MKSSS's Cummins College of Engineering for Women, Pune
(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Autonomous Program Structure of Third Year B. Tech. Sixth Semester (Electronics and Telecommunication Engineering) Academic Year: 2022-2023 Onwards

Course Code	Course Title	Teaching Scheme Hours /Week			Examination Scheme				Total Marks	Credit
		Lecture	Tutorial	Practical	In Sem	End Sem	Oral	Practical		
20EC601	Wave Theory and Antenna	3	1	0	50	50	0	0	100	4
20EC602	Computer Networks and Security	3	0	0	50	50	0	0	100	3
20EC603	Control Systems	3	1	0	50	50	0	0	100	4
20HS601	Management for Engineers	3	0	0	50	50	0	0	100	3
20PEEC601	Programme Elective-III	3	0	0	50	50	0	0	100	3
20OE601	Open Elective-II	3	0	0	50	50	0	0	100	3
20EC602L	Computer Networks and Security Lab	0	0	2	25	0	25	0	50	1
20PEEC601L	Programme Elective-III Lab	0	0	2	25	0	0	25	50	1
	Total	18	2	4	350	300	25	25	700	22
	Grand Total	**24**			**650**		**50**			

Programme Elective-III			Programme Elective-III Lab		
Sr. No.	Course Code	Course Title	Sr. No.	Course Code	Course Title
1	20PEEC601A	Robotics	1	20PEEC601LA	Robotics Lab
2	20PEEC601B	Biomedical Electronics	2	20PEEC601LB	Biomedical Electronics Lab
3	20PEEC601C	Power Electronics	3	20PEEC601LB	Power Electronics Lab
4	20PEEC601D	Deep Learning	4	20PEEC601LD	Deep Learning Lab

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Secretary Governing Body
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MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

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Chairman Governing Body
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20OE601 Open Elective-II			Eligible Departments				
Sr. No.	Course Code	Course Title	EnTC	Comp	IT	Mech	Instru
1	20OE601A	Automation and Control Engineering	Y	Y	Y	Y	Y
2	20OE601B	Automotive Electronics	Y	Y	Y	Y	Y
3	20OE601C	Avionics	Y	Y	Y	Y	Y
4	20OE601D	Bioinformatics	Y	Y	Y	N	Y
5	20OE601E	Computer Vision	Y	Y	Y	Y	Y
6	20OE601F	Design Thinking	Y	Y	Y	Y	Y
7	20OE601G	e-Business	Y	Y	Y	Y	Y
8	20OE601H	Electric Vehicles	Y	Y	Y	Y	Y
9	20OE601I	Gamification	Y	Y	Y	Y	Y
10	20OE601J	Geographical Information Systems	Y	Y	Y	Y	Y
11	20OE601K	Multimedia Systems	Y	Y	Y	N	Y

MKSSS CUMMINS COLLEGE OF ENGG. FOR WOMEN KARVENAGAR PUNE-52.

20EC601 WAVE THEORY AND ANTENNA

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial :1 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Prerequisite:20ES01 Basic Electrical and Electronics Engineering, 20BSEC301 Calculus and Probability

Course Objectives:
1. To study Electrostatic and Magnetostatic laws
2. To study Maxwell's equations and wave propagation in different media
3. To explain transmission line fundamentals and apply them to solve the problems using Smith chart
4. To study antenna fundamentals and analyze different types of antennas and antenna arrays

Course Outcomes:
After completion of the course, students will be able to

CO1	Apply the relevant laws for solving the problems of Electrostatics and Magnetostatics
CO2	Interpret Maxwell's equations for static and dynamic field and calculate the average power of Electromagnetic wave using Poynting theorem
CO3	Formulate the wave equation and solve it for uniform plane wave
CO4	Determine transmission line parameters using Smith chart
CO5	Analyze wire antenna and antenna arrays and identify the suitable antenna for a given communication system

Unit I: Fundamentals of Electrostatics and Magnetostatics (09)
Coulomb's law and Electric field intensity, Electric flux and flux density, Types of charge distributions and their Electric field, Gauss's law, Biot Savart law, Ampere Circuital law, Magnetic field intensity and flux density, Boundary conditions.

Unit II: Electromagnetic Waves (09)
Faraday's law, Maxwell Equations in point form and integral form, Wave Equation, Uniform Plane wavesin free space, dielectric, and conducting medium, Linear, Circular & Elliptical polarization, Reflection of plane waves, Normal incidence, Oblique incidence, Electromagnetic power and Poynting vector.

Unit III: Transmission Lines (08)
Types of transmission lines, Dissipation less line, Voltage and Current on a transmission line, Input impedance, Open and short-circuited transmission line, Impedance mismatch, Standing waves, EMI, EMC, Smith chart and applications.

