Department of Electronics and Communication Engineering

Curriculum Structure & Syllabi

of

B.Tech.

In

ECE (IoT)

(w.e.f. 2023-2024)

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

M. M. M. UNIVERSITY OF TECHNOLOGY

GORAKHPUR-273010, UP

July-2023

PROPOSED OVERALL CREDIT STRUCTURE FOR B.TECH. PROGRAM

Credit Courses			
Core Courses (CC)**		**Electives Courses (EC)****	
Category	**Min. Credits**	**Category**	**Min. Credits**
Basic Sciences & Maths (BSM)	18	Program Electives (PE)	12
Engineering Fundamentals (EF)	18	Open Electives (OE) (Other Departments)	3
Professional Skill (PS)	4		
Program Core (PC)	64	Humanities & Social Science elective (HSSE)	2
Management (M)	4		
Humanities & Social Science (HSS)	6		
Project (P)	5		
Seminar (S)	2		
Industrial Practice (IP)/ Industrial Elective (IE)	12		
Program link basic science and engineering courses (PLBSE) (To be decided by the department)	15		
Sub-total	**148**	**Sub-total**	**17**
Grand Total	**165**		
**** subjects to be taught for more than one branch may be scheduled both in odd and even semesters.**			

1. Extracurricular Activities Courses (ECA) Two compulsory courses from the following S. No (ii) to (v) non-credit courses: (i) Induction Program (compulsory) (ii) Skill development (iii) Unity and Discipline (NCC or NSS) (iv) Sports, Cultural, and Games (v) Personality Development	**Non-Credit**
2. *Audit Courses (AC) Two of the Audit Courses are compulsory ***Audit Courses** 1. Constitution of India 2. Indian Culture and Heritage 3. Indian Architecture 4. Indian Festivals 5. Vaidic Mathematics 6. Astronomy 7. Arts of India 8. Intellectual Property Right 9. Logical Research	**Non-Credit**

10. Professional Ethics 11. Environmental Law 12. Health Law 13. Human Rights 14. Basics of Human health and preventive medicine	

Minor Degree Courses (Optional) from any department	**Credits**
Department Minor (DM) Courses	18-20

Credit Structure for B. Tech. ECE (IoT)

Category **Semesters**	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**
Basic Sciences & Maths (BSM)	8	4	2	4	-	-	-	-	**18**
Engineering Fundamentals (EF)	5	8	5	-	-	-	-	-	**18**
Professional Skill (PS)	2	2	-	-	-	-	-	-	**4**
Program Core (PC)	-	-	10	18	13	14	9	-	**64**
Management (M)	-	-	-	-	2	2	-	-	**4**
Humanities & Social Science (HSS)	2	2	2	-	-	-	-	-	**6**
Humanities & Social Science Elective (HSSE)	-	2	-					-	**2**
Project (P)	-	-	-	-	-	2	3	0/4	**5/9**
Seminar (S)	-	-	-	-	-	2	-	-	**2**
Industrial Practice (IP)/ Industrial Elective (IE)#	-	-	-	-	-	-	-	12/8	**12/8**
Program link basic science and engineering courses (PLBSE) (To be decided by the department)	4	3	3	2	3		-	-	**15**
Program Electives (PE)	-	-	-	-	4	4	4	-	**12**
Open Electives (OE) (Other Departments)	-	-	-	-	-	-	3	-	**3**
Total	**21**	**21**	**22**	**24**	**22**	**24**	**19**	**12**	**165**

CURRICULUM FOR B.TECH. ECE (IoT) PROGRAM

First Year, Semester I

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-101	Calculus and Linear Algebra	3	1	0	4
2.	EF	BEE-101	Fundamentals of Electrical Engineering	3	1	2	5
3.	HSS	BHM-101	Professional Communication	2	0	0	2
4.	BSM	BSM-127	Engineering Physics	3	0	2	4
5.	PS	BEC-103	Electronic Component Testing and Measurement	0	0	4	2
6.	PLBSE	BIT-181	Computer Programming with C/C++	3	0	2	4
			Total	**14**	**2**	**10**	**21**
	ECA-I	ECA-100	Induction Program	**-**	**-**	**-**	**0**

First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-156	Applied Probability and Statistics	3	1	0	4
2.	EF	BEC-151	Fundamentals of Electronics Engineering	3	1	2	5
3.	HSS	BHM-155	Engineering Economics	2	0	0	2
4.	EF	BEC-155	Introduction to IOT Devices and Applications	2	0	2	3
5.	PS	BEC-153	Electronic Workshop	0	0	4	2
6.	PLBSE	BEC-156	Introduction to Arduino Uno Programming	0	0	6	3
7.	HSSE	BHM-154	Human Values & Professional Ethics	2	0	0	2
			Total	**14**	**2**	**10**	**21**
	ECA-II	ECA-200		**-**	**-**	**-**	**0**

Second Year, Semester III

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-227	Physics of IOT Sensors and Actuators	2	0	0	2

2.	EF	BEC-201	Digital Electronics and Computer Organization	3	1	2	5
3.	HSS	BHM-201	Scientific and Technical Writing	2	0	0	2
4.	PC	BIT-281	Introduction to Java Programming	3	0	2	4
5.	PC	BEC-203	Electronic Measurement and Instrumentation	2	1	0	3
6.	PC	BEC-204	Electronic Devices and Circuits	2	1	0	3
7.	PLBSE	BCS-205	Data Structure & Algorithms	2	0	2	3
			Total	**16**	**4**	**4**	**22**
	ECA-III	ECA-320		-	-	-	0
	AC	AUC-11		1/2	-	-	0

Second Year, Semester IV

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-276	Principles of Electromagnetism and Antenna Systems	3	1	0	4
2.	PC	BEC-257	Computer Networks	3	1	0	4
3.	PC	BEC-252	Principles of Communication Systems	3	1	0	4
4.	PC	BEC-258	Introduction to Raspberry Pi Programming	3	0	4	5
5.	PC	BCS-258	Python for IOT	3	1	2	5
6.	PLBSE	BEC-255	Electronic Software Tools	1	0	2	2
			Total	**16**	**5**	**6**	**24**
	ECA-IV	ECA-401		-	-	-	0
	AC	AUC-09		1/2	-	-	0

Third Year, Semester V

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	M	BHM-302	Industrial Management	2	0	0	2
2.	PC	BEC-302	Control System	3	1	0	4
3.	PC	BEC-306	Advanced IOT Applications	3	1	2	5
4.	PC	BEC-307	Information and Network Security	3	1	0	4
5.	PE1	-	Program Elective-I	3	1	0	4
6.	PLBSE	BEC-308	Python Based Machine learning and AI	2	0	2	3
			Total	**16**	**4**	**4**	**22**
	ECA-V	ECA-531		-	-	-	0

Third Year, Semester VI

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	M	BHM-354	Business Management	2	0	0	2
2.	PC	BEC-354	Wireless Sensor Network	3	0	2	4
3.	PC	BEC-355	Android Application Development	3	0	4	5
4.	PC	BEC-356	Digital and Wireless Communication	3	1	2	5
5.	PE2	-	Program Elective-2	3	1	0	4
6.	P	BEC-371	Project Part-I	0	0	4	2
7.	S	BEC-381	Seminar	0	0	4	2
			Total	**14**	**4**	**12**	**24**
	ECA-VI	ECA-651		-	-	-	0

Program Elective

S.N.	Paper Code	Subject	Prerequisite Subject	L	T	P	Credits
			PE1				
01.	BEC-333	Fundamental of AIOT		3	1	0	4
02.	BEC-334	Computer Vision for IoT		3	1	0	4
03.	BEC-335	Data Analytics for IOT		3	1	0	4

Course Code: BSM-101	Calculus and Linear Algebra	
Course category	:	Basic Sciences &Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial:1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss, Stoke's and Green's theorem.
5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I	9
Differential Calculus: Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.	
UNIT-II	9
Linear Algebra: Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem, Diagonalization of matrices.	
UNIT-III	9
Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral.	
UNIT-IV	9
Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).	

Text and Reference Books

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,

Course Code: BEE-101/ 151		**Fundamentals of Electrical Engineering**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	**1.** To demonstrate and understand the basic knowledge of electrical quantities such as current, voltage, power, energy, and frequency to understand the impact of technology in a global and societal context. **2.** To demonstrate and understand the basic concepts of analysis of simple DC and AC circuits, Magnetic Circuits, Transformers and Electrical Machines.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:

1. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
2. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
3. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
4. Understand 3 phase balanced and unbalanced, star and delta connected supply and load and to measure power in 3 phase circuits
5. Explain construction and working principle of transformer with background of magnetic circuits.
6. Classify and compare different types of Electrical machines.

Topic Covered	
UNIT I **D C Circuit Analysis and Network Theorems:** Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power	**9**

Transfer theorem.	
UNIT II **Steady- State Analysis of Single-Phase AC Circuits:** AC fundamentals: Sinusoidal, square and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, Three-phase power, and its measurement	**9**
UNIT III **Magnetic Circuit & Single-Phase Transformers:** Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses. Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.	**9**
UNIT IV **Electrical Machines:** Concept of electromechanical energy conversion DC machines: Types, EMF equation of generators and torque equation of motor, Characteristics, and applications of DC Generators & motors. Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications. Three Phase Induction Motor: Types, Principle of operation, Torque-slip characteristics, Applications	**9**
EXPERIMENTS 1. Verification of Kirchhoff's Law. 2. Verification of Norton's Theorem. 3. Verification of Thevenin's Theorem. 4. Verification of Superposition Theorem. 5. Verification of Maximum Power Transfer Theorem. 6. Verification of Series R-L-C circuit. 7. Verification of Parallel R-L-C circuit. 8. Measurement of Power and Power factor of three phase inductive load by two wattmeter method. 9. To perform O.C. and S.C. test of a single-phase transformer. 10. To draw the magnetization characteristics of separately excited dc motor. 11. To perform the external load characteristics of dc shunt motor.	
Text and Reference Books: 1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-	

Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

Course Code: BHM-101/151	**PROFESSIONAL COMMUNICATION**	
Course category	:	HSS
Pre-requisite Subject	:	None
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	02
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, two minor tests and one major theory examination.
Course Objectives	:	To sensitize the students to understand the role & importance of communication for personal & professional success and enable learners to exhibit knowledge, skills, and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Use of various facets of communication skills, such as, Reading, Writing, Listening and speaking skills.
2. To identify, formulate and solve the real-life problems with positive attitude.
3. To inculcate the habit of learning and developing the communication and soft skills by practice.
4. To create an amicable ambience to make them learn the different part of English language with the correction of the language.
5. Enhancing word power by counselling scientific literature.
6. Focusing on effortless speaking and writing.

Topics Covered	
UNIT-I	6
VERBAL COMMUNICATION: Received Pronunciation; how to activate passive vocabulary; Technical/non-technical and Business Presentations; questioning and answer skills; soft skills for professionals; role of body postures, movements, gestures, facial expressions, dress in effective communication; Information/ Desk/ Front Office/ Telephone conversation; how to face an interview/press	

conference; Group discussions, debates, elocution.	
UNIT-II	
READING COMPREHENSION Skimming and Scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; use and interpretation of visuals and graphics in technical writing.	6
UNIT-III	
WRITTEN COMMUNICATION: Note Making and Note Taking; summarizing; invitation, advertisement, agenda, notice and memos; official and commercial letters; job application; resume and curriculum vitae; utility, technical, project and enquiry reports; paragraph writing: General – Specific, Problem – Solution, Process – Description, Data – Comment.	6
UNIT-IV	
SHORT ESSAYS: Description and Argument; comparison and contrast; illustration; using graphics in writing: tables and charts, diagrams and flow charts, maps and plans, graphs; how to write research paper; skills of editing and revising; skills of referencing; what is a bibliography and how to prepare it.	6

Text and Reference Books

1. Bansal, R.K. & Harrison J.B., (1972) *Spoken English*, Orient Longman, India.
2. Chauhan, Narender Kr. & Singh, Sudhir N., (2013) *Formal Letters,* Pankaj Publication International, New Delhi.
3. Chhabra T.N., (2019) *Business Communication*, Sun India Publication, New Delhi.
4. Dixon Robert J., (1986) *Complete Course in English,* Prentice Hall of India, New Delhi.
5. Jones, Daniel., (2012) *Cambridge English Pronouncing Dictionary*, 18th Edition, Paperback, CUP, India.
6. Lewis, Norman, (2015) *Word Power Made Easy*, Penguin India.

