SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR

M. Sc. (INSTRUMENTATION) – FOURTH SEMESTER
Syllabus Effective from Academic year June 2018-19

PS04CINC21 : MEDICAL IMAGING SYSTEMS & THERAPEUTIC EQUIPMENTS

Total Marks:100 (External – 70, Internal – 30)

Basis of Diagnostic Radiology, X-Ray Machine, Visualization of X-Rays, Physical parameters for X-Ray Detectors, Computed Tomography Basic Principle & System Components, Positron Emission Tomography

Principle of NMR Imaging System, Image Reconstruction Techniques, NMR Components, Biological Effects & Advantages of NMR System, Pulse Echo System using Ultrasound, Real Time Ultrasonic Imaging System, Thermo-Graphic Equipment

Cardiac Pacemakers, Types of Pacemakers, Types of Leads & Electrodes, Cardiac Defibrillator, DC Defibrillator with Synchronizer, Automatic Defibrillator, Principle of Surgical Diathermy, Surgical Diathermy Machine, Surgical Diathermy Analyzer

Types of Laser Applications in Biomedical, Short Wave Diathermy, Microwave Diathermy, Electrotherapy Haemodialysis Machine, Portable Kidney Machine, Lithotriptor System, Modern Ventilator

BOOKS:

1. *Handbook of Biomedical Instrumentation,* II-Edition, R. S. Khandpur, Tata McGraw-Hill.

2. *Biomedical Instrumentation and Measurements,* Leslie Cromwell, Fred J. Weibell & Erich A. Pfeiffer, Prentice Hall of India.

3. *Introduction to Biomedical Instrumentation and Measurement Technology*, Carr, Brown, Pearson Education.

4. *Medical Instrumentation Application and Design,* III-Edition, John G. Webster-Editor, John Wiley & Sons, INC.

5. *Biomedical Transducers and Instruments,* Tatsuo Togawa, Toshiyo Tamura & P. Ake Oberg, CRC Press.

M. Sc. (INSTRUMENTATION & CONTROL) – FOURTH SEMESTER
PS04CINC22 : PROGRAMMING IN C / C++
Total Marks:100 (External – 70, Internal – 30)

Importance of C, Program Design & Coding, Constants, Variables & Data Types, Operators & Expressions, Managing Input & Output Operations, Decision Making & Branching**:** IF, IF-ELSE, Nesting of IF-ELSE, WHILE, DO & FOR statements & Jumps in Loops

Arrays**:** One, Two & Multi-Dimensional, Character Arrays & Strings, User-defined Functions**:** Types, Nesting & Recursion, Structures & Unions**:** Structure Initialization, Arrays of Structures, Structures & Functions

Pointers**:** Declaration, Expressions, Increments & Scale Factors, Preprocessor**:** Macro Substitution, File Inclusion, Compiler Control Directives, File Management in C, Graphics

Principles of Object Oriented Programming, Applications of C^{++}, Classes & Objects, Managing Console I/O Operations, Object Oriented Systems Development, Templates & Exception Handling

BOOKS:

1. *Programming in ANSI C,* E. Balagurusamy, Tata McGraw-Hill Publishing Company Limited.

2. *Object Oriented Programming with* C^{++}, E. Balagurusamy, Tata McGraw-Hill Publishing Company Limited.

3. *Computer Programming in C,* V. Rajaraman, Prentice Hall of India Private Limited.

4. *Let us C*, Yashvant P. Kanetkar, BPB Publications.

5. *Graphics under C,* Yashvant P. Kanetkar, BPB Publications.

6. *Object Oriented Programming with* C^{++}, Yashvant P. Kanetkar, BPB Publications.

