FLUID MECHANICS QUESTION BANK

COURSE B.E SUBJECT CODE : UAMCC04

PART-A

UNIT-I

1. Define fluid.
2. Define real and ideal fluids.
3. Define mass density and specific weight.
4. Distinct b/w statics and kinematics.
5. Define viscosity.
6. Define specific volume.
7. Define specific gravity.
8. State Newton's law of viscosity.
9. Name the types of fluids.
10. Define compressibility.
11. Define kinematic viscosity.
12. Write down the expression for capillary fall.
13. Explain vapor pressure and cavitation.
14. What is continuity equation?
15. Define Bernoulli's equation with assumptions.
16. What is Reynold's equation of motion?
17. What is capillarity?
18. What is pitot tube?
19. What is momentum equation?
20. What are the properties of Newtonian fluid?

UNIT-II

1. What do you mean by viscous flow?
2. What is loss of head due to friction?
3. Define total energy line.
4. What are the various minor losses?
5. Define hydraulic gradient line.
6. Define the major energy loss and minor energy loss.
7. What is water hammer in pipes
8. Write down the examples of laminar flow/viscous flow.
9. What are the characteristics of laminar flow?
10. Write down the expression for finding the head loss due to entrance of pipe h_i?
11. Write the Darcy –Weisbach formula.
12. What are the factors influencing the frictional loss in pipe flow.
13. What are the factors to the determined when viscous fluid flows through the circular pipe?
14. Define velocity gradient.
15. Define boundary layer.
18. Define laminar boundary layer.

19. Define turbulent boundary layer.
20. Define laminar sub layer.

UNIT-III

1. Define Buoyancy.
2. What is centre of buoyancy?
3. Define Metacentre.
4. What is meta centric height?
5. What is the value for volume of water displaced?
6. Give the expression to calculate the metacentric height analtically.
7. How the weight of a body could be calculated?
8. What is meant by stability of a submerged body?
9. Define stable equilibrium of a submerged body.
10. Define unstable equilibrium of a submerged body.
11. Define neutral equilibrium of a submerged body.
12. What is meant by stability of a floating body?
13. Define stable equilibrium of a floating body.
14. Define unstable equilibrium of a floating body.
15. Define neutral equilibrium of a floating body.
16. Give the expression to calculate the metacentric height experimentally.
17. What is force of buoyancy?
18. When will the body floats?
19. What is gauge pressure?
20. What is absolute pressure?

UNIT-IV

1. Define pump.
2. How pumps are classified?
3. Differentiate pump and turbine.
4. Define Rotodynamic pump.
5. Define Positive displacement pump.
6. Define cavitation in pump.
7. What is the need for priming in pump?
8. Why the foot valve is fitted with strainer?
9. Differentiate between volute casing and vortex casing.
10. What is the function of volute casing?
11. What is the function of guide vanes?
12. Why the vanes are curved radially backward?
13. What do you mean by relative velocity?
14. What is whirl velocity?
15. What is the function of impeller?
16. Define specific speed of pump.
17. Name the important characteristic curves for centrifugal pump?
18. What is slip of reciprocating pump?
19. What is negative slip?
20. What does indicator diagram indicates?

UNIT-V

1. Define turbine.
2. What are the classifications of turbine
3. Define impulse turbine.
4. Define reaction turbine
5. What is the function of draft tube?
6. Define specific speed of turbine.
7. What is breaking jet in Pelton wheel turbine?
8. What is the function of casing in Pelton turbine
9. How the inlet discharge is controlled in Pelton wheel?
10. What do you mean by head race?
11. What is speed ratio?
12. Mention the parts of Kaplan turbine.
13. What is mixed flow reaction turbine? Give an example.
14. Why draft tube is not required in impulse turbine?
15. What does velocity triangle indicates?
16. Give example for a low head, medium head and high head turbine.
17. What is the function of spear end nozzle?
18. What is gross head and net or effective head.
19. Name the important types of characteristic curves for turbine.
20. What is jet ratio in Pelton wheel?

