Reg. No. : | | | | | | | | | | | | |

Question Paper Code : 21560

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2013.

Third Semester

Mechanical Engineering

ME 2204/CE 3213/ME 34/CE 1208/10122 ME 305/080180007 — FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering, Automobile Engineering, Production Engineering, Mechatronics Engineering, Mechanical and Automation Engineering and Fourth Semester Manufacturing Engineering, Industrial Engineering and Industrial Engineering and Management)

(Regulation 2008/2010)

(Common to PTCE 3213/PTME 2204 – Fluid Mechanics and Machinery for B.E. (Part-Time) Third Semester – Manufacturing Engineering Regulation 2009)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define relative or specific viscosity.
2. What do you understand by impulse momentum equation?
3. Mention the general characteristics of laminar flow.
4. What do you mean by flow through parallel pipes?
5. Give the dimensions of the following physical quantities: surface tension and dynamic viscosity.
6. State Froude's model law.
7. Define hydraulic efficiency and axial thrust of a roto-dynamic hydraulic machine.
8. Distinguish between reaction turbine and impulse turbine.
9. What is negative slip in a reciprocating pump? What are the causes for it?
10. What are the advantages of air vessel?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A liquid is compressed in a cylinder having a volume of 0.012 m^3 at a pressure of 690 N/cm^2. What should be the new pressure in order to make its volume 0.0119 m^3? Assume bulk modulus of elasticity (K) for the liquid = 6.9×10^4 N/cm^2. (8)

(ii) A 15 cm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 15.10 cm. Both cylinders are 25 cm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12.0 Nm is required to rotate the inner cylinder at 100 r.p.m., determine the viscosity of the fluid. (8)

Or

(b) (i) State Bernoulli's theorem and assumptions for steady flow of an incompressible fluid. (4)

(ii) The water is flowing through a taper pipe of length 100 m having diameters 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 litres/s. The pipe has a slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm^2. (12)

12. (a) For a flow of viscous fluid flowing through a circular pipe under laminar flow conditions show that the velocity distribution is a parabola. And also show that the average velocity is half of the maximum velocity. (16)

Or

(b) 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 water level in the tank is 8 m above the centre of the pipe. Considering all losses of head which occur, determine the rate of flow. Take $f = 0.01$ for both sections of the pipe. (16)

13. (a) State Buckingham's π -theorem. The discharge of a centrifugal pump (Q) is dependent on N (speed of pump), d (diameter of impeller), g (acceleration due to gravity), H (monometric head developed by pump) and ρ and μ (density and dynamic viscosity of the fluid). Using the dimensional analysis and Buckingham's π -theorem, prove that it is given by $Q = Nd^3 f\left(\frac{gH}{N^2 d^2}, \frac{\mu}{Nd^2\rho}\right)$. (16)

Or

(b) (i) What are the similarities between model and prototype. Mention the applications of model testing. (4)

(ii) A spillway model is to be built to a geometrically similar scale of $\frac{1}{50}$ across a flume of 600 mm width. The prototype is 15 m high and maximum head on it is expected to be 1.5 m.

(1) What height of model and what head on the model should be used?

(2) If the flow over the model at a particular head is 12 litres per second, what flow per metre length of the prototype is expected?

(3) If the negative pressure in the model is 200 mm, what is the negative pressure in prototype? Is it practicable? (12)

14. (a) A Francis turbine with an overall efficiency of 75% is required to produce 148.25 kW power. It is working under a head of 7.62 m. The peripheral velocity = $0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at 150 r.p.m. and the hydraulic losses in the turbine are 22 % of the available energy. Assuming radial discharge, determine :

(i) The guide blade angle

(ii) The wheel vane angle at inlet

(iii) Diameter of the wheel at inlet, and

(iv) Width of the wheel at inlet. (16)

Or

(b) The internal and external diameter of an impeller of a centrifugal pump which is running at 1000 r.p.m, are 200 mm and 400 mm respectively. The discharge through pump is 0.04 m^3/s and velocity of flow is constant and equal to 2.0 m/s. The diameters of the suction and delivery pipes are 150 mm and 100 mm respectively and suction and delivery heads are 6 m (abs.) and 30 m (abs.) of water respectively. If the outlet vane angle is 45° and power required to drive the pump is 16.186 kW, determine :

