Reg. No. : | | | | | | | | | | | |

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B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2008.

Fourth Semester

(Regulation 2004)

Mechanical Engineering

ME 1251 — THERMAL ENGINEERING

(Common to B.E. (Part-Time) Third Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

(Use of Steam tables/charts and refrigeration table/charts is permitted)

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Define air standard efficiency of Diesel cycle.

2. What is the significance of Mean effective pressure?

3. Draw the port timing diagram of a petrol engine.

4. What is splash lubrication?

5. What do you mean by supersaturated flow?

6. What is the function of governors in steam turbine?

7. Why clearance is necessary in reciprocating compressors?

8. Differentiate positive and non positive displacement compressors.

9. Define dew point temperature.

10. Explain adiabatic humidification of air.

PART B — (5 × 16 = 80 marks)

11. (a) Sketch the Diesel cycle on P-V and T-S diagrams and derive the expression for its mean effective pressure.

Or

(b) A dual combustion air standard cycle has a compression ratio of 10. The constant pressure part of combustion takes place at 40bar. The highest and lowest temperatures of the cycle are 1727°C and 27°C respectively. The pressure at the beginning at the compression is 1bar. Calculate :

(i) the pressure and temperature at the key points of the cycle,

(ii) the heat supplied at constant pressure,

(iii) the heat supplied at constant volume,

(iv) the heat rejected,

(v) the work out put,

(vi) the efficiency and

(vii) mep.

12. (a) Explain why cooling is necessary in IC engine? With neat sketches describe the working of water cooling system used for a multi cylinder engine. Why should a pump and thermostat be provided in the cooling system of an engine? (4 + 8 + 4)

Or

(b) The following details were noted in a test on a four-cylinder, four stroke engine, diameter = 100 mm ; stroke = 120 mm ; speed of the engine = 1600 rpm ; fuel consumption = 0.2 kg/min ; fuel calorific value = 44,000 kJ/kg ; difference in tension on either side of the brake pulley = 40 kg ; brake circumference is 300 cm. If the mechanical efficiency is 80 %, calculate :

(i) brake thermal efficiency

(ii) indicated thermal efficiency

(iii) indicated mean effective pressure and

(iv) brake specific fuel consumption.

13. (a) Steam enters the blade row of an impulse turbine with a velocity of 500m/sec, at an angle of 30° to the plane of rotation of the blades. The mean blade speed is 280m/sec. the blade angle on the exit side is 35°. The blade friction coefficient is 12%. Determine :

(i) The blade angle at inlet

(ii) The work done per kg of steam.

(iii) The diagram efficiency.

(iv) The axial thrust per kg of steam per second.

Or

(b) (i) Explain with the sketches the velocity and pressure compounded impulse turbines. (8)

(ii) Dry saturated steam enters a steam nozzle at a pressure of 10bar and is discharged to a pressure of 1.5bar. If the dryness fraction of a discharged steam is 0.95 what will be the final velocity of steam? Neglect initial velocity of steam. (8)

14. (a) A single acting single stage compressor is belt driven from an electric motor at 400 rpm. The cylinder diameter is 15 cm and the stroke is 17.5 cm the air is compressed from 1bar to 7bar and the law of compression $PV^{1.35}$ = const. Find the power of the motor, if the transmission efficiency is 97% and the mechanical efficiency of the compressor is 90%. Neglect clearance effects.

Or

(b) A two stage double acting air compressor operating at 200 rpm takes in air at 1.013bar and 27°C. The size of the L.P cylinder is 355 × 375 mm, the stroke of HP cylinder is the same as the LP cylinder and the clearance of both the cylinders is 4%. The LP cylinder discharges the air at a pressure of 0.452bar. The air passes through the inter cooler so that it enters the HP cylinder at 27°C and 3.850bar, finally it is discharged from the compressor at 15.4bar. The values of n for both cylinders are 1.25. C_p = 1.0035 kJ/kg K and R = 0.28 kJ/kg K.

Calculate :

(i) The heat rejected in the inter- cooler.

(ii) The diameter of HP cylinder and

(iii) The power required to drive HP cylinder.

15. (a) Explain with a neat sketch practical Ammonia-water vapour absorption refrigeration system. Also bring out any four important differences between vapour compression and vapour absorption refrigeration systems. (12 + 4)

Or

(b) A restaurant with a capacity of 100 persons is to be air-conditioned with the following conditions :

Outside conditions = 30°C, 70% RH

Desired inside conditions = 23°C, 55% RH

Quantity of air supplied = 0.5 m^3/min/person

The desired conditions are achieved by cooling, dehumidifying and then heating. Determine :

(i) Capacity of cooling coils in tones of refrigeration

(ii) Capacity of heating coil and

(iii) Amount of water removed by dehumidifier.