SIDDARTHA INSTITUTE OF SCIENCE AND TECHNOLOGY : PUTTUR

(AUTONOMOUS)

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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Thermal Engineering (**19ME0314**) **Branch**: B.Tech - ME

Year & Sem: III-B. Tech & I-Sem **Regulation:** R19

UNIT –I

Air Compressors

1	a)	Explain the working principle of single stage single acting reciprocating air compressor.	L2	CO1	6M
	b)	Mention single stage compressor equation for work, if neglecting clearance volume.	L2	CO1	6M
2	a)	Construct an expression for minimum work required for two stage reciprocating air compressor with perfect inter-cooling and neglect clearance volume.	L3	CO1	6M
	b)	Explain the working of vane compressor with neat sketch	L2	CO1	6M
3		Construct the expression for work done single stroke single acting reciprocating compressor.	L3	CO1	12M
4		A single stage reciprocating compressor takes 1 m^3 of air per minute at 1.013 bar and 15 ^oC and delivers it at 7 bar. Assuming that the law of compression is $pV^{1.35}$ = constant, and the clearance is negligible, calculate the indicated power.	L3	CO1	12M
5	a)	Construct the multi stage compressor equation for work with perfect inter cooling.	L3	CO1	6M
	b)	Explain the working of Roots Blower compressor with neat sketch	L2	CO1	6M
6		A single stage reciprocating air compressor is required to compressor 1 kg of air from 1 bar to 4 bars. The initial temperate is 27 ^{0} c. compare the work requirement in the following cases i) Isothermal compression ii) Compression with PV 1.2 = const iii) Isentropic compression	L3	CO1	12M

7	a)	Explain the working of Centrifugal compressors with neat sketch	L2	CO1	6M
	b)	State how the air compressors are classified.	L1	CO1	6M
8	a)	Explain the working of Axial Flow compressor with neat sketch	L2	CO1	6M
	b)	Construct the relation for Volumetric efficiency of a single stage reciprocating compressor.	L3	CO1	6M
9		In a two stage air compressor the pressure are atmospheric 1.0 bar: intercooling 7.4 bar: delivery 42.6 bar. Assuming complete intercooling to the original temperature of 15°C and compression index n = 1, find the work done in compressing 1 kg of air.	L3	CO1	12M
10		Estimate the work done by a two stage reciprocation single acting air compressor to compress 2.8 m^3 of air per minute at 1.05 Bar and 10 ^{0} C to a final pressure of 35 bar. The intermediate receiver cools the air to 30 ^{0} C and 5.6 bar pressure. For air take n=1.4	L3	CO1	12M

UNIT – II
Gas Turbines

1	a)	What are essential components of a simple open cycle gas turbine Plant?	L1	CO2	6M
	b)	Write short note on fuels used for gas turbine.	L1	CO2	6M
2	a)	Explain about the open cycle and closed cycle turbines with neat sketches and also draw the P-V & T-S diagrams.	L2	CO2	6M
	b)	Define gas turbine and classification?	L1	CO2	6M
3	a)	Write the various methods to improve the performance of a gas turbine power plant.	L1	CO2	6M
	b)	State the merits of gas turbine over the IC engine.	L2	CO2	6M
4		A gas turbine unit receives air at 100 kPa and 300 K and compresses it adiabatically to 620 kPa with efficiency of the compressor 88%. The fuel has a heating value of 44180KJ/Kg and the Fuel/air ratio is 0.017 kg fuel /kg air. The turbine internal efficiency is 90%. Calculate the Compressor work , turbine work and thermal efficiency. Take Cp= 1.005KJ/Kg K.	L3	CO2	12M
5		Describe with neat sketches the working of simple constant pressure open cycle gas turbine	L2	CO2	12M
6	a)	List out the differences between the open cycle gas turbines and closed cycle gas turbines.	L2	CO2	6M
	b)	State the merits and demerits of closed cycle gas turbine.	L2	CO2	6M

