Form A: Paper-setting Blank Ref. No. EX/PG/PE/T/112A/2018

Master of Power Engineering 1st Sem. Examination, 2018
Subject: Applied Fluid Mechanics

Time: Three hours Full marks: 100

Answer any 5 question

No. of questions		Marks
1.	Find the expression of velocity profile of the flow between two concentric cylinders while the outer cylinder with infinite radius is stationary. Draw the characteristic curves of non-Newtonian fluids with yield stress at zero velocity gradient.	15+5
2.	Stating boundary conditions derive the expression of discharge per unit width of the flow for flow between two parallel plates (upper plate is at stationary)..	20
3.	Discuss and draw the velocity profiles for different pressure gradients for flow between two parallel plates (one plate is at stationary). Derive Reynolds Transport Theorem. Using this, find the continuity equation for steady, incompressible fluid flow.	4+16
4.	What do you mean by strain rate tensor? State the properties of stress tensor. Show that the Eulers' equation of motion can be expressed in Cartesian tensor coordinate system as $-\frac{\partial p}{\partial x_i}+f_{Bi}=\rho\left[\frac{\partial U_i}{\partial t}+U_j\frac{\partial U_i}{\partial x_j}\right]$ Symbols have their own meanings. State all the assumptions.	3+2+15
5.	Find the expression of discharge, velocity and shear stresses for fluid flowing through an annulus pipe.	20
6.	What do you mean by bulk viscosity and 2nd coefficient of viscosity? Prove that circulation of radius r, vorticity is twice the mean angular velocity. Prove that for the volumetric deformation in a 2-D fluid flow $\sigma_{xx}=\frac{1}{2}\varepsilon_{xx}$, symbols have their own meanings.	4+8+8
7.	A 3-dmensional flow is described by $V=(y^2+z^2)\hat{i}+(x^2+z^2)\hat{j}+(x^2+y^2)\hat{k}$. Find the components of	10+10

	acceleration and components of rotation at (1,2,3). Velocity field of different incompressible fluid flow are given by $u = x^2 + z^2 + 5,\ \ v = y^2 + z^2 - 3$. Find whether the flow is irrotational or not.	
8.	From 1st law of thermodynamics show that $$\rho\left(\frac{De}{Dt}\right) = \left(\frac{\partial q_i}{\partial x_i}\right) + f_{Bi}U_i + \frac{\partial}{\partial x_j}\left(\tau_{ji}U_i\right)$$ symbols have their own meaning. What do you mean by extensive and intensive property? Show their relationship.	16+4