**NARASIMHA REDDY ENGINEERING COLLEGE**
**(Autonomous)**
**Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad**
**Accredited by NAAC with A Grade, Accredited by NBA**

## MECHANICAL ENGINEERING

## QUESTION BANK

**Course Title** : **Fluid Mechanics and Hydraulic Machines**

**Course Code** : **23ME403**

**Regulation** : NR23

## UNIT–I

## UNIT NAME: FLUID STATICS

| S.No | | Questions | BT | CO | PO |
|---|---|---|---|---|---|
| **Part – A (Short Answer Questions)** | | | | | |
| 1 | | Explain newtons law of viscosity | L1,L2 | 1 | 1 |
| 2 | | Define absolute, gauge and vacuum pressures | L1 | 1 | 2,3 |
| 3 | | Enunciate newtons law of viscosity. Explain the importance of viscosity in fluid motion | L2 | 1 | 2,3 |
| 4 | | Name the phenomenon of capillarity. | L1 | 1 | 1 |
| 5 | | Differentiate between :a) compressible and incompressible fluid b)real fluid and ideal fluid | L2 | 1 | 2,3 |
| 6 | | Explain what monomer is. How it is classified? | L1,l2 | 1 | 1 |
| 7 | | Differentiate U-tube manometer and differential manometer. | L1,l2 | 1 | 2,3 |
| 8 | | What is Capillarity? State the factors that affect the viscosity of a fluid | L1,l2 | 1 | 2,3 |
| 9 | | Define Viscosity. How it varies with temperature? | L1,l2 | 1 | 2,3 |
| 10 | | Calculate the density, specific weight and weight of one of litre of petrol of specific gravity is 0.7. | L1,l2 | 1 | 1 |
| 11 | | Explain the difference between simple and differential manometer. | L1,l2 | 1 | 2,3 |
| **Part – B (Long Answer Questions)** | | | | | |
| 11 | a) | Distinguish between:<br>i) standard and local atmospheric pressures,<br>ii) barometric pressure and absolute pressure and<br>iii) absolute pressure and gauge pressure | L1 | 1 | 2,3 |
| | b) | Define Viscosity, Surface tension and Vapor Pressure and explain their influence<br>on fluid motion | L1 | 1 | 2,3 |
| 12 | a) | Derive an equation for capillary raise and fall of water when a glass tube immersed on it. | L2 | 1 | 2,3 |
| | b) | Explain with neat sketch of the following:<br>i) Simple manometers | L1 | 1 | 2,3 |

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| | | ii) U tube manometers | | | |
| 13 | a) | Explain the following terms:<br>i) Specific weight ii) Vapour pressure iii) atmospheric pressure. | L2 | 1 | 2,3 |
| | b) | Differentiate between:<br>a) ) Cohesion and Adhesion<br>b) Real fluid and Ideal fluid<br>c) Compressible and Incompressible fluids | L1, L2 | 1 | 2,3 |
| 14 | a) | Explain how vacuum pressure can be measured with the help of a U-tube manometer. | L1, L2 | 1 | 2,3 |
| | b) | Two horizontal plates are placed 1.25cm 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. | L1, L2 | 1 | 2,3 |
| 15 | a) | Find the kinematic viscosity of an oil having density 981 kg/m $^3$. The shear stress at a point in oil is 0.2452 N/m$^2$ and velocity gradient at that point is 0.2 per second. | L1, L2 | 1 | 2,3 |
| | b) | The pressure outside the droplet of water of water of diameter 0.04mm is 10.32N/cm$^2$. Calculate the pressure within the droplet if surface tension is given as 0.0725N/m of water. | L1, L3 | 1 | 2,3 |
| 16 | a) | The right limb of a simple U- tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of sp. gr. 0.9 is flowing. The centre of the pipe is 12cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm. | L1, L2 | 1 | 2,3 |
| | b) | A pipe contains an oil of sp. gr. 0.9. A differential manometer connected at the two points A and B shows a differential in mercury level as 15 cm. Find the difference of pressure at the two points. | L1, L2 | 1 | 2,3 |

