

Biomedical Engineering (M. S & Ph. D.)

Candidates will be tested for basic mathematics. Apart from that, for the purpose of the interview, candidates can choose any two of the following areas for Ph. D. and any one of the following areas for M. S.

1. Biomedical instrumentation
2. Biomedical imaging systems
3. Biomechanics
4. Signal processing
5. Image processing
6. Computer graphics
7. Design of algorithms and data structures.

Syllabus:

Biomedical instrumentation-

Bio electric signals (ECG, EMG, EEG etc.), transducers and their application in biomedicine, basics of electrical and electronic circuits, measurements and instrumentation, bioamplifier circuits.

References:

1. R. S. Khandpur, "Biomedical instrumentation-Technology and applications", McGraw-Hill, 2005.
2. L. Cromwell, "Biomedical instrumentation and measurements", Prentice Hall, 1980.
3. J. A. Edminister, "Theory and problems of electric circuits", Schaum's outline series, McGraw-Hill, 1991.
4. J. Millman and C. C. Halkias, "Integrated electronics", McGraw-Hill, 1972.
5. E. W. Golding and F. C. Widdis, "Electrical measurements and measuring instruments", Ed.5, Pitman Publishing Ltd., London, 1963.

Biomedical imaging systems-

Different diagnostic imaging modalities (Radiography, Ultrasound, Magnetic resonance imaging etc.), role of photonics in biomedical engineering, concepts of endoscopic imaging, sensory response and their assessment in clinical medicine.

References:

1. J. L. Prince and J. M. Links, "Medical imaging signals and systems", Prentice Hall, 2005.

2. P. Suetens, "Fundamentals of medical imaging", Cambridge University Press, 2002.
3. J. G. Webster, "Minimally invasive medical technology", IOP Publishing, 2001.

Biomechanics-

Movements of the body; tissue types; characteristics of biological tissues; Measuring biological materials; Skeletal system; muscular system; Analyzing gaits.

Signal processing-

Discrete time signals and systems, discrete Fourier transform, time and frequency domain filtering, digital filters and their design.

Reference:

1. A. V. Oppenheim and R. W. Schaffer, "Digital signal processing", Prentice Hall, 1975.
2. L. R. Rabiner and B. Gold, "Theory and application of digital signal processing", Prentice Hall, 1975.
3. J. L. Simmlow, "Biosignal and biomedical image processing-*Matlab based applications*", CRC, 1 ed., 2004.

Image processing-

Digital image properties, factors affecting the image quality, data structures for image analysis, image pre-processing, image enhancement and restoration, segmentation.

Reference:

1. J. L. Simmlow, "Biosignal and biomedical image processing-*Matlab based applications*", CRC, 1 ed., 2004.
2. K. R. Castleman, "Digital image processing", Prentice Hall, 1995.

Computer graphics-

Points, Lines, Plane, Polygon representations; 2D and 3D translation, scaling, rotation, and shear; projection transformation; scan conversion; Lighting, reflection, and transmission models and Shading algorithms.

Data structure and algorithms-

Running time analysis; stacks, queues, and lists; trees; dictionaries; sorting and selection; graphs; strings.