



ACE Engineering College

(An Autonomous Institution)

Question Paper Code:

ME403PC

ACE-R20

Semester End Examination II B. Tech- II Semester- AUGUST -2022 THERMAL ENGINEERING-I MECHANICAL ENGINEERING

Time: 3 Hours

Max. Marks: 70

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Answer any 5 Questions out of 8 Questions from the following

Q.No	Question	Marks
1.	Explain the working of a four stroke CI engine and indicate the processes on PV and TS plots.	14
2. a)	Explain the various factors that influence the flame speed.	7
b)	With the help of a neat diagram explain the working principle of indirect injection combustion chamber of a C.I. engine?	7
3. a)	Compare and contrast fans, blowers and compressors.	7
b)	A single acting, single cylinder reciprocating air compressor is compressing 20 kg/min. of air from 110kPa, 30°C to 600 kPa and delivers it to a receiver. Law of compression is $pv^{1.25} = \text{constant}$. Mechanical efficiency is 80%. Find the power input to compressor, neglecting losses due to clearance, leakages and cooling.	7
4. a)	Explain the effect of various engine variables on SI engine knock.	7
b)	Explain with figures the various types of combustion chambers used in CI engines	7
5.	A single-stage double-acting air compressor is required to 14 m ³ of air per minute measured at 1.013 bars and 20°C. The delivery pressure is 6 bar and the speed 300 rpm. Take the clearance volume as 5% of the swept volume with the compression and expansion index of $n=1.3$. Calculate: (i) Swept volume of the cylinder (ii) The delivery temperature (iii) Indicated power	14
6.	Air at a temperature of 290 K flows in a centrifugal compressor running at 20000 rpm. The other data is as follows: Slip factor= 0.80 ; Isentropic total head efficiency =0.75 ; Outer diameter of blade tip = 500 mm Determine : (i) The temperature rise of air passing through the compressor (ii) The static pressure ratio. (iii) Assume that the velocities of air at inlet and exit of the compressor are same	14
7. a)	Describe with neat sketch the working of a simple constant pressure open cycle gas turbine.	7
b)	A gas turbine unit receives air at 100 kPa and 300 Kelvin and compresses it adiabatically to 620 kPa with efficiency of the compressor 88%. The fuel has a heating value of 44180 kJ/kg and the fuel/air ratio is 0.017. The turbine internal efficiency is 90%, The maximum temperature in a gas turbine unit is 1500 Kelvin. Calculate the compressor work, turbine work and thermal efficiency.	7
8.	An axial flow air compressor of 50% reaction design has blades with inlet and outlet angles of 50° and 15° respectively. The compressor is to produce a pressure ratio of 6:1 with an overall isentropic efficiency of 0.8 when the air inlet temperature is 45° C. The blade speed and axial velocity are constant throughout the compressor. If blade speed is 480 rpm, Find power input required by the compressor.	14