

GOVERNMENT POLYTECHNIC SHEOHAR

(DEPARTMENT OF SCIENCE TECHNOLOGY AND TECHNICAL EDUCATION)



DEPARTMENT OF MECHANICAL ENGINEERING

Previous year Questions and important questions' bank

(As per SBTE OBE syllabus)

SEM: 4 TH	SUB: FLUID MECHANICS AND HYDRAULICS MACHINERY	<u>SUB. CODE:</u> T2425402
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Unit:1

Section A (Objective questions)

1. Kinematic Viscosity is defined as:-
 (a) Dynamic Viscosity / density (b) Dynamic Viscosity * pressure
 (c) Dynamic Viscosity * density (d) none of these
2. Poise is the unit of
 (a) Mass density (b) Kinematic Viscosity (c) Viscosity (d) None of these
3. Density of water is maximum at
 (a) 0°C (b) 0°K (c) 4°C (d) 100°C
4. Pascal's law states that pressure at a point is equal in all directions.
 (a) In a liquid at rest (b) In a fluid at rest (c) In a laminar flow (d) In a turbulent flow
5. Rain drops are spherical because of
 (a) Viscosity (b) Air resistance (c) Surface tension force (d) Atmospheric pressure
6. A body just floats in sea water but sinks in river water because
 (a) Sea water has lesser density than river water
 (b) Sea water has greater density than river water
 (c) River water is more contaminated sea water
 (d) None of these
7. Center of pressure is
 (a) At the center of gravity (b) Below the center of gravity (c) Above the center of gravity
8. Which of the following is not a property of fluid?
 (a) Mass flow rate (b) density (c) viscosity (d) External diameter
9. The unit of kinematic viscosity is
 (a) cm²/sec (b) kg.sec/meter (c) Newton-sec/meter (d) meter/sec
10. The specific volume of a liquid is the reciprocal of
 (a) Weight density (b) Mass density (c) Specific weight (d) Specific volume
11. Popularly used device for low pressure measurement is
 (a) Inverted U-tube differential manometer
 (b) U-tube differential manometer
 (c) Inclined single column manometer
 (d) Vertical single column manometer

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Section B (Subjective Questions)

- Define the following terms with their units
(a) Viscosity (b) Compressibility (c) capillarity (d) vapour pressure
- Determine the viscosity of a liquid having kinematic viscosity 6 stokes and specific gravity 1.9.
- State and explain Pascal's law.
- The pressure inside a soap bubble of 50 mm diameter is 25 N/m² above atmospheric pressure. Calculate the surface tension in soap film.
- Find the depth below the free surface of oil having a density of 784 Kg/m³ with the pressure be very nearly equal to 1 bar.
- A circular plate 3.5 m diameter is fully immersed in water at an angle of 45° with the vertical. Determine the total pressure and center of pressure on the plate when its center is 3m below the free surface of water.
- A liquid of specific gravity 0.7 is filled in a tank up to the height of 2m. Calculate the pressure of liquid in tank in terms of water head.
- Explain construction and working of simple manometer.
- Why mercury is used in manometer?
- A differential manometer is connected at two points in a horizontal pipe running full of water. If the difference in mercury levels is recorded as 100 mm. calculate difference in pressure at the two points in head of water.
- Find the shear stress developed in a lubricating oil, of viscosity 9.81 poise, filled between two parallel plates 1 cm apart and moving with relative velocity of 2 m/s.
- A liquid weighs 15 kN and occupies 3.75 m³. Find its specific weight, mass density and specific gravity?
- Define the following terms:
(i) Atmospheric pressure (ii) Gauge pressure (iii) Vacuum pressure
(iv) Pressure head (v) specific gravity (vi) surface tension

Unit 2

Section A (Objective questions)