(i) Vane angle of the impeller at inlet,

(ii) The overall efficiency of the pump, and

(iii) Manometric efficiency of the pump. (16)

15. (a) The cylinder of a single- acting reciprocating pump is 15 cm in diameter and 30 cm in stroke. The pump is running at 30 r.p.m. and discharge water to a height of 12 m. The diameter and length of the delivery pipe are 10 cm and 30 m respectively. If a large air vessel is fitted in the delivery pipe at a distance of 2 m from the centre of the pump, find the pressure head in the cylinder.

(i) At the beginning of the delivery stroke, and

(ii) In the middle of the delivery stroke. Take $f = 0.01$. (16)

Or

(b) (i) Explain in detail the working principle and construction of rotary pumps with neat sketch. (8)

(ii) Calculate the work saved by fitting an air vessel for a double acting single cylinder reciprocating pump. (8)

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Question Paper Code : C 1366

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2010.

Third Semester

Mechanical Engineering

ME 1202 — FLUID MECHANICS AND MACHINERY

(Regulation 2004)

(Common to B.E. Aeronautical Engineering, Automobile Engineering, Production Engineering and Mechatronics Engineering)

(Common to B.E. (Part-Time) Second Semester – Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by vapour pressure of a fluid?

2. Distinguish between atmospheric pressure and gauge pressure.

3. Define: Stream function

4. What are the applications of Bernoulli's theorem?

5. State the characteristics of laminar flow.

6. Mention the types of minor losses.

7. Classify fluid machines.

8. What is meant by specific speed of a turbine?

9. Why is priming necessary in centrifugal pumps?

10. What are the functions of an air vessel?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The velocity distribution over a plate is given by $u = 2y - y^2$, where u is the velocity in m/sec at a distance of y metre above the plate. Determine the velocity gradient and shear stress at the boundary and 1.5 m from it. Dynamic viscosity of the fluid is 0.9 N.s/m². (8)

(ii) State and prove Pascal's Law. (8)

Or

(b) (i) Determine the mass density, specific volume and specific weight of a liquid whose specific gravity 0.85. (8)

(ii) What is capillarity? Derive an expression for capillary rise. (8)

12. (a) (i) In a three dimensional incompressible fluid flow, the velocity components in x and y directions are $u = x^2 + y^2 z^3$ and $v = -(xy + yz + zx)$. Use continuity equation to evaluate an expression for the velocity component w in the z direction. (8)

(ii) State the similarity laws used in model analysis. (8)

Or

(b) (i) Derive Bernoulli's theorem and state its limitations. (10)

(ii) A horizontal venturimeter with inlet diameter 200 mm and throat diameter 100 mm is employed to measure the flow of water. The reading of the differential manometer connected to the inlet is 180 mm of mercury. If $C_d = 0.98$, determine the rate of flow. (6)

13. (a) Derive an expression for head loss through pipes due to friction. (16)

Or

(b) The velocity distribution in the boundary layer is given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate $u = U$ at $y = \delta$, δ being boundary layer thickness. Find the displacement thickness, momentum thickness and energy thickness. (16)

14. (a) (i) Write a note on performance curves of turbine. (4)

(ii) Explain the component parts and working of a Pelton wheel turbine. (12)

Or

(b) A Francis turbine with an overall efficiency of 76% and hydraulic efficiency of 80% is required to produce 150 kW. It is working under a head of 8 m. The peripheral velocity is $0.25\sqrt{2gH}$ and radial velocity of flow at inlet is $0.95\sqrt{2gH}$. The wheel runs at 150 rpm. Assuming radial discharge, determine (i) Flow velocity at outlet (ii) The wheel angle at inlet (iii) Diameter and width of the wheel at inlet.

15. (a) (i) Show that the work done by a reciprocating pump is equal to the area of the indicator diagram. (6)

(ii) Classify pumps. Explain the working of a double acting reciprocating pump with a neat diagram. (10)

Or

(b) A centrifugal pump running at 800 rpm is working against a total head of 20.2 m. The external diameter of the impeller is 480 mm and the outlet width is 60 mm. If the vane angle at outlet is 40° and manometric efficiency is 70%, determine (i) Flow velocity at outlet, (ii) Absolute velocity of water leaving the vane. (iii) Angle made by the absolute velocity at outlet with the direction of motion. (iv) Rate of flow through the pump.

