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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S,FE) Examination June 2022 (2015 scheme)

Course Code: ME204

Course Name: THERMAL ENGINEERING

Max. Marks: 100 *Use of steam table is permitted.* Duration: 3 Hours

Missing data if any, may be suitably assumed

PART A

Answer any three questions. Each question carries 10 marks.

1	a)	Draw a neat diagram of Benson Boiler. What are its special features?	5
	b)	Explain with a neat sketch, the working of binary vapour cycle and represent it on T-s diagram.	5
2	a)	With suitable sketches, differentiate impulse and reaction turbines based on: (i) Blade shape and (ii) Blade efficiency vs velocity ratio plot	5
	b)	Draw velocity triangles for an impulse turbine blading, where steam enters the blade without shock, and leaves the blade in axial direction. Derive the equation for blade efficiency.	5
3	a)	The blade angles at inlet and discharge of a Parson reaction turbine are 35° and 20° respectively. The speed of rotation is 1500 rpm. At a particular stage, the mean ring diameter is 0.67 m and steam condition is at 1.5 bar, 0.97 dry. Estimate: (i) Required height of blading to pass 3.6 kg/s of steam, (ii) power developed by the ring.	10
4	a)	A steam power plant operates with a single reheat system. Steam from boiler at 150 bar, 550°C expands through the high pressure turbine. It is reheated at a constant pressure of 40 bar to 550°C and then expands through the low pressure turbine to 0.1 bar. With the help of h-s diagram, find (i) quality of quality of steam at turbine exhaust; (ii) cycle efficiency and (iii) specific steam consumption. State any assumptions if used.	10

PART B

Answer any three questions. Each question carries 10 marks

5	a)	Discuss the effect of variation of specific heat on power developed by an Otto cycle with neat sketches.	5

	b)	Discuss the purpose of turbocharging with a neat sketch.	5
6	a)	Define: (i) Mean Effective pressure, (ii) Volumetric efficiency and (iii) specific fuel consumption	5
	b)	List out desirable characteristics for SI engine fuels.	5
7	a)	An engine works on air standard diesel cycle, whose compression ratio is 14. The pressure and temperature at beginning of compression is 1 bar, 300 K respectively. The maximum temperature of the cycle is limited to 2500°C. Determine the thermal efficiency and mean effective pressure of the cycle.	10
8	a)	Describe any method for experimental determination of the Indicated Power of a multi-cylinder engine with illustration.	10

PART C

Answer any four questions. Each question carries 10 marks.

9	a)	List out any two biofuels and their characteristics.	5
	b)	Write a short note on soot control methods for CI engines.	5
10	a)	List the stages of combustion in CI engine and explain the events in each stage in detail with the support of pressure vs crank angle diagram.	10
11	a)	Classify combustion chambers for CI engine. Explain various types of combustion chamber designs with suitable diagrams.	10
12	a)	Explain with a neat sketch, the CAN-type combustion chamber of a gas turbine plant. Why air supply is staged in primary, secondary and tertiary forms employed in combustors?	5
	b)	Explain the effect of intercooling on gas turbine plant output and efficiency.	5
13	a)	Derive an expression for the optimum pressure ratio producing maximum net specific work output for an air standard Brayton cycle, when compression and expansion are non-isentropic. State all assumptions made	10
14	a)	The pressure ratio of an open cycle constant pressure gas turbine plant is 6. The temperature range of the plant is 288 K and 1073 K. Take specific heat of air and gases are 1 kJ/kg K and 1.07 kJ/kg K respectively. Calorific value of fuel is 40 MJ/kg. Both compressor and turbine operates with isentropic efficiency of 92%. Determine: (i) thermal efficiency; (ii) indicated power of the plant for air flow rate of 5 kg/s and (iii) Air-fuel ratio.	10

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