- Minor losses in pipe is due to
 - Sudden contraction and expansion
 - Loss at inlet and outlet
 - Loss due to bend
 - All the these
-of fluid accounts for the major losses in pipes.
 - Density
 - Specific gravity
 - Viscosity
 - Compressibility
- Pitot tube is used to measure
 - Velocity at stagnation point
 - Stagnation pressure
 - Static pressure
 - none of these
- The continuity equation for a two dimensional flow is
 - $\frac{\partial u}{\partial x} - \frac{\partial v}{\partial y} = 0$
 - $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} = 0$
 - $\frac{\partial u}{\partial y} + \frac{\partial v}{\partial x} = 0$
 - none of these
- Which method is most commonly used in fluid mechanics for analysis?
 - Langragian method
 - Eulerian method
 - Control volume analysis
 - None of these
- During the opening of valve in a pipe line, the flow is.....
 - Steady
 - unsteady
 - uniform
 - laminar
- The head loss through fluid flowing pipe due to friction is
 - The minor loss
 - The major loss
 - Both (a) and (b)
 - None of these
- The relation between C_d , C_v and C_c for orifice is
 - $C_c * C_d = C_v$
 - $C_c * C_v = 1$
 - $C_c = C_d * C_v$
 - $C_d / C_c = C_v$
- If the velocity of flow is constant then the ratio of discharge between flow through 1m diameter and 3m diameter of pipe will be
 - 1:3
 - 1:9
 - 3:1
 - 9:1
- The frictional head loss for maximum power transmission through a pipe is equal to
 - $H/3$
 - $H/2$
 - $H/4$
 - $3H/5$
- is a formula for the friction factor of circular pipes?
 - $Re/64$
 - $16/Re$
 - $64/Re$
 - $Re/16$

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12. The Bernoulli's equation is based on the assumption that
- There is no loss of energy of the liquid flowing
 - The velocity of flow is uniform across any cross section of the pipe.
 - No force except gravity acts on the fluid
 - all of the above
13. Continuity equation is based on the principle of
- Conservation of momentum
 - Conservation of energy
 - Conservation of mass
 - None of the above
14. Continuity equation can take the form of
- $A_1V_1=A_2V_2$
 - $\rho_1A_1=\rho_2A_2$
 - $\rho_1A_1V_1= \rho_2A_2V_2$
 - $P_1A_1V_1=P_2A_2V_2$
15. A flow is said to be laminar when
- The fluid particle moves in zig-zag way
 - The Reynolds's number is high
 - The fluid particles move boundary in layers parallel to the boundary.
 - None of the above
16. A stream line is a line -
- Which is along the path of a particle
 - Which is always parallel to the main direction of flow
 - Across which there is no flow
 - On which tangent drawn at any point gives the direction of velocity.
17. Stream lines and path lines are all identical in case of-
- Uniform
 - steady flow
 - unsteady flow
 - none of these
18. If the fluid flow characteristics such as density, velocity, etc. do not change with time the flow is-
- Steady
 - unsteady
 - laminar
 - turbulent
19. The piezometric head is-
- velocity head + elevation head
 - velocity head + pressure head
 - pressure head + elevation head
 - elevation head + pressure head + velocity head
20. Darcy Weisbach formula for frictional head loss in pipe length L is expressed as
- $h_l = \frac{4fLv^2}{2gd}$
 - $h_l = f \frac{v^2}{2gd}$
 - $h_l = \frac{fLv^2}{gd}$
 - none of these

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Section B (Subjective Questions)

1. State and explain continuity equation
2. Explain
 - (a) uniform and non-uniform flow
 - (b) steady and unsteady flow
 - (c) compressible and incompressible flow
 - (d) laminar and turbulent flow
3. A 50 mm diameter orifice is provided in a tank containing water to a height of 2m above the centre of orifice. Find coefficient of discharge and actual discharge of coefficient of contraction and coefficient of velocity are 0.6 and 0.95 respectively.
4. Briefly describe various minor loss of heads in a pipe line and also give formulae to calculate their values
5. The diameters of large and smaller ends of a pipe are 150 cm and 50 cm respectively If discharge through pipe is 3000 lit/sec, calculate velocities at both ends.
6. Find the head lost due to friction in a pipe of diameter 300mm and length 50m through which water is flowing at a velocity of 3m/s. Take coefficient of friction, $f = 0.003$ and $g=10\text{m/s}^2$.
7. Explain the construction and working principle of orifice meter.
8. What is venturimeter? Write its working principle with neat sketch.
9. A horizontal venturimeter with inlet and throat diameter 20cm and 10cm respectively is used to measure the Flow of water. The reading of differential manometer connected to the inlet and the throat is 20cm of mercury. Determine the rate of Flow. Take $C_d = 0.98$.
10. Explain Bernoulli's theorem with assumptions, also state various energy heads involved in it.
11. In a 200 meter long and 10 cm diameter pipe, water is flowing at a velocity of 3 m/sec. find the head loss due to friction by Darcy's and Chezy's equation. (Given that $f'=0.005$ and $C=50$).
12. Explain the construction and working principle of pitot tube.
13. Define coefficient of contraction, coefficient of velocity and coefficient of discharge. State the relationship between them?
14. Define major losses in a pipe with the help of Darcy's Weishbach equation.