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Question Paper Code : 10409

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2012.

Third Semester

Mechanical Engineering

ME 2204/113303/ME 34/CE 1208/10122 ME 305/080180007 — FLUID MECHANICS AND MACHINERY

(Common to Aeronautical Engineering, Automobile Engineering and Production Engineering)

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Two horizontal plates are placed 12.5 mm apart, the space between them being filled with oil of viscosity 14 poise. Calculate the shear stress in the oil if the upper plate moved with a velocity of 2.5 m/s. Define specific weight.

2. Calculate the height of capillary rise for water in a glass tube of diameter 1 mm.

3. What are the minor losses? Under what circumstances will they be negligible?

4. What factors account for the energy loss in laminar flow?

5. Under what circumstances, will the Buckingham-Pi theorem yield incorrect number of dimensionless group?

6. If two systems (model and prototype) are dynamically similar, is it implied that they are also kinematically and geometrically similar?

7. What precautions are to be taken while starting and closing the centrifugal pump?

8. Differentiate reaction turbine and impulse turbine.

9. What is the function of non-return valve in a reciprocating pump?

10. What factors govern the speed of reciprocating pump?

PART B — (5 × 16 = 80 marks)

11. (a) (i) The space between two large flat and parallel walls 25 mm apart is filled with a liquid of absolute viscosity 0.7 Pa.sec. Within this space a thin flat plate, 250 mm × 250 mm is towed at a velocity of 150 mm/s at a distance of 6 mm from one wall, the plate and its movement being parallel to the walls. Assuming linear variations of velocity between the plate and the walls, determine the force exerted by the liquid on the plate. (8)

(ii) Eight kilometers below the surface of the ocean the pressure is 81.75 MPa. Determine the density of sea water at this depth if the density at the surface is 1025 kg/m^3 and the average bulk modulus of elasticity is 2.34 GPa. (8)

Or

(b) (i) A 0.3 m diameter pipe carrying oil at 1.5 m/s velocity suddenly expands to 0.60 m diameter pipe. Determine the discharge and velocity in 0.6 m diameter pipe. (4)

(ii) Derive the momentum equation for steady flow. (12)

12. (a) (i) A pipe line 20 cm in diameter, 70 m long, conveys oil of specific gravity 0.95 and viscosity 0.23 N.sec/m^2. If the velocity of oil is 1.38 m/s, find the difference in pressure between the two ends of the pipe. (8)

(ii) Oil of mass density 800 kg/m^3 and dynamic viscosity 0.02 poise flows through 50 mm diameter pipe of length 500 m at the rate of 0.19 litres/sec. Determine

(1) Reynolds number of flow

(2) Centre line velocity

(3) Pressure gradient

(4) Loss of pressure in 500 m length

(5) Wall shear stress and

(6) Power required to maintain the flow. (8)

Or

(b) (i) Obtain expression for Darcy-Weishbach friction factor f for flow in a pipe. (6)

(ii) A smooth pipe carries 0.30 m^3/s of water discharge with a head loss of 3.0 m per 100 m length of pipe. If the water temperature is 20°C, determine the diameter of the pipe. (10)

13. (a) The power required by the pump is a function of discharge Q, head H, acceleration due to gravity g, viscosity μ, mass density of the fluid ρ, speed of rotation N and impeller diameter D. Obtain the relevant dimension less parameters.

Or

(b) Model tests have been conducted to study the energy loss in a pipeline of 1 m diameter required to transport kerosene of specific gravity 0.80 and dynamic viscosity 0.02 poise at the rate of 2000 litre/sec. Tests were conducted on a 10 cm diameter pipe using water at 20°C. What is the flow rate in the model? If the energy head loss in 30 m length of the model is measured as 44.0 cm of water, what will be the corresponding head loss in the prototype? What will be the friction factor for the prototype pipe?