BSM-127/177	**ENGINEERING PHYSICS**	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	Physics at 12th standard
Contact hours/week	:	Lecture: 3, Tutorial:0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	Understanding of the principle and concepts of Crystallography, Quantum Mechanics, Basic principles of electricity and magnetism, Maxwell's Equations, of and Advanced Materials for their applications Engineering.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Basics of crystallography and its applications in Engineering
2. Quantum Mechanics and its application to understand material properties at atomic level.
3. Basic principles of electricity and magnetism applied in Engineering.
4. Maxwell's equation of electromagnetic theory and its applications in engineering.
5. Basic principles of semiconducting materials and its application.
6. Basic Principles of advanced materials and their applications in Engineering.

Topics Covered

UNIT-I	9
Crystal Structures and X-ray Diffraction: Space lattice, basis, Unit cell, Lattice parameter, seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Laue's experiment, Bragg's Law, Bragg's spectrometer.	
UNIT-II	9
Quantum Mechanics: De Broglie waves and Group velocity concept, Uncertainty principle and its application, Davisson-Germer experiment, Derivation of Schrodinger equation for time independent and time dependent cases. Postulates of quantum mechanics, Significance of wave function, Application of Schrodinger wave equation for a free particle; Particle in a box (one dimensional)	
UNIT-III	9
Electrodynamics –I: Basic concepts of Gauss's law, Ampere's law and faradays law of electromagnetic induction. Correction of Ampere's law by Maxwell (concept of displacement current), Maxwell's equation, transformation from integral form to differential form, physical significance of each equation **Electrodynamics –II:** Maxwell's equation in free space, velocity of electromagnetic wave, transverse character of the wave and orthogonality of E, H and k vectors, Maxwell's equations in dielectric and conducting medium, velocity of e. m. wave, comparison with free space, penetration depth	
UNIT-IV	9
Physics of Advanced Materials Semiconducting Materials**,** Concept of energy bands in solids, concept of direct and indirect band gap, Carrier concentration and conductivity in semiconductors, Optoelectronic Materials, Superconducting Materials**,** Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, BCS theory (Qualitative), Introduction of	

nanoscience and technology

EXPERIMENTS

1. To determine the specific resistance of a given wire using Carrey Foster's Bridge.
2. To study the variation of magnetic field along the axis of current carrying circular coil.
3. To study the Hall's effect and to determine Hall coefficient in n type Germanium.
4. To study the energy band gap of n- type Germanium using four probe method.
5. To determine e/m of electron using Magnetron valve.
6. To draw hysteresis curve of a given sample of ferromagnetic material.

Text and Reference Books

1. Introduction to Solid State Physics- Kittel , 7th edition, Wiley Eastern Ltd.
2. Solid State Physics - S. O. Pillai, 5th edition, New Age International.
3. Quantum Mechanics: Theory and Applications- AjoyGhatak, Tata McGraw-Hill
4. Introduction to Electrodynamics- David J. GriffithsPearson, New International Edition
5. Semiconductor Devices and Application - S.M. Sze, Wiley
6. Introduction to Nano Technology - Poole Owens, Wiley India
7. Engineering Physics by B. K. Pandey and S. Chaturvedi, 2e Cengage Learning Pvt. Limited, India

Course Code: BEC-103	**Electronic Component Testing and Measurement**	
Course category	:	Professional Skill (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:0, Tutorial: 0, Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through viva voce, practical work/record, attendance and major practical examination.
Course Objectives	:	The objective of this course is to identify different electronic components & to develop the understanding of different instruments.
Course Outcomes	:	After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes.

1. Able to identify electronics components.
2. Understanding of measuring instruments.
3. Able to demonstrate the measuring process using measuring instruments and components.
4. Able to execute the experiment based on DC bridges.
5. Able to examine the experiment performed on breadboard.
6. To study and analyze the signal using CRO and DSO.

Topics covered

List of experiments

Note: At least seven experiments should be performed

1. To identify the components which are used in electronic circuits.
2. To study the resistance, voltage, current measurement by using of multimeter.
3. To get familiarization and to study the operation of a function generator instrument and visualize the types of waveforms produced by a function generator.
4. To study the CRO and to find the Amplitude, phase difference and Frequency of a sinusoidal waveform using CRO.
5. Study of Lissajous patterns and measurement of frequency through Lissajous patterns
6. Measurement of low resistance using Kelvin's double bridge.
7. Measurement of medium resistance using Wheatstone bridge.
8. Measurement of time constant of RC circuit.
9. To study the bread board measurement and perform experiment no 2 on bread board.
10. To study the DSO and measure the amplitude, phase difference and frequency of sinusoidal waveform
11. Measure the values of capacitors using DMM and Schering bridge method.
12. Measure the values of inductors using Maxwell bridge method.
13. To Study of AC and DC Waveforms on CRO & DSO.
14. To study of classification and coding of capacitors-using numerals, directly printed values on capacitors, Ceramic capacitor and Electrolytic capacitor.
15. Measurement of h-parameters of CE configuration

Course Code: BIT-181	**Computer Programming with C/C++**	
Course category	:	Program link basic science and engineering courses (PLBSE) PLBSE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous Assessment through Two Tests, Teacher Assessment (Quiz, Tutorial, Assignment, Attendance), Practical Work & Viva-voce, and One Major Theory &OnePractical Examinations.
Course Objectives	:	The course covers the basics of programming and demonstrates fundamental programming techniques, customs and terms including the most common library functions and the usage of the pre-processor. 1. To develop C/C++ Programs using basic programming constructs.

		2. To develop C/C++ programs using arrays and strings. 3. To develop applications in C using functions, structures and pointers.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge,skills, and attitudes after completing this course.

1. Basic terminology used in computer programming.
2. Programs development in C/C++ Language by writing, compiling and debugging.
3. Design of programs involving simple statements, conditional statements, iterative Statements.
4. Program with array, strings, functions, recursion, structure and union.
5. Dynamic memory allocations and use of pointers.
6. C++ Inheritance, functions and outputs.

Topics covered

UNIT-I

Basics of C: Introduction to programming language paradigms – Problem solving methods, Flowcharts and Algorithms Structure of a C Program, Variables, Identifiers, Keywords, Data Typesand Sizes, Constants, Declarations, Assignment & Intilization, Operators & Expressions, Precedenceand Order of Evaluation, Type Conversions.
Input and Output: Non- Formatted input & output, Formatted input & output.
Control Statements: Specifying Test Condition for Selection & Iteration, Conditional Execution &Selection, Iteration & Repetitive Execution, Goto Statement, Special Control Statements, NestedLoops.

UNIT-II

Arrays: One-Dimensional Array- Declaration, Initilization, Accessing Array Elements, Multi-Dimensional Array-Declaration, Initilization Unsized Array Initilization, Accessing Multi-DimensionalArrays, Linear Search and Binary Search, Selection and Bubble Sort.
Functions : Concept of Function, Using Functions, Parameter Passing techniques, Passing Arrays toFunctions, Scope & Extent, Storage Classes, Recursion.
C Preprocessor : #include, #define, #if, conditional compliliation.
Pointers : Pointers and Addresses, Address Operator, Declaring a Pointer, Initilizing the Pointer,Pointer Deferencing, Void Pointer, Null Pointer. Pointer and Function Arguments, Pointer Arithmetic,Arrays &Pointers, Pointers to Pointers, Implementing Multi Dimensional arrays using pointers,Command line arguments.

UNIT-III

Structures and Unions : Basics, Structure and functions, arrays of structures, Pointers to Structures,Self Referential Structure, Union and Enumeration Types.
Files : Basics and File Handling functions : Copy file and display file text Files.
Classes and data abstraction : Class scope, accessing class members, constructors, destructors,constant objects and member functions, this pointer, new and delete operators, Static DataMembers and Member Functions.

UNIT-IV

C++ : Introduction, simple program, standard library, header files, inline functions, references andreference parameters, default arguments, empty parameter lists, unary, scope resolution operator,function overloading.

C++ Inheritance : Base and derived classes, casting base class, pointers to derived class pointers,overriding, member functions, public, protected and private inheritance, constructors anddestructors in derived classes.

C++ Virtual Functions : Abstract base class, polymorphism, dynamic binding, virtual destructors.C++ Stream Input/Output : Streams, stream output, stream input.

C++ Templates : Introduction, class templates, templates and inheritance, templates and staticmembers.

C++ Exception Handling: Try, throw, catch.

List of experiments

Note: At least Eight experiments should be performed

1. Write programs to print statements in sequential order using simple printf, scanf input/output functions.
2. Write programs to implement if-else condition (simple as well as nested) on suitable problems.
3. Write program to implement switch-case conditional logic on suitable examples.
4. Write programs to implement for, while and do-while loop control statements on suitable problems.
5. Write programs to implement 1D & 2D array concepts on suitable problems such as sorting of elements, searching of element, matrix addition, subtraction, multiplication etc.
6. Write programs to implement string related concepts such as sorting of a string, finding its length, reversing, concatenation, comparing two strings etc.
7. Write programs to implement concept of user defined functions (call by value, call by reference, recursive calling etc.) on suitable examples.
8. Write programs to implement concepts of pointer.
9. Write programs to implement the concept of structure and union.
10. Write programs to implement dynamic memory allocation functions (calloc, malloc, free, realloc)
11. Write programs to implement file handling concepts such as reading from a file, writing to a file using file related functions (fclose, fopen, sscanf, sprint, fread, fwrite, getc, putc, getw, putw etc.)

Text books:

1. Object Oriented Programming with C++ : E. Balagurusamy, The McGraw-Hill
2. Let Us C++: Yesvant Kanetkar, BPB Publications
3. The C++ Programming Language: Bjarne Stroustrup, Addision Wasley.
4. Object Oriented Programming in C++ : Robert Lafore, Galgotia Publications.
5. Jeri R. Hanly and Elliot B. Koffman, Problem Solving and Program Design in C, 7th Edition, Pearson.

6. Schildt, Herbert, Complete Reference with C, Tata McGraw Hill.
7. Kerninghan and Ritchie, The C programming Language, 2nd Edition, Prentice Hall.
8. Richard Bird, Introduction to Functional Programming using Haskell, 2nd Edition, PrenticeHall International, 1998.

Reference Books :

1. Raja Raman, Computer Programming in C, PHI Learning, 2013.
2. Bhushan Trivedi, Programming with ansi C++, Second edition, Oxford University Press, 2012.
3. Greg Michaelson, An Introduction to Functional Programming Through Lambda Calculus, Dover Edition, Addition Wesley Publication.
4. 4. Samuel P. Harbison, and Guy L. Steele Jr., C-A Reference Manual, Fifth Edition, Prentice Hall, 2002. BSM-129

BEC-101/ 151	**FUNDAMENTALS OF ELECTRONICS ENGINEERING**	
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	The objective of this course is to gain knowledge of basic electronic components and develop the understanding of the working principle of different electronic devices such as voltmeter, multimeter, CRO, etc.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Able to memorize the basic concept of electronic circuits using Diode, BJT, FET, etc.
2. Able to execute and examine the general characteristic of electronic circuits.
3. Illustrate the basics of Boolean algebra and logic gates with their realisation using discrete electronic components.
4. Compute different parameters for characterising different circuits like rectifier, amplifiers, integrators, etc.
5. Examine the working principle of digital voltmeter, multimeter using block diagram approach.
6. Discuss and calculate voltage, current, phase and frequency using CRO.