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Unit 3

Section A (Objective questions)

1. The force exerted (in Newton) by a jet of water impinging normally on a fixed plate is
 (a) $\rho av/2$ (b) ρav (c) $\rho av^2/2$ (d) ρav^2
2. Reynolds number is more than 10,000, the flow is
 (a) Turbulent (b) Laminar (c) Transient (d) none of these
3. The forced analysis on a curved vane is understood using
 (a) Velocity triangle (b) Angle of the plate (c) Vane angles (d) Plate dimensions
4. The force exerted by a jet of liquid impinging normally with a velocity V on a plate, which moves in the direction of the jet with a velocity U is
 (a) $\rho A(V-U)^2$ (b) $\rho A(V-U)^2/2$ (c) $2\rho A(V-U)^2$ (d)) none of these
5. A jet of water flowing with a velocity V impinges on a flat plate moving with a velocity U in the direction of flow. The relative velocity of the jet of water with respect to the moving plate will be
 (a) $U+V$ (b) $V-U$ (c) $U-V$ (d) None of these
6. Impact is the force exerted due to
 (a) Change of momentum of a mass
 (b) Weight of the mass
 (c) Change of KE of the mass
 (d) Inertia of motion of a mass
7. When a jet of water impinges on a series of plates approaching successively, the maximum possible efficiency is
 (a) 25% (b) 50% (c) 75% (d) 90%
8. The force exerted by a jet of water impinging on a fixed plate inclined at an angle θ with jet.
 (a) $\frac{\rho}{2} AV \sin \theta$ (b) $\rho AV^2 \sin \theta$ (c) $\frac{\rho}{2} AV^2 \sin \theta$ (d) $\rho AV \sin \theta$

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Section B (Subjective Questions)

1. Explain the expression of force exerted by the impact of jet on an inclined fixed plate.
2. A water jet 0.0015 m^2 in area issues from a nozzle with 15 m/s velocity. If is made to impinge perpendicular on to a plate that moves away from the jet with a velocity of 5 m/s . Calculate the force on plate due to this impact.
3. Find the force exerted and work done by a Jet of water of diameter 100mm on a stationary flat plate, when the jet strikes the plate normally with a velocity of 25m/s .
4. Derive an expression for the force exerted and work done by a jet of water having velocity V on a moving vertical flat plate having velocity U with suitable assumptions.
5. Write the theory of impact of jets.
6. A 10 cm diameter jet of water strikes fixed stationary plate at right angle with a velocity of 100 m/sec . Calculate force exerted on it. If plate starts moving in the direction of jet with a velocity of 25m/s . determine the work done on it.
7. A jet of water having a velocity of 35m/s impinges a series of vanes moving with a velocity of 20 m/s . The jet makes an angle of 30° to the direction of motion of vanes when entering and leaves at 120° . Draw the triangles of velocities at inlet and outlet and find,
 - (i) The angles of vane tips so that water enters and leaves without shock.
 - (ii) The work done per unit weight of water entering the vanes.
 - (iii) Efficiency.

