Hall Ticket No | | | | | | | | | | | Question Paper Code: AAEB02

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - I

B.Tech III Semester End Examinations, November/December – 2019

Regulations: IARE - R18

ENGINEERING THERMODYNAMICS

(AERONAUTICAL 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)	Explain, the role of chemical equilibrium in thermodynamic equilibrium	**[7M]**
	b)	Two thermometers one centigrade and other Fahrenheit are immersed in a fluid, after the thermometers reached equilibrium with the fluid, it is noted that both the thermometers indicate the same numerical values. Find that the identical numerical values shown by the thermometers? Determine the corresponding temperature of the fluid, express in degrees Kelvin and degrees Rankine?	**[7M]**
2.	a)	List the scales of temperature and explain in detai, Sketch the constant volume gas thermometer and explain ita working.	**[7M]**
	b)	A fluid contain in a horizontal cylinder with a frictionless leak proof piston is continuously agitated by a stirrer passing through the cylinder cover. The diameter of the cylinder is 50cm and the piston is held against the fluid due to atmospheric pressure equal to 100kPa. The stirrer turns 8000 revolutions with an average torque of 1.5Nm. If the piston slowly moves outwards by 60cm. Determine the network transfer to the system?	**[7M]**
		MODULE – II	
3.	a)	Compare the first law and second law of thermodynamics with suitable examples.	**[7M]**
	b)	A domestic food freezer maintains a temperature of -150C, the ambient air temperature is 300C, 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)	Explain the limitations of First law of thermodynamics in detail? Explain about thermal reservoir with a neat sketch?	**[7M]**
	b)	Heat flows from a hot reservoir at 800K to another reservoir at 250K.If the entropy change of overall process is 4.25kJ/K, Compare calculation for the heat flowing out of the high temperature reservoir?	**[7M]**

	MODULE – III		
5.	a)	Explain, how the heat and work transfer observed in perfect gas, explain the equation of State with variations.	**[7M]**
	b)	On a particular day the weather forecast states that the dry bulb temperature is 37o C, while the relative humidity is 50% and the barometric pressure is 101.325 kPa. Find the humidity ratio, dew point temperature and enthalpy of moist air on this day.	**[7M]**
6.	a)	Explain in detail about terms 'heating and dehumidification' and 'heating and dehumidification.	**[7M]**
	b)	Moist air at 1 atm. pressure has a dry bulb temperature of 32o C and a wet bulb temperature of 26o C. Calculate a) the partial pressure of water vapour, b) humidity ratio, c) relative humidity, d) dew point temperature, e) density of dry air in the mixture, f) density of water vapour in the mixture and g) enthalpy of moist air using perfect gas law model and psychrometric equations.	**[7M]**
	MODULE – IV		
7.	a)	What is the difference between Otto and Diesel cycle? Show that the efficiency of Diesel cycle is always lower than the efficiency of the Otto cycle for the same compression ratio.	**[7M]**
	b)	An engine with 200mm cylinder diameter and 300mm stroke working on theoretical diesel cycle. The initial pressure and temperature of air used are 1bar and 270C. The cut of is 8% of the stroke. Determine air standard efficiency, mean effective pressure and power of the engine if the working cycles per minute are 300? Assume the compression ratio is 15 and the working fluid is air.	**[7M]**
8.	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)	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]**
	MODULE – V		
9.	a)	Show that, for estimating radial heat conduction through a spherical wall, the geometric mean area of the inner and outer surfaces to be considered	**[7M]**
	b)	Three 10 mm dia. Rods A, B and C protrude from a steam path at I00°C to a length of 0.25 m into the atmosphere at 20°C. The temperatures of the other ends are found to be 26.76°C for A, 32.00°C for B and 36.93°C for C. Neglecting the effects of radiation and assuming the surface film coefficient of 23 W/m^2K, evaluate their thermal conductivities.	**[7M]**
10	a)	Discuss the indicator diagram for reciprocating compressor. Also describe the factors responsible for deviation of hypothetical indicator diagram to actual diagram.	**[7M]**
	b)	An oil fraction at 121 °C is to be cooled at the rate of 20.15 kg/s in a simple counter flow heat exchanger using 5.04 kgs of water initially at 10°C. The exchanger contains 200 tubes each 4.87 m long and 1.97 cm o.d., with U_0 = 0.34 kW/m K. If the specific heat of oil is 2.094 kJ/kgK, calculate the exit temperature of the oil and the rate of heat transfer.	**[7M]**

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COURSE OBJECTIVES:

The course should enable the students to:

S. No	Description
I	Understand the laws of thermodynamics and determine thermodynamic properties, gas laws.
II	Apply knowledge of pure substances, mixtures, usage of steam tables and Mollier chart, psychrometric charts
III	Understand the direction law and concept of increase in entropy of universe.
IV	Understand the working of ideal air standard, vapour cycles and evaluate their performance in open systems like steam power plants, internal combustion engines, gas turbines and refrigeration systems.
V	Understand the basic concepts of heat transfer and working and types of heat exchangers.

