SYLLABUS FOR FOUR YEARS UG PROGRAMME

in

B.Sc.(H) Electronics

with Major in

Digital Electronics

Minor in

Solar Photovoltaic Systems/Data Science

Under

APPRENTICESHIP EMBEDDED DEGREE PEOGRAMS(AEDPs)

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Course Structure for Four Year UG Program of B.Sc.(H) Electronics with Major in Digital Electronics Minor in Solar Photovoltaic Systems/ Data Science for Apprenticeship Embedded Degree Programs (AEDPs)

Semester	Type of Course	Credits	Course Title
I	MJC-1 (T)	4	Circuit Analysis and Network Synthesis
	MJC-1 (P)	2	Circuit Analysis and Synthesis Lab
	MIC-1 (T)	2	Engineering Mathematics
	MIC-1 (P)	1	Engineering Mathematics Using MATLAB/R/Python/SciLab
	MDC-1	3	Fundamental of Computer and Programming in C & Python
	SEC-1	3	Human Resource Management or other from Basket
	AEC-1	2	Communicative English or other from Basket
	VAC-1	3	Fundamentals of Indian Constitution or other from Basket
	Total Credits: 20		
II	MJC-2 (T)	4	Electronic Devices and Circuits
	MJC-2 (P)	2	Electronic Devices and Circuits Lab
	MIC-2 (T)	2	An Introduction to Data Science or An Introduction to Optoelectronics and Photovoltaic Devices
	MIC-2 (P)	1	Data Analysis using MATLAB/Python or Photovoltaic Lab
	MDC-2	3	Computational Statistics MATLAB/R/Python
	SEC-2	3	Digital Marketing or other from Basket
	AEC-2	2	Environmental Awareness or other from Basket
	VAC-2	3	Vedic Mathematics or other from Basket
	Total Credits: 20		
III	MJC-3 (T)	3	Basic Digital electronics
	MJC-3 (P)	2	Basic Digital Electronics Lab
	MJC-4 (T)	3	Microprocessor and Microcontroller
	MJC-4 (P)	1	Microprocessor and Microcontroller Lab
	MIC-3 (T)	2	Grid Connected Photovoltaic Systems or Digital Signal Processing
	MIC-3 (P)	1	Solar Grid Connected Photovoltaic Systems Lab or Digital Signal Processing Lab
	MDC-3	3	Data Base Management Systems (DBMS)
	SEC-3	3	Computer Graphics Design or other from Basket
	AEC-3	2	Minor Project on Solar energy/Data analysis or other from Basket
	Total Credits: 20		
IV	MJC-5 (T)	3	Communication Electronics
	MJC-5 (P)	2	Communication Electronics Lab
	MJC-6 (T)	3	Fundamental of Embedded System and IoT
	MJC-6 (P)	2	Embedded System & IoT Lab
	MJC-7 (T)	3	Advance Digital Electronics
	MJC-7 (P)	2	Advance Digital Electronics Lab
	MIC-4	3	Fundamental of Artificial Intelligence and Logic Programming

Semester	Type of Course	Credits	Course Title
	AEC-4	2	Fundamental of Electronic Measurements and Troubleshooting or other from Basket
	Total Credits: 20		
V	Apprenticeship	**20**	Apprenticeship
VI	Apprenticeship	**20**	Apprenticeship
VII	MJC 8 (T)	3	Control Theory
	MJC 8 (P)	2	Control Theory Lab
	MJC 9 (T)	3	Fundamental of Robotics and its applications
	MJC 9 (P)	2	Robotics Lab
	MIC 5 (T)	2	SPV Grid Connected Systems: Design and economics or Computational Intelligence and Machine Learning
	MIC 5 (P)	1	SPV Lab or AI Lab
	MIC 6 (T)	3	Web Designing
	MIC 7 (T)	4	Electronic Project Management and Development of Entrepreneurship Competency
	Total Credits: 20		
VIII (CGPA 7.5 and above) upto VI semester	MJC 10	4	Research Methodology
	MJC11	4	Medical Electronics /Advance Communication System
	Project	12	Research Project/
	Total Credits: 20		
VIII (CGPA less than 7.5) upto VI semester	MJC 10	4	Research Methodology
	MJC11	4	Medical Electronics /Advance Communication System
	MJC 12 (T)	**4**	Instrumentation & Automation
	MJC 12 (P)	**2**	Instrumentation & Automation Lab
	MJC13 (T)	**4**	Consumer and Industrial Electronics
	MJC13 (P)	**2**	Consumer and Industrial Electronics Lab
Total Credits: 20			

Course Basket

Course Basket for Skill Enhancement Course		
	Course Code	**Course Options**
Semester 1	SEC-1	1. Human Resource Management 2. Office Automation Tools 3. Basics of E-Commerce
Semester 2	SEC-2	1. Digital Marketing 2. Big Data Analysis 3. Introduction to Cloud Computing
Semester 3	SEC-3	1. Computer Graphics Design 2. Basics of PCB Design and Fabrication 3. Visual Communication & Photography

Course Basket for Ability Enhancement Course		
Semester	**Course Code**	**Course Options**
Semester 1	AEC-1	1. Communicative English 2. Personality Development and Communication
Semester 2	AEC-2	1. Environmental Awareness 2. Disaster Risk Management
Semester 3	AEC-3	1. Minor Project on Solar Energy 2. Minor Project on Data Analysis 3. Internship/Industrial Exposure
Semester 4	AEC-4	1. Fundamentals of Electronic Measurement and Troubleshooting 2. Basic Safety & Quality Control 3. Startup and Innovation

Course Basket for Value Added Course		
Semester	**Course Code**	**Course Options**
Semester 1	VAC-1	1. Fundamentals of Indian Constitution 2. Ethics in Science and Technology 3. E-Waste Management 4. Digital Citizenship
Semester 2	VAC-2	1. Vedic Mathematics 2. Yoga Philosophy & Practice 3. Ayurveda and Nutrition 4. Emotional Intelligence

Semester-I: Major Core Course (MJC)

Major Course-1 (MJC-1): Circuit Analysis and Network Synthesis

Credit: 04 (Theory) Lectures:60

Course Objective

To provide students with a fundamental understanding of electric and electronic circuits, their analysis in DC and AC domains, network theorems, and two-port network parameters, along with the basics of network functions and synthesis.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the concepts of basic circuit elements, voltage/current sources, and apply Laplace transforms for analyzing electrical networks.

CO 2: Apply Kirchhoff's laws, node and mesh analysis techniques, and perform transient analysis of RL, RC, and RLC circuits.

CO 3: Analyze AC circuits for voltage, current, power, resonance, frequency response, and design simple passive filters.

CO 4: Solve networks using various theorems, characterize two-port networks, and interpret network functions, poles, zeros, and basics of network synthesis.

Syllabus Contents

Unit-1 Basic Circuit Concepts (13 Lectures)

Voltage and Current Sources, Regulated DC power supply, Controlled sources, Basic Circuit Elements R, L, C. Lumped and distributed circuit Elements, **Resistors:** Fixed and Variable resistors; construction, characteristics, and colour coding; resistors in series and parallel. **Inductors:** Fixed and Variable inductors; Transformer and its working principle, **Capacitors:** Principles of capacitance; parallel plate capacitor; permittivity; dielectric constant; dielectric strength; energy stored in a capacitor; Concept of Network, Differential equation, Laplace transform and its role in Network analysis, Network Models, Representation of Basic Network Elements in transform domain. Transform Network

Unit-2 Circuit Analysis (12 Lectures)

Kirchhoff's Current Law (KCL) and Voltage Law (KVL), Node analysis, Mesh analysis, Star-Delta Conversion. Introduction to some software used in circuit analysis and simulation

DC Transient Analysis in time domain and transform domain: RC Circuit: charging and discharging with initial charge, RL Circuit: initial current, time constant, RL and RC circuits with sources, DC response of series RLC circuits.

Unit-3 AC Circuit Analysis (14 Lectures)

Sinusoidal voltage and current, instantaneous, peak, peak-to-peak, RMS and average values. Voltage-current relationships in resistor, inductor, capacitor; phasor, complex impedance. Power in AC circuits: instantaneous power, average power, reactive power, power factor. Sinusoidal analysis for RL, RC, RLC circuits; resonance in series and parallel RLC circuits. Frequency response, quality factor (Q), bandwidth. Passive filters: low pass, high pass, band pass, band stop.

Unit-4 Network Theorems (15 Lectures)

Thevenin's, Norton's, Reciprocity, Millman's, Maximum power transfer theorem, Principle of duality, Superposition theorem, Compensation Theorem, Tellegen's theorem, AC circuit analysis with the help Network theorems.

Two-Port Networks: Impedance (Z), admittance (Y), Hybrid Parameter (h), inverse hybrid parameter (g), transmission line (ABCD) parameters.

Unit-5 Network Function and its Synthesis (6 Lectures)

Transfer function, Network function, Positive Real function, Concept of pole and zero, Introduction to Network Synthesis, Concept of Foster and Cauer realizations.

Suggested Books:

1. S. A. Nasar, Electric Circuits, Schaum's Outline Series, Tata McGraw Hill (2004)
2. M. Nahvi, J. Edminister, Electrical Circuits, Schaum's Outline Series, Tata McGraw Hill (2005)
3. Robert L. Boylestad, Essentials of Circuit Analysis, Pearson Education (2004)
4. W. H. Hayt, J. E. Kemmerly, S. M. Durbin, Engineering Circuit Analysis, Tata McGraw Hill (2005)
5. Alexander & M. Sadiku, Fundamentals of Electric Circuits, McGraw Hill (2008)
6. David A. Bell, Electric Circuits, Oxford University Press

Semester-I: Major Core Course (MJC)

Major Course-1 (MJC-1): Circuit Analysis and Network Synthesis Lab

Credit: Practical-02 Lectures: 60 h

Course Objective

To impart practical knowledge of basic circuit elements and networks through hands-on experiments and simulations, enabling students to verify theoretical principles, analyze circuit responses, and effectively use electronic instruments and software tools.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Perform experiments to verify Kirchhoff's laws, Thevenin's, Norton's, Superposition, and Maximum Power Transfer theorems, and analyze practical circuits using CRO measurements.

CO 2: Design and analyze the frequency response of low pass and high pass RC filters and understand their practical applications.

CO 3: Use circuit simulation tools like Pspice and ADS to model, analyze, and interpret DC and AC circuit behaviors.

Syllabus Contents

1. **Familiarization with:**
   (a) Resistance in series, parallel, and series–parallel combinations.
   (b) Capacitors and inductors in series and parallel.
   (c) Multimeter: Checking of components.
   (d) Voltage sources in series, parallel, and series-parallel.
   (e) Voltage and current dividers.
2. **Simulation, verification and realization of following**
   a) Measurement of amplitude, frequency, and phase difference using CRO.
   b) Kirchhoff's Laws.
   c) Norton's Theorem and Thevenin's Theorem.
   d) Superposition Theorem.
   e) Maximum Power Transfer Theorem.
3. **Design and study**
   a) Low Pass RC Filter and its frequency response.
   b) High Pass RC Filter and its frequency response.
   c) DC and AC circuit analysis using Pspice and ADS/ nl5/MATLAB/OCTAVE

Semester I- Minor Course (MIC)

Minor Course-1 (MIC-1): Engineering Mathematics

Credit: 02 (Theory) Lectures:30

Course Objective

To provide students with foundational knowledge of differential equations, matrices, transforms, complex variable functions, and rigid body kinematics, enabling them to apply mathematical techniques to solve engineering and physical problems.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Solve first and second order ordinary differential equations and apply series methods to obtain solutions involving special functions like Legendre and Bessel functions.

CO 2: Analyse systems of linear equations using matrix methods, compute eigenvalues and eigenvectors, apply Cayley-Hamilton theorem, and perform diagonalization of matrices.

CO 3: Apply Laplace, Fourier, and Z-transforms to solve differential and difference equations and analyse signals and systems.

CO 4: Understanding functions of complex variables, evaluate integrals using Cauchy's theorems and residue calculus, and analyse rigid body motion including basic 2D robotic structures.

Syllabus Contents

Unit-1 Ordinary Differential Equations (07 Lectures)

First order ODEs: basic concepts, separable, exact, linear ODEs, Second order ODEs: homogeneous and non-homogeneous.

Series Solutions & Special Functions: Power series method, Legendre polynomials, Frobenius method. Bessel's equations and Bessel functions (first and second kind). Error functions and gamma function.

Unit-2 Matrices (08 Lectures)

Introduction to matrices, system of linear algebraic equations, Gaussian elimination, Gauss-Seidel method, LU decomposition. Solution of linear systems by LU decomposition. Eigen values & eigen vectors, linear transformation, properties. Cayley-Hamilton theorem,

diagonalization, powers of a matrix. Real & complex matrices: symmetric, skew symmetric, orthogonal quadratic form, Hermitian, skew Hermitian, unitary matrices. Introduction to some Software using matrix as data structure.

Unit-3 Basic Transforms (05 Lectures)

Laplace transformation, Fourier series, Fourier transformation, Z- transformation

Unit-4 Complex Variables and Functions (07 Lectures)

Complex variables and functions: continuity, differentiability, analyticity. Cauchy-Riemann (C-R) equations, harmonic & conjugate harmonic functions. Exponential, trigonometric, hyperbolic functions. Line integrals in complex plane, Cauchy's integral theorem & formula. Derivative of analytic functions. Sequences, series & power series, Taylor & Laurent series. Zeros and poles, residue integration method, residue integration of real integrals.

Unit-5 Rigid body kinematics (03 Lectures)

Rigid body, Rigid body kinematics, Plane kinematics of rigid body motion and rotation, absolute and relative motion analysis- velocity, acceleration, frame of references, Simple robotic structure-2D planner robots

References

1. E. Kreyszig, *Advanced Engineering Mathematics*, Wiley India (2008).
2. Murray Spiegel, Seymour Lipschutz, John Schiller, *Outline of Complex Variables*, Schaum Outline Series, Tata McGraw Hill (2007).
3. R. K. Jain, S. R. K. Iyengar, *Advanced Engineering Mathematics*, Narosa Publishing House (2007).
4. C. R. Wylie, L. C. Barrett, *Advanced Engineering Mathematics*, Tata McGraw-Hill (2004).
5. B. V. Ramana, *Higher Engineering Mathematics*, Tata McGraw Hill Publishing Company.
6. S. S. Sastry, *Introductory Methods of Numerical Analysis*, Prentice Hall India (2008).
7. MIT Open Course Ware: Course 6.094, Introduction to MATLAB, https://ocw.mit.edu.

Semester I- Minor Course (MIC)

Minor Course-1 (MIC-1): Engineering Mathematics Lab

Credit: 01 (Practical) Lectures:30

Course Objective

To develop computational skills for solving mathematical problems involving differential equations, matrix operations, transforms, and rigid body modelling using MATLAB, R, or Python.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Solve first order differential equations and perform matrix algebra operations using MATLAB/R/Python.

CO 2: Implement algorithms for solving systems of linear equations, finding roots of equations, eigenvalues, eigenvectors, and performing SVD decomposition.

CO 3: Develop programs to compute and analyze Laplace and Fourier transforms for mathematical and engineering applications.

CO 4: Model and analyze simple rigid body tree structures of robots computationally.

Syllabus Contents

1. Solution of First Order Differential Equations using symbolic mathematics toolbox in MATLAB
2. Learning the matrix algebra using MATLAB/R/ Python
3. Solving linear equation in MATLAB/R/Python
4. Finding Roots of Equations: Implementing methods like Newton-Raphson or bisection
5. Finding Eigenvalues and Eigen Vectors, SVD Decomposition
6. Computer programs for different transforms such as Fourier, Laplace
7. Study on rigid body tree model of robots

Semester I- Multidisciplinary Course (MDC)

Multidisciplinary Course-1 (MDC-1):

Fundamental of Computer and Programming in C & Python

Credit: 03 (Theory) Lectures: 45

Course Objective

To introduce students to the fundamentals of programming using C and Python languages, enabling them to develop logical thinking and implement solutions to computational problems through structured programming concepts.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Understand the basic concepts of C programming, including data types, operators, expressions, and write simple structured programs.

