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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Fourth Semester B.Tech Degree (S,FE) Examination August 2021 (2015 Scheme)

Course Code: ME204
Course Name: THERMAL ENGINEERING

Max. Marks: 100 Duration: 3 Hours

Use of steam tables permitted

PART A

Answer any three questions. Each question carries 10 marks.

1	a)	Draw the *T-s* diagram of Rankine cycle with superheated steam at the inlet of the steam turbine and develop the equation of cycle efficiency.	4
	b)	A steam turbine plant operates on Rankine cycle with steam entering turbine at 40 bar, 350ºC and leaving at 0.05 bar. Steam leaving turbine condenses to saturated liquid inside condenser. Feed pump, pumps the liquid into boiler. Determine (i) pump work per kg of steam, (ii) net work per kg of steam and (iii) the cycle efficiency assuming all processes to be ideal.	6
2	a)	Explain the working of a Velox boiler with the aid of a neat sketch.	10
3	a)	The data pertaining to single stage impulse turbine is as follows: Steam velocity = 500 m/s; Blade speed = 200 m/s; Exit angle of moving blade = 25°; Nozzle angle = 20°. Neglecting the effect of friction when passing through the blade passages, calculate (a) inlet angle of moving blade, (b) exit velocity , (c) work done per kg of steam, (d) axial thrust and (e) diagram efficiency.	10
4	a)	Illustrate any two methods of compounding steam turbines	5
	b)	Obtain the condition for maximum blade efficiency in single stage impulse turbine.	5

PART B

Answer any three questions. Each question carries 10 marks

5	a)	List the advantages of four stroke cycle engine over two stroke cycle engines?	4
	b)	An engine is working on an Otto cycle, and has air at a pressure of 1 bar and temperature 300K at the entry. Air is compressed adiabatically to a compression ratio of 7. The heat is added at constant volume till the temperature rises to 2000 K. Find (i) the air standard efficiency. (ii) the heat supplied. Take C_v =0.717 kJ/kg K and γ = 1.4.	6

6	a)	Derive an expression for the Air Standard Efficiency of the Diesel cycle in terms of the compression ratio and cut-off ratio.	10
7	a)	During the test on single cylinder oil engine, working on the four stroke cycle and fitted with a rope brake, the following readings are taken: Effective diameter of brake wheel = 630 mm ; Dead load on brake = 200 N; Spring balance reading = 30N ; Speed = 450 r.p.m. ; Area of indicator diagram = 420 mm^2 ; Length of Indicator diagram = 60 mm ; Spring scale = 1.1 bar per mm ; Diameter of cylinder =100mm ; Stroke = 150 mm ; Quantity of oil used = 0.815 kg/h ; calorific value of oil = 42000 kJ/kg Calculate brake power, indicated power, mechanical efficiency, brake thermal efficiency and brake specific fuel consumption.	10
8	a)	What is the influence of octane number and cetane number on petroleum fuels?	5
	b)	Determine the air-fuel ratio and the theoretical amount of air required by mass for complete combustion of a fuel containing 85% of carbon, 8% of hydrogen, 3% of oxygen, 1% of sulphur and the remaining as ash.	5

PART C

Answer any four questions. Each question carries 10 marks.

9	a)	Explain the difference between 'Pre-ignition" and "Auto-ignition"	5
	b)	What is meant by "delay period". What are the various factors that affect the delay period?	5
10	a)	List and discuss on any four alternative fuels for internal combustion engines	5
	b)	Sketch and explain T-head and L-head combustion chamber of SI engine.	5
11	a)	Bring out the differences in the combustion process in S.I. and C.I. engines with the aid of pressure – crank angle diagrams	10
12	a)	Discuss the different methods employed for improving the performance of open cycle gas turbine plant	10
13	a)	Write the merits and demerits of gas turbine over internal combustion engine	5
	b)	With the aid of a diagram, explain any one combustion chamber for gas turbines.	5
14	a)	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. If $W_T = 2.5\ W_C$, where W_T and W_C are the turbine and compressor work respectively, calculate the maximum temperature and the cycle efficiency.	10

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