Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

IV SEMESTER B.S. DEGREE EXAMINATION –MAY 2016

SUBJECT: THERMODYNAMICS & FLUID MECHANICS (ME 241)

(BRANCH: CIVIL)

25TH MAY, 2016

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

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Any mission data may be suitably assumed.**

1A. Differentiate the following terms:

a. Open system and closed system b. Microscopic and Macroscopic viewpoint
c. Intensive and Extensive properties d. Point function and path function.

1B. Explain the state of thermodynamic equilibrium of a system.

1C. A spherical ballon 1 m diameter contain gas at 240 kPa and 290 K. When the gas inside the ballon is heated, its pressure raises to 485 kPa and pressure is being proportional to the diameter. Determine the work done by the gas inside the ballon.

(8+6+6=20)

2A. Explain Joule's experiment of 1st law of thermodynamics.

2B. Explain the first law of thermodynamics applied to a closed system executing a cyclic process and an open system executing a process.

2C In an engine the charge is at 105 kPa and 310 K at the beginning of compression. It reaches 2.5 MPa after compression by following the law $PV^{1.4} = c$. Calculate the temperature at the end of compression and work done.

(6+6+8=20)

3A. Show that the energy of a system is a property.

3B. State statements of the second law of thermodynamics and show that violation of one equally violates the other.

3C. In a rotary compressor air flow steadily at a rate of 1.5 kg/s. The air enters with a velocity of 80 m/s and leaves at 4.5 m/s. The specific volume at inlet is 0.9 m^3/ kg and at the exit is 0.4 m^3/kg. As the air passes through the compressor, the specific enthalpy of air is increased by 110 kJ/kg and losses heat of 20 kJ/kg. Determine, a) The inlet and exit areas of the compressor in m^2 and, b) The power required to drive the compressor in kW.

(6+6+8=20)

4A. Derive an expression of co-efficient of performance of a reversible Carnot heat pump cycle.

4B. Explain the working of vapour compression refrigeration cycle

4C. A reversible heat engine takes 900 kJ of heat from a source at 700 k. The engine develops 350 kJ of network and rejects heat to two low temperature reservoirs at 600 k and 500 k. Determine engine thermal efficiency and heat rejected to each low temperature reservoirs.

(6+6+8=20)

5.A Explain various properties of fluids and Newton's law of viscosity.

5B. Explain surface tension and capillarity action of liquid and derive the expression for surface tension on a liquid droplet.

5C. The dynamic viscosity of an oil, used for lubrication between a shaft and sleeve is 0.6 N.s/m2. The shaft of diameter 0.4 m and rotates at 200 rpm. Calculate the power loss in the bearing for a sleeve length of 90 mm. The thickness of oil film is 1.5 mm.

(6+6+8=20)

6A. Define pascal's law and show that the intensity of pressure is same all directions.

6B. Differentiate between the following.

i) Uniform and non-uniform flow
ii) Compressible and in-compressible flow
iii) Laminar and turbulent flow

6C. An inverted U-tube monometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cm. When an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted monometer [when measured from the respective center lines of the pipes] are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes. (6+6+8=20)

7A. Derive continuity equation in three dimensional flows.

7B. Explain minor losses in flow through pipes.

7C. A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of oil of specific gravity 0.8. The discharge of oil through venturimeter is 60 liters/s. Find the reading of the oil-mercury differential manometer.

(6+6+8=20)

8A. Derive Darcy Weisbatch's equation to determine the loss of head due to friction in pipes.

8B. State Buckingham's π-theorem and explain methods of selecting repeating variables

8C. State Buckingham's π- theorem. The efficiency ή of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ώ, diameter D of the rotor, and discharge Q. Express ή in terms of dimensionless parameters. (6+6+8=20)