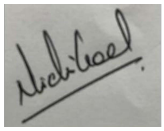
Indira Gandhi Delhi Technical University For Women
(Established by Govt. of Delhi vide Act 09 of 2012)
Department of Electronics and Communication Engineering

Course Structure for B. Tech ECE-AI
(Electronics & Communication Engineering- Artificial Intelligence)

First Year

First Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BEC-101	Analog Electronics	3-0-2	4	**DCC**
2.	BEC-110	Basic Electrical Engineering	3-0-2	4	**DCC**
3.	BCS-110	Programming in C Language	3-0-2	4	**DCC**
4.	BAI-101	Intelligent Systems	3-0-0	3	**DCC**
5.	BAS-109	Applied Mathematics	3-1-0	4	**ASH**
6.	HMC-110	Communication Skills	3-1-0	4	**HMC**
		Total		**23**	

Second Semester					
S. No.	**Code**	**Subject**	**L-T-P**	**Credits**	**Category**
1.	BEC-104	Digital Electronics	3-0-2	4	**DCC**
2.	BEC-106	Signals and Systems	3-0-2	4	**DCC**
3.	BAI-110	Programming with Python	3-0-2	4	**DCC**
4.	BAS-106	Environmental Sciences	2-1-2	4	**ASH**
5.	BAS-108	Probability and Statistics	3-1-0	4	**ASH**
6.	BAI-108	IT Workshop	1-0-2	2	**DCC**
		Total		**22**	



ANALOG ELECTRONICS	
Course Code: BEC-101 Contact Hours:L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 1

Introduction: It a branch of electronics which deals with analog electronic circuits and electronic components. The course will introduce solid state electronic devices such as p-n junction diode, BJT and FET which form the basic building block of any electronic system.

Course Objective:

- To give an insight into fundamental concepts of semiconductor devices and design of Analog integrated circuits
- To give the broad spectrum of Analog principles and design equations

Pre-requisite: Theory of semiconductor physics

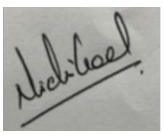
Course Outcome: After completion of the course, student will be able to:

- Understand the basic electronics components such as diodes and transistors
- Develop the capability to analyse and design transistor based circuits
- Understand various models for designing and analysing circuits

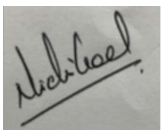
Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	12 Hours
Review of semiconductor physics, p-n junction diode, p-n diode characteristics and its operation, p-njunction capacitances (depletion and diffusion), breakdown in p-n diodes Diode applications: Clipping and clamping circuits, rectifier circuits, Zener diode, Zener diode as regulators, voltage multipliers, switching behavior of p-n diode Bipolar junction transistor: Introduction and types of transistors, construction, BJT characteristics inCB, CE & CC mode, operating point, ac/dc load line, leakage current, saturation and cut off mode ofoperations, Ebers-moll model Bias stabilization: Need for stabilization, various biasing schemes, bias stability with respect to variations in Ico, V_{BE} & β, Stabilization factors, thermal stability.	
UNIT-II	10 Hours



Models: Low frequency models for transistor (h-parameter, Hybrid – Π, r_{Π}) BJT amplifiers: Analysis at low frequency (CB, CE, CC & CE with R_E), comparison of varioustypes of configurations, cascaded Amplifiers, Darlington pair, cascode amplifiers High frequency response of amplifier: Hybrid-Π Model at high frequency, CE short circuit currentgain, current gain with resistive load	
UNIT-III	12 Hours
Multistage Amplifiers: Methods of coupling, RC coupled amplifier, frequency response analysis(Low, Mid & High), calculation of gain bandwidth Feedback Amplifiers: Feedback concept, Classification of Feedback amplifiers, properties of negative feedback amplifiers, overall gain using feedback, impedance considerations in different configurations, examples of analysis of feedback amplifiers Special semiconductor devices: SCR (Operation, Characteristics & applications), Thyristors, TRIAC, DIAC, Unijunction Transistor (UJT), UJT Relaxation Oscillator	
UNIT-IV	8 Hours
Field Effect Transistor: Classification, JFET characteristics, operating point, various biasing techniques, enhancement & depletion type MOSFETs, JFET Model, JFET amplifier analysis (CD, CS & CG), CMOS, MISFET, MESFET, VFET	
Text Books	
1	Millman and Halkias, "Electronic devices and circuits" TMH, 4th Edition, 2015.
2	Salivahanan, Suresh Kumar, Vallavaraj, "Electronic devices and circuits" TMH, 4th Edition. 2016
3	Boylestad & Nashelsky, "Electronic Devices & Circuit Theory" PHI, 5th Edition, 2014.
Reference Books	
1	Balbir Kumar and S. B. Jain, "Electronic Devices and Circuits" PHI, 2012.
2	Sedra& Smith, "Micro Electronic Circuits" Oxford University Press, 6th Edition, 2012.
3	J. Millman and Halkias, "Integrated Electronics, Analog & Digital Circuits & Systems" TMH, 2017.



BASIC ELECTRICAL ENGINEERING	
Course Code : BEC-110 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester : 1

Introduction: To impart basic knowledge of electrical engineering with an understanding of fundamental knowledge.

Course Objective: The aim of this course is to:

- Prepare the students to develop the ability of solving real world problems, going a step ahead of what they have studied in school. The curriculum is so designed that the students get an
- Provide students with in-depth knowledge of everyday systems and phenomena surrounding them.
- Make student understand the classical laws with modern devices which will enhance the ability of students to apply fundamentals to various applications.