7		The air enters the compressor of an open cycle constant pressure gas turbine at a pressure of 1 bar and temperature of 20° C. The pressure of the air after compression is 4 bar. The isentropic efficiencies of compressor and turbine are 80% and 85% respectively. The air-fuel ratio used is 90:1. If flow rate of air is 3 kg/s. find,(i) Power developed,(ii) Thermal efficiency of the cycle.	L3	CO2	12M
8		In an air standard regenerative gas turbine cycle the pressure ratio is 5.Air enters the Compressor at 1 bar, 300 K and leaves at 490 K. The maximum temperature in the cycle is 1000 K. Calculate the cycle efficiency, given that the efficiency of regenerator and the adiabatic efficiency of the turbine are each 80%.Assume for air, the ratio of specific heats is 1.4. Also show the cycle on T-S diagram.	L3	CO2	12M
9		In a gas turbine plans, the air is compressed in a single stage compressor from 1 bar to 9 bar and from an initial temperature of 300 K. The same air is then heated to a temperature of 800 K and then expanded in the turbine. The air is then reheated to a temperature of 800 K and then expanded in the second turbine. Find the maximum power that can be obtained from the installation, if the mass of air circulated per second is 2 kg. Take c_p, = I kJ/kg K.	L3	CO2	12M
10		A gas turbine consists of a two stage compressor with perfect intercooler and a single stage turbine. If the plant works between the temperature limits of 300K and 1000K and 1 bar and 16 bar : find the net power of the plant per kg of air. Take specific heat at const. pressure as 1 KJ/Kg K .	L3	CO2	12M

UNIT – III
Steam Nozzles

1		Define Steam nozzle and also explain about expansion of steam in nozzle with neat sketch.	L1	CO3	12M
2	a)	The dry sat steam at a pressure of 5 bar is expanded isentropically in nozzle to a pressure of 0.2 bar. Find the velocity of steam during the nozzle	L3	CO3	6M
	b)	Explain what is meant by critical pressure ratio of a nozzle.	L2	CO3	6M
3		Steam at it pressure of 6.3 bar and 200°C is expanded in a nozzle to a pressure 010.2 bar. Find the final velocity and dryness fraction of steam, if (a) Friction is neglected and *(b)* 10% of the heat drop is lost in friction.	L3	CO3	12M
4	a)	Explain various types of nozzles with neat sketches	L2	CO3	6M
	b)	The dry sat steam at a pressure of 5 bar is expanded Isentropically in a convergent nozzle to a pressure of 1 bar and X=0.94. Find the velocity of steam during the nozzle	L3	CO3	6M
5		Derive an expression for maximum discharge through convergent divergent nozzle for steam.	L3	CO3	12M
6	a)	What are types of condensers used in steam power plant?	L1	CO3	6M

	b)	Explain briefly mixing and non-mixing condensers	L2	CO3	6M
7		Dry saturated steam enters a steam nozzle at a pressure of 15 bar and is discharged at a pressure of 2 bar. If the dryness fraction of discharge steam is 0.96, what will be final velocity of steam? Neglect initial velocity. If 10% of heat drop is lost in friction, find the percentage reduction in the final velocity.	L3	CO3	12M
8		What are the effects of super saturation on discharge and heat drop?	L1	CO3	12M
9		In a convergent nozzle initial velocity 5 m/s dry sat steam at a pressure of 10 bars and 250 ^{0}c is expanded Isentropically until the dryness fraction reaching 0.9. Find the final pressure of the steam and exit velocity of steam during the nozzle. By using Mollier diagram.	L3	CO3	12M
10		Steam at a pressure of 10 bar and 0.9 dry discharges through a nozzle having throat area of 450 mm^2. If the back pressure is 1 bar. find i)final velocity of the steam, and ii) crass-sectional area of the nozzle at exit for maximum discharge.	L3	CO3	12M

UNIT – IV
Steam Turbines

1		In a D-level turbine, the steam enters the wheel through a nozzle with a velocity of 500 m/s and at an angle of 20 ^{0} to the direction of motion of the blade. The blade speed is 200 m/s and the exit angle of the moving blade is 25°. Find the inlet angle of the moving blade, exit velocity of steam and its direction and work done per kg of steam.	L3	CO4	12M
2	(a)	Explain the working process of reaction turbine.	L2	CO4	6M
	(b)	Show the velocity triangle diagram of reaction turbine	L3	CO4	6M
3	(a)	Distinguish between impulse and reaction turbines.	L2	CO4	6M
	(b)	Explain the working process of impulse turbine.	L2	CO4	6M
4	(a)	What are the methods of steam turbine governing?	L1	CO4	6M
	(b)	List out the various losses in steam turbines? Explain them Briefly	L1	CO4	6M
5		The velocity of steam, leaving the nozzles of an impulse turbine, is 1200 m/s the nozzle angle is 20°. The blade velocity is 375 m/s and the blade velocity coefficient is 0.75.Assuming no loss due to shock at inlet, calculate for a mass flow of 0.5 kg/s and symmetrical blading: (a) blade inlet angle ; (b) driving force on the wheel ; (c) axial thrust on the wheel; and (d) power developed by the turbine.	L3	CO4	12M
6		A reaction turbine runs at 300 r.p.m. and its steam consumption is 15400 Kg/hr. The pressure of steam at certain pair is 1.9 bar; its dryness 0.93 and power developed by the pair is 3.5 kW. The discharging blade tip angle is 20° for both fired and moving blades and the axial velocity of flow is 0.72 of the blade velocity. Find the	L3	CO4	12M