CO 2: Implement decision-making, branching, looping, and modular programming using functions in C.

CO 3: Explain the fundamentals of Python programming, its syntax, data types, operators, and error handling mechanisms.

CO 4: Develop Python programs using conditional statements and various looping constructs to solve computational problems.

Syllabus Contents

Unit- 1 (15 Lectures)

C Programming Language: Introduction, Importance of C, Character set, Tokens, keywords, identifier, constants, basic data types, variables: declaration & assigning values. Structure of C program, Arithmetic operators, relational operators, logical operators, assignment operators, increment and decrement operators, conditional operators, bit wise operators, expressions and evaluation of expressions, type cast operator, implicit conversions, precedence of operators.

Unit-2 (15 Lectures)

Decision making, branching & looping: Decision making, branching and looping: if, if-else, else-if, switch statement, break, for loop, while loop and do loop. Functions:

Defining functions, function arguments and passing, returning values from functions.

Unit-3 (15 Lectures)

Python Programming: Introduction, History, features, Installing Python, Running Python program, Debugging : Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages, The Difference Between Brackets, Braces, and Parentheses, Variables and Expressions Values and Types, Variables, Variable Names and Keywords, Type conversion, Operators and Operands, Expressions, Interactive Mode and Script Mode, Order of Operations. **Conditional Statements**: if, if-else, nested if –else **Looping:** for, while, nested loops

Suggested Books:

1. Yashavant Kanetkar, Let Us C , BPB Publications
2. Programming in ANSI C, Balagurusamy, 2nd edition, TMH.
3. Byron S Gottfried, Programming with C , Schaum Series
4. Computer system Architecture- M. M . Mano (PHI)
5. Computes Organization & Architecture-William Stallings (PHI)
6. Ellis Horowitz and Sartaz Sahani “Fundamentals of Computer Algorithms”, ComputerScience Press.
7. Introduction to Problem Solving with Python E. Balagurusamy TMH 1st 2015
8. Think Python Allen Downey O’Reilly 1st 2012

Semester-II: Major Core Course (MJC)

Major Course-2 (MJC-2): Electronic Devices and Circuits

Credit: 04 (Theory) Theory Lectures:60

Course Objective

To provide a comprehensive understanding of semiconductor physics and the operation, characteristics, and applications of various electronic devices including diodes, transistors, and field-effect transistors.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain semiconductor material properties, carrier concentration, transport phenomena, and analyze current flow using continuity and current density equations.

CO 2: Describe the working, characteristics, and applications of p-n junction diodes, including Zener, tunnel, varactor diodes, and solar cells.

CO 3: Analyze the structure, operation, input/output characteristics, and biasing of BJTs in different configurations, and explain concepts like base-width modulation and energy band diagrams.

CO 4: Understand the construction, operation, and characteristics of JFETs, MOSFETs, CMOS, and apply transconductance models to analyze FET behavior.

Syllabus Contents

Unit 1 **(**15 Lectures)

Semiconductor Basics: Introduction to Semiconductor Materials, Energy Band in Solids, Concept of Effective Mass, Density of States, Carrier Concentration at Normal Equilibrium in Intrinsic Semiconductors, Derivation of Fermi Level for Intrinsic & Extrinsic Semiconductors, Donors, Acceptors, Dependence of Fermi Level on Temperature and Doping Concentration, Temperature Dependence of Carrier Concentrations. Carrier Transport Phenomena: Carrier Drift, Mobility, Resistivity, Hall Effect, Diffusion Process, Einstein Relation, Current Density Equation, Carrier Injection, Generation and Recombination Processes, Continuity Equation.

Unit 2 (15 Lectures)

P-N Junction Diode: Diode and I-V Characteristics. Zener diode, Zener and Avalanche Junction Breakdown Mechanism, Rectification, Uncontrolled Rectifier, Zener diode as Voltage regulator, Clipper, Clamper

Derivation of Diode Equation, Formation of Depletion Layer, Space Charge at a Junction, Derivation of Electrostatic Potential Difference at Thermal Equilibrium. Concept of Linearly Graded Junction, Tunnel diode, varactor diode, solar cell: circuit symbol, characteristics,

Unit 3 (15 Lectures)

Bipolar Junction Transistors (BJT): PNP and NPN Transistors, Basic Transistor Action, Current Gain, Transistor Biasing, Transistor as an amplifier, h parameter equivalent circuit of transistor.

Energy Band Diagram of Transistorin Thermal Equilibrium, Quantitative Analysis of Static Characteristics (Minority Carrier Distribution and Terminal Currents), Base-Width Modulation, Modes of operation, Input and Output Characteristics of CB, CE and CC Configurations.

Unit 4 (15 Lectures)

Field Effect Transistors: JFET, Construction, Idea of Channel Formation, Pinch-Off and Saturation Voltage, Current-Voltage Output Characteristics. MOSFET, types of MOSFETs, Circuit symbols, Working and Characteristics of Depletion type MOSFET and Enhancement type MOSFET. Complimentary MOS (CMOS). Transconductance model of FET,

Suggested Books:

1. S. M. Sze, Semiconductor Devices: Physics and Technology, 2nd Edition, Wiley India edition (2002).
2. Ben G Streetman and S. Banerjee, Solid State Electronic Devices, Pearson Education (2006)
3. Jasprit Singh, Semiconductor Devices: Basic Principles, John Wiley and Sons (2001)
4. Kanaan Kano, Semiconductor Devices, Pearson Education (2004)

Semester-II: Major Core Course (MJC)

Major Course-2 (MJC-2): Electronic Devices and Circuits Lab

Credit: 02 (Practical) Theory Lectures:60

Course Objective

To enable students to experimentally investigate the characteristics and behaviors of various semiconductor devices, reinforcing theoretical concepts through practical measurements and analysis.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Plot and interpret the I-V characteristics of diodes (ordinary and Zener) and understand their applications in rectification and voltage regulation.

CO 2: Analyze the input and output characteristics of BJTs in CE, CB, and CC configurations to determine current gains and operating regions.

CO 3: Examine the I-V characteristics of UJT, SCR, JFET, and MOSFET to understand their operation and device parameters.

CO 4: Demonstrate and analyze the Hall Effect to determine carrier type and mobility in semiconductor materials.

Syllabus Contents

1. Study of the I-V Characteristics of Diode Ordinary and Zener Diode.
2. Study of the I-V Characteristics of the CE configuration of BJT.
3. Study of the I-V Characteristics of the Common Base Configuration of BJT.
4. Study of the I-V Characteristics of the Common Collector Configuration of BJT.
5. Study of the I-V Characteristics of the UJT.
6. Study of the I-V Characteristics of the SCR.
7. Study of the I-V Characteristics of JFET.
8. Study of the I-V Characteristics of MOSFET.
9. Study of Hall Effect.
10. Obtaining I-V characteristics of devices in nl5/MATLAB

Semester II- Minor Course (MIC)

Minor Course-2 (MIC-2): An Introduction to Data Science

Credit: 02 (Theory) Lectures:30

Course Objective

To introduce students to the fundamental concepts, life cycle, tools, and techniques of Data Science, along with its practical applications across various domains.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the key components of Data Science, its life cycle, roles, and ethical considerations, and illustrate its use cases in diverse domains.

CO 2: Describe the challenges of handling large data sets, and apply data preprocessing techniques including cleaning, integration, transformation, reduction, and discretization.

CO 3: Differentiate among types of data (structured, semi-structured, unstructured) and data analysis methods (descriptive, exploratory, predictive, inferential), and perform basic model evaluation and decision making

CO 4: Identify and utilize tools and programming platforms (R, MATLAB/OCTAVE) for data storage, analysis, visualization, and gain an introductory understanding of machine learning applications in Data Science through case studies.

Syllabus Contents

Unit 1: Introduction to Data Science (5 lectures)

Introduction to Data Science, Key components in Data Science, Use cases from different application domains such as Banking, Retail, Telecom, Life Science and Healthcare, etc, Data Science life cycle, the roles in a Data Science stream, Challenges involved in Data Science, Ethics in Data Science

Unit 2: Challenges in handling large data (5 lectures)

Challenges in handling large data sets, Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data, Integration and Transformation – Data Reduction – Data Discretization.

Module 3: Characteristics of Data (3 lectures)

Characteristics of Data – Big data introduction, Structured, Semi-structured and Unstructured data, data at rest, data in motion, etc, good data versus bad data

Unit 4: Types of Data Analysis (10 lectures)

Types of Data Analysis – Descriptive, Exploratory, Predictive, Inferential, Steps in Data Analysis, model development and evaluation Simple and Multiple Regression – Model Evaluation using Visualization – Residual Plot –Distribution Plot – Polynomial Regression and Pipelines – Measures for In-sample Evaluation – Prediction and Decision Making.

Unit 5: Data Science and Machine Learning Tools (7 lectures)

Tools used in Data storage, Databases, Data Analysis, Data Visualization, Different programming tools required for Data Science. verview of Machine learning with the help of cases in Data Science, Discuss different case studies of Data Science domain.

Suggested Books:

1. An Introduction to Data Science, Jeffrey Stanton, Syracuse University
2. A Simple Introduction to DATA SCIENCE, Lars Nielsen, Noreen Burlingame
3. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontiline" by Schroff/O'Reilly, 2013.
4. Foster Provost, Tom Fawcett, "Data Science for Business" What You Need to Know About Data Mining and Data-Analytic Thinking" by O'Reilly, 2013.
5. John W. Foreman, "Data Smart: Using data Science to Transform Information into Insight" by John Wiley & Sons, 2013.

Semester II- Minor Course (MIC)

Minor Course-2 (MIC-2): An Introduction to Data Science Lab

Credit: 01 (Practical) Lectures:30

Course Objective

To develop practical skills in statistical analysis, data visualization, and data modeling using programming tools such as Python, MATLAB, R, or OCTAVE.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Implement programs to compute descriptive statistics such as mean, median, mode, standard deviation, quartiles, skewness, and kurtosis for data sets.

CO 2: Detect outliers and perform data summarization using visualizations like histograms, box plots, pie charts, and scatter plots.

CO 3: Apply data fitting techniques, particularly linear regression, and interpret model results through visualization tools.

CO 4: Utilize libraries and functions in Python, R, MATLAB, or OCTAVE for statistical analysis and effective data representation.

Syllabus Contents

1. Programming practices in Python/MATLAB/R/OCTAVE
2. Write a program that find the statistics (mean, median , mode , standard deviation)
3. Find the quartile
4. Histogram
5. Computing quartile.
6. Finding outlier in the dataset
7. Kurtosis and Skewness
8. Visualization: Box plot, pi chart and other
9. Fitting the data: Linear regression.
10. **Data Visualization:** Summary statistics (mean, median, variance, skewness, kurtosis), Histograms, boxplots, scatterplots., Plotting with matplotlib/ggplot2/MATLAB plotting functions.

Semester II- Minor Course (MIC-2)

Minor Course-2 (MIC-2): An Introduction to Optoelectronics and Photovoltaic Devices

Credit: 02 (Theory) Lectures:30

Course Objective

To provide a thorough understanding of optoelectronic devices, solar radiation principles, and the design, analysis, and performance assessment of solar photovoltaic systems.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the principles, construction, and working of various optoelectronic devices including LEDs, semiconductor lasers, photodetectors, and LCD displays.

CO 2: Analyze the geometry of solar radiation, measure and estimate solar resources on different surfaces, and interpret solar radiation data with a focus on Indian conditions.

CO 3: Describe the operation and characteristics of photovoltaic cells, modules, and arrays, including I-V curves, shading effects, MPPT techniques, and both grid-connected and stand-alone PV systems.

CO 4: Design and evaluate solar photovoltaic systems, perform shadow and reliability analyses, and understand system components such as regulators, inverters, and concentrating systems along with testing methods.

Syllabus Contents

Unit-1 Optoelectronics (10 Lectures)

Optoelectronic Devices: Classification of Photonic Devices, Interaction of Radiation and Matter, Radiative Transition and Optical Absorption, Light Emitting Diodes, Construction, Materials and Operation, Semiconductor Laser, Condition for Amplification, Laser Cavity, Photodetectors: Photoconductor, Photodiodes (p-i-n, Avalanche) and Photo Transistors, Quantum Efficiency and Responsivity, Photomultiplier Tube. LCD Displays: Types of Liquid Crystals, Principle of Liquid Crystal Displays, Applications, Advantages over LED Displays.

Unit-2: Solar Radiation and Solar Cell (10 Lectures)

Sun as Energy Source, Solar Radiation at The Earth's Surface, Solar Radiation Geometry, Solar Time and Equation of Time, Sun Earth angles, Sun path diagram, Sunshine hours, Measurement of Solar Diffuse, Global and Direct Solar Radiation, Equipment, Estimation of Solar radiation on horizontal and tilted Surfaces, Global Solar radiation data, Indian Solar Radiation data analysis, Solar Resource, Generic Photovoltaic Cell, Equivalent Circuits, Cells to Modules to Arrays, I –V Curve, Impacts of Temperature and Insolation, Shading impacts on I–V curves, I–V Curves for different loads, MPPT, Grid-Connected Systems, Stand-Alone PV Systems, Dynamics of PV generation sources. Advances in PV controls.

Unit 3: Solar photovoltaic System: (10 Lectures)

Solar cell array system analysis and performance prediction, Shadow analysis: Reliability, Solar cell array design concepts, PV system design, Design process and optimization: Detailed array design, Voltage regulation, Maximum tracking, Quick sizing method, Array protection.

Sun Simulator, Testing and performance assessment of Solar PV generator, Electronic Control and Regulation, Power Conditioning, Converters and inverter, Concentrating system, System design and configuration

Suggested Books

1. Fundamentals of Solar Cells: PV Solar Energy Conversion by AL Fahrenbruch and RH Bube, Academic Press, New York.
2. Principles of Solar Engineering by F Kreith and JF Kreider, McGraw-Hill.
3. Solar Photovoltaics. Fundamental Technologies and Application by Chetan Singh Solanki, PHI Publicaton.
4. 4.Wilson and Hawkes, Optoelectronics: An Introduction, Pearson.
5. Gupta, Optoelectronic Devices and Systems, PHI.

Semester II- Minor Course (MIC)

Minor Course-2 (MIC-2): An Introduction to Optoelectronics and Photovoltaic Devices

Credit: 01 (Practical) Lectures:30

Course Objective

To enable students to practically investigate the electrical characteristics and performance parameters of photovoltaic (PV) cells and modules under various operating conditions.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Measure and analyze the I-V characteristics of PV cells, determine maximum power point (MPP), fill factor, and efficiency.

CO 2: Examine the effects of light intensity, temperature, angle of incidence, and partial shading on PV cell and module output.

CO 3: Study the behaviour of PV cells connected in series and parallel and investigate their spectral response using different colour filters.

CO 4: Record and interpret the daily variation of PV power output, enhancing understanding of real-world PV system dynamics.

Syllabus Contents

1. Study of I-V characteristics of a PV cell
2. Determination of maximum power point (MPP) of a PV cell
3. Effect of light intensity on the performance of a PV cell
4. Effect of temperature on PV cell output parameters
5. Study of PV cells connected in series and parallel
6. Measurement of fill factor (FF) and efficiency of a PV cell
7. Spectral response of a PV cell using different color filters
8. Effect of angle of incidence of light on PV cell output
9. Study of partial shading effect on PV module output
10. Measurement of daily variation of PV power output (time of day experiment)

Semester II- Multidisciplinary Course (MDC)

Multidisciplinary Course-2 (MDC-2): Computational Statistics MATLAB/R/Python

Credit: 03 (Theory) Lectures:45

Course Objective

To introduce students to computational approaches in statistical data analysis using MATLAB, R, or Python, covering descriptive statistics, probability, statistical inference, regression, and modern computational techniques.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Understand the role of computational statistics in data analysis, utilize data structures, and perform descriptive statistical analysis and data visualization using programming tools.

