Course Code: 20CE0160 **R20**

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
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QUESTION BANK (DESCRIPTIVE)

Subject with Code: Thermal Engineering(20ME0305) **Course & Branch**: B.Tech - ME

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

UNIT –I

1	a	What are the various classifications of air compressors?	L2	CO1	6M
	b	Explain the working of any two Rotary compressors with neat sketch.	L2	CO1	6M
2	a	A two stage air compressor compresses air from 1 bar and 20°C to 42 bar. If the lawof compression is pv1.3 = constant and the inter cooling is perfect. Find per kg of air (i) The work done in compression.	L3	CO1	6M
	b	Derive the relation for work done on single stage reciprocating compressor without Clearance.	L3	CO1	6M
3	a	With the help of neat sketch explain the working principle of single stage Reciprocating air compressor.	L2	CO1	6M
	b	With the help of neat sketch explain the working principle of multi stage reciprocating air compressor with effect of intercooler.	L2	CO1	6M
4		Derive the relation for Volumetric efficiency of a single stage reciprocating Compressor.	L3	CO1	12M
5	a	Derive an expression for minimum work required for two stage reciprocating air Compressor with perfect inter-cooling and neglect clearance volume.	L3	CO1	6M
	b	A single stage single acting air compressor has an effective swept volume of $5m^3$/min and delivers to a receiver pressure of 6.5 bar. The index of compression is 1.2, and the temperature at the end of suction stroke is 35°C and pressure is 1.03 bar. Calculate: (i) The mass of compressed air per minute (ii) The Temperature at the end of Compression. Take R=0.287 KJ/Kg K.	L4	CO1	6M
6	a	With the help of neat sketch, explain the working of roots blower and vane type blower.	L2	CO1	6M
	b	A single stage reciprocating air compressor is required to compress 80 m^3 of air from 1 bar abs to 10 bar abs. Find the work to be supplied if the law of expansion is$PV^{1.25}$=Constant.	L3	CO1	6M
7		An air compressor cylinder has 150mm bore and 150mm stroke and the clearance is 15%. It operates between 1 bar, 27^0C and 5 bar. Take polytropic exponent n=1.3 forcompression and expansion processes. Find (i). Cylinder volume at the various salient points of in cycle. (ii). Flow rate in m3/min at 720 rpm. (iii). Volumetric efficiency.	L3	CO1	12M

8		A single –stage double –acting air compressor is required to deliver 14 m3 of air per Minute measured at 1.013 bar and 150^0C. The delivery pressure is 7 bar and the speed300 r.p.m. Take the clearance volume as 5% of the swept volume with the compression and expansion index of 1.3 Calculate: (i) Swept volume of the cylinder; The delivery temperature;(iii). Indicated power.	L4	CO1	12M
9		Air from an initial condition of 25^oC and 1 bar abs is compressed in 2 stage according to law $PV^{1.25}$=constant and with complete intercooling to a pressure of 36 bar abs. Estimate the minimum work required and heat rejected in the intercooler per kg of air. Assume C_P=1.05KJ/Kg and R=0.29KJ/Kg K.	L4	CO1	12M
10		Describe the working of Centrifugal and axial flow compressors with a neat sketch	L2	CO1	12M
		UNIT-II			
1		Explain the working of Open Cycle Brayton cycle with neat sketch.	L2	CO2	12M
2		With the help of neat sketch describe the working of Closed Cycle Brayton cycle	L2	CO2	12M
3		Derive the expression for the efficiency of Brayton cycle in terms cycle parameters.	L3	CO2	12M
4		In an oil gas turbine installation, air is taken at 1bar and 30^0C.The air is compressed to 4 bar and then heated by burning the oil to a temperature of 500^0C.If the air flows at the rate of 90Kg/Minute, find the power developed by the plant. Take γ for air as 1.4 and C_p as 1KJ/KgK.	L3	CO2	12M
5		Air enters the compressor of a gas turbine plant operating on Brayton cycle at 1 bar, 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume the turbine work as 2.5 times the compressor work. Take γ=1.4	L4	CO2	12M
6		Briefly explain the working of Brayton Cycle with the help of p-v diagram and T-s diagram.	L2	CO2	12M
7		Explain various methods of Improving Brayton Cycle Efficiency.	L2	CO2	12M
8		In a Gas turbine plant, the air is compressed in a single stage compressor from 1 barto 9 bar and from an initial temperature of 300K.The same air is then heated to a temperature of 800K and then expanded in the turbine. The air is then reheated to a temperature of 800K 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 2Kg. Take C_p=1 KJ/Kg.	L3	CO2	12M
9		A gas turbine plant consists of two stage compressor with perfect intercooler and a single stage turbine. If the plant works between the temperature limits of 300K	L3	CO2	12M

