Course Code: 20ME0303 **R20**

SIDDHARTH INSTITUTE OF ENGINEERING &TECHNOLOGY : PUTTUR

(AUTONOMOUS)

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QUESTION BANK (DESCRIPTIVE)

Subject with Code : Basic Thermodynamics(20ME0303) **Branch**: B. Tech - AGRI

Year & Sem : I-B. Tech & I-Sem **Regulation:** R20

UNIT –I

BASIC CONCEPTS

1	a)	Show that heat and work is a path function and not a property of the system	L1	CO1	6M
	b)	What is quasi static process? What are its characteristics features?	L1	CO1	6M
2		Explain the following a) Enthalpy b) Internal Energy c) Specific heat d) Thermodynamic cycle	L2	CO1	12M
3		Explain thermodynamics system, surrounding and universal. Distinguish between closed, open, isolated Systems.	L2	CO1	12M
4	a)	Explain about Thermodynamic Equilibrium	L2	CO1	6M
	b)	What is the difference between a closed system and an open system?	L1	CO1	6M
5	a)	Explain about Quasi Static Process.	L2	CO1	6M
	b)	What do mean by property"? Distinguish between intensive and extensive	L1	CO1	6M
6	a)	Differentiate between the cyclic process and non-cyclic process	L2	CO1	6M
	b)	State the following b) Pressure b) Temperature c) volume d) Density	L1	CO1	6M
7	a)	What do you understand by path function and point function? What are the exact and inexact differentials?	L1	CO1	6M
	b)	State the thermodynamic system control volume.	L1	CO1	6M
8		What is meant by thermodynamics equilibrium? Explains its types briefly.	L1	CO1	12M
9		State the differences between heat and work.	L1	CO1	12M
10		State the following c) State b) Path c) thermodynamic cycle d) Enthalpy	L1	CO1	12M

UNIT – II
FIRST LAW OF THERMODYNAMICS

1	a)	State and explain first law of thermodynamics.	L1	CO1	26M
	b)	In a cycle which has five processes, the following are the heat transfers at five points. Q_1 = +50KJ, Q_2 = 85KJ, Q_3= -30KJ, Q_4=-70KJ and Q5= +135KJ, the work transfers are W_1 = +60KJ, W_2 = -40KJ, W_3= 35KJ, W_4=-20KJ and W5=? Find out the work transfer at the fifth point.	L3	CO1	6M
2	a)	What are the Limitations of First laws of thermodynamics?	L1	CO1	6M
	b)	A system changes from state 1 to state 2 along the path 1a2 absorbs 75JK of heat and does 30 KJ of work. The system is returned from state 2 to state 1 along the pa 2b1 by doing a work of 10 KJ. Find out the heat transfer along the path 2b1.	L3	CO1	6M
3		A system undergoes a cycle composed of four processes and the energy transfers are tabulated below.	L3	CO1	12M

Process	Heat transfer in KJ/min	Work done in KJ/min	Change in internal energy KJ/min
1-2	550	230	-
2-3	230	-	380
3-4	-550	-	-
4-1	0	70	-

a) Complete the table and b) determine rete of work in KW.

4		The system contains piston and cylinder is subjected to a process, such that its volume increases from 0.004 m^3 to 0.034 m^3 at constant pressure of $750KN/m^2$. The heat supplied through the walls of cylinder the process is 8 KJ. Calculate the change in internal energy of the system.	L3	CO1	12M
5	a)	The air in a system expands from a temperature of 60^0C to 300^0C at a constant pressure of 2 bars. Calculate the heat transfer, work done and change in internal energy. The mass of the air is 0.6 Kg. Assume C_p=1.02 KJ/Kg^K and C_v= 0.71 KJ/Kg^K for air.	L3	CO1	6M
	b)	State second law of thermodynamics	L1	CO1	6M
6		Explain reversible and irreversible process	L2	CO1	12M
7		What are the different modes in which energy is stored in a system	L1	CO1	12M
8	a)	During a cycle consisting of four processes, the heat transfer are a s following. Q1 = +60KJ, Q_2 = -40KJ, Q_3= 15KJ, and Q_4=-20KJ, Determine the net work done by the system.	L3	CO1	6M
	b)	Explain reversible and irreversible process	L2	CO1	6M
9		State the concept of entropy of gas and availability and unavailability	L1	CO1	12M
10		Explain about the heat engine, refrigeration and heat pump.	L2	CO1	12M

