Reg.No.									

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

III SEMESTER B.S. DEGREE EXAMINATION – NOV. / DEC. 2016

SUBJECT: THERMO FLUIDS (MET 231)

(BRANCH: MECHATRONICS)

Friday, 25 November 2016

Time: 3 Hours **Max. Marks: 100**

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A) Discuss with an example **(04)**

a. Homogeneous and heterogeneous properties.

b. Intensive and extensive properties.

1B) Write different temperature scales with relevant equations. **(04)**

1C) With an example explain closed, open and isolated system. **(04)**

1D) Define thermodynamic equilibrium and explain the three equilibrium conditions. **(08)**

2A) With an example sketch and explain different types of work transfer. **(08)**

2B) Write a short notes on path function and point function. **(04)**

2C) A bicycle tyre has pressure of 3.8bar. It is to be inflated using a reciprocating pump with a stroke of 0.25m. Initially, the cylinder of pump contains air at a pressure of 1bar. Calculate the length of stroke that will be swept before the air begins to enter the tyre , **(08)**

i) If process is Isothermal.

ii) If the process follows a polytrophic law $PV^{1.4}$=Constant. Assume air as an ideal gas.

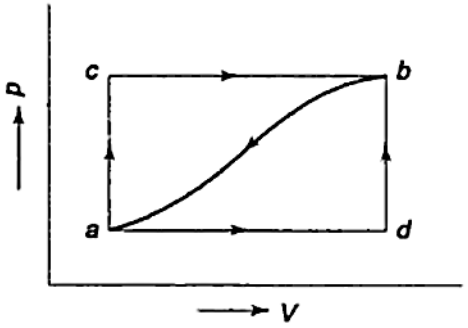
3A) Derive an equation for Steady Flow Energy Equation (SFEE) for an open system. **(12)**

3B) When a system is taken from state A to state B along path ACB, 84KJ of heat flow into the system and the system does 32KJ of work.

a) How much heat will flow into the system along the path ADB if work done is 10.5 KJ.

b) When the system is returned from B to A along the curved path, the work done on the system is 21KJ. Does the system absorb or liberate heat? And how much of the heat is absorbed or liberated?

c) If U_A=0 U_D=42KJ, find the heat absorbed in process AD and DB. **(08)**



4A) Describe the first law for a closed system undergoing a cycle. **(06)**

4B) Prove that internal energy is a property of a system. **(06)**

4C) A gas undergoes a thermodynamic cycle consisting of the following processes: **(08)**

1) Process 1-2: Constant pressure P= 1.4 Bar, V_1 = 0.028m3, W_{1-2} = 10.5KJ
2) Process 2-3: Compression with PV=C, $U_3=U_2$
3) Process 3-1: Constant volume, U_1-U_3 =-26.4KJ. There are no significant change in K.E & P.E.

A. Sketch the cycle on a P-V diagram
B. Calculate the net work done for the cycle
C. Calculate net heat transfer

Show that ∑Qcycle=∑Wcycle.

5A) Give the Clausius statement of second law. **(04)**

5B) Derive an equation for efficiency of a Carnot engine. **(06)**

5C) A reversible heat engine operates between two reservoirs at temperature of 600^0C and 40^0C. The engine drives a reversible refrigerator which operates between reservoirs at temperature of 40^0C and -20^0C. The heat transfer to the heat engine is 2000KJ and the net work output of the combined engine refrigerator plant is 360KJ. **(10)**

a) Evaluate the heat transfer to the refrigerant and net heat transfer to the reservoir at 40^0C.
b) Reconsider (a) given that the efficiency of the heat engine and the COP of the refrigerator are each 40% of their maximum values.

6A) Draw the pressure-volume diagram of an Otto cycle and explain its working. **(08)**

6B) Sketch and explain working of a vapour compression refrigeration cycle. **(08)**

6C) Write a short notes on applications of refrigeration. **(04)**

7A) Derive Bernoulli's equation using infinitesimal stream tube. **(10)**

7B) Two large surfaces are 2.5 cm apart. This space is filled with glycerin of absolute viscosity 0.82 NS/m2. Find what force is required to drag a plate of area 0.5m^2 between the two surfaces at a speed of 0.6m/s. (i) When the plate is equidistant from the surfaces, (ii) when the plate is at 1cm from one of the surfaces. **(05)**

7C) List the losses of energy in pipes and mention different minor energy (head) losses. **(05)**

8A) Derive an equation for discharge through Venturimeter. **(08)**

8B) List advantages and disadvantages of Orifice-meter. **(06)**

8C) The inlet and throat of a horizontal Venturimeter are 30cm and 10cm respectively. The liquid flowing through the meter is water. Pressure intensity at inlet is 13.734N/cm^2 while the vacuum pressure head at the throat is 37cm of mercury. Find rate of flow. Assume that 4% of differential head is lost between inlet and throat. Find also value of C_d for Venturimeter. **(06)**