Total No. of Printed Pages:2

**SUBJECT CODE NO:- 479**
**FACULTY OF ENGINEERING AND TECHNOLOGY**
**S.E.(MECH/PROD) Examination Nov/Dec 2015**
**Thermodynamics-I**
**(Revised)**

**[Time: Three Hours]** **[Max. Marks: 80]**

"Please check whether you have got the right question paper."

N.B i) Q.No.1 Q.No.6 are compulsory.
ii) Solve any two questions from each section.
iii) Use of steam tables is allowed.
iv) Assume suitable data, if required.

**Section A**

Q.1 Solve any five. 10
i) State concept of control volume.
ii) Write short note o PMM-I.
iii) State the first law of thermo dynamics for cyclic process with equation
iv) State any two reasons of irreversibility.
v) State "Kelin Planks" statement of II[nd] law of thermodynamic.
vi) Draw constant entropy process on P-V and T-S diagrams.
vii) What do you mean by unavailable energy?

Q.2 a) Derive an expression W= $-\int v \, . \, dp$. 06
b) In the water heating derive using steam operators under steady flow conditions receiving 4.5 kg/sec. of water at 80 ℃ temperatures. Enthalpy of water as 317 KJ/kg. The water is heated by mixing with steam which is supplied to the heater at temperature 100℃ with enthalpy 2676 KJ/kg. Te mixture leaves the heater as liquid water at a temperature of 100℃ and enthalpy 419 KJ/kg. How much steam must be supplied to the heater per hour? 09

Q.3 a) Prove the equivalence of Kelvin Plank and clauses statements of $II^{nd}$ law of thamodymics. 06
b) A reversible heat engine is supplied with from two constant temperature sources at 900K and 500K and rejects to the low temperature reservoir at 300K. Assuming the engine to execute number complete cycles, while developing 70 KW and rejecting 53KW. Calculate heat supplied by each source and efficiency of the engine. 09

Q.4 a) State and prove the " clausius In-equality". 08
b) What do you mean by entropy. Explain temperature entropy diagram. 07

Q.5 Write short notes on any three. 15
i) Limitations of $I^{st}$ law of thermodynamics
ii) Heat engine, refrigerator and heat pump.
iii) Principle of increase of entropy.
iv) Thermodynamic temperature scale.

**Section B**

Q.6 Solve any five. 10
i) Draw Dual cycle on P-V and T-S diagrams.
ii) State any three assumption of air standard cycle.
iii) What do you mean by critical point and what is its significances.
iv) Define pure substance and state its examples.
v) Advantages of superheats steam.



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vi) Define caloritic value of fuel and its types.

vii) What do you mean by excess air and deficient air.

Q.7 a) Drive an expression for mean effective pressure of Otto cycle . 06

b) In an air standard diesel cycle, the compression ratio is 16. And at the beginning of isentropic compression the temperature is 15°C and pressure is 1.01235 bar. Heat is added until temperature at the end of the constant pressure process is 1380°$c$. Calculate. 09

i) The cut off ratio.

ii) The heat supplied per kg of air .

iii) The cycle efficiency & m.e.p.

Q.8 a) Write short note on "Triple point". 04

b) Two boilers one with superheater and other without superheater are delivering equal quantities of steam into a common main .The pressure in the two boilers and main is 20 bar. The temperature of the steam from the boiler with a superheater is 380°C and temperature of steam in the main is 250°C. Determine quality of steam supplied by the other boiler 11

Q.9 a) Write short note on Orsat apparatus 05

b) The fuel oil used in a diesel engine has the following composition. C= 85% , H=12 % ,$o_2 = 3\%$ .The exhaust gas analysis is by volume is given as 10

$$Co_2 = 9\% \quad C_o = 1\%$$
$$O_2 = 8\% \quad , N_2 = 82\%$$

Determine actual air to fuel ratio.

Q.10 Write short notes on any three. 15

i) Atkinson cycle.

ii) Comparison of Otto dual and diesel cycle on the basis of maximum pressure and temperature.

iii) Enthalpy- entropy diagram

iv) Quality of steam



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