

B.E. DEGREE EXAMINATIONS: OCTOBER / NOVEMBER-2008

Second Semester

U07 CE204 – Fluid and Solid Mechanics

(Common to Electrical and Electronics Engineering & Electronics and Instrumentation Engineering)

Time: Three Hours**Maximum Marks: 100****Answer ALL Questions:-****Part A (20 x 2 = 40 Marks)**

1. The Newton's law of viscosity is related to

a) Stress and strain	b) Shear stress, pressure and velocity
c) Shear stress and rate of strain	d) Viscosity and shear stress
2. Units of kinematic viscosity are

a) m^2/Sec	b) Newton Sec / m^2
c) Newton Sec / m^3	d) Kg Sec / m^2
3. The imaginary line drawn such that the tangents at its all points indicates the direction of the velocity of the fluid particle at each point is called

a) Path line	b) Stream line
c) Potential line	d) Streak line
4. Ir-rotational flow is such that

a) Circulation is zero	b) The particles cannot go in a circular motion
c) Stream function exists	d) Velocity may not be zero
5. The integral momentum equation requires the assumption that

a) The flow is uniform	b) The flow is uni -- directional
c) The fluid is incompressible	d) The flow is steady
6. The hydraulic gradient line is
 - a) Sometimes above the energy gradient line
 - b) Always sloping downward in the direction of flow
 - c) Velocity head below the energy gradient line
 - d) Velocity head above the energy gradient line.
7. The ratio of friction factor and coefficient of friction used in general equation for a head loss in a pipe is

a) 1	b) 2
c) 3	d) 4
8. Specific speed of fluid machine
 - a) Is specific to the particular machine
 - b) Refers to the speed of a machine of unit dimensions
 - c) depends only upon the head under which the machine operates
 - d) Is a type-number representative of its performance.
9. Cavitation is caused by

a) Low pressure	b) High pressure
c) Low velocity	d) High velocity

10. The efficiency of an impulse turbine

- a) May never be beyond 50% even theoretically
- b) May approach 100% for frictionless vanes
- c) May exceed 50% with inclined flat-plate vanes
- d) May approach 100% for hemispherical bucket vanes.

11. The internal resistance which the body offers to meet the load or external force is called

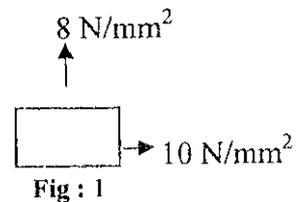
- a) Strain
- b) Stress
- c) Pressure
- d) Young's modulus

12. The elongation of a circular tapered bar is given by

- a) $\frac{4 Pl}{\pi E d_1 d_2}$
- b) $\frac{2 Pl}{\pi E d_1 d_2}$
- c) $\frac{4 P \pi}{E l d_1 d_2}$
- d) $\frac{4 l}{P \pi E d_1 d_2}$

13. For the element shown in fig 1 the max shear stress is

- a) 1 N/mm²
- b) 9 N/mm²
- c) 10 N/mm²
- d) 20 N/mm²



14. The ratio of lateral strain to linear strain is

- a) Bulk modulus
- b) Rigidity modulus
- c) Numeric strain
- d) poisson's ratio

15. For an element subjected to bi axial state of stress that Principal plane is determined by

- a) $\tan 2\theta = \frac{-2q}{P_x - P_y}$
- b) $\sin 2\theta = \frac{-2q}{P_x - P_y}$
- c) $\tan 2\theta = \frac{P_x - P_y}{-2q}$
- d) $\sin 2\theta = \frac{-q}{2(P_x - P_y)}$

16. When a circular shaft is subjected to Torque the stress developed in the material is

- a) Tensile stress
- b) Shear stress
- c) Principal stress
- d) Compressive stress.

17. Power transmitted by a shaft in watts is given by

- a) $\frac{2\pi NT}{60}$
- b) $\frac{2\pi N}{T.60}$
- c) $\frac{60}{2\pi NT}$
- d) $\frac{\pi NT}{60}$

18. The stiffness of the spring is given by

- a) W.d
- b) $\frac{d}{W}$
- c) $\frac{W}{d}$
- d) $\frac{W^2}{d}$

19. A perfect frame should satisfy the relation

- a) $m = 2j - 4$
- b) $m = 4j - 2$
- c) $m = 2j - 3$
- d) $m = 3j - 2$

20. A force 20 kN acting outward from the joint is inclined 30° to horizontal. What would be the vertical component of that force

a) $\frac{20}{\cos 30^\circ}$

b) $20 \cos 30^\circ$

c) $\frac{20}{\sin 30^\circ}$

b) $20 \sin 30^\circ$

Part B (12 x 5 = 60 Marks)

