Government College of Engineering, Aurangabad

(An Autonomous Institute of Government of Maharashtra)

S. E. (Mechanical) Examination

End Semester Examination Nov 2016

ME204: ENGINEERING THERMODYNAMICS

18.NOV 2016

Time: Three Hours *Max. Marks: 60*

"Verify the Course Code and check whether you have got the correct question paper"

N.B:-

1. *All questions are compulsory.*
2. *Figures to the right indicate full marks.*
3. *Assume suitable data if necessary and state it clearly.*
4. *Use of non-programmable calculator is allowed.*
5. *Use of Steam tables is permitted.*

Q.1) Attempt any **Two** 12

i) Define i) Enthalpy, ii) Sp. Heat at constant pressure, iii) Sp. Heat at constant volume.

ii) Write down the Steady Flow Energy Equation. Explain each term involved in it and modify it for IC Engine, Pump & blower.

iii) In a steam plant, 1 kg of water per second is supplied to the boiler. The enthalpy and velocity of water entering the boiler are 800 kJ/kg and 5 m/s. The water receives 2200 kJ/kg of heat in the boiler at constant pressure. The steam after passing through the turbine comes out with a velocity of 50 m/s, and its enthalpy is 2520 kJ/kg. The inlet is 4 m above the turbine exit. Assuming the heat losses from the boiler and the turbine to the surroundings are 20 kJ/s, calculate the power developed by the turbine. Consider the boiler and the turbine as single system.

Q.2) Attempt any **Two** 12

i) Compare heat engine, refrigerator & heat pump.

ii) Prove that, Entropy is a property of system.

iii) Establish the equivalence of Kelvin-planks and Clausius statements.

Q.3) Attempt any **Two** 12

i) Describe the method of finding the dryness fraction of steam by bucket calorimeter. Clearly explain its limitations.

ii) Determine the mass of 0.15 m^3 of wet steam at a pressure of 4 bar and dryness fraction of 0.8. Also calculate the heat of 1 m^3 of steam.

iii) Determine the enthalpy and internal energy of 2 kg of steam at a pressure of 1.4 MPa and 0.85 dryness. Also determine the heat supplied at constant pressure if the final condition of the steam is 70^0C of superheat. Take C_{ps} (superheated steam) = 2.25 kJ/kg.

Q.4) Attempt any **Two** 12

i) Derive the equation for air standard efficiency of Otto cycle.

ii) Explain Ericsson cycle and derive equation for its efficiency. State the assumptions made.

iii) An air engine working on the Otto cycle has the compression ratio raised from 5 to 6. Compare the change in efficiency due to this rise. Assume $\gamma = 1.4$.

Q.5) Attempt any **Two** 12

i) How the analysis of exhaust and flue gas is carried out using ORSAT apparatus.

ii) The ultimate analysis of dry coal burnt a boiler is C 84%, H_2 9% and incombustibles 7% by mass. Determine the mass of dry flue gases per kg of coal burnt, if the volumetric composition of the flue gas is : CO_2 8.75%, CO 2.25%, O_2 8% and N_2 81%.

iii) The analysis of coal supplied to a boiler was: C = 81%, H_2 = 4.5%, O_2 = 8% and rest is ash. The ORSAT analysis of dry flue gases was: CO_2 = 8.3%, CO = 1.4%, O_2 = 10%, & N_2 (by difference) = 80.3%. Find a) the mass of air supplied per kg of coal, b) the percentage of Excess air.