## UNIT–II

## UNIT NAME: FLUID KINEMATICS & FLUID DYNAMICS

| S.No | | Questions | BT | CO | PO |
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| **Part – A (Short Answer Questions)** | | | | | |
| 1 | | Examine critically one Dimensional and three Dimensional flows | L1, L2 | 2 | 1 |
| 2 | | What are the practical applications of Bernoulli's equation? | L1, L2 | 2 | 1 |
| 3 | | What do you mean by rotational and irrigational flows?. | L1, L2 | 2 | 1 |
| 4 | | What is momentum equation? What are its applications? | L1, L2 | 2 | 1 |
| 5 | | Define stream length and stream tube with neat sketch. | L1, L2 | 2 | 1 |
| 6 | | Describe assumptions of Bernoulli's theorem | L1, L2 | 2 | 1 |
| 7 | | Explain rotational and irrotational flows with practical examples | L1, L2 | 2 | 1 |
| 8 | | What are different types of fluid flow? | L1, L2 | 2 | 1 |
| 9 | | Write the continuity equation for 2D and 3D flows. | L1, L2 | 2 | 1 |
| 10 | | State the of Bernoulli's theorem. | L1, | 2 | 2,3 |
| **Part – B (Long Answer Questions)** | | | | | |
| 1 | a) | Derive continuity equation for 3-D flow. | L1, L2 | 2 | |
| 1 | b) | Derive Bermoullis equation from Eulers equation | L1, L2 | 2 | 2,3 |

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| 12 | | State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an | L1, L2 | 2 | 2,3 |
| | | expression for Bernoulli's theorem from first principle | L1, L2 | 2 | 1 |
| 13 | a) | Discuss the classification of fluids and give one example for each type of fluid | L1, L2 | 2 | 1 |
| | b) | Explain the terms: (i) Path line (ii) Streak line (iii) Stream line and (iv) Stream tube | L1, L2 | 2 | 1 |
| 14 | | A $45^0$ reducing bend is connected in a pipe line, the diameter at the inlet and outlet of the bend being 600mm and 300mm respectively. Find the force exerted by water on the bend if the intensity of pressure at inlet to bend is 8.829 $N/cm^2$ and rate of water is 600 litres/s. | L1, L2 | 2 | 2,3 |
| 15 | a) | A 30 cm diameter pipe, conveying water, branches into two pipes of diameters 20cm and 15cm respectively. If the average velocity in the 30cm diameter pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15cm pipe if the average velocity in 20 cm discharge pipe is 2 m/s. | L1, L2 | 2 | 2,3 |
| | b) | The water is flowing through a pipe having diameter 20cm and 10 cm at section 1 and 2 receptivity. The rate of flow through pipe is 35 litres/s. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is $39.24N/cm^2$, find the intensity of pressure at section 2. | L1, L2 | 2 | 1 |
| 16 | a) | A 20cmx 10 cm venturimeter is inserted in a vertical pipe carrying oil of sp.gr. 0.8, the flow of oil is in upward direction. The difference of levels between the Throat and inlet section is 50 cm. The oil mercury differential monomer gives a reading of 30cm of mercury. Find the discharge of oil. Neglect losses. | L1, L2 | 2 | 1 |
| | b) | A oil of sp.gr.0.8 is flowing through a venturimeter having inlet diameter 20cm and throat diameter 10cm. The oil-mercury differential manometer shows a reading of 25cm. calculate the discharge of oil though the horizontal venturimeter .Take $C_d$=0.98 | L1, L2 | 2 | 2,3 |

## UNIT–III

### UNIT NAME: BOUNDARY LAYER CONCEPTS

| S.No | | Questions | BT | CO | PO |
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| **Part – A (Short Answer Questions)** | | | | | |
| 1 | | Write any two practical application of Bernoulli's equation | L1, L2 | 3 | 1 |
| 2 | | Define drag and lift. | L1, L2 | 3 | 1 |
| 3 | | Distinguish between Orifice meter and venturimeter | L1, L2 | 3 | 2,3 |
| 4 | | Write Darcy- Weisbach equation for head loss in pipes due to friction and name the terms. | L1, L2 | 3 | 1 |
| 5 | | Distinguish between major and minor losses | L1, L2 | 3 | 1 |
| 6 | | Define HGL and TEL. | L1, L2 | 3 | 1 |
| 7 | | What is meant by pipes in series and pipes in parallel? | L1, L2<br>L1, L2 | 3 | 1 |
| 8 | | List out the losses in pumps | L1, L2 | 3 | 1 |
| 9 | | Write any two four head losses due to minor losses in pipes | L1, L2 | 3 | 2,3 |
| 10 | | Define Hydraulic gradient line and Total energy line. | L1, L2 | 3 | 2,3 |
| **Part – B (Long Answer Questions)** | | | | | |
| 11 | a) | Explain in detail laminar boundary layer, turbulent boundary layer, laminar sub-layer | L1, L2 | 3 | 1 |

