

**B. TECH. SEM - III (MECHANICAL ENGG.) (2014 COURSE) (CBCS)
: WINTER - 2017**

SUBJECT: ENGINEERING THERMODYNAMICS

Day: **Friday**
Date: **19/01/2018**

W-2017-2049

Time: **10.00 AM TO 01.00 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 a)** Prove that the kelvin plank and Clausius statements of the second law of thermodynamics are equivalent to each other. **(04)**
b) State a prove the Carnot theorem. **(06)**

OR

- Q.2 a)** State a prove the clausius theorem. **(06)**
b) A heat engine operates on a carnot cycle between source and sink temperatures of 338°C and 56°C respectively. If the heat engine receives 390 KJ of heat from the source find the efficiency net work done and heat rejected to the sink. **(04)**

- Q.3 a)** Discuss in brief with their function **(04)**
i) Fusible plug ii) Man hole
iii) Blow off cock iv) Feed check valve
b) A boiler generates 500 kg/h feed water at 300°C . Coal used is 60 kg/h of calorific value 30,000 kJ/kg. Find **(06)**
i) Equivalent evaporation
ii) Boiler efficiency

OR

- Q.4 a)** Discuss equivalent evaporation, factor evaporation and boiler efficiency. **(05)**
b) Explain the terms forced draught, induced draught and balanced draught with neat sketch. **(05)**

- Q.5 a)** Explain how the wet steam dry saturated steam and superheated steam is produced. **(04)**
b) A steam power plant is supplied with dry saturated steam at a pressure of 12 bar and exhausts into a condenser at 0.1 bar calculate the Rankine efficiency. **(06)**

OR

- Q.6 a)** Explain construction and working of combined separating and throttling colorimeter with neat sketch. **(05)**
b) Compare Carnot and Rankine cycle. **(05)**

- Q.7 a)** When is multi-stage compression used for air? What are its advantages? **(05)**
b) A two stage air compressor compressor air from 1 bar and 20°C to 42 bar. If the law of compression is $PV^{1.35} = \text{constant}$ and the inter cooling is complete to 20°C , find per kg of air i) The work done is compressing ii) The mass of water necessary for abstracting the heat in the intercooler, if the temperature rise of the cooling water is 25°C . Take $R = 287 \text{ KJ/kg}$ and $C_p = 1 \text{ KJ/kg K}$. **(05)**

OR

- Q.8 a)** Explain construction and working of multistage compressor with neat sketch. **(07)**
b) Explain different methods of improving volumetric efficiency of compressor. **(03)**

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- Q.9** a) Compare reciprocating compressor with a rotary compressor. (04)
b) Explain construction and working of vane- type compressor with neat sketch. (06)

OR

- Q.10** a) Calculate the power required to run the vane compressor and its efficiency, (05)
when it handles 7m^3 of air per minute from 1 bar to 2.2 bar. The pressure rise due to compression in the compressor is limited to 1.6 bar. Take mechanical efficiency of compressor as 80%.
b) Explain surging, choking and stalling characteristics curves of rotary compressor. (05)

- Q.11** a) Sketch and explain the use of orsat apparatus used in determining the (05)
percentage of the flue or exhaust gases. Does this help in controlling combustion.
b) Explain the terms theoretical air, excess air and deficient air for fuels and (05)
combustion. Also explain stoichiometric and actual air to fuel ratio.

OR

- Q.12** a) What is the available energy? Define availability and unavailability. (04)
b) Write the steps involved in conversion of volumetric analysis to gravimetric (06)
analysis.

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