

BE BIOMEDICAL ENGINEERING
SEMESTER VII
19D701 MACHINE LEARNING

3 0 0 3

INTRODUCTION : Introduction to Probability Theory and Probability Distribution - Formulation of Learning Problem, Learning model, Probabilistic model - Types of learning : supervised, unsupervised, reinforcement - challenges in Machine Learning : error and noise. (8)

SUPERVISED LEARNING : Basic Regression - Linear Regression, Nonlinear regression, Basic Classification - Decision Trees, Nearest neighbor, Probabilistic Approach - Logistic Regression - Bayesian Network - Case Studies : Tumor Type Prediction, Vital Signs Monitoring. (10)

NEURAL NETWORKS AND KERNEL METHODS : Introduction to ANN, Perceptron, Multilayer Perceptron, Back propagation, Support Vector Machines - SVM, The Kernel trick, Support Vector Regression, Case Study – Cognitive State Detection. (10)

FEATURE SELECTION : Filter, Wrapper and Embedded Methods, Linear Discriminant Analysis (LDA), mRMR Feature Selection. (8)

UNSUPERVISED LEARNING : Dimensionality Reduction - KL Transform - Singular Value Decomposition (SVD) - Eigenspace and Eigen Analysis - Clustering: k means, Gaussian Mixture Models, Principal Component Analysis (PCA) - Case Study in Medical Imaging. (9)

Total L: 45

TEXT BOOKS:

1. Abu-Mostafa Y.S., Magdon-Ismaïl M., Lin H.T., "Learning from Data", AMLBook Publishers, California, 2017.
2. C.M. Bishop, "Pattern Recognition and Machine Learning", Springer Information Science and Statistics, Switzerland, 2007.

REFERENCES:

1. Shalev S., Shai S., David B., "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, Cambridge, 2015.
2. Solomon J., "Numerical Algorithms: Methods for Computer Vision, Machine Learning, and Graphics", CRC Press, Florida, 2015.
3. Rogers S., Girolami M., "First Course In Machine Learning", CRC Press, Florida, 2015.
5. Laurene V. Fausett, "Fundamentals of Neural Networks: Architectures, Algorithms and Applications", Pearson Education India, New Delhi, 2004.

19D702 BIOFLUIDICS AND THERMODYNAMICS

3 0 0 3

FLUID STATICS : Basic concepts of fluid mechanics - Static equilibrium - Surface tension - Membrane and cortical tension Constitutive relation: Newton's law of viscosity, Non-Newtonian rheology, Time-dependant viscoelastic behavior - Dimensionless numbers - Laminar and turbulent flow - Slip and No-slip boundary conditions. (9)

FLUID KINEMATICS : Control volume - Velocity field - Flow rate - Acceleration - Streamlines - Stream tubes and Streak lines - Conservation relations and boundary conditions: Conservation of mass, Momentum balances, Forces and boundary conditions - Applications: Flow induced by a sliding plate - Pressure driven flow through a rectangular and cylindrical channel. (10)

THERMODYNAMICS : Introduction - Energy - Entropy - Reversible and Irreversible processes – Thermodynamic laws Balance equation - Principle of mass transfer: Diffusion and convection. (8)

THERMAL TRANSPORT IN BIOLOGICAL SYSTEMS : Heat transfer and temperature variation within the human body - Blood perfusion through capillaries in tissues - Bioheat equation - Metabolic heat generation - Heat conduction within the tissue - Interaction between the human skin surface and surroundings. (9)

FLUIDICS OF BLOOD AND OTHER FLUIDS : Rheology of blood - Oscillating fluid flow - Flow in curved vessels - Flow in Branched vessels - Flow in arteries - Turbulent flow in heart valves - Fluid flow in lungs and kidneys – Nanoscale drug delivery systems. (9)

Total L: 45

TEXT BOOKS:

1. Yunus A. Cengel, Michael A. Boles, "Thermodynamics: An Engineering Approach", Tata McGraw-Hill Publications, New York, 2015.
2. Ali Ostadfar, "Biofluid Mechanics: Principles and Applications", Academic Press, London, 2016.

REFERENCES:

1. George A. Truskey, Fan Yuan, David F. Katz , "Transport Phenomena in Biological Systems", Prentice Hall, New York, 2009.
2. Mustafa Ozilgen, Esra Sorguven Oner , "Biothermodynamics: Principles and Applications", CRC Press, New York, 2016.
3. Y. C. Fung , "Biodynamics: Circulation", Springer Science & Business Media, New York, 2013.
4. John Enderle, Joseph Bronzino , "Introduction to Biomedical Engineering", Academic Press, Oxford, 2012.

19D710 BIO MODELING AND SIMULATION LABORATORY

0 0 2 1

1. Introduction to Modeling and Simulation Tools
2. Fluid Flow in Straight Channel
3. Fluid Flow in Curved Channel
4. Fluid Flow in Branched Channel
5. Fluid – Structure Interaction Study in Artificial Organs
6. Design of Micropump
7. Design of Gas Sensor
8. Design of Pressure Sensor
9. Design of Cantilever based Biosensor
10. Design of Photoresist Mask For MEMS Device

Total P: 30

19D711 DATA ANALYTICS LABORATORY

0 0 2 1

1. Introduction to R Environment and R packages
2. Vectors, creating sequences, common functions
3. Generating summaries of categorical and continuous data
4. Branching and looping instructions
5. Preprocessing of given dataset
6. Visualization of data
7. Univariate and Multivariate regression
8. Classification techniques
9. Clustering techniques
10. Computer Aided Decision Making – Miniproject

Total P: 30

19D720 PROJECT WORK I

0 0 4 2

1. Identification of a real life problem in thrust areas
2. Developing a mathematical model for solving the above problem
3. Finalisation of system requirements and specification
4. Proposing different solutions for the problem based on literature survey
5. Future trends in providing alternate solutions
6. Consolidated report preparation of the above

Total P:60

SEMESTER VIII

19D820 PROJECT WORK II

0 0 8 4

THE PROJECT INVOLVES THE FOLLOWING:

PREPARING A PROJECT - BRIEF PROPOSAL INCLUDING

- Problem identification
- A statement of system / process specifications proposed to be developed (block diagram / concept tree)
- List of possible solutions including alternatives and constraints
- Cost benefit analysis
- Time line of activities

A REPORT HIGHLIGHTING THE DESIGN FINALIZATION [BASED ON FUNCTIONAL REQUIREMENTS & STANDARDS (IF ANY)]

A PRESENTATION INCLUDING THE FOLLOWING:

- Implementation phase (hardware / software / both)
- Testing & validation of the developed system
- Learning in the Project
- Consolidated report preparation

Total P: 120

PROFESSIONAL ELECTIVES

19D001 ELECTROMAGNETIC FIELDS IN BIOLOGY AND MEDICINE

3 0 0 3

VECTOR ANALYSIS : Review of vector space - Coordinate systems and transformations: Cartesian , Cylindrical , Spherical coordinates - Line - Surface and Volume integrals - Del operator - Gradient of a scalar - Divergence of vector - Curl of a vector. (8)

ELECTROSTATIC FIELDS : Coulomb's law - Electric field Intensity: Point charge , Line charge ,Surface charge , Volume charge - Electric flux density - Gauss's law - Maxwell's equation - Application of Gauss's law - Electric potential - Relationship between field intensity and potential. (10)

MAGNETOSTATIC FIELDS : Biot - Savart's law - Ampere's circuital law - Maxwell's equation - Applications of ampere's law - Magnetic field Intensity: Line current , Surface current , Volume current - Magnetic flux density - Forces due to magnetic fields - Magnetic torque and moment - Magnetic dipole - Magnetic energy. (10)

BIOLOGICAL EFFECTS OF EMF : Introduction - Electromagnetic radiation: Non ionizing radiation , Ionization by multiple photons - Different forms of fields and waves - Thermal and non thermal effects: Temperature rise , Specific absorption ratio - Mechanism for action of EMF on cells: Bioactivity characteristics - Case study: MRI principles. (8)

THERAPEUTIC APPLICATIONS: Static and Time varying fields: Biophysical Considerations , Tissue Repair , Orthopedics, Soft Tissue Applications , EMF Sensitivity - Heating Applications: Radio Frequency Energy , RF Heating Mechanisms, Cancer treatment , RF Ablation: Clinical Applications. (9)

Total L: 45

TEXT BOOKS:

- 1.Frank S, Barnes,Ben Greenebaum, "Biological and Medical Aspects of Electromagnetic Fields", Taylor & Francis, New York, 2018.
- 2.Sadiku M H , "Elements of Electromagnetics", Oxford University Press, Chennai, 2018.

REFERENCES:

- 1.Peter Stavroulakis , "Biological Effects of Electromagnetic Fields", Springer, New York, 2013.
- 2.Hayt, Buck, Akhtar , "Engineering Electromagnetics", Mcgraw Hill Education, Noida, 2015.
- 3.Gerd Mrozynski Matthias Stallein , "Electromagnetic Field Theory: A Collection of Problems", Springer, Berlin, 2013.
- 4.Ashutosh Pramanik , "Electromagnetism - Theory and Applications", Prentice Hall of India, New Delhi, 2014.

19D002 MEDICAL OPTICS

3 0 0 3

OPTICAL PROPERTIES OF TISSUE : Refraction - Scattering - Absorption - Light transport in Tissue - Preliminaries to Radiation Transport Theory - Monte Carlo Simulations - Tissue Properties: Refractive Indices, Scattering, Absorption. - Refraction - Scattering - Absorption - Light transport in Tissue - Preliminaries to Radiation Transport Theory - Monte Carlo Simulations - Tissue Properties: Refractive Indices, Scattering, Absorption. (9)

LIGHT-TISSUE INTERACTIONS : Light Interactions with a Strongly Scattering Tissue: Continuous Wave Light, Polarized Light, Short Light Pulses - Opto- Thermal Interactions - Fluorescence - Laser-Biomatter Interaction Laser Therapy. (9)

INSTRUMENTATION IN PHOTONICS : Measurements: Absorption, Scattering , Emission - Instrumental Components: Excitation Light Sources, Optical Filter, Dispersive Devices, Optical Fibers, Polarizers, Detectors – Detection Methods: Time-resolved, Phase-resolved. (9)

OPTICS IN DIAGNOSTICS : Two Photon Excitation Fluorescence Microscopy - Fluorescence Spectroscopy - Ultra Violet Spectroscopy for diagnosis - Near-Field Imaging - Optical Coherence Tomography Imaging - Thermal Imaging for Biological and Medical Diagnostics. (9)

LASER INTERVENTIONS AND TREATMENT: Principles of Photodynamic therapy – Lasers in: Ophthalmology, Dermatology, Gastroenterology, Image Guided Surgery. (9)

Total L: 45

TEXT BOOKS:

- 1.Lihong V. Wang, Hsin-i Wu , "Biomedical Optics: Principles and Imaging", John Wiley & Sons, New Jersey, 2012.
- 2.Valery V Tuchin , ""Handbook of Photonics for Biomedical Science "" , CRC Press, Boca Raton, 2010.

REFERENCES:

- 1.Paras N Prasad , ""Introduction to Biophotonics"" , John-Wiley & Sons Inc, New York, 2003.
- 2.Mool C Gupta, John Ballato , "Handbook of Photonics", CRC Press, New York, 2007.
- 3.Shun Lien Chuang , "Physics of Photonics Devices", John Wiley and Sons, New Jersey, 2009.
- 4.Gines Lifante , "Integrated Photonics Fundamentals", John Wiley and Sons, England, 2003.

