Subject Code…… **ROLL NO……**

SEMESTER EXAMINATION 2022-23
1st year M.Tech. Thermal Engineering

Advanced Fluid Mechanics (TET-305)

Duration : 3 hrs **Max. Marks: 100**

Note:- Attempt all questions. All question carry equal marks. In case any ambiguity or missing data, the same may be assumed and state the assumption made in the answer.

Q.1.	**Answer any four parts of the following.**	**5×4=20**
	a) How would you distinguish between hydrodynamically smooth and rough boundaries? b) Mention two most important characteristics of turbulent flow. **c)** What are similarity laws? d) For 2-D irrotational flow $\Phi = 2xy$ find the velocity at (1,2) and (2,2). Determine also the discharge passing between streamlines passing between these points. e) Discuss normaland oblique shock wave, f) What is a stagnation state ?what do you mean by stagnation properties	
Q.2.	**Answer any four parts of the following.**	**5×4=20**
	a) State Buckingham's π theorem. Why is this theorem considered superior to Rayleigh's method of dimensional analysis? **b)** Define shear velocity for turbulent flow in circular pipes. c) Discuss Mach cone. **d) Discuss Newtonian and non-Newtonian fluids.** e) Explain vorticity and circulation f) Velocity potential of a certain flow field is given as: $\psi = 4xy$. Check whether the stream function exists or not?	
Q.3.	**Attempt any two parts of the following.**	**10×2=20**
	a) The velocity potential is given by components are given by $\Phi = y^2 - x^2$, determine the velocity components in x and y direction. .Also show that Φ represents a possible case of fluid flow. b) Find the expression of displacement thickness and momentum thickness if velocity distribution in the boundary layer for a flat plate $\frac{u}{U} = \frac{y}{\delta}$ c) Explain phenomenon of boundary layer separation and also discus control of boundary layer separation.	
Q.4.	**Attempt any two parts of the following.**	**10×2=20**

	a) Water is flowing through a pipe of diameter 20 cm. The flow is turbulent. If the velocities at the pipe centre and 50 mm from the centre are 4 m/s and 3 m/s respectively, find the wall shear stress. b) A river reach of 2.0 km length with maximum flood discharge of 10000 m^3/s is to be physically modelled in the laboratory where maximum available discharge is 0.20 m^3/s. For a geometrically similar model based on equality of Froude number, find the length of the river reach (m) in the model. c) Drive of Navier-Stokes equation for Newtonian fluid	
Q.5.	**Attempt any two parts of the following.**	**10×2=20**
	a) Discuss the velocity distribution in Couette flow between two parallel flat plates. b) The stream function for a flow is given by $\psi = xy$. Is the flow irrotational? Determine (a) u, v (b) the vorticity and (c) circulation c) Explain the effect of area change in subsonic and supersonic flows.	