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| | b) | Explain with neat sketch how to determine type of flow with help of Reynolds experiment. | L1, L2 | 3 | 2,3 |
| 12 | | What conditions should be satisfied for separation of boundary layer? Discuss briefly the methods that can be used to prevent separation | L1, L2 | 3 | 2,3 |
| | | | | | 1 |
| 13 | a) | Find the loss of head when a pipe of diameter 200mm is suddenly enlarged to a diameter 400 mm. The rate of flow of water though the pipe is 250 litres/s . | L1, L2 | 3 | 2,3 |
| | b) | What do you understand by pipes in series, pipes in parallel and equivalent pipe | L1, L2 | 3 | 1 |
| 14 | a) | Explain the principle of Venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it. | L1, L2 | 3 | 2,3 |
| | b) | Show that the loss of head due to sudden expansion in pipe line is a function of velocity head | L1, L2 | 3 | 1 |
| 15 | | Derive the Darcy- Weisbach equation for head loss in pipes due to friction. | L1, L2 | 3 | 2,3 |
| | | | | 3 | 1 |
| 16 | a) | A plate 1.5m X 1.5m moves at 50 km/hour in stationary air of density 1.15 kg/$m^3$. If the co-efficient of drag and lift are 0.15 and 0.75 respectively. Determine a) the lift force b) the drag force c) the resultant force d) the power required to keep the plate in motion. | L1, L2 | 3 | 1 |
| | b) | A oil of sp.gr.0.8 is flowing through a venturimeter having inlet diameter 20cm and throat diameter 10cm. The oil-mercury differential manometer shows a reading of 25cm. calculate the discharge of oil though the horizontal venturimeter .Take $C_d$=0.98 | L1, L2 | 3 | 2,3 |

## UNIT–IV

## UNIT NAME: BASICS OF TURBO MACHINERY

| S.No | | Questions | BT | CO | PO |
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| **Part – A (Short Answer Questions)** | | | | | |
| 1 | | Summarize the classification of turbines | L1, L2 | 4 | 1 |
| 2 | | Explain different types of Heads in hydraulic turbines | L1, L2 | 4 | 2 |
| 3 | | What is the difference between turbine and pump? | L1, L2 | 4 | 1 |
| 4 | | Distinguish between drag and lift. | L1, L2 | 4 | 1 |
| 5 | | What are classifications of turbines? | L1, L2 | 4 | 1 |
| 6 | | Write any two definitions impulse turbine and reaction turbine | L1, L2 | 4 | 1 |
| 7 | | Define gross head and net head with respect to turbine. | L1, L2 | 4 | 1 |
| 8 | | Define mechanical efficiency and volumetric efficiency for a turbine. | L1, L2 | 4 | 1 |
| 9 | | What is draft tube .Write any two type of draft tube?. | L1, L2 | 4 | 1 |
| 10 | | What is cavitation? What is the significance of it? | L1, L2 | 4 | 1 |
| **Part – B (Long Answer Questions)** | | | | | |
| 11 | a) | Derive the Darcy Weisbach equation for pipe flow system. | L1, L2 | 4 | 2,3 |
| | b) | What are the uses of a draft tube? Describe with neat sketches different types of draft tubes. | L1, L2 | 4 | 1 |
| 12 | a) | Define the term: impact of jets. Obtain an expression for the force exerted by a jet of water on a fixed vertical plate in the direction of the jet. | L1, L2 | 4 | 1 |
| | b) | Pelton wheel has a mean bucket speed of 10 meters per second | L1, L2 | 4 | 1 |