Unit IV: Wire Antennas and Antenna Arrays (10)
Antenna fundamentals, Types of antennas, Near and far field, Radiation mechanism, Antenna parameters, Infinitesimal dipole, Small dipole, Finite length dipole, Half wavelength dipole, Small circular loop antenna, Antenna arrays, Two element array, Array factor, Pattern multiplication, N-element linear array: Uniform amplitude and spacing, Broad side and End-fire array, N-element linear array: Non-uniform amplitude and uniform spacing, Binomial and Dolph Chebyshev-array.

Unit V: LF to SHF Antennas (06)

Hertz & Marconi antennas, electrically short antennas, Beverage antenna, medium frequency antennas, Resonant & non-resonant antennas, VAntenna, Rhombic antenna, TW antennas, Loop antenna, Ferrite rod antenna, Whip antenna, Yagi Uda, Helical, Horn, Parabolic reflector, Microstrip patch antenna.

Text Books:

1. Mathew N. O Sadiku**, "Principles of Electromagnetics",** *Oxford University Press*, (4th Edition), (2009).
2. C.A. Balanis**, "Antenna Theory- Analysis and Design",** *John Wiley*, (4th Edition), (2016).

Reference Books:

1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, **"Antennas for All Applications"**, *The McGraw Hill Companies*, (5rd Edition), (2017).
2. K. D. Prasad, **"Antenna and Wave Propagation"**, *Satya Prakashan New Delhi*, (2014).
3. John D Kraus, **"Antenna & Wave Propagation",** *McGraw Hill*, (4th Edition),(2010).

Online Resources:

1. Nptel Course **"Electromagnetic Theory"**
   https://nptel.ac.in/courses/108/104/108104087/
2. Nptel Course **"Antennas"**
   https://onlinecourses.nptel.ac.in/noc20_ee20/preview

20EC602 COMPUTER NETWORKS AND SECURITY

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: 20EC401 Digital Electronics

Course Objectives:
1. To introduce network models and functions of each layer
2. To introduce networking protocols, architectures, and applications
3. To describe basic concepts of the threats for data and network and security mechanism
4. To provide theoretical and practical base regarding computer networks issues
5. To outline the basic network configurations

Course Outcomes:
After completion of the course, students will be able to
CO1 Explain the principles of computer networking
CO2 Analyze networking protocols, inter-networking devices and their functions
CO3 Illustrate computer network applications based on Client-Server architecture
CO4 Identify the threats to the data and network and apply techniques to resolve them

Unit I: Physical Layer and Data Link Layer (10)
Networks models: OSI model, Layers in OSI model, TCP / IP protocol suite, Addressing, Network performance measurement criterion, Data link control: Framing, Flow Control (Stop and Wait and Sliding Window Protocols), Error control (CRC), HDLC and PPP, Multiple access: Random access (Aloha, CSMA, CSMA/CD, CSMA/CA) protocols.

Unit II: Wired and Wireless LANS (07)
Wired LANS: Ethernet (IEEE 802.3), Ethernet standards (Ethernet, Fast Ethernet and Gigabit Ethernet) Wireless LANS: IEEE 802.11, Bluetooth IEEE 802.15, Connecting LANS, Connecting devices, VLAN, VxLANs, Ultra Wide Band.

Unit III: Network Layer (09)
Network layer functions, Logical addressing: IPv4, IPv6 addresses, IPv4 to IPv6 conversion , Unicast routing algorithms, Routers, L3 Switches, Network layer Protocols: ARP, RARP, ICMP and IGMP, Software Defined Networking.

Unit IV: Transport layer and Application Layer (08)
Process to Process Communication, Addressing, Transport layer protocols: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Stream Control Transport Protocol (SCTP), Quality of service (QoS): data flow characteristics, Internet Applications and protocols: Domain Name System (DNS), E-mail, FTP, HTTP.

Unit V: Data Security and Network Security (08)
Security goals, Attacks and Defense strategies, Cryptography: Substitution cipher, DES, AES and RSA algorithms, Digital signatures, Authentication protocols: One-Way Authentication, Dictionary Attacks, Network, Transport and application layer security, Attacks: DoS and DDoS, Session Hijacking and Spoofing, ARP Spoofing and Attacks on DNS, Viruses, Worms and Malware, Virus and Worm Features.

Text Books:

1. Behrouz A. Forouzan, **"Data Communication and Networking"**, *Tata McGraw-Hill*, (5th Edition), (2013).
2. Andrew S. Tannenbaum, **"Computer Networks",** *Pearson Education*, (4th Edition), (2003).
3. William Stallings**, "Cryptography and Network Security Principles and Practice"**, *Pearson Education,* (7th Edition), (2017).
4. Srilatha Vemula, Jason Gooley, Roddie Hasan, "**Cisco Software-Defined Access**" *Cisco Press* (1st Edition), (2020).

