject: Applied Thermodynamics

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION A **20**

1. Attempt all parts:-

1-a. Combustion reaction of fuels is a/an _____ reaction. (CO1) 1

(a) auto-catalytic

(b) exothermic

(c) endothermic

(d) none of the mentioned

1-b. The maximum adiabatic flame temperature in air is _____ the maximum flame temperature in pure oxygen. (CO1) 1

(a) lower than

(b) higher than

(c) same as

(d) not related

1-c. Which of the following boiler is best suited to meet the fluctuating demand of steam? (CO2) 1

(a) Locomotive boiler

(b) Lancashire boiler

(c) Cornish boiler

(d) Babcock and wilcox boiler

1-d. The economiser is used in boilers to (CO2) 1

(a) Increase thermal efficiency of boiler

(b) Economise on fuel

(c) Extract heat from the exhaust the gases

(d) Increase flue gas temperature

1-e. At ideal condition of vapour power cycle, reversible constant pressure heat rejection is carried out at (CO3) 1

(a) Boiler

(b) Turbine

(c) Condenser

(d) Feed pump

1-f. The efficiency of a Rankine cycle may be expected to (CO3) 1

(a) increase with decreasing temperature of heat rejection

(b) decrease with decreasing temperature of heat rejection

(c) decrease with increasing temperature of heat rejection

(d) increase with increasing exhaust pressure

1-g. In a reaction turbine, when the degree of reaction is zero, then there is (CO4) 1

(a) No heat drop in the moving blades

(b) No heat drop in the fixed blades

(c) Maximum heat drop in the moving blades

(d) Maximum heat drop in the fixed blade

1-h. If mach number is less than one then its flow is _____. (CO4) 1

(a) subsonic flow

(b) turbulent flow

(c) laminar flow

(d) supersonic flow

1-i. Automatic spray nozzles (CO5) 1

(a) increases the waste

(b) maintains a clean environment

(c) doesn't spray precise volume

(d) none of these

1-j. Boiler operation using computerized system measures (CO5) 1

(a) heat flux

(b) mass flow rate

(c) pressure

(d) all of these

2. Attempt all parts:-

2.a. Write the complete combustion reaction of propane. (CO1) 2

2.b. Explain fire tube boilers with examples. (CO2) 2

2.c. Draw a schematic diagram of Rankine cycle with reheating and regeneration. (CO3) 2

2.d. Explain the need of compounding in steam turbines. (CO4) 2

2.e. What is the need of Turbine control system? (CO5) 2

SECTION B **30**

3. Answer any <u>five</u> of the following:-

3-a. Differentiate between specific heat and latent heat. (CO1) 6

3-b. 300 g of ice at 0 °C converts into water at 0 °C in 1 minute when heat is supplied to it at a constant rate. In how much time, 200 g of water at 0 °C will change to 20 °C? Take specific latent heat of ice = 336 J/g. (CO1) 6

3-c. Calculate the height of chimney required to generate a pressure difference of 150 mm of water column. The temperature of outside air is 27 degree C and the average temperature of flue gases in the chimney is 200 degree C. (CO2) 6

3-d. Explain low level parallel flow jet condenser with a neat sketch. (CO2) 6

3.e. In a regenerative cycle the inlet conditions are 40 bar and 400°C. Steam is bled at 10 bar in regenerative heating. The exit pressure is 0.8 bar. Neglecting pump works determine the efficiency of the cycle. (CO3) 6

3.f. What do you understand by compounding of steam turbines? State various types of compounding impulse turbine. (CO4) 6

3.g. What are gas turbines? State the advantages of using electronically controlled gas turbine engines. (CO5) 6

SECTION C **50**

4. Answer any <u>one</u> of the following:-

4-a. What is the use of calorimeter? A molten metal of mass 150 g is kept at its melting point 800 °C. When it is allowed to freeze at the same temperature, it 10

gives out 75000 J of heat energy. What is the specific latent heat of the metal? If the specific heat capacity of metal is 200 J/kg/K, how much additional heat energy will the metal give out in cooling to – 50 °C ? (CO1)

4-b. Explain: a) Heat of reaction b) Heat of formation c) Significance of adiabatic flame temperature d) Fuel air ratio e) Fuel (CO1) 10

5. Answer any <u>one</u> of the following:-

5-a. What are different types of boiler draught? For the maximum discharge conditions through a chimney having height of 15 m determine the draught in mm of water when ambient air temperature is 15 degree C. (CO2) 10

5-b. What are the sources of air in condenser and effects of air leakages on condenser performance? (CO2) 10

6. Answer any <u>one</u> of the following:-

6-a. In an air standard Brayton cycle the minimum and maximum temperature are 300 K and 1200 K respectively. The pressure ratio is that which maximizes the net work developed by the cycle per unit mass of air flow. Calculate the compressor and turbine work, each in kJ/kg air, and thermal efficiency of the cycle. (CO3) 10

6-b. What is the ideal cycle for gas power plants? In an air standard Brayton cycle the minimum and maximum temperature are 303 K and 1500 K respectively. The pressure ratio is that which maximizes the net work developed by the cycle per unit mass of air flow. Calculate the compressor and turbine work, each in kJ/kg air, and thermal efficiency of the cycle. (CO3) 10

7. Answer any <u>one</u> of the following:-

7-a. Derive expressions for velocity and mass flow rate per unit area of steam in a nozzle. (CO4) 10

7-b. Explain constructional design and working of Pressure-Velocity Compounded impulse turbine. (CO4) 10

8. Answer any <u>one</u> of the following:-

8-a. Differentiate between electronic control of gas turbine and digital steam turbine. (CO5) 10

8-b. Give the significance of electronic control of gas turbine engines. What are the advantages of electronic control of gas turbine engines? (CO5) 10