Reg.No.										

INTERNATIONAL CENTRE FOR APPLIED SCIENCES

(Manipal University)

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

SUBJECT: THERMODYNAMICS & FLUID MECHANICS (ME 241)

(BRANCH: CIVIL)

Thursday, 01 December 2016

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

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

1A. Define the following terms.
i) System and Surround. ii) Open system and closed system
iii) Intensive and Extensive properties.

1B. Explain the first law of thermodynamics applied to a closed system executing a cyclic process and an open system executing a process.

1C The pressure-volume relation for a non-flow reversible process is P= (8 - 4V) bar, where V is in m^3. If 130 kJ of work is supplied to the system, calculate final pressure and volume of the system. Take initial volume = 0.5 m^3. (6+6+8)

2A. Explain Joule's experiment of I^{st} law of thermodynamics.

2B. Obtain an expression for PdV work done in the following cases and show the processes on P-V diagram. (i) Polytropic process ii) Isothermal process iii) Adiabatic process.

2C. 0.015 m^3 of gas at constant pressure of 2060 kN/m^2 expands to a pressure of 210 kN/m^2 by following the law $PV^{1.35} = C$. Determine the work done by the gas during expansion process. (6+6+8)

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

3B. With help of the block diagram explain the working of vapour compression refrigeration cycle

3C. Air enters a gas turbine with velocity 105 m/s, specific volume 0.8 m^3/kg and leaves at 135m/s and 1.5 m^3/kg. The inlet area of the gas turbine is 0.05m^2. As air passes through the turbine the specific enthalpy decreases by 145 kJ/kg and air losses 27 kJ/kg of heat. Determine i) Mass flow rate of air ii) Exit area of the turbine iii) Power developed by the turbine. (6+4+10)

4A. Derive an expression of thermal efficiency of a reversible Carnot refrigeration cycle.

4B. Show that the COP of a heat pump is greater than the COP of a refrigerator.

4C. A source at temperature T_1 K supplies heat to a reversible heat engine which rejects heat to a low temperature sink at 780 K. The sink at 780 K acts as a source for second reversible engine which rejects heat to a cold reservoir at 280 k. Determine T_1, (i) for equal thermal efficiencies of the two engines (ii) when two engines deliver the same amount of work. (6+4+10)

5A. Define and explain following properties of fluids.

i) Specific weight ii) Viscosity iii) Specific gravity iv) Capillary v) Newtonian fluid vi) Surface tension.

5B. Explain surface tension and capillarity action of liquid and derive the expression for capillary rise of a liquid surface in a small tube.

5C. An oil of viscosity 5 poise is used for lubrication between a shaft and sleeve. The diameter of the shaft is 0.5 m and it rotates at 200 rpm. Calculate the power loss in oil for a sleeve length of 100 mm. The thickness of oil film is 1.0 mm. (6+6+8)

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

6B. Explain the following states of flow

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

6C. A 0.3 m diameter pipe conveying water branches into two pipes of a diameters 0.2 m and 0.15 m respectively. If the average velocity in the 0.3 m diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 0.15 m pipe If the average velocity in 0.2 m diameter pipe is 2 m/s. (6+6+8)

7A. Derive Euler's equation of motion and then find Bernoulli's energy equation for incompressible steady flow.

7B. Explain various minor losses of energy in flow through pipes.

7C. Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2. Determine the difference In datum head if the rate of flow through pipe is 40 lit/s. (6+6+8)

8A. Derive continuity equation in three dimensions and simplify the expression for the various types of flow.

8B. State Buckingham's π-theorem and The efficiency η of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω, diameter D of the rotor and the discharge Q. Express η in terms of dimensionless parameters. (8+12)