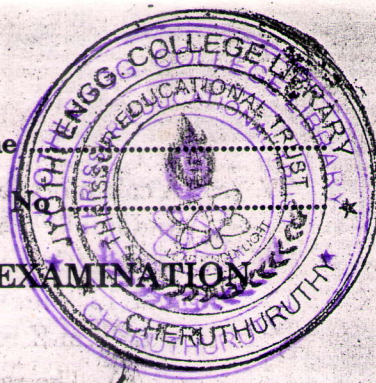


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Name _____

Reg. No. _____



SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2006

EC 2K 605—MECHANICAL ENGINEERING

Time : Three Hours

Maximum : 100 Marks

- I. (a) What are the limitations of first law ? Mention *two* statements of second law.
- (b) A cyclic machine receives 325 kJ from a 1000 K energy reservoir. It rejects 125 kJ to a 400 K energy reservoir, and the cycle produces 200 kJ of work as output. Is this cycle reversible, or impossible ?
- (c) Derive the equation for air-standard efficiency for Diesel cycle in terms of compression ratio and cut-off ratio.
- (d) Compare Petrol and Diesel engines.
- (e) How does radiation differ from conduction and convection ? State Stefan-Boltzmann law of thermal radiation.
- (f) State and prove Kirchhoff's law of thermal radiation.
- (g) Describe about streak line and stream tube.
- (h) Discuss briefly about various flow measuring devices.

(8 × 5 = 40 marks)

- II. (a) (i) A closed vessel contains 2 kg. of CO₂ at temperature of 20°C and pressure of 0.7 bar. Heat is supplied to the vessel till the gas acquires a pressure of 1.4 bar. Calculate the final temperature, work done and heat added. Take specific heat of gas at constant volume as 0.157 kJ/kg.K.

(8 marks)

- (ii) Derive SFEE for diffuser and turbine.

(7 marks)

Or

- (b) Prove the statement "No heat engine working between two given temperature reservoirs is more efficient than a reversible engine working between the same temperature reservoirs".

(15 marks)

- III. (a) Explain the operation of SI engine which has one power stroke in every revolution of crankshaft. Compare this with Diesel engine.

(15 marks)

Or

- (b) (i) What is the use of Mollier chart ?

(3 marks)

- (ii) In a Rankine cycle, the steam at inlet to turbine is saturated at a pressure of 35 bar and the exhaust pressure is 0.2 bar. Determine the turbine work and rankine efficiency neglecting the pump work.

(12 marks)

Turn over

- IV. (a) A cold storage room has walls made of 0.23 m. brick on the outside, 0.08 m. of plastic foam and finally 1.5 cm. of wood on the inside. The outside and inside air temperatures are 22°C and -2°C respectively. The inside and outside heat transfer coefficients are respectively 29 and $12 \text{ W/m}^2\text{-K}$. The thermal conductivities of brick, foam and wood are 0.98, 0.02 and 0.12 W/m-K respectively. Calculate the following :—

- (i) The rate of heat removal by refrigeration if the total wall area is 90 m^2 .
- (ii) The inside surface temperature of the brick.

(15 marks)

Or

- (b) Discuss briefly the electromagnetic wave spectrum. Explain in detail the thermal radiation.

(15 marks)

- V. (a) Derive Bernoulli's equation from Euler's equation of motion.

(15 marks)

Or

- (b) A pipe 300 m. long has a slope of 1 in 100 and tapers from 1.2 m. diameter at the high end to 0.6 m. diameter at the low end. Quantity of water flowing is 5400 litres per minute. If the pressure at the high end is 68.67 kPa, find the pressure at the low end neglecting losses.

(15 marks)

[4 × 15 = 60 marks]