19D003 ULTRASOUND IN MEDICINE**3 0 0 3**

INTRODUCTION : History - Role of Ultrasound in Medical Imaging - Stress And Strain Relationships – Acoustic Wave Equation - Acoustic Properties of Biological Tissues - Doppler Effect. (7)

ULTRASOUND TRANSDUCERS : Piezoelectric Effect - Properties of Important Piezoelectric Materials - Ultrasonic Transducers - Acoustic Properties of Transducer Materials - Transducer Beam Characteristics. (9)

GRAY-SCALE ULTRASONIC IMAGING : A (Amplitude)-Mode - B (Brightness)-Mode Imaging - Beam Forming - Speckle - Image Quality - M-Mode - C-Mode - Ultrasound Computed Tomography. (8)

DOPPLER FLOW MEASUREMENTS : Nondirectional CW Flow Meters - Directional Doppler Flow Meters - Pulsed Doppler Flow Meters - Clinical Applications And Doppler Indices - Color Doppler Flow Imaging - Elasticity Imaging Intravascular imaging. (9)

BIOLOGICAL EFFECTS AND APPLICATIONS : Acoustic Phenomena at High-Intensity Levels - Ultrasound Bioeffects: Mechanical Effects and Index - Ultrasound Therapy - Hyperthermia - High-Intensity Focused Ultrasound Lithotripsy - Diagnostic Ultrasound Imaging. (12)

Total L: 45**TEXT BOOKS:**

- 1.KK Shung , "Diagnostic Ultrasound: Imaging and Doppler Flow Measurements", Francis & Taylor, CRC Press, Boca Raton FL, 2015.
- 2.Szabo T , "Diagnostic Ultrasound Imaging: Inside Out", Elsevier Academic Press, Amsterdam, 2014.

REFERENCES:

- 1.Jerry L Prince, Jonathan M Links , "Medical Imaging Signals and System", Pearson Education, India, 2014.
- 2.Sanches, João Miguel, Laine, Andrew F, Suri, Jasjit S , "Ultrasound Imaging: Advances and Applications", Springer-Verlag, New York, 2012.
- 3.P. Suetens , "Fundamentals of Medical Imaging", Cambridge University Press, Cambridge, UK,, 2009.
- 4.R.S.C. Cobbold , "Foundations of Biomedical Ultrasound", Oxford University Press, Oxford, UK, 2007.

19D004 MAGNETIC RESONANCE IMAGING**3 0 0 3**

FUNDAMENTALS : Introduction - Production of net magnetization - Concepts of magnetic Resonance, Relaxation: T1 relaxation and saturation, T2 relaxation and spin echoes. (10)

PRINCIPLES OF MAGNETIC RESONANCE IMAGING : Gradient fields, Slice Selection - Encoding: Readout or frequency encoding , Phase encoding , Sequence looping , Frequency selective excitation, Composite pulses - Raw data and image data matrices - Raw data and k space - Reduced k space acquisitions - Parallel acquisition techniques. (12)

PULSE SEQUENCES : Spin echo sequences - Gradient echo sequences - Echo planar imaging sequences Magnetization, Prepared sequences. (10)

ARTIFACTS : Motion Artifacts - Sequence / Protocol, Related Artifacts , External artifacts - Motion artifacts reduction techniques: Acquisition parameter modification - Triggering - Flow Compensation - Radial based motion compensation. (8)

ADVANCED APPLICATIONS : Diffusion - Perfusion - Functional Brain Imaging - Ultra High Field Imaging – Noble Gas Imaging. - MR Angiography. (5)

Total L: 45**TEXT BOOKS:**

- 1.Brain M Dale, Mark A. Brown, Richard C. Semelka , "MRI Basic Principles and Applications", John Wiley & Sons, Oxford, 2015.

2.Vincent Perrin , "MRI Techniques", John Wiley & Sons, USA, 2013.

REFERENCES:

- 1.Govind B Chavhan , "MRI made easy (for Beginners)", Jaypee Publications, New Delhi, 2013.
- 2.Catherine Westbrook , "Handbook of MRI Technique", John Wiley & Sons, Oxford, 2013.
- 3.Scott A. Huettel, Allen W. Song, Gregory McCarthy , "Functional Magnetic Resonance Imaging", Springer, China, 2010.
- 4.Peter Jezzard, Paul M Matthews, Stephen M Smith , "Functional MRI: An Introduction to Methods", Oxford University Press, USA, 2003.

19D005 EMBEDDED SYSTEM DESIGN

3 0 0 3

INTRODUCTION: Definition - Need for embedded applications and philosophy for its development - Hardware and software components - Building an embedded system - Design and development Process - Life cycle. (9)

REAL TIME OPERATING SYSTEMS : Tasks and task management - Memory management - Deadlocks - Performance analysis and optimization (9)

INTERFACING WITH DEVICES : Model of Interprocess communication - Interprocess interaction - Local device model - Interrupts and polling - Remote device model - Interfacing with local devices - Interfacing with remote devices - Design process - Design examples. (9)

ARM PROCESSOR : Design philosophy - Processor fundamentals - Barrel shifter - Memory organization - Instruction set - Pipelined architecture - Instruction level parallelism - Writing and optimizing assembly code – Embedded C programming - Peripheral programming - Exception and interrupt handling. (9)

CASE STUDIES : Smart card based patient identity management systems - Patient monitoring system – Digital endoscopy camera - Heart beat monitoring system. (9)

Total L: 45

TEXT BOOKS:

- 1.James K. Peckol , "Embedded Systems: A contemporary Design Tool", Wiley-Blackwell, 2019.
- 2.Shibu Kizhakke Vallathai , "Introduction to Embedded Systems", McGraw Hill Education (I), 2018.

REFERENCES:

- 1.Steve Heath , "Embedded Systems Design", Elsevier India P Ltd, New Delhi, 2016.
- 2.Richard Zurawski , "Embedded Systems Handbook: Embedded Systems Design and Verification", CRC Press, Boca Raton, 2014.
- 3.Frank Vahid, Tony Givargis , "Embedded System Design: A Unified Hardware/Software Introduction", Wiley India Pvt Ltd, New Delhi, 2018.
- 4.Andrew N. Sloss, Dominic Symes, Chris Wright , "ARM System Developers Guide: Design and Optimizing system software", Elsevier, New Delhi, 2017.

19D006 ADVANCED MEDICAL EQUIPMENTS

3 0 0 3

FLEXIBLE AND STRETCHABLE MEDICAL DEVICES: History - Carbon Nanotube Based Flexible and Stretchable Electronics: Introduction - Carbon Nanotube networks: Applications in Flexible Electronics, Applications in Stretchable Electronics - Digital Printing. (9)

SURGICAL AND IMAGE-GUIDED TECHNOLOGIES : Instrumentation for Laparoscopic Surgery: Introduction , Basic Principles , Laparoscopic Instrumentation , Trocars - Surgical Instruments in Ophthalmology: Introduction , Cataract Surgery , Principles of Phacoemulsification , Phacoemulsification Instruments , Phacoemulsification Systems , Vitreoretinal Surgery , Principles of Vitrectomy , Vitrectomy Instruments , Vitrectomy Systems - Image Guided Surgery. (9)

SURGICAL ROBOTICS : Introduction - Human-Machine Interfaces: System Approach - Tissue Biomechanics - Teleoperation - Image-Guided Surgery - Commercial Systems: CyberKnife ,daVinci , Sensei X. (9)

IMAGING AND IMAGE-GUIDED TECHNIQUES: Endoscopy: Principles of Modern Endoscopy, Advances in Flexible Endoscope Design - Medical Ultrasound Devices: Intravascular and Intracardiac Applications, Surgical Applications, Ophthalmic Ultrasound. (9)

NEUROSURGERY: Instrumentation in Neurosurgery - Functional Neurosurgery - Neuroimaging for Neurosurgery - Implementation of Neuronavigation: Surgical Planning, Patient Registration, Navigation - Augmented Reality and Virtual Reality. (9)

Total L: 45

TEXT BOOKS:

- 1.Kuniharu Takei , "Flexible and Stretchable Medical Devices", John Wiley & Sons, Germany, 2018..
- 2.Alexandra J. Golby , "Image-Guided Neurosurgery", Elsevier, London, 2015.

REFERENCES:

1. Martin Culjat, Rahul Singh, Hua Lee , "Medical Devices: Surgical and Image-Guided Technologies", John Wiley & Sons, New Jersey, 2013.
2. Joseph J Carr, John M Brown , "Introduction to Biomedical Equipment Technology", Pearson Education, New Delhi, 2013.
3. John G Webster , "Medical Instrumentation Application and Design", John Wiley & Sons, New Delhi, 2015.
4. Leslie Cromwell , "Biomedical Instrumentation and Measurement", Prentice hall of India, New Delhi, 2015.

19D007 HOSPITAL SYSTEMS MANAGEMENT**3 0 0 3**

HOSPITAL ADMINISTRATION: Role of hospitals: Classifications, Primary health care, Medical staff and hospital organization – Health system performance -Health and national economy - Distinction between hospital and industry - Challenges in hospital administration : Hospital planning, Equipment planning, Functional planning. (9)

ORGANISATIONAL BEHAVIOUR : Concept and definition of organization - Management of human resources in health care environment - Principles and methods of work: Employee recruitment, Selection, Retention, Training, Evaluation, Wage and salary administration ,Communication - Psychology and human relationship in hospital -Roles and responsibilities of district - Medical and health officer. (9)

MANAGEMENT FUNCTIONS: Operations - Finance and cost - Human resource - Materials - Biomedical waste - Current issues in hospital management - Case studies. (6)

SUPPORT SYSTEMS : Clinical services: Clinical lab services, Radiology and imaging services - Information services: Management decisions and related information requirements, - Medical information services - Administrative services: Medical records ,Central sterilization and supply , Pharmacy, Food and laundry services. (9)

QUALITY AND SAFETY ASPECTS : Quality system : Elements, Implementation, Documentation, Quality auditing - International standards : ISO and its features : ISO 9001 , ISO 9004, ISO 14000 - Quality control :Six sigma, NABH and levels ,NABA,JCI,NABL - Security: Loss, Prevention, Fire safety, Alarm system, Hazard and safety rules in a hospital - Health insurance - Health policy - Hospital laws: Doctor and consumer protection act, Act related to manufacture and sale of drugs.(12)

Total L: 45**TEXT BOOKS:**

1. Sharma D. K, Goyal R.C , "Hospital Administration and Human Resource Management", Prentice Hall of India Pvt Ltd, New Delhi, 2013..
2. Ramani K.V , "Hospital Administration -Text and Cases", Pearson Education, New Delhi, 2013.

REFERENCES:

1. Goyal R.C , "Handbook of Hospital Personal Management", Prentice Hall of India Pvt Ltd, New Delhi, 2005.
2. Kunders G.D , "Hospitals – Facilities Planning and Management", Tata Mc-Graw Hill Publishers, New Delhi, 2008.
3. Goel S.L , "Hospital Administration and Management: Theory and Practice", Deep and Deep Publications, Chennai,2007.
4. Malhotra A.K , "Hospital Management - An Evaluation", Global India Publications, New Delhi, 2009.

