Hall Ticket No. | | | | | | | | | | | Question Paper Code: AMEB04

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER-I

B. Tech III Semester End Examinations, May - 2019

Regulations: R18

THERMODYNAMICS

(Mechanical Engineering)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. a) Enumerate the Isobaric process from thermodynamic point of view? And derive its work done under p-V coordinates. **[7M]**
   b) If a gas of volume 6000 cm3 and at pressure of 100 kPa is compressed quasi statically according to pV2 = constant until the volume becomes 2000 cm3, determine the final pressure and the work transfer. **[7M]**

2. a) Explain the first law of thermodynamics applied to closed system when system undergoing a change of state? **[7M]**
   b) A piston cylinder device operates 1kg of fluid at 20atm pressure with initial volume is 0.04m3. Fluid is allowed to expand reversibly following pV1.45=C. So that the volume becomes double. The fluid is cooled at constant pressure until the piston comes back. Determine the work done in each process? **[7M]**

MODULE – II

3. a) Define Gibb's and Helmholtz's functions? Compare the importance of them. **[7M]**
   b) A domestic food freezer maintains a temperature of -15°C the ambient air temperature is 30°C, if heat leaks into the freezer at the continuous rate of 1.75kJ/sec. State the least power necessary to pump this heat out continuous? **[7M]**

4. a) What are the classifications of cement? Explain hydration reaction of Bogue compound indicating the products of hydration? **[7M]**
   b) Demonstrate action of plasticizers and classification of super plasticizer? **[7M]**

MODULE – III

5. a) Why can not a throttling calorimeter measure the quality, if the steam is wet? Explain how is the quality been measured? **[7M]**

b) A vessel of volume 0.04 m3 contains a mixture of saturated water and steam at a temperature of 250°C. The mass of the liquid present is 9 kg. Find the pressure. mass, specific volume, enthalpy, entropy. **[7M]**

6. a) Enumerate the Perfect Gas Laws and analyze from thermodynamics point of view? **[7M]**
   b) The volume of a high altitude chamber is 40m3.It is put into operation by reducing pressure from 1bar to 0.4bar and temperature from 250C to 50C. How many kg of air must be removed from the chamber during the process? Express this mass as a volume measured at 1bar and 250C. **[7M]**

MODULE – IV

7. a) Define dry bulb temperature, wet bulb temperature, dew point temperature and degree of saturation? **[7M]**
   b) The analysis by weight of a perfect gas mixture at 200C and 1.3bar is 10%O2, 70% N2, 15%CO2 and 5%CO. For a reference state of 00C and 1bar, determine partial pressure of the constituent and gas constant of mixture. **[7M]**

8. a) Differentiate the Relation between specific humidity and relative humidity and derive the relation between them? **[7M]**
   b) An air water vapor mixture enters an adiabatic saturator at 300C and leaves at200C, which is the adiabatic saturation temperature? The pressure remains constant at 100kPa. Determine the relative humidity and humidity ratio of the inlet mixture. **[7M]**

MODULE – V

9. a) Obtain an expression for the air standard efficiency on a volume basis of an engine working on the Otto cycle. And represent the processes on p-V and T-S diagrams. **[7M]**
   b) The stroke and cylinder diameter of Compression Ignition engine are 250mm and 150mm respectively. If the clearance volume is 0.0004m3 and fuel injection takes place at constant pressure for 5% of the stroke. Determine the efficiency of the engine. Assume the engine working on Diesel cycle? **[7M**

10. a) Explain the dual combustion cycle? Why the cycle is also called limited pressure cycle? Represent on p-V and T-S diagrams. **[7M]**
    b) A Bell-Coleman refrigerator operates between pressure limits of 1bar and 8bar. Air is drawn from the cold chamber at 9^0C, compressed and then it is cooled to 29^0C before entering the expansion cylinder. Expansion and compression follow the law $pV^{1.35}$=C. Calculate theoretical C.O.P of the system. Take ɣ of air is 1.4. **[7M]**

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

COURSE OBJECTIVES:

The course should enable the students to:

I	Understand the laws of thermodynamics and determine thermodynamic properties, gas laws
II	Knowledge of properties during various phases of pure substances, mixtures, usage of steam tables and Mollier chart, psychometric charts
III	Understand the direction law and concept of increase in entropy of universe.
IV	Understand the working of ideal air standard, vapor cycles and evaluate their performance in open systems like steam power plants.

COURSE OUTCOMES (COs):

CO 1	Describe the basic concepts and first law of thermodynamics.
CO 2	Describe the second law of thermodynamics and understand the concept of entropy and third law of thermodynamics.
CO 3	Understand the Pure Substances various thermodynamic processes.
CO 4	Understand the concept of mixtures of perfect gases and psychometric properties.
CO 5	Develop the concept power cycle with description and representation on P-V and T-S diagram.

