**19BMO501T INTRODUCTION TO BIOMEDICAL ENGINEERING**

**3 0 0 3**

**INTRODUCTION TO BIOLOGY:**Engineering in modern medicine, Physiological Systems-Cell Structure, Structure of nerve cell and functions, Heart & Circulatory system, Respiratory Physiology, Kidney function, Brain & Central Nervous System. (9)

**BIO PHYSIOLOGICAL SIGNALS:** Signal representation, Signal analysis in time and Frequency domain, Signal Estimation, Bioelectric Signals: Electrocardiogram & Electroencephalogram, Vital Signs, Bio magnetic Signals. (9)

**MEDICAL IMAGING SYSTEMS& EMERGING TECHNOLOGIES:** Principles and Applications - X-ray & CT, Ultrasound Imaging, MRI, Nuclear Medicine, Microscopy, Biophotonics, Optical Biosensors, Carbon Nano Tubes, Quantum Dots, MEMS, Neuroengineering. (9)

**BIOMECHANICS & BIOMATERIALS:** Mechanical Properties of Tissue - Stress, Strain, Viscosity and Viscoelasticity, Applications of Sports Biomechanics, Biomaterials - Types, Properties, Applications - Artificial heart & Membrane Oxygenators.(9)

**SOCIAL AND ETHICAL ISSUES RELATED TO BIOMEDICAL ENGINEERING:** Principles of clinical research, randomized controlled trials, Technology and community, Environmental aspects of technology related to healthcare delivery, Healthcare economics and health rationing.(9)

**Total L: 45**

**TEXT BOOKS:**

1. John D. Enderle and Susan M. Blanchard, “Introduction to Biomedical Engineering”, Elsevier International Projects Ltd., Boston, 2005.
2. Laurence J. Street, “Introduction to Biomedical Engineering Technology”, CRC Press, London, 2008.

**REFERENCES:**

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.
2. John G. Webster, “Medical Instrumentation: Application and Design”, John Wiley and sons, New York, 2007.
3. Joseph J. Carr and John M. Brown, “Introduction to Biomedical Equipment Technology”, John Wiley & Sons, New York, 2008.

**19BMO502T WEARABLETECHNOLOGIES**

**30 0 3**

**INTRODUCTION TO WEARABLE AND HAPTICS:**Attributes of wearables, Meta-wearable, Challenges and opportunities, Future of wearables - Social aspects ofwearabilityandinteraction:SocialinterpretationofAesthetics-Casestudy:Googleglass-Wearablehaptics:Needforwearblehapticdevices-Categoriesofwearablehapticandtactile display-Wearablesensorimotor enhancer. (9)

**WEARABLE SENSORS DESIGN AND CHALLENGES:**Chemical and Biochemical sensors, System design, Challengesinchemical biochemicalsensing,Applicationareas-Inertiasensors,Parametersfrominertiasensors - Applications for wearable motion sensors -Measurementofenergyexpenditurebybodywornheatflow sensors. (9)

**FLEXIBLE ELECTRONICS:**Introduction, Thin-film transistors: Materials and Technologies, Review of semiconductors in flexibleelectronics-Low-powerIntegratedCircuitDesignforbiopotentialsensing:Analogcircuitdesigntechniques-Low-powerdesignforADCs-Digitalcircuitdesigntechniques-Architectural designforlow-powerbiopotentialacquisition,Practicalconsiderations.(9)

**ENERGY HARVESTING SYSTEMS:**Energy harvesting from human body: Temperature gradient, Foot motion - Wirelessenergytransmission-EnergyharvestingfromlightandRFenergy-Energy andpowerconsumptionissues, Futureconsiderations.(9)

**MONITORINGPHYSICALANDPHYSIOLOGICALPARAMETERS:**Wearablesensors for physiological signalmeasurement - Physical measurement: Cardiovascular diseases, Neurological diseases, Gastrointestinal diseases - Wearable andnon-invasive assistive technologies: Assistive devices for individuals with severe paralysis, Wearable tongue drive system,Dual-modetonguedrivesystem. (9)

# TotalL: 45

**TEXTBOOKS:**

1. EdwardSazonov,MichaelRNeuman,"WearableSensors:Fundamentals,ImplementationandApplications",AcademicPress, Edition 2,USA,2020.
2. Tom Bruno , "Wearable Technology: Smart Watches to Google Glass for Libraries", Rowman& Littlefield Publishers,Lanham,Maryland,2015.

# REFERENCES:

1. RaymondTong,"WearableTechnologyinMedicineandHealthCare",AcademicPress, USA,2018.
2. HaiderRaad,"TheWearableTechnologyHandbook",UnitedScholarsPublication,USA,2017.
3. AnnalisaBonfiglio,DaniloDeRossi,"WearableMonitoringSystems",SpringerScience&BusinessMedia,USA,2011.
4. Röcker, Carsten , "Smart Healthcare Applications and Services: Developments and Practices: Developments and Practices",IGIGlobal,USA,2010.

**19BMO503T MEDICALROBOTICS**

**30 0 3**

**INTRODUCTION :**Introduction to medical robotics (applications and paradigms), Basic kinematics concepts (forward, inverse, remote center of motion)Basic control concepts (impedance, admittance)Surgery for engineers, Interventional radiology for engineers (9)

**MINIMALLY INVASIVE SURGERY (MIS):** Human-machine interfaces, Teleoperation, Cooperative manipulation, Port placement for MIS, Robot design concepts, Video images in MIS, Augmented reality. (9)

**IMAGE-GUIDED INTERVENTIONS:** Medical imaging modalities (e.g., MRI, US, X-ray, CT), Robot compatibility with medical imagers, Image segmentation and modeling, Tracking devices, Frames and transformations, Surgical navigation, Calibration, Rigid and non-rigid registration, Radiosurgery (9)

**ROBOTS IN CLINICAL & NON CLINICAL APPLICATIONS:**Cardiac, abdominal, and urologic procedures with tele operatedrobots, Orthopedic surgery with cooperative robots, Prostate interventions with manual “robots”, Robotic catheters for heart electrophysiology.(9)

**ROBOTS IN HEALTH CARE:**Modular robots, Service robots, Social robots, Mobile robots and Autonomous robots (9)

# Total : 45

**TEXTBOOKS:**

1. JohnJ. Craig,"IntroductiontoRobotics:MechanicsandControl",PrenticeHallofIndia,NewDelhi,2018.
2. AchimSchweikard,FlorisErnst,"MedicalRobotics", Springer,NewYork,2015.

# REFERENCES:

1. JocelyneTroccaz,"MedicalRobotics",Wiley-ISTE,USA,2013.
2. SaeedBNiku,"IntroductionToRobotics:Analysis,Systems,Applications",PearsonEducation,NewDelhi,2010.
3. DanielR.Faust,"MedicalRobots", TheRosen PublishingGroup,NewYork,2017.
4. BrunoSiciliano,LorenzoSciavicco,LuigiVillani,"Robotics:Modelling,PlanningandControl",Springer-Verlag,NewYork,2011.