# OPEN BOOK EXAM

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| Menofia University<br>Faculty of Engineering<br>Basic Engineering Sci. Department<br>Academic Year : 2015-2016<br>Date : 9 / 1 / 2016 | Minoufia University | Subject : Bio-Mathematics<br>Code: BES 513<br>Time Allowed : 3 hours<br>Year : Master<br>Total Marks: 100 Marks |

**Answer all the following questions: [100 Marks]**

**Q.1** **(A)** ***Write brief notes on the following topics:*** [20]

1. What is biomathematics? And Why to study biomathematics?
2. Classification of Bio-signals?
3. What the Sources of Bio-Potential?
4. Bioengineeringand Biomaterials and its applications.
5. Biomechanics and Bio-fluid mechanics, view point of blood flow.
6. Biomedical engineering and its new career areas.
7. Bioenvironmental engineering and Biosensors engineering.
8. Bioprocess engineering and tasks of bioprocess engineer.

**(B)** State the steps of constructing a mathematical model.

**Q.2** If we consider a two-dimensional channel of uniform thickness $2d$, filled with a compressible viscous liquid. The walls of the channel are deformed in the shape of a traveling sinusoidal wave with constant amplitude$a$ (Peristaltic motion). The vertical displacements of the upper and lower walls ($y = d$ and $y = -d$) are thus presumed to be$\eta$ and$\eta$, respectively, $x$ and $y$ are Cartesian coordinates with $x$ measured in the direction of wave propagation and $y$ measured in the direction normal to the mean position of the walls. Write the mathematical model of this problem. [20]

**Q.3** Consider an axisymmetric flow of a mixture of small spherical solid particles and an incompressibleNewtonian viscous fluid through a uniform circular cylindrical tube. The tube wall is flexible on which [20]

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| | are imposed travelling sinusoidal wave with constant amplitude $b$ (Peristaltic motion). The flow in cylindrical coordinates $(r, z)$ with $z$ measured in the direction of wave propagation, whereas $r$stands for theradial coordinate. Write the mathematical model of this problem. | |
| **Q.4** | Consider axially symmetric and fully developed pulsatile flow ofblood in an axisymmetric cylindrical artery of radius $R$ through porous medium with body acceleration under theinfluence of an external uniform transverse magnetic field. Blood is assumed to be Newtonian, incompressible, electrically conducting and viscous fluid. The fluid subjected to a constant magnetic field acts perpendicular to the artery.Assume that the magnetic Reynolds number of the flow is taken to be small enough.Draw the geometry of the problem, then Write the mathematical model of this problem. | [20] |
| **Q.5** | Consider pulsatile flow of an incompressible couple stress fluid between two permeable beds through a porous medium in the presence of magnetic field. The fluid is injected into the channel from the lower permeable bed with a velocity $V$ and is sucked into the upper permeable bed with the same velocity. The flow between the permeable beds is governed by couple stress fluid flow equations of Stokes. Let the $x$-axis be taken along the interface and the $y$-axis perpendicular to it. Let $y = 0$ and $y = h$ represent the interfaces of the permeable beds under consideration. The flow as axially symmetric and fully developed. Draw the geometry of the problem. Write the mathematical model. | [20] |

| This exam measures the following ILOs | | | | | | | | |
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| **Question Number** | **Q1-a** | **Q1-b** | **Q3-b** | **Q4-a** | **Q1-c** | **Q2-a** | **Q3-a** | **Q4-c** |
| | **Q4-b** | | | | **Q2-b** | **Q2-c** | **Q3-c** | |
| | **Knowledge &understanding skills** | | | | **Intellectual Skills** | | **Professional Skills** | |

With our best wishes

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