CO 2: Apply probability concepts, generate random samples from various distributions, and use Monte Carlo simulation to estimate probabilities and expectations.

CO 3: Conduct statistical inference through parameter estimation, hypothesis testing (t-tests, chi-square, ANOVA), and compute p-values and confidence intervals using computational methods.

CO 4: Develop regression models (linear and logistic), perform residual analysis, and apply computational techniques such as bootstrapping and cross-validation to evaluate models

Syllabus Contents

Unit I: Introduction to Computational Statistics: (8 Lectures)

Role of computational statistics in data analysis, Overview of MATLAB / R / Python environments for statistics. Data structures: vectors, matrices, data frames, lists.

Unit II: Descriptive Statistics & Data Visualization: (10 Lectures)

Summary statistics (mean, median, variance, skewness, kurtosis), Histograms, boxplots, scatterplots., Plotting with matplotlib/ggplot2/MATLAB plotting functions.

Unit III: Probability Distributions & Simulation: (12 Lectures)

Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes'

Theorem. Expectation.Generating random samples from discrete and continuous distributions. Monte Carlo simulation. Estimating probabilities and expectations.

Unit IV: Statistical Inference: (8 Lectures)

Estimation of parameters (point & interval estimation). Hypothesis testing (t-test, chi-square, ANOVA). p-values and confidence intervals via computational methods.

Unit V: Regression & Statistical Modelling: (7 Lectures)

Simple & multiple linear regression. Residual analysis. Logistic regression (basics), Bootstrapping. Cross-validation. Writing custom functions & scripts.

References

1. Probability Random Variables And Stochastic Processes Paperback – by Athanasios Papoulis (Author), S Pillai (Author)
2. Computational Statistics Handbook with MATLAB by Wendy L. Martinez, Ang
3. Computational Statistics in Data Science, Richard A. Levine (Editor), Hao Helen Zhang (Editor), Thomas C. M. Lee (Editor)
4. Probability and Statistics in Engineering Hardcover –by William W. Hines (Author), Douglas C. Montgomery (Author), David M. Goldsman (Author)
5. Probability and Statistics for Engineers and Scientists by Ronald E. Walpole Raymond Myers, Sharon Myers, Keying Ye.

Skill Enhancement Course

Semester I

Course Tittle: Human Resource Management

Course Objective

To provide students with a fundamental understanding of electric circuits, their analysis in DC and AC domains, network theorems, and two-port network parameters, along with the basics of network functions and synthesis.

Course Objective

To provide students with foundational knowledge of human resource management principles, practices, and processes, enabling them to understand workforce planning, recruitment, compensation, and industrial relations in organizational settings..

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the evolution, significance, and core functions of HRM, and analyze human resource planning, job analysis, job descriptions, and job evaluations.

CO 2: Understand the concepts of employee rewards and compensation, distinguish between financial and non-financial benefits, and discuss factors affecting wage structures and employee welfare.

CO 3: Discuss the principles of industrial relations, causes and consequences of industrial disputes, and various approaches for maintaining harmonious employer-employee relationships.

Syllabus Content

Unit 1: Introduction to HRM Introduction to Human Resource Management, Evolution of HRM, Importance, HRM Functions, Forces Changing HRM, Human Resource Planning: Meaning, Process, HRP Models, Human Resource Forecasting Methods, Challenges and Relationship with Other HR Functions, Job Analysis, Job Description, Job Evaluation.

Unit 2: Recruitment and Selection Recruitment: Meaning and Process, Purpose, Types: Internal, Job Posting, Virtual Job Fairs, Executive Search Firms, Recruitment Advertising,

Factors Affecting Recruitment, Selection: Meaning, Procedure, Types of Tests, Consequences of Selection Decisions, Interview, Types of Interviews.

Unit 3: Employee Rewards Employee Rewards: Meaning, Concepts, Objectives, Components of Remuneration, Types of Employee Benefits, Financial and Non-Financial Benefits, Factors Affecting Wage and Salary, Salary Components, Employee Welfare, Safety Issues.

Unit 4: Industrial Relations and Disputes Concept of Industrial Relations and Industrial Disputes, Approaches to Industrial Relation, Causes, Consequences of Industrial Disputes.

Reference Books:

1. Rao, T. V. (2017). Performance Management and Appraisal Systems: HR Tools for Global Competitiveness. Sage Publications India.
2. Aswathappa, K. (2019). Human Resource Management: Text and Cases. McGraw Hill Education (India) Private Limited.
3. Mathis, R. L., & Jackson, J. H. (2018). Human Resource Management. Cengage Learning India.
4. Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2020). Human Resource Management: Gaining a Competitive Advantage. McGraw Hill Education.
5. Mondy, R. W., & Martocchio, J. J. (2018). Human Resource Management. Pearson India.

Course Tittle: Office Automation Tools

Course Objective

To equip students with foundational knowledge of computer systems, proficiency in common office applications, and awareness of organizational change processes and modern IT tools such as cloud computing and virtual environments.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Describe the characteristics, generations, and functional components of computers, different types of memory and storage devices, and various input-output peripherals.

CO 2: Demonstrate the use of MS Windows for file management, and apply MS Word, Excel, and PowerPoint features for creating professional documents, spreadsheets with formulas and charts, and multimedia presentations.

CO 3: Explain the concepts and processes involved in organizational change and identify strategies for managing resistance to change in a technology-driven environment.

Syllabus Content

Unit-1: Computer Fundamentals: Characteristics and Generation of Computers, Block diagram of Computer. Units of memory, RAM, ROM, Secondary storage devices – HDD, Flash Drives, Optical Disks: DVD, Keyboard, Mouse, LCDs, Scanner, Plotter, Printer and Latest I/O devices in market

Unit-2: MS Windows: Desktop, My Computer, Files and folders using windows explorer; Control Panel, Searching Files and folders

MS Word: Introduction, Environment, Help, Creating and Editing Word Document. Saving

Document, Working with Text: Selecting, Formatting, Aligning and Indenting, Finding Replacing Text, Bullets and Numbering, Header and Footer, Working with Tables, Properties Using spell checker, Grammar, AutoCorrect Feature. Graphics: Inserting Pictures, Clipart, Drawing Objects, Using Word Art. Setting page size and margins; Printing documents. Mail Merge Practical

MS-Excel: Environment, Creating, Opening, and Saving Workbook, Range of Cells. Formatting Cells, Functions: Mathematical, Logical, Date, Time, Auto Sum, Cell referencing , Formulas. Graphs: Charts, Types and Chart Tool Bar. Header and Footer Tab, Pivot tables, V-lookup, Validation and what-if analysis

MS PowerPoint: Environment, Creating and Editing presentation, Auto content wizard,

using built-in templates; formatting presentations, Graphics: AutoShapes, adding multimedia contents, printing slides

Unit 3: Organizational change: concepts and process of change, managing resistance to change, e-mail, Instant Messaging, Internet Telephony, Videoconferencing, Web Browser and its environment, Public and Private Cloud; Virtualization, Virtual Server, Cloud Storage, Database Storage.

Suggested Books

1. Fundamentals of Computers by Balagurusamy, Mc Graw Hill.
2. Introduction to Information Technology By Raja Raman, V., Phi Learning Pvt. Ltd.

Course Tittle: Basics of E-Commerce

Course Objective

To introduce students to the fundamental concepts, models, technologies, consumer and business applications, electronic payment systems, and regulatory frameworks of e-commerce, enabling them to understand and critically evaluate electronic business practices.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the meaning, scope, advantages, and disadvantages of e-commerce, and analyze its value chain using models such as Porter's framework to understand competitive strategies.

CO 2: Describe consumer-oriented e-commerce practices, including traditional versus e-retailing, success factors, and e-service models like e-malls, auctions, and web-based services.

CO 3: Identify and evaluate different electronic payment systems and discuss the key features of the regulatory and legal framework governing e-commerce, including India's IT Act 2000 and its amendments

Syllabus Content

Unit 1: Introduction to E-Commerce: Meaning and concept of ecommerce, ecommerce vs. e-business, advantages and disadvantages of ecommerce, value chain in ecommerce, Porter's value chain model, competitive advantage and competitive strategy

Unit 2: Categories of E-Commerce: Different types of ecommerce like B2B, B2C, C2C, C2B, G2C, E commerce: Business Models and Concepts, Business to Business e-commerce: Meaning, benefits and opportunities in B2B, key B2B models and their main functions, EDI as a B2B tool. E-core values: ethical issues, legal issues, taxation issues and international issues.

Unit 3: E- Commerce - A Consumer Oriented Approach: Consumer oriented e-commerce: traditional retailing and e retailing, benefits and key success factors for e-retailing, models for e-retailing like specialized and generalized e-stores, e-mall, direct selling by manufacturer, e-broker and e-services like web-enabling services, information selling on the web, entertainment services and auction services.

Unit 4: Electronic Payment Systems: Types of E-payment systems; 4C payment methods, E-Cheques, ACID and ICES test Credit Cards, SET protocol for credit card payment, electronic payment media: e-cash and e-wallet, echeck, credit card, debit card, smart card, EFT and ACH; Components of an effective E-Payment system.

Unit 5: Regulatory and Legal Framework of E-Commerce: Cyber Law (I.T. Act, 2000) - Aims and Salient Provisions; Scheme of I.T.Act; Application of I.T.Act; Advantages of Cyber Laws; Cyber Laws in India and their limitations; IT (Amendment) Act, 2008; Taxation issues in E-Commerce.

Suggested Books

1. C.S.V. Murthy. (2010) E-Commerce: Concepts, Models, Strategies. Himalaya Publishing House Pvt. Ltd. India.
2. K.N. Agarwala & Ararwala Deeksha: Business on the Net: What's and How's of E-Commerce; Macmillan, New Delhi.
3. Dave Chaffey, "E-Business and E-Commerce Management- Strategy, Implementation and Practice (Fifth Edition)
4. Vakul Sharma: (2011) Information Technology-Law & Practice: Law & Emerging Technology, Cyber Law & E-Commerce; Universal Law Publishing House, New Delhi. V.Rajaraman: (2010)

Skill Enhancement Course
Semester II

Course Tittle: Digital Marketing

Course Objective

To provide students with comprehensive knowledge of digital marketing concepts, tools, strategies, and ethical practices, enabling them to effectively leverage digital channels for branding, engagement, and business growth.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the key concepts, importance, and benefits of digital marketing, and analyze its role in sectors such as the Indian education system.

CO 2: Develop online branding strategies, create compelling content, and utilize various digital marketing channels including SEO, PPC, email, social media, influencer, and affiliate marketin

CO 3: Discuss legal and ethical considerations in digital marketing, including privacy, data protection, intellectual property, online advertising regulations, and ethical marketing practices.

Syllabus Content

Unit 1: Introduction to Digital Marketing: Overview of digital marketing, Importance and benefits of digital marketing, Key concepts and terminology, Digital marketing in the Indian education system.

Unit 2. Online Branding and Channels: Branding strategies in the digital age, creating a brand identity, crafting compelling content, Effective storytelling in digital marketing, Personal branding for professionals, Digital Marketing Channels, Search engine optimization (SEO), Pay- per-click (PPC) advertising, Email marketing, social media marketing, Content marketing, Influencer marketing, Affiliate marketing. (9 Lectures)

Unit 3: Website Optimization and Social media Marketing: Website design and user experience, On -page and off-page optimization, Keyword research and analysis, Website analytics and tracking, social media platforms and their features. Social media strategy

development, creating engaging content for social media, Social media advertising and targeting, social media analytics and reporting

Unit 4: Legal and Ethical Considerations: Privacy and data protection, Intellectual property rights, Online advertising regulations, Ethical issues in digital marketing.

Suggested Books

1. "Digital Marketing: Strategy, Implementation and Practice" by Dave Chaffey and Fiona Ellis-Chadwick.
2. "The Art of SEO: Mastering Search Engine Optimization" by Eric Enge, Stephan Spencer, Jessie Stricchiola, and Rand Fishkin.
3. "Social Media Marketing: A Strategic Approach" by Melissa Barker, Donald I. Barker, Nicholas F. Bormann, and Debra Zahay.

Course Tittle: Big Data Analysis

Course Objective

To introduce students to the fundamentals of big data, including its storage, analysis, and processing using Hadoop and MapReduce, while addressing the architecture and challenges of big data analytics.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the characteristics of big data, its analytical process, and identify the need for new analytical architectures and frameworks to handle big data challenges.

CO 2: Demonstrate the design and operation of the Hadoop Distributed File System (HDFS), perform data loading, reading, writing, and use command line interfaces to interact with HDFS.

CO 3: Implement basic parallel programming concepts using MapReduce, including different I/O formats, joins, secondary sorting, and understand the execution pipeline involving map, shuffle, sort, and reduce phases.

Syllabus Content

Unit-1: Understanding Big Data: Data Storage and Analysis-The process of data analysis, Characteristics of Big Data, Big Data Analytics, Typical Analytical Architecture, Requirement for new analytical architecture, Challenges in Big Data Analytics: Need of big data frameworks

Unit-2: Foundations of Big Data: Getting started with Hadoop, Requirement of Hadoop Framework, Design principle of Hadoop –Comparison with other system, Understanding Hadoop Ecosystem: Hadoop Components – Hadoop 1 vs Hadoop 2

Unit-3: HDFS (Hadoop Distributed File System): The Design of HDFS, Hadoop Daemon's HDFS Commands, HDFS Concepts, Command Line Interface, Hadoop file system interfaces-Loading data into HDFS, read/write process to HDFS

Unit-4: Introduction to Parallel Programming with Map Reduce: Map Reduce Programming: I/O formats, Map side join, Reduce Side Join, Secondary sorting, Pipelining Map Reduce jobs (Map Reduce Execution Pipeline)- Map, Shuffle and Sort, Reduce

Suggested Books

1. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.

Course Tittle: Introduction to Cloud Computing

Course Objective

To provide students with foundational knowledge of cloud computing concepts, architecture, services, security considerations, tools, and applications, enabling them to understand and evaluate cloud-based solutions.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the fundamentals of cloud computing, its types, underlying technologies, and how cloud computing operates.

CO 2: Describe the architecture of cloud computing, including modeling, design principles, and the role of virtualization in enabling cloud and grid infrastructures.

CO 3: Discuss cloud data storage concepts, from local networks to wide-area networks, and understand the delivery of cloud computing services in different environments.

Syllabus Content

Unit 1: Cloud Computing Foundation: Introduction to Cloud Computing, Move to Cloud Computing, Types of Cloud, Working of Cloud Computing

Unit 2: Cloud Computing Architecture: Cloud Computing Technology, Cloud Architecture, Cloud Modeling and Design, Virtualization: Foundation of Grid, Cloud and Virtualization and Cloud Computing

Unit 3: Data Storage and Cloud Computing: Data Storage, Cloud Storage, Cloud Storage from LANs to WANs, Cloud Computing Services: Cloud Services, Cloud Computing at Work.

Unit 4: Cloud Computing and Security: Risks in Cloud Computing, Data Security in Cloud, Cloud Security Services, Cloud Computing Tools: Tools and Technologies for Cloud, Cloud Mashaps, Apache Hadoop, Cloud Tools

Unit 5: Cloud Applications: Moving Applications to the Cloud, Microsoft Cloud Services – Google Cloud Applications, Amazon Cloud Services, Cloud Applications

Suggested Books

1. A.Srinivasan and J.Suresh, “Cloud Computing – A Practical Approach for Learning and Implementation”, Pearson India Publications 2014.
2. Rajkumar Buyya, James Broberg, Andrzej , “Cloud Computing: Principles and Paradigms”, Wiley India Publications 2011.
3. Arshdeep Bahga and Vijay Madisetti ,“Cloud Computing – A Hands on Approach”, Universities Press (India) Pvt Ltd. 2014

Ability Enhancement Course

Semester I

Course Tittle: Communicative English

Course Objective

To equip students with essential business communication skills—including listening, speaking, reading, and writing—while fostering cultural awareness and proficiency in both traditional and digital professional contexts.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the fundamentals of business communication, including language nuances, cross-cultural considerations, and strategies to overcome communication barriers like stereotypes and miscommunication.