19D008 ENGINEERING OF NANOMATERIALS**3 0 0 3**

NANO SCALE MATERIALS : Introduction - Classification of nanostructures - Nanoscale architecture - Effects of the nanometer length scale - Changes to the system total energy - Changes to the system structures - Effect of nanoscale dimensions on various properties: Structural, Thermal, Chemical, Mechanical, Magnetic, Optical and Electronic properties. (9)

NANOMATERIALS SYNTHESIS METHODS : Fabrication methods - Top-down processes: Milling, Lithography and Machining process - Bottom-up process: Vapour phase deposition methods, Plasma-assisted deposition process, Colloidal and sol-gel methods - Methods for templating the growth of nanomaterials - Ordering of nanosystems - Self-assembly and Self-organization. (9)

NANO CHARACTERIZATION TECHNIQUES: General classification of characterization methods - Analytical and imaging techniques - Microscopy techniques: Electron microscopy, Scanning electron microscopy, Transmission electron microscopy, Atomic force microscopy - Diffraction techniques - Spectroscopy techniques: X-ray spectroscopy. (9)

INORGANIC SEMICONDUCTOR NANOSTRUCTURES : Quantum confinement in semiconductor nanostructures - Quantum wells - Quantum wires - Quantum dots - Super lattices - Fabrication techniques - Epitaxial growth - Electrostatically induced dots and wires - Quantum well width fluctuations - Thermally annealed quantum wells. (9)

NANO DEVICES AND APPLICATIONS : Organic FET: Principle, Description, Requirements, Integrated circuits - Organic LED's: Basic processes, Carrier injection, Excitons, Optimization - Organic photovoltaic cells - Carbon nanotubes: Structure, Synthesis, Electronic properties, Applications - Fuel cells - Nanorobots - Nanoparticles for Medical Imaging and Drug Delivery. (9)

Total L: 45

TEXT BOOKS:

1. Dinesh C Agrawal , "Introduction to Nanoscience and Nanomaterials", World Scientific Publishing Company, Singapore, 2013.
2. Pradeep T , "NANO: The Essentials: Understanding Nanoscience and Nanotechnology", McGraw Hill Education, Bengaluru, 2017.

REFERENCES:

1. Michael Kohler, Wolfgang Fritzsche , "Nanotechnology: An Introduction to Nanostructuring Techniques", Wiley- VCH, Weinheim, 2017.
2. William Goddard, Donald W Brenner , "Handbook of Nano Science Engineering and Technology", CRC Press, Boca Raton, 3. 2014.
4. B Wang , "Drug Delivery: Principles and Applications", Wiley Interscience, New Jersey, 2005.
5. Robert W Kelsall, Ian W Hamley, Mark Geoghegan , "Nanoscale Science and Technology", John Wiley and Sons, West Sussex, 2005.

19D009 DRUG DELIVERY SYSTEMS

3 0 0 3

PHARMACOKINETICS AND DYNAMICS : Introduction: Bioavailability, Drug absorption, Pharmacokinetic and Pharmacodynamic processes, Timing for optimal therapy - Terminology of drug delivery and targeting - Routes of administration, Strategies to increase drug absorption - Prodrugs: Bioconjugation , Rate controlled release, Sustained and Controlled delivery of prodrugs. (9)

POLYMERS AS DRUG CARRIERS : Polymers for controlled release, Osmotic pumps, Pulsatile drug delivery systems - Drug polymer conjugates, Gels and Hydrogels, Nano and Microparticles - Synthetic hydrogels, Nano and Microcapsules - Polymers used in the formulation of nano and microspheres - Smart Polymers, pH and Temperature sensitive hydrogels, Capsosomes and Dendrimers. (9)

TARGETED DRUG DELIVERY : Transdermal - Nasal - Pulmonary - Vaginal - Ophthalmic - Targeting to Central Nervous system - Cell and Gene delivery: Delivery of Vaccines. (8)

NANOPARTICLES FOR CANCER THERAPY : Cancer Markers, Folate receptors, Targeting through angiogenesis - Tumour specific targeting, Combination therapy, Neutron capture therapy - Targeting tumour vasculature for imaging - Delivery of specific anticancer agents: Paclitaxel, Doxorubicin, Fluorouracil. (9)

NANOMEDICINE : Properties of nanocarriers - Drug delivery systems used in nanomedicine - Nanoparticles targeting, Theranostic Nanoshells, Nanoporous microsystems for islet cell replacement - Transdermal drug delivery using low frequency sonophoresis - Nanoporous implants for controlled drug delivery – Enhanced Permeability and Retention effect - Health and environmental impacts of Nanotechnology. (10)

Total L: 45

TEXT BOOKS:

1. Raphael M Ottenbrite, Sung Wan Kim , "Polymeric Drugs and Drug Delivery Systems", CRC Press, London, 2019.
2. Chandra P Sharma , "Drug Delivery Nanosystems for Biomedical Applications", Elsevier, Netherlands, 2018.

REFERENCES:

1. Rakesh K. Tekade , "Basic Fundamentals of Drug Delivery", Academic Press, Oxford, 2018.
2. Anya M Hillery, Kinam Park , "Drug Delivery: Fundamentals and Applications", CRC Press, Florida, 2016.
3. Challa S. S. R. Kumar , "Polymeric Nanomaterials", Wiley, Germany, 2011.
4. Sabyasachi Maiti, Kalyan Kumar Sen , "Bio-Targets and Drug Delivery Approaches", CRC Press, Newyork, 2016.

19D010 BIOANALYTICAL TECHNIQUES AND CHARACTERIZATION

3 0 0 3

CENTRIFUGATION AND ELECTROPHORETIC TECHNIQUES : Biomolecules: Amino acids, Peptides , Proteins and Nucleic acids - Quantitative Biochemical Measurements, Modern approaches in Bioanalysis and Bioassays, Centrifugation - Electrophoresis: Principle, Paper electrophoresis , Gel electrophoresis , Electrophoresis of proteins , Electrophoresis of nucleic acids , Capillary electrophoresis. (12)

CHROMATOGRAPHIC TECHNIQUES : Principle, Chromatographic performance parameters - Types: HPLC, Adsorption, Partition, Ion-exchange, Size exclusion, Affinity and Gas chromatography. (8)

MICROSCOPIC TECHNIQUES : Light microscope - Fluorescence microscope - Electron microscope - Application of microscope in analyzing biological samples - Imaging live cells and tissues - Measuring cellular dynamics. (8)

SPECTROSCOPIC TECHNIQUES I : UV-Vis spectroscopy - Fluorescence spectroscopy - Luminometry – Circular Dichroism spectroscopy - Light scattering - Atomic spectroscopy. (9)

SPECTROSCOPIC TECHNIQUES II : Infrared and Raman spectroscopy - Surface Plasmon spectroscopy - X-ray diffraction spectroscopy - Mass spectroscopy. (8)

Total L: 45

TEXT BOOKS:

1. Andreas Hofmann, Samuel Clokie , "Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology", Cambridge University Press, New York, 2018.
2. Victor A. Gault, Neville H. McClenaghan , "Understanding Bioanalytical Chemistry: Principles and Applications", John Wiley & Sons, Oxford, 2013.

REFERENCES:

1. Friedrich Lottspeich, Joachim W. Engels , "Bioanalytics: Analytical Methods and Concepts in Biochemistry and Molecular Biology", John Wiley & Sons, Germany, 2018.
2. Wilson K, Walker J , "Principles and Techniques of Biochemistry and Molecular Biology", Cambridge University Press, New York, 2010.
3. Shourie A , "Bioanalytical Techniques", The Energy and Resources Institute (TERI), New Delhi, 2005.
4. Manz A, Pamme N, Lossifidis D , "Bioanalytical Chemistry", World Scientific Publishing Company, Singapore, 2004.

19D011 CELL BIOLOGY AND TISSUE ENGINEERING

3 0 0 3

PRINCIPLES OF CELL BIOLOGY : General organizations of cell - Structure and transport across cell membrane - Membrane potential - Receptors - Cytoskeleton - Cell motility - Cell surface and cell adhesions - Organization of cell nucleus. (9)

INTRODUCTION TO TISSUE ENGINEERING : History and scope of tissue engineering - Dynamics of cell - Extra Cellular Matrix (ECM) interaction - Matrix molecules and their ligands - Principles of tissue culture and Bioreactor design. (9)

STEM CELLS AND GENE THERAPY : Embryonic stem cells - Liver stem cells - Adult epithelial tissue stem cells - Mesenchymal stem cells - Strategies of gene therapy - Ex vivo versus in vivo gene therapy - Gene transfer vector - Cell specific targeting strategies - Combining gene transfer with stem cell strategies. (9)

ENGINEERING METHODS AND DESIGN : Soft lithography - Self assembled monolayer - Micro contact printing - Micro fluidic patterning - Laminar flow patterning - Cell interaction with Polymer scaffolds and gels - Polymer scaffolds fabrications: Electrospinning, Freeze drying, Solvent casting and Particulate leaching, Microfabrication of cell seeded scaffolds. (9)

ORGAN ENGINEERING : Corneal tissue replacement - Cell source for lung repair - Lung tissue engineering -Bioengineering of human skin substitutes - Engineering pancreatic beta cells - Bioartificial liver – Tissue engineering approach to renal function replacement - Regulations and ethics. (9)

Total L: 45

TEXT BOOKS:

1. Robert P Ianza, Robert Langer, Joseph Vacanti , "Principles of Tissue Engineering", Academic Press, California, 2013.
2. Cecie Starr, Ralph Taggart , "Cell Biology and Genetics", Brooks Cole Publishers, California, 2009.

REFERENCES:

1. John P Fisher, Antonios G Mikos, Joseph D Bronzino , "Tissue Engineering", CRC press, Boca Raton, 2007.
2. Bruce Alberts , "Molecular Biology of the Cell", Garland Science Publications, New York, 2008.
3. Bernhard O Palsson, Sangeeta N. Bhatia , "Tissue Engineering", Dorling Kindersley (India) Private limited, Uttar Pradesh, 2009.
4. Yoshito Ikada , "Tissue Engineering: Fundamentals and Applications", Elsevier, Oxford, 2006.

19D012 MODELING OF PHYSIOLOGICAL SYSTEMS

3 0 0 3

INTRODUCTION TO PHYSIOLOGICAL MODELING : Physiological processes & principles of their control, Control mechanism, Blood flow, Gas exchange, Ultra-filtration, Biochemical reactions, Pneumatic transport, Digestion, Energy utilization and waste disposal, Linear and Non-linear control systems, Principles of open loop & feedback systems, Techniques for system response characterization. (8)

PRINCIPLES OF MODELING : Mathematical approach, Electrical analogues, Introduction to process controls of Cardiac rate, Blood pressure, Respiratory rate, Blood-glucose regulation, Electrical model of neural control mechanism. (9)

MODELING OF HUMAN THERMAL REGULATORY SYSTEM : Parameters involved, Control system model, Biochemistry of digestion, Types of heat loss from body, Models of heat transfer between subsystems of human body, Systems within body-environment. (8)

RESPIRATORY AND ULTRA FILTRATION SYSTEM : Modeling of oxygen uptake by RBC and pulmonary capillaries, Mass balancing by lungs, Gas transport mechanisms of lungs, Oxygen and carbondioxide transport in blood and tissues, Transport

through cells and tubules, Diffusion, Facilitated diffusion and active transports, Methods of waste removal, Counter current model of urine formation in nephron, Modeling Henle's loop. (11)

MODELING BODY DYNAMICS : Mechanical properties of bones, Tissues, Modeling of bones, Stress propagation in bones, Hills model of muscle mechanism, Current trends in computer aided modeling. (9)

Total L: 45

TEXT BOOKS:

1. Michal CK Khoo , "Physiological Control Systems: Analysis Simulation and Estimation", Wiley-IEEE Press, New York, 2018.
2. Ewart Carson, Claudio Cobelli , "Modelling Methodology for Physiology and Medicine", Elsevier insights, New York, 2014.

REFERENCES:

1. John Enderle, Susan Blanchard, Joseph Bronzino , "Introduction to Biomedical Engineering", Academic Press, New York, 2012.
2. Michael Chappell, Stephen Payne , "Physiology for Engineers: Applying Engineering Methods to Physiological Systems", Springer, New York, 2016.
3. Sherwood L , "Human Physiology: From Cells to Systems", Thomson Learning, Singapore, 2015.
4. Willem van Meurs , "Modeling and Simulation in Biomedical Engineering", McGraw-Hill Education, New Delhi, 2011.

