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BRAINWARE UNIVERSITY

Term End Examination 2024-2025
Programme – B.Tech.(ME)-2021/B.Tech.(ME)-2023
Course Name – Applied Thermodynamics
Course Code - PCC-ME402
(Semester IV)

Full Marks : 60 **Time : 2:30 Hours**

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A
(Multiple Choice Type Question) 1 x 15=15

1. *Choose the correct alternative from the following :*

(i) The first law of thermodynamic for an adiabatic process, indicate as
a) du = δw b) du = 0
c) du = - δw d) du = δH+2δW

(ii) A close system, indicate as
a) Variable mass and variable energy system b) Fixed mass and variable energy system
c) Fixed mass and fixed energy system d) Constant entropy system

(iii) A system is define to be in equillibrium if
a) It is in mechanical, chemical and thermal equillibrium b) It is in thermal equillibrium
c) It is in electrical, chemical, mechanical equillibrium d) Volume is changing and pressure is constant

(iv) Identify the correct statement
a) temperature is an extensive property b) mass remains same in an open system
c) the system boundaries may expand or collapse d) an isolated system allows exchange of energy in the form of heat only

(v) Identify, the specific property of a thermodynamic system
a) viscosity b) pressure
c) density d) temperature

(vi) Gibbs free energy is also indicate as
a) Free energy b) Free entropy
c) Free enthalpy d) Free motion

(vii) Compressible flow is a flow that associate with
a) fluid density b) fluid pressure
c) fluid geometry d) fluid temperature

(viii) Identify the following statement is true about velocity of gas when it is subsonic

a) becomes sonic at throat
b) it is subsonic before throat
c) becomes supersonic till its exit
d) all of the mentioned

(ix) Identify the critical pressure ratio for a nozzle

a) 0.5
b) 1
c) 1.5
d) 2

(x) The difference of supersaturated temperature and saturation temperature at that pressure is indicate as

a) Degree of supersaturation
b) Degree of superheat
c) Degree of undercooling
d) None of these

(xi) The purpose of governing in steam turbines is to

a) Maintain the speed of the turbine
b) Reduce the effective heat drop
c) Reheat the steam and improve its quality
d) Completely balance against end thrust

(xii) The equivalent evaporation is defined as

a) The ratio of heat actually used in producing the steam to the heat liberated in the furnace
b) The amount of water evaporated or steam produced in kg per kg of fuel burnt
c) The amount of water evaporated from and at 100°C into dry and saturated steam
d) The evaporation of 15.653 kg of water per hour from and at 100°C

(xiii) Identify the thermodynamic process where pressure remains constant.

a) Isothermal process
b) Isobaric process
c) Adiabatic process
d) Isentropic process

(xiv) Compare the work done in an isothermal process to an adiabatic process.

a) Isothermal process does more work.
b) Adiabatic process does more work.
c) Both processes do the same work.
d) Work depends on the system.

(xv) Describe the concept of a polytropic process.

a) A process that follows the relation PV^n = constant.
b) A process that occurs at constant temperature.
c) A process that occurs at constant pressure.
d) A process that occurs at constant volume.

Group-B

(Short Answer Type Questions) 3 x 5=15

2. Describe a steady flow process. State all the assumptions for steady flow process. (3)
3. Explain the limitations of 1st law of thermodynamics. (3)
4. Describe the regeneration process with schematic diagram. (3)
5. Define a quasistatic process and state its salient characteristics. (3)
6. Calculate the entropy change in the system, and surroundings, and the total entropy change in the universe during a process in which 245 J of heat flow out of the system at 77°C to the surrounding at 33°C. (3)

OR

1 mole of an ideal gas, maintained at 4.1 atm and at a certain temperature, absorbs heat 3710J and expands to 2 litres. Calculate the entropy change in expansion process. (3)

Group-C

(Long Answer Type Questions) 5 x 6=30

7. Draw a neat diagram of air-conditioning system required in winter season. Explain the working of different components in the circuit. Is it possible to use the steam for such air-conditioning system. (5)
8. Show that the discharge through a nozzle is maximum when there is a sonic condition at its throat. (5)

9. Explain the advantages of multi-stage compression over a single stage compression for the same pressure ratio? Judge inter-cooling is necessary in multi-stage compression. (5)
10. Explain speed ratio, blade velocity coefficient, diagram or the blade efficiency and stage efficiency in connection with steam turbines. Explain the importance of each in the design of steam turbines. (5)

11. Explain the Statement: "Energy is always conserved, but its quality is always degraded". (5)
12. Generalize three methods which may be adopted to control the amount of air delivered by an air- compressor, and point out the main advantages of each. (5)

OR

Express the effect of intake temperature and pressure of air on the output of a compressor. (5)

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