UNIT – III
Law of Perfect Gas

1	a)	What is Avogadro’s law?	L1	CO3	6M
	b)	State Internal Energy and Enthalpy of Gas	L1	CO3	6M
2	a)	What is the gas equation of ideal gas?	L1	CO3	6M
	b)	State Dalton’s law of partial pressures	L1	CO3	6M
3	a)	Explain the differences between isothermal and adiabatic processes.	L2	CO3	6M
	b)	One kg of air in a closed system, initially at 5°C and occupying 0.3m^3 volume, undergoes a constant pressure heating process to 100°C. There is no work other than *pdv* work. Find (a) the work done during the process, (b) the heat transferred, and (c) the entropy change of the gas.	L3	CO3	6M
4	a)	Draw P –V and T-S diagrams on Isochoric process and Isobaric process with derive the (i) work done (ii) heat transfer (iii) internal energy.	L4	CO3	6M
	b)	Air contained in a cylinder fitted with a piston is compressed reversibly according to the law pv1.25 = const. The mass of air in the cylinder is 0.1 kg. The initial pressure is 100 kPa and the initial temperature 20°C. The final volume is 1/ 8 of the initial volume. Determine the work and the heat transfer.	L3	CO3	6M
5	a)	2.5 kg of gas with an initial volume 1.2 m^3 is cooled at constant pressure of 799 KN/m^2. The temperature at the end of cooling is 287 ^{0} c. determine (i) the change in internal energy (ii) work done (iii) heat transfer take R= 0.32 KJ/kg^k and cp=1.16 KJ/kg^k.	L3	CO3	6M
	b)	Determine the final temperature, external work done, change in internal energy, in the case of 2 kg of gas at 20^0 c being heated at constant volume until the pressure is doubled.	L3	CO3	6M
6	a)	Sketch the following processes on P-V and T-S diagrams (a) constant volume (b) constant pressure (c) constant temperature (d) isentropic process (e) polytropic process.	L4	CO3	6M
	b)	In a closed vessel a certain quantity of gas is heated from 200 KN/m^2 to 500 KN/m^2. If the volume of the vessel is 5000 liters find the quantity of i) heat transfer ii) change in internal energy iii) work done. c_p= 1.005 KJ/kg^k and c_v =0,715 KJ/kg^k .	L3	CO3	6M
7	a)	Derive an expression for work done during isothermal process.	L4	CO3	6M
	b)	0.2 kg of air at pressure of 1.1 bars and 15^{0}c is compressed isothermally to a pressure of 5.5 bars. Calculate (i) final volume (ii) heat rejected (iii) change in internal energy. Assume R= 0.292 KJ/Kg K	L3	CO3	6M
8	a)	Derive an expression for work done during isentropic process.	L4	CO3	6M

	b)	Air in a closed stationary system expands in a reversible adiabatic process from 0.5 MPa, 15°C to 0.2 MPa. Find the final temperature, and per kg of air, the heat transferred, and the work done.	L3	CO3	6M
9	a)	Explain the Specific heat capacities (C_p & C_v),	L3	CO3	6M
	b)	Derive an expression for heat transfer during polytropic process	L4	CO3	6M
10		Explain the differences between isochoric and isobaric processes.	L2	CO3	12M

UNIT – IV
THERMODYNAMIC CYCLES

1	a)	Find the change in enthalpy steam, initial pressure 10 bar and 0.98 then it will reach 20 bar and 350 temperature. By using steam tables.	L3	CO4	6M
	b)	Explain Limitations of Carnot cycle.	L2	CO4	6M
2		A power plant operating between 30 bars and 0.02 bars. If the steam supplied is $350\ ^0$ C and the cycle of operation is Rankine, Find (i) cycle efficiency, (ii) change in enthalpy.	L3	CO4	12M
3	a)	Explain the P-V, P-T, T-S diagrams of Pure Substances	L2	CO4	6M
	b)	Derive an expression for thermal efficiency & mean effective pressure of a dual combustion cycle by drawing PV and TS diagrams.	L4	CO4	6M
4		An engine working on the otto cycle is supplied with air at 0.1 MPa ,350C .the compression ratio is 8.the heat supplied is 2100 kJ/kg .calculate the Maximum pressure and temperature of the cycle ,the cycle efficiency and the mean effective pressure.(for air Cp=1.005kj/kg. k , Cv = 0.717 kJ/kgk, and R=0.287 kJ/kgk)	L3	CO4	12M
5	a)	Derive an expression for the thermal efficiency of Sterling cycle and draw P-V & T-S diagrams	L4	CO4	6M
	b)	Find the change in enthalpy steam, initial pressure 15 bar and 0.95 then it will reach 25 bar and 400 temperature. By using mollier diagram.	L3	CO4	6M
6		Derive an expression for the thermal efficiency of Ericson cycle and draw P-V & T-S diagrams	L4	CO4	12M
7	a)	Derive an expression for the thermal efficiency of Carnot cycle and draw P-V & T-S diagrams	L4	CO4	6M
	b)	Find the change in enthalpy steam, initial pressure 5 bar and 0.98 then it will reach 10 bar and 250 temperature.	L3	CO4	6M
8		Derive an expression for the thermal efficiency of Diesel cycle and draw P-V & T-S diagrams.	L4	CO4	12M
9	a)	Derive an expression for the thermal efficiency and mean effective pressure of an Otto cycle by drawing PV and TS diagrams	L4	CO4	6M
	b)	Find the change in enthalpy steam, initial pressure 12 bar and $200\ ^0$c then it will reach 0.95 in isentropic process.	L3	CO4	6M
10		State the followings b) Mollier Diagram c) Dryness Fraction d) Steam table	L1	CO4	12M