Reference Books:

1. Wayne Tomasi, **"Introduction to Data Communication and Networking"**, *Pearson Education*, (1st Edition), (2007).
2. James. F. Kurose and W. Ross, **"Computer Networking: A Top down Approach"**, Pearson *Education*, (3rd Edition), (2007).
3. Faranak Nekoogar, **"Ultra-Wideband Communications: Fundamentals and Applications"** Pearson *Education*, (1st Edition), (2005).
4. William Stallings, **"Data and Computer Communication"**, *Pearson Education*, (8th Edition), (2000).
5. Greg Tomsho, Ed Tittel, David Johnson, **"Guide to Networking Essentials"**, Thomson *India Learning*, (5th Edition), (2007).

Online Resources:

1. **NPTEL Course "Computer Networks"** https://nptel.ac.in/courses/106105081/
2. **NPTEL Course "Cryptography and Network Security"**https://nptel.ac.in/courses/106105031/
3. Yusnita Rahayu; Tharek Abd. Rahman; Razali Ngah, **"Ultra wideband technology and its applications"**in International Conf.on Wireless and Optical Communications Networks (WOCN '08).IEEE
4. **Software-defined networking: The new norm for networks**,Oct. 2012,[online] Available: https://www.opennetworking.org/images/stories/downloads/s_dne resources/white-papers/wp-sdn-newnorm.pdf.

20EC603 CONTROL SYSTEMS

Teaching Scheme
Lectures: 3 Hours / Week
Tutorial:1 Hour / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 4

Prerequisite: 20BSEC301 Calculus and Probability, 20ES01: Basic Electrical and Electronics Engineering

Course Objectives:

1. To explain the components and types of control systems
2. To find response of first order and second order systems using standard input signals
3. To analyze feedback control system stability in time domain using Routh-Hurwitz criterion and Root Locus technique
4. To analyze feedback control system stability in frequency domain using Bode and Nyquist plot
5. To explain state space approach for control system analysis
6. To explain various types of controllers

Course Outcomes:

After completion of the course, students will be able to

CO1 Classify and explain different systems, interpret transfer function of physical components and construct system transfer function
CO2 Determine and analyze system response to find time and frequency domain specifications and steady state error
CO3 Examine system stability in time domain and in frequency domain
CO4 Examine the stability of system by plotting Root Locus, Bode and Nyquist plots
CO5 Analyze control system using state space approach
CO6 Apply controlling (P, D, I, PID) actions and determine its effect on various system parameters

Unit I: Control System Modeling (08)

Basic Elements of Control System, Open loop and Closed loop systems, Differential equations and Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems, Block diagram reduction Techniques, Signal flow graph.

Unit II: Time Response Analysis (07)

Standard input signals, Time response analysis of First Order Systems, Time response analysis of Second Order Systems, Effect of ξ on Second Order System performance, Steady state errors and error constants, design specifications for Second Order Systems.

Unit III: Stability Analysis (07)

Concept of Stability, Routh-Hurwitz Criterion, Relative Stability, Root Locus Technique, Construction of Root Locus.

Unit IV: Frequency Response Analysis (08)

Frequency domain Versus Time domain analysis and its correlation, Bode Plots, Polar Plots and development of Nyquist Plots, Frequency domain specifications from the plots, Stability analysis from plots.

Unit V: State Variable Analysis (07)

State space advantages and representation, Transfer function from State space, Physical variable form, Phase variable forms: Controllable canonical form, Observable canonical form, Solution of homogeneous state equations, State transition matrix and its properties, Computation of state transition matrix by Laplace transform method only, Concepts of Controllability and Observability.

Unit VI: Introduction to Controllers (05)

Classification of controllers, Introduction to P, D, I and PID controllers, Response of controllers to standard inputs, Determine effects of controlling action on various system parameters.

Text Books:

1. I. J. Nagrath, M. Gopal, **"Control Systems Engineering"**, *New Age International Publishers*, New Delhi, (5th Edition), (2007).
2. Katsuhiko Ogata, **"Modern Control Engineering"**, *PHI Learning Private Limited, New Delhi*, (5th Edition), (2010).

Reference Books:

1. B. C. Kuo, **"Digital Control Systems"**, *Oxford University Press, New York*, (2nd Edition), (1992).
2. Richard C. Drof, Robert N. Bishop, **"Modern Control Systems"**, *Addison Wesley Pub.Company*, (1st Edition), (2001).
3. C. D. Johnson, **"Process Control Instrumentation Technology"**, *Pearson Pub*, (6th Edition), (2006).

Online Resources:

1. NPTEL Course "Control Engineering"
   http://nptel.ac.in/courses/108101037/1

20HS601 MANAGEMENT FOR ENGINEERS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: Nil

Course Objectives:
1. To develop understanding about the basics of management functions
2. To explain the concept of total quality management
3. To analyze cost and financial aspect of the business
4. To develop the strategic thinking and decision making abilities in the rapidly changing global business environment

Course Outcomes:
After completion of the course, students will be able to
1. Explain the principles and functions of management
2. Identify social responsibility and ethical issues involved in the Organization
3. Apply tools of quality management
4. Analyze the cost, financial aspects of business and the need of globalization

Unit I: Basics of Management (08)
Introduction, Definition of management, characteristics of management, functions of management: Planning, Organizing, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision making.