M. Sc. (INSTRUMENTATION & CONTROL) – FOURTH SEMESTER
PS04CINC23 : ROBOTICS AND FUZZY LOGIC
Total Marks:100 (External – 70, Internal – 30)

Robot**:** Classification, Advantages – Disadvantages, Components, Degrees of Freedom, Joints, Coordinates, Reference Frames, Programming Modes, Characteristics, Languages & Applications, Robots as Mechanisms

Matrix Representation, Homogenous Transformation Matrices, Representation of Transformations, Inverse of Transformation Matrices, Forward & Inverse Kinematics of Robot, Denavit - Hartenberg Representation of Forward Kinematic Equations, Inverse Kinematic Solution, Kinematic Programming

Degeneracy & Dexterity, Fundamental Problem with Denavit - Hartenberg Representation, Design Project**:** Three Degree of Freedom, Examples, Differential Relationships, Jacobian, Differential Motions of Frame, Differential Motions of Robot and its Hand Frame, Relation of Jacobian & Differential Operator, Inverse Jacobian, Design Project

Fuzzy Sets **-** Types & Concepts, Operations on Fuzzy Sets, Fuzzy Arithmetic, Fuzzy Relations & Possibility Theory, Fuzzy Logic, Uncertainty based Information, Fuzzy Expert System – Overview, Fuzzy Controllers, Applications of Fuzzy Logic in Robotics.

BOOKS:

1. *Introduction to Robotics – Analysis, Systems, Applications,* Saeed B. Niku, Prentice Hall of India Private Limited.

2. *Robotics Technology and flexible automation*, S.R. Deb, Tata McGraw - Hill

3. *Robotics – Principles and Practice,* K. C. Jain, L. N. Aggarwal, Khanna Publishers.

4. *Fuzzy Sets, Uncertainty and Information,* George J. Klir & Tina A. Folger, Prentice Hall of India Private Limited.

5. *Fundamentals of Robotics – Analysis & Control,* Robert J. Schilling, Prentice Hall of India Private Limited.

M. Sc. (INSTRUMENTATION & CONTROL) – FOURTH SEMESTER
PS04EINC21: FABRICATION TECHNIQUES & INSTRUMENTATION
Total Marks:100 (External – 70, Internal – 30)

Physical Vapour Deposition Methods**:** Direct, Flash, Electron Beam, RF Induction Heating & Molecular Beam Epitaxy, Metal Organic Chemical Vapour Deposition (MOCVD), Sputtering**:** DC, RF, Magnetron & Ion Beam

Film Thickness & Deposition Monitoring Methods, Vacuum Pumps**:** Rotary, Diffusion, Turbo Molecular, Ion Getter & Cryo Pump, Vacuum Gauges**:** Pirani, Penning & Hot Cathode Ionization

Silicon Single Crystal Growth**:** Czochralski & Float Zone Methods, Silicon Shaping & Processing Considerations, Epitaxial Deposition of Silicon, Oxidation of Silicon, Lithographic Techniques.

Scanning & Transmission Electron Microscopy, Low Energy Electron Diffraction, Reflection High Energy Electron Diffraction, X-Ray Spectrometry Introduction to Numerical Control of Machine Tools, Tool Movement, Elements of CNC Machines NC / CNC Programming, FANUC Codes & Illustrations, Sample Programs

BOOKS:

1. *Thin Film Technology and Applications,* K. L. Chopra & L. K. Malhotra, Tata McGraw-Hill Publishing Company Limited.

2. *Vacuum Science and Engineering,* C. M. Vanatta, Tata McGraw-Hill Publishing Company Limited.

3. *VLSI Fabrication Principles - Silicon and Gallium Arsenide,* Sorab K. Gandhi, John Wiley & Sons, Inc.

4. *VLSI Technology,* C. Y. Chang & S. M. Sze, McGraw-Hill Companies, Inc.

5. *Semiconductor Devices – Physics and Technology,* S. M. Sze, John Willy & Sons, Inc.

6. *CNC Programming,* S. K. Sinha, Galgotia publications Pvt. Ltd.

7. *Machine Tool Design and Numerical Control,* N. K. Mehta, Tata McGraw-Hill Publishing Company Limited.

8. *Handbook of Analytical Instruments,* R. S. Khandpur, Tata McGraw-Hill Publishing Company Limited.

