[06 –2209]

II/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

THERMAL PRIME MOVERS

(Common with M.S.E.E.E.)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any other FOUR questions from the remaining.

All questions carry equal marks.

1. Explain : $(14 \times 1 = 14)$

   (a) Internal energy is a property.

   (b) Carnot Cycle.

   (c) Entropy.

   (d) Throttling.

   (e) Dryness fraction.

   (f) Draw the otto cycle on a p – v diagram.

   (g) Define compression ratio.

   (h) Define point function.

7. (a) With a neat sketch the working principle of a four stroke diesel engines. (7)

(b) In a ideal brayton cycle air from the atmosphere at 1 atm, 300 k is compressed to 6 atm and the maximum cycle temperature is limited to 1100 k by using large air-fuel ratio. If the heat supply is 100 mw, find (i) the thermal efficiency of the cycle (ii) work ratio, (iii) power output, (iv) energy flow rate of the exhaust gas leaving the turbine. (7)

8. (a) Derive the expression of optimum pressure ratio for maximum net work output in an ideal Brayton cycle. (7)

(b) An air standard diesel engine has compression ratio of 18, the heat transferred to the working fluid per cycle is 1800 kJ/kg. At the beginning of compression stroke, the pressure is 1 bar and the temperature is 300 K. Calculate (i) Thermal efficiency (ii) Mean effective pressure. (7)

(i) What is fine tube boiler?

(j) What is pre-ignition?

(k) List the functions of injector.

(l) State the necessities for cooling of an engine.

(m) Classify the boilers.

(n) Define work ratio.

2. (a) Derive an expression for work done and heat transferred during adiabatic expansion. (7)

(b) A mass of 0.05kg of carbon dioxide (mol. weight 44), occupying a volume of 0.03 m^3 at 1.025 bar, is compressed reversibly until the pressure is 6.15 bar. Calculate final temperature, the work done on the CO_2, the heat flow to or from the cylinder walls, (i) When the process is according to law $pv^{1.4}$ = constant (ii) when the process is isothermal. (iii) When the process takes place in a perfectly thermally insulated cylinder. Assume CO_2 to be a perfect gas, and take $\gamma = 1.3$. (7)

3. (a) What are the various methods of finding dryness fraction and at least one method in detail? (7)

(b) A rigid container is filled with steam at 7 bar and 200° C. At what temperature and pressure will the steam starts condense when the container is cooled? To what temperature and pressure must the container be cooled to condense 50 % of the steam mass? (7)

4. (a) Explain how steam boilers are classified. (7)

(b) Explain with a neat diagram, the construction and working of a Babcock and Wilcox Water tube boiler. (7)

5. The blade speed of a single ring of an impulse turbine is 300 m/s and the nozzle angle is 20°. The isentropic heat drop is 473 kJ/kg and the nozzle efficiency is 0.85. Given that the blade velocity coefficient is 0.7 and the blades are symmetrical, draw the velocity diagrams and calculate for a mass flow of 1 kg/s : (a) Axial thrust on the blading (b) Steam consumption per B.P. hour if the mechanical efficiency is 90 per cent (c) Blade efficiency, stage efficiency and maximum blade efficiency. (14)

6. (a) Differentiate between impulse and reaction turbine. (7)

(b) In an isentropic flow through nozzle, air flows at the rate of 600 kg/hr. At inlet to the nozzle, pressure is 2 MPa and temperature is 127 degree celsius. The exit pressure is 0.5 MPa. Initial air velocity is 300 m/s determine (i) Exit velocity of air (ii) Inlet and exit area of nozzle. (7)