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# MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

*A Constituent Institution of Manipal University*

**III SEMESTER B.Tech. (BME) DEGREE MAKEUP EXAMINATIONS DEC/JAN 2016-17**
**SUBJECT: BIOMECHANICS (BME 2104)**
**(REVISED CREDIT SYSTEM)**
**Friday, 6th January 2017, 9 to 12 noon**

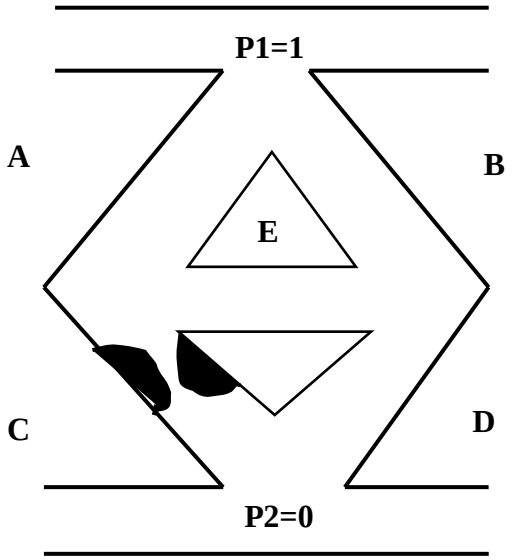
**TIME: 3 HOURS** **MAX. MARKS: 100**

**Instructions to Candidates:**

1. **Answer all FIVE full questions.**
2. **Draw labeled diagram wherever necessary.**

**1A.** By considering the composition of blood, explain why blood is a non-Newtonian fluid. **6**

**1B.** If an idealized network is upset by a sphincter (in the branch C) shown below, mention the possible changes that might happen in the total n/w with reasons, when the blood has to flow from 1 to 2? Assume that A, B, C, D, E branches are equal in diameter and length. **6**




**1C.** Define viscosity and derive the Newton's law of viscosity. **8**

**2A.** Using Einstein's equation to predict viscosity as a function of Hematocrit and temperature, calculate the viscosity of blood at 37 $^{o}$C using a Hematocrit of 42% and plasma viscosity of $1.24 \times 10^{-3}$ Ns/m$^2$. **6**

**2B.** Explain about the viscoelastic nature of the protoplasm. **6**

**2C.** Derive and obtain the differential equation for Maxwell model. **8**

**3A.** Explain the mechanical properties of capillaries. **6**

**3B.** Draw the pressure-volume curves for a normal functioning lung and an excised human lung (separately) and compare them. **6**

**3C.** Diagrammatically represent the following major categories of mechanical prosthetic heart valves. **8**

(i) Caged-ball
(ii) Caged-disk
(iii) Tilting-disk
(iv) Bileaflet pivoting-disk

**4A.** Describe about the following skin abnormalities which can be detected by durometer. **6**

(i) Scleroderma
(ii) Lipodermatoscelrosis
(iii) Neuropathic foot

**4B.** How do you explain the non-linear phase in the force-deformation curve for tendon and ligament? **6**

**4C.** Explain the mechanical properties of skin. **8**

**5A.** Write the functions performed by a muscle. **6**

**5B.** Explain the biomechanics of trabecular bone. **6**

**5C.** With appropriate examples, define the following muscle action. **8**

(i) Agonist
(ii) Antagonist
(iii) Stabilizer
(iv) Neutralizer