		and 1000K and 1 bar and 16 bar. Find the power of the plant per kg of air. Take specific heat at constant pressure as 1KJ/Kg K.			
10		Explain Reheat and Intercooling Brayton cycle with neat sketch.	L2	CO2	12M
		UNIT-III			
1	a	Define Steam nozzle and also explain about expansion of steam in nozzle with neat sketch.	L2	CO3	6M
	b	Explain various types of nozzles with neat sketches.	L2	CO3	6M
2	a	Explain about super saturated flow in nozzles with neat sketch. And represent in H-S diagram.	L2	CO3	6M
	b	What are the effects of friction on flow through nozzle?	L2	CO3	6M
3		Determine the throat area, exit area and exit velocity for a steam nozzle to pass 0.2kg/s when the inlet conditions are 12 bar and 250^{0}C and final pressure is 2bar.Assume that the expansion is isentropic and inlet velocity is negligible. Take n=1.3 for superheated steam.	L3	CO3	12M
4		Derive an expression for condition of maximum discharge through a nozzle.	L3	CO3	12M
5	a	Derive an expression for critical pressure ration through nozzle.	L3	CO3	8M
	b	Write a relation for calculating Mass flow rate of steam through nozzle.	L3	CO3	4M
5					
6	a	Dry saturated steam enters a frictionless adiabatic nozzle with negligible velocity at atemperature of 300^{0}C.It is expanded to a pressure of 5000KPa.The mass flow rate is 1Kg/s. Calculate the exit velocity of steam.	L3	CO3	6M
	b	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 befinal velocity of steam?	L3	CO3	6M
7	a	Define the following terms (i) Degree of super saturation (ii) Degree of intercooling	L1	CO3	4M
	b	Dry saturated steam at a pressure of 11 bar is Expanded in a nozzle to 2 bar. If the flow is isentropic, determine, (i) the throat velocity (ii) exit velocity (iii) ratio of cross sectional area from exit to throat.	L3	CO3	8M
8		A steam nozzle passes 0.3kg/s when the inlet conditions are 14 bar and 300^{0}C and final pressure is 2.5bar.Assume that the expansion is isentropic and inlet velocity is negligible. Determine throat area, exit area, dryness fraction and exit velocity. Take n=1.3 for superheated steam.	L3	CO3	12M
9		How do you classify the condensers and describe about Surface condenser with a neat sketches.	L2	CO3	12M
10		Classify the non-mixing type condensers and explain them in brief.	L2	CO3	12M

