Register Number:……..

KUMARAGURU
college of technology
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B.E DEGREE EXAMINATIONS: NOV/DEC 2016

(Regulation 2015)

Third Semester

CIVIL ENGINEERING

U15CET301**:** Fluid Mechanics

COURSE OUTCOMES After successful completion of this course, the students will be able to

CO1: Measure the pressure of a fluid and fluid pressure on a plane and curved surface.

CO2: Analyze the stability of floating and submerged bodies.

CO3: Formulate the functional relationships that exist between dependent and independent variables of fluid flow.

CO4: Apply inter-relationship of various properties of fluid in practical problems.

CO5: Understand the kinematics that exists in the fluid flow.

CO6: Apply the working concepts of various devices used to measure the velocity and discharge of fluid.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. Match List I and List II CO3 [K_2]

List I	List II
A. Reynold's Number	i. Viscous force
B. Mach Number	ii. Velocity
C. Froude's Number	iii. Gravity force
D. Weber Number	iv. Cohesive force

	A	B	C	D
a)	1	2	3	4
b)	2	1	4	3
c)	4	3	2	1
d)	3	4	1	2

2. Fluid is a substance that CO1 [K_2]

a) Cannot be subjected to shear force b) Always expands until it fills any

container

c) Has the same shear stress at a point regardless of its motion

d) Cannot remain at rest under action of any shear force

3. Density of water is maximum at — CO1 [K_2]

a) 0^0C

b) 0 K

c) 4^0C

d) 100^0C

4. One dimensional flow is one which — CO4 [K_2]

a) Is uniform flow

b) Is steady uniform flow

c) Involves zero transverse component of flow

d) Takes place in one dimension

5. Choose the wrong statement(s) — CO2 [K_2]

1. Centre of buoyancy is located above centre of gravity of the displaced liquid.

2. Mercury is lighter than water

3. A reservoir is used in a manometer to measure higher pressure.

4. Surface tension is due to adhesion

a) 1,2

b) 2

c) 3,4

d) 4

6. Principle of similitude forms the basis of — CO3 [K_2]

a) Designing models so that the results can be converted to prototypes

b) Comparing two identical equipments

c) Hydraulic design

d) Performing acceptance tests

7. Assertion (A): Distorted models are also helpful in model analysis — CO3 [K_3]

Reason (R): Systems involving large dimensions in a particular directions needs to modeled as distorted models

a) Both are true. R is the correct reason for A

b) Both are true. But R is not the correct reason for A

c) A is true. R is false

d) Both A and R are false

8. For a floating body to be in stable equilibrium, its metacentre should be — CO2 [K_2]

a) Above centre of gravity

b) Below centre of gravity

c) Above centre of buoyancy

d) Below centre of buoyancy

9. In a depressed nappe — CO6 [K_1]

a) The pressure below the nappe is atmospheric

b) The pressure below the nappe is negative

c) The pressure above the nappe is atmospheric

d) The pressure above the nappe is negative

10. A weir is said to be broad crested weir, if the width of the crest of the weir is ___ half the height of water above the weir crest. CO6 [K_1]

a) Equal to

b) Less than

c) More than

d) Not related to

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Two horizontal plates are placed 1.25 cm apart, the space between them being filled with oil of viscosity 14 poises. Calculate the shear stress in oil if upper plate is moved with a velocity of 2.5 m/s. CO1 [K_3]

12. Find the volume of water displaced for a wooden block of width 2.5 m and depth 1.5 m, when it floats horizontally in water. The density of wooden block is 650 kg/m^3 and its length 6.0 m. CO2 [K_3]

13. List the types of losses in flow through pipes CO3 [K_1]

14. Derive Bernoulli's equation from Euler's equation. CO4 [K_2]

15. Classify Flow. CO5 [K_1]

16. Explain the term 'velocity of approach'. CO6 [K_2]

17. Differentiate notches and weir. CO6 [K_2]

18. List the uses of flow net. CO5 [K_1]

19. List the applications of Momentum equation. CO4 [K_1]

20. Explain the various types of similitude. CO3 [K_2]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. A U-tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m^2, calculate the new difference in the level of mercury. Sketch the arrangements in both CO1 [K_3]

cases.

22. A circular plate 3.0 m diameter is immersed in water in such a way that its greatest and least depth below free surface are 4 m and 1.5 m respectively. determine the total pressure on one face of the plate and position of the centre of pressure. CO1 [K_4]

23. A wooden log of 0.6 m diameter and 5 m length is floating in river water. Find the depth of the wooden log in water when the sp.gravity of the log is 0.7. CO2 [K_3]

24. Assuming that the resistance of motion, F of a body moving in a compressible fluid is a function of a characteristic dimension 'l' of the body, the velocity 'u' of the body and fluid properties density 'ρ', viscosity 'μ', and bulk modulus 'K'. find the expression for F in terms of these quantities using Buckingham's π-theorem. CO3 [K_3

$$F = \frac{1}{2}\rho u^2 l^2 \Phi\left(\frac{\rho u l}{\mu}, \frac{u}{\sqrt{Kl\rho}}\right)$$

25. A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used to measure the flow of water. The reading of differential manometer connected to the inlet and the throat is 20 cm of mercury. Determine the rate of flow. Take C_d = 0.98. CO4 [K_3]

26. A two dimensional flow is described by the velocity components, $u=5x^3$ and $v=-15x^2y$. Determine the stream function, velocity and acceleration at a point P(x=1m,y=2m). CO5 [K_3]

27. A rectangular channel 2.0 m wide has a discharge of 250 liters per second, which is measured by a right angled V-notch weir. Find the position of the apex of the notch from the bed of the channel if maximum depth of water is not to exceed 1.3m. Take C_d = 0.62. CO6 [K_4]

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