M. Sc. (INSTRUMENTATION & CONTROL) – FOURTH SEMESTER
PS04EINC22: METEOROLOGICAL INSTRUMENTATION
Total Marks:100 (External – 70, Internal – 30)

Principles of Measurement & Instrumentation: Instrument response time, calculations combining uncertainties, calibration experiments
Temperature: Thermometer exposure, Surface & below surface temperature measurement
Humidity: Hygrometers principles, Practical psychrometers, Hygrometer calibration using salt solutions
Atmospheric pressure: Barometers, Corrections to Barometers

Wind Speed & Direction: Types of Anemometer, Wind Direction, Anemometer exposure
Radiation: Solar geometry, Short wave radiation instruments, Long wave instruments
Clouds, Precipitation & Atmospheric Electricity: Visual range, Rain gauges, Atmopsheric electricity

Upper Air Instruments: Radiosonde technology, Uncertainties, Specialist radiosondes, Aircraft measurements, Data Acquisition Systems: Data acquisition, Custom Data Logging, Management of data files, Preliminary data examination
Environmental Data Analysis: Physical models, Solar radiation models, Statistical models, Ensemble averaging, Spectral methods

RADAR: Basic principles, Radar Hardware, Radar Equation for Point Targets, Distributed Targets, Doppler Velocity Measurements, Spectrum Width & turbulence, Meteorological Targets, Meteorological Uses of Weather Radar. Synthetic aperture radar, Radar remote sensing from space, Shuttle imaging radar, ENVISAT, Radarsat, Passive microwave sensing, Lidar

BOOKS:

1. *Meteorological Measurements and Instrumentation* – R. Giles Harrison, Wiley Blackwell

2. *Guide to Meteorological Instruments and method of observation " WMO-8 Meteorological Instruments"* W.E.K.Middleton and A.F. Spilhaus

3. *Applications of Remote Sensing to Agrometeorology* F.Toselli, Kluwer

4. *Probing the atmospheric boundary layer* , D.H. Lenschow

5. *Instruments and Techniques for probing the atmospheric boundary layer,* D.H. Lenchow.

M. Sc. (INSTRUMENTATION & CONTROL) – FOURTH SEMESTER
PS04EINC23 : ARTIFICIAL INTELLIGENCE & NEURAL NETWORKS
Total Marks:100 (External – 70, Internal – 30)

Artificial Intelligence**:** Databases & Medical Records, Mathematical Modeling & Simulation, Pattern Recognition, Bayesian Analysis, Decision Theory & Symbolic Reasoning Techniques, Knowledge Representation**:** Production Rules, Frames, Databases, Predicate Calculus & Semantic Nets & Temporal Data Representations.

Knowledge Acquisition**:** Expert Input, Learned Knowledge, Meta-Knowledge, Knowledge based Maintenance, Reasoning Methodologies**:** Problem Representations, Blind Searching, Ordered Search, AND/OR Tree, Searching Game Trees, Searching Graphs, Rule base Searching, Higher Level Reasoning Methodologies & Examples in Biomedical Expert Systems.

Validation & Evaluation**:** Algorithm Evaluation, Knowledge base Evaluation & System Evaluation, Genetic Algorithm**:** Representation Schemes, Genetic Operators, Evolution Strategies & Examples, Probabilistic Systems**:** Bayesian Approach, Parameter Estimation, Discriminant Analysis, Statistical Pattern Classification, Regression Analysis & Biomedical Applications.

Neural Networks**:** Modeling of Biomedical Systems, Decision Making Systems, Neural Models, Current Models, Resurgence of Neural Network Approach, Network Properties & Radial Basis Functions, Models**:** Classification, Association, Optimization & Self-organization, Classification Networks & Learning**:** Network Structure, Feature Selection, Types of Learning & Interpretation of Output, Supervised Learning**:** Decision Surfaces, Two-category Separation, Linearly Separable Sets, Nonlinearly Separable Sets, Multi Category Classification Problems, Relationship to Neural Network Models, Comparison of Methods & Applications.

BOOKS:

1. *Neural Networks and Artificial Intelligence for Biomedical Engineering,* Donna L. Hudson, Maurice E. Cohen, Prentice Hall of India Private Limited.

2. *Artificial Intelligence Application Programming,* M. Tim Jones, Dreamtech Press.

3. *Introduction to Artificial Neural Networks,* S. N. Srivanandam & M. Paulraj, Vikas Publishing House Private Limited.

4. *Neural Networks – A Comprehensive Foundation,* Simon Haykin, Pearson Education.

5. *An Introduction to Neural Networks,* James A. Anderson, Prentice Hall of India Private Limited.