Course Outcome:

Having successfully completed this course, the student will be able to:

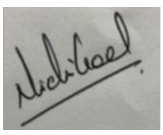
- Gain knowledge and comprehend various fundamentals of electrical engineering.
- Build a sound foundation of applications of electrical engineering.
- Identify and analyze relationship between different principles of electrical engineering and integrate them for various field of engineering.
- Evaluate and apply the quantitative and qualitative aspects of electrical engineering to innovate devices in the constantly competitive Technologies

Pedagogy:

The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

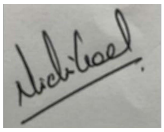
Contents

UNIT-I	11 Hours
Circuit Analysis: Ohm‘s Law, KCL, KVL Mesh and Nodal Analysis, Circuit parameters, energy storage aspects, Superposition, Thevenin‘s, Norton‘s, Reciprocity, Maximum Power Transfer Theorem, Millman‘s Theorem, Star Delta Transformation, Applicationof theorems for the Analysis of dc circuits.	
UNIT-II	10 Hours
A. C. Circuit: Basics of AC, effective, average and maximum values, form factor and k-factor, different types of AC power, R-L, R-C, R-L-C circuits (series and parallel), Time Constant, Phasor- representations, Response of R-L, RC and R-L-C circuit to sinusoidalinput, Resonance-series and parallel Circuits, Q-factor, and Bandwidth.	



UNIT-III	10 Hours
Measuring Instruments: Principles, construction and application of moving coil, moving iron, dynamometer type, induction type instruments, extension of range of ammeter, voltmeter (shunt and multiplier), Two-wattmeter method, for the measurement of power	
UNIT-IV	11 Hours
Transformer and Electrical Machines: Construction and working principles, phasor diagrams of single-phase Transformer, Emf equation, equivalent circuit, regulation and efficiency, auto transformer. Rotating Machines DC Machines: Construction and working principles of dc motor andgenerator and its characteristics, applications of DC machines.	

Text Books	
1	Vincent DEL TORO, "Electrical Engineering Fundamental's", Prentice Hall India, Ed 2011 or latest.
2	J. Edminister, M. Nahvi, K. Rao, "Electric Circuits," Schaum's Outline Series, 2017.
Reference Books	
1	Hayt, W. H., Kemmerly, J. E., & Durbin, S. M. (1986), "Engineering CircuitAnalysis", (p. 74), New York: McGraw-Hill or latest.
2	Fitzgerald, Arthur Eugene, David E. Higginbotham, and Arvin Grabel, "Basic Electrical Engineering," McGraw-Hill Series in Electrical Engineering, Auckland: McGraw-Hill, 1981, 5th ed. (1981) or latest.



PROGRAMMING IN C LANGUAGE	
Course Code: BCS- 110 Contact Hours: L-3 T-0 P- 2 Course Category: DCC	Credits: 4 Semester: 1

Introduction: This course briefs about basic introduction to computers and its corresponding concepts in benefit of students coming from non-computer background. Apart from this, programming concepts are also discussed in this courseusing C programming language.

Course Objective:

- To provide an understanding of basic computer architecture includingNumber System. Discussion of computer history and overview of operating systems.
- To impart adequate knowledge on the need and concept of algorithms andprogramming.
- Develop, execute and document computerized solution for variousproblems using the features of C language.
- To enable effective usage of arrays, structures, functions, pointers andto implement the concepts of file organization.

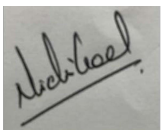
Pre-requisite: None

Course Outcome: After studying this course students will be able to:

- Explain the fundamentals of computers and programming.
- Apply problem solving skills in programming.
- Learn logic development
- Develop and run computer programs in C language

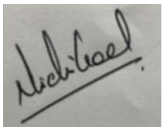
Pedagogy:

The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

UNIT-I	12 Hours
Introduction to computer systems, ALU, registers, memory. Concepts of the finite storage, bits bytes, kilo, mega and gigabytes. Idea of program execution at micro level. Introductionto system software: operating systems, compilers, assemblers, interpreter and multi-user environments. Concept of flow chart and algorithms, algorithms to programs. Logic development for solving problems, development of flow chart and algorithms	
UNIT-II	12 Hours
Concept of variables, program statements and function calls from the library (Printf for example), C data types: int, char, float etc., C expressions, arithmetic operation, relational and logic operations, C assignment statements, extension of assignment of the operations. Cprimitive input output using getchar and putchar, exposure to scanf and printf functions, C Statements, conditional executing using if, else, switch case, go-to and break statements.	
UNIT-III	09 Hours
Concept of loops in C using for, while and do-while. Arrays: single and two--dimensional arrays, initializers, array parameters, example of iterative programs using arrays and use in matrix computations. Functions, parameters and return values, standard library functions.	
UNIT-IV	09 Hours
Pointers, relationship between arrays and pointers, Call by reference. Array of pointers, passing arrays as arguments. Character strings: processing strings using loops, and string library functions Structure and Unions: structure concepts, structures as Parameters, arrays of structures.	
Text Books	
1	Mastering C, 2nd Edition, K R Venugopal,Sudeep R Prasad, McGraw Hill Education, 2017
2	Let Us C, 13th Edition, Yashavant Kanetkar, BPB Publications, ISBN: 978-8183331630, 2013.
3	Fundamentals of Computers, 6th Edition, V Rajaraman, PHI Learning, 2014.
Reference Books	
1	Programming in ANSI C, 6th Edition, McGraw Hill Education (India) PrivateLimited E Balagurusamy, ISBN:978-1259004612, 2012.
2	The C Programming Language, B W Kernighan, Dennis Ritchie, 2nd Edition, 2015.
3	The Complete Reference C, Herbert Schildt, Tata McGraw Hill, 4th Edition, 2017.