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Unit 4

Section A (Objective questions)

1. Cavitation is caused by
 (a) high pressure (b) high velocity (c) low velocity (d) none
2. Pelton wheel is used where
 (a) High head and low discharge are available
 (b) Low head and high discharge are available
 (c) High head and high discharge are available
 (d) None
3. Hydraulic turbine converts
 (a) Mechanical energy into hydraulic energy
 (b) Kinetic energy into electrical energy
 (c) Hydraulic energy into mechanical energy
 (d) None of these
4. The relation between hydraulic efficiency (η_h), mechanical efficiency (η_m) and overall efficiency (η_o) is
 (a) $\eta_m = \eta_h * \eta_o$ (b) $\eta_h = \eta_m * \eta_o$ (c) $\eta_o = \eta_h * \eta_m$ (d) none
5. Specific speed of a turbine is given by the equation (Where-N=Speed, P=Power, H = Head)
 (a) $\frac{N\sqrt{P}}{H^{3/2}}$ (b) $\frac{N\sqrt{P}}{H^2}$ (c) $\frac{N\sqrt{P}}{H^{5/4}}$ (d) none
6. Turbine is preferred for 450 m head of water
 (a) Pelton wheel (b) Kaplan turbine (c) Francis turbine (d) none
7. Braking jet in an impulse turbine is used
 (a) To break the jet of water
 (b) To bring the runner to rest in a short time
 (c) To change the direction of runner
 (d) None of these
8. Pelton wheel turbine is a
 (a) Tangential flow turbine
 (b) Radial flow turbine
 (c) Outward flow turbine
 (d) Inward flow turbine

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9. Impulse turbine requires
 (a) High head and low discharge
 (b) High head and high discharge
 (c) Low head and low discharge
 (d) Low head and high discharge
10. The purpose of a draft tube is to
 (a) Prevent flow separation
 (b) Avoid pressure drag
 (c) Prevent reflection of heat
 (d) Increase efficiency.
11. The maximum hydraulic efficiency of an impulse turbine is
 (a) $(1 + \cos \phi)/2$ (b) $(1 - \cos \phi)/2$ (c) $(1 + \sin \phi)/2$ (d) $(1 - \sin \phi)/2$
12. The unit speed of the turbine runner is
 (a) $N/\sqrt{H}$ (b) N/H (c) $N/\sqrt{H^3}$ (d) N/H^2
13. Water hammer is developed in
 (a) Penstock (b) Draft tube (c) Turbine (d) Surge tank
14. A turbine develops 2515 KW power at 240 rpm. The torque in the shaft will be
 (a) 100 KN-m (b) 400 KN-m (c) 1000 KN-m (d) 3355 KN-m
15. The angle of taper on draft tube is
 (a) Greater than 15° (b) Greater than 8° (c) Greater than 5° (d) Less than 8°
16. Francis turbine is a
 (a) Impulse turbine
 (b) radial flow turbine
 (c) axial flow turbine
 (d) reaction radial flow turbine
17. Kaplan turbine is anturbine. (impulse/radial flow/axial flow)
18. Cavitation occurs at inlet of draft tube and exit of turbine. (true/false)
19. Kaplan turbine is ahead and..... discharge turbine.
 (High/low, low/high, high/high, low/low)
20. Draft tube is used inturbine. (impulse/reaction)

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Section B (Subjective Questions)

- Define the following terms with respect to turbine
 - Hydraulic efficiency
 - Mechanical efficiency
 - Overall efficiency
- State different types of draft tubes used in reaction turbine.
- Explain the concept of cavitation in the turbine.
- Draw a layout of hydroelectric power plant and explain in brief.
- State the classification of hydraulic turbine.
- Differentiate between Impulse and Reaction turbine.
- Explain construction and working of Pelton wheel turbine with neat sketch.
- Explain construction and working of Francis turbine with neat sketch.
- Explain construction and working of Kaplan turbine with neat sketch.
- What is cavitation? How it can be avoided in reaction turbines?
- What are unit quantities with respect to hydraulic turbine? Also, Derive expression for these unit quantities?
- A hydraulic power plant is having Pelton wheel working under a head of 600 m produces 16000 KW at 430 rpm. If the efficiency of wheel is 90%, determine: (i) discharge in m^3/s , (ii) diameter of nozzle, (iii) diameter of wheel. Assume speed ratio U/V as 0.46 and $C_v = 0.98$.
- Two jets strike the bucket of a Pelton wheel which develops 15000 kW. The total discharge is $6 \text{ m}^3/\text{sec}$. If the net head on the turbine is 350 m, find the overall efficiency of turbine.