CO 2: Demonstrate effective listening skills, follow netiquettes, engage with audiobooks, and apply note-taking techniques in academic and professional scenarios.

CO 3: Develop and deliver oral presentations, participate in group discussions and interviews, handle business meetings and negotiations, and practice persuasion and public relations activities.

Syllabus Content

Unit 1: Theory of Business Communication: Introduction, what is Business Communication, Language of Business Communication, Cultural Components – Cross-Cultural Communication, Cultural Shock, Stereotyping, Ethnocentrism, Miscommunication & Effective Communication

Unit 2: Listening Skills: Netiquettes, Audiobook Listening & Discussions, Note-taking

Unit 3: Speaking Skills: Presentation Skills – Oral Presentation, PPT Preparation, PPT Presentation, Group Discussion, Talks: Domain-specific, Ted-Talks, Business Meets, Motivational Talks, Telephonic Skills, Persuasion Skills, Meeting & Negotiation, Interview – Promotion Interview, Job Interview, Business Interview, Functions and activities of PR

Unit 4: Writing Skills: Summarising & Paraphrasing, Job-Oriented Skills – CV, Resume & Bio-Data, Job Application Letter, Documentation, Advertisements & Invitation, Letter Writing – Applications, Business Letters, Report – Analytical Report, Project Report, Digital Communication in Social Space – Social Media Posts (Twitter, Facebook), Blog Writing, Review Writing

Advertisement/Invitation/Poster Designing – Canva/MS Word/Corel, Memo, Office Order, Minutes, Making Online Academic/Work Profile – LinkedIn

Suggested Readings

1. Kaushik, J.C. and K.K. Sinha (eds.), *English for Students of Commerce*, Oxford University Press, New Delhi.
2. Sethi, Anjana & Bhavana Adhikari, *Business Communication*, Tata McGraw Hill.
3. Anjana Neira Dev, et al. (eds.), *Business English*, Department of English, University of Delhi, 2011, Pearson Publications, New Delhi.

Course Tittle: Personality Development and Communication

Course Objective

To develop students' comprehensive communication competencies—including written, verbal, non-verbal, intercultural, and persuasive skills—enabling them to effectively navigate diverse business contexts, presentations, teamwork, and negotiations.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the principles, processes, and modes of communication—including written, verbal, visual, non-verbal, and intercultural communication.

CO 2: Develop and deliver professional business cases and presentations using appropriate verbal and non-verbal cues, audiovisual aids, and write structured business reports, letters, memos, and circulars.

CO 3: Identify barriers to communication, apply techniques to enhance listening, emotional intelligence, teamwork, leadership, and interpersonal skills, and manage work conflicts constructively.

Syllabus Content

Unit 1:

- Introduction, need for Communication, Process of Communication
- Written and Verbal Communication, Visual communication
- Signs, Signals and Symbols, Silence as a Mode of Communication
- Inter-cultural, Intra-cultural, Cross-cultural and International communication
- Communication through Questionnaires, Business Letter Writing, Electronic Communication

Unit 2:

- Business Cases and Presentations
- Letters within the Organizations, Letters from Top Management, Circulars and Memos
- Business Presentations to Customers and other stakeholders
- Presenting a Positive Image through Verbal and Non-verbal Cues
- Preparing and Delivering Presentations, Use of Audio-visual Aids
- Report Writing

Unit 3

- Barriers to Communication, Improving Communication Skills
- Preparation of Promotional Material, Non-verbal communication, Body language, Postures and gestures
- Value of time, Organizational body language, Importance of Listening
- Emotional Intelligence, Working individually and in a team
- Leadership skills, Leadership Lessons, Teamwork and Team building
- Feedback, Feed forward, Interpersonal skills - Delegation, Humour, Trust, Expectations, Values, Status
- Compatibility and their role in building team
- Work Conflict Management - Types of conflicts, how to cope with conflict

Unit 4

- Negotiation Skills, Types of Negotiation, Negotiation Strategies
- Selling skills – Selling to customers, Selling to Superiors, Selling to peer groups, team mates and subordinates, Conceptual selling, Strategic selling, Selling skills - Body language

Suggested Books:

1. Kushal Jin - Business Communication, VK India.
2. Krishnamacharyulu, C.S.G., Ramakrishnan Lalitha - Personality Development, Interpersonal Skills and Career Management, Himalaya Publishing.
3. Corvette Budjac - Conflict Management: A Practical Guide to Developing Negotiation Strategies, Pearson.
4. Mitra, B.K. - Personality Development and Soft Skills, Oxford University Press.
5. Kumar Sanjay and Pushplata - Communication Skills, Oxford University Press.
6. Mandal S.K. - Effective Communication and Public Speaking, Jaico Publishing.

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Ability Enhancement Course

Semester II

Course Tittle: Environmental Awareness

Course Objective

To create awareness and impart knowledge about the multidisciplinary nature of environmental studies, covering ecosystems, natural resources, biodiversity, pollution, environmental policies, and the interaction between human communities and the environment.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the scope and importance of environmental studies, the concept of sustainability, and the structure, function, and energy flow of various ecosystems.

CO 2: Analyze issues related to natural resources, biodiversity conservation, and understand threats such as habitat loss, pollution, and climate change.

CO 3: Identify different types of environmental pollution, their causes, impacts, control measures, and examine environmental laws and international agreements for sustainable management.

CO 4: Discuss the impact of human population growth on the environment, principles of disaster management, water conservation techniques, and the role of ethics, culture, and communities in environmental protection.

Syllabus Content

Unit 1: Introduction to Environmental Studies

- Multidisciplinary nature of environmental studies
- Scope and importance; Concept of sustainability and sustainable development

Unit 2: Ecosystems

- What is an ecosystem?
- Structure and function of ecosystem
- Energy flow in an ecosystem: food chains, food webs and ecological succession
- Case studies of the following ecosystems:

  a) Forest ecosystem

b) Grassland ecosystem

c) Desert ecosystem

d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit 3: Natural Resources: Renewable and Non-renewable Resources

- Land resources and land-use change; Land degradation, soil erosion and desertification
- Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations
- Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts
- Food resources: World food problems, changes caused by agriculture and over-grazing, effects
- Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies

Unit 4: Biodiversity and Conservation

- Levels of biological diversity: genetic, species and ecosystem diversity; Bio-geographic zones of India; Biodiversity patterns and global biodiversity hotspots
- India as a mega-biodiversity nation; Endangered and endemic species of India, threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions
- Conservation of biodiversity – In-situ & Ex-situ conservation of biodiversity
- Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and informational value

Unit 5: Environmental Pollution

- Environmental pollution: types, causes, effects and controls; Air, water, soil and noise pollution
- Nuclear hazards and human health risks
- Solid waste management: Control measures of urban and industrial waste
- Pollution case studies

Unit 6: Environmental Policies & Practices

- Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities and agriculture
- Environment Laws:
    - Environment Protection Act

    - Air (Prevention & Control of Pollution) Act
    - Water (Prevention & Control of Pollution) Act
    - Wildlife Protection Act
    - Forest Conservation Act
- International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity (CBD)
- Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context

Unit 7: Human Communities and the Environment

- Human population growth: Impacts on environment, human health and welfare
- Disaster management: floods, earthquake, cyclones and landslides
- Water conservation, rainwater harvesting, watershed management
- Environmental ethics: Role of Indian and other religions and cultures in environmental conservation

Course Tittle: Disaster Risk Management

Course Objective

To equip students with an understanding of the types, causes, and impacts of natural and man-made disasters, and to develop competencies in risk assessment, preparedness, response, and long-term recovery planning for effective disaster management.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Identify and explain different types of natural and man-made disasters, their causes, effects.

CO 2: Analyze the concepts of risk and vulnerability, and develop strategies for reducing risk and enhancing community resilience.

CO 3: Describe disaster preparedness measures, early warning systems, safety protocols, and the roles of government, NGOs, IT, and engineers in disaster management.

CO 4: Discuss disaster response, relief, rehabilitation, and long-term reconstruction processes, including psychological aspects, livelihood restoration, and promoting disaster-resilient development.

Syllabus Content

Unit 1: Introduction on Disaster: Different Types of Disasters

Natural Disasters: Flood, Cyclone, Earthquakes, Landslides etc.

Man-made Disasters:

- Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters
- Accidents (Air, Sea, Rail & Road)
- Structural failures (Building and Bridge)
- War & Terrorism
- Causes, effects and practical examples for all disasters

Unit 2: Risk and Vulnerability Analysis

- Risk: Its concept and analysis, Risk Reduction, Vulnerability: Its concept and analysis, Strategic Development for Vulnerability Reduction

Unit 3: Disaster Preparedness and Response Preparedness

- Disaster Preparedness: Concept and Nature
- Disaster Preparedness Plan
- Prediction, Early Warnings and Safety Measures of Disaster
- Role of Information, Education, Communication, and Training
- Role of Government, International and NGO Bodies
- Role of IT in Disaster Preparedness
- Role of Engineers on Disaster Management

Unit 4: Response

- Disaster Response: Introduction
- Disaster Response Plan
- Communication, Participation, and Activation of Emergency Preparedness Plan
- Search, Rescue, Evacuation and Logistic Management
- Role of Government, International and NGO Bodies
- Psychological Response and Management (Trauma, Stress, Rumor and Panic)
- Relief and Recovery
- Medical Health Response to Different Disasters
- Role of Educational Institutes

Unit 5: Rehabilitation, Reconstruction and Recovery

- Reconstruction and Rehabilitation as a Means of Development
- Damage Assessment
- Post Disaster effects and Remedial Measures
- Creation of Long-term Job Opportunities and Livelihood Options
- Disaster Resistant House Construction
- Sanitation and Hygiene
- Education and Awareness

- Dealing with Victims' Psychology
- Long-term Counter Disaster Planning

Suggested Books:

1. Alexander, D. (2002). *Principles of emergency planning and management*. Oxford University Press.
2. Coppola, D. P. (2015). *Introduction to international disaster management* (3rd ed.). Butterworth-Heinemann.
3. Gupta, H. K. (2003). *Disaster management*. Universities Press.
4. Sinha, P. C. (2006). *Disaster management process*. Anmol Publications.
5. Sharma, R. K. (2001). *Natural disasters*. APH Publishing.
6. Wisner, B., Blaikie, P., Cannon, T., & Davis, I. (2004). *At risk: Natural hazards, people's vulnerability and disasters* (2nd ed.). Routledge.
7. Parasuraman, S., & Unnikrishnan, P. V. (Eds.). (2000). *India disasters report: Towards a policy initiative*. Oxford University Press.
8. NDMA. (2010). *National Disaster Management Guidelines*. National Disaster Management Authority, Government of India.

Value Added Course

Semester I

Course Tittle: Fundamentals of Indian Constitution

Course Objective

To provide students with structural framework of the Indian Constitution and its functioning at the Union and State levels.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the concept of the Indian Constitution, including the Preamble, Fundamental Rights, Directive Principles, and Duties.

CO 2: Analyze the structure, roles, and functions of the Union Government, including the President, Prime Minister, Cabinet, Parliament.

CO 3: Describe the organization and functioning of State Governments, detailing the roles of the Governor, Chief Minister, State Legislature.

Syllabus Content

Unit 1: Introduction: what is Business Communication, Course contents: Historical Background – Constituent Assembly of India – Philosophical Foundations Of The Indian Constitution – Preamble – Fundamental Rights – Directive Principles Of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies For Citizens.

Unit-2: Union Government: Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Lok Sabha – Composition and Powers - Rajya Sabha – Composition and Powers - Supreme Court of India – Judicial Review

Unit-3: State Government: Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

Suggested Readings:

1. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.

Course Tittle: Ethics in Science and Technology

Course Objective

To familiarize students with the fundamental concepts, theories, and professional codes of ethics in science and technology, and to develop their ability to identify, analyze, and address ethical issues in scientific research, technological development, and societal applications.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the definition, scope, and significance of ethics in personal, professional, scientific, and technological contexts, and differentiate between ethics, morals, and laws.

CO 2: Identify and evaluate ethical issues in scientific research, including research integrity, human and animal experimentation, conflicts of interest, and the ethical aspects of intellectual property rights.

Syllabus Content

Unit I: Fundamentals of Ethics in Science and Technology

- **Definition and Scope of Ethics:** What is ethics? Importance in personal and professional life, Difference between ethics, morals and laws.
- **Core Ethical Theories:** Utilitarianism, Deontology, Virtue ethics, Rights-based approaches.
- **Values in Science and Technology:** Honesty, integrity, objectivity, openness, respect for intellectual property.
- **Introduction to Professional Codes of Ethics:** Codes from IEEE, ASME, and scientific bodies.
- **Case Studies:**Examples of scientific fraud (e.g., fabricated data), consequences.

Unit II: Ethical Issues in Scientific Research:

- **Research Integrity:** Plagiarism, falsification, fabrication.
- **Responsible Conduct of Research:** Authorship, peer review, data management.
- **Human & Animal Experimentation:** Ethical guidelines, informed consent, role of ethics committees.
- **Conflict of Interest:** Identifying and managing conflicts.

- **Patents and Intellectual Property Rights (IPR):** Ethical dimensions of patents in pharmaceuticals, biotechnology.

Unit III: Ethical Implications of Technology & Emerging Areas

- **Technology and Society:** Ethical issues in AI, robotics, nanotechnology, genetic engineering.
- **Environmental Ethics:** Technology's impact on environment, sustainability considerations.
- **Privacy and Data Security:** Ethics in IT, big data, surveillance.
- **Dual Use of Technology:** Civil vs military applications (e.g., drones, nuclear technology).
- **Global and Social Justice:** Access to technology, digital divide, inclusivity.

Suggested Books:

1. Stimmel, B. L. (2009). *Ethics in science and engineering*. CRC Press.
2. Tavani, H. T. (2016). *Ethics and technology: Controversies, questions, and strategies for ethical computing* (5th ed.). Wiley.

Course Tittle: E-Waste Management

Course Objective

To provide students with knowledge of e-waste identification, segregation, handling, relevant environmental regulations, and international frameworks, enabling them to analyze and contribute to sustainable e-waste management practices aligned with circular economy principles.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Identify different types of e-waste, understand their composition, and demonstrate dismantling and handling procedures through practical exposure and facility visits.

CO 2: Evaluate environmental protection laws, producers' responsibilities, and regulatory mechanisms for e-waste management, with specific focus on educational institutions.

CO 3: Assess the status of e-waste handling at local or institutional levels, suggest improvements in line with E-Waste (Management) Rules, 2016, and understand the process for procuring e-waste import permissions.

CO 4: Solve networks using various theorems, characterize two-port networks, and interpret network functions, poles, zeros, and basics of network synthesis.

Syllabus Content

Unit 1: Introductions: Identification of e-waste and its types, Composition of e-waste and segregation – from the material provided, Dismantling of e-waste and handling process, Visit a nearby e-waste handling facility

Unit II: Extended Exercises & Studies

- Study of environmental protection laws and producer's responsibility for e-waste management
- Build understanding of how regulatory mechanisms can be utilized in managing e-waste in educational institutions
- Discussion on plausible ways and implementation of e-waste reduction at the source
- Evaluation of the status of e-waste handling at your institution; suggest potential solutions as per existing norms of E-Waste (Management) Rules, 2016 and beyond
- Estimate how recycling of e-waste in metro cities will align with the circular economy
- Develop understanding and itinerary for the process of procuring e-waste import permissions
- Inventory of e-waste disposal mechanisms

Unit III: Legal & International Aspects

- Study evolution of e-waste management rules and implementation, Study international laws on e-waste management & international legislations, Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union, Restrictions of Hazardous Substances (RoHS) Directive

Suggested Books:

1. Robinson, B. H. (2009). E-waste: An assessment of global production and environmental impacts. Science of the Total Environment, 408(2), 183–191.