Unit II: Organizational Environments and Cultures (06)
External environments, Internal environments, Ethics and social responsibility.

Unit III: Quality Management (10)
Definition of quality, continuous improvement definition of quality, types of quality, quality of design, conformance and performance, phases of quality management, Quality Management Assistance Tools: Ishikawa diagram, Pareto Analysis, Pokka Yoke (Mi stake Proofing), Quality circles, TQM, Kaizen, Five S (5S), Six sigma Quality Management, The ISO 9001:2015, Quality Management System Standard, Software quality management with respect to CMM level and ISO standard.

Unit IV: Cost and Financial Accounting (10)
Basic concepts of cost accounting, Classification and analysis of costs, Marginal costing, Break-even point, Cost Volume Profit analysis, key financial statements, financial analysis.

Unit V: Globalization (06)
Global trends and commerce, new opportunities offered by globalization, preparation for globalization, globalization drivers, implementation issues related to globalization, quality of global leadership.

Text Books:
1. Stephen P. Robbins, Mary Coulter, **"Management",** *Prentice Hall of India,* (8th Edition), (2014).
2. Charles W.L Hill, Steven L McShane, **"Principles of Management",** *McGraw Hill*

Education, Special Indian Edition, (2007).

Reference Books:

1. Freeman-Bell, James Balkwill, **"Management in Engineering",** *Prentice Hall of India*, (2nd Edition), (2005).
2. T. R. Banga, S.C. Sharma, **"Industrial organization and Engineering Economic",** *PHI Publication*, (25rd Edition), (2002).
3. M.C. Shukla, **"Business Organization and Management",** *PHI Publication*, (2rd Edition), (2002).
4. C. M. Chang, **"Engineering Management: meeting the Global Challenges",** Publisher: *CRC Press*, (2016).

20PEEC601A ROBOTICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks

Prerequisite: 20BS01Linear Algebra and Univariate Calculus, 20ES01: Basic Electrical and Electronics Engineering

Course Objectives:

1. To explain fundamentals of robotic system
2. To introduce kinematics, dynamics and control for robotics systems
3. To introduce trajectory planning for motion
4. To describe application of robots in automation

Course Outcomes:
After completion of the course, students will be able to

CO1	Classify, Compare and Explain functionality of components used to develop robots
CO2	Select sensors, actuators and grippers for developing robots.
CO3	Apply formulations to obtain kinematics, dynamics and trajectory planning of manipulator
CO4	Explain path planning algorithms for robotic system
CO5	Analyze components, robot mechanics and algorithm used to develop robots
CO6	Build a Robotic system to perform a given task.

Unit I: Introduction to Robotics (06)
Definition of robotics, Components of Robot system, Classification of robots based on co-ordinate systems, Degrees of freedom, Links and Joints, Robot Specifications

Unit II: Robotic Sensors, Actuators and End Effectors (10)
Classification of sensors, Internal and External sensors, Position, Acceleration sensors, Proximity, Velocity sensors, Force sensors, Tactile sensor, Camera and Robot vision, Overview of actuators: Electric, Pneumatic and Hydraulic actuators, Classification of End Effectors and Types of Gripper.

Unit III: Transforms and Kinematics (07)
Pose of rigid body, Position and orientation description, Coordinate transforms, Homogeneous transform, Denavit and Hartenberg (DH) parameters, Forward and Inverse Kinematic Analysis.

Unit IV: Dynamics and Trajectory (07)
Dynamics and Inverse Dynamics of robots, Link inertia tensor and manipulator inertia tensor, Newton – Eller formulation. Trajectory planning, Joint space planning, Cartesian space planning and Position and Orientation trajectories.

Unit V: Robot Programming Methods (08)
Robot language classification, Robot language structure, Online and Offline Programming, Line Following Algorithms, Robot Navigation, Path planning algorithms based on Simultaneous Localization and Mapping (SLAM) algorithm.

Unit VI: Application of Robot in Automation **(04)**

Application in Manufacturing: Material Transfer, Material handling, loading and unloading processing, spot and continuous arc welding & spray painting, Robot application in Medical, Progressive advancements in robots, Present trends and future trends in robotics.

Text Books:

1. S.K. Saha, **"Introduction to Robotics",** *Tata McGraw Hill*, (2nd Edition), (2014).
2. R. K. Mittal, I. J. Nagrath**, "Robotics and Control",** *Tata McGraw Hill, New Delhi"*, (1st Edition), (2003).
3. K.S. Fu, R.C .Gonzalez, C. S. G. Lee, "**Robotics Control, Sensing, Vision and Intelligence",** *Tata McGraw Hill* **,** (2nd Edition), (2008).
4. R. Siegwart, I. R. Nourbakhsh, **"Introduction to Autonomous Mobile Robots"**, *The MIT Press*, (2nd Edition), (2011).