14. (a) A centrifugal pump discharges 2000 l/s of water per second developing a head of 20 m when running at 300 rpm. The impeller diameter at the outlet and outflow velocity is 1.5 m and 3.0 m/s respectively. It vanes are set back at an angle of 30° at the outlet, determine

(i) Manometric efficiency

(ii) Power required by the pump.

If inner diameter is 750 mm, find the minimum speed to start the pump.

Or

(b) An inward flow reaction turbine discharges radially and the velocity of flow is constant, show that the hydraulic efficiency can be expressed by

$$\eta = \frac{1}{1 + \frac{0.5\tan^2\alpha}{1 - \frac{\tan\alpha}{\tan\theta}}}$$

Where α and θ are the guide and vane angles at inlet.

15. (a) (i) Determine the percentage of work saved in one cycle when an air vessel is provided on the delivery side of a single cylinder single acting reciprocating pump. (8)

(ii) Explain the working principle of reciprocating pump with neat diagram in detail and state its advantages and disadvantages over centrifugal pump. (8)

Or

(b) (i) A single cylinder double acting reciprocating pump has a piston diameter of 300 mm and stroke length of 400 mm. When the pump runs at 45rpm, it discharges 0.039 m^3/s under a total head of 15 m. What will be the volumetric efficiency, work done per second and power required if the mechanical efficiency of the pump is 75%? (10)

(ii) With an example, explain in detail the working principle and construction of rotary pumps with neat diagram. (6)

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H 2101

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2009.

Third Semester

Mechanical Engineering

CE 253 — FLUID MECHANICS AND MACHINERY

(Common to Mechatronics Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Distinguish between 'mass density' and 'weight density'.
2. Define compressibility of a fluid.
3. State atleast two assumptions in Bernoulli's equation.
4. Differentiate between 'hydraulic gradient line' and 'energy gradient line'.
5. Define :
   (a) Euler number
   (b) Mach number.
6. Define 'specific speed' as applied to pumps.
7. What is an 'indicator diagram'?
8. Distinguish between 'major' and 'minor' losses with reference to flow through pipes.
9. State the 'momentum equation'. When can it be applied?
10. State the advantages of fitting air vessels in a reciprocating pump.

PART B — ($5 \times 16 = 80$ marks)

11. (a) (i) The space between two parallel plates 5 mm apart, is filled with crude oil of specific gravity 0.9. A force of 2 N is required to drag the upper plate at a constant velocity of 0.8 m/s. The lower plate is stationary. The area of the upper plate is 0.09 m^2. Determine. (1) The dynamic viscosity in prise and (2) Kinematic viscosity of the oil in stokes. (10)

(ii) Determine the bulk modulus of elasticity of a liquid, if, the pressure of the liquid is increased from 7 MN/m^2 to 13 MN/m^2, the volume of liquid decreases by 0.15%. (6)

Or

(b) (i) The velocity components in a three dimensional fluid flow are :

$u = x^2 + y^2 z^3$; $v = -(xy + yz + zx)$.

Determine the missing component of velocity such that the continuity equation is satisfied. (6)

(ii) Derive from first principles, the Euler's equation of motion for a steady flow along a stream line. Hence derive Bernoulli's equation. State the various assumptions involved in the above derivation. (10)

12. (a) (i) A uniform circular tube of bore radius R_1 has a fixed co-axial cylindrical solid core of radius R_2. An incompressible viscous fluid flows through the annular passage under a pressure gradient $\left(\frac{-\partial p}{\partial x}\right)$. Determine the radius at which shear stress in the stream is zero, given that the flow is laminar and under steady state condition. (6)

(ii) An existing 300 mm diameter pipeline of 3200 m length connects two reservoirs having 13 m difference in their water levels. Calculate the discharge Q_1. If a parallel pipe 300 mm in diameter is attached to the last 1600 m length of the above existing pipeline, find the new discharge Q_2. What is the change in discharge? Express it as a percentage of Q_1. Assume friction factor $(f) = 0.04$ in Dancy - Weisbach formula. (10)

Or

(b) (i) Define the term 'boundary layer'. (4)

(ii) Define 'miner losses'. How they are different from 'major losses'? (4)