Topics Covered

UNIT-I

Semiconductor materials and properties: electron-hole concepts, Basic concepts of energy bands in materials, concept of forbidden gap, Intrinsic and extrinsic semiconductors, donors and acceptors impurities, Junction diode, p-n junction, depletion layer, v-i characteristics, diode resistance, capacitance, diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage). Diode Applications in rectifier, filters, voltage multipliers, load regulators, clipper and clamper circuits, Breakdown mechanism (Zener and avalanche),Breakdown characteristics, Zener resistance, Zener diode ratings, Zener diode application as shunt regulator	9
UNIT-II	
Transistors (BJT); Basic construction, transistor action, CB, CE and CC configurations, input/output characteristics, Biasing of transistors-fixed bias, emitter bias, potential divider bias, comparison of biasing circuits. Transistor Amplifier: Graphical analysis of CE amplifier, concept of voltage gain, current gain, h- parameter model (low frequency), computation of Ai, Av, Ri, Ro of single transistor CE and CC amplifier configurations.	9
UNIT-III	
Field Effect Transistors(JFET and MOSFET): Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristic equation CG, CS and CD configurations, fixed & self-biasing. MOSFET: depletion and enhancement type MOSFET - construction, operation and characteristics. Computation of Av, Ri, Ro, of single FET amplifiers using all the three configurations **Switching theory and logic design**: Number systems, conversion of bases, Boolean algebra, logic gates, concept of universal gate, canonical forms, Minimization using K-map	9
UNIT-IV	
Operational Amplifiers andElectronics Instruments: Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers, integratorsWorking principle of digital voltmeter, digital multi-meter (block diagram approach), CRO (its working with block diagram), measurement of voltage, current, phase and frequency using CRO	9
EXPERIMENTS **Note: Minimum Five experiments are to be performed** 1. To plot the forward / Reverse Characteristics of Si P-N junction diode. 2. To plot the forward / Reverse Characteristics of Zener diode 3. Study and plot the characteristic of Zener diode as voltage regulator 4. Study of half wave rectifier and draw the nature of input / output signal. Calculate the value of Idc, Irms and ripple factor. 5. Study of Full wave rectifier and draw the nature of input / output signal. Calculate the	

value of Idc, Irms and ripple factor.

6. Study of Bridge Rectifier and draw the nature of input / output signal. Calculate the value of Idc, Irms and ripple factor.
7. Draw input output characteristic curve of n-p-n transistor in CE configuration
8. Draw input output characteristic curve of n-p-n transistor in CB configuration
9. Draw the drain and transfer curve of JFET
10. Study of OPAMP (741) and calculate the gain in (i)Inverting mode and (ii)Non-inverting mode
11. Study of OP-AMP as a (i) Summer (ii) Integrator (iii) Differentiator; and plot the nature of input & output waveform
12. Study of CRO and multi-meter measurement voltage, frequency, phase difference using CRO along with the testing of electronics component

Text and Reference Books

1. Electronic Devices and Circuits-Boylestad and Nashelsky, 6e, PHI, 2001
2. Electronic Devices and Circuits, A Mottershead, PHI,2000, 6e
3. Digital Computer Design, Morris Mano, PHI,2003
4. Electronic Instrumentation-H.S. Kalsi, 2e,TMH, 2007

BHM-155	**ENGINEERINGECONOMICS**	
Coursecategory	:	HSS
Pre-requisiteSubject	:	NIL
Contact hours/week	:	Lecture:2,Tutorial:0,Practical:0
Numberof Credits	:	2
Course Assessment methods	:	Continuousassessmentthroughattendance,homeassignments, quizzesandtwominortests andonemajortheoryexamination.
Objectives	:	Enablestudentstounderstandthefundamentaleconomicconcepts applicable to engineering
Course Outcomes	:	Thestudents are expected tobe abletodemonstratethefollowing knowledge,skillsandattitudesaftercompletingthiscourse

1. StudentswillacquirebasicknowledgeinEngineeringEconomics,whichallowsstudentsto gain theoretical and empirical skill of Economics.
2. TodevelopthebasicunderstandingofMicroeconomicsandMacroeconomicsandits application to decision making and Managerial Economics.
3. Becomeacquaintedwithbasiceconomicconceptssuchasdemandandsupplyand Elasticity of Demand.
4. Todevelopa significantunderstanding ofvarious conceptsof cost.
5. Todeveloptheabilitytounderstand thevariouskindsofmarket structure.
6. Todeveloptheabilitytoacquirethe knowledgeofNationalIncomeandits measurement.

TopicsCovered

UNIT-I	
Introduction:Meaning,NatureandScopeofMicroEconomics,MacroEconomicsand Managerial Economics, Decision making Process with reference to Managerial economics, Managerial Economics and its application in engineering perspective.	6

UNIT-II	
ConceptsofDemandandSupply:DemandAnalysis,LawofDemand,Determinantsof Demand, Elasticity of Demand: Price, Income and cross Elasticity. Uses of concept of elasticity of demand in managerial decision, Law of Supply.	6
UNIT-III	
Productionfunction,Overviewofcost:fixedcost,variablecost, averagecost,marginal cost,opportunitycost, Anover-viewofshort and long runcost curves.	6
UNIT-IV	
MarketStructure:PerfectCompetition,Imperfect competition–Monopolistic,Oligopoly, Monopoly,NationalIncome:ConceptandMeasurementofNationalIncome.	6
TextBooks &References	
1. Mote,PaulandGupta, ManagerialEconomics, TM H,NewDelhi. 2. HLAhuja,Managerial Economics,SChand &Co.New Delhi 3. P.L.Mehta,ManagerialEconomics,Analysis,ProblemsandCases,SultanChand Sons, New Delhi. 4. Prof.D.N.Kakkar,ManagerialEconomicsforEngineering,PHIpublication,New Delhi 5. Varshney andMaheshwari,ManagerialEconomics,SultanChandandSons,NewDelhi.	

BEC-155	**IntroductiontoIoTDevicesandApplications**	
Coursecategory	:	EngineeringFundamentals(EF)
Pre-requisiteSubject	:	NIL
Contact hours/week	:	Lecture:2,Tutorial:0,Practical:2
Numberof Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments,quizzes,practicalwork,record,vivavoiceand2-Minor testsandOneMajor Theory&Practical Examination.
Objectives	:	1. TounderstandtheconceptsofInternetofThingsandthe application of IoT. 2. ToDeterminetheMarket perspectiveof IoT. 3. ToUnderstandthevisionof IoTfromaglobal context.
Course Outcomes	:	Thestudentsareexpectedtobeabletodemonstratethefollowing knowledge,skillsandattitudesaftercompletingthiscourse.
1. UseofDevices,Gateways andDataManagementin IoT. 2. DesignIoTapplicationsindifferentdomain andbeabletoanalysetheirperformance 3. ImplementbasicIoTapplicationsonembeddedplatform. 4. Usingsensor-enabled IoTsystemslikeTraffic,HumidityandTemperature. 5. Real-timedataontheproduct'slocationandtransportationisprovidedthroughIoT. 6. IoTsupplychainsystemcapturesdataonvehiclethatpromptsautomatedcondition modification.		
TopicsCovered		
UNIT-I		

IoT & Web Technology, The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.	8
UNIT-II	
M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoTValueChains,AnemergingindustrialstructureforIoT,Theinternationaldrivenglobal valuechainandglobalinformationmonopolies. M2Mto IoT-AnArchitecturalOverview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.	8
UNIT-III	
IoT Architecture -State of the Art – Introduction, State of the art, Architecture. Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views, IoT Applications for Value CreationsIntroduction,IoTapplicationsforindustry:FutureFactoryConcepts,Brownfield IoT.	8
UNIT-IV	
SmartObjects,SmartApplications,FourAspectsinyourBusinesstoMasterIoT,Value CreationfromBigDataandSerialization,IoTforRetailingIndustry,IoTforOilandGas	8
Industry,OpinionsonIoTApplicationandValueforIndustry,HomeManagement,eHealth. Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security,PrivacyandTrustinIoT-Data-PlatformsforSmartCities,SmartieApproach.Data Aggregation for the IoT in Smart Cities.	
EXPERIMENTS **Note:Minimumeightexperimentsaretobeperformed** 1. ControllingtheLightEmittingDiode(LED)withapush button. 2. Tointerfaceof IRSensor withArduinoandwrite aprogramtodetectan object. 3. ToInterfacetheRGBLEDwiththe Arduinoandwriteaprogramtoturnon LED. 4. ControllingtheLEDblinkratewiththepotentiometerinterfacingwithArduino. 5. Interfacingof DHT11temperature/Humidity sensorLM35with Arduino. 6. InterfacingServoMotorwiththeArduinoandwriteaprogramwithangleof deflection. 7. InterfacingoftheActiveBuzzerwithArduinoandwriteaprogramtoturnonBuzzer at each 3 seconds. 8. InterfacingoftheRelay withArduinoandwriteaprogramtoturnon serialmonitor 9. BuildingIntrusionDetectionSystemwithArduinoandUltrasonicSensor. 10. DirectionalControl of theDC motor using Arduino.	
TextBooks &References	

1. VijayMadisettiandArshdeep Bahga,"InternetofThings:(AHands-onApproach)", Universities Press (INDIA) Private Limited 2014, 1st Edition.
2. MichaelMiller,"TheInternetofThings:HowSmartTVs,SmartCars,SmartHomes, and Smart Cities Are Changing the World", Pearson Education 2015.
3. FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachto Connecting Everything", Apress Publications 2013, 1st Edition.
4. WaltenegusDargie,ChristianPoellabauer,"FundamentalsofWirelessSensorNetworks: Theory and Practice", Wiley 2014.

WebReferences

https://github.com/connectIOT/iottoolkit
https://www.arduino.cc/http://www.zettajs.org/

Course Code: BEC-153	**ELECTRONIC WORKSHOP**	
Course category	:	Professional Skills (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:0, Tutorial: 0 , Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, practical work, record, viva voce, and practical major examination.
Course Objectives		The objective of this course is to develop the skill and working of different circuit board & prototypes of the designed electronics circuits.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. To identify the circuit components and their application specially for electronics PCB design.
2. Understand the design processes and production methods used in the manufacturing of a printed circuit board.
3. Understand the use and application of chemical itching and drilling in the manufacture of an electronic circuit.
4. Be able to design and manufacture a prototype printed circuit board and use it to assemble and test an electronic circuit.
5. Able to design rectifier and filter and study their practical applications.
6. Able to have knowledge of these circuits using breadboard.

List of Experiments

Note: Minimum Seven experiments should be performed

1. Winding shop: Step-down transformer winding of less than 5VA.
2. Soldering shop: Fabrication of DC regulated power supply.
3. Printing of circuits on PCB.

4. Design a PCB using Etching & drilling. 5. Coating of etched PCB to protect it from oxidation. 6. Convert the power supply circuit into PCB & simulates its 2D & 3D view. 7. Design a full wave center tapped rectifier & study the effect of capacitive filter & it's output on a virtual oscilloscope. 8. Design a RLC resonance circuit & verify the transient & phase response for different values of R, L&C. 9. Assemble electronic circuit/system on general purpose PCB, test and show the functioning. 10. Construct various electronic circuits on breadboard 11. Identify and test different types of ICs. 12. To study the specifications and working of a Transistor radio kit and perform measurements on it. 13. Study the working of Distortion Meter. 14. To study the working of Spectrum analyzer and determine the bandwidth of different signals.	
Text and Reference Books	
1. Electronics Components and Materials by SM Dhi, Tata McGraw Hill, New Delhi 2. Electronics Device and circuits by Millman and Halkias; McGraw Hill. 3. Principle of Electronics by Albert Paul Malvino; Tata McGraw Hill.	

BEC-156	**IntroductiontoArduinoUnoProgramming**	
Coursecategory	:	PLBSE
Pre-requisiteSubject	:	NIL
Contact hours/week	:	Lecture:0,Tutorial:0,Practical:6
Numberof Credits	:	3
Course Assessment methods	:	Continuousassessment,attendance,quizzes,practicalwork,record, vivavoiceandPracticalExamination.
Objectives	:	1. In this course students will learn how the Arduino platform works in terms of the physical board and libraries and the IDE (Integrated Development Environment). 2. ThiscoursewillalsofamiliarArduinoUnobasedEmbedded system design, their programming with python and C code and accessing the pins on the board via the software to control external devices.
Course Outcomes	:	Thestudentsareexpectedtobeabletodemonstratethefollowing knowledge,skillsandattitudesaftercompletingthiscourse.

1. Studentswillacquirebasic knowledgeinArduinobasedEmbeddedSystemDesign.
2. TodevelopthebasicunderstandingofMicrocontrollers,Actuator,Sensor,andMotorsin various applications.
3. To develop a significant understanding of how to connect relays LED, LCD, IR, Ultrasonic sensor and servomotors to ARDUINO Board.
4. Design IoT applications in different domain like Filters, resistors, LCD displays etc., and be able to analyze their performance.
5. To understand the basic concept of UART/USART communication.
6. To understand the basic concept of I2C communication.

EXPERIMENTS

Note:Minimum Eight experimentsaretobeperformed.