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| | | with a jet of water flowing at the rate of 700 liters/s under head of 30 meters. The buckets deflect the jet through an angle of $160^0$.calculate the power given by water to the runner and the hydraulic efficiency of the turbine. Assume co-efficient of velocity as 0.98. | | | |
| 13 | a) | Water is flowing through a pipe at the end of which a nozzle is fitted .The diameter of the nozzle is 100mm and the head of water at the centre nozzle is 100m.find the force exerted by the jet of water on a fixed vertical plate. The co-efficient of velocity is given as 0.95. | L1, L2 | 4 | 1 |
| | b) | Explain the boundary layer characteristics along thin plate, bring out essential important points | L1, L2 | 4 | 1 |
| 14 | a) | What is specific speed? State its significance in the study of hydraulic machines. | L1, L2 | 4 | 1 |
| | b) | Find the expression for the force exerted by the jet on a flat vertical plate moving in the direction of the jet | L1, L2 | 4 | 1 |
| 15 | a) | By means of a neat sketch, explain the working of pelton Turbine. | L1, L2 | 4 | 1 |
| | b) | A turbine is a to operate under a head of 25m at r.p.m. The discharge is 9cumec. If the efficiency is 90%, determine a) specific speed of turbine b) power generated, and c) types of turbine. | L1, L2 | 4 | 1 |
| 16 | a) | Describe the theory of a draft tube with the help of a neat sketch | L1, L2 | 4 | 1 |
| | b) | A turbine develops 500 kW power under a head of 100 meters at 200 r.p.m. What would be its normal speed and output under a head of 81 meters? | L1, L2 | 4 | 1 |

## UNIT–V

**UNIT NAME: Centrifugal pumps and Reciprocating pumps**

| S.No | | Questions | BT | CO | PO |
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| **Part – A (Short Answer Questions)** | | | | | |
| 1 | | Mention the advantages of centrifugal pumps. | L1, L2 | 5 | 1 |
| 2 | | Define specific speed of centrifugal pump | L1, L2 | 5 | 1 |
| 3 | | Discuss the importance of priming in pumps. Can priming be avoided in pumps? | L1, L2 | 5 | 2,3 |
| 4 | | Define Specific Speed of a Pump. | L1, L2 | 5 | 1 |
| 5 | | What is slip? | L1, L2 | 5 | 2,3 |
| 6 | | Define Slip, percentage slip and negative slip in of a reciprocating pump | L1, L2 | 5 | 1 |
| 7 | | How the centrifugal pumps are classified? | L1, L2 | 5 | 2,3 |
| 8 | | What is priming of a centrifugal pump? Why it is needed. | L1, L2 | 5 | 2,3 |
| 9 | | Give the classification of pumps. | L1, L2 | 5 | 1 |
| 10 | | What is NPSH? Explain. | L1, L2 | 5 | 1 |
| **Part – B (Long Answer Questions)** | | | | | |
| 11 | a) | Define the terms ‘unit power’, ‘unit speed’ and ‘unit discharge’ with reference to a hydraulic turbine. Also derive expressions for these terms. | L1, L2 | 5 | 1 |
| | b) | Define the following in case of Centrifugal pumps i) Manometric efficiency ii) Volumetric efficiency iii) Mechanical efficiency iv) Specific speed. | L1, L2 | 5 | 1 |

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| 12 | | Define centrifugal pump and explain the working of a single-stage centrifugal pump with neat sketch | L1, L2 | 5<br>5 | 2,3 |
| 13 | | Define a centrifugal pump. Explain the working of a multistage Centrifugal pumps with sketches. | L1, L2 | 5<br>5 | 1 |
| 14 | | A three stage centrifugal pump has impellers 40cm in diameters and 2 cm wide at outlet. The vanes are curved at the back at the outlet at $45^0$ and reduce the circumference area by 10%. The manometric efficiency is 90% and the overall efficiency is 80%. Determine the head generated by the pump when running at 1000 r.p.m. Delivering 50 liters per second. What should be the shaft horse power | L1, L2 | 5<br>5 | 1 |
| 15 | a) | A single –acting reciprocating pump, running at 50r.p.m, delivers $0.01m^3/s$ of water. The diameter of the piston is 200mm and stroke length 400 mm. determine: a) the theoretical discharge of the pump b) co-efficient of discharge and c) slip and the percentage slip of the pump. | L1, L2 | 5 | 2,3 |
| | b) | Define the term NPSH. Discuss the various provisions required for prevention of cavitation. | L1, L2 | 5 | 2,3 |
| 16 | | Explain the principle and working of a Reciprocating pump. | L1, L2 | 5<br>5 | 1 |

* **Blooms Taxonomy Level (BT)**(L1 – Remembering; L2 – Understanding; L3 – Applying; L4 – Analyzing; L5 – Evaluating; L6 – Creating)

**Course Outcomes (CO)**

**Program Outcomes (PO)**

**Prepared By:** **HOD,**