Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER III • EXAMINATION – SUMMER 2015

Subject Code: 733102 **Date:02/05/ 2015**

Subject Name: Cardiovascular Mechanics **Time:**

Total Marks: 70

Instructions:

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

Q.1	**(a)**	Define below given terms: 1. The Wormersley Number 2. Bernoulli Equation 3. Conservation of Mass 4. Reynolds number	**08**
	(b)	Explain Coronary Circulation & Microcirculation briefly.	**06**
Q.2	**(a)**	Derive the equation of velocity as a function of radius with necessary assumptions.	**07**
	(b)	Explain Displacement & Velocity as a fluid characteristic with necessary equations.	**07**
		OR	
	(b)	Explain Shear Stress & Viscosity as a fluid characteristic with necessary equations.	**07**
Q.3	**(a)**	Write a brief note on Mechanics of Arterial Walls.	**07**
	(b)	Define flow rate for pipe flow. Derive mathematical equation for the average velocity across the cross-section of the tube.	**07**
		OR	
Q.3	**(a)**	Explain General Structure and types of Arteries.	**07**
	(b)	What do you mean by Compliance of blood vessel? Derive equations of compliance & modulus of elasticity.	**07**
Q.4	**(a)**	Explain the Navier-Stokes Equations for Newtonian fluid flow.	**07**
	(b)	Explain the pulsatile flow in rigid tubes by Wormersley Solution.	**07**
		OR	
Q.4	**(a)**	Show that the parabolic velocity profile from horizontal Poiseuilleôs flow is a solution of the Navier-Stokes equations using the cylindrical form.	**07**
	(b)	Explain the pulsatile flow in rigid tubes by Fry Solution.	**07**
Q.5	**(a)**	Draw and explain electrical analog model of flow in a tube	**07**
	(b)	To study the flow through a 7 mm diameter venous valve carrying blood at a flow rate of 170 ml/min, we will use water instead of blood, which is more difficult to obtain and more difficult to work with. Take the viscosity of blood to be 0.005 Ns/m^2 and the viscosity of water to be 0.002 Ns/m^2. Complete geometric similarity exists between the model and prototype. Assume a model inlet of 10 cm in diameter. Determine the required flow velocity in the model that would be required for Reynolds number similarity.	**07**
		OR	
Q.5	**(a)**	Briefly describe the modeling of flow through the Mitral valve.	**07**

(b) The velocity V of an erythrocyte settling slowly in plasma can be expressed as a function of diameter ***d***, thickness ***t***, plasma viscosity $\boldsymbol{\mu_p}$, erythrocyte density $\boldsymbol{\rho_e}$, plasma density $\boldsymbol{\rho_p}$, and gravity ***g***. Written in mathematical formulation, this equals to **07**

$$V_s = f(d, t, \mu_p, \rho_e, \rho_p, g)$$

Determine a suitable set of π terms for expressing this relationship.

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