# APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

**FIRST SEMESTER MTECH DEGREE EXAMINATION, DECEMBER 2019**

MECHANICAL ENGINEERING (THERMAL ENGINEERING)

**03ME 6021 COMPRESSIBLE & INCOMPRESSIBLE FLOW**

Max marks-60 Duration-3 Hrs

**PART A**

**(Answer all questions)**

1. Distinguish between streamlines and streak lines.
2. Explain, What is meant by local acceleration and convective acceleration?
3. What do you mean by fully developed flow?
4. Discuss Colburn analogy**.**

**PART B**

**( Answer all questions)**

5. An open circular cylindrical tank 1m high is filled with water to its top. The water is given a rigid body rotation about the axis of the tank and the pressure at the centre line at the bottom surface is found to be 0.6m of water .Find the ratio of volume of water spilled out of the tank to the original volume.

**OR**

6. Show that for forced vortex, the rise of liquid at the ends is equal to the fall of liquid at the axis of rotation.

7. For a fluid it was observed that the velocity components are u= a (x2-y2), y= (-2axy), w=0. Find the pressure distribution for the given flow using Navier stokes equation.

**OR**

8. Consider incompressible flow of water at 293 K is to be transported through a 20cm diameter pipe at a flow rate of 0.0003 m3/s. Calculate the pressure drop for a length of 100m.Viscosity of water at 293K is 0.001 Ns/m2.Also calculate the power required to maintain the flow.

9.An oil with density 900kg/m3 and viscosity 0.18Ns/m2 flows through a 10cm diameter horizontal pipe. The pressure drop over a 10m length of pipe is 10kPa.Determine the average velocity , the flow rate and wall shear stress.

**OR**

10.An open cylinder 20 cm in diameter and 30cm high is full of water .Find the speed at which the cylinder to be rotated so that one third of water will spill out.

11.Air flows over a heated plate at a velocity of 50m/s.The local skin friction coefficient at a point on a plate is 0.004.Estimate the local heat transfer coefficient as this point. The following property data far air given, Density=0.88kg/ $m^3$, viscosity=2.28x$10^{-5}$kgm/s, specific heat=1.001kJ/kgK, conductivity = 0.035W/mK. Use Colburn analogy.

**OR**

12.A square plate maintained at 368K experiences a force of 10.5 N when forced air at 298K flows over it at a velocity of 30m/s.Assuming the flow to be turbulent and using Colburn analogy , calculate the heat transfer coefficient and heat loss from the plate surface.