INTELLIGENT SYSTEMS	
Course Code: BAI-101 Contact Hours: L-3 P-0 C-0 Course Category: DCC	Credits: 3 Semester: 1

Introduction

The field of computer science has continuously evolved to build intelligent systems. The design and development of intelligent systems grounded in the field of artificial intelligence is becoming quite popular in Computer Science. The fundamental question 'Can intelligent systems mimic humans and surpass them in all kinds of work?' has kept computer scientists occupied for many decades in the past, and will continue to occupy them in future. This course is a gentle introduction to the field of intelligent systems.

Course Objectives

- Understand the basic building blocks of Intelligent Systems.
- Appreciate some of the approaches to build Intelligent Systems.
- Understand the importance of application of Intelligent Systems in different domains.

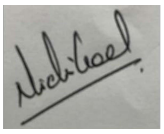
Pre-requisites: None

Course Outcome Upon successful completion of this course, students will be able to:

- Understand the different approaches to the design of intelligent systems.
- Appreciate the importance of intelligent systems in different domains.
- Development of an intelligent system is not expected. But 'thinking' in that direction should start.

Pedagogy

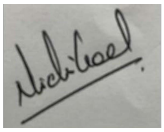
The teaching-learning of the course would be organized through lectures, assignments, case studies/presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

UNIT- I	7 Hrs
Intelligence, Intelligent Systems, Characteristics of Intelligent Systems, Knowledge vs Intelligence, Knowledge Representation, Reasoning, Deductive vs. Inductive vs. Abductive Reasoning, Propositional Logic, Inference Foundations of AI, Intelligent Agents, Structure of Intelligent Agent. Environment of Intelligent Agent. Case Studies.	
UNIT - II	7 Hrs
Importance of Data, Dataset, Introduction to Data driven approaches, Introduction to Machine Learning, Training and Testing, Various approaches to intelligent system, Pattern recognition and classification,	
UNIT - III	7 Hrs
Domains of Intelligent Systems – Computer Vision, Natural Language Processing, Speech Processing, Mobile Robotics, Internet of Things (IoT), Intelligent IoT Applications, Drones, Intelligent Web Applications	
UNIT - IV	7 Hrs
Intelligent Applications – Agriculture, Healthcare, Education, Smart Cities, Autonomous Vehicle.	

Text Books	
1	Stuart J. Russel and Peter Norvig. Artificial Intelligence – A Modern Approach. 4th/Latest Edition, Pearson Education, 2020.
2	Deepak Khemani, A First course on Artificial Intelligence –McGraw Hill India, 2013
3	Peter Flach, The Art and Science of Machine Learning, Cambridge University Press, 2012.
Reference Books	
1	Josh Patterson, Adam Gibson. Deep Learning: A Practitioner's Approach. O'Reilly Media, 2017.
2	Gregory Dudek and Michael Jenkin. Computational Principles of Mobile Robotics. Cambridge University Press, 2012.



APPLIED MATHEMATICS	
Course Code: BAS-109 Contact Hours: L-3 T-1 P-0 Course Category: ASH	Credits: 4 Semester: 1

Introduction: Mathematics is used in almost every field of engineering be it computer science and information technology wherein it may be used in modeling, machine learning, image processing etc., or by electrical engineers for signal processing, control engineering or by mechanical engineers for design, modeling, manufacturing etc. But the problem faced by engineers is to how to apply the basic mathematical concepts in engineering problem which they would be dealing in coming years. The course covers the various topics of engineering mathematics such as matrices, sequences and series, calculus of functions of more than one variable and vector calculus.

Course Objective:

- The students will be made familiar with the concepts of matrices, sequences and series.
- To provide students with skills and knowledge of calculus of functions of several variables and vector calculus which would enable them to devise solutions for given situations they may encounter in day-to-day engineering problems.

Prerequisite: Fundamentals of matrices, calculus of functions of single variable, vectors.

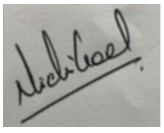
Course Outcomes:

Having successfully completed this course, the student will be able to

- Build a sound foundation and have comprehensive knowledge of matrices, Infinite series, Fourier series, calculus of functions of more than one variable and vector calculus.
- Evaluate rank, inverse, Eigen values and Eigen vectors of a matrix.
- Determine the convergence/divergence of an infinite series, approximation of functions and error estimation using Taylor's series expansion.
- Analyze some mathematical problems encountered in engineering applications.
- Learn various concepts and applications of maxima and minima, multiple integrals, gradient, divergence, curl, Green's theorem, Gauss divergence theorem and Stoke's theorem.