PART-B

UNIT-I

1. Calculate the density, specific weight and weight of one liter of petrol of specific gravity 0.7
2. Explain about the types of the fluids.
3. The capillary rise in glass tube is not to exceed 0.2mm of water. Determine its minimum size given that surface tension for water in contact with air is 0.0725N/m
4. Determine the specific gravity of fluid having dynamic viscosity 0.05 poise and kinematic viscosity is 0.035 stokes.
5. Calculate the specific weight, density, specific gravity of one liter of liquid which weighs 7N.
6. Water is flowing through a pipe of 5 cm diameter under a pressure of 29.43N/cm²and with mean velocity of 2m/sec. Find the total head or total energy/unit weight of water at a cross section which is 5m above datum line.
7. Derive Bernoulli's equation from Euler's equation of motion.
8. What is specific gravity? How is it related to density?
9. A plate 0.025 mm distant from a fixed plate, moves at 60 cm/s and requires a force of 2 N/m^2 to maintain this speed. Determine the fluid viscosity between the plates.
10. What are the applications of Bernoulli's equation and give its uses.
11. Write about the devices which work under the practical application of Bernoulli's equation.
12. Calculate the capillary rise/fall in a glass tube of 2.5 mm in diameter when immersed in water and mercury. Take surface tension of water as 0.0725 N/m and for mercury is 0.52 N/m. The specific gravity of mercury is 13.6 and angle of contact is 130^0.
13. Determine the viscosity of fluid having kinematic viscosity 6 stokes and specific gravity 0.9
14. The diameters of a pipe at section 1 is 10 cm and at section 2 is 15 cm. Find the discharge through the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s. Also determine the velocity at section 2.
15. A 30 cm diameter pipe conveying water branches into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm pipe is 2.5 m/s, find the discharge in this pipe. Also determine the velocity in 15 cm pipe if the average velocity in 20 cm pipe is 2 m/s.

UNIT-II

1. What is the physical significance of Reynold's number?
2. What is boundary layer and give its significance with the diagram?
3. List the various minor energy losses in flow through pipes with their expressions.
4. What is meant by total energy line and hydraulic gradient line.
5. What are the losses experienced by a fluid when it is passing through a pipe?
6. Explain the terms boundary layer thickness and displacement thickness.
7. Explain the various types of fluid flow.
8. Give Darcy's formula and Chezy's formula for loss of head due to friction and explain them.
9. Find the head lost due to friction in a pipe of diameter 300 mm and length 50 m, through which water is flowing at a velocity of 3 m/s, using Darcy's formula and Chezy's formula for which C= 60.Take kinematic viscosity of water is 0.01 stoke.
10. Find the loss of head when a pipe of diameter 200 mm is suddenly enlarged to a diameter of 400 mm. The rate of flow of water through the pipe is 250 litres/sec.
11. With Reynold's experiment, explain laminar flow and turbulent flow.

12. An oil of specific gravity 0.7 is flowing through a pipe of diameter 30 cm at the rate of 500 liters/sec. Find the head lost due to friction and power required to maintain the flow for a

length of 1000 m. Take υ= 0.29 stokes.

13. An oil of viscosity 0.1N./m² and relative density 0.9 is flowing through a circular pipe of diameter 50mm and of length 300mm.The rate of flow of fluid through the npipe is 3.5litre/sec. find the pressure drop in a length of 300m .
14. The velocity of water in a pipe 200mm diameter is 5m/s.The length of the pipe is 50m. Find the loss of head due to friction, if f= 0.08.
15. Crude oil of kinematic viscosity 0.4 stoke is flowing through a pipe of diameter 300 mm at the rate of 300 litres/sec. Find the head lost due to friction for a length of 50 m of the pipe.

UNIT-III

1. What are the conditions of equilibrium of a sub-merged body? Explain them.
2. What are the conditions of equilibrium of a floating body? Explain them.
3. Find the volume of the water displaced and the position of centre of buoyancy for a wooden block of width 2.5 m and depth 1.5 m when it floats in water horizontally. The density of the wooden block is 650 kg/m^3 and its length is 6 m.
4. A stone weighs 392.4 N in air and 196.2 N in water. Compute the volume of the stone and its specific gravity.
5. A body of dimensions 1.5 m x 1.0 m x 2 m weighs 1962 N in Water. Find its weight in air. What will be its specific gravity?
6. A rectangular block of dimensions 5 m in length , 3 m wide and 1.2 m depth. The depth of immersion of the block is 0.8 m. If the center of gravity is 0.6 m above the bottom of the block, determine the metacentric height.
7. A body of size 3 m long x 2 m wide x 1 m deep floats in water. What is the weight of the body if the depth of immersion is 0.8 m? Also determine the metacentric Height.
8. A solid cylinder of diameter 4 m and has a height of 4 m. Fine the metacentric height if the specific gravity of the cylinder is 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.
9. Find the volume of the water displaced and the position of centre of buoyancy for a wooden block of width 2 m and depth 1 m when it floats in water horizontally. The density of the wooden block is 700 kg/m^3 and its length is 5 m.
10. A body of dimensions 2 m x 3 m x 2 m weighs 3123 N in Water. Find its weight in air. What will be its specific gravity?
11. A solid cylinder of diameter 5 m and has a height of 10 m. Fine the metacentric height if the specific gravity of the cylinder is 0.9 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.
12. A rectangular block of dimensions 5 m in length , 4 m wide and 1.5 m depth. The depth of immersion of the block is 1 m. If the center of gravity is 0.75 m above the bottom of the block, determine the metacentric height.
13. A solid cylinder of diameter 3 m and has a height of 6 m. Fine the metacentric height if the specific gravity of the cylinder is 0.7 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.
14. A body of size 4 m long x 2 m wide x 2 m deep floats in water. What is the weight of the body if the depth of immersion is 1.6 m? Also determine the metacentric Height.