COURSE LEARNING OUTCOMES (CLOs):

AMEB04.01	Understand the concepts of conservation of mass, conservation of energy.
AMEB04.02	Demonstrate knowledge of ability to identify & apply fundamentals to solve problems like system properties, amount of work transfer and heat during various processes.
AMEB04.03	Explore knowledge & ability to design the thermal related components in various fields of energy transfer equipment.
AMEB04.04	Derive the first law of Thermodynamics from the concept of conservation of energy
AMEB04.05	Discuss the nature of steady and unsteady processes under the influence of time.
AMEB04.06	Determine entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations based on Carnot Cycle.
AMEB04.07	Develop the second law of thermodynamics from the limitations of first law.
AMEB04.08	Knowledge of the Gibbs and Helmholtz free energies as equilibrium criteria, and the statement of the equilibrium condition for closed and open systems.
AMEB04.09	Discuss pressure-temperature, volume-temperature, pressure-volume phase diagrams and the steam tables in the analysis of engineering devices and systems.
AMEB04.10	Understand the inter relationship between thermodynamic functions and an ability to use such relationships to solve practical problems.

AMEB04.11	Understand the equation of state, specific and universal gas constants, throttling and free expansion processes.
AMEB04.12	Discuss deviations from perfect gas model, Vander Waals equation of state.
AMEB04.13	Understand mole fraction, mass friction, gravimetric and volumetric analysis, volume fraction
AMEB04.14	Discuss dalton's law of partial pressure, Avogadro's laws of additive volumes, and partial pressure, equivalent gas constant.
AMEB04.15	Understand enthalpy, specific heats and entropy of mixture of perfect gases.
AMEB04.16	Understand the process of psychrometry that are used in the analysis of engineering devices like air conditioning systems
AMEB04.17	Develop Otto, Diesel, Dual combustion cycles, description and representation on P-V and T-S diagram.
AMEB04.18	Discuss thermal efficiency; mean effective pressures on air standard basis.
AMEB04.19	Understand the comparison of various cycles
AMEB04.20	Understand introduction to Brayton cycle and Bell Coleman cycle.

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Bloom's Taxonomy Level
1	a	AMEB04.01	Understand the concepts of conservation of mass, conservation of energy.	CO 1	Understand
	b	AMEB04.02	Demonstrate knowledge of ability to identify & apply fundamentals to solve problems like system properties, amount of work transfer and heat during various processes.	CO 2	Understand
2	a	AMEB04.04	Derive the first law of Thermodynamics from the concept of conservation of energy.	CO 4	Understand
	b	AMEB04.04	Derive the first law of Thermodynamics from the concept of conservation of energy.	CO 4	Understand
3	a	AMEB04.08	Knowledge of the Gibbs and Helmholtz free energies as equilibrium criteria, and the statement of the equilibrium condition for closed and open systems.	CO 8	Remember
	b	AMEB04.06	Determine entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations based on Carnot Cycle.	CO 6	Understand
4	a	AMEB04.08	Knowledge of the Gibbs and Helmholtz free energies as equilibrium criteria, and the statement of the equilibrium condition for closed and open systems.	CO 8	Remember
	b	AMEB04.07	Develop the second law of thermodynamics from the limitations of first law	CO 7	Understand
5	a	AMEB04.09	Discuss pressure-temperature, volume-temperature, pressure-volume phase diagrams and the steam tables in the analysis of engineering devices and systems	CO 9	Remember
	b	AMEB04.09	Understand the inter relationship between thermodynamic functions and an ability to use such relationships to solve practical problems.	CO 3	Remember
6	a	AMEB04.11	Understand the equation of state, specific and universal gas constants, throttling and free expansion processes..	CO 11	Understand
	b	AMEB04.12	Discuss deviations from perfect gas model, Vander Waals equation of state.	CO 12	Understand
7	a	AMEB04.13	Understand masonry, English and Flemish bonds. Finishing plastering painting and know about building services.	CO 13	Remember
	b	AMEB04.13	Understand the types of properties of wood, aluminum and manufacture of glass.	CO 13	Understand

8	a	AMEB04.16	Understand the process of psychometric that is used in the analysis of engineering devices like air conditioning systems.	CO 16	Understand
	b	AMEB04.16	Understand the process of psychometric that is used in the analysis of engineering devices like air conditioning systems.	CO 16	Remember
9	a	AMEB04.17	Develop Otto, Diesel, Dual combustion cycles, description and representation on P-V and T-S diagram.	CO 17	Understand
	b	AMEB04.17	Principle of building planning and by laws and standards of building material components and orientation of the building.	CO 17	Remember
10	a	AMEB04.20	Understand introduction to Brayton cycle and Bell Coleman cycle.	CO 20	Understand
	b	AMEB04.20	Principle of building planning and by laws and standards of building material components and orientation of the building.	CO 20	Understand

Signature of Course Coordinator **HOD, ME**