2. Schmidt, C. W. (2006). Unfair trade: e-waste in Africa. Environmental Health Perspectives, 114(4), A232–A235.
3. Li, J., Zeng, X., Chen, M., Ogunseitan, O. A., & Stevels, A. (2015). "Control-Alt-Delete": Rebooting solutions for the e-waste problem. Environmental Science & Technology, 49(12), 7095–7108.

Course Tittle: Digital Citizenship

Course Objective

To equip students with the knowledge and skills to responsibly engage with digital technologies, understand the vision of digital empowerment initiatives, practice ethical and respectful communication, and maintain digital wellness in the modern information society.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the concepts of digital inclusion and digital empowerment, and describe key initiatives under Digital India such as DigiLocker, e-Pathshala, and online public utility services.

CO 2: Utilize various digital communication and collaboration tools—including email, social media, blogs, file sharing, online learning platforms, and video conferencing—effectively in academic and professional contexts.

Syllabus Content

Unit 1: Digital inclusion and Digital Empowerment

● Definition and importance in the modern digital era

● Vision of Digital India: DigiLocker, E-Hospitals, e-Pathshala, BHIM, e-Kranti (Electronic Delivery of Services), e-Health Campaigns

● Public utility portals of Govt. of India such as RTI, Health, Finance, Income Tax filing, Education

Unit 2: Communication and Collaboration in the Cyberspace

● Electronic Communication: electronic mail, blogs, social media

● Collaborative Digital platforms

● Tools/platforms for online learning

● Collaboration using file sharing, messaging, video conferencing

Unit 3: Digital Etiquette & Communication

- Netiquette, respectful online interaction
- Managing digital footprint and online reputation
- Cyberbullying, hate speech awareness, and response strategies

Unit 4: Digital Wellness & Ethics

- Digital health: screen-time, ergonomics, mental well-being
- Ethical considerations in digital environments
- AI, VR/AR ethics & their societal implications

Suggested Books:

1. David Sutton. “Cyber security: A practitioner's guide”, BCS Learning & Development Limited, UK, 2017.
2. https://www.mha.gov.in/document/downloads/cyber-safety-handbook

Value Added Course

Semester II

Course Title - Vedic Mathematics

Course Objective

Enhance computation skills in students through Vedic Mathematics. Develop logical and analytical thinking. Promote joyful learning of mathematics. Discuss the rich heritage of mathematical temper of Ancient India

Course Outcomes

At the end of this course, Students will be able to

CO 1: Overcome the fear of maths, Improved critical thinking

CO 2: Familiarity with the mathematical underpinnings and techniques

CO 3: Ability to do basic maths faster and with ease.

CO 4: Appreciate the Mathematical advancements of Ancient India.

Syllabus

Unit 1: Vedic Maths- High Speed Addition and Subtraction

- Vedic Maths: History of Vedic Maths and its Features
- Vedic Maths formulae: Sutras and Upsutras
- Addition in Vedic Maths: Without carrying, Dot Method
- Subtraction in Vedic Maths: Nikhilam Navatashcaramam Dashatah
- Fraction-Addition and Subtraction

Unit II: Vedic Math - Miracle Multiplication and Excellent Division

- Multiplication in Vedic Maths: Base Method (any two numbers upto three digits) Multiplication by Urdhva Tiryak Sutra
- Miracle multiplication: Any three-digit number by series of 1's and 9's • Division by Urdhva Tiryak Sutra (Vinculum method)

Unit III: Vedic Maths-Lightening Squares and Rapid Cubes

- Squares of any two-digit numbers: Base method
- Square of numbers ending in 5: Ekadhikena Purvena Sutra
- Easy square roots: Dwandwa Yoga (duplex) Sutra

- Square root of 2: Baudhayana Shulbasutra
- Cubing: Yavadunam Sutra

Unit IV. Vedic Mathis-Eullghten Algebra and Geometry

- Factoring Quadratic equation: Anurupyena, Adyamadyenantyamantya Sutra
- Concept of Baudhayana (Pythagoras) Theorem
- Circling a square: Baudhayana Shulbasutra
- Concept of pi: Baudhayana Shulbasutra
- Concept angle (•) 0^O, 30^O, 45^O, 60^O and 90^O: Baudhayana number

Suggested Books:

1. Tirthaji, B. (1992). Vedic mathematics: Sixteen simple mathematical formulae from the Vedas. Motilal Banarsidass.

Course Title - Yoga: Philosophy and Practice

Course Objective

To learn the fundamentals of Yoga for harmonising the body, mind and emotions. To demonstrate the value and the practice of holistic living. To value the heritage of Yoga for self and society.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Understanding ways to harmonise the body and mind through Yoga.

CO 2: Disciplining the mind through practicing Yoga.

CO 3: Understanding of consciousness through practical training.

Syllabus

Unit 1: Yoga: Asana, Prāṇāyāma and Dhyana

- History of Yoga
- Significance of Asana
- Effect of Pranayama
- Importance of Dhyana

Unit II: Patanjali's Yogasutra and Chakra

- Patanjali's Yogasūtra: a summary
    - First sutra
    - Second sutra
    - Chakras (psychic centres)

Unit III: Understanding Asana and Pranayama

- Asana: the basics
    - SuryaNamaskara
    - Nadishodhana Pranayama

Suggested Books

1. Patanjal Yog Pradeep-Swami OmanandSaraswati, Gita Press, Gorakhpur, 2013.
2. Science of Pranayama-Swami Sivananda, Edition by David De Angellis, 2019, All Rights Reserved.
3. Udayveer Shastri Granthavali,4, Patanjal-Yoga Darshanam, Udayavir Shastri, Govindram Hasanand, Delhi 6.

Course Tittle: Ayurveda and Nutrition

Course Objective

To introduce students to the foundational concepts of Ayurvedic nutrition, traditional Indian food practices, principles of diet planning based on doshas, and lifestyle management for holistic health and well-being.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the historical evolution of Indian food cultures, the influence of Ayurveda on nutrition, and regional dietary traditions.

CO 2: Describe the basic principles of nutrients, Ayurvedic concepts of doshas and ahara vidhi visheshaayatana, along with understanding FSSAI regulations on Ayurvedic Aahar.

CO 3: Develop lifestyle and diet plans incorporating Ayurvedic principles like Dincharya and Ritucharya, and apply them to manage stress-related eating behaviors.

Syllabus Content

Unit 1: Introduction to Ayurvedic Nutrition

● Ayurveda and Indian food cultures

● Nutrition and lifestyle transition over the years

● Regional Food Traditions of India

Unit II: Basic principles of Food and Nutrition and Ayurveda

Understanding rich sources of nutrients

● Concept of Doshas & assessment

● Ayurvedic Principles of food habits and factors determining

quality of food (Ahara vidhi visheshaayatana)

● FSSAI regulations on Ayurvedic Aahar

Unit III: Ayurvedic Diets

● Principles of Diet: Aharavidhi vidhan, Sattvic, Rajasi,Tamasic foods

● Incompatible food (Viruddha Ahara), Pathya; Apathya; Viprita Ahaar

● Lifestyle Management with Dincharya and Ritucharya

● Application of Ayurvedic diets to stress linked food behaviour

Suggested Books

1. Rastogi S (2014) Ayurvedic Science of Food and Nutrition. ASIN: BOOHWMV094, Springer: ISBN-13:978-1461496274
2. Rastogi S (2010) Building bridges between Ayurveda and modern science. Int J Ayurveda Res. 1(1):41-46.
3. FSSAI regulations on Ayurveda Aahar Regulations 2022. Gazette of India CG-DL-E-07052022-235642. New Delhi, Friday, May 6, 2022/ Vaisakha 16, 1944.
4. Frawley D (2012) Ayurvedic healing: A comprehensive guide. Lotus Press, India.
5. https://iksindia.org/: Indian Knowledge Systems

Course Tittle: Emotional Intelligence

Course Objective

To develop an understanding of the fundamentals, models, and core components of emotional intelligence (EI), and to equip students with the skills to assess, manage, and enhance their emotional and social competencies for personal and professional growth.

Course Outcomes

At the end of this course, Students will be able to

CO 1: Explain the nature, significance, and various models of emotional intelligence, including ability, trait, and mixed models.

CO 2: Demonstrate personal competence by recognizing their own emotions (self-awareness) and effectively managing emotions like anxiety, fear, and anger (self-management).

CO 3: Evaluate emotional intelligence through established measures and implement strategies to develop and enhance EI for overall personal and interpersonal effectiveness.

Syllabus Content

Unit I: Fundamentals of Emotional Intelligence

- Nature and Significance
- Models of emotional intelligence: Ability, Trait and Mixed

- Building blocks of emotional intelligence: self-awareness, self-management, social awareness, and relationship management

Unit II: Personal Competence

- Self Awareness: Observing and recognizing one's own feelings, Knowing one's strengths and areas of development.
- Self Management: Managing emotions, anxiety, fear, and anger.

Unit III: Social Competence

- Social Awareness: Others' Perspectives, Empathy and Compassion
- Relationship Management: Effective communication, Collaboration, Teamwork, and Conflict management

Unit IV: Emotional Intelligence: Measurement and Development

- Measures of emotional intelligence
- Strategies to develop and enhance emotional intelligence

Suggested Books:

1. Goleman, D. (1995). *Emotional intelligence: Why it can matter more than IQ*. Bantam Books.
2. Goleman, D. (1998). *Working with emotional intelligence*. Bantam Books.
3. Salovey, P., & Mayer, J. D. (1990). *Emotional intelligence*. Imagination, Cognition and Personality, 9(3), 185–211.
4. Bradberry, T., & Greaves, J. (2009). *Emotional intelligence 2.0*. TalentSmart.
5. Bar-On, R. (2006). *The Bar-On model of emotional-social intelligence (ESI)*. Psicothema, 18(Suppl), 13–25.

Semester-III: Major Core Course (MJC)

Major Course-3 (MJC-3): Basic Digital Electronics

Credit: 03 (Theory) Theory Lectures:45

Syllabus Contents

Unit-1 (10 Lectures)

Number System and Codes: Decimal, Binary, Hexadecimal and Octal number systems, base conversions, Binary, octal and hexadecimal. Representation of signed and unsigned numbers, Binary Coded Decimal code.

Logic Gates and Boolean algebra: Introduction to Boolean Algebra and Boolean operators, Truth Tables of OR, AND, NOT, Basic postulates and fundamental theorems of Boolean algebra, Truth tables, construction and symbolic representation of XOR, XNOR, Universal (NOR and NAND) gates.

Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Speed power product, TTL and CMOS families and their comparison.

Unit-2 (10 Lectures)

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Encoder and Decoder, Multiplexers and Demultiplexers, Implementing logic functions with multiplexer, binary Adder, binary subtractor, parallel adder/subtractor.

Unit-3 (12 Lectures)

Sequential logic design: Latches and Flip flops , S-R Flip flop, J-K Flip flop, T and D type Flip flop, Clocked and edge triggered Flip flops, master slave flip flop, Registers, Counters (synchronous and asynchronous and modulo-N), State Table, State Diagrams, counter design using excitation table and equations, Ring counter and Johnson counter.

Programmable Logic Devices: Basic concepts- ROM, PLA, PAL, CPLD, FPGA

Suggested Books:

1. M. Morris Mano Digital System Design, Pearson Education Asia,(Fourth Edition)
2. Thomas L. Flyod, Digital Fundamentals, Pearson Education Asia (1994)
3. W. H. Gothmann, Digital Electronics: An Introduction To Theory And Practice, Prentice Hall of India (2000)
4. R. L. Tokheim, Digital Principles, Schaum's Outline Series, Tata McGraw- Hill (1994)

Semester-III: Major Core Course (MJC)

Major Course-3 (MJC-3): Basic Digital Electronics Lab

Credit: 02 (Practical) Theory Lectures:60

Syllabus Contents

1. Design and verification of AND, OR, NOT and XOR gates using NAND gates.
2. Conversion of Boolean expression into logic gate circuit and assemble it using logic gate IC's.
3. Design a Half and Full Adder.
4. Design a Half and Full Subtractor.
5. Design a seven-segment display driver.
6. Design a 4 X 1 Multiplexer using gates.
7. Build a Flip- Flop Circuits using elementary gates. (RS, Clocked RS, D-type).
8. Design a counter using D/T/JK Flip-Flop.

Semester-III: Major Core Course (MJC)

Major Course-4 (MJC-4): Microprocessor and Microcontroller

Credit: 03 (Theory) Theory Lectures:45

Syllabus Contents

Unit-1 (12 Lectures)

Introduction to Microprocessor: Revision of logic circuits with emphasis on control lines, SAP concepts with stress on timing diagrams, Microinstructions, Microprogramming, Variable machine cycle, Architecture of 8085 Processor, Functions of all signals, Bus concepts, Multiplexed and De-multiplexed Bus. Instruction set, Addressing modes, Timing diagrams. 8085 Programming examples on Time delay, Looping, Sorting and Code conversions. 8085 based Microcomputer system, Memory Organization, Memory Interfacing, Memory Mapped I/O, I/O Mapped I/O, Interrupts, Hardware and Software Interrupts, Interrupt instructions, Programmed I/O, Interrupt driven I/O, and DMA.

Unit-2 (10 Lectures)

Introduction to 16-bit processor, 8086 architectures, BIU and EU, Pin description, Maximum and Minimum Mode, Instruction set, Addressing modes. Memory organization, Advantages of memory segmentation, Memory banking (even and odd), Programming Examples.

Unit-3 (10 Lectures)

Introduction of programmable peripheral interfacing (PPI), Architecture of 8255, Modes of operation, ADC 0801/0808, and its interfacing with 8085/86, DAC 0808 and its interfacing with 8085/86, Sample and Hold. DAS architecture and its programming in automation application. 8253(PIT), Modes of operation, Programming examples.

Unit-4 (13 Lectures)

Introduction to Microcontrollers: Architecture of 8051, Memory structure. Pin descriptions, Instruction set, Addressing modes. Programming examples for simple control applications. LED, Switches, Solid State Relay, Seven Segment Display, 16x2 LCD display, 4x4 Matrix Keyboard, Digital to Analog Converter, Stepper Motor and DC Motor.

Suggested Books:

1. Digital Computer Electronics, 2/e. by A. P. Malvino.

2. Advanced Microprocessors and Peripherals by K. M. Bhurchandi and A. K. Ray.

3. Microprocessor Architecture, Programming and Applications with 8085, Ramesh S.Gaonkar, Wiley Eastern Limited- IV Edition.

4. Fundamentals of Microprocessor & Microcomputer: B. Ram, Danpat Rai Publications.

5. The 8051 Microcontroller and Embedded System by Muhammad Ali Mazidi.

Semester-III: Major Core Course (MJC)

Major Course-4 (MJC-4): Microprocessor and Microcontroller

Credit: 01 (Practical) Theory Lectures:30

Syllabus Content

1. 8085 Assembly language programs:
2. Program to transfer a block of data.
3. Program for multibyte addition
4. Program for multibyte subtraction
5. Program to multiply two 8-bit numbers.
6. Program to divide a 16 bit number by 8 bit number.
7. Program to search a given number in a given list.
8. Program to generate terms of Fibonacci series.
9. Program to sort numbers in ascending/descending order.

Microcontroller Programming

1. LED blinking with a delay of 1 second.
2. Solid State Relay Interface
3. Interfacing of LCD (2X16).
4. To test all the gates of a given IC74XX is good or bad.
5. Generate sine, square, saw tooth, triangular and staircase waveform using DAC interface.
6. Display of 4- digit decimal number using the multiplexed 7-segment display interface.
7. Analog to digital conversion using internal ADC and display the result on LCD.
8. Digital to analog conversion using PWM (pulse delay to be implemented using timers).
9. Speed control of DC motor using PWM (pulse delay to be implemented using timers).

