Student Exam No. _____

GANPAT UNIVERSITY

B. Tech. Semester : III Mechatronics Engineering

CBCS Regular Examination November/December-2013

Subject: 2MC306 Thermal Engineering

Time: 2 Hours **Total Marks: 50**

Instructions: *1. Attempt all questions.*
2. Don't write anything on the question paper.
3. Use of non programmable scientific calculator is permitted.
4. Also use heat and mass Transfer Data Book.

SECTION-I

Que. – 1 **(a)** Define a thermodynamic system. Differentiate between open system, closed system and an isolated system. **4**

(b) Explain the following terms : **4**
(*i*) State, (*ii*) Process, and (*iii*) Cycle.

OR

Que. – 1 **(a)** An ideal gas is heated at constant volume until the temperature is three times of the original temperature, then expanded ISO-thermally until it reaches an original pressure: gas is then cooled at constant pressure until it restored to the original state. Determine : **5**
The network has done per kg of gas, initial temp is 350k , represent answer in terms of gas constant are **(R).**

(b) Explain Entropy change in an irreversible process. **3**

Que. – 2 **(a)** Explain the concept of available and unavailable energy. When does the system become dead ? **4**

(b) With the help of P-V and T-S diagrams, show that for the same maximum pressure and heat input and compare diesel and Otto cycle. **4**

OR

Que. – 2 **(a)** Write down the general energy equation for steady flow system and simplify when applied for the following systems: **4**
(*iii*) Steam nozzle (*iv*) Steam turbine

(b) What is the Heat Pump? How does it differ from a Refrigerator? Show the COP of a heat pump is greater than COP of a refrigerator by unity. **4**

Que. – 3 **(a)** Derive the air standard efficiency of diesel engine. **5**

(b) Explain the following statements of second law of thermodynamics. **4**
(*i*) Clausius statement
(*ii*) Kelvin-Planck statement

P.T.O.

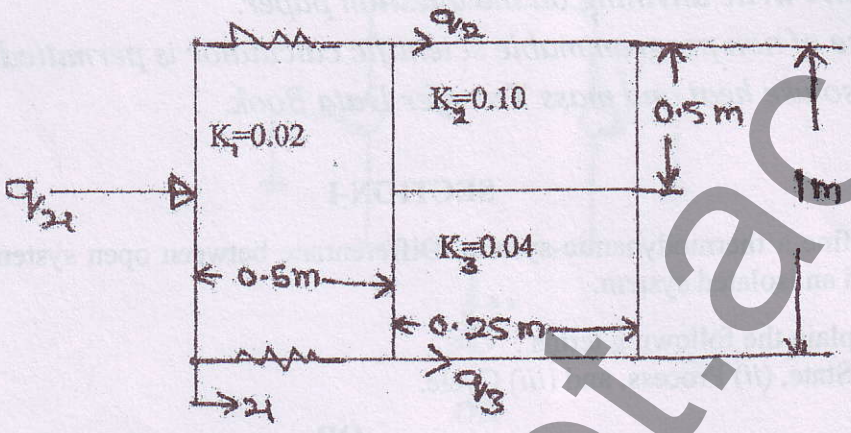
SECTION-II

Que. – 4 **(a)** A plane wall is 150 mm thick and its wall area is 4.5 m^2 . if its conductivity is 9.35 W/m^0C and surface temperatures are steady at 150^0C and 45^0C, Determine :

(i) Heat flow across the plane Wall

(ii) Temperature gradient in the flow direction.

(b) Heat flows through a composite slab, as shows below. the depth of the slab is 1m and the k value are in W/m. k. The overall thermal resistance R_{th} in K/W is. 4



OR

Que. – 4 **(a)** What is Fourier's Law? Explain the different modes of heat transfer. 5

(b) What is difference in **NTU&LMTD** approach? 3

Que. – 5 A counter flow double pipe heat exchanger using superheated steam is used to hot water at the rate of 10500 kg/h. The steam enters the heat exchanger at 180°C and leaves at 130°C. The inlet and exit temperature of water are 30°C and 80°C respectively. If overall heat transfer coefficient from steam to water is 814 W/m^2C, calculate the heat transfer area. What would be the increase in area if the fluid flow were parallel? 8

OR

Que. – 5 The flow rates of hot and cold water streams running through a parallel flow heat exchanger are 0.2 kg/s and 0.5 kg/s respectively. The inlet temperatures on the hot and cold sides are 75°C and 20°C respectively. The exit temperature of hot water is 45°C. If the individual heat transfer coefficients on both sides are 650 W/m^2C, calculate the area of the heat exchanger. 8

Que. – 6 **(a)** Derive an expression for logarithmic mean temperature difference (LMTD) in case of parallel flow. 5

(b) Which is a batter HE? Counter flow, parallel flow or cross flow why? 2

(c) How does the science of Heat transfer (HT) is different from thermodynamic? 2

END OF PAPER