Registration No : | | | | | | | | | | |

Total Number of Pages : 02 **B.Tech.**
PME6D001

6th Semester Regular Examination 2017-18
ADVANCED FLUID MECHANICS
BRANCH : MECH
Time : 3 Hours
Max Marks : 100
Q.CODE : C515

Answer Part-A which is compulsory and any four from Part-B.
The figures in the right hand margin indicate marks.
Answer all parts of a question at a place.

Part – A (Answer all the questions)

Q1. Answer the following questions: multiple type or dash fill up type **(2 x 10)**

a) When a cylindrical vessel, containing some liquid, is rotated about its vertical axis, the liquid surface is depressed down at the axis of its rotation and rises up near the walls of the vessel on all sides. This type of flow is known as
(i) Steady flow (ii) Turbulent flow
(iii) Vortex flow (iv) Uniform flow

b) Bernoulli's equation cannot be applied when the flow is
(i) rotational (ii) turbulent
(iii) unsteady (iv) all of the above

c) Streamline and equipotential lines in a flow field
(i) are parallel to each other (ii) are identical to each other
(iii) are perpendicular to each other (iv) intersect at acute angles

d) A flow is called super-sonic if the
(i) velocity of flow is very high (ii) discharge is difficult to measure
(iii) Mach number is between 1 and 5 (iv) Mach number is less than 1

e) The dynamic viscosity of a liquid is 1.2×10^{-4} Ns/m^2, whereas, the density is 600 kg/m^3. The kinematic viscosity in m^2/s is
(i) 72×10^{-3} (ii) 20×10^{-8}
(iii) 7.2×10^{3} (iv) 70×10^{6}

f) Choose the wrong statement
(i) Fluids are capable of flowing
(ii) Fluids conform to the shape of the containing vessels
(iii) When in equilibrium, fluids cannot sustain tangential forces
(iv) When in equilibrium, fluids can sustain shear forces

g) Ratio of inertia force to elastic force is known as
(i) Mach number (ii) Froude number
(iii) Reynolds number (iv) Weber's number

h) A flow whose streamline is represented by a curve, is called
(i) One-dimensional flow (ii) Two-dimensional flow
(iii) Three-dimensional flow (iv) Four-dimensional flow

i) The divergent portion of a Venturimeter is made longer than convergent portion in order to
(i) Avoid the tendency of breaking away the stream of liquid
(ii) To minimize frictional losses
(iii) Both (A) and (B)
(iv) None of these

j) 10. In a free vortex motion, the radial component of velocity everywhere is
(i) Maximum (ii) Minimum
(iii) Zero (iv) Nonzero and finite

Q2. **Answer the following questions: Short answer type** **(2 x 10)**

a) What is coquette flow?
b) Determine the velocity and acceleration of a fluid particle at (2,4,6) at t=0.3s for the velocity field given by $V=12x^2z\ i +20xy\ j+50t$
c) Explain Euler's equation and its significance.
d) Define stream function and potential function.
e) What is flownet ? Mention its significance.
f) What changes has to be made in Navier-Stokes equation for incompressible flow, in order to get Euler equation for that flow.
g) Differentiate between streamlined body and bluff body.
h) Write the conditions for boundary layer separation.
i) Define shear velocity for the turbulent flow in circular pipes.
j) What do you mean by laminar sub region?

Part – B (Answer any four questions)

Q3. **a)** Derive the Navier-Stokes equation for compressible flow. **(10)**
b) Derive the mass coservationequation **(5)**

Q4. **a)** Assuming second degree velocity distribution, i.e. $u/U_{max}=2(y/\delta)-(y/\delta)^2$ in the boundary layer, determine using integral momentum equation, the thickness of boundary layer friction coefficient, displacement and momentum thickness. **(10)**
b) Differentiate between Eulerian and Lagrangian description of flow. **(5)**

Q5. **a)** Find the velocity profile, co-efficient of friction factor and average velocity for a fully developed laminar flow in between two parallel plates. State your assumptions clearly. **(10)**
b) Write short notes on Karman's velocity defect law. **(5)**

Q6. **a)** What do you mean by continuity equation? Derive the differential form of continuity equation for compressible fluid in Cartesian coordinates. **(10)**
b) Prandtl's Mixing Length Theory. **(5)**

Q7. **a)** Explain any one Turbulence model used for analysis for fluid flow. **(10)**
b) Explain Stokes and Oseen's approximation. **(5)**

Q8. **a)** Discuss Reynolds transport theorem in brief. Explain wall shear in brief. **(10)**
b) Define translation, rotation and vorticity. **(5)**

Q9. **a)** The velocity potential is given as $\Phi=x^2-y^2$. Determine the stream function. Also calculate the value of the stream functions and the velocity at point (4,5). Calculate the slope of the stream function. State, if the flow is rotational or irrotational. **(10)**
b) Briefly discuss about Hiemenz flow. **(5)**