Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

M.Tech. Winter 2019 -20 Examination

Semester: 1 **Date:17/12/2019**
Subject Code: 203210102 **Time: 10:30 am to 01:00 pm**
Subject Name: Advanced Fluid Mechanics **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 A) Derive continuity equation. **(05)**

B) A Schlieren photograph showing wave front by a bullet moving in air giving a Mach angle of 45^{o}. Find the speed of bullet if the pressure and temperature are 1 bar and 8 ^{o}C. **(05)**

C) Explain hydrodynamic boundary layer theory for flow past flat plate. **(05)**

Q.2 **Answer the following questions**. (Attempt any three) (Each five mark) **(15)**

A) Explain fully developed flow for flow between two parallel plates.

B) Define Dipole and Doublet. Show that stream lines and equipotential lines are circles. Also find the velocity at origin.

C) Explain continuum hypothesis.

D) Explain different types of oblique shock with neat sketch.

Q.3 A) Explain boundary layer separation and its control. **(07)**

B) Explain displacement thickness, Momentum thickness and Energy thickness. **(08)**

OR

B) Diabatic flow of dry air takes place through a frictionless constant area duct. At some particular section of the duct the Mach number is 4 while the stagnation temperature and the static pressure are 7 ^{o}C and 0.5 bar respectively. Calculate the stagnation temperature, stagnation and static pressure at a section where the Mach number is 2. Also find the amount of heat transfer which causes this reduction in Mach number. **(08)**

M	$\frac{T_0}{T_0^*}$	$\frac{P}{P^*}$	$\frac{P_0}{P_0^*}$
2	0.7934	0.3636	1.5031
4	0.5891	0.1026	8.2268

Q.4 A) For given equation of convergent-divergent nozzle $\frac{A}{A*} = \frac{1}{M}\left[\frac{2}{\gamma+1} + \frac{\gamma-1}{\gamma+1}M^2\right]^{\frac{\gamma+1}{2(\gamma-1)}}$ sketch graph and discuss the same. **(07)**

OR

A) The air on the upstream of a normal shock is moving with Mach number 3 and has temperature and pressure of 27 ^{o}C and 1 bar. Calculate the pressure temperature and Mach number at downstream of the shock. **(07)**

B) Derive Reynolds Transport Theorem. **(08)**