Pedagogy:

The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

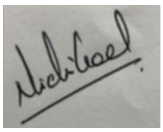
UNIT-I	10 Hours
Matrix Algebra: Elementary operations and their use in getting the rank, Inverse of a matrix and solution of linear simultaneous equations, orthogonal, symmetric, skew-symmetric, hermitian, skew-hermitian, normal & unitary matrices and their elementary properties, linear transformations, Eigen values and eigenvectors of a matrix, Cayley Hamilton theorem, diagonalization of a matrix.	
UNIT-II	12 Hours
Sequences and series: Introduction to sequences and Infinite series, tests for convergence/divergence, Limit comparison test, ratio test, root test, Raabe's test, log test, Gauss's test, Cauchy integral test, alternating series, absolute convergence and conditionalconvergence. Fourier series and its convergence, Fourier half range series.	
UNIT-III	10 Hours
Differential Calculus: Functions of several variables: Limits, continuity and Differentiability, Successive differentiation, Leibnitz theorem, Partial differentiation, Euler's Theorem for homogenous equations. Composite functions, Change of variables, Taylor's and Maclaurin's Series, maxima and minima, Lagrange's method of undetermined multiplier.	
UNIT-IV	10 Hours
Vector Calculus: Vector point functions, Gradient, Divergence and Curl and their physical interpretation, Line integrals, Multiple Integrals, Change of order of integration, Surface and Volume integrals, Green's, Gauss Divergence and Stoke's theorems (without proof).	

Text Books

1	D. G. Zill and W. S. Wright, "Advanced Engineering Mathematics", 6th Edition, The Jones and Bartlett Learning Publishers, 2016 or latest.
2	Jain R. K. and Iyengar S. R. K., "Advanced Engineering Mathematics", 4th Edition, Narosa Publishing House Pvt. Ltd.2012 or latest.
3	Grewal, B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017 or latest.

Reference Books

1	George B. Thomas Jr., Ross L. Finney, "Calculus and Analytic Geometry", 9th Edition, Pearson Education India, 2010 or latest.
2	Greenberg M., "Advanced Engineering Mathematics", 2nd Edition, Pearson Education, 1998 or latest.
3	Kreyszig E. "Advanced Engineering Mathematics", 10th Edition, John Wiley &Sons, 2010 or latest.



COMMUNICATION SKILLS	
Course Code: HMC-110 Contact Hours: L-3 T-1 P-0 Course Category: HMC	Credits:4 Semester: 1

Introduction: This course facilitates communication skills development by exposing the students to various nuances of effective communication. The course provides an in-depth understanding of several key concepts of Communication like importance and functions of communication, barriers to communication, active listening, group discussions, presentation skills etc. The course also provides valid inputs on the ethical dimension of communication to enable the students to be ethical communicators.

The highlight of the course is special emphasis on Employment Communication i.e. job application and resume writing along with preparing and appearing for Interviews. The students are also acquainted with various forms of business correspondence used in organizations on a regular basis like agenda and minutes of meetings, business letters, reports etc.

Course Objectives:

- To enable students to evaluate their personal communication styles and improve upon it.
- To help the students understand the contemporary trends in communication.
- To facilitate the students in becoming aware of different communication theories andtheir application.
- To encourage students to develop their own unique style of communication.

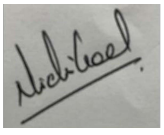
Pre-requisites: None

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

- Evaluate and analyze their personal communication style while adapting their communication style to better expression of their ideas at workplace.
- Enhance their knowledge of contemporary trends for effective Communication
- Effective comprehension and application of different Communication theories.
- Synthesis their own unique communication style.

Pedagogy:

The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

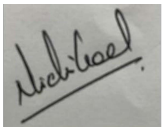
UNIT-I	7 Hours
Introducing Communication: Importance and function of Communication, Communication Cycle, Characteristics and Types of Communication, Channels and Medium of Communication, 7 C's of Communication, Barriers to Communication. Ethics of Communication (plagiarism, language sensitivity towards gender, caste, race, disability etc.	
UNIT-II	7 Hours
Everyday Communication: Non-Verbal Language (Symbols, Appearance, Paralanguageand Body Language, Proxemics, Chronemics), Listening Skills (Importance, Barriers, Essentials of Good Listening), Communication Skills (greetings, introducing, making requests, asking and giving permission, offering help and giving instructions and directions etc.), Understanding Telephone Skills (handling calls, leaving a message, asking and giving information and instructions etc.), Net Etiquettes.	
UNIT-III	7 Hours
Presentations & Employment Communication: Classroom Presentations (purpose, types, preparing and presenting - use of visual aids/ power point presentations), Group Discussion (purpose, strategies, guidelines etc.), Job Application (Resume and Cover Letter), Interview Skills (purpose, types of interviews, guidelines and preparing for facing the interviews). Presentation, Group discussion and Mock interview practice should be undertaken in class.	
UNIT-IV	7 Hours
Writing on the Job: Formal and Informal Writing, Basics of Paragraph Writing, Email Writing, Letters at the workplace, Meeting documentations (Agenda and Minutes of meeting etc.), Report Writing (characteristics, types, structure of formal report).	

Text Books

1	M. Raman and S. Sharma. Technical Communication: Principles and Practice, 3rd Edition, Oxford University Press, 2011 or latest.
2	M. Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hill Publications, 2005 or latest.

