

B. Tech. Sem - III (Mechanical Engg.) (2014 COURSE) (CBCS) :
SUMMER - 2019

SUBJECT: ENGINEERING THERMODYNAMICS

Day: Tuesday
Date: 14/05/2019

S-2019-2578

Time: 02.30 PM TO 05.30 PM
Max Marks: 60

N.B.:

- 1) All questions are **COMPULSORY**.
 - 2) Figures to the **RIGHT** indicate Full marks.
 - 3) Use of non- programmable **CALCULATOR** is allowed.
 - 4) Use of steam table is allowed.
 - 5) Assume suitable data if necessary.
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Q.1 What is the difference between a refrigerator and a heat pump? A reversed heat engine working as refrigerator absorbs heat from low temperature region of 650KJ when work input is 250KJ. Find its COP and heat transferred to surroundings. If the reversed heat engine work as heat pump. Find its COP. If the system work as engine. Find its efficiency. **(10)**

OR

Q.1 Define: **(10)**

- | | |
|----------------------|------------------|
| i) Thermal reservoir | iii) Heat pump |
| ii) Heat Engines | iv) Refrigerator |

An engine develops 80 KW when it receives heat at the rate of 240 KW. Find the efficiency and the heat rejected. If this engine is reversed to act as refrigerator with same rate of energy transfers find its COP.

Q.2 Explain with neat sketches any three of the following: **(10)**

- | | |
|--------------------------|---------------------|
| i) Water level indicator | iv) Blow off clock |
| ii) Pressure gauge | v) Steam stop valve |
| iii) Feed check valve | |

OR

Q.2 What is an equivalent evaporation? A boiler evaporates 3.6 Kg of water per Kg of coal into dry saturated steam at 10 bar. The temperature of feed water is 32°C. Find equivalent evaporation from and at 100°C. **(10)**

Q.3 Explain the process of formation of steam. Also explain critical and triple point. What is throttling process? How it is used to measure dryness fraction. **(10)**

OR

Q.3 A Rankine cycle operates between boiler pressure of 10 MPa and condenser pressure of 5KPa. Determine the thermal efficiency, work ratio and specific steam consumption. **(10)**

P.T.O.

Q.4 Sketch the theoretical indicator diagram for a single stage, single cylinder reciprocating compressor with clearance volume showing the various processes. For such compressor, derive the expression for work done in terms of mass rate of flow of air, initial temperature, pressure ratio and index of compression. **(10)**

OR

Q.4 Determine the size of the cylinder for a double acting air compressor of 40 KW indicated power, in which air is drawn in at 1 bar and 15°C and compressed according to the law $pv^{1.2} = \text{constant}$ to 6 bar. The compressor runs at 100 r.p.m. with average piston speed of 152.5 m/min Neglect clearance. **(10)**

Q.5 A rotary air compressor compresses 100Kg of air per minute from 1.2 bar and 20°C to 4.8 bar. Find the power required by the compressor, if the compression is isentropic and by the relation $pv^{1.5} = C$ Take $C_p = 1.008 \text{ KJ/Kg.K}$. **(10)**

OR

Q.5 Explain with a neat sketch the working of a centrifugal compressor and obtain an expression for the work done. **(10)**

Q.6 The volumetric analysis of a gas is CO₂ 14%, CO 1%, O₂ 5% and N₂ 80%. Calculate the fuel gas composition by mass. **(10)**

OR

Q.6 A fuel gas has the following percentage composition by mass. CO₂-13.3%, CO-0.95%, O₂-8.35%, and N₂-77.4%. Convert this into volumetric analysis. **(10)**

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