(iii) The discharge of water through a horizontal pipe is 0.25 m^3/s. The diameter of above pipe which is 200 mm, suddenly enlarges to 400 mm at a point. If the pressure of water in the smaller diameter of pipe is 120 kN/m^2, determine : loss of head due to sudden enlargement; pressure of water in the larger pipe and the power lost due to sudden enlargement. (8)

13. (a) (i) State Buckingham-π theorem. Mention the important principle for selecting the repeating variables. (6)

(ii) The resistance R, to the motion of a completely submerged body depends upon the length of the body (L), velocity of flow (V), mass density of fluid (ρ), Kinematic viscosity of fluid (γ). Prove by dimensional analysis that

$$R = \rho V^2 L^2 \phi\left(\frac{VL}{\gamma}\right).$$ (10)

Or

(b) (i) What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attainable? If not, why? (8)

(ii) In order to predict the pressure drop in a large air duct a model is constructed with linear dimension $\left(\frac{1}{10}\right)^{th}$ that of the prototype and that water was used as the testing fluid. If water is 1000 times denser than that of air and has 100 times the viscosity of air, determine the pressure drop in the prototype, for the conditions corresponding to a pressure drop of 70 kPa, in the model. (8)

14. (a) (i) Enumerate the losses that occur during the operation of a centrifugal pump. (6)

(ii) A centrifugal pump with 1.2 m diameter, runs at 200 rpm and discharges 1880 litres/s, against an average lift of 6 m. The angle which the vanes make at exit with the tangent to the impeller is 26° and the radial velocity of flow is 2.5 m/s. Find the manometric efficiency and the least speed to start the pump against the head of 6 m. Assume the inner diameter of the impeller as 0.6 m. (10)

Or

(b) (i) How is a 'specific speed' of a turbine, defined? (4)

(ii) A Francis turbine with an overall efficiency of 75% is required to produce 149.26 kN. It is working against a head of 7.62 m. The peripheral velocity is $0.26\sqrt{2gH}$ and the radial velocity of flow at inlet is $0.96\sqrt{2gH}$. The wheel runs at 150 rpm and the hydraulic losses in the turbine account for 22% of the available energy. Assume radial discharge, determine : the guide blade angle, the wheel vane angle at inlet, diameter of the wheel at inlet and width of the wheel at inlet. (12)

15. (a) (i) Define : slop, percentage slip and negative slop with respect to a reciprocating pump. (6)

(ii) The diameter and length of stroke of a single acting reciprocating pump are 100 mm and 200 mm respectively. The pump is used to deliver water to a tank 14 m above the pump through a pipe 30 mm in diameter and 18 m long by taking its supply from a sump 4 m below the pump, through a pipe 40 mm in diameter and 6 m long. If separation occurs at 78.48 kN/m^2, below the atmospheric pressure find the maximum speed at which the pump can be operated without separation. Assume 1 atm pressure = 10.3 m of water column and the plunger undergoes simple harmonic motion. (10)

Or

(b) (i) Prove that work done by the pump is proportional to the area of indicator diagram. (6)

(ii) The plunger diameter and stroke length of a single-acting reciprocating pump are 300 mm and 500 mm, respectively. The speed of the pump is 60 rpm. The diameter and length of delivery pipe are 150 mm and 60 m respectively. If the pump is equipped with an air vessel on the delivery side at the centre lone of the pump, find the power saved in overcoming friction in the delivery pipe. Assume Darcy's friction factor as 0.04, and the plunger undergoes a simple harmonic motion. (10)

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L 1140

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

Third Semester

Mechanical Engineering

CE 253 — FLUID MECHANICS AND MACHINERY

(Common to Mechatronics Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the difference between cohesion and adhesion?
2. What do you mean by surface tension?
3. How are fluid flows classified?
4. List the assumptions which are made while deriving Bernoulli's equation.
5. What is an equivalent pipe?
6. Write the formula for calculating loss of head due to

   (a) Sudden enlargement (b) Sudden contraction.
7. Write down the uses of dimensional analysis.
8. What are the applications of model testing?
9. Define Specific speed of a turbine.
10. Draw the Ideal indicator diagram.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine the mass density, weight density and specific volume of a liquid whose Relative density is 0.85 (6)