Reference Books

1	Lewis and Hedwig, Body Language: A Guide for Professionals, New Delhi, Response Books, 2000 or latest.
2	Sides and H. Charles, How to Write & Present Technical Information, Cambridge, CUP, 1999 or latest.
3	S. Kumar and P. Lata. Language and Communication Skills for Engineers, Oxford University Press, 2018.
4	Hasson, Gill. Brilliant Communication Skills. Pearson Education, 2012 or latest.



DIGITAL ELECTRONICS	
Course Code: BEC-104 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 2

Introduction: Digital circuits are the basic blocks of modern electronic devices like mobile phones, digital cameras, microprocessors and several other devices. In this course, we will learn the fundamentals of digital circuits and how to engineer the building blocks that go into digital subsystems. We will first learn the basics of Boolean algebra and combinational logic. We will then have a thorough treatment of sequential circuits and state machines. Finally, we will learn how to analyse the performance of digital circuits and how to design high performance circuits.

Course Objective:

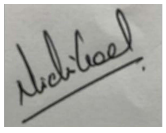
- To understand number representation and conversion between different representation indigital electronic circuits.
- To analyse logic processes and implement logical operations using combinational logiccircuits.
- To understand characteristics of memory and their classification.
- To understand concepts of sequential circuits and to analyse sequential systems in terms ofstate machines.
- To understand concept of Programmable Devices, PLA, PAL, TTL, ECL, CMOS logic families.

Pre-requisite: Basic understanding of diode, transistor operation. If this is not covered in 10+2 Boardof the students, then the same may be studied from Analog Electronics course.

Course Outcome: After successful completion of the course student will be able to

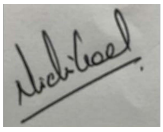
- Create a digital logic and apply it to solve real life problems.
- Analyse, design and implement combinational logic circuits.
- Understand different semiconductor memories.
- Analyse, design and implement sequential logic circuits.
- Analyse digital system design using PLA.

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

UNIT-I	11 Hours
Analog & Digital signals, AND, OR, NOT, NAND, NOR & XOR gates, Boolean algebra. Standard representation of Logical functions, K-map representation and simplification of logical functions, Don't care conditions, X-OR & X-NOR simplification of K-maps. Combinational circuits: Multiplexers, demultiplexers, Decoders & Encoders, Adders & Subtractor, Code Converters, comparators, decoder/ drivers for display devices.	
UNIT-II	10 Hours
Flip Flops: S-R, J-K, D & T Flip-flops, excitation table of a flip-flop, race around condition. Sequential circuits: Shift registers, Ripple counter, Design of Synchronous counters and sequence detectors, sequence generators.	
UNIT-III	11 Hours
A/D and D/A converters: ADC Performance Characteristics - Resolution, Sampling Rate, Dynamic Range; Binary-weighted DAC, R-2R Ladder type networks, Successive-approximation ADC, Linear ramp ADC, Dual-slope ADC. Logic Families: Characteristics, RTL and DTL circuits, TTL, ECL and CMOS Logic families. Comparison of all Logic Families.	
UNIT-IV	10 Hours
Logic Implementations using ROM, PAL & PLA. Semiconductor Memories: Memory organization & operation, classification and characteristics of memories, RAM, ROM and content addressable memory.	
Text Books	
1	R.P. Jain, "Modern Digital Electronics", TMH, 4th Edition, 2014.
2	Morris Mano, "Digital Design", PHI, 5th Edition. 2014.
3	Malvino and Leach, "Digital principles and applications", TMH, 7th Edition, 2010.
Reference Books	
1	R. J. Tocci, "Digital Systems", PHI, 10th Edition, 2009.
2	I. J. Nagrath, "Electronics, Analog & Digital", PHI, 2nd Edition, 2013.
3	J. M. Yarbrough, "Digital Logic-Application and Design", PWS Publishing, 4th Edition, 2012.



SIGNAL AND SYSTEMS	
Course Code: BEC-106 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester:2

Introduction: Introduction to analog and digital signal processing, a topic that forms an integral partof engineering systems in many diverse areas, including seismic data processing, communications, speech processing, image processing, defense electronics, consumer electronics, and consumerproducts. The course presents and integrates the basic concepts for both continuous-time and discrete-time signals and systems. It addresses the following topics: classifications of signals and systems, basic signal operations, linear time-invariant (LTI) systems, time-domain analysis of LTI systems, signal representation using Fourier series, continuous-time Fourier transform, discrete-time Fourier transform, and Laplace transform.

Course Objective: The course will provide strong foundation on signals and systems which will be useful for creating foundation of communication and signal processing. The students will learn basiccontinuous time and discrete time signals and systems. Student will understand application of varioustransforms for analysis of signals and systems both continuous time and discrete time. Students will also explore to power and energy signals and spectrum.

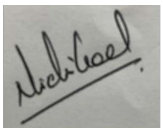
- Foundation of signals and systems for electrical, electronics and electronics and Communication engineering.
- Create strong foundation of communication and signal processing to be studied in the subsequent semester.
- Students will also explore to power and energy signals and spectrum.

Pre-requisite: Inclination to learn mathematics, basic knowledge of differential equations and difference equations, electrical circuits and networks.

