Sr. No. 013406

August/September 2022

B.Tech(ME) Re-Appear IV SEMESTER

Applied Thermodynamics (PCC-ME-202)

Time: 3 Hours **Max. Marks:75**

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Use of Psychometric Chart, Steam and Refrigeration Tables is allowed.*

PART -A

Q1 (a) Define stoichiometric air-fuel ratio. (1.5)

(b) Draw a diesel cycle on a p-V plot. Also give the expression for its air standard efficiency defining all the terms used (no derivation needed). (1.5)

(c) An engine working on an Otto cycle has pressure at the beginning of compression as 1 bar and at the end of compression as 11 bar. Find its thermal efficiency. (1.5)

(d) Give few desirable properties of a refrigerant. (1.5)

(e) Define compression ratio. (1.5)

(f) Differentiate between primary and secondary refrigerants. (1.5)

(g) Define sensible heat factor. (1.5)

(h) Define specific humidity and relative humidity. (1.5)

(i) Define volumetric efficiency of a reciprocating air compressor. (1.5)

(j) What is meant by reheat factor and state why its value is always greater than unity? (1.5)

PART -B

Q2 (a) What is a fuel? Compare solid and liquid fuels giving at least two examples of each. (5)

(b) What do you understand by exhaust gas analysis? Discuss the exhaust gas analysis by an orsat apparatus. (10)

Q3 (a) What is a reheat cycle? Derive its thermal efficiency. (5)

(b) A simple Rankine cycle steam power plant operates between the temperatures of 260°C and 95°C. The steam is supplied to the turbine at a dry saturated condition. In the turbine, it expands in an isentropic manner. Determine the efficiency of the Rankine cycle followed by the turbine and the efficiency of the Carnot cycle, operating between these two temperature limits. Draw the turbine cycle on h-s and T-s diagrams. (10)

Q4 (a) With the help of a psychometric chart, explain the following processes: (5)
(i) Heating and humidification
(ii) Cooling and dehumidification

(b) What is a vapour compression refrigeration system? Establish an expression for its coefficient of performance. Also mention its advantages over the air refrigeration system. (10)

Q5 (a) Give the relation between velocity of steam and heat in a nozzle. What is the effect of friction on the flow of steam through a nozzle? (5)

(b) Find the expression for the mass of steam discharged through a nozzle. Also find the expression for the maximum discharge and hence define the critical pressure ratio. (10)

Q6 (a) Derive the expression for work done in a single stage compressor. (5)

(b) A single stage, single acting reciprocating air compressor has a bore of 240 mm and a stroke length 320 mm. It receives air at 1.013 bar and 22^{0}C and delivers it at 6 bar. If the compression follows the law $pV^{1.3}$= C and clearance is 7 percent of the stroke volume, determine (i) mean effective pressure and (ii) power required to drive the compressor, if it runs at 620 rpm. (10)

Q7 What do you mean by compounding of steam turbines? Discuss in detail the various methods of compounding. (15)

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