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		UNIT-IV			
1	a	Draw and explain the velocity triangle of impulse turbine.	L1	CO4	8M
	b	Derive an expression for work done in impulse turbine.	L3	CO4	4M
2	a	Draw and explain the velocity triangle of reaction turbine.	L1	CO4	8M
	b	Derive an expression for work done in reaction turbine.	L3	CO4	4M
3		Draw the combined velocity triangle of Impulse turbine and explain the salient features.	L1	CO4	12M
4		Draw the combined velocity triangle of Parson's reaction turbine and explain the salient features.	L1	CO4	12M
5		Explain Compounding and its types with appropriate sketches.	L2	CO4	12M
6		The following data refers to a single stage impulse turbine; Steam velocity = 800m/s; Blade speed=300m/s; Nozzle angle=20^0; Blade outlet angle=25^0.Neglecting effect of friction, calculate the power developed by the turbine for the steam flow rate of 25Kg/s. Also calculate the axial thrust on the bearings.	L4	CO4	12M
7		In a De-Laval turbine, steam issues from the nozzle with a velocity of 1200m/s. The nozzle angle is 20^0, the mean blade velocity is 400m/s. The inlet and outlet angles of blades are equal. The Mass of steam flowing through turbine per hour is 1200kg.Calculate Force on blade and Power developed.	L4	CO4	12M
	a	What are the various losses in steam turbines? Explain them Briefly.	L2	CO4	6M
8	b	Explain Throttle Governing in steam turbines with neat sketch.	L2	CO4	6M
9		Distinguish between impulse and reaction turbines.	L4	CO4	12M
10		Explain Nozzle Governing and Bypass Governing in steam turbines with neat sketches.	L2	CO4	12M
		UNIT-V			
1	a	Explain any six classifications of Internal Combustion engines.	L2	CO5	6M
	b	With a neat sketch explain any three parts in Internal Combustion engine	L2	CO5	6M
2	a	Draw theoretical and actual valve-timing diagram for 4 stroke engine.	L2	CO5	6M
	b	Draw Theoretical and actual port timing diagrams of a 2 stroke engine.	L2	CO5	6M
3	a	Explain the Working Principle of 2-Stroke Engine.	L2	CO5	6M
	b	Briefly explain the Working Principle of 4-Stroke SI Engine.	L2	CO5	6M
4		Compare 2-stroke engine with 4-stroke engine.	L2	CO5	12M
5		List out various parameters of performance and explain the methods of Measuring them.	L3	CO5	12M

6		The following readings were taken during the test of a single cylinder four stroke oil engine: Cylinder diameter=250mm,Stroke Length=400mm,M.E.P=7bar, Engine Speed=250rpm, Net Load on the brake=1080N,Effective diameter of the brake=1.5 metres, Fuel used per hour=10Kg, calorific value fo fuel=44300Kj/Kg. Calculate (i)Indicated Power (ii) Brake Power (iii) Mechanical Efficiency (iv) Indicated thermal efficiency	L3	CO5	12M
7		Briefly explain the method of Measuring the following (i) Fuel Consumption. (ii) Air intake (iii) Exhaust gas composition (iv) Brake power (v) Indicated power (vi) Friction power	L3	CO5	12M
8		During a test on single cylinder oil engine, working on four stroke cycle and fittedwith a rope brake, the following readings are taken. Effective diameter of brake wheel =630mm, Effective Brake Load=170N,Engine Speed=450 rpm, Area of Indicator Diagram=420mm^2, Length of indicator diagram=60mm, Spring Constant=1.14 bar/mm, Cylinder Diameter=100mm, Stroke=150mm, Quantity of oil used=0.815Kg/hr, Calorific Value of oil used=42000KJ/Kg. Calculate (i) IP & BP (ii) Mechanical Efficiency (iii) Brake thermal Efficiency (iv) BSFC.	L3	CO5	12M
9		A test on a single cylinder 4 stroke Otto cycle engine yields the following data:950Nm Torque, 7.6 bar mean effective pressure, 280mm bore, 305mm stroke, 300 rpm, 0.003Kg/s fuel consumption with heating value of 42000KJ/Kg. Determine: (i) Indicated thermal Efficiency (ii) Mechanical efficiency.	L3	CO5	12M
10	a	Write a brief note on the heat balance sheet	L2	CO5	4M
	b	A Diesel Engine developing an IP of 37.5KW consumes fuel of calorific value 45000KJ/Kg at the rate of 9 Kg/hr. If 8.5 KW are absorbed by friction and pumping losses within the engine, Determine (i) Brake Power (ii) BSFC (iii) Mechanical Efficiency (iv) Indicated thermal efficiency (v) Brake thermal efficiency.	L3	CO5	8M

Prepared by: J Suresh