15. A stone weighing 640 N in air and 267 N in water. Compute the volume of the stone and its specific gravity.

UNIT-IV

1. Describe slip of reciprocating pump.
2. Differentiate between centrifugal pump and reciprocating pump.
3. Can actual discharge be greater than theoretical discharge in a reciprocating pump? Explain
4. Explain the design of multistage centrifygal pump for high heads.
5. What is suction head,delivery head and manometric head of centrifugal pump?
6. What is reciprocating pump?
7. List the components and briefly explain their functions of a reciprocating pump.
8. What is centrifugal pump?
9. Classify pumps on the basis of transfer of mechanical energy.
10. Find the force exerted by a jet of water of diameter 75 mm on a stationery flat plate, when the jet strikes the plate normally with velocity of 20 m/s.
11. A jet of water of diameter 75 mm moving with a velocity of 25 m/s strikes a fixed plate in such a way that the angle between the jet and plate is 60^0. Find the fore exerted by the jet on the plate in the direction of the jet.
12. A jet of water of 30 mm diameter strikes a hinged plate at its center with a velocity of 20 m/s. The plate is deflected through an angle of 20^0. Find the weight of the plate. If the plate is not allowed to swing, what will be the force required at the lower edge of the plate to keep it in vertical position.
13. Explain the design of multistage centrifugal pump for high discharge.
14. Derive an expression for specific speed for pump.
15. A double acting reciprocating pump running at 40 rpm is discharging 1.0 m^3/minute. The pump has a stroke of 400 mm.The diameter of the piston is 200mm.The delivery and suction heads are 20m and 5m respectively. Find the slip of the pump and power required to drive the pump.

UNIT-V

1. Differentiate between the turbines and pumps.
2. A turbine is to operate under a load of 25m at 200 rpm. The discharge is 9 m^3 /sec .If the efficiency is 90% determine a) specific speed of the machine b) power generated.
3. The mean velocity of the buckets of the Pelton wheel is 10 m/s. The jet supplies water at 0.7 m^3/s at a head of 30 m. The jet is deflected through an angle of 160° by the bucket. Find the hydraulic efficiency. Take Cv = 0.98.
4. Give an example for a low head turbine, a medium head turbine and a high head turbine.
5. Draw velocity triangle diagram for Pelton Wheel turbine.
6. What are the various efficiencies against which turbines are studied?
7. How turbines are classified.
8. What is the difference between impulse turbine and reaction turbine?
9. What is draft tube and its types?
10. Draw main characteristic curves of hydraulic turbine.
11. A jet of water of diameter 10cm strikes a flat plate normally with a velocity of 15m/sec. The plate is moving with a velocity of 6m/sec in the direction of jet and away from it. Find 1)

force exerted by the jet on the plate 2) work done by jet on plate/sec. 3) power of the jet.

12. A Kaplan turbine develops 24647.6kw power at an average head of 39 m. Assuming a speed ratio of 2,flow ratio 0.6, diameter of boss equal to 0.35 times diameter of runner and overall efficiency is 0.95%. Calculate the diameter ,speed and specific speed of turbine
13. Explain the general layout of hydroelectric power plant.
14. Draw the operating characteristic curves of hydraulic turbine
15. Draw the constant efficient curves of hydraulic turbine.

PART-C

UNIT-I

1. Two large plate surfaces are 2.4 cm apart. The space between the surfaces is filled with glycerine. What force is required to drag a very this plate of 0.5 m^2 area between two large plate surfaces at a speed of 0.6 m/s if, (a) the this plate is in the middle of the two plate surfaces, (b) the thin plate is at a distance of 0.8 cm from one plate surface.
   Take dynamic viscosity of glycerine as 8.1 x 10^{-1} N s /m^2.
2. Water flows through a pipe AB of 1.2 m in diameter at 3 m/s and then passes through a pipe BC of 1.5 m in diameter. At C, the pipe branches. Branch CD is 0.8 m in diameter and carries one-third of the flow of AB. The flow velocity in branch CE is 2,5 m/s. Find the rate of flow in AB, velocity in BC, the velocity in CD and the diameter of CE.
3. Derive Bernoulli's equation of motion.
4. The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through the pipe is 35 litres/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2.
5. A 45^0 reducing bend is connected to a pipe line, the diameters at the inlet and outlet of the bend being 600 mm and 300 mm respectively. Find the force exerted by bend on water if the intensity of pressure at the inlet to bend is 8.829 N/cm^2 and rate of flow of water is 600 litres/s.
6. The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of diameter 0.4m and rotates at 190 rpm, calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the film is 1.5mm.

