Roll No. | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech.(ME) (2011 Onwards) (Sem.–4)

FLUID MECHANICS

Subject Code : BTME-403

M.Code : 59131

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Write in short on following :

(i) Define Velocity potential function.

(ii) Define Mach number.

(iii) Write Beroulli's equation

(iv) Explain Differential Manometers.

(v) Explain Dynamic Viscosity

(vi) Kinematic Viscosity.

(vii) Laminar boundary layer.

(Viii) Pathlines, Steaklines and Streamlines

(ix) Rotational and irrotational flow

(x) Meta Centre

SECTION-B

Q.2 The velocity componenet of a 2-D incompressible flow tiled are expressed as :

$u = (y^3/3) + 2x - x^2y$ and $v = xy^3 + (-2y) - (x^3/3)$

(i) Is the flow physically Possible?

(ii) What is the discharge between stream lines passing through (1.3) and (2, 3)?

(iii) Is the flow irrotational?

Q.3 Find the convective acceleration at the middle of a pipe which converges uniformly from 0.4 m diameter to 0.2 m diameter over 2 m length. The rate of flow is 20 lit/s. If the rate of flow changes uniformly from 201/s to 401/s in 30 seconds, find the total acceleration at the middle of the pipe at 15^{th} second.

Q.4 Dervie the Bernaulli's theorem along with its assumptions. How it is modified for practical applications?

Q.5 A horizontal venturimeter with inlet diameter 30 cm and throat diameter 10 cm is used to measure the flow of water. The pressure intensity at the inlet is 13.734 N/cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Find also the value of C_d for the venturimeter. assume that 4% of the differential head is lost between the inlet and throat.

Q.6 An external cylindrical mouthpiece of diameter 150 mm is discharging water under a constant head of 6 m. Determine the discharge and absolute pressure head of water at vena-contracta. Take $C_d = 0.855$ and C_c for vena contracta = 0.62. Atmospheric pressure head = 10.3 m of water.

SECTION-C

Q.7 A body has the cylindrical upper portion of 3 m diameter and 1.8 m deep. The lower portion is a curved one, Which displaces a volume of 0.6 m^3 of water. The centre of buoyancy of the curved portion is at a distance of 1.95 m below the top of the cylinder. The centre of gravity of the whole body is 1.20 m below the top of the cylinder. The total displacement of water is 3.9 tonnes. Find the meta-centric height of the body.

Q.8 For a town water supply, the main pipe line of diameter 0.4 m is required. As pipes more than 0.35 m diameter are not readily available, two parallel pipes of same diameter were used for water supply. If the total discharge in the parallel pipe is same as in the single main pipe. Find the diameter of the parallel pipe. Assume the co-efficient of friction same for all pipes.

Q.9 The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given bv $T = D^5 N^2 \rho\phi\left[\frac{\mu}{D^2 N\rho}\right]$.

Prove this by the method of dimensions.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.