		drum diameter and blade height Take the tip leakage steam as 8%, but neglect blade thickness.			
7	(a)	What are the advantages of steam turbine over steam engine?	L1	CO4	6M
	(b)	Show the velocity triangle diagram of impulse turbine.	L2	CO4	6M
8		Explain about the various methods of Governing steam turbines with neat sketches.	L2	CO4	12M
9		In one stage of a reaction steam turbine, both the fixed and moving blades have inlet and outlet blade tip angles of 35^0 and 20^0 respectively. The mean blade speed is 80 m/s and the steam consumption is 22500 kg per hour. Determine the power developed In the pair, if the isentropic heat drop for the pair is 23.5 KJ per kg.	L3	CO4	12M
10		Steam at 5 bar and 200 ^{0} C is first made to pass through nozzles. It is then supplied to an impulse turbine at the rate of 30 kg/minute. The steam is finally exhausted to a condenser at 0.2 bar. The blade speed is 300 m/s. The nozzles are inclined at 25^0 with the direction of motion of the blades and the outlet blade angle is 35^0 Neglecting friction, find the theoretical power developed by the turbine.	L3	CO4	12M

UNIT – V
I C Engines

1		What is the difference between IC and EC engines? How the Internal Combustion Engines are classified	L1	CO5	12M
2	a)	What are the important basic components of an IC engines?	L1	CO5	6M
	b)	With a neat sketch explain any three parts in Internal Combustion engine	L2	CO5	6M
3	a)	Explain any six classifications of Internal Combustion engines.	L2	CO5	6M
	b)	Show the theoretical and actual valve-timing diagram for Diesel engine.	L2	CO5	6M
4		The following observations were recorded in a test of one hour duration on a single cylinder oil engine working on four stroke cycle. Bore = 300mm, Stroke = 450 mm, Fuel used = 8.8 kg, Calorific value of fuel = 41800 kJ/kg, Average speed = 200 rpm, m.e.p. = 5.8 bar, Brake friction load = 1860 N, Quantity of cooling water = 650 kg, Temperature rise = 22^{o}C, Diameter of the brake wheel = 1.22 m. Calculate: i). Mechanical efficiency, ii). Brake thermal efficiency. Draw the heat balance sheet	L3	CO5	12M
5		Following observations were recorded during a test on a single cylinder oil engine:Bore = 300 mm, Stroke = 450 mm, Speed = 300 rpm, i.m.e.p. = 6 bar, net brake laod = 1.5 kN, brake drum diameter = 1.8 m, brake rope diameter = 2 cm. Calculate: i) Indicate power, ii) Brake power, iii) Mechanical efficiency.	L3	CO5	12M
6		The following results refer to a test on a petrol engine: Indicated power = 30 kW, Brake power = 26 kW, Engine speed = 1000 rpm, fuel per brake power hour = 0.35 kg, calorific value of the fuel used = 43900 kJ/kg. Calculate: i) The indicated thermal efficiency ii) The brake thermal efficiency iii) the mechanical efficiency.	L3	CO5	12M
7	a)	Explain the working of 4-stroke Diesel engine.	L2	CO5	6M
	b)	Give explanation about the Working Principle of 2-Stroke SI Engine	L1	CO5	6M
8		A single cylinder, four stroke cycle oil engine is fitted with a rope brake. The diameter of the brake wheel is 600 mm and the rope diameter is 26 mm. The dead load on the brake is 200 N and the spring balance reads 30 N. If the engine runs at 450 rpm, Discover the brake power of the engine?	L3	CO5	12M

9	a)	Explain the working of 4-stroke Petrol engine.	L2	CO5	6M
	b)	Show the theoretical and actual valve-timing diagram for Petrol engine.	L2	CO5	6M
10		A two stroke cycle internal combustion engine has a mean effective pressure of 6 bar. The speed of the engine is 1000 rpm. If the diameter of piston and stroke are 110 mm and 140 mm respectively, find the indicated power developed.	L3	CO5	12M

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