19D013 COMPUTATIONAL BIOLOGY AND BIOINFORMATICS

3 0 0 3

INTRODUCTION : Introduction to Operating Systems - Linux commands - File Transfer Protocols: FTP and Telnet - Introduction to Bioinformatics and Computational Biology - Biological Sequences - Biological Databases - Genome Specific Databases - Data File Formats - Data Life Cycle - Database Management System Models - Basics of Structured Query Language (SQL) - Introduction to Proteins and Nuclei Acids: Structure, Sequencing and Matching. (9)

BIOLOGICAL SEQUENCE ANALYSIS : - Sequence Analysis - Pairwise Alignment - Dynamic Programming Algorithms for computing Edit Distance - String Similarity - Shotgun DNA Sequencing - End Space Free Alignment Multiple Sequence Alignment - Algorithms for Multiple Sequence Alignment - Generating Motifs and Profiles - Local and Global Alignment - Needleman and Wunsch Algorithm - Smith Waterman Algorithm - BLAST – PSIBLAST and PHIBLAST Algorithms. (9)

STRUCTURE PREDICTION : Introduction to Phylogenetics - Distance Based Trees - UPGMA Trees - Molecular Clock Theory - Ultrametric Trees - Parsimonious Trees - Neighbor Joining Trees - Trees Based on Morphological Traits - Bootstrapping - Prediction Methods: Protein Secondary Structure, Tertiary Structure - Homology Modeling - Abinitio Approaches - Threading - Critical Assessment of Structure Prediction - Structural Genomics. (9)

MACHINE LEARNING TECHNIQUES : Artificial Neural Networks in Protein Secondary Structure Prediction - Hidden Markov Models for Gene Finding - Decision Trees - Support Vector Machines. Introduction to Systems Biology and Synthetic Biology - Microarray Analysis - DNA Computing - Bioinformatics Approaches for Drug Discovery - Applications of Informatics Techniques in Genomics and Proteomics: Assembling the Genome - STS Content Mapping for Clone Contigs - Functional Annotation - Peptide Mass Fingerprinting. (9)

BASICS OF PERL PROGRAMMING FOR BIOINFORMATICS : Data types: Scalars and Collections - Operators - Program Control Flow Constructs - Library Functions: String Specific Functions - User Defined Functions – File Handling. (9)

Total L: 45

TEXT BOOKS:

1. Arthur Lesk , "Introduction to Bioinformatics", Oxford University Press, Oxford, 2013.
2. Gautam B. Singh , "Fundamentals of Bioinformatics and Computational Biology", Springer, New York, 2015.

REFERENCES:

1. Dan Gusfield , "Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology", Cambridge University Press, New York, 1997.
2. Richard Durbin, Sean Eddy, Anders Krogh, Graeme Mitchison , "Biological Sequence Analysis Probabilistic Models of Proteins and Nucleic Acids", Cambridge University Press, Cambridge, 2013.
3. David W. Mount , "Bioinformatics Sequence and Genome Analysis", Cold Spring Harbor Laboratory Press, New York, 2004.
4. James Tisdall , "Beginning Perl for Bioinformatics: An Introduction to Perl for Biologists", O'Reilly Media, California, 2001.

19D014 WEARABLE TECHNOLOGIES

3 0 0 3

INTRODUCTION : Attributes of wearables, Meta-wearable, Challenges and opportunities, Future of wearables - Social aspects of wearability and interaction: Social interpretation of Aesthetics - Case study: Google glass - Wearable haptics: Need for wearable haptic devices - Categories of wearable haptic and tactile display - Wearable sensorimotor enhancer. (9)

WEARABLE SENSORS : Chemical and Biochemical sensors, System design, Challenges in chemical biochemical sensing, Application areas - Inertia sensors, Parameters from inertia sensors - Applications for wearable motion sensors -

Measurement of energy expenditure by body worn heat flow sensors. (9)

FLEXIBLE ELECTRONICS : Introduction, Thin-film transistors: Materials and Technologies, Review of semiconductors in flexible electronics - Low-power Integrated Circuit Design for biopotential sensing: Analog circuit design techniques - Low-power design for ADCs - Digital circuit design techniques - Architectural design for low-power biopotential acquisition, Practical considerations. (9)

ENERGY HARVESTING SYSTEMS : Energy harvesting from human body: Temperature gradient, Foot motion - Wireless energy transmission - Energy harvesting from light and RF energy - Energy and power consumption issues, Future considerations. (9)

MONITORING PHYSICAL AND PHYSIOLOGICAL PARAMETERS : Wearable sensors for physiological signal measurement - Physical measurement: Cardiovascular diseases, Neurological diseases, Gastrointestinal diseases - Wearable and non-invasive assistive technologies: Assistive devices for individuals with severe paralysis, Wearable tongue drive system, Sensor signal-processing algorithm, Dual-mode tongue drive system. (9)

Total L: 45

TEXT BOOKS:

1. Edward Sazonov, Michael R Neuman , "Wearable Sensors: Fundamentals, Implementation and Applications", Academic Press, USA, 2014.
2. Tom Bruno , "Wearable Technology: Smart Watches to Google Glass for Libraries", Rowman & Littlefield Publishers, Lanham, Maryland, 2015.

REFERENCES:

1. Raymond Tong , "Wearable Technology in Medicine and Health Care", Academic Press, USA, 2018.
2. Haider Raad , "The Wearable Technology Handbook", United Scholars Publication, USA, 2017.
3. Annalisa Bonfiglio, Danilo De Rossi , "Wearable Monitoring Systems", Springer Science & Business Media, USA, 2011.
4. Röcker, Carsten , "Smart Healthcare Applications and Services: Developments and Practices: Developments and Practices", IGI Global, USA, 2010.

19D015 TELEMEDICINE AND HEALTHCARE DELIVERY

3 0 0 3

TELEMEDICINE : Biomedical telemetry - Benefits - Types of telemedicine services - Delivery mechanisms - Challenges in implementing telemedicine - Telemedicine standards and guidelines - Telemedicine System: Process in telemedicine, Parameters, Trends, Delivery modes in telemedicine - Setting up a telemedicine facility. (9)

TECHNOLOGIES : Transmission of data: Audio, Still images, Video - Telemedicine workstation and interfacing techniques - Telecommunication technologies for telemedicine - Networking in telemedicine – Wireless technologies for telemedicine. (9)

APPLICATIONS AND ISSUES : Teleradiology - PACS - Telepathology - Teledermatology - Teleophthalmology - Telecardiology - Telesurgery - Teleoncology - Teleneurology - Teleaudiology - Telepsychiatry - Telerehabilitation - Issues in telemedicine systems: Ethical, Privacy, Security, Legal issues. (9)

MOBILE HEALTHCARE : Key technologies for mHealth - Wireless connectivity in mHealth - Ubiquitous healthcare - WBAN - WPAN - WS N - mHealth in intensive care monitoring - Mobile telemedicine - Telehome care and telehealth: Categories, Technologies, Requirements - Chronic disease management - mHealth Apps and challenges - Personal health monitors. (9)

EHEALTH AND CYBER MEDICINE : Internet and telemedicine - Cyber medicine and telemedicine - Future developments in cyber medicine - Multimedia data exchange - Multipoint video conferencing - Standards and other audio/video interactive system. (9)

Total L: 45

TEXT BOOKS:

1. Khandpur R S , "Telemedicine: Technology and Applications (mHealth, TeleHealth and eHealth)", PHI Learning, New Delhi, 2017.
2. Karen A. Wager, Frances W. Lee, John P. Glaser , "Health Care Information Systems: A Practical Approach for Health Care Management", Jossey-Bass, San Francisco, CA, 2017.

REFERENCES:

1. Victor Lyuboslavsky , "Telemedicine and Telehealth 2.0: A Practical Guide for Medical Providers and Patients", CreateSpace Independent Publishing, USA, 2015.
2. Brown Mary , "Introduction to Healthcare Delivery", Kendall Hunt Publishing, USA, 2012.
3. Norris A C , "Essentials of Telemedicine and Telecare", John Wiley & Sons, England, 2008.
4. Bernard Fong, Fong A C M, Li C K , "Telemedicine Technologies: Information Technologies in Medicine and Telehealth", John Wiley & Sons, United Kingdom, 2011.

19D016 MOBILE APPLICATION DEVELOPMENT

3 0 0 3

INTRODUCTION : Mobile devices and desktop devices - Mobile Architecture and Design guidelines - Power Management - Screen resolution - Touch interfaces - Review of java programming. (9)

MOBILE OS FUNDAMENTALS : Basic Building blocks: Activities, Fragments, Services, Broadcast Receivers & Content provider - UI Components: Views & notifications - Components for communication: Intents & Intent Filters - Activity life cycle - Dalvik Virtual machines - Android Architecture Native vs. web applications - Introduction to Android SDK IDE - hello world programming. (9)

APPLICATION DESIGN : User-interface design for mobile applications - Creating activity - Working with views - Notifications and alarms - Graphics and animations - Storing and retrieving data. (9)

SENSOR INTERFACING : Augmented Reality via GPS - Bluetooth - Accelerometer - Gyroscopes and Camera - Integrating with cloud services - Integration of network, OS and hardware into mobile applications - Case study. (9)

APPLICATION DEVELOPMENT MANAGEMENT : Addressing enterprise requirements in mobile applications: performance, scalability, modifiability, availability and security - Mobile malware, Device protections - Android rooting - Testing methodologies for mobile applications - Publishing - Deployment - Maintenance and management. (9)

Total L: 45

TEXT BOOKS:

1. Reto Meier, Ian Lake, "Professional Android", John Wiley & Sons, California, 2018.
2. Meikang Qiu, Wenyun Dai, Keke Gai, "Mobile Applications Development with Android: Technologies and Algorithms", CRC Press, Florida, 2016.

REFERENCES:

1. G. Blake Meike, Zigurd Mednieks, Masumi Nakamura, Laird Dornin, "Programming Android", O'Reilly, California, 2012.
2. Brain Fling, "Mobile Design and Development: Practical concepts and techniques for creating mobile sites and web app", O'Reilly, California, 2009.
3. Valentino Lee, Heather Schneider, Robbie Schell, "Mobile Applications: Architecture, Design, and Development", Pearson Education, London, 2009.
4. W. Frank Ableson, Robi Sen, Chris King, C. Enrique Ortiz, "Android in Action", Manning Publications, New York, 2012.

19D017 MEDICAL ROBOTICS

3 0 0 3

INTRODUCTION : Robots and Robotics - Classification of robots - Robot components - Degrees of freedom - Robot joints - Coordinates and frames - Robot characteristics - Workspace and Programming languages – Robot applications. (6)

KINEMATICS AND DYNAMICS OF ROBOTS : Introduction: Robot mechanism, Conventions, Representations, Transformations - Forward and Inverse Kinematics: Denavit-Hartenberg Convention, Differential relationship, Jacobian, Differential motions of a frame, Lagrangian mechanics - Dynamic equations of multiple DOF robots - Static force analysis of robots. (11)

TRAJECTORY AND PATH PLANNING OF ROBOTS : Introduction: Path Vs Trajectory, Joint space Vs Cartesian Trajectories - Joint space trajectory planning - Cartesian space trajectories - Geometric problems with cartesian paths - Path generation at run time - Planning paths when using the dynamic model - Collision - Free path planning. (11)

MOTION TRACKING AND PREDICTION : Motion correlation - Regression and normal equations - Support vectors Least mean square prediction - Wavelet based LMS Prediction - Performance measures. (7)

APPLICATIONS OF ROBOTICS : Robot assisted laparoscopic surgery - Image Guided Robotic Systems for Surgical Applications - Da Vinci Surgical Robotic System - Motion Tracking for Minimally Invasive Robotic Surgery - Telerobotic Surgery - Assistive Robotics for Long Bone Fracture Reduction - Rehabilitation for limbs robots - Neuroprosthetics robots. (10)

Total L: 45

TEXT BOOKS:

1. John J. Craig, "Introduction to Robotics: Mechanics and Control", Prentice Hall of India, New Delhi, 2018.
2. Achim Schweikard, Floris Ernst, "Medical Robotics", Springer, New York, 2015.

