Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FOURTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: ME204

Course Name: THERMAL ENGINEERING (ME)

Max. Marks: 100 Duration: 3 Hours

Use of Approved Data Book is Permitted

PART A

Answer any three full questions, each carries 10marks.

			Marks
1		An ideal Rankine cycle employs steam as working fluid. Saturated vapor enters the turbine at 80 bar and saturated liquid exits the condenser at a pressure of 0.08 bar. The net power output of the cycle is 100 MW. Both turbine and the pump have an isentropic efficiency of 85%.Determine for the cycle (a) the thermal efficiency, (b) the mass flow rate of the steam, and (c) the rate of heat transfer into the working fluid as it passes through the boiler.	(10)
2		In a single heater regenerative cycle the steam enters the turbine at 30 bar, 400^{o}C and the exhaust pressure is 0.1 bar. The feed water heater is a direct contact type which operates at 5 bar. Find 1) the efficiency and specific steam consumption of the cycle, 2) Increase in efficiency and specific steam consumption as compared to cycle without regeneration. Pump work may be neglected	(10)
3	a)	Explain 'Reheat Factor'. Why is its magnitude always greater than unity?	(4)
	b)	Define the term degree of reaction as applied to a steam turbine. Show that for Parson's reaction turbine the degree of reaction is 50%.	(6)
4		Explain the working of Babcock-Wilcox boiler with neat sketch and differentiate between fire tube and water tube boiler.	(10)

PART B

Answer any three full questions, each carries 10marks.

5	a)	Compare Otto and Diesel cycle for i) same compression ratio and heat input, ii) same maximum pressure and heat input.	(4)
	b)	Explain the supercharging of engine.	(6)
6		In an engine working on Diesel cycle, inlet pressure and temperature are 1 bar and 17^{o}C respectively. Pressure at the end of adiabatic compression is 35 bar. After constant pressure heat addition, the ratio of expansion is 5. Calculate i) heat addition, ii) heat rejection and iii) efficiency of the cycle. Assume Υ = 1.4, C_p = 1.004 kJ/kg K and Cv = 0.717 kJ/kg	(10)
7	a)	Sketch the heat balance curves for C I Engine at constant speed and discuss the nature of curve.	(4)
	b)	Describe Morse test. What are the assumptions made in this test?	(6)
8	a)	Explain flash point, fire point and calorific value of fuels.	(6)
	b)	Explain the working of a rotary engine with a neat sketch.	(4)

PART C

Answer any four full questions, each carries 10marks.

9	a)	What are the basic requirements of a good combustion chamber	(4)
	b)	"Factors tending to increase detonation in S I Engine tend to reduce knock in C I Engine". Explain the validity of the above statement.	(6)
10	a)	Write a short note on alternate fuels for IC engines.	(5)
	b)	What is EGR? Explain how EGR reduces NOx emission.	(5)
11	a)	Write a short note about the pollutants from SI and CI engines.	(4)
	b)	Explain the stages of combustion in C I Engine.	(6)
12		At the design speed the following data apply to a gas turbine set employing a heat exchanger: Isentropic efficiency of compressor = 75%, Isentropic efficiency of turbine = 85%, Combustion efficiency = 98%, Mechanical Transmission efficiency = 99%, Mass rate of air = 22.7 kg/sec, Pressure ratio = 6:1, Heat exchanger effectiveness = 75%, Maximum cycle temperature = 1000 K. The ambient air pressure and temperature are 15^{o}C and 1.013 bar respectively. Assuming no pressure loss in heat exchanger and combustion chamber, calculate the net power output, specific fuel consumption and thermal efficiency of the cycle. Take calorific value of fuel as 43125 kJ/kg, c_p = 1.005 kJ/kg K and Υ = 1.4 during compression and c_p = 1.147kJ/kg K and Υ = 1.33 during heating and expansion.	(10)
13		In an open cycle constant pressure gas turbine, air enters the compressor at 1.02 bar and 27^{o}C. The pressure of air after the compression is 4.08 bar. The isentropic efficiencies of the turbine and compressor are 80% and 85% respectively. The air fuel ratio used is 80:1. Find the power output and thermal efficiency of the cycle if the flow rate of air is 2.5 kg/sec. Take c_p = 1 kj/kg K and Υ = 1.4 for air and gases. Calorific value of fuel used is 41720 kJ/kg.	(10)
14	a)	Derive an expression for thermal efficiency of Brayton cycle. Represent Brayton cycle in Pv and Ts diagrams.	(5)
	b)	Discuss the means of improving the specific output and thermal efficiency of the simple open cycle gas turbine plant.	(5)

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