21. a) i) Explain specific gravity, viscosity, surface tension and capillarity (6)

ii). A 150 mm diameter shaft rotates at 1800 rpm in a 250 mm long journal bearing with 150.5 mm internal diameter. The uniform angular space between the shaft and the bearing is filled with oil of dynamic viscosity 0.80 poise. Calculate the power dissipated as heat. (6)

(OR)

b) i) With a sketch briefly explain the relationship between pressures. (6)

ii) Obtain the equation to the stream lines for the velocity field given as $V = 2x^3i - 6x^2yj$ (6)

22. a) i) Derive the Euler's equation for motion (6)

ii) Water is flowing through a pipe having diameter 500 mm and 380 mm at the bottom and upper end respectively. The intensity of pressure at the bottom is 400 kN/m^2 and the pressure at the upper end is 120 kN/m^2 . Determine the differences in datum head if the rate of flow through the pipe in 70 litres/Sec. (6)

(OR)

b) i) Briefly explain major and minor losses in a pipe flow (6)

ii) Three pipes of diameter 300 mm, 200 mm and 400 mm and length 450 m, 250 m and 300 m respectively are connected in series. The difference in water surface levels in two tanks is 19 m. Determine the rate of flow of water if co-efficients of friction are 0.0075, 0.0078 and 0.0072 respectively. Consider minor losses also. (6)

23. a) i) Briefly explain the classification of hydraulic turbines. (6)

ii) A Pelton wheel having a mean bucket diameter of 1.2 m is running at 1000 rpm. The net head on the pelton wheel is 850 m. If the side clearance angle is 15° and discharge through the nozzle is $0.12 \text{ m}^3/\text{s}$ determine the power available at nozzle and the hydraulic efficiency. (6)

(OR)

b) i) Briefly explain the classification of pumps. (6)

ii) A single acting reciprocating pump running at 50 rpm delivers $0.00736 \text{ m}^3/\text{s}$ of water. The diameter of the piston is 200 mm and stroke length 300 mm. The suction and delivery heads are 3.5 m and 11.5 m respectively. Determine the theoretical discharge, coefficient of discharge and power required to run the pump. (6)

24. a) i) Derive the equation $E : 2G (1+\mu)$ (6)

ii) A steel wire 2m long and 3 mm diameter is extended by 0.75 mm when a weight is suspended from the wire. If the same weight is suspended from a brass wire, 2.5 m long and 2 mm in diameter it is elongated by 4.64 mm. Determine the modulus of elasticity of brass if that of steel be $2 \times 10^5 \text{ N/mm}^2$. (6)

(OR)

b) i) An element in a material is subjected to tensile stresses of 10 N/mm^2 and 2 N/mm^2 in x and y directions respectively. A shear stress of 5 N/mm^2 is also acting. Find the principal planes and Principal stresses. (6)

ii) Explain the importance of strength, stability and stiffness of materials in the design of structural elements. (6)

25. a) i) A hollow shaft is to transmit 300 kW at 80 rpm. If the shear stress is not to exceed 60 MN/m^2 and internal diameter is 0.5 of the external diameter, find the internal and external diameters. Maximum torque is 1.4 times mean torque. (6)

ii) A close coiled helical spring has mean diameter of 75 mm and spring constant of 80 kN/m . It has 8 coils. What is the suitable diameter of the spring wire if maximum shear stress is not to exceed 250 N/mm^2 $G = 80 \text{ GN/m}^2$. (6)

(OR)

b) For the truss shown in fig 2. find the forces in all the members by method of joints. The truss is supported by hinge at A and roller at D. (12)

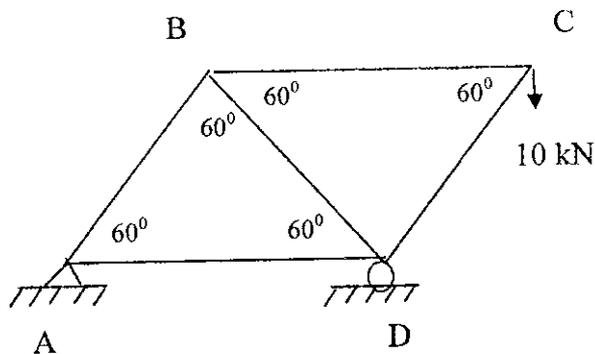


Fig : 2