Reference Books:

1. Robert Schilling, **"Fundamentals of Robotics: Analysis and Control",** *PHI. New Delhi*, (1st Edition), (2003).
2. S. R. Deb**, "Robotics Technology and Flexible Automation",** S. Deb, Tata McGraw Hill, (1st Edition), (2010).
3. Francis X. Govers, **"Artificial Intelligence for Robotics",** *Packt Publishing Ltd., United Kingdom*, (1st Edition), (2018).

Online Resources:

1. **NPTEL Course " Mechanics and Control of Robot Manipulator"**https://onlinecourses.nptel.ac.in/noc21_me108/
2. NPTEL Course **" Wheeled Mobile Robot"** https://nptel.ac.in/courses/112/106/112106298/

20PEEC601B BIOMEDICAL ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: 20EC302Signals and systems, 20EC404Embedded Systems, 20EC302Digital signal processing

Course Objectives:

1. To explain and analyse important organ systems in a human body
2. To understand different diagnostic and lifesaving biomedical equipment
3. To introduce AI/ML techniques used in Biomedical Applications
4. To explore signal conditioning and processing system for real life biosignals

Course Outcomes:

After completion of the course, students will be able to

CO1 Explain and analyse important organ systems in a human body
CO2 Compare different diagnostic and lifesaving biomedical equipment
CO3 Develop a signal conditioning and processing system for real life biosignals
CO4 Select the appropriate AI/ML techniques for Reference biomedical signals

Unit I: Human Anatomy and Biomedical Electronic System (04)

Organ systems: Cardiovascular System, Nervous System and Respiratory System, Cell, Nerve cell, Action Potential, Introduction to Biomedical Electronics system, its advantages and applications.

Unit II: Biomedical Sensors, Signal Acquisition and Processing (10)

Transducers and Sensors: Temperature transducers, Infrared radiation thermometers, Clinical thermometers, Pressure transducers: Strain Gauge for pressure measurement, SpO2 sensor,
Sources of Biomedical Signals, Classification of Biomedical Signals, Bioelectric signals like ECG, EEG, EMG and EOG. Recording Electrodes, Motion artefacts, Electrodes for EEG, ECG and EMG, Isolation amplifiers, Differential Amplifiers, Instrumentation Amplifiers, Analysis of non-stationary signals, Time-variant system, Short time Fourier transform, Multi resolution Analysis (Wavelet), Introduction to Adaptive filters and its applications.

Unit III: Cardiovascular System (06)

Anatomy of Heart, Conducting system of the heart, Lead Configuration to acquire ECG, Einthoven Triangle, ECG Machine, Normal rhythm and Rhythm Abnormality (Arrhythmia), Heart Sounds (Phonocardiograph), Blood Pressure Measurement, Echocardiography.

Unit IV: Central Nervous System(CNS) and Peripheral Nervous System(PNS) (06)

Functional Components of a Human Nervous System, Electroencephalogram (EEG), Types and Significance of EEG Signal, 10-20 Electrode Placement System, Evoked Potential, EEG Machine, EEG Amplifier and Filters, EEG applications: Epilepsy, Sleep disorder and Human Brain-Computer Interface (HCI/BCI), Sensory (Pain, temp, touch, pressure) and Motor components , Muscles and EMG.

Unit V: Biomedical Equipment (08)

ICU equipment: Bedside Monitors, Central Monitoring System, Diagnostic Equipment: Block diagram of X-Ray machine, CT Scan and MRI machines, Ultrasound Imaging, Life saving equipment: Pacemakers, Defibrillators and Ventilators

Unit VI: Applications of AI and ML Techniques in Biomedical Field (08)

Overview of AI/ML (SVM, Clustering, KNN) techniques and Neural Networks, Representation of biomedical signals, Data exploration and processing, Applications to image analysis (X-rays) and Time-series (ECG and EEG signals)

Text Books:

1. Joseph J. Carr and John M. Brown, **"Introduction to Biomedical Equipment Technology"**, *Prentice Hall India*, (4th Edition), (2000).
2. R. Rangayyan, **"Biomedical Signal Analysis"**, *Wiley India Pvt. Limited*, (1st Edition), (2002).
3. R. S. Khandpur**, "Handbook of Biomedical Instrumentation",** *Tata McGraw Hill*, (2nd Edition), (2003).

Reference Books:

1. D. C. Reddy **"Biomedical Signal Processing: Principles and techniques",** *Tata McGraw*, (1st Edition), (2005).
2. Bruce, **"Biomedical Signal Processing & Signal Modeling",** *Wiley India Pvt. Limited*, (Wiley student edition), (2009).
3. John L. Semmlow, **"Bio-signal and Medical Image Processing",** *CRC Press*, (2nd Edition), (2009).