Course Outcome: After successful completion of the course, student will be able to

- Understand about various types of signals, classify them, analyse them, and perform variousoperations on them.
- Understand about various types of systems, classify them, analyse them and understand theirresponse behaviour.
- Apply transforms in analysis of signals and system.
- Analyse the effects of applying various properties and operations on signals and systems bycarrying out simulation

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

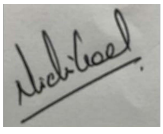
UNIT-I	11 Hours
Introduction: Continuous and Discrete – Time Signals & their Classification, Continuous & Discrete– Time system & their properties. Linear Time Invariant Systems, properties of LTI systems, State variable Description for LTI systems, Convolution for Continuous- time systems (CTS), convolution for Discrete time systems (DTS), Correlation of DTS.	
UNIT-II	10 Hours
Fourier analysis for CTS: Importance of Frequency Domain Analysis, Response of LTI systems to Exponential Signals, Periodic signals and properties, Fourier Transform (FT) its Properties, system analysis of LTI system using FT Fourier	
UNIT-III	11 Hours
Discrete Time Fourier Series (DFS), Discrete Time Fourier transform (DTFT) & its properties analysis of LTI system using DFS, DTFT. Time and Frequency Characterization of Signals and Systems: The Magnitude Phase Representation of the Fourier Transform, Classification of Linear and Nonlinear phase, Phase Delay and Group Delay. Min Phase system, Max phase system, all passsystem	
UNIT-IV	10 Hours
Sampling: The sampling Theorem, Effect of under sampling, aliasing, interpolation, signal reconstruction using zero order hold system, Sample and Hold circuit. Z- Transform: Definitions and Properties, Significance and properties of ROC, Inversion of Z-Transform using partial fractionsand residue theorem, Application of Z-transform for LTI system	

Text Books

1	Alan V. Oppenheim, Alan S. Wilsky and Nawab, "Signals and Systems", Prentice Hall ,2nd Edition ,2017
2	JG.Proakis and DG.Manolakis, "Digital Signal Processing Principles, Algorithms and Applications", 4th Edition, Pearson, 2009
3	Simon Haykin and Bary Van Veen," Signals and Systems", Wiley India Publications,2nd Edition,2002

Reference Books

1	Michal J. Roberts and Govind Sharma, "Signals and Systems", Tata Mc-Graw Hill Publications,2nd Edition ,2017
2	B.P.Lathi , "Linear Systems and Signals", Oxford University Press,3rd Edition, 2017
3	Ramesh Babu, "Signal & Systems", Scitech, 4th Edition, 2011



PROGRAMMING WITH PYTHON	
Course Code: BAI-110 Contact Hours: L-3 T-0 P-2 Course Category: DCC	Credits: 4 Semester: 2

Introduction: Python is a versatile programming language, suitable for projects ranging from small scripts to large systems. It is widely used in many scientific areas for data exploration. This course will be useful for both text and data processing.

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Course Objective:

- To know the basics of algorithmic problem solving for reading and writing Python programs.
- To develop Python programs with conditionals and loops.
- To use Python data structures – lists, tuples dictionaries.
- To define Python functions and call them.
- To do input/output with files in Python

Prerequisite: Nil

Course Outcomes:

Having successfully completed this course, the student will be able to

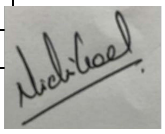
- Write python programs that solve simple business problems.
- Create python applications that are robust and multithreaded.
- Manage exceptions in Python
- Write simple GUI interfaces for a program to interact with users, and to understand the event-based GUI handling principles in python.

Pedagogy:

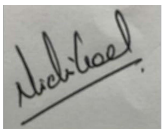
The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

Contents

UNIT-I	10 Hours
Introduction to Python programming language, The concept of data types, variables, assignments, immutable variables, numerical types, arithmetic operators, Data and Expressions, Literals, Variables and Identifiers, Understanding error messages, Conditions, Boolean Logic, Logical Operators, ranges, Control statements: if-else, loops (for, while);	
UNIT-II	11 Hours
Strings and text files; manipulating files and directories, os and sys modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab separated); String manipulations: subscript operator, indexing, slicing a string, Lists, Tuples, and Dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries; Function, Execution of A Function, Keyword and Default Arguments, Scope Rules.	
UNIT-III	10 Hours



Exception, Testing and Debugging: Handling if exceptions to handle the code cracks, handling and helping file operations, coding with the exceptional handling and testing Anonymous method, Properties, Indexers, Exception Handling	
UNIT-IV	11 Hours
Python packages: Simple programs using the built-in functions of packages like matplotlib, numpy, pandas etc., Graphical user interfaces; Tkinter introduction, Tkinter and Python Programming, event-driven programming paradigm; creating simple GUI; buttons, Labels, entry fields, dialogs; widget attributes - sizes, fonts, colors layouts, nested frames.	
Textbooks	
1	C. Dierbach, Introduction to Computer Science Using PYTHON: A Computational Problem-Solving Focus (1st Edition), Wiley, 2015 or latest.
2	Let Us Python, Yashavant Kanetkar, BPB Publishers, 2019, 1st edition
Reference Books	
1	Allen B. Downey, Think Python: How to Think Like a Computer Scientist (2nd Edition), O'Reilly, 2016 or latest.
2	Martin C. Brown, Python: The Complete Reference (4th Edition), McGraw-Hill, 2018.



ENVIRONMENTAL SCIENCES	
Course Code: BAS-106 Contact Hours: L-2 T-1 P-2 Course Category: ASH	Credits: 4 Semester: 2

Introduction:

A scientific study of the natural world and how it is influenced by people. It Surveys environmental studies, examining ecological, socioeconomic, and technological factors that influence the quality of life on Earth.