Semester III- Minor Course (MIC)

Minor Course-3 (MIC-3): Grid Connected Photovoltaic Systems

Credit: 02 (Theory) Lectures:30

Syllabus Contents

Types of Solar PV Systems – Standalone, Grid-connected and Hybrid, Design Methodology for SPV System, Grid connected Solar PV Power Systems – Introduction, Components and Configurations, Grid-connected PV System Design for Small Power Applications and for Power Plants. Economics of PV Systems-sample payback period, lifecycle costing

Solar Photovoltaic energy conversion and utilization, solar power generation systems a) off-grid systems b) grid connected systems c) power control and management systems, economics of solar photovoltaic systems, World Energy Requirement, Energy and Role of Photovoltaic, Types of PV Installation, Common Systems type, GRID-TIED System, Hybrid Systems, Photovoltaic in Energy Supply.

Introduction to Smart Meters, Advanced Metering Infrastructure, Distribution Automation, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid Technology (V2G), Smart Sensors, Smart Homes, Building Energy Management System Substation Automation, Feeder Automation.

Suggested Books

1. Chetan Singh Solanki, Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, PHI Learning Publications, 3rd Edition, 2015,
2. Ajay Kumar Gupta, Solar PV Power and Solar Products hand book, NIIR Project Consultancy Services, 1st Edition,2022, ISBN: 9788195577590
3. Angèle Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Photovoltaic Solar Energy: From Fundamentals to Applications, Wiley Publishers, 2016, ISBN: 978-1-118-92746-5
4. Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning Publications, 3rd Edition, 2015,
5. Roger A. Messenger and Amir Abtahi, 'Photovoltaic Systems Engineering', Taylor and Francis Group Publications, 3rd Edition, 2017(CRC Press Reprint – 2020), ISBN 9780367736330

Semester III- Minor Course (MIC)

Minor Course-3 (MIC-3): Grid Connected Photovoltaic Lab

Credit: 01 (Practical) Lectures:30

Syllabus Contents

1. I-V and P-V Characteristics of Grid-Connected PV Modules
2. Testing of MPPT Algorithms (P&O and Incremental Conductance)
3. Synchronization of PV Inverter with the Utility Grid
4. Measurement of Power Quality Parameters in Grid-Connected PV Systems
5. Performance Analysis under Partial Shading and Its Effect on Grid Feed-in

Semester III- Minor Course (MIC)

Minor Course-3 (MIC-3): Digital Signal Processing

Credit: 02 (Theory) Lectures:30

Syllabus Contents

Unit 1. Discrete-Time Signals and Systems: Classification of Signals, Transformations of the Independent Variable, Periodic and Aperiodic Signals, Energy and Power Signals, Even and Odd Signals, Discrete-Time Systems, System Properties. Impulse Response, Convolution Sum; Graphical Method; Analytical Method, Properties of Convolution; System Response to Periodic Inputs, LTI System Properties; Causality; Stability; Invertibility, Unit Step Response. and the Impulse Response, Difference Equation, Analysis of LTI system in Z-domain, LTI system as frequency selective filter, Inverse system, and de-convolution.

Unit-2:

Z transform, Discrete Time Fourier Transform (DTFT) and Discrete Fourier Transform (DFT), Periodic convolution, Fast Fourier Transform (FFT) and its algorithms-Decimation in time and Decimation in frequency.

Unit-3 Digital Filter Structures (FIR & IIR): Direct form I&II, cascade, parallel and ladder realizations, lattice structure, representation of numbers, quantization of filter coefficients, round-off effects.

Unit-4 Design of IIR Filter: Design based on analog filter approximations, Impulse invariance method, Matched Z-transformation, Bilinear transformation. Design of FIR Filters: Symmetric and antisymmetric FIR filters, design of linear phase FIR filters using windows and frequency–sampling methods, design of optimum equiripple linear phase FIR filters, comparison of FIR and IIR filters.

References

1. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.

2. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.

Semester III- Minor Course (MIC)

Minor Course-3 (MIC-3): Digital Signal Processing Lab

Credit: 01 (Practical) Lectures:30

Syllabus Contents

1. Generation of unit sample sequence, unit step, ramp function, discrete time sequence,
2. real sinusoidal sequence.
3. Generate and plot sequences over an interval.
4. Fourier Transform, Discrete Fourier Transform and Fast Fourier Transform
5. Design of a Butterworth analog filter for low pass and high pass.
6. Design of digital filters.

Semester III- Multidisciplinary Course (MDC)

Multidisciplinary Course -3 (MDC-3): Data Base Management Systems

Credit: 02 (Theory) Lectures:30

Syllabus Contents

Unit 1: Introduction to Database: Database, characteristics of database approach, data models, database management system, three-schema architecture, components of DBMS, data independence, and file system approach vs database system approach.

Unit 2: Entity Relationship Modeling: Conceptual data modeling - motivation, entities, entity types, attributes, relationships, relationship types, constraints on relationship, Entity Relationship diagram as conceptual data model.

Unit 3: Relational Data Model: Data anomalies, Relational Data Model - Characteristics of a relation, schema-instance distinction, types of keys, relational integrity constraints. Relational algebra operators like selection, projection, cartesian product, join and write simple queries using them.

Unit 4: Structured Query Language (SQL): DDL to create database and tables, table constraints, DML, querying in SQL to retrieve data from the database, aggregation functions group by and having clauses, generate and query views.

Unit 5: Database Design: Mapping an Entity Relationship diagram to corresponding relational database scheme, functional dependencies and Normal forms, 1NF, 2NF, and 3NF decompositions and desirable properties of them.

Suggested Books:

1. Connolly T. M., Begg C. E. Database Systems: A Practical Approach to Design, Implementation, and Management, 6th edition, Pearson, 2019.
2. Ramakrishnan R., Gehrke J. Database Management Systems, 3rd Edition, McGraw-Hill, 2014.
3. Silberschatz A., Korth H.F., Sudarshan S. Database System Concepts, 7th Edition, McGraw Hill, 2019

Semester-IV: Major Core Course (MJC)

Major Course-5 (MJC-5): Communication Electronics

Credit: 03 (Theory) Theory Lectures:45

Unit-1 (10 Lectures)

Electronic communication: Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation. Concept of Noise, Types of Noise, Signal to noise ratio, Noise Figure, Noise Temperature, Friss formula.

Unit-2 (15 Lectures)

Amplitude Modulation: Amplitude Modulation, modulation index and frequency spectrum. Generation of AM, Amplitude Demodulation (diode detector), Concept of Double side band suppressed carrier, Single side band suppressed carrier, other forms of AM (Vestigial Side Band modulation, Independent Side Band Modulation). Block diagram of AM Transmitter and Receiver

Angle modulation: Frequency and Phase modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods), FM detector (PLL). Block diagram of FM Transmitter and Receiver Comparison between AM,FM and PM.

Unit -3 (10 Lectures)

Pulse Analog Modulation: Channel capacity, Sampling theorem, PAM, PDM, PPM modulation and detection techniques, Multiplexing, TDM and FDM.

Pulse Code Modulation: Need for digital transmission, Quantizing, Uniform and NonuniformQuantization, Quantization Noise, Companding, Coding, Decoding.

Unit -4 (10 Lectures)

Digital Carrier Modulation Techniques: Block diagram of digital transmission and

reception,Information capacity, Bit Rate, Baud Rate and M-ary coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Binary Phase Shift Keying (BPSK) and Quadrature Phase Shift Keying (QPSK)

Suggested Books:

1. Electronic communication systems- Kennedy, 3rd edition, McGraw internationalpublications
2. Principles of Electronic communication systems – Frenzel, 3rd edition, McGraw Hill
3. Communication Systems, S. Haykin, Wiley India (2006)
4. Advanced electronic communications systems – Tomasi, 6th edition, PHI.
5. Communication Systems, S. Haykin, Wiley India (2006)

Semester-IV: Major Core Course (MJC)

Major Course-5 (MJC-5): Communication Electronics Lab

(Hardware and Circuit Simulation Software)

Credit: 02 (Practical) Lectures: 60

Syllabus Content

1. To study the function of Amplitude Modulation and demodulation (under modulation, perfect modulation & over modulation) and also to calculate the modulation index. Study of Frequency Modulation
2. To study the process of frequency modulation and demodulation and calculate the depth of modulation by varying the modulating voltage.
3. To verify the spectrum of AM and FM signals using the spectrum analyzer.
4. To study the frequency response of Pre-Emphasis and De-Emphasis circuits.
5. To study the frequency division multiplexing and De multiplexing Techniques.
6. To study the Pulse amplitude modulation & demodulation Techniques.
7. To study the operation of frequency synthesizer using PLL
8. To study the sampling theorem and its reconstruction.

Semester-IV: Major Core Course (MJC)

Major Course-6 (MJC-6): Fundamental of Embedded System and IoT

Credit: 03 (Theory) Lectures: 45

Syllabus Contents

Unit – 1 (8 Lectures)

Introduction to Embedded Systems: Overview of Embedded Systems, Features, Requirements and Applications, Recent Trends in the Embedded System Design, Common architectures for the Embedded System Design, Embedded Software design issues.

Unit – 3 (16 Lectures)

Embedded C Programming: Introduction to C programming, Structure of C program, character set, keywords and identifiers, constants and variables, data types and data ranges, expressions and operators. Study of IO statements, Structure of embedded C program, Need of OS, Concept of Super loop, Time delay program using timer, square wave generation, I/O port programming, Serial Port Programming. Introduction of Aurdino programming.

Unit – 4 (16 Lectures)

Introduction to IoT: Definition and Characteristics of IoT, Architectural Overview, Design principles and needed capabilities. Physical design of IoT: IoT protocols in Link Layer, Network/Internet Layer, Transport Layer, Application Layer, Basics of Networking. Logical design of IoT: Functional blocks, Communication Models and APIs, IoT levels and deployment templates. M2M and IoT Technology Fundamentals, Software defined networks (SDN), network function virtualization (NFV), Basics of IoT System Management with SNMP, NETCONF - YANG.

Unit – 4 (16 Lectures)

Communication Protocols and IoT Components : MQTT, Bluetooth, CoAP, TCP. Hardware Components: Transducers, Sensors, Actuators and I/O interfaces – Concept, Characteristic and Classification of Sensors (Position, Velocity,

Force, Temperature and Humidity, Motion Detection, ADC, Light, Bluetooth, etc.)

Suggested Books:

1. AVR Microcontroller and Embedded Systems: Using Assembly and C by Muhammad AliMazidi, Sarmad Naimi, Sepehr Naimi, PHI
2. Embedded system Design - Frank Vahid and Tony Givargis, John Wiley, 2002
3. A Internet of Things - A Hands-on Approach", Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
4. Designing Internet of Things", Adrian McEwen and Hakim Cassimally, John Wiley and Sons, 2014.
5. Introduction to Internet of Things: A practical Approach", Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, ETI Labs

Semester-IV: Major Core Course (MJC)

Major Course-7 (MJC-7): Advance Digital Electronics

Credit: 03 (Theory) Lectures: 45

Syllabus Contents

Unit 1: Introduction to VHDL: A Brief History of HDL, Structure of HDL Module, Comparison of VHDL and Verilog, Introduction to Simulation and Synthesis Tools, Test Benches. VHDL Modules, Delays, data flow style, behavioral style, structural style, mixed design style, simulating design.

Unit 2: Introduction to Language Elements, Keywords, Identifiers, White Space Characters, Comments, format. VHDL terms, describing hardware in VHDL, entity, architectures, concurrent signal assignment, event scheduling, statement concurrency, structural designs, sequential behavior, process statements, process declarative region, process statement region, process execution, sequential statements, architecture selection, configuration statements, power of configurations.

Unit 3: Behavioral Modeling: Introduction to behavioral modeling, inertial delay, transport delay, inertial delay model, transport delay model, transport vs inertial delay, simulation delta drivers, driver creation, generics, block statements, guarded blocks.

Unit 4: Sequential Processing: Process statement, sensitivity list, signal assignment vs variable assignment, sequential statements, IF, CASE, LOOP, NEXT, EXIT and ASSERT statements, assertion BNF, WAIT ON signal, WAIT UNTIL expression, WAIT FOR time expression, multiple wait conditions, WAIT Time-Out, Sensitivity List vs WAIT Statement Concurrent Assignment, Passive Processes.

Suggested books:

1. A VHDL Primer – J. Bhasker, Prentice Hall, 1999, III Edition.

2. Verilog HDL-A guide to digital design and synthesis-Samir Palnitkar, Pearson, 2nd edition.

Semester-IV: Major Core Course (MJC)

Major Course-7 (MJC-7): Advance Digital Electronics Lab

Credit: 02 (Practical) Lectures: 60

Syllabus Contents

1. Write code to realize basic and derived logic gates.
2. Half adder, Full Adder using basic and derived gates.
3. Half subtractor and Full Subtractor using basic and derived gates.
4. Multiplexer (4x1, 8x1) and Demultiplexer using logic gates.
5. Code converters (Binary to Gray and vice versa).
6. 2 bit Magnitude comparator.

Semester-IV: Minor Course (MIC)

Minor Course-4 (MIC-4): Fundamental of Artificial Intelligence and Logic Programming

Credit: 03 (Theory) Lectures: 45

Syllabus Contents

Unit-1 **(**Lectures – 10)

Introduction to AI: Definition and history of AI, Domains and Applications of AI, advantages and disadvantages of AI, Subsets of AI, Intelligent agents in AI and their types, Agent Environment in AI, Turing Test. Applications of AI, Ethical Issues in AI in social, and legal concerns in AI

Unit- 2 **(**Lectures-10)

Problem Solving and Search techniques: Search Algorithm Terminologies, Properties of search algorithms, types of search algorithms, Breadth-first search, Uniform cost search, Depth-first search, Best-first search, A* search, Hill climbing algorithm, Problem solving as state-space search

Unit 3: Knowledge Representation and Reasoning **(Lectures: 10)**

Types of knowledge and knowledge-based agents, Propositional Logic: syntax, semantics, and inference rules, Predicate (First-Order) Logic: syntax, quantifiers, and inference, Semantic networks, frames, ontologies, Forward and backward chaining, resolution, and unification

Unit-4: Logic Programming: **(**Lectures-14)

Logic Programming: Knowledge-Based Agent and its architecture**,** types of knowledge, Techniques of knowledge representation, Propositional logic, Syntax & Semantic for Propositional logic, rules of inference, First order logic (FOL) and syntax, Inference rule for FOL. Introduction to logical programming, PROLOG.

Recommended Books:

1. S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, Third Edition, 2011
2. Vinod Chandra S.S., and Anand Hareendran S. Artificial Intelligence and Machine Learning 1st Edition.
3. Dan W. Patterson, Introduction to Artificial Intelligence and expert systems, PHI, 2006

Semester-V:

Apprenticeship

Credit: 20

Semester-VI:

Apprenticeship

Credit: 20

Semester-VII: Major Core Course (MJC)

Major Course-8 (MJC-8): Control Theory

Credit: 03 (Theory) Lectures: 45

Course Objectives

Mathematical modelling and analysis of open-loop and closed-loop control systems. Time-domain and Frequency-domain analysis of control systems. Methods for accessing absolute and relative stability of control systems.

Course Outcomes

At the end of this course, students will be able to

CO1: Understand the concepts of closed loop control systems.

CO2: Analyse the stability of closed loop systems.

CO3: Apply the control techniques to any electrical systems.

CO4: Compute and assess system stability.

Syllabus Content

Unit 1 Introduction to Control Systems:

Open loop and Closed loop control systems, Mathematical modeling of physical systems (Electrical, Mechanical and Thermal), Derivation of transfer function, Armature controlled and field controlled DC servomotors, AC servomotors, block diagram representation & signal flow graph, Reduction Technique, Mason's Gain Formula, Effect of feedback on control systems, Parameter Variation and sensitivity.