1. Withthehelp ofArduinoUno/Raspberypi, howtobuildan LEDbinary counter.
2. With the help of Arduino Uno/Raspbery pi, how to read Analog voltage from theserial monitor.
3. TointerfaceofIRSensorandServomotorwithArduinoandwriteaprogramto detect an object.
4. Withthehelp ofArduinoUno/Raspberypi, howto designsimplecircuitofOhm's lawandwrite aprogramalso.
5. With the help of Arduino Uno/Raspbery pi, how to work Push button as a Toggle switch.
6. ControllingtheLEDblinkratewiththepotentiometerinterfacingwithArduino.
7. InterfacingofDHT11temperature/HumiditysensorLM35withArduino.
8. WiththehelpofArduinoUno/Raspberypi,howto designportabletemperatureand humidity sensor with DHT 11.
9. WiththehelpofArduinoUno/Raspberypi,howtodesignserialtoparallelshift resistor with 74HC595.
10. WiththehelpofArduinoUno/Raspberypi,howtodesignCircular shiftleftand circular shift right with 74HC595.
11. WiththehelpofArduinoUno/Raspberypi,howtodesignaportabledistance detector with Ultrasonic sensor.
12. InterfacingoftheActiveBuzzerwithArduinoandhowtochangetheirtoneandwrite a program to turn on Buzzer at each 3 seconds.
13. WiththehelpofArduinoUno/Raspberypi,howto designBinaryandHexadecimal Bit Flipper.
14. Interface UART /USART communication for exchanging serial data between two devices.
15. Interface Inter Integrated Circuit (I2C) for serial communication between two devices.

TextBooks &References

1. Arduino-Based Embedded Systems : By Rajesh Singh, Anita Gehlot, Bhupendra Singh, and Sushabhan Choudhury.
2. https://www.arduino.cc/en/Tutorial/HomePage
3. ArduinoMadeSimplebyAshwin Pajankar
4. EmbeddedC,Pont,MichaelJ
5. ARM System Developer's Guide - Designing and OptimizingSystem Softwareby: Andrew NSloss, Dominic Symes, Chris Wright; 2004, Elsevier
6. ARMSystem-On-ChipArchitecture,Furber,Steve
7. AssemblyLanguageProgramming: ARM Cortex-M3:Mahout, Vincent

BHM-154	HUMANVALUES&PROFESSIONALETHICS-1	
Coursecategory	:	HSS
Pre-requisiteSubject	:	None
Contact hours/week	:	Lecture:2,Tutorial:0,Practical:0
Numberof Credits	:	2
Course Assessment methods	:	Continuousassessmentthroughattendance,homeassignments, quizzesandtwominortestsandonemajortheory examination.
CourseObjectives	:	To give basic insights and inputs to the students to inculcate Human valuestogrowasaresponsiblehumanbeingwithholisticpersonality and enable them to understand and appreciate versatility and universalityofhumanvaluesandtheirpivotalroleinprofessional field.
CourseOutcomes	:	Thestudentsareexpectedtobeabletodemonstratethe following knowledge,skillsandattitudesaftercompletingthiscourse

1. Tocreateconduciveenvironmentforprofessionalstogrowasgoodandresponsiblehuman beings imbibing values and ethics.
2. Understandingthesignificanceofenvironment.
3. Developinghumanitarianoutlook.
4. Abletounderstandnatureoftheindividualandlegalaspectsofenvironment.
5. Understandinggmajorideas,values,beliefs,andexperiences.
6. Theseissueswillhelptosensitisestudentstobebroadertowardsthesocial,culturaland human issues involved in social changes.

TopicsCovered

UNIT-I	
Origin,Meaning,andDefinitionofValue,TypesofValues,IndividualValue,FamilyValue, SocietalValue,HumanValue,ValueinEducationSystem,UnderstandingHappinessand Prosperity,Self-ExplorationandNaturalAcceptance.	6
UNIT-II	
Harmony in family, Harmony in Society, Values Leading to Harmony, Creating a world family,HarmonyinNature,EnvironmentandSustainableDevelopmental,LegalaspectsofEnvironment, HolisticPerspectivesofValues,ExistenceandCo-existence.	6
UNIT-III	
Origin,MeaningandDefinitionofEthics,Ethics:ThescienceoftheMoralityofTheArtofCorrect Living,EthicsinHumanActs,EthicsandReligion,EthicalNormsandLaws,EthicsinLiterature, EthicsinScienceand Technology.	6
UNIT-IV	
EthicalApproaches:TheisticApproach,AtheisticApproach,GeneralandSpecialEthics, ProfessionalEthics:Ethicsatwork-place,EthicsasSkill,ValuesandEthics,EthicswithValue Education, Managerial and Business & Corporate Ethics, Corporate Social Responsibilities.	6

Text Books&References

1. Bangaria, G. P et.al, (2010) A foundation course in Human Values and Professional Ethics, Excel books.
2. Govindrajan,M.(2013)ProfessionalEthicsandHumanValues,EasternEconomyEdition.
3. Naagrazan,R.S.(2018)TextbookonProfessionalEthicsandHumanValues,Newage International. Misra, Anuranjanand Shukla, Dr. R.K., Human values and Professional Ethics.
4. Fernando,A.C.,(2009)BusinessEthics:AnIndianPerspective,Pearson,India.

Course Code:	Physics of IOT Sensors and Actuators

BSM-227		
Course category	:	BSM
Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:2, Tutorial:0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor test and one major theory examination.
Course Objectives	:	Understand the fundamental physical principles governing the operation of sensors and actuators.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Analyze the behavior of various sensor types, including their sensing mechanisms and limitations.
2. Design and implement signal conditioning circuits for interfacing sensors with microcontrollers or IoT devices.
3. Evaluate different communication protocols and methods used for transmitting sensor data in IoT systems.
4. Analyze the characteristics and functionalities of actuators commonly used in IoT applications.
5. Design and implement basic control algorithms for actuator systems in IoT environments.
6. Integrate sensors and actuators into IoT systems for specific applications.

Topics Covered

UNIT-I	**6**
Introduction to IoT and Sensor Networks, Overview of IoT architecture and applications, Characteristics and challenges of IoT sensor network, Fundamentals of Sensors, Sensor classification and characteristics, Sensing principles: resistive, capacitive, inductive, optical, etc.	
UNIT-II	**6**
Sensor calibration and error analysis, Signal Conditioning and Processing, Analog signal conditioning techniques, ADC (Analog-to-Digital Conversion) basics, Digital signal	

processing for sensor data.Communication in IoT Systems, Wired and wireless communication protocols (e.g., Bluetooth, Wi-Fi, Zigbee)	
UNIT-III	**6**
IoT communication architectures (client-server, peer-to-peer), Data transmission and security considerations, Actuators in IoT, Types of actuators: motors, solenoids, relays, etc., Principles of operation and characteristics.	
UNIT-IV	**6**
Control mechanisms for actuators, Integration of Sensors and Actuators, Sensor and actuator interfacing with microcontrollers and IoT devices, IoT system design considerations, Case studies and applications.	
Text and Reference Book	

Textbook:

"Principles of IoT Sensors and Actuators"

References:

1. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes and Gonzalo Salgueiro
2. "Sensors and Actuators: Engineering System Instrumentation" by Clarence W. de Silva
3. "Internet of Things (IoT): A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti
4. Note: The specific textbooks and references may vary based on instructor preference and course focus.

Course Code: BEC-201		**Digital Electronics and Computer Organization**
Course category	:	Engineering Fundamental (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.

Course Objectives	:	The course is aimed to develop the concepts of digital electronic and computer organization skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Acquired knowledge about basics of digital electronics and solving problems related to number systems and Boolean algebra.
2. Ability to identify, analyze and design combinational and sequential circuits.
3. To design, implement and evaluate various synchronous and asynchronous sequential circuits and applications.
4. Acquired knowledge about internal circuitry and logic behind any digital system.
5. Ability to understand basic building blocks of a computer system and addressing techniques in computer organization.
6. Acquired knowledge about Indian Super Computer 'PARAM'.

Topics Covered	
UNIT-I	
Overview of Digital Electronics: Number Systems, Boolean algebra: Representation of values and complements, De'Morgans theorem-simplifying expressions. AND, OR, NOT, XOR, XNOR, NAND, NOR gates and their truth tables, Combinational logic circuits for expressions using NAND and NOR gates, Logic circuit families and characteristics, SSI, MSI, LSI and VLSI circuits	**9**
UNIT-II	
Combinational and sequential circuits: (Simple block diagrams, truth tables and IC packages only required). Adders, decoders, multiplexers, encoder circuits, Flip-flops: RS, clocked RS, JK, D and T flip flops, Master slave flip flops, edge and level triggering, Multivibrators - Astable, Bistable, Monostable, counters-ripple and decade. Registers, latches and Tristate buffers.	**9**
UNIT-III	
Building blocks of a computer system: Basic building blocks-I/O, memory, ALU, Control and their interconnections, Control unit and its functions- Instruction-word, Instruction execution cycle, organizational sequence of operation of control registers; controlling of arithmetic operations; branch, skip, jump and shift instructions, ALU-its components. **Addressing techniques and registers:** Addressing techniques-Direct, immediate addressing; paging, relative, Indirect and indexed addressing. Memory buffer register; accumulators; Registers-Indexed, General purpose, Special purpose; overflow, carry, shift, scratch registers; stack pointers; floating point; status information and buffer registers	**9**
UNIT-IV	
Memory: Main, RAM, static and Dynamic, ROM, EPROM, EAROM, EEPROM, Cache and Virtual memory. Interconnecting System components: Buses, Interfacing buses, Bus formats-address, data and control, Interfacing keyboard, display, auxiliary storage devices, and printers. I/O cards in personal computers. Development of Indian Super Computer 'PARAM': History, Characteristics, Strengths, Weakness and basic Architecture.	**9**

LIST OF EXPERIMENTS

1. Design and verification of following arithmetic circuits using 74xx family ICs.
   a. Half adder and Full adder
   b. Half subtractor and full subtractor
2. To perform the code conversion- binary to gray and gray to binary and its truth table verification.
3. To design a combinational logic circuit using 74xx family ICs and its truth table verification in both SOP and POS forms.
4. Realization of 2:4 decoders and 4:2 encoder circuit and verification of its truth table.
5. To design and verify the truth table of multiplexer and demultiplexer circuits.
6. To design a 1-bit comparator using 74xx family ICs and to study the performance of 4-bit comparator IC 7485.

Text and Reference Books

1. Digital principle and applications Malvino and Leach- (TMH)
2. A.S.Tannenbaum : Structured Computer Organization, Pearson
3. Thomas C. Bartee : Digital Computer Fundamentals, McGraw-Hill
4. Duglus V Hall : Microprocessors and Interfacing: programming and Hardware, McGraw-Hill, 1986

Course Code: BHM-201		**SCIENTIFIC AND TECHNICAL WRITING**
Course category	:	HSS
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial : 0 , Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two Minor Testsand one Major Theory Examination.
Course Objectives	:	To Prepare Professionals with a view to developing the power of know-how of the subject and enhance them face challenges in English language.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Overcome the problems he/she faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication, such as, reports, proposals and business letters etc.
3. Use and practice compositions correctly.
4. Enhancing word power by counselling scientific literature.
5. Focusing on effortless speaking and writing.
6. Give Presentations in different sessions and make self-appraisal

Topics Covered

UNIT-I	
Language Vs communication: Communication as coding and decoding – signs, symbols & pictograph – verbal and non –verbal symbols – Language & communication; Types of Communication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication.Thinking and Articulation – cognitive, affect, critical, creative aspects of articulation. **Skills of Language Acquisition:** Natural Language Acquisition Skills: Listening, Speaking, Reading & Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing, Grammar & Vocabulary {LSRWGV} **Phrase, Clause & Sentence:Professional Drafting-**Simplicity, Clarity and Conciseness of a Presentation, Differentiating between Professional & Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial and other forms of bias in Professional Writing. Pre Writing, Drafting and Re-writing. **Processing Professional Data:** Data Collection, Literature Review, Data Analysis, Drafting Data & Deriving Inferences.	**6**
UNIT-II	
Technical Paper Writing: Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organising References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title, Keywords, Synopsis, Preface and abstract. Drafting Research Article & Methodology. **Thesis/Dissertation Writing:** Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections-Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis. **Professional Presentation & Seminar Delivery Tools**: Designing the Presentation; Establishing the Objectives. Making Professional Power Point Presentations, Signalling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team & Meet etc.	**6**
UNIT-III	

Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens: Drafting E-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media. **Professional Drafting:** Letters Vs E-mails, Formal and Informal mails, Parts of e-mails, Types of e-mails, Managing tone of E-mails & Business Letters, Examples of Letters & E-mail, Professional Correspondence through E-mail, Job Applications & Covering Letters. Introduction to DOs (Demi-Official Letters) **Conducting Professional Meeting:** Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Minutes. **Career & Correspondence:** Developing a Professional C.V, Bio Data & Resume Building. Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.	**6**
UNIT-IV	
Professional Interviews- Interview skills-body language, gesture, posture, tips, and tactics of interview. Professional interview of an expert. Questioning & Answering Skills. **Case study-** objectives, methods, examples of various case-study. **Audience Analysis in Technical Writing**: Industrial vs. non-industrial users; Exploring primary, secondary, tertiary users in contexts of production and use; Creating personas; Multicultural issues; Analysing real-world examples. Estimating, tracking, and managing tech writing projects. Determine the project scope, Estimates and schedules, Assemble the team, provide resources and leadership, Evaluate the project, Appendixes and Annexure, References, Peripherals—Official Formalities, Rights and Permission, Certificate and Copyright, Dedication, Acknowledgement, Correspondences. Managing Tone in Writing. **Project Writing:** Elements of a Professional Project Making: Making a final Project on topics, given by the instructor, Result & Discussion.	**6**
Text and Reference Books	
1. Acharya Anita. (2012) *Interview Skills- Tips & Techniques*. Yking Books, Jaipur. 2. Basu, B. N., (2008) *Technical Writing*. PHI Learning Pvt. Ltd.., New Delhi. 3. Chauhan, N. K & Singh, S. N. (2013) *Formal Letters*, Pankaj Publication International, New Delhi. 4. Chhabra T.N. (2018) *Business Communication. Sun* India Publication New Delhi. 5. Dubey Arjun et.al. (2016) *Communication for Professionals. Alfa* Publications, Delhi.	