Course Objectives:

- Environmental science prepares students for career success in environmental monitoring and remediation, natural resources and conservation, public health, industrial environmental management.
- The curriculum is so designed that the students get an in-depth knowledge of the environment and various issues arising due to mismanagement of resources.

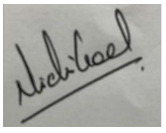
Pre-requisites: None

Course Outcomes:

Upon successful completion of this course, students will be able to:

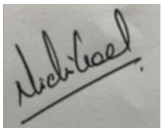
- Plan and execute experiments that demonstrate the use and understanding of modern instruments, accurate quantitative measurements, appropriate recording skills, safe lab practices.
- Understand and evaluate the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales
- Analyze data statistically, assess reliability, interpret results and draw reasonable conclusions.
- Gain comprehensive knowledge of interdisciplinary branches like Toxicology, Green Technology, synthesis and applications of Eco friendly polymers.

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.

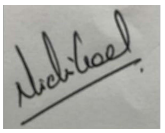


Contents

UNIT-I	6 Hours
Natural Resources, Conservation and Management: Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water. Mineral resources: Environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs renewable and non-renewable energy sources. Resource Management-Concept of Sustainable development, Environmental Management Systems, Environmental Impact Assessment, Biodiversity- conservation and threats.	
UNIT-II	8 Hours
Environmental Pollution and Control: Air Pollution: Types of air pollutants; Source, effects, sink & control of common air pollutants (CO, oxides of nitrogen & sulphur, hydrocarbons and particulates), Photochemical smog, acid rain, greenhouse effect, global warming, Carbon dioxide sequestration and the concept of Carbon Credits Water Pollution: Classification of pollutants and their sources, Waste water treatment (Primary, secondary and tertiary treatment), Impact of water pollution on hydrological ecosystems. Solid and Hazardous Waste Pollution: Classification, waste treatment and disposal methods: Sanitary landfill, thermal processes, chemical and biological processes, disposal methods for nuclear waste, nuclear disaster (case study), disposal methods for e-waste. Green Technology And Green Chemistry: Introduction to concept of Green Technology and Zero Waste Technology, Green Chemistry & its basic principles, Atom Economy, evaluation of feedstock, reaction types, methods, reagents and solvents.	
UNIT-III	8 Hours
Fuels and Alternate Energy Sources: Classification, Calorific value of fuels (gross and net), Dulong's formula, Determination of calorific value of fuels using bomb's calorimeter, Determination of calorific value of fuels using Boy's Gas Calorimeter (Numerical). Liquid fuels-petroleum chemical composition, fractional distillation, Cracking – Thermal & catalytic cracking, Octane & Cetane numbers with their significance. Analysis of flue gases (Orsat's Apparatus)-(Numerical), Combustion of fuels. Use of alternate energy sources including solar energy harnessing (photovoltaic), wind energy, hydro-energy, geothermal energy, ocean energy, biodiesel, power alcohol, biomass energy.	
UNIT-IV	6 Hours
Chemical Toxicology and Eco-Friendly Polymers Toxicology: terminology & toxic effects, chemical interactions, impact of toxic chemicals on enzymes, Biochemical effects of arsenic, mercury, lead, chromium, & cadmium. Polymers-Introduction: Functionality of monomer, polymerization, degree of polymerization, Number average and weight average molecular weight of polymers. Environmental degradation of polymers: Biodegradable, Photo-biodegradable polymers, Hydrolysis & Hydro-biodegradable polymers Biopolymers & Bioplastics.	



Text Books	
1	Ranu Gadi, Sunita Rattan, Sushmita Mohapatra. A Text book of Environmental Studies (with experiments), 4th Ed., S. K. Kataria & Sons, 2014.
2	S. Rattan, "Applied Chemistry", S.K. Kataria & Sons, 2013.
3	S. S. Dara, D. D. Mishra. A Textbook of Environmental Chemistry and Pollution Control (With Energy, Ecology, Ethics and Society) S. Chand and Company Pvt. Ltd. (India), 2011.
Reference Books	
1	Richard T. Wright, Environmental Science, 9th Edition, Pearson Education, 2007.
2	Gerard Kiely, Environmental Engineering, special Indian edition The McGraw-Hill Companies, 2007.
3	E. Barucha, Textbook of Environmental Studies for Undergraduate Courses, Universities Press (India) Pvt. Ltd., 2005.
4	C.N. Sawyer, P.L. McCarty, and G.F. Parkin, "Chemistry for Environmental Engg. and Science", 5th Ed., The McGraw-Hill Companies, 2003.
5	R. Rajagopalan, Environmental studies from crisis to cure, 3rd edition, Oxford University Press., 2016.



PROBABILITY AND STATISTICS	
Course Code: BAS-108 Contact Hours: L-3 T-1 P-0 Course Category: ASH	Credits: 4 Semester: 2

Students will learn fundamental rules of Probability, discrete and continuous distributions, and statistical methods most commonly used in Computer Science and & Engineering.

Course Objectives:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.

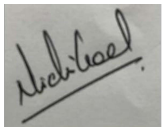
Course Outcomes:

On completion of the course, the student should be able to:

- Conduct simple calculations of probabilities and conditional probabilities, in particular by using methods for independent events;
- Give an account of basic properties for random variables and for the most common probability distributions, as well as calculations of expectations and variances for these distributions;
- Use probabilistic methods in some areas of applications;
- Explain the basics of statistical surveys and for methods of descriptive statistics;
- Implement the above concepts in EXCEL/R/Mathematica.

