PAPER ID-411675

Subject Code: KCE303

Roll No: | | | | | | | | | | | | | |

BTECH
(SEM III) THEORY EXAMINATION 2021-22
FLUID MECHANICS

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

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

Q no.	Question	Marks	CO
a.	Distinguish between gauge pressure and absolute pressure.	2	1
b.	What do you mean by Newtonian and non-Newtonian fluids?	2	1
c.	What is meta centric height? How is it determined?	2	1
d.	Define velocity potential function.	2	2
e.	Explain difference between Siphon and a Normal Tube.	2	2
f.	Differentiate between free and forced vortex	2	3
g.	Describe major and minor losses in pipes.	2	3
h.	Define the displacement thickness.	2	4
i.	What do you mean by 'Dimensional Analysis'?	2	5
j.	Explain bluff and streamlined body.	2	5

SECTION B

2. Attempt any *three* of the following: 3 x 10 = 30

Q no.	Question	Marks	CO
a.	An oil tanker of 2.5 × 2.5 m square cross section is 4 m ling. Oil is filled upto a depth of 2m. At what acceleration is the direction of its length the tanker be moved so that the corner A is exposed? What is then the net horizontal force acting on the tanker sides? Take sp. gr. of oil as 0.8.	10	1
b.	Calculate the stream function for the given data: (i) Velocity components; u = x – 4y and v = - y – 4x (ii) velocity potential function ø = 4x (3y – 4).	10	2
c.	Calculate the discharge of water flowing through a pipe of 30 cm diameter placed in an inclined position where a venturi meter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and the throat is measured by a liquid of specific gravity0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and the throat is 0.2 times the kinetic head of the pipe.	10	3
d.	Derive the momentum thickness for velocity distribution on the boundary layer given below- $\frac{u}{v} = \frac{3}{2}\eta - \eta^2$ Where $\dot{\eta} = y/\delta$	10	4
e.	The variables controlling the motion of floating vessel through water are the drag force F, the speed V, the length L, the density d, dynamic viscosity μ of water and acceleration due to gravity g. Determine the expression for F by dimensional analysis.	10	5

SECTION C

3. Attempt any *one* part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO
a.	A tank contains water up to the height of 5 m above the base. An immiscible liquid of specific gravity 0.9 is filled on the top of the water up to 1m height. Calculate total pressure on one side of the tank and the position of center of pressure	10	1

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b.	Derive an expression for the depth of centre of pressure from free surface of a liquid of an inclined plane surface submerged into the liquid	10	1

4. Attempt any *one* part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO
a.	Illustrate velocity potential and stream function. Show that 3 D continuity equation for 3 D flow in Cartesian coordinates is given by $\frac{\partial \rho}{\partial t}+\frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho w)}{\partial z}=0$	10	2
b.	The velocity potential function is given by an expression $\emptyset=-\frac{xy^3}{3}-x^2+\frac{yx^3}{3}+y^2$ (i) Find the velocity component in x and y direction. (ii) Show that $\emptyset$ represent a possible case of flow. iii) Find Stream function.	10	2

5. Attempt any *one* part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO
a.	Derive Euler's equation of motion. Also derive the Bernoulli's equation from Euler's equation and mention the necessary assumptions for this equation.	10	3
b.	Describe: (i) Stream-lined body and bluff body (ii) Darcy-weisbach formula and chezy's formula (iii) Equivalent pipe and compound pipe (iv) Hydraulic gradient line and total energy line (v) Reynold's number and Euler's number.	10	3

6. Attempt any *one* part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO
a.	Illustrate Prandtl mixing length concept to describe the turbulence during the fluid flows at high Reynold's number.	10	4
b.	A pipe carrying water has average height of roughness of 0.48mm. The diameter of pipe is 0.6 mm, length is 4.5 m .The discharge of water is 0.6 m3/sec. Determine the power required to maintain the flow if $\mu = 10^{-3}$ N-sec/m^2. Use the relation $\frac{1}{\sqrt{f}}=2\log_{10}\left(\frac{R}{k}\right)+1.74$	10	4

7. Attempt any *one* part of the following: 1 x 10 = 10

Q no.	Question	Marks	CO
a.	Illustrate terminal velocity of the body. Also illustrate the drag on a sphere and on a cylinder.	10	5
b.	Discuss geometric, kinematic and dynamic similarity. Are these equations obtainable?	10	5