Course Code: **BIT-281**	**Introduction to Java Programming**	
Course category	:	PC

Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:3, Tutorial:0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor test and one major theory examination.
Course Objective	:	The course covers the programming and demonstrates fundamental programming techniques, customs and terms including the most common library functions and the usage of the pre-processor. 1. To develop Programs in Java using basic programming constructs. 2. To develop programs in Java using arrays and strings. 3. To develop applications in Java functions, structures and pointers.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. To improve your problem-solving skills.
2. To understand the concept of Object-Oriented Programming
3. To analyze and explain the behavior of programs involving the fundamental program constructs
4. To identify and correct syntax and logic errors in short programs
5. To design and implement a class based on attributes and behaviors of objects
6. To describe the parameter passing mechanisms in terms of formal parameters, actual parameters, non-object parameters and object parametersand master OOP using C++.

Topics Covered

UNIT-I	**9**
Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism. - Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes	
UNIT-II	**9**
The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes. Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT	

event hierarchy – introduction to Swing – Model-View-Controller design pattern – buttons – layout management – Swing Components – exception handling – exception hierarchy – throwing and catching exceptions.	
UNIT-III	**9**
Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – introduction to Swing – Model-View-Controller design pattern – buttons – layout management – Swing Components – exception handling – exception hierarchy – throwing and catching exceptions.	
UNIT-IV	**9**
Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics - Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – Executors – synchronizers. JDBC: The connectivity Model, JDBC/ODBC Bridge, java.sql package, connectivity to remote database.	
List of Experiments	
1. Basic programs of simple statements, conditional statements, iterative statements and arrays 2. Programs having object-oriented concepts like Inheritance and Interface 3. Programs for Exception Handling and Event Handling 4. Programs of Threads and Multithreading 5. Programs related to Applets and Swings 6. Programs including JAVA Beans and Servlets	
Text and Reference Book	
1. Naughton, Schildt, The Complete Reference JAVA2, TMH. 2. Balaguruswamy E, Programming in JAVA, TMH 3. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press 4. K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.	
Reference Book	
1. Margaret Levine Young, The Complete Reference Internet, TMH. 2. Dustin R. Callway, Inside Servlets, Addison Wesley. 3. Mark Wutica, JAVA Enterprise Edition, QUE. 4. Steven Holzner, JAVA2 Black book, Dreamtech. 5. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition,	

Pearson Education, 2000.
6. C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.

Course Code: BEC-203		**Electronic Measurement & Instrumentation**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Nil
Contact hours/week	:	Lecture: 2, Tutorial:1, Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor tests and one major theory examination.
Course outcomes	:	The course is aimed to develop the concepts of electronic measurement & instrumentation skills of engineering students.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Able to explain the quality measurements with electronic instruments.
2. Able to articulate the range of measuring instruments.
3. Able to solve and illustrate the numerical problem for DC/AC bridge-based circuits.
4. Able to illustrate the principles of various types of transducers and their applications.
5. Able to explain the construction, principle of operation, and applications of Data Acquisition System (DAS).
6. Able to use the digital display devices in practical applications.

UNIT-I	6
Measuring Instruments: classification, absolute and secondary instruments, Performance Characteristics, Error in measurement, Sources of error, Arithmetic mean, Deviation from the mean, Average deviation, Standard deviation, Limiting errors. Ammeters and Voltmeters, PMMC, Moving Iron (MI) type, Expression for the deflecting torque and control torque, Extension of range using shunts and series resistance.	
UNIT-II	6
DC/AC Bridges: General equations for bridge balance, Self-inductance measurement by Maxwell's bridge, Hay's bridge, Capacitance measurement by Schering bridge, Method of measuring low, medium and high resistance: Kelvin's double bridge for measuring low	

resistance, Wheat-stone's bridge, measurement of high resistance, Basics of wattmeter and energy meter	
UNIT-III	6
Transducers: Introduction, Selection Parameters of Transducer, Type of Transducer, Resistive Transducer, Strain Gauges, Inductive Transducer: LVDT, Capacitive Transducer, Photo-electric Transducer, Photo-Voltaic Cell, Photo Transistors, Temperature Transducers, Digital Transducer.	
UNIT-IV	6
Data Acquisition and Conversion: Introduction, Objective of Data Acquisition System, Single and Multichannel DAS, A/D and D/A converters using Op-Amp, Data Loggers: Block diagram, principle of operation Digital Display Devices: LED, LCD, Incandescent Display, LVD (Liquid Vapour Display)	
Text and Reference Books 1. H. S. Kalsi, "Electronic Instrumentation", 3rd Ed., McGraw Hill Education(India), 2015. 2. David A. Bell, "Electronic Instrumentation and Measurements", 3rd Ed., Oxford University Press, 2013. 3. A K Sawhney, "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co.	

Course Code: BEC-204		**ELECTRONIC DEVICES & CIRCUITS**
Course category	:	Department Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 1, Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, and two minor tests and one major theory examination.
Course Outcomes	:	The course is aimed to develop the concepts of electronic devices & circuits skills of engineering students that are imperative for effective understanding of engineering subjects.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Ability to understand the basic operation and working of BJT.
2. Able to understand the small-signal operation and models of BJT.
3. To understand and use of the device models to explain and calculate the characteristics of the field effect transistors.
4. Able to understand the small-signal operation and models of MOSFET.
5. To be able to understand and analyze the feedback amplifiers.
6. Understand the basic principles of oscillators.

Topics Covered

UNIT-I	6
BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit; Small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier. Darlington pair, BJT differential pair, Cascode and Cascade amplifier.	
UNIT-II	6
MOSFET: Review of device structure operation and V-I characteristics, MOSFET Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits; Small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier.	
UNIT-III	6
Feedback Amplifiers: The general feedback structure, properties of negative feed- back, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt-series feedback amplifier.	
UNIT-IV	6
Oscillators: Basic principles of sinusoidal oscillators, RC Phase-shift Oscillator circuits, Resonant-circuit based LC oscillators.	

Text and Reference Books

1. Milman, Halkias&Jit- Electronics Devices and Circuits- TMH
2. Donald ANeaman, "Semiconductor Physics and Devices Basic Principles", 3e, TMH India.

Course Code: BCS-205	**DATA STRUCTURE & ALGORITHMS**	
Course category	:	PLBSE
Pre-requisite Subject	:	NIL

Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 2
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course helps the students in gaining the knowledge of data structure concepts, arrays, stack, queues, trees etc, discussion of various implementations of these data objects, programming styles, and run-time representations. Course also examines algorithms for sorting and searching. Algorithm analysis and efficient code design is discussed.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course.

1. Explain how to use a specific data structure in modelling a given problem
2. Identify, construct, and clearly define a data structure that is useful for modelling a given problem.
3. Use a specific algorithmic technique in solving a given problem.
4. Design an algorithm to solve a given problem.
5. Define the notions of worst-, best-, and average-case running times of algorithms.
6. Combine fundamental data structures and algorithmic techniques in building a complete algorithmic solution to a given problem.

Topics Covered

UNIT-I	**9**
Introduction to Algorithms and Algorithm Strategies: Overview, Algorithm Strategies, Overview of Specific Algorithms, Introduction to Run Time Analysis and Big-O: Overview, Asymptotic Run Time Complexity, Big O Notation, Analysis of Algorithms, Implementation of Specific Algorithms, Algorithm Specifications: Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best & worst case analysis).	
UNIT-II	9
Introduction to Essential Data Structures: Overview, Fundamental Data Structures, Visualizing Data Structures, Types of Data Structures-Linear & Non-Linear Data Structures. **Linear Data Structure:** Array: Representation of arrays, Applications of arrays, sparse matrix and its representation, Stack: Definitions & Concepts, Operations on Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression and Their Compilation, Recursion, Tower of Hanoi.	
UNIT-III	9
Queue: Representation of Queue, Operations on Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue, Linked List: Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue **Nonlinear Data Structure**: Tree-Definitions and Concepts, Representation of binary, tree, Binary tree traversal (Inorder, Postorder, Preorder), Threaded binary tree, Binary search trees, AVL trees.	

UNIT-IV	9
Graph-Matrix Representation of Graphs, Elementary, Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree). **SORTING And SEARCHING:** Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Linear Search, Binary Search.	

EXPERIMENTS:

1. **Stack operations-**Write a program to perform PUSH, POP, PEEP & CHANGE operations on Stack.
2. **Queue Operations-**Write a program to implement insertion & deletion in a queue.
3. **Circular Queue Operations-**Write a program to implement insertion & deletion in a circular queue
4. Write a program for linked list insertion, deletion & copy
5. **Sorting and searching:** Write a program to perform
    a. Selection sort
    b. To sort the given number using bubble sort
    c. Merge sort
    d. Quick sort
    e. Sequential and binary search

Text and Reference Books

1. Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, Publisher-Tata McGraw Hill.
2. Ten Baum, Data Structures using C &C++ , Publisher – Prenctice-Hall International.
3. Horowitz, Sahni, Fundamentals of Computer Algorithms, Galgotia Pub. 2001 ed.
4. Sartaj Sahani, Fundamentals of Data Structures in C++.
5. Gilberg & Forouzan, Data Structures: A Pseudo-code approach with C, Publisher-Thomson Learning.

Course Code: **BSM-276**	**Principles of Electromagnetism and Antenna Systems**	
Course category	:	BSM
Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:3, Tutorial:1, Practical: 0
Number of Credits	:	4

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor test and one major theory examination.
Course Objectives	:	This course provides an in-depth study of electromagnetism principles and their application to antenna systems. Topics include Maxwell's equations, electromagnetic waves, transmission lines, antenna fundamentals, radiation patterns, and antenna design techniques.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Fundamental understanding of electric circuits
2. Understand the fundamental principles of electromagnetism.
3. Analyze electromagnetic fields and waves using Maxwell's equations.
4. Gain knowledge of transmission lines and their characteristics.
5. Learn the principles of antenna design and analysis.
6. Develop skills in designing and optimizing antenna systems.