    (ii) A Liquid of 10 litres with Relative density of 1.30 is mixed with 8 litres of a liquid of Relative density 0.80. If the bulk of the liquid shrinks one percent on mixing, calculate the relative density, the density, the volume and weight of the mixture. (10)

Or

(b) (i) A block of base area 200 cm^2, weight 100 N slides down 20° inclined plane, over an oil film of 1 mm of thickness and dynamic viscosity of 500 poise. Estimate the velocity of the block. (10)

(ii) A U-tube is made of two capillaries of bore 1 mm and 2 mm respectively and is partially filled with liquid of surface tension 0.05 N/m and zero contact angle. Calculate the mass density of the liquid if the estimated difference in the level of two meniscii is 12.5 mm (6)

12. (a) (i) Water is flowing through a pipe having diameters 600 mm and 400 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 350 Kpa and the pressure at the upper end is 100 Kpa. Determine the differencing datum head if the quantity of liquid passing through the pipe is 60 lit/sec. (6)

(ii) A fireman must reach a window 40 m above the ground with a water jet, issued form a nozzle 30 mm in diameter and discharging 30 kg/sec assuming the nozzle height to be 2 m above the ground, determine the greatest horizontal distance from the building where the fireman can stand and still reach the jet the window. (10)

Or

(b) (i) Water enters a reducing pipe horizontally and comes out vertically in the downward direction, lf the inlet velocity is 5 m/sec and pressure is 80 Kpa (gauge) and the diameters at the entrance and exit sections are 300 m and 200 m respectively. Calculate the components of the reaction acting on the pipe. (6)

(ii) Derive from the first principle the Euler's equation of motion for steady flow along a stream line. Obtain Bernoulli's equation from Euler's equation. (10)

13. (a) (i) Oil of absolute viscosity 1.5 poise and density 848.3 kg/m^3 flows through a 300 mm pipe. If the head loss in 3000 m length of pipe is 200 m, assuming a laminar flow, determine the following

(1) The velocity

(2) Reynolds number. (6)

(ii) For sudden expansion in a pipe flow, work out the optimum ratio between the diameter of the before expansion and the diameter of the pipe after expansion so that pressure rise is maximum. (10)

Or

(b) (i) A pipe line 2000 m long is used for power transmission. 110 kw is to be transmitted through the pipe in which water having a pressure of 5000 kN/m^2 at inlet is flowing. If the pressure drop over a length of pipe is 1000 kN/m^2 and coefficient of friction is 0.0065, find the diameter of the pipe and efficiency of transmission. (6)

(ii) Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 300 m, 170 m and 210 m respectively are connected in series. The difference in water surface levels in two tanks is 12 m. Determine the rate of flow if co-efficient of friction are 0.005, 0.0052 and 0.0048 respectively considering

(1) Minor losses, and

(2) Neglecting minor losses. (10)

14. (a) (i) Determine the dimensions of the following quantities:

Discharge, Kinematic viscosity, Force and Specific weight (6)

(ii) What are distorted models? What are the merits and demerits of distorted models? (10)

Or

(b) State Buckingham's π theorem and describe how the Buckingham's method differ from Raleigh's method. (16)

15. (a) (i) With the help of a neat sketch, describe the components of a pelton wheel. (6)

(ii) A Single acting Reciprocating Pump has a plunger of diameter 300 mm and stroke of 200 mm. If the speed of the pump is 30 rpm and the actual discharge is 6.5 litres per second of water, find the coefficient of discharge and percentage slip, if overall efficiency is 75 %. What horse power is required to drive the pump. If the suction lift is 4 m and delivery head is 30 m. (10)

Or

(b) (i) What are the effects of Cavitations? Give the necessary precautions against cavitations. (6)

(ii) What are the functions of a draft tube?

The following data refers to an inward flow reaction turbine:

Supply 1.2 Cumecs at 30 m head.

Wheel diameter = 750 mm at outlet and 500 mm at inlet.

Radial exit velocity = 2.4 m/sec.

Inlet vane angle = 35°

Calculate the HP and RPM of the turbine. Assume the width of the wheel as constant and turbine efficiency is 80%. (10)