UNIT-II

1. Determine the rate of flow of water through a pipe of diameter 20 cm and length 50 m when one end of the pipe is connected to a tank and other end of the pipe is open to the atmosphere. The pipe is horizontal and the height of the water in the tank is 4 m above the center of the pipe. Consider all minor losses and take f = 0.009. Also draw the hydraulic gradient line and total energy line of the same.
2. A main pipe divides into two parallel pipes which again form as one pipe. The length and diameter for the first parallel pipe are 2000 m and 1 m respectively, while the length and diameter for second parallel pipe are 2000 m and 0.8 m respectively. Find the rate of flow in each parallel pipe, if total flow in main pipe is 3 m^3/s. The co-efficient of friction for each pipe is equal and equal to 0.005.
3. Derive Darcy-Weisbach equation for loss of head due to friction in pipes.
4. The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2. Determine (a) loss of head due to sudden enlargement, (b) pressure intensity in the large pipe, (c) power lost due to enlargement.
5. The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210 m and of diameters 300 mm, 200 mm and 400 mm respectively, is 12m. Determine the rate of flow of water if co – efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering: (i) minor losses also (ii) neglecting minor losses.
6. A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the

pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of the water level in the tank is 8 m above the center of the pipe. Considering all losses of head which occur, determine the rate of flow also draw the hydraulic gradient line and total energy line of the same. Take f=0.01 for both sections of the pipe.

UNIT-III

1. Find the density of a metallic body which floats at the interface of mercury of specific gravity 13.6 and water such that 40% of its volume is submerged in mercury and 60% in water.
2. A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of the block if its size is 2 m X 1 m X 0.8 m.
3. A solid cylinder of diameter 4 m and has a height of 3 m. Find the metacentric height of the cylinder when it is floating in water with its axis being vertical. The specific gravity of the cylinder is 0.6.
4. Derive the expression experimentally for finding the metacentric height of a floating body.
5. A rectangular pontoon 10 m long, 6 m broad, 2.5 m deep weighs 687.6 kN. It carries on its upper deck an empty boiler of 5 m diameter weighing 588.6 kN. The center of gravity of the boiler and the pontoon are at their respective centers along a vertical line. Find the meta-centric height. Weight density of sea water is 10.104 kN/m^3.
6. A ship 70 m long and 10 m broad has a displacement of 19620 kN. A weight of 343.35 kN is moved across the deck through a distance of 6m. The ship is tilted through an angle of 6^0.The moment of inertia of the ship at water-line about its fore and aft axis is 75% of M.O.I. of the circumscribing rectangle. The centre of buoyancy is 2.25 m below the water-line. Find the meta-centric height and position of center of gravity of ship. Specific weight of sea water is 10.104 KN/m^3.

UNIT-IV

1. Define a centrifugal pump. Explain the working of a single stage centrifugal pump with sketches.
2. What is the difference between single stage and multistage centrifugal pump? Describe multistage pump with (a) impellers in parallel (b) impellers in series.
3. A centrifugal pump is to discharge 0.118m3 / sec at a speed of 1450 rpm against a head of 25m. The impeller diameter is 250mm,its width at outlet is 50mm and manometric efficiency is 75% . Determine the vane angle at the outer periphery of the impeller.
4. What is a reciprocating pump? Describe the principle and working of a reciprocating pump with a neat sketch.
5. The internal and external diameters of the impeller of a centrifugal pump are 200mm and 400mm respectively. The pump is running at 1200 rpm the vane angles of the impeller at inlet and outlet are 20^0 and 30^0 respectively. The water enters the impeller radially and velocity of flow is constant. Determine the work done by the impeller /unit weight of water.
6. Write about (1) various efficiencies of centrifugal pump (2) characteristic curves of centrifugal pump

UNIT-V

1. Explain with neat sketch the working principle of Pelton wheel turbine.
2. Explain in detail about Governing of Turbines.
3. A Pelton wheel is to be designed for the following specifications. Shaft power = 11772 kw, Head= 380 m, speed = 750 rpm, overall efficiency = 86%, jet diameter not to exceed 1/6 of wheel diameter. Determine 1) Wheel diameter 2) Number of jets required 3) Diameter of jet. Coefficient of viscosity =0.985, speed ratio = 0.45.
4. With the help of neat diagram explain the construction and working of a radial flow reaction turbine.
5. A jet of water having a velocity of 40m/sec strikes curved vane which is moving with a velocity of 20 m/sec. The jet makes an angle of 30^0 with the direction of motion of vane at inlet and leaves at an angle of 90^0 to the direction of motion of vane at outlet. Draw the velocity triangles at inlet and outlet and determine the vane angles at inlet and outlet so that the water enters and leaves the vane without shock.
6. Draw with neat sketch and explain the working of Kaplan turbine.