Topics Covered

UNIT-I	**9**
Introduction to Electromagnetism: Overview of electromagnetism, Coulomb's law and electric fields, Gauss's law and electric flux, Magnetic fields and Biot-Savart law, Ampere's law, **Maxwell's Equations**: Formulation of Maxwell's equation, Differential form and integral form, Boundary conditions, Time-varying fields and electromagnetic waves.	
UNIT-II	**9**
Electromagnetic Waves: Wave equation**,** Plane waves**,** Polarization**,** Energy and power in electromagnetic waves **Transmission Lines:** Transmission line equations**,** Reflection and transmission coefficients**,** Smith chart**,** Impedance matching techniques	
UNIT-III	**9**
Antenna Fundamentals: Introduction to antennas**,** Antenna parameters: gain, directivity,	

efficiency, Radiation mechanisms, Antenna types and classifications **Radiation Patterns:** Far-field approximation, Radiation pattern characteristics, Beamwidth, directivity, gain, Antenna arrays	
UNIT-IV	**9**
Antenna Analysis: Antenna impedance, Input impedance matching, Antenna measurements and testing. **Antenna Design Techniques:** Wire antennas: dipole, monopole, Aperture antennas: microstrip, horn, reflector, Arrays and array synthesis, Numerical methods in antenna design,Antenna modeling and simulation software, Microwave antennas, Recent advancements in antenna technology	
Text and Reference Book	
1. "Antenna Theory: Analysis and Design" by Constantine A. Balanis, Wiley 2. "Antenna Theory and Design" by Warren L. Stutzman and Gary A. Thiele Publisher: Wiley	

Course Code: **BEC-257**	**Computer Networks**	
Course category	:	PC
Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:3, Tutorial:1, Practical: 0
Number of Credits	:	4

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor test and one major theory examination.
Course Objective	:	The objective of the course is to equip the students with a general overview of thefundamental concepts of computer networks, understand basic network models and Different transmission used for datacommunication.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Gain the knowledge of the basic computer network technology.
2. Gain the knowledge of the functions of each layer in the OSI and TCP/IP reference model.
3. Obtain the skills of subnetting and routing mechanisms.
4. Able to explain the principles of routing and the semantics and syntax of IP.
5. Develop application layer protocols.
6. Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation

Topics Covered

UNIT-I	**9**
Introduction to networks, internet, protocols and standards, the OSI model, layers in OSI model, TCP/IP suite, Addressing, Analog and digital signals. Physical Layer: digital transmission, multiplexing, transmission media, circuit switched networks, Datagram networks, virtual circuit networks, switch and Telephone network.	
UNIT-II	**9**
Data link layer: Introduction, Block coding, cyclic codes, checksum, framing, flow and error control, Noiseless channels, noisy channels, HDLC, point to point protocols. Medium Access sub layer: Random access, controlled access, channelization, IEEE standards, Ethernet, Fast Ethernet, Giga-Bit Ethernet, wireless LANs.	
UNIT-III	**9**

Connecting LANs, backbone networks and virtual LANs, Wireless WANs, SONET, frame relay and ATM. Network Layer: Logical addressing, internetworking, tunneling, address mapping, ICMP, IGMP, forwarding, uni-cast routing protocols, multicast routing protocols.	
UNIT-IV	**9**
Transport Layer: Process to process delivery, UDP and TCP protocols, SCTP, data traffic, congestion, congestion control, QoS, integrated services, differentiated services, QoS in switched networks. Application Layer – Domain name space, DNS in internet, electronic mail, FTP, WWW, HTTP, SNMP, multi-media, network security	
Text and Reference Book	
1. Data Communications and Networking – Behrouz A. Forouzan, Fourth Edition TMH,2006. 2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education. 3. Computer and Communication Networks,Nader F. Mir, Pearson Education 4. Computer Networking:A Top-Down Approach Featuring the Internet,James F.Kurose,K.W.Ross,3rd Edition,Pearson Education.	

Course Code: **BEC-252**	**Principles of Communication Systems**	
Course category	:	PC
Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:3, Tutorial:1, Practical: 0

Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, record, viva voce, two minor tests and one major theory examination.
Course Objective	:	This course is intended to develop the concepts of signals, frequency domain transformation, communication systems with analog modulation schemes.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Able to understand the characteristics of different signals and operation on signals.
2. Acquire the knowledge of Fourier Series, Fourier Transform, Laplace Transform and their properties.
3. Able to analyze the behavior of continuous and discrete time system in time & frequency domain.
4. Able to understand the amplitude modulation.
5. Able to understand the angle modulation.
6. Able to understand the multiple access techniques.

Topics Covered

UNIT-I	**9**
Signals: Introduction to elementary signals, Representation of Composite signals using elementary signals, Classification of signals, Operation on signals, Time shifting, Time scaling, Time Reversal, Fourier series and its properties, Magnitude & Phase spectrum of Fourier coefficient, Fourier transform for continuous time signals (CTFT), Fourier transform of Discrete time signals (DTFT), Inverse Fourier Transform CT & DT Signals, Properties of CTFT & DTFT	
UNIT-II	**9**
Laplace Transform and properties, Inverse Laplace Transform, Z-transform and properties, Inverse Z-transform, Sampling theorem and applications,	

Systems: Introduction to Continuous and Discrete time LTI systems, Properties of LTI Continuous and discrete time systems, Response of Continuous and discrete time LTI system, Time domain analysis and Frequency domain analysis of Continuous & Discrete time LTI System. Block diagram representation of continuous and discrete time system	
UNIT-III	**9**
Introduction of Communication system: Elements of Communication systems, Need of modulation and Modulation techniques, Baseband and Pass band signals, Introduction of analog and digital modulation. **Detailed Analysis of Amplitude Modulation (AM) and demodulation:** Modulation index, Types of amplitude modulation, Double sideband with Carrier (DSB-C), Double side band without Carrier (DSB-SC), Single Side Band Modulation (SSB), vestigial Modulation (VSB), Power Spectrum and Bandwidth of different modulation scheme	
UNIT-IV	**9**
Detailed Analysis of Angle modulation: Types of angle modulation, Frequency Modulation (FM): Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, Phase modulation (PM): Transmission bandwidth of PM Signals, Generation of PM Signals, Demodulation of PM Signals, Carson's Bandwidth, Comparison of FM and PM system. superheterodyne receivers, Basics of TDMA, FDMA and CDMA.	
Text and Reference Book	
1. Alan V Oppenheim and S Hamid, "Signals and Systems", Pearson New International Edition 2. Barry Van Veen and Simon Haykin "Signals and Systems", 2e, Wiley India 3. H. Taub, D L Schilling and GoutomSaha, "Principles of Communication", 3e, Tata McGraw-Hill Publishing Company Ltd. 4. Simon Haykin, "Communication Systems",4e, Wiley India. 5. H. P. HSU and D. Mitra, "Analog and Digital Communications", 2e, Tata McGraw-Hill Publishing Company Ltd.	

Course Code: **BEC-258**	**Introduction to Raspberry Pi Programming**	
Course category	:	PC
Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:3, Tutorial:0, Practical: 4
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, two minor test and major theory examination.
Course Objective	:	This course elucidates concepts related to Internet of Things. The students will get hands-on experience in working with Raspberry Pi 3 and exploring IoT.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi.
2. The course focuses on higher-level operating systems, advanced networking, user interfaces, multimedia
3. Able to use more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice, while also exposing the student to other comparable platforms.
4. Able to understand the working of Raspberry Pi, its features and how various components can be used with Pi.
5. After doing this course, students should be able to design and deploy multiple IoT devices that could connect to the gateway.
6. Analyze applications of IoT in real time scenario

Topics Covered

UNIT-I	**9**
Getting Started with Raspberry Pi: Raspberry Pi: Raspberry Pi board and its processor, Programming the Raspberry Pi using Python, Communication facilities on Raspberry Pi	

(I2C,SPI, UART), Interfacing of sensors and actuators. Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS.	
UNIT-II	**9**
Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operate the Raspberry Pi in "headless mode", Bash Command line, operating Raspberry Pi without needing a GUI interface, Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.	
UNIT-III	**9**
Communication with devices through the pins of the Raspberry Pi, RPi. GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface	
UNIT-IV	**9**
IoT Design using Raspberry Pi, IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi.	
List of Experiments	
1. To assemble Raspberry Pi hardware components and Boot up Raspberry Pi and access the command line interface. 2. To Write a simple Python script to blink an LED connected to GPIO pins. 3. To Write a Python script to read temperature and humidity data from the sensor by connect a DHT11 or DHT22 sensor to Raspberry Pi. 4. To write a Python script to detect button presses and trigger an action (e.g., LED blinking). 5. To write a Python script to detect motion using the Passive Infrared (PIR) motion sensor	

to Raspberry Pi.

6. To Write a Python script to control the servo motor's position to Raspberry Pi and data seen on serial monitor.
7. To write a Python script to measure distance using the an ultrasonic distance sensor (e.g., HC-SR04) to Raspberry Pi.
8. To Create a simple web server that displays sensor data (e.g., temperature and humidity) on a web page.
9. To write a Python script to capture images or record videos using the camera.

Text and Reference Book

1. Simon Monk, "Programming the Raspberry Pi: Getting Started with Python", January 2012, McGraw Hill Professional
2. Massimo Banzi, "Getting Started with Arduino", First Edition, February 2009, O'Reilly Media, Inc
3. Eben Upton and Gareth Halfacree, "Raspberry Pi User Guide", August 2016, 4th edition, John Wiley & Sons
4. Alex Bradbury and Ben Everard, "Learning Python with Raspberry Pi", Feb 2014, John Wiley &Sons .
5. Michael Margolis, "Arduino Cookbook", First Edition, March 2011, O'Reilly Media, Inc.

Course Code: **BCS-258**	**Python for IOT**	
Course category	:	PC
Pre-requisite Subject	:	**NIL**
Contact hours/week	:	Lecture:3, Tutorial:1, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, two minor test and one major theory

		examination.
Course Objective	:	1. Develop proficiency in Python programming language 2. Learn how to interact with IoT devices using Python 3. Gain hands-on experience in building IoT applications
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1. Gain a comprehensive understanding of the Internet of Things (IoT) ecosystem, its components, and its applications across various domains.
2. Develop a strong foundation in Python programming language, including syntax, control structures, data types, and data structures.
3. Acquire the skills to interface with sensors and actuators using Python, enabling communication and data exchange with IoT devices.
4. Learn how to implement IoT protocols such as MQTT for efficient communication between IoT devices and systems.
5. Understand techniques for collecting, processing, and analyzing sensor data using Python, including storing and retrieving data from databases.
6. Develop the ability to control actuators and implement automation logic using Python scripts, facilitating responsive and intelligent IoT applications.
7. Gain hands-on experience in designing and developing IoT applications using Python, integrating sensor data with web applications and building end-to-end IoT systems.
8. Understand the security challenges inherent in IoT systems and learn best practices for implementing security measures to protect IoT devices and data.

Topics Covered

UNIT-I	**9**
Introduction to IoT: Understanding IoT ecosystem**,** Applications of IoT**,** IoT architecture and components**. Introduction to Python:** Basics of Python programming language**,** Control structures (if, else, loops)**,** Data types and data structures	
UNIT-II	**9**

Working with Sensors and Actuators: Introduction to sensors and actuators, Interfacing sensors and actuators with microcontrollers, Communicating with sensors and actuators using Python. **IoT Protocols:** Overview of IoT protocols (MQTT, CoAP, HTTP), Hands-on experience with MQTT protocol for IoT communication	
UNIT-III	**9**
Data Acquisition and Processing: Collecting sensor data using Python, Processing sensor data for insights, Storing and retrieving data from databases. **IoT Device Control:** Controlling actuators using Python, Implementing automation and control logic	
UNIT-IV	**9**
IoT Application Development: Designing IoT applications, Integrating sensor data with web applications, Building a complete IoT system. **Security in IoT:** Understanding IoT security challenges, Implementing security measures in IoT applications, Best practices for secure IoT development	
Text and Reference Book	
1. Python Crash Course" by Eric Matthes 2. Getting Started with Raspberry Pi" by Matt Richardson and Shawn Wallace	

Course Code: BEC-255	**Electronic Software Tools**	
Course category	:	Programming Language based Skill (PLBSE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture :1, Tutorial : 0 , Practical: 2
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, assignments, quizzes, practical work, record, viva voce, two minor tests and one major theory & practical examination.
Course Objectives	:	This course is intended to develop the skills on electronic software tools using Multisim and SPICE tools like Cadence, Mentor etc.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.
1. Able to familiarized with Multisim 2. Use Multisim to capture circuit schematics 3. Able to perform simulation and implementation of electronic circuits		

4. Use interactive simulation to check circuit design 5. Perform circuit Analysis using SPICE 6. Able to transfer PSICE design to PCB layout	
Topics Covered	
UNIT-I	
Introduction to MultiSim, Design procedures, Setting MultiSim simulation environment: Capture of schematics.	3
UNIT-II	
Simulation and result display, Implementation of simple electronic circuits	3
UNIT-III	
Work with design variants, Configuring application circuits, Analysis of circuits using MultiSim	3
UNIT-IV	
design of Analog and Digital circuits, SPICE modelling and circuit analysis,Perform measurements and test on circuits, Comparison of simulated results with measured results of real circuit, Design transfer to PCB layout	3
List of Experiments: (8 practicals out of 13 will be conducted) 1) Design and simulation of RC based filter circuits. 2) Design and simulation of oscillator circuit. 3) Design and simulation of inverter circuit. 4) Simulation of diodes based circuit using SPICE simulator software 5) Simulation of transistors based circuit using SPICE simulator software 6) Circuit design and simulation using Cadence. 7) Circuit design and simulation using Mentor Graphics. 8) Introduction to VHDL and Verilog. 9) To layout the basic prototype of elevator in proteus simulation software program using Atmega16 microcontroller. 10) Developing domestic Home Automation Circuit using Atmega328p in proteus simulation software to enforce UART protocol. 11) Using Soil Moisture and DHT sensor build a IoT based irrigation system using Atmega328p as microcontroller in proteus simulation software (both schematic and PCB layout). 12) Simulation of smart street light in on proteus professional software. 13) Development of Humidity Sensor Unit using ATMega16 and Simulate on Proteus professional software.	

