Register No:

Dhanalakshmi Srinivasan Engineering College

(Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai)
(Accredited with 'A' Grade by NAAC)
Perambalur – 621 212

Internal Assessment Test II

Department of Aeronautical Engineering

AE 8301 | Aero Engineering Thermodynamics

(Common to Aeronautical and Aerospace Engineering)

Year | Semester	: II | III	**Date**	: 29.08.2019
Duration	: 1 ½ hour	**Max. Marks**	: 50 Marks

Answer all the Questions

Part – A (5 X 2 = 10)

1. What are the assumptions in air standard cycle?
2. Write the effect of compression ratio on engine thermal efficiency of an Otto cycle with a suitable graph.
3. Define: Mean effective pressure.
4. Draw and explain a p-T diagram for a pure substance.
5. What is meant by Specific Steam Consumption in a Rankine cycle?

Part – B (2 X 13 = 26)

6. a) An engine working on the Otto cycle is supplied with air at 0.1 MPa, 35 ºC. The compression ratio is 10. Heat supplied is 2400 kJ/kg. Calculate the maximum pressure and temperature of the cycle, the cycle efficiency and the mean effective pressure. Take C_p, C_v and R as 1005 J/kg-K, 718 J/kg-K and 287 J/kg-K respectively.

(Or)

b) Drive the Thermal Efficiency and the Mean Effective Pressure of an Ideal Diesel Cycle in terms of the compression ratio, pressure ratio and the adiabatic index.

7. a) Show the Rankine cycle on p-v and T-s diagrams and explain the processes involved. Also draw the mechanical system to show different processes of the Rankine cycle.

(Or)

b) In a reheat cycle, the initial steam pressure and the maximum temperature are 150 bar and 550 °C respectively. If the condenser pressure is 0.1 bar and the moisture at the condenser inlet is 5 % and assuming ideal processes, determine i. The reheat pressure, ii. The cycle efficiency and iii. The steam rate.

Part – C (1 X 14 = 14)

8. a) A vegetable oil engine works on dual cycle, the heat released during the constant pressure process being the twice of that released during the constant volume process. Given compression ratio is 8.5 and expansion ratio is 5.5, with the compression and expansion processes occurring as per the relation $pV^{1.3} = C$, pressure and temperature

at the beginning of compression are 1 bar and 27 °C respectively. Assume C_p=1004 J/kg.K, C_v=717 J/kg.K for air. Calculate the air standard efficiency and mean effective pressure.

(Or)

b) A thermal power plant operating on the ideal regenerative Rankine cycle with one closed feed water heater. Steam enters the turbine at 3 MPa and 400 °C and is condensed in the condenser at a pressure of 10 MPa. Some quantity of steam is extracted from the turbine at a pressure of 0.6 MPa and enters the open feed water heater. Compute the fraction of the steam extracted from the turbine and the thermal efficiency of the cycle.

Prepared by

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Part – A (5 X 2 = 10)

1. Sketch the T-s diagram and p-v diagram of Otto cycle.
2. State the four processes of the Diesel cycle.
3. What is the significance of mean effective pressure?
4. What is the difference between saturated liquid and compressed liquid?
5. What are the advantages and disadvantages of reheating?

Part – B (2 X 13 = 26)

6. a) The maximum temperature and pressure of an Otto cycle are 200 ºC and 100 kPa. The amount of heat addition to the air per cycle is 1480 kJ/kg. Find the pressure and temperature at all points of the cycle, the specific work output and thermal efficiency of the cycle for the compression ratio of 6:1. Assume the C_v as 0.72 kJ/kg.K and γ as 1.4.

(Or)

b) An air standard ideal cycle using air as the working fluid has a compression ratio of 16 and cut off ratio of 2. The intake conditions are 100 kPa, 20 ºC and displace value of 2000 cm^3. Using cold air standard assumptions determine: (a) The temperature and pressure at the end of each process (b) The net work output (c) Thermal efficiency of cycle.

7. a) In a closed vessel the 100 kg of steam at 100 kPa, 0.5 dry is to be brought to a pressure of 1000 kPa inside vessel. Determine the mass of dry saturated steam admitted at 2000 kPa for raising pressure. Also determine the final quality.

(Or)

b) In a Rankine cycle steam enters the first stage turbine at 10 MPa and 500 °C, expands to 0.1 MPa. It is then reheated to 450 °C before expansion in the LP turbine. It then expands to a condenser pressure of 0.01 MPa. Net power developed is 100 MW. Both the turbines have an efficiency of 80 %. Calculate i. Thermal Efficiency of the cycle, ii. Mass flow rate of steam.

Part – C

(1 X 14 = 14)

8. a) In an engine working on a dual cycle the temperature and pressure of beginning of cycle are 100 °C and 1 bar. The compression ratio is 10. The maximum pressure is limited to 70 bar and total heat supplied per kg of air is 1680 kJ. Find the following i. Pressure and Temperature at salient point, ii. Efficiency of the cycle and iii. Mean Effective Pressure.

(Or)

b) Steam at 20 bar, 360 °C is expanded in a steam turbine to 0.08 bar. It is then entering a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, find the network per kg of steam and Rankine cycle efficiency. Also determine the percentage reduction in network and efficiency if the turbine and the pump each have 80 % efficiency.

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