UNIT – V
VAPOUR POWER CYCLE

1	(a)	Describe the different operations of Rankine cycle and also derive the expression for its efficiency.	L1	CO5	6M
	(b)	A steam power plant works between 40 bar and 0.05 bar. If the steam supplied is dry saturated and the cycle of operation is Rankine, Find: (i) Cycle efficiency, (ii) Specific steam consumption.	L3	CO5	6M
2	(a)	State the methods of increasing the thermal efficiency of Rankine cycle.	L1	CO5	6M
	(b)	In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 30 bar and the exhaust pressure is 0.2 bar. Determine. (i) The pump work, (ii) Turbine work, (iii) Rankine efficiency, (iv) Condenser heat flow, (v) Dryness fraction at end of expression. Assume flow rate of 12kg/s.	L3	CO5	6M
3	(a)	Explain with the help of neat diagram about Regenerative Cycle.	L2	CO5	6M
	(b)	In a regenerative cycle inlet conditions are 40 bar and 400^0C. Steam is bled at 10 bar in regenerative heating. The exit pressure is 0.8 bar. Neglecting the pump work. Determine the efficiency of the cycle.	L3	CO5	6M
4	(a)	State the advantages of Regenerative cycle over Rankine cycle, and explain effect of operating conditions on Rankine cycle efficiency	L1	CO5	6M
	(b)	A Steam power plant operates on a theoretical reheat cycle. Steam in boiler at 150 bar, 550^0C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550^0C and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-S and h-s diagrams. Find: (i) Quality of steam at turbine exhaust,(ii) Cycle efficiency,(iii) Steam rate in kg/kWh.	L3	CO5	6M
5	(a)	A steam power plant works between 40 bar and 0.05 bar. If the steam supplied is dry saturated and the cycle of operation is Rankine, Find (i) cycle efficiency, (ii) Specific steam consumption	L3	CO5	6M
	(b)	Derive the expression for efficiency of Rankine cycle with P-V, T-S Diagrams.	L4	CO5	6M
6	(a)	State the advantages and disadvantages of a Reheat cycle	L1	CO5	6M
	(b)	A Steam power plant operates at a pressure of 15 bar, 300^0C expands through a high pressure turbine. It is reheated at a pressure of 4 bars to 300^0 C and expands through the low pressure turbine to a condenser pressure of 0.1 bar. Determine work done and cycle efficiency.	L3	CO5	6M
7	(a)	Write the followings a) Enthalpy of Water b) Enthalpy of Wet steam c) Enthalpy of Dry steam d) Enthalpy of super-heated steam	L1	CO5	6M
	(b)	Explain the followings a) dryness Fraction b) saturated water c) latent heat and d) sensible heat.	L2	CO5	6M
8		Steam at a pressure of 15 bars and 250^oC is expanded through a turbine	L3	CO5	12M

	at first to a pressure of 4 bar. It is then reheated at constant pressure to the initial temperature of $250^{o}C$ and is finally expanded to 0.1 bars. Using mollier chart, estimate the work done per kg of steam and amount of heat supplied.			
9	A steam power plant operates on a theoretical reheat cycle. Steam at boiler at $550^{o}C$, 150 bar expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to $550^{o}C$ and expands through the low pressure turbine to a condenser at 0.1 bar. Draw T-S and h-s diagrams. Find (i) Quality of steam at turbine exhaust (ii) Cycle Efficiency (iii) Steam rate in Kg/ Kw-hr.	L3	CO5	12M
10	In a single heater regenerative cycle the steam enters turbine at 30 bars, $400^{0}C$ and the exhaust pressure is 0.10 bar. The feed water heater operates at 5 bars. Calculate (i) Efficiency and steam rate of cycle. (ii) Also compare efficiency with cycle without regeneration. Pump work may be neglected.	L3	CO5	12M

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