Online Recources:

1. NPTEL Course **"Biomedical Signal Processing"** https://nptel.ac.in/courses/108/105/108105101/:

20PEEC601C POWER ELECTRONICS

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: 20ES01: Basic Electrical and Electronics Engineering

Course Objectives:
1. To explain the power devices structure and characteristics
2. To study electrical motors and use power converters to control motor speed
3. To analyze the power converters
4. To calculate the performance parameters of power converters
5. To explain power converter applications

Course Outcomes:
After completion of the course, students will be able to
CO1 Describe the structure of power devices and their characteristics
CO2 Explain the construction and characteristics of electrical motors
CO3 Analyse power converters and determine their performance parameters
CO4 Select and justify the use of suitable power converter for the given application

Unit I: Power Devices (07)
SCR, Power MOSFET, IGBT: Construction, Turn on mechanism, Static and Dynamic Characteristics, Gate drive circuits, Isolation techniques, SCR specifications and ratings, Gate-cathode characteristic, Line and Forced commutation.

Unit II: Introduction to Motors (06)
DC motors (Shunt and Series): Working principle, Load characteristics, Speed-torque characteristic, Field control of series motor, Motoring and braking principle, Induction motor: Speed-torque characteristic, Operation of induction motor from non-sinusoidal supply, Basic blocks of drives.

Unit III: Phase Controlled Rectifiers (10)
Analysis of single-phase semi converters and full converters for R and R-L, R-L-E load, Quadrant operation of converter, Effect of freewheeling diode, Performance parameters, Fourier analysis of supply current, Three phases converters for R load, Speed control of dc motor using phase-controlled rectifiers.

Unit IV: AC Voltage Controllers (05)
Single Phase AC voltage controller for R and R-L load, Three Phase AC voltage controller for R load, Light dimmer, Induction heating.

Unit V: Inverters (08)
Single-phase half bridge and full bridge inverters for R and R-L load and their performance parameters, Three phase bridge inverters for R load (120° and 180° mode operation),
PWM inverters, Single pulse and multiple pulse inverters, Stator voltage control and variable frequency control of induction motors using VSI, ONLine and OffLine UPS.

Unit VI: Choppers **(06)**

Step-down chopper with R and R-L load, Step-up chopper for R load, Control strategies for output voltage control, Two quadrant and Four quadrant choppers, Motoring and braking of dc motor using chopper, SMPS.

Text Books:

1. M. H. Rashid, **"Power Electronics Circuit, Device and Application",** *Prentice Hall (PHI),* (3rd Edition), (2009).
2. M. D. Singh and K. B. Khanchandani, **"Power Electronics",** *Tata McGraw-Hill,* (2nd Edition), (2008).
3. Nagarath, D. P. Kothari, "**Electrical machines"**, *Tata McGraw-Hill,* (3rd Edition), (1998).
4. Ned Mohan, T. M. Undeland, and W.P. Robbins, **"Power Electronics Converter Application and Design",** *John Wiley and Sons,* (3rd Edition), (2009).
5. Vedam Subramhanyam, **"Electric drives-Concepts and Applications",** *Tata McGraw-Hill,* (2nd Edition), (2011).

Reference Books:

1. M. S. Jamil Asghar, **"Power Electronics",** *Prentice Hall* **(***PHI), New Delhi,* (1st Edition), (2011).
2. P. C. Sen, **"Power Electronics"**, *John Wiley and Sons,* (1st Edition), (2008).

Online Resources:

1. **NPTEL Course "Power Electronics"** https://nptel.ac.in/courses/108/105/108105066/
2. **NPTEL Course "Fundamentals of Electric Drives"**https://nptel.ac.in/courses/108/104/108104140/

20PEEC601D DEEP LEARNING

Teaching Scheme
Lectures: 3 Hours / Week

Examination Scheme
In Semester: 50 Marks
End Semester: 50 Marks
Credits: 3

Prerequisite: 20EC403 Machine Learning with Python

Course Objectives:

1. To introduce basic concepts and learning algorithms of Artificial Neural Networks
2. To become familiar with feedforward and recurrent neural networks
3. To build CNN model and elaborate effects of hyperparameters on its performance
4. To get detailed insight of deep learning algorithms and their applications to solve real world problems

Course Outcomes: *

After completion of the course, students will be able to

CO1 Explain basic concepts of neural network and its learning algorithms
CO2 Calculate feature map dimensions and learnable parameters in Convolutional Neural Network (CNN)
CO3 Analyze effects of hyperparameter tuning on the performance of L-layer deep networks and interpret results
CO4 Solve image recognition and classification problems using pretrained CNN architectures
CO5 Compare recurrent neural networks, their types for sequence data processing and explain gradient issues
CO6 Design a deep neural network architecture to solve real-world problems

Unit I: Basics of Artificial Neural Network (09)

Biological neuron, McCulloch–Pitts unit and Thresholding logic, Linear Perceptron, Perceptron learning algorithm, Linear separability, Activation functions, Feedforward networks: Multilayer Perceptron, Gradient Descent, Backpropagation

Unit II: Deep Neural Networks (09)

Deep feedforward networks, Architecture design, Gradient based learning, Vanishing and exploding gradients, Regularization, Optimization methods (AdaGrad, AdaDelta, RMSProp, Adam, NAG) for training deep models, Hyperparameters.