REFERENCES:

1. Jocelyne Troccaz, "Medical Robotics", Wiley-ISTE, USA, 2013.
2. Saeed B Niku, "Introduction To Robotics: Analysis, Systems, Applications", Pearson Education, New Delhi, 2010.
3. Daniel R. Faust, "Medical Robots", The Rosen Publishing Group, New York, 2017.
4. Bruno Siciliano, Lorenzo Sciacivco, Luigi Villani, "Robotics: Modelling, Planning and Control", Springer-Verlag, New York, 2011.

19D018 REHABILITATION ENGINEERING

3 0 0 3

INTRODUCTION : Rehabilitation concepts - Engineering concepts: Sensory rehabilitation , Motor rehabilitation, Communication disorders - Examples of rehabilitation engineering. (6)

WHEEL CHAIR ENGINEERING : Categories of wheel chairs - Wheel chair structure and component design - Ergonomics of wheel chair propulsion - Power wheel chair electrical system - Personal transportation - Wheelchair : Standards, Transportation safety. (9)

SENSORY REHABILITATION : Sensory augmentation and substitution: Visual system , Auditory system, Tactual system - Aids for vision and hearing impaired - Automatic speech synthesis and voice recognition – Audiometry and speech therapy aids. (9)

MOTOR REHABILITATION : Orthopedic prosthetics and orthotics in rehabilitation: Fundamentals, Applications - Computer Aided Engineering(CAD) in customized component design - Examples of innovative component design: Intelligent prosthetic knee , Hierarchically controlled prosthetic hand ,Self aligning orthotic knee joint - Externally powered and controlled orthotics and prosthetics: FES systems: Restoration of hand function, Restoration of standing and walking , Hybrid Assistive Systems (HAS) - Active prostheses: Active above knee prosthesis, Myoelectric hand and arm prostheses, MARCUS intelligent hand prosthesis. (12)

COMPUTER APPLICATIONS IN REHABILITATION : Augmentative and Alternative Communication (AAC): Acceleration techniques , User interface , Outputs ,Intervention and training - Computer and web access - Performance measurement - Cost - effectiveness of high vs low technology approaches - Environmental control systems and access to computers - Robotic manipulation aids. (9)

Total L: 45

TEXT BOOKS:

1. Joseph D. Bronzino , "Biomedical Engineering Handbook: Volume II", CRC Press, New York, 2013.
2. Rory A. Cooper , "An Introduction to Rehabilitation Engineering", Taylor and Francis, New York, 2006.

REFERENCES:

1. Randall L. Braddom , "Handbook of Physical Medicine and Rehabilitation", W.B. Saunders Publications, Pennsylvania, 2006.
2. Horia-Nicolai L.T, Lakhmi C.J , "Intelligent Systems and Technologies in Rehabilitation Engineering", CRC Press, New York, 2001.
3. Tan Y. Kheng , "Rehabilitation Engineering", In-Teh, Croatia, 2009.
4. Alex Mihalidis , ""Rehabilitation Engineering Principles and Practice Synopsis"", CRC Press, New York, 2019.

19D019 OCCUPATIONAL BIOMECHANICS AND ERGONOMICS

3 0 0 3

INTRODUCTION TO ERGONOMICS : Definition of occupational biomechanics - Ergonomic design - Principles of human centered design - Models of human performance: Helson's hypothesis - Trends in industry that impact ergonomic design - Methods of ergonomic analysis. (9)

HUMAN SYSTEM AND DESIGN TO FIT : Anthropometry - Body movement - Sensory subsystem – Support subsystem - Ergonomic design principles - Analysis of task and jobs. (9)

ASSESSMENT AND DESIGN OF PHYSICAL ENVIRONMENT : Cleanliness - Clutter and disorder - Temperature and humidity - Lighting and illumination: Luminous environment and measurement, Lighting methods, Principles of lighting design - Noise: Health effect on noise, Annoyance and other effect of noise, Noise control strategies, Hearing protection. (9)

DESIGN OF TOOLS AND EQUIPMENTS : Design of seating - Hands and handedness - Techniques for determining hand tool adequacy - Power tools - Point of operation hazards - Protective equipment for the operator Accommodation strategy for handicapped people. (9)

ERGONOMICS OF PRODUCT QUALITY AND USABILITY : Quality management and customer driven design: Identifying customer requirement, Specifying design requirement, Prototyping and testing - Usability analysis and testing: Task analysis method, Expert evaluation - Experiments involving humans: Independent variables, Dependent variables, Basic experimental designs. (9)

Total L: 45

TEXT BOOKS:

1. Mark R Letho, James R Buck , "Introduction to Human Factors and Ergonomics for Engineers", CRC press, New York, 2012.
2. Gavriel Salvendy , "Handbook of Human Factors and Ergonomics", John Wiley and Sons, New Jersey, 2012.

REFERENCES:

1. Shrawan Kumar , "Biomechanics in Ergonomics", Taylor and Francis, London, 2001.
2. Martin Helander , "A Guide to the Ergonomics of Manufacturing", Taylor and Francis, London, 2001.

3. Neville Morray , "Ergonomics: Physiological Mechanisms and Models in Ergonomics", Taylor and Francis, London, 2005.
4. Christopher M Schlick , "Industrial Engineering and Ergonomics", Springer, Germany, 2009.

19D020 PATTERN RECOGNITION AND NEURAL NETWORKS

3 0 0 3

INTRODUCTION : Classification: Classification Process - Features - Training and Learning - Supervised Learning and Algorithm Selection - Approaches to Classification- Applications. (7)

PARAMETRIC & NON PARAMETRIC LEARNING : Parametric Learning: Bayesian Decision Theory, Discriminant Functions and Decision Boundaries - Nonparametric Learning: Parzen Window, k-Nearest Neighbor (kNN) Classification. (10)

FEATURE EXTRACTION AND SELECTION : Reducing Dimensionality: Pre-processing - Feature Selection: Inter/ Intra-class Distance - Subset Selection - Feature Extraction - Principal Component Analysis - Independent Component Analysis - Linear Discriminant Analysis - Genetic Algorithm. (10)

NEURAL NETWORKS : Introduction: Difference between biological and artificial neural networks, Architecture, Activation functions - Single layer perceptron - Multilayer perceptron - Back propagation algorithm - Hopfield's network - Kohonen's self organizing maps - Adaptive resonance theory. (10)

NEURAL NETS FOR PATTERN CLASSIFICATION : Architecture: Biases and threshold - Linear Separability - Data Representation - Hebb Net: Algorithm - Applications, Perceptron: Architecture - Algorithm - Applications, Adaline: Architecture - Algorithm - Applications, Madaline - Neural Network Optimization using Genetic Algorithm. (8)

Total L: 45

TEXT BOOKS:

1. Geoff Dougherty , "Pattern Recognition and Classification: An Introduction", Springer, USA, 2017.
2. Laurene V. Fausett , "Fundamental of Neural Networks, Architectures, Algorithms and Applications", Pearson Education, New Delhi, 2011.

REFERENCES:

1. Richard O. Duda, P.E. Hart, D.G Stork , "Pattern Classification", John Wiley & Sons Inc, New Delhi, 2012.
2. Rajasekaran S, Vijayalakshmi Pai G A , "Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis and Applications", PHI Learning Pvt. Ltd, New Delhi, 2014.
3. Christopher M. Bishop , "Pattern Recognition and Machine Learning", Springer, USA, 2013.
4. Narasimha Murty M, Susheela Devi V , "Pattern Recognition: An Algorithmic Approach", University Press, New Delhi, 2011.

19D021 ADVANCED DIGITAL SIGNAL PROCESSING

3 0 0 3

MULTIRATE SIGNAL PROCESSING : Representation of discrete signals - Down sampling - Up sampling - Noble identities - Cascading sampling rate convertors - Decimation with transversal filters - Interpolation with transversal filters - Decimation with polyphase filters - Interpolation with polyphase filters - Decimation and Interpolation with rational sampling factors -Multistage implementation of sampling rate convertors. (12)

FILTER BANKS : Two channel filter banks - QMF filter banks - Perfect Reconstruction Filter banks - Filter banks with tree structure and parallel structure - DFT filter Banks. (9)

MULTI RESOLUTION ANALYSIS : Definition - Construction of general orthonormal MRA - Wavelet basis: Harr-properties-Scalogram - Application of wavelets in denoising. (8)

POWER SPECTRUM ESTIMATION : Parametric methods :Auto Regressive (AR) spectrum estimation - Relationship between auto correlation and model parameters - Moving Average (MA) and Auto Regressive Moving Average (ARMA) spectrum estimation. - Time Series Analysis. (8)

ADAPTIVE FILTERS : Introduction - FIR adaptive filters: Steepest descent adaptive filter - The LMS algorithm - Convergence of LMS algorithm - Adaptive recursive filters - The RLS algorithm - Adaptive Interference Cancellation. (8)

Total L: 45

TEXT BOOKS:

1. Vikram Gadre, Aditya Abhyankar , "Multiresolution and Multirate Signal Processing: Introduction, Principles and Applications", McGraw Hill Education, India, Chennai, 2017.
2. Alan V. Oppenheim and Ronald W. Schaffer , "Digital Signal Processing", Pearson Education, Harlow, 2014.

REFERENCES:

1. Jose Luis Rojo-Alvarez, Manel Martinez-Ramon, "Digital Signal Processing with Kernel Methods", Wiley&Sons, New York, 2018.
2. Proakis J G and Manolakis D G , "Digital Signal Processing Principles, Algorithms and Applications", Pearson Education Ltd,

- London, 2014.
- Benesty J, Huang Y , "Adaptive Signal Processing: Applications to Real-world Problems", Springer, London, 2011.
 - S G Mallat , "A wavelet tour of signal processing : the Sparse way", Academic Press, Boston, 2009.

19D022 DATABASE MANAGEMENT SYSTEMS

3 0 0 3

INTRODUCTION AND CONCEPTUAL MODELING : Databases and database users - Database system concepts and architecture - Data modeling using entity relationship model - Enhanced entity relationship model. (9)

RELATIONAL MODEL AND DATABASE DESIGN : Relational data model - Database design by Entity Relationship diagrams (ER) and Enhanced ER to relational mapping - SQL - Functional dependencies - Axioms - Normal Forms: First normal form, Second normal form, Third normal form, Boyce Codd normal form - Multi-valued dependency - Join dependency. (9)

DATA STORAGE AND INDEXING : Introduction - Record storage - Primary file organization - Index structures for files: Single level Indexing - Multilevel Indexing. (9)

BIOINFORMATIC DATABASES : Sequence databases - Phylogenetic databases - Structure and pathway - Microarray and boutique databases. (9)

BIOLOGICAL DATA INTEGRATION : Data cleaning - Case study in biological data cleaning - General data integration - Biological data integration. (9)

Total L: 45

TEXT BOOKS:

- Ramez Elmasri and Shamkant B Navathe , "Fundamentals of Database Systems", Pearson Education, England, 2016.
- Kevin Byron, Katherine G Herbert, Jason T.L.Wang , "Bioinformatics Database Information Systems", CRC press, Boca Raton, 2017.

REFERENCES:

- Date C J, Kannan A, Swamynathan S , "An Introduction to Database Systems", Pearson Education, New Delhi, 2018.
- Raghu Ramakrishnan, Johannes Gehrke , "Database Management Systems", McGraw Hill, New Delhi, 2014.
- Abraham Silberschatz, Henry F Korth, Sudharshan S , "Database System Concepts", Tata McGraw Hill, New Delhi, 2015.
- Claudia Plant and Christian Bohm , "Database Technology for Life Sciences and Medicine", World Scientific, Singapore, 2010.