COURSE OUTCOMES (COs):

CO 1	Understand basics of thermodynamics along with basic laws of thermodynamics.
CO 2	Understand the limitations of first law of thermodynamics and different forms of second law of thermodynamics.
CO 3	Describe the properties of pure substances with help of phase diagrams and also understand the psychrometric properties.
CO 4	Understand different processes in different standard cycles and calculate efficiencies of each cycle.
CO 5	Understand working of heat exchangers, different types of heat exchangers and working of them.

COURSE LEARNING OUTCOMES (CLOs):

Students, who complete the course, will have demonstrated the ability to do the following:

AAEB02.01	Understand the basic terms and terminologies of thermodynamics along with different view point of thermodynamic systems.
AAEB02.02	Get knowledge about concept of temperature and explain zeroth law of thermodynamics and also about quality of temperature.
AAEB02.03	Explain about first law of thermodynamics and its various corollaries along with Joules experiment.
AAEB02.04	Understand the limitations of first law of thermodynamics.
AAEB02.05	Explain about thermal reservoir, heat pump, heat engine and parameters of performance.
AAEB02.06	Explain second law of thermodynamics, Kelvin planck and Clausius statement of it.
AAEB02.07	Understand the Kelvin planck and Clausius equivalence, corollaries and understand about perpetual motion machine one.
AAEB02.08	Understand the term entropy, its principle and how it influences the availability and irreversibility of thermodynamic potentials.
AAEB02.09	Understand pure substances and phase diagrams and about terms triple point and critical point.
AAEB02.10	Understand how properties like wet bulb temperature, dry bulb temperature, dew bulb temperature help in building mollier chart and psychrometric chart.

AAEB02.11	Determine the equilibrium states of a wide range of systems, ranging from mixtures of gases, liquids, solids and pure condensed phases that can each include multiple components.
AAEB02.12	Introduction to concepts of power and refrigeration cycles. Their efficiency and coefficients of performance.
AAEB02.13	Ability to use modern engineering tools, software and equipment to analyze energy transfer in required air-condition application.
AAEB02.14	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.
AAEB02.15	Understand about working of heat exchangers and different types of heat exchangers.
AAEB02.16	Understand the working of gas compressors and air compressors and different types of air compressors.

MAPPING OF SEMESTER END EXAMINATION TO COURSE OUTCOMES

SEE Question No.		Course Learning Outcomes		Blooms' Taxonomy Level
1	a	AAEB02.03	Explain about first law of thermodynamics and its various corollaries along with Joules experiment.	Remember
	b	AAEB02.02	Get knowledge about concept of temperature and explain zeroth law of thermodynamics and also about quality of temperature.	Understand
2	a	AAEB02.01	Understand the basic terms and terminologies of thermodynamics along with different view point of thermodynamic systems.	Remember
	b	AAEB02.03	Explain about first law of thermodynamics and its various corollaries along with Joules experiment.	Understand
3	a	AAEB02.05	Explain about thermal reservoir, heat pump, heat engine and parameters of performance.	Understand
	b	AAEB02.04	Understand the limitations of first law of thermodynamics.	Understand
4	a	AAEB02.07	Understand the Kelvin planck and Clausius equivalence, corollaries and understand about perpetual motion machine one.	Remember
	b	AAEB02.06	Explain second law of thermodynamics, Kelvin planck and Clausius statement of it.	Understand
5	a	AAEB02.08	Understand the term entropy, its principle and how it influences the availability and irreversibility of thermodynamic potentials.	Remember
	b	AAEB02.11	Determine the equilibrium states of a wide range of systems, ranging from mixtures of gases, liquids, solids and pure condensed phases that can each include multiple components.	Understand
6	a	AAEB02.10	Understand how properties like wet bulb temperature, dry bulb temperature, dew bulb temperature help in building mollier chart and psychrometric chart.	Remember
	b	AAEB02.11	Determine the equilibrium states of a wide range of systems, ranging from mixtures of gases, liquids, solids and pure condensed phases that can each include multiple components.	Understand
7	a	AAEB02.12	Introduction to concepts of power and refrigeration cycles. Their efficiency and coefficients of performance.	Remember
	b	AAEB02.12	Introduction to concepts of power and refrigeration cycles. Their efficiency and coefficients of performance.	Understand
8	a	AAEB02.13	Ability to use modern engineering tools, software and equipment to analyze energy transfer in required air-condition application.	Remember
	b	AAEB02.14	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.	Understand
9	a	AAEB02.16	Understand the working of gas compressors and air compressors and different types of air compressors.	Understand
	b	AAEB02.15	Understand about working of heat exchangers and different types of heat exchangers.	Understand
10	a	AAEB02.15	Understand about working of heat exchangers and different types of heat exchangers.	Remember

SEE Question No.		Course Learning Outcomes		Blooms' Taxonomy Level
	b	AAEB02.16	Understand the working of gas compressors and air compressors and different types of air compressors.	Understand

Signature of Course Coordinator **HOD, AE**