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E-711

B. E. IV Semester (Main & Re-Exam) Examination, May – 2018

BASIC FLUID MECHANICS & RATE PROCESS

Branch : ME

Time : Three Hours] *[Maximum Marks : 75*
[Minimum Marks : 30

Note : Attempt ***all*** questions of Section-**A**, ***four*** questions from Section-**B** and ***three*** questions from Section-**C**.

SECTION – A 1.5 × 10 = 15

(Objective Type Questions)

Note : This Section will contain ten objective type questions :

1. The viscosity of liquids, with increase in temperature :
   (a) Decreases (b) Increases
   (c) remains constant (d) No effect on viscosity

2. If the Reynold's number is less than 2000, the flow in pipe is :
   (a) Laminar flow (b) Turbulent flow
   (c) Transition flow (d) None of these

3. Geometric similiarity between model & prototype means the similiarity of :
   (a) discharge (b) linear dimensions
   (c) motion (d) forces

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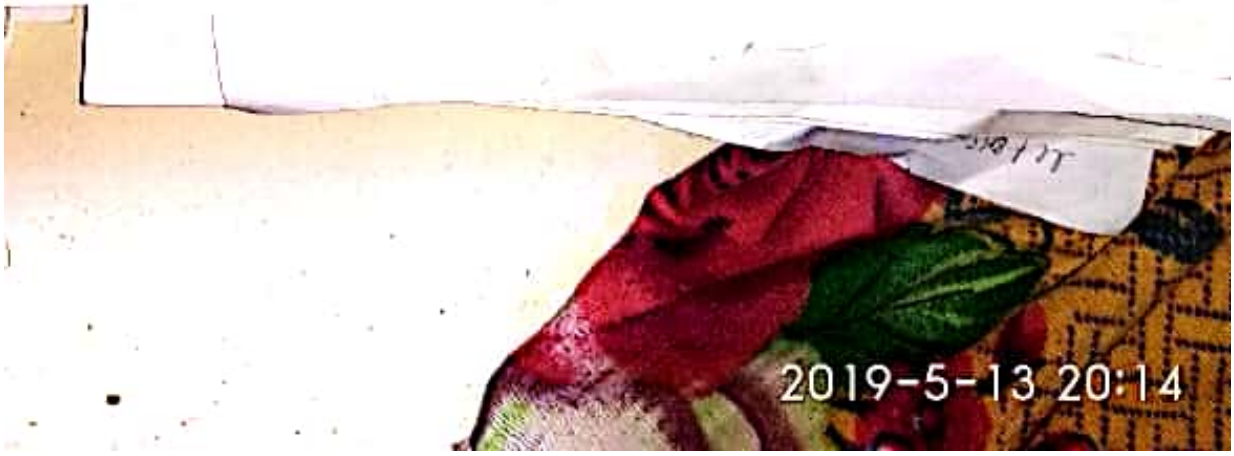

4. Navier's-Stockes equation represent the conservation of :

(a) Mass
(b) Momentum
(c) Energy
(d) Pressure

5. Continuity equation for incompressible flow is :

(a) $A_1V_1 = A_2V_2$
(b) $\rho_1A_1V_1 = \rho_2A_2V_2$
(c) $P_1A_1 = P_2A_2$
(d) None of these

6. At the point of boundary layer separation :

(a) Shear stress is maximum
(b) Shear stress is zero
(c) Velocity is negative
(d) Density variation is maximum

7. In radiation, for opaque surfaces :

(a) $\alpha + \rho = 1$
(b) $\alpha + \tau = 1$
(c) $\alpha + \tau = 0$
(d) $\tau + \rho = 1$

8. Which of the following is least thermal conductive ?

(a) Iron
(b) Steel
(c) Copper
(d) Diamond

9. Thermal diffusivity (α) is represented in ratio of :

(a) $K/\rho C_P$
(b) $K/\rho A$
(c) K/hA
(d) ρ/Kh

10. Free convection flow depends on following except :

(a) Density
(b) Gravity force
(c) Co-efficient of viscosity
(d) Velocity

SECTION – B

(Short Answer Type Questions)

Note: This Section will contain six questions. Students will ask to attempt any *four* questions out of six questions.

1. Discuss types of pressure measurement devices with suitable examples. Also discuss types of pressures.

2. Explain Newton's law of viscosity. Write effect of temperature variation in Newtonian liquids & gases both.

3. Define & give significance of following dimensionless numbers :

   (a) Reynolds number

   (b) Weber number

   (c) Mach number

   (d) Euler number

4. What do you mean by separation of boundary layer ? What is the effect of pressure gradient on boundary layer separation ? Also explain why golf balls have dimple over its surface.

5. Explain Newton's law of cooling. Write basic difference between forced convection & natural convection with the help of suitable example.

6. Water flows through a pipe AB 1.2 m diameter at 3m/s and then passes through a pipe BC 1.5 m diameter. At C, pipe branches. CD branch is 0.8 m is diameter and carries one third of flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, velocity in BC, velocity is CD & diameter of CE.

$12 \times 3 = 36$

SECTION – C

(Long Answer Type Questions)

Note : This Section will contain *five* questions. Students will ask to attempt any *three* questions out of *five* questions.

1. Derive Navier Stoke's equation.

2. Starting from steady flow energy equation, show how Bernouli's equation for invscid incompressible flow can be obtained. List out assumptions & limitations.

3. A kite weighing 3.2 N has a planform area of 0.6 m^2 and is flying in a wind velocity of 20 km/hr. When the string attached to the kite is inclined at an angle 30° to vertical, the tension in the string was found to be 5.6 N. Compute the co-efficient of drag & drift. Density of air is 1.22 kg/m^3.

4. (a) Derive the 3D heat conduction eq^n is Cartesian form.

   (b) A plane wall has a thermal conductivity of 1.15 W/mK. If the inner surface is at 1100°C & outer surface is at 350°C, then calculate the design thickness (in mts.) of the wall to maintain a steady heat flux of 2500 W/m^2.

5. Write short notes on any *four* of the following :

   (a) Drag & lift

   (b) Laminar boundary layer

   (c) Aerofoil theory

   (d) Types of flows in fluid

   (e) Magnus effect

   (f) Displacement thickness & momentum thickness