19D023 ARTIFICIAL INTELLIGENCE

3 0 0 3

INTRODUCTION : History - Difference between Machine Learning and AI - Intelligent agents - Agent based system - Structure of Agents - Problem Formulation. (8)

SEARCH STRATEGIES : Breadth-First Search - Uniform Cost Search - Depth-First Search - Depth-Limited Search Iterative Deepening Search - Bidirectional Search - Heuristic Search Techniques - A* Search - AO* Algorithm. (9)

KNOWLEDGE REPRESENTATION AND REASONING : Knowledge representation: Logics, First order logic, Inference in first order logic, Higher order logic - Reasoning with Default Information: Truth Maintenance Systems, Acting under Uncertainty, Certainty Factors and Rule Based Systems, Dempster-Shafer Theory. (9)

NATURAL LANGUAGE PROCESSING : Phases: Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing - Learning: Supervised Learning, Unsupervised learning, Reinforced learning. (9)

EXPERT SYSTEMS : Overview - Components, Knowledge-Based Expert System (KBES) - Architecture of KBES -Applications: Prospector – Mycin. (10)

Total L: 45

TEXT BOOKS:

- Stuart Russell, Peter Norvig , "Artificial Intelligence: A Modern Approach", Pearson Education, New Delhi, 2016.
- Elaine Rich, Kevin Knight , "Artificial Intelligence", Tata McGraw Hill Publishing Company, New Delhi, 2014.

REFERENCES:

- Dan W Patterson , "Introduction to AI and Expert Systems", Prentice Hall of India, New Delhi, 2010.
- David Pool, Alan Mackworth , "Artificial Intelligence: Foundations of Computational Agents", Cambridge University, New Delhi, 2011.
- Eugene Charniak, Drew McDermott , "Introduction to Artificial Intelligence", Pearson Education, New Delhi, 2010.
- C.S. Krishnamoorthy, S. Rajeev , "Artificial Intelligence and Expert Systems for Engineers", CRC Press, Florida, 2018.

19D024 ADVANCED MACHINE LEARNING

3 0 0 3

BASICS OF MACHINE LEARNING : Supervised - Unsupervised - Learning methods - Linear and Non-linear methods - Spaces - Complexity - Dimensionality - VC-dimension computation - bounds and details - PAC learning - Deep learning. (9)

PROBABILITY ESTIMATES : Generalization and Over fitting - Regularization - Validation - Maximal Likelihood and Maximum a posteriori methods - Maximum Entropy methods - Structured Support Vector Machines. (9)

DETAILED GRAPHICAL MODELS : Bayesian Networks - Hidden Markov Models - Markov Random Fields Conditional Random Fields - Generalizations of SVD - LSA - pLSA - LDA - Chinese Restaurant Analysis. (9)

TIME SERIES PROCESSING : Preprocessing - Similarity measures - Motif Discovery in Bio-signals. (8)

LEARNING TECHNIQUES : Convolution Neural Networks (CNN) - Recurrent Neural Networks (RNN) - Bagging and Boosting - Semi-supervised learning - Reinforcement learning - Transfer learning. (10)

Total L: 45

TEXT BOOKS:

- 1.Duda R. O., Hart P.E., Stork D. G. , " Pattern Classification", John Wiley & Sons, New Jersey, 2001.
- 2.Alpaydin E. , "Introduction to Machine Learning ", The MIT Press, Massachusetts, 2014.

REFERENCES:

- 1.Sutton R.S., Barto, R.G. , "Reinforcement Learning:An Introduction", The MIT Press, Massachusetts, 2012.
- 2.Bishop C. M. , "Pattern Recognition and Machine Learning", Springer Information Science and Statistics, USA, 2007.
- 3.Shawe-Taylor J. & Cristianini N. , "Kernel Methods for Pattern Analysis", Cambridge University Press, Cambridge, 2004.
- 4.Hastie, T., Tibshirani R., Friedman J. H. , "The Elements of Statistical Learning: Data Mining, Inference and Prediction", Springer, USA, 2001.

19D025 SECURITY FOR MEDICAL DEVICES

3 0 0 3

INFORMATION SECURITY FUNDAMENTALS: Overview of security principles- Threats - Attacks - Vulnerabilities-Classical cryptosystem–Symmetric key and public key cryptosystem–Data Integrity- Sources of threats- Attack vectors- Data breach – Hacking –Malware,Overview of Health IT System: Impact of Health IT Components on Patient Safety,Risk management: Factors Important to Medical Device Risk Assessment. (9)

NETWORKING AND COMMUNICATION FOR HEALTHCARE EQUIPMENT: Device Classification : Class I, II and III, Hardware and Physical Interface Security, Network Architecture, Network Security, Security at the Transport Layer: SSL and TLS Protocol, Host Intrusion detection and prevention systems,Firewalls, Security Management tools. (9)

SECURITY STANDARDS IN HEALTHCARE: Medical Device QMS ISO 13485, Risk management of medical devices ISO 14971, IEC 62304 Software development life cycle process, UL-2900-1 Cybersecurity Standard for Medical Devices, Secure Exchange of Electronic Health Records , Medical Devices Directive : In Vitro Diagnostic Medical Device and Directive Regulation (IVDR), Medical Device and Directive Regulation (MDR). (9)

SECURITY IN WIRELESS DEVICES: Wireless Implantable Devices, Security issues in Implantable Devices, Attack Model, Patient Access Pattern based defence scheme, Performance Evaluation, Wireless patient monitoring, Buildingsecure 802.11 Wireless LAN networks. (9)

SECURITY IN INTERNET OF THINGS: Cyber Security versus IoT security – IoT attacks and Countermeasures – Common IoT attack types, Attack trees, Fault trees and CPS-Attacks, Wireless reconnaissance and mapping, Security Protocol attacks, Physical security attacks, Application security attacks - Security Engineering for IoT Development. (9)

Total L : 45

TEXT BOOKS:

- 1.Axel Wirth, Christopher Gates, Jason Smith, " Medical Device Cybersecurity: A Guide for Engineers and Manufacturers", Artech House, Massachusetts, 2020.
- 2.Forouzan, Behrouz A., Debdeep Mukhopadhyay, "Cryptography and network security", McGraw-Hill Education, New Delhi, 2011.

REFERENCES:

- 1.Richard Fries, "Reliable Design of Medical Devices", CRC Press, Boca Raton, 2006.
- 2.XialiHei, Xiaojiang Du, "Security in Wireless Implantable Devices", Springer Briefs in Computer Science, Springer-Verlag, New York,2013.
- 3.Shancang Li, Li Da Xu, "Securing the Internet of Things", Elsevier,USA, 2017.
- 4.Chryssanthou Anargyros, Apostolakis Ioannis, Varlamis Iraklis (Eds.), "Certification and Security in Health-Related Web Applications: Concepts and Solutions", Medical Information Science Reference, 2010.

19D026 COMPUTER AIDED DRUG DESIGN

3 0 0 3

INTRODUCTION: Introduction to Artificial Intelligence and Chemistry-Artificial Intelligence in History-Chemistry Finding Artificial Intelligence-Synthesis Planning-Predictive Modeling of Properties. (7)

CHEMICAL TOPIC MODELING: Topic Modeling & LDA: Mathematical Framework of LDA, Advanced Topic Modeling Extensions, Topic Modeling relation to Machine learning methods, Chemical Topic Modeling: Feature representation for Chemical Topic Modeling, Creating and Interpretation of Chemical Topic Model. (10)

COMPUTATIONAL DRUG DISCOVERY: Conformal Prediction Modalities: Inductive Conformal Prediction (ICP)-Handling Imbalanced Dataset: ICP for Regression-Conformal Prediction methods for Deep Learning-Open-source Implementation of Conformal Prediction-Deep learning Case Study: Spectroscopic Analysis, Natural Language Processing. (10)

STRUCTURE-BASED PREDICTIVE MODELING: Predicting Protein-ligand Binding Affinities: Potential Based Method, Simulation Based Method, Data-Based Method- Modern Machine learning Scoring Functions: Domain Applicability, Descriptors, Models, Interpretability, Implementation & Availability. (9)

MOLECULAR DYNAMICS SIMULATION USING MACHINE LEARNING: Basics of Molecular Dynamics: Machine Learning Applications-Using Machine learning to Improve Force Fields: Multi-Variate Linear Regression, Bayesian Inference, Genetic Algorithm, Random Forest Regression- Improving Sampling in MD Simulations: General Sampling Enhancement-Learning from MD Trajectories: Application to Clustering. (9)

Total L:45

TEXT BOOKS:

1. Nathan Brown, "Artificial Intelligence in Drug Discovery", Royal Society of Chemistry, UK, 2020.
2. Adam Bohr, Kaveh Memarzadeh, "Artificial Intelligence in Healthcare", Elsevier, UK, 2020.

REFERENCES:

1. Richard B. Silverman, Mark W. Holladay, "Organic Chemistry of Drug Design and Drug Action", Academic Press, USA, 2014.
2. Siddiqui A.A, "Computer Aided Drug Design (HB 2020)", CBS Publishing, New Delhi, 2020.
3. Mohane S. Coumar, "Molecular Docking for Computer-Aided Drug Design: Fundamentals, Techniques, Resources and Applications", Academic Press Inc, New Delhi, 2021.
4. Dev Bukhsh Singh, "Computer-Aided Drug Design", Springer, USA, 2020.

LANGUAGE ELECTIVES

19G001 COMMUNICATION SKILLS FOR ENGINEERS

0 0 4 2

COMMUNICATION CONCEPTS :

Process of Communication
Inter and Intrapersonal Communication
Inter and Intrapersonal Communication Activities

(9)

FOCUS ON SOFT SKILLS :

Etiquette — Work Place etiquette — Telephone etiquette
Body Language
Persuasive Communication
Public Speaking
Critical Reasoning and Conflict Management based on Case Studies
Group Communication
Meetings
Interview Techniques

(14)

TECHNICAL WRITING :

Technical Writing Principles
Style and Mechanics
Technical Definitions – Physical, Functional and Process Descriptions
Technical Report Writing
Preparing Instructions and Manuals
Interpretation of Technical Data

(15)

BUSINESS CORRESPONDENCE :

Writing Emails
Preparing Resumes

Memos
Technical and Business Proposals

(7)

TECHNICAL COMMUNICATION :

Seminars
Process Description and Group Discussions
Use of Visual Aids

(15)

Total P: 60

TEXT BOOKS:

1.Faculty Incharge "Course Material on "Communication Skills for Engineers"", PSG College of Technology., Coimbatore, 2019

REFERENCES:

- 1.Jeff Butterfield "Soft Skills for Everyone", Cengage Learning., New Delhi, 2013
- 2.Jean Naterop B and Rod Revell "Telephoning in English", Cambridge University Press., Cambridge, 2011
- 3.David A Mc Murrey and Joanne Buckley "Handbook for Technical Writing", Cengage Learning., New Delhi, 2011
- 4.Simon Sweeney "English for Business Communication", Cambridge University Press., New Delhi, 2012

19G002 GERMAN- LEVEL A1.1

0 0 4 2

GUTEN TAG! :

- 1.To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
- 2.Vocabulary: related to the topic
- 3.Grammar: W — Questions, Verbs & Personal pronouns I.