Text and Reference Books
1. ElectronicDevicesandCircuits-BoylestadandNashelsky, 6e, PHI, 2001 2. Neamen, Donald A. *Microelectronics: circuit analysis and design*. Vol. 43. New York: McGraw-Hill, 2007. 3. Salivahanan, S. *Electronic devices and circuits*. 5th edition, Oxford publication

Course Code: BHM-302/ 305 **INDUSTRIAL MANAGEMENT**

Course category	:	M
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will become efficient and acquire acumen for more profitable business practices.
2. Able to understand concept of plant location and layout
3. Students will understand the importance of better customer service and product quality.
4. Able to make work safer, faster, easier, and more rewarding.
5. Able to help the industry in the production of more products that possess all utility factors.
6. Reducing costs associated with new technologies.

Topics Covered

UNIT-I

9

Introduction of Modern Management: Definition, Nature and Scope of Management, Process of Management, Elements of Management, Definition of Industrial Management, Scope and Application of Industrial Management.

Plant Location and Layout: Factors affecting Plant Location, Objectives and Principles of Plant Layout, Types of Plant-Layouts

UNIT-II **9**

Work Analysis and Measurement: Design of work Study, Steps involved in Work-study process, Definition and Concept of Method study, Procedure involved in Method Study, Objectives and techniques of Work Measurement, Work -sampling and its application, Selection of Personnel and wage payment plans.

UNIT-III **9**

Organizational Structures: Types of organizations, Functions, and objectives of industrial organizations, Ownership of Industries; Proprietorship, Partnership, Joint-stock companies, Public and Private undertakings, Co-operative organizations. Sources of finance, Types of Bank accounts.

UNIT-IV **9**

Material Management: Meaning of Inventory management, Economic Order Quantity(EOQ) Model, ABC analysis, Just-in-time (JIT), Minimum Safety Stock

Industrial Safety: Occupational safety, safety programs; Safety aspects in work systemdesign,

Text and Reference Books

1. P. Crowson. Economics for Managers, Macmillan, London.
2. J. Russell (Joseph Russell) Smith, “The Elements of Industrial Management”, Hard Press
3. Rieske, David W., Asfahl and C. Ray, “Industrial Safety and Health Management”, 6thEd., Prentice Hall Professional Technical Ref.
4. Gavriel Salvendy, “Handbook of Industrial Engineering: Technology and Operations Management”, John Wiley & Sons, Inc.

5. Herman B. Henderson, Albert E. Haas, "Industrial Organization and Management Fundamentals", Industrial Press, The University of California.

Course Code: BEC-302 **Control Systems**

Course category		Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	This course is aimed at developing the concepts of control systems skills with introducing the components & their representation of control systems, analyzing the time & frequency response, andstate variable analysis.
Course Objective		This course is aimed at developing the concepts of control systems skills with introducing the components & their representation of control systems, analyzing the time & frequency response, andstate variable analysis.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completingthis course

1. Describe the response characteristic and differentiate between the open loop and closed loopcontrol system.
2. Measure and evaluate the performance of basic control systems in time domain.
3. Determine the response of a control system using poles and zeros to determine the responseof a control system.
4. Determine the stability of a control system using Routh-Hurwitz method.
5. Measure and evaluate the performance of basic control systems in frequency domain.
6. Able to derive mathematical models for simple electrical and mechanical systems using transfer function and state variable method.

Topics Covered

UNIT-I

9

Basic Components of a control system, Feedback and its effect, Types of feedback control **9**Systems, Block diagrams: representation and reduction, Signal Flow Graphs, Modeling of Physical Systems: Electrical Networks and Mechanical Systems, Force-voltage analogy, Force-current analogy.

UNIT-II **9**

Time response of continuous data systems, Different test Signals for the time response, Unit **9**step response and Time-Domain Specifications, Time response of a first order and second order systems for different test signals, Steady State Error and Error constants, Sensitivity, Control Actions: Proportional, Derivative, Integral and PID control. Introduction to Process Control Systems, Pneumatic hydraulics, Actuators.

UNIT-III **9**

Stability: Methods of determining stability, Routh Hurwitz Criterion, Root Locus, Frequency **9**Domain Analysis: Resonant Peak, Resonant frequency and Bandwidth of the second order system, Effect of adding a

zero and a pole to the forward path, Nyquist Stability Criterion, Relative Stability: Gain Margin and Phase Margin, Bode Plot

UNIT-IV **9**

State-Space Analysis of Control System: Vector matrix representation of state equation, State **9**transition matrix, Relationship between state equations and high-order differential equations, Relationship between state equations and transfer functions, Block diagram representation of state equations, Decomposition Transfer Function, Kalman's Test for controllability and observability

Text and Reference Books

1. B.C. Kuo& Farid Golnaraghi, "Automatic Control Systems", 8e, John Wiley India, 2008.
2. I.J. Nagrath & M.Gopal, "Control System Engineering", New Age International Publishers.
3. William A. Wolovich, "Automatic Control Systems", Oxford University Press, 2010.
4. Katsuhiko Ogata, "Modern Control Engineering", 3e, PHI Publication,2000

Course Code: BEC-306		**Advanced IoT Applications**
Course category	:	PC
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will become efficient for IoT Architecture and Frameworks: Layers of IoT, communication protocols (MQTT, CoAP, AMQP), cloud integration. Able to understand concept of plant location and layout.
2. Students will understand the importance of IoT Sensors, Actuators, and Communication: Advanced IoT Devices: Able to make work safer, faster, easier, and more rewarding.
3. Able to help the Data Analytics in IoT: Big Data in IoT: Storage and processing (Hadoop, Spark).
4. Reducing costs associated with new technologies.

Topics Covered

UNIT-I **9**

IoT Architecture and Frameworks: Layers of IoT, communication protocols (MQTT, CoAP, AMQP), cloud integration. Emerging Trends: Edge computing, fog computing, and AI at the edge. IoT Standards and Interoperability: IEEE standards, IoT open standards, and interoperability challenges. Use Cases: Overview of IoT applications in smart cities, industrial automation, healthcare, and agriculture.

UNIT-II **9**

IoT Sensors, Actuators, and Communication: Advanced IoT Devices: Intelligent sensors, low-power design, energy harvesting. Communication Technologies: Short-range: Zigbee, Bluetooth Low Energy (BLE), RFID, NFC. Long-range: LoRaWAN, NB-IoT, Sigfox, and 5G for IoT. Data Acquisition and Preprocessing: Sensor interfacing, filtering, and fusion techniques. IoT Gateways: Role, architecture, and design considerations.

UNIT-III **9**

IoT Data Analytics and Security: Data Analytics in IoT: Big Data in IoT: Storage and processing (Hadoop, Spark). Real-time analytics and visualization. AI/ML in IoT for predictive maintenance, anomaly detection, etc. IoT Security Challenges: Secure communication protocols and encryption techniques. Device authentication and access control. Security standards (ISO/IEC 27001, NIST). Privacy Concerns: Data anonymization and GDPR compliance

UNIT-IV **9**

IoT Applications and Future Directions: Advanced IoT Applications: Smart Healthcare: Remote monitoring, wearable devices, and telemedicine. Industry 4.0: Industrial IoT (IIoT), digital twins, and predictive maintenance. Autonomous Systems: Connected vehicles, drones, and robotics. Smart Grids: Energy management and renewable energy integration. IoT Ecosystem Tools: Platforms like AWS IoT, Google Cloud IoT, Azure IoT Hub. Research Trends and Challenges: IoT scalability and deployment in resource-constrained environments. Ethical and societal impacts of IoT. Quantum IoT and next-gen technologies.

List of Experiments

1. To study and draw the architecture of IoT, showing the four layers: sensing, network, data processing, and application.
2. To interface a DHT11 sensor and display temperature and humidity values on serial monitor.
3. To send temperature data to the ThingSpeak cloud using HTTP protocol and view it on a real-time graph.
4. To send real-time sensor data from NodeMCU to ThingSpeak cloud using HTTP protocol.
5. To build an RFID-based identification system and display card UID on serial monitor
6. To visualize sensor data on a local web dashboard using charts (Temperature chart using Node-RED).
7. To demonstrate data transmission between two NodeMCU boards using ESP-NOW (short-range, peer-to-peer protocol).
8. To create a dashboard using Node-RED to visualize live sensor values (temperature, humidity, etc.).

To develop an IoT-based authentication system using a keypad and password verification with cloud-based logging.

Text and Reference Books

1. Designing the Internet of Things, Authors: Adrian McEwen and Hakim Cassimally, Publisher: Wiley, Edition/Year: 2013
2. The Elements of Industrial Management, Author: J. Russell (Joseph Russell) Smith , Publisher: Hard Press, Edition/Year: 1915 (Reprint available)

References

1. Building the Internet of Things: Implement New Business Models, Disrupt Competitors, and Transform Your Industry, Author: Maciej Kranz. Publisher: Wiley, Edition/Year: 2016
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Authors: David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Publisher: Cisco Press, Edition/Year: 2017
3. Fog Computing and Its Role in the Internet of Things, Authors: Flavio Bonomi et al., Published In: Proceedings of the MCC Workshop on Mobile Cloud Computing, Year: 2012

Course Code: BEC-307	**Information and Network Security**
Course category	PC
Pre-requisite Subject	NIL
Contact hours/week	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	4
Course Assessment methods	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will become efficient for Media- Based-Vulnerabilities, Network Device Vulnerabilities.
2. Students will understand the importance of Authentication Service, Scanning: Port Scanning, Port Knocking- Advantages
3. Able to help the Application level gateways, Encrypted tunnels, Cookies.
4. Assignments on latest network security techniques

Topics Covered

UNIT-I **9**

Introduction to Network security, Model for Network security, Model for Network access security, Real-time Communication Security: Introduction to TCP/IP protocol stack, Implementation layers for security protocols and implications, IPsec: AH and ESP, IPsec: IKE.

UNIT-II **9**

Media- Based-Vulnerabilities, Network Device Vulnerabilities, Back Doors, Denial of Service (DoS), Spoofing, Man-in-the-Middle, and replay, Protocol -Based Attacks, DNS Attack, DNS Spoofing, DNS Poisoning, ARP Poisoning, TCP/IP Hijacking, Virtual LAN (VLAN), Demilitarization Zone (DMZ) , Network Access Control (NAC), Proxy Server , Honey Pot , Network Intrusion Detection Systems (NIDS) and Host Network Intrusion Prevention Systems Protocol Analyzers, Internet Content Filters, Integrated Network Security Hardware .

UNIT-III **9**

Authentication: Kerberos, X.509 Authentication Service, Scanning: Port Scanning, Port Knocking-Advantages, Disadvantages. Peer to Peer security. Electronic Mail Security: Distribution lists, Establishing keys, Privacy, source authentication, message integrity, non-repudiation, proof of submission, proof of delivery, message flow confidentiality, anonymity, Pretty Good Privacy (PGP)

UNIT-IV **9**

Firewalls and Web Security: Packet filters, Application-level gateways, Encrypted tunnels, Cookies. Assignments on latest network security techniques, Security applications in wireless sensor network and wireless Communication networks

Text and Reference Books

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Prentice Hall of India, Third Edition, 2003.