Prerequisite: NIL

Pedagogy: The teaching-learning of the course would be organized through lectures, assignments, projects/ presentations and quizzes. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

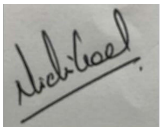
UNIT – I	14 Hours
PROBABILITY AND RANDOM VARIABLES Concept of probability, additive and multiplicative law of probability, total and conditional probabilities, Baye's theorem. Measures of Central Tendency, dispersion, kurtosis, moments. Random Variables, density and distribution functions, mathematical expectation, variance, standard deviation and moment generating function.	
UNIT – II	8 Hours
TWO – DIMENSIONAL RANDOM VARIABLES Jointly distributed random variables, Marginal and conditional distributions, Expected values, Covariance and Correlation. Central limit theorem (for independent and identically distributed random variables).	
UNIT – III	10 Hours
PROBABILITY DISTRIBUTIONS AND REGRESSION Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions. Linear Correlation, Correlation Coefficient, Rank Correlation Coefficient, Regression.	
UNIT –IV	10 Hours
APPLIED STATISTICS Formation of Hypothesis, Test of significance: Large sample test for single proportion, Difference of proportions, Single mean, Difference of means, and standard deviations. Test of significance for small samples: t- Test for single mean and difference of means, t-test for correlation coefficients, F- test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	
Case Study / Implementation of above concepts using Excel.	

Text Books

1.	Montgomery, Douglas C., and George C. Runger. "Applied Statistics and Probability for Engineers", John Wiley & Sons, 7th Edition (2018) or latest.
2.	Sheldon Ross M., Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 6th Edition (2020) or latest.
3.	Rukmangadachari E., and Keshava, Reddy E. Probability and Statistics, Pearson Education India (2015) or latest.
4.	Ravichandran J., Probability and Statistics for Engineers. Wiley India, 2010.

Reference Books

1.	Devore, Jay L. "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage (2010) or latest.
2.	Scheaffer, Richard, Madhuri Mulekar, and James McClave. Probability and Statistics for Engineers. Nelson Education, 2010.
3.	Meyer, Paul L. Introductory Probability and Statistical Applications. 2nd Edition, Oxford and IBH publishing, 1965.
4.	Gupta S.C. and Kapoor V.K., Fundamentals of Mathematical Statistics, S Chand Publications, 11th Edition(20) or latest



IT WORKSHOP	
Course Code: BAI-108 Contact Hours: L-1 T-0 P-2 Course Category: DCC	Credits: 2 Semester: 2

Introduction: IT Workshop is a practical course where students will learn programming with R. R is capable of handling mathematical and statistical manipulations. It has its own programming language as well as built-in functions to perform any specialized task.

Course Objectives:

- To introduce students to the statistical package R for data analysis.
- To use R to perform descriptive statistics including graphics, perform basic inferential statistical analyses including regression analysis, read and write data files,
- To perform basic data manipulations (eg, creating new variables, merging data sets), write and use R script files, use R packages, write and use R functions, and perform basic programming in R.

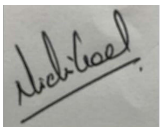
Pre-Requisites: Fundamentals of Mathematics background.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- Perform simple calculations, make simple plots and perform multiple operations in sequence, or at once
- Troubleshoot errors
- Perform exploratory data analysis, data modeling and interpretation of results
- Format “clean” data and clean up “dirty” data

Pedagogy: The teaching-learning of the course would be organized mainly through lectures, and practical sessions in lab. Faculty members strive to make the classes interactive so that students can correlate the theories with practical examples for better understanding. Use of ICT, web-based sources as well as flipped class room teaching will be adopted.



Contents

UNIT I	11 Hours
An overview of R language: Basic fundamentals, installation and use of software, data editing, use of R as a calculator, functions and assignments. getting R and running R, R packages expressions, objects, symbols, functions Special Values	
UNIT II	11 Hours
Constants, Numeric vectors, Character vectors, operators. R syntax, Data structure in R (Matrices, Arrays, Factors, Data frames), Attributes, Symbols and environment, Functions, Loading, saving, and editing data in R, combining datasets, transformations, Binning data	
UNIT III	10 Hours
Subsets, summarizing functions, data cleaning. Analyzing data, probability distribution, continuous data , discrete data, T-test design, Anova Test design, introduction to regression, linear model, smoothening	
UNIT IV	10 Hours
Graphics and Plots: Scatter plots, bar charts, pie charts, three-dimensional data, plotting distribution, customizing charts, basic graphic functions common arguments for chart functions.	

Text Books:

1	Long, James D., and Paul Teetor. R Cookbook: Proven Recipes for Data Analysis, Statistics, and Graphics. O' Reilly Media, 2019.
2	Christian Heumann, Michael Schomaker and Shalabh, Introduction to Statistics and Data Analysis - With Exercises, Solutions and Applications in R, Springer, 2016
3	Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet, The R Software-Fundamentals of Programming and Statistical Analysis, Springer 2013

Reference Books:

1	Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters, A Beginner's Guide to R (Use R), Springer 2009
2	Hadley Wickham, ggplot2 Elegant Graphics for Data Analysis, Springer 2016
3	Internet Sources: www.nptel.ac.in