Unit 2 Time Domain Analysis: Time domain performance criteria, transient response of first, second & higher order systems, steady state errors and static error constants, Performance indices. Concept of Stability: Asymptotic stability and conditional stability, Routh–Hurwitz criterion, relative stability analysis, Root Locus plots and their applications.

Unit 3 Frequency Domain Analysis: Correlation between time and frequency response, Polar and inverse polar plots, frequency domain specifications, Logarithmic plots (Bode Plots), gain and phase margins, Nyquist stability criterion, relative stability using Nyquist criterion, constant M & N circles.

Unit 4 State Space Analysis: Definitions of state, state variables, state space, representation of systems, Solution of time invariant, homogeneous state equation, state transition matrix and its properties. Controllers and Compensation Techniques: Response with P, PI and PID Controllers, Concept of compensation, Lag, Lead and Lag-Lead networks

Suggested Books:

1. J. Nagrath & M. Gopal, Control System Engineering, New Age International, 2000
2. K. Ogata, Modern Control Engineering, PHI 2002
3. B. C. Kuo , "Automatic control system", Prentice Hall of India, 2000

Semester-VII: Major Core Course (MJC)

Major Course-8 (MJC-8): Control Theory Lab

(Hardware and SCILAB/MATLAB/Other Mathematical Simulation software)

Credit: 03 (Theory) Lectures: 45

Course Objectives

Mathematical modelling and analysis of open-loop and closed-loop control systems Perform experiments involving concepts of control systems.

Course Outcomes

At the end of this course, students will be able to

CO1: Design experiments for controlling devices like AC/DC motors etc.

CO2: Study the behaviour of First and Second Order systems.

CO4: Comparison of various types of control mechanisms.

Syllabus Content

1. To study position control of DC motor
2. To study speed control of DC motor
3. To study time response of type 0, 1 and 2 systems
4. To study frequency response of first and second order systems
5. To study time response characteristics of a second order system.
6. To study effect of damping factor on the performance of second order system
7. To study frequency response of Lead and Lag networks.
8. Study of P, PI and PID controller.

Semester-VII: Major Core Course (MJC)

Major Course-9 (MJC-9): Fundamental of Robotics and its applications

Credit: 03 (Theory) Lectures: 45

Course Objectives

After completion of this course students should be well versed in programming a micro controller. Student would be able to make rudimentary robot which is capable of moving along a predetermined path, follow a drawn line and equivalent applications.

Course Outcomes

At the end of this course, students will be able to

CO1 Familiarize with the programming environments used in robotics applications.

CO2 Understand the working of sensors, actuators and other components used robotics.

CO3 Design timer/counter circuits and display their outputs using LCD.

CO4 Understand the communication standards like RS232 etc.

Syllabus Content

Programming Environments: Integrated Development Environment (IDE) for AVR, microcontrollers, free IDEs like AVR Studio, WIN AVR. Installing and configuring for Robot programming, In System Programmer (ISP), loading programmes on Robot.

Actuators: DC Motors, Gearing and Efficiency, Servo Motors, Stepper motors, Motor Control and its implementations

Sensors: White line sensors , IR range sensor of different range, Analog IR proximity sensors, Analog directional light intensity sensors, Position encoders, Servo mounted sensor pod/ Camera Pod, Wireless colour camera, Ultrasound scanner, Gyroscope and Accelerometer, Magnetometer, GPS receiver, Battery voltage sensing, Current Sensing.

LCD interfacing with the robot (2 x 16 Characters LCD)

Other indicators: Indicator LEDs, Buzzer

Timer / Counter operations: PWM generation, Motor velocity control, Servo control, velocity calculation and motor position Control, event scheduling

Communication: Wired RS232 (serial) Communication, Wireless ZigBee Communication, USB Communication, Simplex infrared Communication (IR remote to robot)

Suggested Books:

1. Saha, S.K., Introduction to Robotics, 2nd Edition, McGraw-Hill Education, New Delhi, 2014
2. R.K. Mittal, I.J. Nagrath, ―Robotics & Control‖, Tata McGraw & Hills, 2005

Semester-VII: Major Core Course (MJC)

Major Course-9 (MJC-9): Robotics Lab

Credit: 02 (Practical) Lectures: 60

Course Objectives

After completion of this course students should be well versed in programming a micro controller. Student would be able to make rudimentary robot which can move along a predetermined path, follow a drawn line and equivalent applications.

Course Outcomes

At the end of this course, students will be able to

CO1 Familiarize with the programming environments used in robotics applications.

CO2 Understand the working of sensors, actuators and other components used robotics.

CO3 Design timer/counter circuits and display their outputs using LCD.

CO4 Understand the communication standards like RS232 etc.

Syllabus Content

1. Interfacing experiment using available hardware like LCD, LED, Buzzer, Motors.
2. Read IR proximity sensor to determine if there is some object nearby and thus Control the motion of robot using IR sensors.
3. Control a robot using LDR and laser.

4. Simple Motion Control (programming the robot to move forward, backward, left and right)
5. Line following Robot (programming the robot to move along a define path, white line or black line)
6. Obstacle Detection (programming the robot for obstacle detection)
7. Designing a simple Robotic Arm and programming it for picking and placing objects
8. Control experiment using available hardware or software.
9. Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system.
10. Project work

Semester-VII: Minor Course (MIC)

Minor Course-5 (MIC-5): SPV Grid Connected Systems: Design and Economics

Credit: 02 (Theory) Lectures: 30

Course Objectives

Understand the basic Electrical Quantities and identify instruments used to measure them. Understand Energy calculations and estimation of Energy Requirement. Compare Solar PV Technology with other Renewable Energy Technologies.

Course Outcomes

At the end of this course, students will be able to

CO1: Describe the basics of Power and Energy calculations in relation to SPV Systems.

CO2: Interpret the parameters of PV Modules and their connections to form Arrays.

CO3: Demonstrate the design, integration and economics of PV Systems.

CO4: Understand the Importance of balance of System and MPPT.

CO5: Explain types of batteries and their necessity for remote applications of Solar PV Systems

Syllabus Contents

UNIT 1: Parameters of Solar Cells , Factors affecting Electricity generated from a Solar Cell , Solar PVModules–Ratings , Module Parameters Factors Affecting Electricity Generated by a Solar PVModule, MeasuringModule Parameters, Solar PV Module Arrays - Connection of Modules in Series, in Parallel andinSeriesand Parallel ((Mixed Combination)

UNIT 2: Types of Solar PV Systems – Standalone, Grid-connected and Hybrid, Design Methodologyfor SPVSystem, Grid-connected Solar PV Power Systems – Introduction, Components and Configurations, Grid-connected PV System Design for Small Power Applications and for Power Plants. Economics of PVSystems-sample payback period, lifecycle costing, Introduction to Solar Advisory Model (SAM)Software.

UNIT 3: Need For Balance of System (BoS) , Power Converters and their efficiency , DC to ACConverters(Inverters) , DC to DC Converters , Charge Controllers, Maximum Power Point Tracking(MPPT), Types of Wires and Wire Sizing, Junction Box.

UNIT 4: Types of batteries , Parameters of Batteries, How to select a battery, Connecting Batteries together–Series , Parallel and mixed combination, Estimating Number of Batteries to be Connected inabatteryBank, Testing and Maintenance of Batteries , Fault Detection, Instruments used for Maintenance. Sample Case Study of a Solar PV System, Environmental Considerations of PV Systems.

Suggested Books:

1. Chetan Singh Solanki ,Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, PHI Learning Publications, 3rd Edition, 2015

2. SAM Ver. 2.0 User guide - https://www.nrel.gov/docs/fy08osti/43704.pdf

Semester-VII: Minor Course (MIC)

Minor Course-5 (MIC-5): SPV Lab

Credit: 01 (Practical) Lectures: 30

Course Objectives

Demonstrate knowledge of and apply key solar electric system. Mount, ground, position, install, wire and connect a photovoltaic system. Participants will learn different types of solar PV module and batteries used in solar PV plant. Design of solar PV Plant based on estimated loads.

Course Outcomes

At the end of this course, students will be able to

CO1: Size and design a photovoltaic system

CO2: Test voltage generated by photovoltaic system Operate & Maintain of Solar Power

CO3: Participants will learn different types of solar PV module and batteries used in solar PV plant

CO4: Design of solar PV Plant based on estimated loads.

Syllabus Contents

1. Current-voltage characteristic curve (I-V Curve) construction
2. Physical properties of solar module and temperature dependence
3. I-V and P-V characteristics with series and parallel combination of modules
4. Effect of direct and diffuse radiation on crystalline and thin film modules
5. Assemble and dismantle of solar lanterns
6. Solar water pump system (Day (water pump) + Night (Home lighting))
7. Understanding of various parts of the inverter (non-working)
8. Tools and accessories used in solar PV systems and power plants

Semester-VII: Minor Course (MIC)

Minor Course-5 (MIC-5): Computational Intelligence and Machine Learning

Credit: 02 (Theory) Lectures: 30

Course Objectives

To introduce the basic concepts and techniques of computational intelligence and machine learning (ML). To understand various learning paradigms, algorithms, and their applications. To develop skills to implement CI and ML algorithms for solving practical problems.

Course Outcomes

At the end of this course, students will be able to

CO1: Understand the concepts of computational intelligence like machine learning

CO2: Explain the fundamental concepts of computational intelligence and machine learning.

CO3: Apply supervised and unsupervised learning techniques to real-world data.

CO4: Implement basic algorithms in Python/R/MATLAB.

CO5: Evaluate model performance and optimize parameters.

CO6: Discuss applications of CI & ML in engineering, science, and management.

Syllabus Contents

Unit I: Introduction to Computational Intelligence & Machine Learning: Concepts of CI: Neural networks, fuzzy logic, evolutionary algorithms, Definitions of machine learning, data-driven vs rule-based approaches, Types of learning: supervised, unsupervised, reinforcement learning, Applications in classification, regression, clustering, optimization.

Unit II: Data Preprocessing & Feature Engineering: Data cleaning, normalization, transformation, Feature selection and dimensionality reduction (PCA, LDA), Handling missing data & outliers.

Unit III: Supervised Learning Techniques: Classification: Decision Trees, k-Nearest Neighbors, Naïve Bayes, Regression: Linear and polynomial regression, Support Vector Machines, Model evaluation: Cross-validation, confusion matrix, ROC curve.

Unit IV: Unsupervised & Reinforcement Learning: Clustering: k-Means, Hierarchical, DBSCAN, Association rule mining (Apriori, FP-Growth), Basics of reinforcement learning: Markov decision processes, Q-learning.

Unit V: Neural Networks & Computational Intelligence Approaches: Artificial Neural Networks (ANN): Perceptron, multilayer perceptron, Backpropagation algorithm, Introduction to deep learning (CNN, RNN basics), Overview of fuzzy logic systems and genetic algorithms.

Suggested Books:

1. Mitchell, T. M. (1997). *Machine Learning.* McGraw Hill.
2. Haykin, S. (1999). *Neural Networks: A Comprehensive Foundation.* Prentice Hall.
3. Russell, S., & Norvig, P. (2010). *Artificial Intelligence: A Modern Approach.* Prentice Hall.
4. Hastie, T., Tibshirani, R., & Friedman, J. (2009). *The Elements of Statistical Learning.* Springer.
5. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep Learning.* MIT Press.
6. Kecman, V. (2001). *Learning and Soft Computing.* MIT Press.

Semester-VII: Minor Course (MIC)

Minor Course-5 (MIC-5): AI Lab

Credit: 01 (Practical) Lectures: 30

Course Objectives

Understand the fundamental concepts and methodologies of computational intelligence and machine learning. Explore various supervised, unsupervised, and reinforcement learning techniques along with their mathematical foundations. Implement machine learning and computational intelligence algorithms using programming tools such as Python / MATLAB / R.

Course Outcomes

At the end of this course, students will be able to

CO1: Explain the concepts of computational intelligence paradigms such as neural networks, fuzzy systems, and evolutionary algorithms.

CO2: Describe different machine learning approaches including supervised, unsupervised, and reinforcement learning.

CO3: Apply computational intelligence techniques and machine learning algorithms to solve real-world problems using appropriate software tools.

Syllabus Contents

1. Implement simple linear regression to predict continuous outcomes.
2. Classify samples using k-Nearest Neighbors.
3. Build decision tree and visualize decision paths.
4. Implement SVM for classification with different kernels.
5. Apply unsupervised learning to cluster data.
6. Reduce data dimensions and visualize.
7. Implement feedforward neural network using ML
8. Discover frequent item sets & association rules.
9. Optimize a mathematical function using GA.
10. Build fuzzy inference system (e.g., temperature control).
11. Compare different models and validate using k-fold cross validation.

Semester-VII: Minor Course (MIC)

Minor Course-6 (MIC-6): Web Designing

Credit: 3 (Theory) Lectures: 45

Course Objectives

The course is designed to introduce the web page designing concepts using HTML and CSS to students. The course also aims to achieve competence amongst its students to develop correct and efficient online websites for businesses.

Course Outcomes

At the end of this course, students will be able to

CO1: To gain basic knowledge of HTML.

CO2: To understand various elements of HTML.

CO3: . Implementation of frames and forms.

CO4: Explore structures and implementation of CSS.

CO5: Analyze, design and develop a website

Syllabus Contents

Unit I: Unit 1 Introduction to HTML: (6 Hours)

Basic structure of an HTML Document, Markup tags, heading, paragraphs, line breaks, HTML tags.

Unit 2 Elements of HTML: (15 Hours):

Introduction to elements of HTML, working with text, lists, tables, hyperlinks, images, multimedia, inline elements, Block level elements, internal hyperlinks, external hyperlinks.

Unit 3 Frames and Forms: (9 Hours)

Frames, forms and controls.

Unit 4 Cascading Style Sheets: (9 Hours)

Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, CSS Id and Class, Box Model (Introduction, Border propetties, Padding Properties, Margin properties. ·

Unit 5 Web Designs (6 Hours): Creating page Layout and Site Designs.

Practical component (30 Hours): The practical assignments must include exercises on creating static websites using HTML and CSS on . platforms like Notepad/Notepad++/Visual Studio.

Suggested Books:

1. Bayross, I. Web enabled commercial application development using HTML, JavaScript, DHTML and PHP, 4th edition, BPB Publication (2013).
2. Boehm, A., & Ruvalcaba,Z.Murach's HTML5 and CCS3 (3rdedition).
3. Mike Murach& Associates. (soft copy version) (2015)
4. I .Minnick, J. Web Design with HTML5 and CSS3 (8th edition). Cengage Learning (2015).

Semester-VII: Minor Course (MIC)

Minor Course-7 (MIC-7): Electronic Project Management and Development of Entrepreneurship Competency

Credit: 3 (Theory) Lectures: 45

Course Objectives

The course is designed to introduce the web page designing concepts using HTML and CSS to students. The course also aims to achieve competence amongst its students to develop correct and efficient online websites for businesses.

Course Outcomes

At the end of this course, students will be able to

CO1: To gain basic knowledge of HTML.

CO2: To understand various elements of HTML.

CO3: . Implementation of frames and forms.

CO4: Explore structures and implementation of CSS.

CO5: Analyze, design and develop a website

Syllabus Contents

Unit I: Unit 1 Introduction to HTML: (6 Hours)

Basic structure of an HTML Document, Markup tags, heading, paragraphs, line breaks, HTML tags.

Unit 2 Elements of HTML: (15 Hours):

Introduction to elements of HTML, working with text, lists, tables, hyperlinks, images, multimedia, inline elements, Block level elements, internal hyperlinks, external hyperlinks.

Unit 3 Frames and Forms: (9 Hours)

Frames, forms and controls.

Unit 4 Cascading Style Sheets: (9 Hours)

Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, CSS Id and Class, Box Model (Introduction, Border propetties, Padding Properties, Margin properties. ·

Unit 5 Web Designs (6 Hours): Creating page Layout and Site Designs.