(10)

FREUNDE, KOLLEGEN UND ICH :

- 1.To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
- 2.Vocabulary: related to the topic
- 3.Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural

(10)

IN DER STADT :

- 1.To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences
- 2.Vocabulary: related to the topic
- 3.Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs

(12)

GUTEN APPETIT! :

- 1.To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences
- 2.Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs

(13)

TAG FÜR TAG/ZEIT MIT FREUNDEN :

- 1.To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone
- 2.Vocabulary: related to the topic
- 3.Grammar: Time related prepositions, Possessive articles, Modalverbs

(15)

Total P: 60

TEXT BOOKS:

- 1.Dengler Stefanie "Netzwerk A1.1", Klett-Langenscheidt GmbH., München, 2013
- 2.Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCES:

1. Stefanie Dengler "Netzwerk A1", Klett-Langenscheidt GmbH., München, 2013
2. Hermann Funk, Christina Kuhn "Studio d A1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009
3. Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004
4. Christiane Lemcke und Lutz Rohrmann "Grammatik Intensivtrainer A 1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2012

19G003 FRENCH LANGUAGE LEVEL 1

0 0 4 2

PARTS OF SPEECH :

1. inviter et répondre à une invitation, Pronoms sujets
2. L'article définis, l'article indéfinis
3. Conjugation : présent, adjectifs possessifs
4. interrogation, décrire les personnes
5. La vie de quatre parisiens de professions différentes

(12)

ELEMENTS OF GRAMMAR :

1. Exprimer l'ordre et l'obligation demander et commander
2. l'adjectif possessifs, l'article partitif, l'article démonstratif, négation ne
3. pas, l'article contracté
4. verbe pronominaux
5. prepositions

(12)

SENTENCE STRUCTURE :

1. Raconter et reporter-donner son avis
2. Futur simple, pronom complètement d'objet direct, passé composé
3. plusieurs région de France, imparfait, pronom y/en, imparfait

(12)

TENSES AND NUMBERS :

1. Demander l'autorisation-passé récent, futur proche
2. La vie administrative et régionale, Pluriel des noms, moyens de transport

(12)

DISCOURSE :

1. le discours rapporté, décrire un lieu, exprimer ses préférences
2. décrire la carrière, discuter d'un système éducation de France
3. parler de la technologie de l'information

(12)

Total P: 60

TEXT BOOKS:

1. Christine Andant étal "À propos (livre de l'élève", LANGER., NEW DELHI, 2012
2. Myrna Bell Rochester "Easy French Step By Step", MCGrawhill Companies., USA, 2008

REFERENCES:

1. Michael D. Oates "Entre Amis: An Interactive Approach", Houghton Mifflin., 2005, 5th
2. Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French", ..
3. Simone Renaud, Dominique van Hooff "En bonne forme", ..

19G004 BASIC JAPANESE

0 0 4 2

JAPANESE PEOPLE AND CULTURE :

1. Basic greetings and responses
2. Basic script – Method of writing hiragana and katakana – Combination sounds and simple words
3. Self introductions: "Hajimemashite" -Demonstratives "Kore", "Sore", "Are" – Demonstrative "Kono", "Sono", "Ano"
4. Possessive noun particle "no" — Japanese apartments: Greeting your neighbor

(12)

PARTICLE "NI (AT)" FOR TIME :

1. kara (from) ~ made(until) – Particle "to (and)"
2. Time periods: Days of the week, months, time of day –Verbs (Present / future and past tense)
3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle "e".

(12)

LIKES AND DISLIKES :

1. Potential verbs (wakarimasu and dekimasu) – "Kara (~ because)"
2. Adverbs – Asking someone out over the phone-Verbs denoting presence
3. Introduction to Adjectives (na and i type) -Verb groups – I, II and III – Exercises to group verbs- Please do (te kudasai)
4. Present continuous tenses (te imasu) – Shall I? (~ mashou ka) – Describing a natural phenomenon (It is raining)

(12)

DIFFERENT USAGES OF ADJECTIVES :

1. Comparison — Likes and dislikes — Going to a trip- Need and desire (ga hoshii) — Wanting to . . . (Tabeti desu)- Going for a certain purpose (mi -ni ikimasu)
 2. Choosing from a menu-Adjectives ("i" and "na" type) — Adjectives (Positive and negative useage)
- (12)

ROLE PLAYS IN JAPANESE :

1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party

(12)

Total P: 60

TEXT BOOKS:

- 1.Minna no Nihongo, Honsatsu Roma "ji ban (Main Textbook Romanized Version)", . International publisher — 3A Corporation., Tokyo,2012

REFERENCES:

- 1.Eri Banno et.al "Genki I: An Integrated Course in Elementary Japanese I -Workbook", ., 1999
- 2.Tae Kim "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", ., 2014
- 3.Minna No Nihongo "Translation & Grammatical Notes In English Elementary", .,

ONE-CREDIT COURSES

19DF01 RADIATION PROTECTION IN MEDICAL TECHNOLOGY

1 0 0 1

BIOLOGICAL EFFECTS OF RADIATION : Interaction of radiation with matter, the importance of these interactions in diagnostic radiology and radiation oncology-Biological effects with examples-Exposure, Kerma, Dose equivalents and their estimation. (5)

RADIATION PROTECTION, DETECTION AND MONITORING : Types of radiation exposures, Principles of radiation protection, Operational dose limits- Radiation Hazards Control-Detection principles-Radiation protection monitors. (5)

SAFETY ASPECTS AND EMERGENCY HANDLING : Regulatory Requirements-Installation safety, Equipment safety- Radiation warning signs-Radiation accidents in Radiation Therapy & Handling Emergencies. (5)

Total L: 15

TEXT BOOKS:

- 1.Khan F M , "The Physics of Radiation Therapy", Lippincott Williams & Wilkins, 2014.
- 2.E.B. Podgorsak , "Radiation Oncology Physics: A Handbook for Teachers and Students", International Atomic Energy Agency, Vienna, 2005.

REFERENCES:

- 1.Mary Alice Statkiewicz Sherer, Paula J. Visconti, E. Russell Ritenour, Kelli Welch Haynes , "Radiation Protection in Medical Radiography", 7th Edition, Elsevier, Maryland Heights, 2014.

19DF02 RADIATION ONCOLOGY PHYSICS

1 0 0 1

PRINCIPLES OF RADIATION ONCOLOGY PHYSICS : Introduction to external beam therapy physics and brachytherapy physics. (1)

BASIC RADIATION PHYSICS : Structure of atom, nucleus - phenomenon of radioactivity - radioactive emissions,properties - Bremsstrahlung emission: kV, MV regions - radiation sources used in radiation oncology: preparation, usage. (2)

EQUIPMENT IN RADIATION ONCOLOGY : Design of kV, MV, Co-60, HDR RAL (high dose rate remote after loading) treatment, delivery systems, radiation characteristics, clinical use of the equipment. (3)

CLINICAL DOSIMETRY : Concept of charged particle equilibrium - Measurement of air kerma and dose: free air chamber, cavity chamber, ionization chamber, calorimeter - clinical dosimeters: TLD, semiconductor dosimeters - Calibration. (3)

TREATMENT PLANNING : Localization - Percentage depth dose - TAR/TMR: use in SSD/SAD type of treatments - cross beam profiles - isodose curves - beam modifications: wedges, compensators, bolus - 2D planning. (4)

TREATMENT : Time/MU calculations, delivery, verification. (2)

Total L: 15

TEXT BOOKS:

- 1.Edward C. Halperin, Carlos A. Pérez, Luther W. Brady , "Perez and Brady's Principles and Practice of Radiation Oncology", Lippincott Williams & Wilkins, Philadelphia, 2008.
- 2.Murat Beyzadeoglu, Gokhan Ozyigit, Cuneyt Ebruli , "Basic Radiation Oncology", Springer, New York, 2010.

REFERENCES:

- 1.Pam Cherry, Angela Duxbury , "Practical Radiotherapy Physics and Equipment", Wiley - Blackwell, New Jersey, 2009.
- 2.Faiz M. Khan , "The Physics of Radiation Therapy", Lippincott Williams & Wilkins, Philadelphia, 2009.

19DF03 RESPIRATORY PHYSIOLOGY**1 0 0 1**

INTRODUCTION : Introduction to respiratory system - mechanics of respiration. (3)

BASIC PHYSIOLOGY : Respiratory membrane - pulmonary circulation-transport: oxygen, carbon-dioxide - regulation of respiration. (4)

FUNCTIONAL PARAMETERS : Gas exchange - ventilation perfusion ratio - pulmonary function test. (2)

ADVANCED PHYSIOLOGY : High altitude physiology - deep sea physiology - hypoxia and artificial respiration - oxygen therapy -respiratory changes following exercise. (4)

RESPIRATORY AID : Ventilators. (2)

Total L: 15**TEXT BOOKS:**

- 1.Arthur C Guyton, John E.Hall , "Textbook of Medical Physiology", Saunders Elsevier, Pennsylvania, 2005.
- 2.William Owens , "The Ventilator Book", First Draught Press, 2012.

REFERENCE:

- 1.Andrew Davies, G H Blakeley , "Andrew Davies Human Physiology", Churchill Livingstone Publishers, Philadelphia, 2001.

19DF04 SPEECH PRODUCTION AND PROCESSING**1 0 0 1**

INTRODUCTION : Introduction to Speech - Language and Communication Components of speech – Language. (2)

ACOUSTIC THEORY OF SPEECH PRODUCTION: : Sound production mechanisms of the human vocal tract -Vowels and Consonants - Acoustic theory - Articulatory properties, sound propagation - Vocal tract models - Various types of spectrograms. (2)

SPEECH PERCEPTION : Speech Chain - Range of human hearing - Auditory mechanisms - Speech perception - Sound and word perception in noise - Perception and intelligibility. (3)

ANALYSIS OF SPEECH : Time domain and frequency domain representation - Acoustic analysis – Fundamental frequency and Intensity measurement techniques. (3)

NEED FOR DSP : Various applications including assessment of speech pathology - Infant cry analysis - Forensic speech science - Speech coding - Speech synthesis - Speech recognition and understanding - Speech enhancement and others. (5)

Total L: 15**TEXT BOOKS:**

- 1.Amalia Bar-On, Dorit Ravid, Elitzur Dattner , "Handbook of Communications Disorders: Theoretical, Empirical, and Applied Linguistic Perspectives", De Gruyter Mouton, Boston, 2018.
- 2.Thomas F.Quateri , "Discrete-Time Speech Signal Processing: Principles and Practice", Prentice Hall, New Jersey, 2008.

REFERENCE:

- 1.Palani S, Kalaiyarasi D , "Digital Signal Processing", Abe Books Pri. Ltd.,, New Delhi, 2010.

19DF05 MEDICAL TEXTILES**1 0 0 1**

INTRODUCTION TO MEDICAL TEXTILES : Medical textile products and their applications - Sutures - Bandages - Surgical implants - Non surgical implants - Extracorporeal devices - Health care products - Hygiene product – Non woven technology

- Medical textile testing. (6)
- COATING IN MEDICAL TEXTILES** : Fabric coating: Properties, Polymer coatings, Coating methods, Medical applications - Lamination: Methods and applications. (4)
- FACE MASK** : Safety issues - Effectiveness - Types - Recommendations - Production & testing . (3)
- ELECTROSPUN NANOMEMBRANES FOR MEDICAL APPLICATIONS** : Process - Parameters - Polymers used and medical applications. (2)

Total L: 15

REFERENCES:

- 1.Volkmar T. Bartels , "Handbook of Medical Textiles", Woodhead Publishing Limited, UK, 2011.
- 2.Subhash Anand , "Medical and Healthcare textiles", Woodhead Publishing Limited, UK, 2010.

19DF06 MEDICAL REGULATORY STANDARDS

1 0 0 1

- INTRODUCTION** : Overview of medical device quality management system, Introduction to Clauses in ISO 13485 standards. (2)
- QUALITY MANAGEMENT SYSTEM** : Covering requirements, Case study & exercise. (2)
- MANAGEMENT RESPONSIBILITY** : Covering requirements, Case study & exercise. (2)
- RESOURCE MANAGEMENT** : Covering requirements, Case study & exercise. (2)
- PRODUCTION REALIZATION** : Covering requirements, Case study & exercise. (2)
- MEASUREMENT, ANALYSIS & IMPROVEMENT** : Covering requirements, Case study & exercise. (2)
- STEPS TOWARDS IMPLEMENTATION** : Brief about adequacy, Compliance, Gap Analysis, Implementation & Audits. (3)

Total L: 15

TEXT BOOK:

- 1.Ramakrishna S, Tian L, Wang C, Liao S, Teo WE , "Medical devices: regulations, standards and practices", Woodhead Publishing, 2015.

