Printed Pages : 3

180317 NAG-302

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : **180317**

Roll No.

B. Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15

FLUID MECHANICS

Time : **3** Hours] [Total Marks : **100**

Note: The question paper is divided into **three** sections. Attempt each section.

SECTION-A

1 Attempt the following short answer type questions :   10×2=20

(a) Define 'Surface tension and capillarity.

(b) What is the Archimedes's principle?

(c) Why a ship floats on water but a piece of iron sinks in water?

(d) Define metacentre and metacentric height.

(e) What is equation of continuity?

(f) For what purposes orifices are used?

(g) Define Vortex motion and where does it occurs?

(h) What do you understand by turbulent and laminar flow?

(i) List the types of similarities and dimensionless numbers.

(j) What do you understand by streak lines and streamlines?

SECTION-B

2   Attempt any **three** parts of the following :   10×3=30

(a)   Derive Hagen-Poiseuille equation and state the assumptions made.

(b)   Define buoyancy and centre of buoyancy. A rectangular pontoon of 5m long, 3m wide and 1.2 m deep is immersed 0.8m in sea water. If the density of sea water is 10 kN / m², find the metacentric height of the pontoon.

(c)   For an inclined plane surface submerged in water obtain an expression for centre of pressure.

(d)   Define viscosity. Distinguish between dynamic viscosity and kinematic viscosity and what are their uses?

(e)   Derive Darcy-Weisbach equation.

SECTION-C

3   Attempt any **five** questions :   10×5=50

(a)   State Buckingham's theorem. What do you mean by repeating variables? How repeating variables selected for dimensional analysis?

(b)   What is a free jet of fluid? Derive an expression for the path travelled by free jet issuing from a nozzle.

(c)   (i)   How is the continuity equation based on the principle of conservation of mass stated?

(ii)   Show the streamlines and equipotential lines form a net of mutually perpendicular lines.

(d) What is equivalent pipe and derive "Dupit's equation" ? A 150 mm diameter horizontal pipe conveys water. If the slope of the hydraulic gradient is 1 in 130, find the rate of flow. Take f = 0.005.

(e) State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state assumptions made for such a derivation.

(f) With the help of neat sketch, derive an expression for metacentric height.

(g) Discuss the minor and major losses during flow of fluid through pipes and fittings.

―――――――――――