[Total No. of Questions - 9] [Total No. of P. ed Pages - 4]
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B. Tech 5th Semester Examination

Fluid Mechanics and Fluid Machines (NS)

AU-311

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C, D, and all the questions in Section E i.e. Section E is compulsory. Marks of questions are indicated against each question. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same. Use of non-programmable calculators is allowed.

SECTION - A

1. (i) Explain the importance in analyzing the properties of real fluids. Differentiate between ideal and real fluids with respect to their properties.

   (ii) What do you understand by continuum concept of fluid? Explain.

   (iii) Explain Eulerian approach for representing the fluid motion. ([5+4]+5+6=20)

2. (i) State and explain the basic concept of relative equilibrium. Differentiate between stable and unstable equilibrium. Explain with examples.

   (ii) What do you mean by the term 'manometry'? Explain. ([6+8]+6=20)

SECTION - B

3. (i) Define steady and uniform flow of fluids. Explain the streak and path lines of fluid flow with suitable illustration.

   (ii) Determine the equation of a stream line at $t = t_0$ and passing through the point (x_0, y_0) for the velocity field given by, the vector $q = (1+At)i+2xj$; where A is some numerical constant. How would the equation change for a steady flow? (10+10=20)

4. (i) Derive Euler's equation of motion along a streamline, and hence derive the Bernoulli's theorem,

   (ii) Enumerate the limitations that have to be born in mind while applying Bernoulli's theorem to the engineering problems.

   (iii) The discharge through a 20 cm diameter horizontal pipe increases linearly from 25 to 100 litres per second in 3 seconds. What pressure gradient must exit to produce this acceleration? (10+4+6=20)

SECTION - C

5. (i) State and explain the important characteristics of laminar flow. Give examples where such a flow is encountered.

   (ii) An oil of specific gravity 0.85 and viscosity 3.8 poise flow in a 5 cm diameter horizontal pipe at the rate of 4 litre per second. Comment about the type of flow through solve this problem. (10+10=20)

6. (i) Describe Reynolds experiments to demonstrate the laminar fluid flow. How is the type of flow related to Reynold number?

(ii) At a central power station the intensity of pressure is 9.8 MPa and the pressure at the delivery end of a 16 cm diameter pipe is to be 8.82 MPa. The velocity of flow through the pipe line is to be 1 m/s. Assuming no losses determine the power transmitted through the pipe.

(10+10=20)

SECTION - D

7. (i) How centrifugal pumps are classified? Explain briefly.

(ii) Draw the velocity vector diagram and deduce the expressions for work done and efficiency of the centrifugal pump.

((iii) List out the various losses in centrifugal pump and explain all. (4+10+6=20)

8. (i) Explain the construction and working principle of reciprocating pump. Give simple sketch in support of your answer.

(ii) A single acting reciprocating pump has a piston area 0.135 m^2 and a stroke of 30 cm. The cross sectional area of the delivery pipe is 270 cm^2 and the water is lifted through a total head of 12 m. If the speed of the pump is 60 r.p.m. and the actual discharge 2370 kg/min, find the percentage of slip, the coefficient of discharge and the theoretical power required to drive the pump.

(10+10=20)

SECTION - E (Compulsory)

9. Answer the following questions.

(i) What do you mean by flow nets? Explain.

(ii) Differentiate between Pitot and Prandtl tube.

(iii) What do you mean by 'drag on flat plat'? Write it's significance.

(iv) Distinguish between turbulent flow and laminar flow with examples.

(v) Why vane shape is very much important for centrifugal pump? Answer with justification.

(vi) Distinguish between centrifugal and reciprocating pumps. Give at least one application for each pump.

(vii) What is Lagrangian approach? Write it's significance.

(viii) What is discharge coefficient? State its importance.

(ix) State the advantages of flow in parallel pipes over series pipe connection.

(x) What is Navier Stoke equation? Write its importance.

(10×2=20)