KUMARAGURU
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Register Number:…….

B.E DEGREE EXAMINATIONS: NOV/DEC 2014

(Regulation 2013)

Third Semester

AERONAUTICAL ENGINEERING

U13AET301: Mechanics Of Fluids

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

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Kinematic viscosity is equal to
   a) Dynamic viscosity x density
   b) Dynamic viscosity / density
   c) Dynamic viscosity / pressure
   d) pressure x density
2. The hydrostatic law states that rate of increase of pressure in a vertical direction is equal to _____ of the fluid
3. Gauge pressure at a point is equal to
   a) Absolute pressure plus atmospheric pressure
   b) Absolute pressure minus atmospheric pressure
   c) Absolute pressure plus vacuum pressure
   d) Absolute pressure minus vacuum pressure
4. The velocity components in x and y direction in terms of stream function are ------- & -----
5. Equipotential lines are _____ to the streamlines at all points of intersection
   a) Parallel
   b) Equal
   c) Orthogonal
   d) Not equal
6. Continuity equation deals with the law of conservation of ----------
7. Reynold's number is defined as the ratio of
   a) Inertia force to viscous force
   b) Inertia force to gravity force
   c) viscous force to gravity force
   d) viscous force to elastic force
8. Geometric similarity between model and prototype means the similarity of ----------

9. Laminar sub-layer is the region in the ----------boundary layer zone, adjacent to the solid surface of the plate.

a) Laminar b) Turbulent

c) Transition d) Outter

10. Navier Stoke's equation is ----------

PART B (10 x 2 = 20 Marks)

(Not more than 40 words)

11. Distinguish between compressibility and bulk modulus
12. List the commonly used pressure gauges.
13. Define path line and flownet
14. Distinguish between source and sink
15. State the assumptions made in deriving Bernoulli's equation
16. Define dimensionless numbers
17. List any two uses of dimensional analysis.
18. List the types of similarities between model and prototype. Explain them .
19. Define boundary layer.
20. Define energy thickness

PART C (5 x 14 = 70 Marks)

(Not more than 400 words)

Q.No. 21 is Compulsory

21. Derive an expression showing the relationship between the torque and the variables diameter, rotational speed, viscosity and density by Buckingham's Pi-theorem.

22. a) (i) A block of wood of specific gravity 0.7 floats in water. Determine the metacentric height of the block if its size is 2m x 1m x 0.8 m. (7)

(ii) A pipe contains an oil of specific gravity 0.8. A differential manometer connected at the two points A and B of the pipe shows a difference in mercury level as 20 cm. Find the difference of pressure at the two points. (7)

(OR)

b) One litre of crude oil weights 9.6N, determine its specific weight, density, specific volume and specific gravity.

23. a) In two dimensional potential flow, the velocity potential is given by $\varphi=4$ X (3Y-4). Determine the value of stream function at the point (2,3). Also find the value of velocity at the same point.

(OR)

b) Two velocity components of the flow are given in the following cases, find the third component such that they satisfy the continuity equation.

$u = x^3+y^2+2z^2$; $v = - x^2y – yz – xy$

$u = \log (y^2+z^2)$; $v = \log (x^2+z^2)$

$u = -2xyz/(x^2+y^2)^2$; $w = y/(x^2+y^2)$

24. a) 250 liters of water is flowing in a pipe having a diameter of 300 mm . If the pipe is bent by 135˚ (that is change from initial to final direction is 135˚), find the magnitude and direction of the resultant force on the bend . The pressure of water flowing is 39.24 N/cm².

(OR)

b) Derive Euler's equation of motion along a stream line and explain how to get Bernoulli's equation from it.

25. a) (i) List the different methods of preventing the separation of boundary layers (7)

(ii) For the following velocity profile, determine whether the flow has separated or on the verge of separation or will attach with the surface: (7)

$u/U=3y/2\delta-y^3/2\delta^3$

(OR)

b) Find the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $u/U=2y/\delta-y^2/\delta^2$, where u is the velocity at a distance y from the plate and u=U and y=δ . Where δ=boundary layer thickness. Also calculate the value of δ^*/θ.

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