Unit III: Convolutional Neural Networks (09)

Building blocks of Convolutional Neural Network (CNN), Convolution operation and layer, Kernels and Filters, Pooling layer, Stacking of layers, Cross-validation, Data augmentation, Transfer learning, Modern CNN architectures: AlexNet, VGGNet, GoogLeNet, ResNet, Autoencoder.

Unit IV: Sequence Modeling (09)

Recurrent Neural Network (RNN), Types of RNN, Bidirectional RNNs, Back propagation through time (BPTT), Vanishing Gradients with RNNs, Gated Recurrent Unit (GRU), Long Short-Term Memory (LSTM).

Unit V: Applications of Deep Learning (06)

Applications of CNN: Object recognition, Image classification.
Applications of RNN: Speech, language, and text processing.

Text Books:

1. Laurene Fausett, **"Fundamentals of Neural Networks: Architectures, Algorithms and Applications"**, *Pearson Education*, (1st Edition), (2008).
2. S. N. Sivanandan and S. N. Deepa, **"Principles of Soft Computing"**, *Wiley India*, (2nd Edition), (2011).
3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, **"Deep Learning"**, *MIT Press*, (1st Edition), (2016).
4. Josh Patterson and Adam Gibson, **"Deep Learning- A Practitioner's Approach"**, *O'Reilly Media*, (1st Edition), (2017).

Reference Books:

1. Francois Chollet, **"Deep Learning with Python"**, *Manning Publications*, (1st Edition), (2018).
2. Phil Kim, **"MATLAB Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence"**, *Apress*, (1st Edition), (2017).

Online Resources:

1. NPTEL Course **"Fuzzy Logic and Neural Networks"**
   https://onlinecourses.nptel.ac.in/noc21_ge07/preview
2. NPTEL Course **"Deep Learning"**
   https://onlinecourses.nptel.ac.in/noc21_cs76/preview

20EC602L COMPUTER NETWORKS AND SECURITY LAB

Teaching Scheme
Lectures: 2 Hours / Week

Examination Scheme
In Semester: 25 Marks
Oral: 25Marks

-Course Objective

1. To configure network and client server applications
2. To use modern tools to analyse protocols
3. To implement routing algorithms
4. To implement encryption and decryption algorithms

Course Outcome

After completion of the course, students will be able to

	CO Statement
CO1	Demonstrate use of network commands
CO2	Experiment with protocol analyzer tool to study TCP/IP protocols
CO3	Utilize network simulation tool for studying IP routing protocols
CO4	Develop a program for cryptography and routing.

List of Experiments:

1. a. Study of network commands & IP address configurations.
   b. Study of Cable tester for fault detection of UTP-CAT5 Cross / Straight LAN cable
   c. Implementation of LAN using star topology and connectivity between two computers using crossover UTP CAT5 cable.
2. Installation of Suitable Protocol Analyzing software and Analysis of Intranet activities. (Wireshark)
3. Study of any network simulation tools to create a network with three nodes & establish a TCP connection between node 0 & node 1 such that node 0 will send TCP packet to node 2 via node 1.
4. Study of Network simulation tools to configure and see behavior of IP routing protocols like RIP, BGP etc.)
5. a. Installation and configuration of Web Server and hosting web pages using HTML programming.
   b. Installation and configuration of FTP server for FTP communication.
6. Write C/Java code for socket programming.
7. Write a program for Encryption and Decryption(RSA, Substitution)
8. Write a program in C for the Shortest Path algorithm.
9. Simulate DDoS attacks on a server, in a lab environment.

20PEEC601LA ROBOTIC LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester : 25Marks
Practical: 25 Marks
Credits: 1

Course Objectives:

1. To demonstrate robot working and degree of freedom using physical components
2. To demonstrate robot functioning using simulation software
3. To design microcontroller based robotic system for specific task

Course Outcomes:

After completion of the course, students will be able to

CO1 Explain mechanical configuration of robot manipulation
CO2 Select sensors and actuators used in robot manipulation
CO3 Apply formulation to simulate to obtain work space, kinematics, Dynamics and trajectory path of robot manipulator
CO4 Develop robot for specified task

List of Experiments:

1. Velocity and Position measurement using optical encoder.
2. Interface Pneumatic system component to actuate single acting and double acting cylinders.
3. Plot of work space of 2-link planer arm using simulation software.
4. Simulation of Forward Kinematics and Inverse Kinematic of
    1. 3-Link Robot
    2. PUMA 560 Robots.
5. Simulation of Dynamics of 3 link robot
6. Simulation of Trajectory and Path planning of :
    1. 3-Link Robot
    2. PUMA 560 Robots.
7. Hardware simulation of 3 Link robotic arm.
8. Design Robot for any application.