Practical component (30 Hours): The practical assignments must include exercises on creating static websites using HTML and CSS on . platforms like Notepad/Notepad++/Visual Studio.

Suggested Books:

1. Bayross, I. Web enabled commercial application development using HTML, JavaScript, DHTML and PHP, 4th edition, BPB Publication (2013).
2. Boehm, A., & Ruvalcaba,Z.Murach's HTML5 and CCS3 (3rdedition).
3. Mike Murach& Associates. (soft copy version) (2015)
4. I .Minnick, J. Web Design with HTML5 and CSS3 (8th edition). Cengage Learning (2015).

Semester-VII: Minor Course (MIC)

Minor Course-7 (MIC-7): Electronic Project Management and Development of Entrepreneurship Competency

Credit: 3 (Theory) Lectures: 45

Course Objectives

To provide knowledge of project management fundamentals relevant to electronics projects and develop planning, execution, monitoring and evaluation skills for electronic projects. To build entrepreneurial competencies, mindset, and innovation capabilities. To familiarize students with business plan development and techno-commercial feasibility.

Course Outcomes

At the end of this course, students will be able to

CO1: Plan, organize and manage electronic projects efficiently.

CO2: Understand start-up ecosystem, funding opportunities, and incubators.

CO3: Develop entrepreneurial competencies like opportunity recognition, creativity, and strategic thinking.

CO4: Prepare and present a detailed techno-commercial project report.

Syllabus Contents

Unit 1 Introduction: Definition, characteristics, and types of projects, Project life cycle: idea generation, feasibility, design, implementation, evaluation, Project selection methods: market demand, profitability, technical feasibility, Role of project manager and team dynamics in electronics projects.

Unit 2 Entrepreneurship Development: Definition of entrepreneurship & entrepreneur vs intrapreneur, Types of entrepreneurs (innovative, imitative, social, technopreneurs), Start-up ecosystem in India, role of MSME, SIDBI, DIC, and state-level initiatives, Intellectual property rights (IPR), patents, copyrights relevant to electronics, Entrepreneurship & Economic development, Contribution of Small and big enterprises to the economy, Entrepreneurial environment, Types of Entrepreneurs)

Unit 3 Developing the Business Plan: Identification of Business idea, Elements of a Business Plan, Building Competitive Advantage, Conducting feasibility Analysis, Strategy and Planning for Starting Your Small Business, Problems of small business, Introduction to marketing mix (Product, Price, Place and Promotion).
Opportunity identification and idea validation, Design thinking and innovation for electronics, Market analysis and customer discovery, Financial literacy: budgeting, funding avenues (angel, VC, crowd-funding), Case studies on successful electronic start-ups.

Unit 4 Sources of finance: Equity vs. Debt Capital, Sources of Equity Finance, Institutional finance, Venture Capital, Lease Finance, Sole proprietorship, Partnership, Cooperative, Joint-Stock Company.

Unit 6 Business Plan & Project Report: Preparing a techno-economic feasibility report for an electronic product/system, Costing, break-even analysis, pricing strategies, Marketing and distribution channels for electronic products, Preparing and pitching a business plan to investors/incubators, Mini project: develop & present an electronic product business model canvas

Suggested Books:

1. Meredith, J. R., Shafer, S. M., & Mantel, S. J. (2017). Project Management: A Managerial Approach (9th ed.). Wiley.
2. Kuratko, D. F. (2020). Entrepreneurship: Theory, Process, and Practice (11th ed.). Cengage Learning.
3. Pinto, J. K. (2019). Project Management: Achieving Competitive Advantage (5th ed.). Pearson.
4. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2017). Entrepreneurship (10th ed.). McGraw-Hill.
5. Timmons, J. A., & Spinelli, S. (2008). New Venture Creation: Entrepreneurship for the 21st Century (8th ed.). McGraw-Hill.

(CGPA 7.5 and above) upto VI Semester

Semester-VIII: Major Course (MJC)

Major Course-10 (MJC-10): Research Methodology

Credit: 4 (Theory) Lectures: 60

Course Objectives

To introduce fundamental of research process including problem identification, hypothesis concept and to draw conclusion.

Course Outcomes

At the end of this course, students will be able to

CO1: Develop the skill of contextualization of knowledge and critical thinking

CO2: Choose appropriate methods of research aims and objectives.

CO3: Apply ethical principle in research work.

CO4: Understand the philosophy of research integrity and publication ethics.

Syllabus Contents

Unit	Topics to be covered	No. of Hours (60)
1	**Fundamental of Research** 1.1 Philosophy, concept, aims, objectives, purpose and scope of research. 1.2 Types of Research : Descriptive *vs* Analytical, Pure *vs* Applied, Conceptual *vs* Empirical, Qualitative *vs* Quantitative,Scientific *vs*Technical. 1.3 Good Laboratory Practices and safety measures.	04 03 02
2	**Concept of Research Problem and Research Designing** 2.1 Identifying the Research Problem: meaning; importance; sources; selecting, stating and evaluating a research problem 2.2 Hypothesis: Designing and Testing 2.3 Experimental Research and Design: Approximation of data, simulation and modelling 2.4 Sampling: Types of sampling, Questionnaire and observational methods of data collection.	03 03 02 03

3	**Use of Tools and Techniques in Research** 3.1 Use of Search engines for reviewing of literature and data retrieving(Google scholar, PubMed, ResearchGate and ShodhGanga) 3.2 Use of Software: Microsoft Word, Microsoft Excel, Latex,SPSS/R/MATLAB/SCILAB/EndNote 3.3 Basic Statistical Methods and Techniques: Descriptive Statistics, Test of Significance, ANOVA, Regression Analysis. 3.4 Electronic submission of paper in different journals, Transferring big files through software	04 04 04 04
4	**Scientific Communication** 4.1 Steps of Research Paper writing: Title, Abstract and Keywords, Introduction, Material and Methods, Results and Discussion, Conclusion, Conflict of Interest, Acknowledgment, Table and Graphs, Appendices. 4.2 Research Proposal: Writing and Submission 4.3 Funding Agencies: BCST, UGC, CSIR, ICMR,DST, DBT, ICAR 4.4 Seminar/Conference/Webinar presentation: Abstract writing and oral (PPT)and poster presentation. 4.5 Journal: Types, Indexing, Concept of Impact factor and Citation.	06 03 02 02 02
5	**Research Publication and Ethics** 5.1 Ethical issues in Research 5.2 Plagiarism : Meaning, Types and Implications, Checking Software 5.3 IPR: Patent, Copyright and Trademark 5.4 UGC guidelines on Research Ethics	02 02 02 03
	TOTAL	**60**

Suggested Books:

1. Research Methodology- C.R. Kothari
2. Research Methodology :Methods & Technique (2023) – VimalSagar, AGPH, Bhopal
3. Research Methodology for PhD Coursework (2023)- D.N. Pandit, Hindustan Publishing Corporation, New Delhi
4. Statistics: A modern approach (2022) - D.N. Pandit, Hindustan Publishing
5. Essays on Research Methodology (2015)-Hegde D.S. Springer
6. Research Methodology Step by Step Guide for Beginners (2019)-Kumar R. Sage Publication.

(CGPA 7.5 and above) upto VI Semester

Semester-VIII: Major Course (MJC) Elective (a)

Major Course-11 (MJC-11): Medical Electronics

Credit: 4 (Theory) Lectures: 60

Course Objectives

The students analyze the various types of Biomedical instruments and their working and practical implementation in medical.bLearn about Modern Imaging systems like CT scan and MRI techniques and various other cardiac instruments. Use of Microprocessor in medical Instruments and microcontrollers in critical care units. Learn about the emerging fields like MEMS Biosensors , EEG , ECG , EMG etc. Students will learn about the science of Biomedical and connect it with real life problems.

Course Outcomes

At the end of this course, students will be able to

CO1: Understand the basic knowledge of physiology.

CO2: Explore the occurrence of potential and operation of cardiovascular measurements.

CO3: Understand the basic knowledge on respiratory and pulmonary measurements.

CO4: Describe the methods used for monitoring the patients.

Syllabus Contents

Unit-1 (17 Lectures)

Biomedical signals & Physiologica transducers: Source of biomedical signal, Origin of bioelectric signals, recording electrodes, Electrodes for ECG, EMG & EEG .Physiological transducers: Pressure, Temperature, photoelectric & ultrasound Transducers.

Measurement in Respiratory system: Physiology of respiratory system, Measurement of breathing mechanics Spiro meter, Respiratory therapy equipments Inhalators ventilators & Respirators, Humidifiers, Nebulizers Aspirators, Biomedical recorders: ECG, EEG & EMG. MEMS based biosensors.

Unit -2 (16 Lectures)

Patient Monitoring systems & Audiometers: Cardiac monitor, Bedside patient monitor, measurement of heart rate, blood pressure, temperature, respiration rate, Arrhythmia monitor, Methods of monitoring fatal heart rate, Monitoring labor activity. Audiometers:

Audiometers, Blood cell counters, Oximeter, Blood flow meter, cardiac output measurement, Blood gas analyzers.

Unit-3 (16 Lectures)

Modern Imaging systems: Introduction, Basic principle & Block diagram of x-ray machine, x-ray Computed Tomography (CT), Magnetic resonance imaging system (NMR), ultrasonic imaging system. Eco-Cardiograph, Eco Encephalography, Ophthalmic scans, MRI.

Therapeutic Equipments: Cardiac pacemakers, cardiac defibrillators, Hemodialysis machine, surgical diathermy machine.

Unit -4 (11 Lectures)

Patients safety & Electronics Applications in Medical: Precaution, safety codes for electro medical equipment, Electric safety analyzer, Testing of biomedical equipment, Use of microprocessors in medical instruments, Microcontrollers, PC based medical instruments, Computerized Critical care units, Planning & designing a computerized critical care unit.

Suggested Books:

1. Joseph J. Carr & John M. Brown, ―Introduction to Biomedical Equipment Technology‖, Pearson.

3. Khandpur R. S. - Handbook of Biomedical Instrumentation, TMH

4. Bertil Jacobson & John G. Webster - Medicine and Clinical Engineering, PHI

5. Prof. S.K.VenkataRam-Bio-Medical Electronics and Instrumentation, Galgotia Publications

(CGPA 7.5 and above) upto VI Semester

Semester-VIII: Major Course (MJC) Elective (b)

Major Course-11 (MJC-11): Advance Communication System

Credit: 4 (Theory) Lectures: 60

Course Objectives

This course aims to impart advanced knowledge of modern communication systems by exploring digital modulation, optical, cellular, and satellite communication techniques. It prepares students to analyze, design, and evaluate communication networks and technologies relevant to contemporary and future applications..

Course Outcomes

At the end of this course, students will be able to

CO1 Apply the basic knowledge of signals and systems and understand the basics of communication system and analog modulation techniques.

CO2 Apply the knowledge of digital electronics and understand the error control coding techniques.

CO3 Summarize different types of communication systems and its requirements.

CO4 Design and Analyse the performance of communication systems.

Syllabus Contents

Unit-1 (8 Lectures)

Advanced Digital Modulation Technique: DPCM, DM, ADM. Binary Line CodingTechnique, Multi level coding, QAM (Modulation and Demodulation)

Unit-2 (10 Lectures)

Optical Communication: Introduction of Optical Fiber, Types of Fiber, Guidance in Optical Fiber, Attenuation and Dispersion in Fiber, Optical Sources and Detectors, Block Diagram of optical communication system, optical power budgeting

Unit-3 (14 Lectures)

Cellular Communication: Concept of cellular mobile communication – cell and cell splitting, frequency bands used in cellular communication, frequency reuse, roaming

and hand off, authentication of the SIM card of the subscribers, IMEI number, concept of data encryption, architecture (block diagram) of cellular mobile communication network, CDMA technology, Comparative study of GSM and CDMA, 2G, 3G, 4G and 5G concepts.

Unit-4 (13 Lectures)

Satellite communication: Introduction, need, satellite orbits, advantages and disadvantages of geostationary satellites. Satellite visibility, satellite system – space segment, block diagrams of satellite sub systems, up link, down link, cross link, transponders (C- Band), effect of solar eclipse, path loss, ground station, simplified block diagram of earth station. Satellite access, TDMA, FDMA, CDMA concepts, comparison of TDMA and FDMA, Satellite antenna (parabolic dish antenna), GPS-services like SPS & PPS.

Local area networks (LAN): Primary characteristics of Ethernet-mobile IP, TCP/IP model, wireless LAN requirements-concept of Bluetooth, Wi-Fi and WiMAX.

Suggested Books:

1. W. Tomasi, Electronic Communication Systems: Fundamentals through Advanced, PearsonEducation, 3rd Edition
2. Martin S. Roden, Analog & Digital Communication Systems, Prentice Hall, EnglewoodCliffs, 3rd Edition
3. Modern digital and analog Communication systems- B. P. Lathi, 4rd Edition 2009 OxfordUniversity press.
4. ThiagarajanVishwanathan, Telecommunication Switching Systems and Networks, PrenticeHall of India.

(CGPA 7.5 and above) upto VI Semester

Semester-VIII: Research Project

Research Project

Credit: 12 (Project)

AECC (B. Sc. In Electronic Science)

Course Title- Human Resource Management

Teaching hours:- 30

Course objectives-

1. To understand the basic concepts and role of HRM

2. Develop skills for job analysis, recruitment and onboarding .

3. Understand employee training, performance appraisal and compensation strategies.

4. Comply with basic labour laws and maintain industrial relations and safety standards.

Unit 1. Introduction to HRM- Definition, Objectives,and Functions of HRM,Role of HR Manager, Difference between Personnel Management and HRM, HRM in Technical/ Electronics industry

Unit 2.Talent Acquisition and Planning - Human Resource Planning,Job analysis- job Description and Job specification , Recruitment - Sources ,Techniques,Selection process- Interview ing and Testing techniques

Unit3. Development and Performance -Induction/ Onboarding, Training and Development - Types and Methods- On- the- job, Off- the- job , E- Learning, Performance Appraisal,Methods and Process, Career Planning

Unit 4. Compensation Management- Wage, Salary, Incentives, and Benefits,Employee welfare and Safety Measures,Grievance Redressal Mechanism,Discipline Management.

Unit 5..IR and Modern HR Trends- Industrial relations and Trade Unions, Basics of Labour Legislation, Digital HR(HRIS) HR Analytics,and Future of work

Books Recommended

1. Human Resource Management by Gary Dessler

2. Human Resource Management by K Aswathappa

3. Personnel and Human Resource Management by SC Khanka

Start- up and Innovation

AECC 20 teaching hours

Course Objectives:-

1 To incalculate an entrepreneurial mindset among electronic science students

2. To introduce the basics of Innovation, product development, and intellectual property

3. To equip students with tools for market validation and startup management

4. To understand the specific startup ecosystem in the hardware and IoT sectors

Unit-1. Entrepreneurship and Innovation Basics-Concept of Entrepreneurship, Traits of an entrepreneur, Types of Start- ups, Role of Innovation in economic growth, case studies of successful Indian tech startups (Ather Energy, Zerodha)

Unit-2. Ideation to Prototyping - Identifying problems in society/ industry, Design Thinking, Brainstorming solutions, Rapid Prototyping, Role of 3D printing and simulation software (Arduino, LT Spice)

Unit-3. Intellectual Property Rights(IPR) -- Patents in Electronics, Trademarks, Copyrights, Industrial Designs , Process of filling a patent, significance of IPR in protecting innovations.

Unit-4. Market Validation and Business Models-- Market survey techniques, Defining customers Persona, Value Proposition Design, , Business Model Canvas(BMC) Lena Startup Methodology.

Unit-5. Funding and Startup Ecosystem - sources of funding - Angel Investors, Venture capital, Govt. grants, (Start up India, MSME schemes) Pitching your idea. Role of Incubators

Unit-6. Project Assignment - Final Project - Developing a Business Plan for an Electronic Product and presenting a pitch deck