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17MN42

## Fourth Semester B.E. Degree Examination, Aug./Sept. 2020
## Thermodynamics and Fluid Mechanics

Time: 3 hrs.                                                                 Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

### Module-1

1   a. Explain Extensive property and Intensive property.                    (10 Marks)
    b. State Zeroth law of thermodynamics.                                   (02 Marks)
    c. Define thermodynamic system and classify the thermodynamic system.   (08 Marks)

**OR**

2   a. Derive an expression for workdone at the moving boundary.            (08 Marks)
    b. Explain the classification of energy.                                (06 Marks)
    c. Compare work and heat.                                               (06 Marks)

### Module-2

3   a. Obtain an expression for polytropic process and Isothermal process.  (08 Marks)
    b. State first law of thermodynamics.                                   (02 Marks)
    c. A fluid system, contained in a piston and cylinder machine, passes through a complete cycle
       of four processes. The sum of all the heat transferred during a cycle is $-340KJ$. The system
       completes 200 cycles per minute. Complete the following table showing the method for each
       item, and compute the net rate of work output in kW.                 (10 Marks)

| Process | Q(KJ/min) | W(KJ/min) | DE(KJ/min) |
|---------|-----------|-----------|------------|
| 1 – 2   | 0         | 4340      | –          |
| 2 – 3   | 42000     | 0         | –          |
| 3 – 4   | – 4200    | –         | – 73200    |
| 4 – 1   | –         | –         | –          |

**OR**

4   a. Explain the working of single stage and multistage reciprocating air compressor with neat
       sketch.                                                              (10 Marks)
    b. Derive an expression for work done during single stage air compression without clearance
       volume.                                                              (10 Marks)

### Module-3

5   a. Explain any four properties of fluids.                               (08 Marks)
    b. Obtain an expression for capillary rise and capillary fall of a liquid.  (10 Marks)
    c. Define surface tension.                                              (02 Marks)

**OR**

6   a. Explain the working of venturimeter and orificemeter with neat sketch.  (10 Marks)
    b. Derive Darcy-Weisbach equation.                                      (10 Marks)

## Module-4

7  a. Derive an expression for total pressure and center of pressure for vertical plane surface submerged in liquid. **(10 Marks)**

   b. Explain Bourdon's pressure gauge and dead weight pressure gauge. **(10 Marks)**

**OR**

8  a. Obtain an expression for determination of meta-centric height experimentally. **(06 Marks)**

   b. Define (i) Meta-centre and meta centric height.

      (ii) Buoyancy and centre of buoyancy. **(04 Marks)**

   c. Explain the conditions of equilibrium for a floating body and submerged body. **(10 Marks)**

## Module-5

9  a. State Bernoulli's theorem and write Euler's equation of motion. **(06 Marks)**

   b. What are the limitations of Bernoulli's equation? **(06 Marks)**

   c. The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 m above datum and section 2 is 4 cm above datum. If the pressure at section 1 is 39.24 N/cm$^2$, find the intensity of pressure at section 2. **(08 Marks)**

**OR**

10  a. Derive an expression for Bernoulli's equation from Euler's equation of motion. **(10 Marks)**

    b. The water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/sec. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm$^2$ **(10 Marks)**

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