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Code No. : 14524

VASAVI COLLEGE OF ENGINEERING (Autonomous), HYDERABAD**B.E. (Mech. Engg.: CBCS) IV-Semester Main Examinations, January-2021****Applied Thermodynamics**

Time: 2 hours

Max. Marks: 60

*Note: Answer any NINE questions from Part-A and any THREE from Part-B***Part-A (9 × 2 = 18 Marks)**

Q. No.	Stem of the question	M	L	CO	PO
1.	Classify air compressors.	2	1	1	1
2.	Write the advantages of multistage compression over single stage compression.	2	1	1	1
3.	Why actual cycles deviate from air-standard cycles?	2	1	2	1
4.	Draw the layout of magneto ignition system and label the parts	2	1	2	1
5.	Define octane number and cetane number.	2	1	3	1
6.	What are the parameters considered in the design of combustion chambers for SI Engines?	2	1	3	1
7.	Classify steam generators (boilers).	2	1	4	1
8.	List any four boiler accessories.	2	1	4	1
9.	Explain cogeneration.	2	1	5	1
10.	Define critical pressure ratio of a nozzle.	2	1	5	1
11.	Define the terms isothermal efficiency and volumetric efficiency vis-à-vis reciprocating compressor.	2	1	1	1
12.	Define specific fuel consumption and brake thermal efficiency of an IC engine.	2	1	2	1
Part-B (3 × 14 = 42 Marks)					
13. a)	Derive the expression for the work done in a single-stage reciprocating air compressor with clearance volume.	7	2	1	1
b)	A two-stage single acting reciprocating air compressor has a capacity of 4.5 m ³ /min. The suction pressure for the LP stage is 1 bar. The temperature of air at the start of compression in each stage is 27 °C and the delivery pressure is 15 bar. The clearance factor in L.P. cylinder is 5%. The index of compression and expansion is 1.3 and the speed of the compressor is 140 rpm. The intercooler pressure is such that the work is shared equally between the two cylinders. Determine (i) the indicated power and ii) the bore diameter & stroke of LP cylinder, if bore diameter is equal to the stroke.	7	4	1	2
14. a)	What are the drawbacks of carburation system? Explain the operation of multi-point fuel injection system with the help of neat sketch.	7	2	2	1
b)	A four-stroke cycle gas engine has a bore of 200 mm and a stroke of 300 mm. The compression ratio of the engine is 5.5:1. The engine runs at 400 rpm. The imep is 4.5 bar, the air/gas ratio by volume is 6:1 and the calorific value of the gas is 12,000 kJ/m ³ at NTP. At the beginning of the compression stroke the temperature is 67 °C and the pressure is 0.97 bar. Calculate the IP, thermal efficiency and the relative efficiency.	7	4	2	2

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15. a)	Explain the stages of combustion in C I Engine with the help of p-θ diagram.	8	2	3	1
b)	List the major pollutants from the exhaust of gasoline and diesel engines. What are the effects of air pollution from IC engines?	6	2	3	1
16. a)	Explain the differences between water tube and fire tube boilers.	8	2	4	1
b)	Explain the working principle of jet condenser and surface condenser with the help of a simple sketch.	6	2	4	1
17. a)	Derive an expression for the critical pressure ratio of a convergent-divergent nozzle when steam is expanded reversibly and adiabatically.	8	2	5	1
b)	“Rankine cycle is the standard cycle of thermal power plants though Carnot cycle is the ideal power cycle.” Explain with the help of relevant T-S diagrams.	6	2	5	1
18. a)	Derive the expression for volumetric efficiency of a reciprocating air compressor.	7	2	1	1
b)	During the testing of a 4-stroke oil engine fitted with a simple rope brake dynamometer the following readings were taken: Brake wheel diameter = 60 cm, net load on the brake = 200 N, speed = 450 rpm, area of the indicator diagram = 4.2 cm ² , length of the indicator diagram = 6 cm, spring constant = 6 bar/cm, bore = 10 cm, stroke = 15 cm, bsfc = 0.3 kg/kWhr, calorific value of the fuel = 43960 kJ/kg. Determine the brake power, indicated power, mechanical efficiency, brake mean effective pressure and indicated thermal efficiency. Neglect the diameter of the rope.	7	4	2	2
19.	Answer any <i>two</i> of the following:				
a)	Discuss the variables affecting the ignition delay in CI Engine combustion.	7	3	3	1
b)	Explain the working principle of Benson boiler with the help of a neat sketch.	7	2	4	1
c)	A convergent-divergent nozzle is required to discharge 2 kg of steam per second. The nozzle is supplied with steam at 10 bar and 200 °C and discharge takes place against a back pressure of 0.34 bar. Estimate the throat and exit areas. Assume isentropic flow and take n = 1.3.	7	4	5	2

M: Marks; L: Bloom's Taxonomy Level; CO: Course Outcome; PO: Programme Outcome

S. No.	Criteria for questions	Percentage
1	Fundamental knowledge (Level-1 & 2)	71 %
2	Knowledge on application and analysis (Level-3 & 4)	29 %
3	*Critical thinking and ability to design (Level-5 & 6) (*wherever applicable)	0 %