REFERENCE:

- 2.Ogrodnik PJ , "Class 1 Devices: Case Studies in Medical Devices Design", Academic Press, 2014.

19DF07 DATA MINING IN HEALTHCARE

1 0 0 1

- CONCEPT OF DATA MINING** : Knowledge representations and deduction inferences, Uncertainties and reasoning in medicine, data cleaning and data preprocessing. (2)
- INTRODUCTION TO STATISTICAL COMPUTING** : Statistical analysis and characterization of healthcare data, Descriptive statistics, Statistical R package. (3)
- TECHNIQUES OF DATA MINING** : Graph models and Bayesian networks, Statistics and hypothesis testing, Regression analysis, Support vector machine, Decision trees and lazy learning, Association rules, Clustering, Temporal data mining and sequential analysis in Biomedicine. (6)
- APPLICATIONS** : Biomedical sensor analysis, Cloud data analysis, Data mining in medical images, Query Based Image Content, Text mining in Electronic Health Records. (4)

Total L: 15

TEXT BOOKS:

- 1.Hastie, Tibshirani, Friedman , "The Elements of Statistical Learning", Springer Series in Statistics, 2013.
- 2.Jain Pei, Jiawei Han, Micheline Kamber , "Data Mining: Concepts and Techniques", Elsevier, 2011.

REFERENCES:

- 1.T. Mitchell , "Machine Learning", McGraw-Hill Series in Computer Science, 1997.
- 2.Tadeusz Czachorski, Stanislaw Kozielski, Urszula Stanczyk , "Man-Machine Interactions 2", Springer, 2011.

19DF08 INTERNET OF THINGS FOR HEALTHCARE

1 0 0 1

INTRODUCTION TO IOT AND CC3200 : Introduction to Internet of Things (IoT), Review of CC3200 core and its architecture, Introduction to advanced ARM Cortex M4 architecture, Peripherals overview, User API, Power challenges with IoT, CC3200 Simplelink applications, Starting with Code Composer Studio V6. Various wireless protocols and its applications: ZigBee, Bluetooth Low Energy, 6LowPAN, Wi-Fi. (4)

SIMPLELINK WI-FI CPU : Introduction to CC3200 Simplelink Wi-Fi MCU, hardware Functional Block Diagram, Embedded Software Overview, TI-RTOS support for CC3200 Simplelink, TI-RTOS configuration for CC3200 Simplelink, Simplelink Wi-Fi certification, Power Modes. Introduction to WLAN, WLAN parameters, AP/STATION modes and its Security types, Socket connection, WLAN AP and WLAN STATION configuration settings. (4)

SOFTWARES : Introduction to Pin-Mux Tool, Configuration with Pin-Mux Tools, Introduction to Uniflash, Debugging with Uniflash Tools, HTML page Download. (2)

CASE STUDIES AND DEMONSTRATION : Review of User APIs for TI CC3200 & Initialization and Setting of IP addresses - GPIO, PWM Experiments - Setting up the CC3200 as a HTTP Web server - Automation system using the I/O port thru IP based system - Nursing Station Automation using CC3200 - Alarm System Example using CC3200 - Temperature Monitoring and control application using CC3200 - Sending automated E-mail alerts - Getting Information from Cloud Server - Sending sensor value to the cloud server and controlling the system from cloud. (5)

Total L: 15

TEXT BOOKS:

1. Jonathan W Valvano , "Introduction to Arm(r) Cortex -M Microcontrollers", Createspace, South Carolina, 2012.
2. Samuel Greengard , "The Internet of Things", The MIT Press, Cambridge, 2015.

REFERENCE:

1. Andrew Sloss, Dominic Symes, Chris Wright , "ARM System Developer's Guide: Designing and Optimizing System Software", Morgan Kaufmann Publishers, Burlington, 2004.

19DF09 BIOPOLYMERS IN BIOMEDICAL APPLICATIONS

1 0 0 1

INTRODUCTION : Introduction to Polymer technology - Polymerisation and Basic Structure. (1)

POLYMERS USED AS BIOMATERIALS: Polyvinylchloride(PVC) – Polyethylene(PE) – Polypropylene(PP) – Polymethylmetacrylate (PMMA) - Polystyrene (PS) and Its Copolymers (2)

BIODEGRADABLE POLYMERS: Polylactide (PLA), Polyglycolide (PGA), Poly(glycolide co-lactide) (PLGA), Poly(dioxanone), Poly(trimethylenecarbonate), Poly(carbonate) - Surface modifications for improving biocompatibility. (4)

BIOPOLYMERS : Classification - Structure - Uses - Environmental benefits. (4)

POLYMERS FOR MEDICAL AND TISSUE ENGINEERING APPLICATIONS : Medical, Dental and Pharmaceutical applications. (4)

Total L: 15

REFERENCES:

1. Michael Niaounakis , "BioPolymers: Applications and Trends", William Andrew, Elsevier, UK, 2015.
2. Susheel Kalia, Luc Averous , "Biopolymers: Biomedical and Environmental Applications", Wiley, Massachusetts, 2011.

ENGLISH

19GF01 INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

1 0 0 1

INTRA ORGANIZATIONAL COMMUNICATION : Communication Networks in an Organization; Intra- organizational communication (2)

INTER ORGANIZATIONAL COMMUNICATION : Flow Nomenclature; Workplace diversity and intercultural aspects of communication (2)

COMMUNICATION FUNCTIONS IN ORGANIZATIONS : Teamwork and team dynamics; Conflict resolution strategies and styles; Leading and influencing others-facilitation skills (3)

WRITTEN COMMUNICATION : Email Writing, Professional Reports, and Memos (4)

INTERPERSONAL SKILLS : Nature and Dimensions of Interpersonal Communication; Personality and Communication styles; Active listening and intentional responding; Working with emotional intelligence (4)

Total L: 15

REFERENCES:

1. Bagchi Subroto , "The Professional", Penguin Publications, UK, 2011.
2. PMBOK guide , "A Guide to the Project Management Body of Knowledge", Project Management Institute Inc, USA, 2013.

19GF02 HUMAN VALUES THROUGH LITERATURE

1 0 0 1

PROSE : Kalam's vision of college education in Wings of fire - Emerson's advocacy of independence of Human will in Self-reliance - Harmony in Education-views of Betrand Russel (4)

POETRY : Maintaining Human relations in Robert Frost's Mending Wall - Quest for identity and freedom in Kamala Das's An Introduction (2)

DRAMA : Statesmanship and friendship in Girish Karnad's Tughlaq (3)

ONE-ACT PLAY : The theme of love in Chekhov's The Bear (3)

SHORT STORY : Empathy in Somerset maugham's Mr. Know-all - Family bond in Anita Desai's Devoted son (3)

Total L: 15

TEXT BOOKS:

1. Faculty - Department of English , "Course materials", PSG College of Technology, Coimbatore, 2019.

REFERENCES:

1. Abrams M .H, Harpham , "A Glossary of Literary Terms", Cengage, Boston, 2015.
2. Scholes R, et.al. , "Elements of Literature", IV, Indian Rpt. OUP, New Delhi, 2013.

HUMANITIES

19OFA1 EXPORT – IMPORT PRACTICES

1 0 0 1

INTRODUCTION : Export – Import Business – Preliminaries for starting Export – Import Business Registration. (3)

EXPORT PROCEDURES : : Obtaining an Export License – Export Credit Insurance – Procedures and Documentation (4)

FOREIGN EXCHANGE : Finance for Exports – Pricing - Understanding Foreign Exchange Rates. (3)

IMPORT PROCEDURES : Import Policy – License - Procedure and Documentation. (3)

EXPORT INCENTIVES : Incentives - Institutional support (2)

Total L: 15

REFERENCES:

1. Ramagopal C , "Export Import Procedures - Documentation and Logistics", New Age International, 2014.
2. Cherian and Parab , "Export Marketing", Himalaya Publishing House, New Delhi, 2008.
3. Parul Gupta , "Export Import Management", MC-Graw Hill, 2017.
4. Justin Paul, Rajiv Aserkar , "Export Import Management", Oxford, 2013.

19OFA2 INSURANCE - CONCEPTS AND PRACTICES

1 0 0 1

INTRODUCTION TO INSURANCE AND RISK MANAGEMENT : Origin, History, Nature and Scope of insurance – Meaning, types and significance of risk. (3)

INSURANCE LAWS AND REGULATIONS : Insurance Act, IRDA Act, Consumer Protection Act, Ombudsman Scheme. (2)

INSURANCE UNDERWRITING AND RISK MANAGEMENT : Meaning of underwriting and underwriter, guidelines and steps in

the process of underwriting – characteristics, significance and principles of risk management. (4)

FINANCIAL ASPECTS OF INSURANCE MANAGEMENT : Role and functions of financial institutions, determination of premium for various insurance products. (3)

SETTLEMENT OF INSURANCE CLAIMS : Documents needed during various claims, Factors affecting insurance claims (3)

Total L: 15

REFERENCES:

- 1.Scott Harrington, Gregory Niehaus , "Risk Management and Insurance", McGraw Hill Education, 2017.
- 2.George E Rejda , "Principles of Risk Management & Insurance", Pearson Education, 2017.
- 3.John Hull , "Risk Management & Financial Institution", John Wiley and Sons, 2018.
- 4.Arjun Mittal, D D Chaturvedi , "Insurance and Risk Management", Scholar Tech Press, 2017.

190FA3 PUBLIC FINANCE

1 0 0 1

INTRODUCTION: Nature and Scope of public finance – Principles of taxation. (2)

PUBLIC REVENUE AND TAXATION: Sources of Revenue – Tax and non-tax revenue – Classification of Taxes, GST. (4)

PUBLIC EXPENDITURE: Importance – Types – Causes of increase in public expenditure – Effects of public expenditure in India. (3)

DEFICIT FINANCING AND BUDGET: Sources of public debt – Debt redemption – Budget – Types – Preparation of Budget in India. (3)

FEDERAL FINANCE: Centre-State financial relations – Finance commissions. (3)

TOTAL: 15

REFERENCE BOOKS:

1. Richard A Musgrave and Peggy B Musgrave, "Public Finance in Theory and Practice" – Tata McGraw Hill Education, New Delhi, 2004.
2. Bhatia H.L, "Public Finance" – Vikas Publishing House, 29th Edition, New Delhi, 2012.
3. David N Hyman, "Public Finance: A contemporary application of theory and policy", Cengage Publication, 11th Edition, Noida, 2014.
4. Santhosh Dalvi and Krishnan Venkatasubramanian, "An introduction to Goods and Service Tax: The biggest tax reform in India", CCH Publisher, New Delhi, 2015.

190FA4 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

1 0 0 1

INVESTMENT ENVIRONMENT : Financial Markets - Classification - Financial Instruments – Security Trading. (2)

TYPES OF SECURITIES : Trading – Orders, Margin Trading – Clearing and Settlement Procedures. (5)

SECURITY ANALYSIS I : Industry Analysis –Estimation of Rates of Return. (2)

SECURITY ANALYSIS II : Company Analysis — Estimation of Rates of Return. (2)

PORTFOLIO MANAGEMENT : Measuring Risk and Returns and Treatment in Portfolio Management. (4)

Total L: 15

REFERENCES:

- 1.William F Sharpe, Gordon J. Alexander, Jeffery V Bailey , "Investments", Prentice Hall, 2012.
- 2.Prasanna Chandra , "Investment Analysis and Portfolio Management", TATA McGraw Hill Publishing, 2011.
- 3.Ranganathan , "Investment Analysis and Portfolio Management", Pearson, 2004.
- 4.Bhalla V K , "Investment Management", TATA McGraw Hill Publishing, 2011