Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(New) • EXAMINATION – WINTER 2016

Subject Code:2153507 Date:17/11/2016

Subject Name:Elements of Fluid Flow

Time:10:30 AM to 01:00 PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

			MARKS
Q.1		**Short Questions**	**14**
	1	Define: Viscosity	
	2	Define: Compressible flow	
	3	Define: Non-uniform flow	
	4	Define: Pseudoplastic fluid	
	5	Define: Steady flow	
	6	Define: Centre of pressure	
	7	Define: Reynolds number	
	8	Define: Streamlines	
	9	Define: Pathlines	
	10	Define: Dilatent fluid	
	11	Define: Rotational flow	
	12	Define: Vorticity	
	13	Write the range of Reynolds number for laminar, transition and turbulent flow.	
	14	Pascal's law states that the pressure or intensity of pressure at a point in a static fluid is equal in all directions. (True / False)	
Q.2	**(a)**	Define: absolute pressure, gauge pressure and vacuum pressure.	**03**
	(b)	Find the kinematic viscosity of an oil having density 981 kg/m^3. The shear stress at a point in oil is 0.2452 N/m^2 and velocity gradient at that point is 0.2 per second.	**04**
	(c)	An inverted U – tube manometer is connected to two horizontal pipes A and B through which water is flowing. The vertical distance between the axes of these pipes is 30 cm. when an oil of specific gravity 0.8 is used as a gauge fluid, the vertical heights of water columns in the two limbs of the inverted manometer (when measured from the respective centre lines of the pipes) are found to be same and equal to 35 cm. Determine the difference of pressure between the pipes.	**07**
		OR	
	(c)	Define hydrostatic law and derive the equation for hydrostatic law.	**07**
Q.3	**(a)**	Write a short note on boundary layer separation.	**03**
	(b)	A fluid having density of 1200 kg/m^3 flowing through a 0.45 m diameter pipe. The fluid is having viscosity of 10^{-5}N s/m^2 and flowing with 8 m/sec velocity, calculate the Reynolds number and identify the flow regime whether it is laminar o turbulent. .	**04**
	(c)	Write principle, working and construction of rotameter.	**07**
		OR	

Q.3	**(a)**	The velocity potential for a two dimensional flow is $\emptyset = x(2y - 1)$, determine the velocity at the point P (4,5). Also obtain the value of stream function at this point P.	**03**
	(b)	Derive continuity equation.	**04**
	(c)	Write principle, working and construction of pitot tube.	**07**
Q.4	**(a)**	Write a classification of notches and weirs.	**03**
	(b)	Explain laminar and turbulent flow with Reynolds number and examples.	**04**
	(c)	Derive Bernoulli's equation without friction.	**07**

OR

Q.4	**(a)**	What is the criteria of selecting the repeating variables in Buckingham's pi theorem?	**03**
	(b)	Define velocity potential. Express velocities in terms of velocity potential and derive the expression for vorticity in terms of velocity potential.	**04**
	(c)	An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Co – efficient of discharge for the orifice meter is given as 0.6. Find the discharge of water through pipe.	**07**
Q.5	**(a)**	What is tranquil and rapid flow? Explain with example.	**03**
	(b)	Water is flowing through a pipe of diameter 0.5 m with velocity 100 m/sec. The pipe contracts at the exit and reduces its diameter to 0.28 m. Calculate the velocity of water at the exit.	**04**
	(c)	What are sonic, subsonic and supersonic flows? At which dimensionless number they are dependent explain in detail.	**07**

OR

Q.5	**(a)**	What is dimensional analysis?	**03**
	(b)	What are the similarity laws?	**04**
	(c)	The resistance R experienced by a partially submerged body depends upon the velocity V, length of the body l, viscosity of the fluid μ, density of the fluid ρ and gravitational acceleration g. Obtain a dimensionless expression for R by Buckingham's-Pi theorem.	**07**

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