20PEEC601LB BIOMEDICAL ELECTRONICS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester : 25Marks
Practical: 25 Marks
Credits: 1

Course Objectives:
1. To understand signal acquisition of some of the bio signals
2. To explore and select appropriate signal conditioning techniques
3. To study different AI/ML techniques for analysis and automatic classification

Course Outcomes:
After completion of the course, students will be able to
CO1 Compare the performances of different sensors used in Biomedical Applications
CO2 Select and Apply appropriate signal conditioning techniques to the different biomedical signals
CO3 Implement spectral analysis techniques on Biomedical signals
CO4 Develop a microcontroller based system to acquire the real life biosignal and perform analysis of the same

List of Experiments:

1. Temperature measurement using AD590 / LM35/Digital sensor
2. Measure ECG and Heart rate (photoelectric transducers/ finger plethysmography) : Normal and after exercise, Raw signal and after signal conditioning
3. Measure EMG for different muscles while performing any actions
4. Measurement of unknown resistance by using a Strain Gauge/Load cell in the Wheatstone bridge and finding the sensitivity of the bridge
5. Measurement of blood pressure using sphygmomanometer and automatic digital BP instrument (Test points on a Trainer kit). Finding the systolic and diastolic values and calculate Mean Arterial Pressure (MAP)
6. Use of AI/ML techniques for analyzing the spectrum of ECG/EEG/PCG signals
7. Open ended assignment

20PEEC601LC POWER ELECTRONICS LAB

Teaching Scheme
Practical: 2 Hours / Week

Examination Scheme
In Semester : 25Marks
Practical: 25 Marks
Credit: 1

Course Objectives:

1. To demonstrate torque-speed characteristic of dc and ac motors
2. To analyze synchronization in gate drive circuits of the power converters
3. To demonstrate the applications of power converters
4. To compare the output voltage waveforms of power converters for R and R-L loads
5. To examine the power converter using simulation tool

Course Outcomes:

After completion of the course, students will be able to

CO1 Test synchronization in gate drive circuits of power converters
CO2 Analyse the output of power converters for different values of firing angles and duty cycles
CO3 Apply power converters for speed control of motors
CO4 Analyse the power converter performance using simulation tool

List of Experiments:

1. Plot torque-speed characteristics of the DC motor and Induction motor.
2. Simulation of half controlled bridge rectifier and testing the effect of firing angle change on the output.
3. Speed control of a DC motor using a half controlled bridge rectifier circuit.
4. Analysis of the output of a single phase fully controlled bridge rectifier for R, R-L load and R-L with flywheel diode.
5. Test the gate drive circuit and analyse the effect of change of duty cycle on the output of Step-down chopper. Analyse the effect of using a filter at the output.
6. Simulation and analysis of full bridge inverter.
7. Analyse the waveforms of the triggering circuit, output of power circuit and measure the output voltage of ac voltage controller.
8. Speed control of induction motor using ac to ac converter/ inverter.

20PEEC601LD DEEP LEARNING LAB

Teaching Scheme
Practical: 2 Hours /Week

Examination Scheme
In Semester : 25Marks
Practical: 25 Marks
Credits: 1

Course Objectives:

1. To implement Artificial Neural Networks (ANN), Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN)
2. To get familiar with deep learning frameworks and Python libraries used for Deep Learning
3. To apply ANN, CNN and RNN algorithms to solve real-world problems

Course Outcomes:

After completion of the course, students will be able to-

CO1	Apply neural network learning methods and transfer learning for classification/regression applications
CO2	Select a suitable Convolutional Neural Network architecture and hyperparameters to solve real-world image classification, object recognition problems
CO3	Develop an algorithm for text processing and time series prediction using Recurrent Neural Networks and Long Short-Term Memory
CO4	Analyze performance of Deep Learning models based on different evaluation metrics

List of Experiments:

1. Introduction to Python libraries (Keras, TensorFlow) for deep learning.
2. Write a program to implement a Perceptron learning algorithm.
3. Write a program to perform classification (on Kaggle dataset) using Backpropagation.
4. Develop an algorithm and write a program for image classification using Convolutional Neural Network.
5. Write a program to implement image recognition using transfer learning.
6. Develop an algorithm and write a program for object detection using Convolutional Neural Network.
7. Develop an algorithm and write a program to predict the stock prices based on historic data using Long Short-Term Memory/ Gated Recurrent Unit.
8. Develop an algorithm and write a program for text preprocessing and text summarization using Recurrent Neural Network.