Unit 5

Section A (Objective questions)

1. Centrifugal pumps transfer energy from
 - (a) Rotor to fluid
 - (b) Fluid to rotor
 - (c) Draft to rotor
 - (d) Rotor to draft
2. In a centrifugal pump the liquid enters the pump
 - (a) At the top
 - (b) At the bottom
 - (c) At the center
 - (d) from sides
3. In a centrifugal pumps maximum efficiency is obtained when the blades are
 - (a) Straight
 - (b) Bent forward
 - (c) Bent backward
 - (d) Radial
4. A pump is device which convertsenergy intoenergy.
 - (a) mechanical/hydraulic
 - (b) hydraulic/mechanical
5. Manometric efficiency is the ratio of
 - (a) The power of the impeller to the input power
 - (b) The output power of the pump to the power of the impeller
 - (c) Output power of the impeller to the input power
 - (d) None of these
6. Air vessel is a reciprocating pump is used
 - (a) To obtain continuous supply of water at rate uniform
 - (b) To reduce suction head
 - (c) To Increase delivery head
 - (d) None of the above
7. Specific speed is
 - (a) The actual speed of the pump
 - (b) The speed of the model of the pump
 - (c) The speed of a geometrically similar pump which discharge 1 m³ of liquid under a head of 1 m.
 - (d) None of these
8. In a reciprocating pump
 - (a) The piston moves with uniform velocity
 - (b) The piston moves with uniform acceleration
 - (c) The piston moves with uniform retardation
 - (d) The piston moves with variable acceleration and variable retardation

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9. The discharge through a single acting reciprocating pump having speed N rpm is
 - (a) $2 \text{ LAN}/60$
 - (b) $\text{LAN}/60$
 - (c) 60 LAN
 - (d) 120 LAN
10. Reciprocating pump is a..... displacement pump (positive/negative)
11. Slip of reciprocating pump is defined as the
 - (a) Sum of actual discharge and theoretical discharge
 - (b) Difference of actual discharge and theoretical discharge
 - (c) Ratio of actual discharge to theoretical discharge
 - (d) None of these
12. To discharge a large quantity of liquid by multistage centrifugal pump, impellers are connected in
 - (a) In parallel
 - (b) In series
 - (c) In parallel and in series
 - (d) None of these
13. In a reciprocating pump, cavitation occurs during delivery stroke at the
 - (a) Beginning of stroke
 - (b) End of stroke
 - (c) Middle of stroke
 - (d) Both (a) & (b)
14. Shaft power of centrifugal pump is
 - (a) The power available at the outlet of the pump
 - (b) The power of the impeller
 - (c) The power supplied to the impeller
 - (d) None of these
15. Cavitation occurs if
 - (a) Pressure at any point in a liquid is greater than the vapor pressure of the liquid
 - (b) The pressure at any point in a liquid is less than the vapor pressure of the liquid
 - (c) Pressure is much above the atmospheric pressure
 - (d) None of these
16. Overall efficiency of a centrifugal pump is the ratio of
 - (a) Output power of the pump to the input power
 - (b) Output power to the power of the impeller
 - (c) Power of the impeller to the input power
 - (d) None of these

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Section B (Subjective Questions)

1. Write four difference between pump and turbine.
2. Define following terms with respect to pump
 - a) Manometric head
 - b) Manometric efficiency
 - c) Mechanical efficiency
 - d) Overall efficiency
3. Explain the principle and working of centrifugal pump with neat sketch. Also write its application.
4. Explain the construction and working of reciprocating pump with neat sketch.
5. State the methods of priming in centrifugal pump.
6. A centrifugal pump driven by a directly coupled 3KW motor of 1450 rpm speed, is proposed to be connected to another motor of 2900 rpm speed. Calculate the power of motor.
7. Describe priming and write about its necessity.
8. Write different types of impeller of centrifugal pump and explain any one of them in brief.
9. Compare between Centrifugal pumps and Reciprocating pumps
10. A centrifugal pump is to discharge 100 lit/sec at speed of 1500 rpm against a head of 15 m. The Impeller has an outer diameter of 25 cm with a width at the outlet of 6 cm. The Manometric efficiency is 0.85. Find the blade angle at the outlet
11. Explain the working principle of double acting reciprocating pump.
12. Discuss the concept of slip in a reciprocating pump.
13. Explain in details how and when separation of flow take place in a reciprocating pump.