References:

1. Cisco: Fundamentals of Network Security Companion Guide (Cisco Networking Academy Program).

2. Saadat Malik, Saadat Malik. “Network Security Principles and Practices (CCIE Professional Development)”. Pearson Education. 2002. (ISBN: 1587050250) .
3. Mark Ciampa “Security + Guide to Network Security Fundamentals/Edition 3” Cengage Learning publisher, ISBN-10: 1428340661, ISBN-13: 978-1428340664

Course Code: BEC-308 Python-Based Machine Learning and Artificial Intelligence

Course category	:	PLBSE
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 2
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamentals of AI and ML and the role of Python in their development.
2. Apply Python libraries for data analysis and visualization.
3. Develop and train neural networks for AI tasks using TensorFlow/Keras.
4. Analyze the performance of deep learning models in real-world applications.
5. Utilize advanced ML techniques for better model accuracy.
6. Understand ethical implications in AI and ML applications.

Topics Covered

UNIT-I **9**

Overview of AI and Machine Learning (ML): Definitions, types, and applications. Introduction to Python for ML/AI: Libraries such as NumPy, Pandas, Matplotlib, and Scikit-learn. Supervised Learning Basics: Linear regression, logistic regression, and evaluation metrics. Unsupervised Learning Basics: K-means clustering and dimensionality reduction (PCA).

UNIT-II **9**

Neural Networks and Deep Learning with Python, Introduction to Neural Networks: Perceptron, activation functions, and loss functions. Deep Learning Basics: Feedforward and backpropagation algorithms. Frameworks for Deep Learning: TensorFlow and Keras. Case Studies: Image classification, text sentiment analysis.

UNIT-III **9**

Advanced Machine Learning Techniques and Model Optimization Ensemble Learning: Random Forest, Gradient Boosting, and XGBoost. Model Optimization Techniques: Hyperparameter tuning (Grid Search, Random Search). Natural Language Processing (NLP): Tokenization, TF-IDF, Word2Vec. Ethical AI: Bias, fairness, and interpretability in ML models.

UNIT-IV **9**

AI Applications and Future Trends: Reinforcement Learning: Introduction, Q-Learning, and policy gradients. AI in Real-World Scenarios: Robotics, recommendation systems, and predictive analytics. AI for Edge and Cloud: Concepts of AI deployment. Emerging Trends: Generative AI (e.g., GPT), Explainable AI, and Auto ML.

List of Experiments

1. To study and implement basic Python programming constructs such as variables, data types, conditional statements, loops, functions, and file handling.

2. To perform data manipulation using NumPy arrays and pandas DataFrames on a sample dataset.
3. To visualize data using matplotlib and seaborn by creating line graphs, bar charts, histograms, and scatter plots.
4. To apply data preprocessing techniques including handling missing values, label encoding, one-hot encoding, and feature scaling.
5. To implement Linear Regression using scikit-learn on a real-world dataset and evaluate it using Mean Squared Error (MSE) and R^2 score.
6. To build a Logistic Regression model for binary classification (e.g., diabetes prediction) and evaluate it using accuracy and confusion matrix.
7. To implement k-Nearest Neighbors (k-NN) for classification and test it on a small dataset (e.g., Iris dataset).
8. To perform unsupervised learning using k-Means Clustering and visualize the resulting clusters.
9. To implement a simple Artificial Neural Network (ANN) using TensorFlow/Keras for classification on the MNIST or similar small dataset.

Text and Reference Books

1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Authors: Aurélien Géron, Publisher: O'Reilly Media, Edition/Year: 2nd Edition, 2019
2. "Python Machine Learning", Authors: Sebastian Raschka and Vahid Mirjalili, Publisher: Packt Publishing, Edition/Year: 3rd Edition, 2019

References

1. Machine Learning Yearning", Author: Andrew Ng, Publisher: Self-published, Edition/Year: 2018
2. "Artificial Intelligence: A Guide to Intelligent Systems", Authors: Michael Negnevitsky, Publisher: Pearson, Edition/Year: 3rd Edition, 2011
3. "Reinforcement Learning: An Introduction", Authors: Richard S. Sutton and Andrew G. Barto, Publisher: MIT Press, Edition/Year: 2nd Edition, 2018"

PE1 (BEC-333) Fundamental of AIOT

Course category	:	Program Elective
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce, and Minor test and one Major Theory.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the concepts of AIoT and their significance in modern industries.
2. Apply techniques to connect mobile devices to IoT gateways, bridging the gap between different networks.
3. Analyze sensor technologies in IoT and their academic foundations to showcase practical understanding.
4. Develop and Evaluate AIoT applications to address real-world challenges.
5. Gain Understanding of AIOT applications.
6. Develop and collect real time data from sensors.

Topics Covered

UNIT-I

Introduction to AIoT: Overview of Artificial Intelligence (AI) and its applications across various industries. Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration. Connecting Mobile Devices to IoT Gateways: networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile-to-IoT connections. 9

UNIT-II

Sensor Technologies and Academic Concepts: Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. 9

Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.

UNIT-III

AIoT Application Development: Introduction to tools and platforms essential for building AIoT applications. Practical Aspects of AIoT applications, including: Smart Traffic Signal System for Color Blind Individuals Plant Health Analysis Smart Door Access Control System. Weather Forecasting with AIoT: Design and implementation of a weather forecasting system leveraging AIoT technologies. Integration of real-time weather data from sensors with AI algorithms for accurate predictions. Hands-on exercises for building, testing, and refining weather forecasting systems. 9

UNIT-IV

Smart Solutions Development: Development and deployment of smart solutions utilizing AIoT principles. Case studies and real-world examples of successful smart solutions in various domains. Project-based learning allowing students to conceptualize, design, and implement their own AIoT solutions. 9

Books & References

1. " Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson Education, 2021.
2. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016.
3. Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024

PE1 (BEC-334) Computer Vision for IoT

Course category	:	Program Elective
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce, and Minor test and one Major Theory.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamental concepts of computer vision and its integration with IoT systems.
2. Identify and apply key image processing techniques for feature extraction and object detection.
3. Gain understanding of computer vision and its applications in IoT.
4. Comprehend the role of machine learning and deep learning models in vision-based IoT applications.
5. Implement vision solutions on embedded IoT platforms using sensors, cameras, and lightweight AI models.
6. Analyze real-world use cases and develop practical vision-enabled IoT systems for smart applications.

Topics Covered

UNIT-I

Introduction to computer vision and its applications in IoT, image formation and representation including pixels and color spaces such as RGB, HSV, and grayscale, image processing operations like filtering, edge detection using Sobel and Canny operators, histogram equalization, feature extraction techniques including Harris corners, SIFT, SURF, and ORB, basic object detection using contours and bounding boxes, and implementation using OpenCV with Python. 9

UNIT-II

Introduction to machine learning techniques used in computer vision, comparison between supervised and unsupervised learning with examples, fundamentals of deep learning including convolutional neural networks (CNNs), operations like convolution and pooling, exploration of pre-trained models such as VGG, ResNet, and MobileNet suitable for embedded devices, and transfer learning techniques for vision tasks on edge devices using frameworks like TensorFlow. 9

UNIT-III

Overview of IoT architecture and communication protocols including MQTT, HTTP, and CoAP, introduction to embedded platforms for vision applications such as Raspberry Pi, Jetson Nano, and ESP32-CAM, methods to interface cameras and auxiliary sensors like PIR, DHT, and ultrasonic sensors, techniques for capturing and streaming images or video on IoT devices, and deployment of lightweight AI models using TinyML and TensorFlow Lite. 9

UNIT-IV

Development of smart surveillance and security systems using vision, vision-based traffic monitoring and vehicle counting, industrial IoT use cases such as visual inspection and defect detection, agricultural applications including crop monitoring and disease detection with UAV or IoT devices, healthcare solutions such as fall detection and patient monitoring through vision, real-time project discussions on design, deployment, and optimization challenges for IoT-based vision systems. 9

Books & References

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Neural Networks and Learning Machines by Simon Haykin,
2. Practical Python and OpenCV by Adrian Rosebrock,
3. Signals and Systems by Alan V. Oppenheim (for signal and image basics),
4. OpenCV documentation, TensorFlow Lite guides, and Nvidia Jetson developer tutorials.

PE1 (BEC-335) Data Analytics for IOT

Course category : Program Elective
Pre-requisite Subject : NIL
Contact hours/week : Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits : 4
Course Assessment Methods : Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce, and Minor test and one Major Theory.
Course Outcomes : The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamentals of IoT Analytics and Challenges
2. Understand and analyze IoT Devices and Networking Protocols
3. To Analyze the IoT data to infer the protocol and device characteristics
4. Apply IoT Analytics for the Cloud
5. Understand exploring and visualizing data
6. Gain use cases for deep learning with IoT data.

Topics Covered

UNIT-I

Defining IoT Analytics and Challenges: Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges. 9

UNIT-II

IoT Devices and Networking Protocols: IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics. 9

UNIT-III

IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage. Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis. 9

UNIT-IV

Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data. 9

Books & References

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730.
2. Huaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.
3. Practical Python and OpenCV by Adrian Rosebrock.

Course Code: BHM-354 **BUSINESS MANAGEMENT**

Course category	:	M
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial : 0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will comprehend and correlate all the fundamental Management functions and the concepts and principles of Management.
2. Demonstrate Engineering students, demonstrate the roles, skills, and functions of Management.
3. Students will develop Interdisciplinary skills which can help them to thrive in the life- long changing environment in various fields of business.
4. One can analyze the effective application of management knowledge principles and practices to diagnose and solve organizational problems and develop optimal managerial decisions.
5. Demonstrate the acumen in organizing and understanding the staffing process.
6. Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities

Topics Covered

UNIT-I **6**

Meaning and Definition, Need for business, Nature of Business, Scope, Objectives, Qualities of a Successful Businessman. Forms of Business Ownership, Public, Private, and Joint Sector Undertaking, Public-Private Partnership, NGO – only meaning.

UNIT-II **6**

Meaning, Emergence of Management Thought, Characteristics of Management, Bureaucracy, Scientific Management, Administrative Theories of Management, Principles of Management, Social Responsibility of Management, and Business Ethics.

UNIT-III **6**

Meaning & Definition, Characteristics of a Good Plan, Planning Process, Types of Plans, MBO&MBE, Decision making: Types of Decisions, Steps involved in Decision Making, Communication, Importance of Communication and Types of Communication.

UNIT-IV **6**

Meaning, characteristics, the importance of organization, steps in organization, organization structure, departmentation–meaning and basis for departmentation. The span of management-Meaning Only, Centralization vs. Decentralization, Definition, Staffing-Meaning, Functions, Selection Procedure and Instruments used in the selection.

Text and Reference Books

1. Business Management, Dr. P. Subba Rao, Roopa Traisa, Himalaya Publishing.

2. Management, Michael A Hitt, J Stewart Black, Lyman W - Prentice-Hall publishing –2nd Revised edition.
3. Essentials of management, Harold Koontz Heinz Weihrich - Tata Mc Graw hillpublishing.
4. Business management, R. K Sharma, Shashi K. Gupta – Kalyani publishers – 2009.
5. Business management, Appanniah Reddy - Himalaya publishers.2008.

Course Code: BEC-354 **Wireless Sensor Networks (WSN)**

Course category	:	PC
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamental concepts of Wireless Sensor Networks (WSNs) and their applications.
2. Analyse protocols and algorithms for communication, data aggregation, and energy efficiency in WSNs.
3. Develop skills to design and evaluate WSN systems for real-world applications.
4. Explore recent advancements and research challenges in WSNs.
5. Advanced Topics and Applications
6. Quality of Service (QoS): Parameters and trade-offs in WSNs.
7. Mobile WSNs: Mobility models and dynamic network adaptation.
8. IoT and WSN Integration: Role of WSN in IoT applications.
9. Emerging Research Areas: Machine learning in WSNs, blockchain for secure WSNs.
10. Case Studies: Real-world implementations and emerging trends.

Topics Covered

UNIT-I **6**

Introduction to Wireless Sensor Networks Introduction: Overview of WSNs, Characteristics, and Applications, Architecture: WSN architecture, sensor nodes, and network topologies. Technologies: Enabling technologies for WSNs (e.g., IEEE 802.15.4, ZigBee). Challenges: Deployment, Scalability, Fault tolerance, and Energy efficiency. Case Studies: WSN applications in agriculture, health, and smart cities.

UNIT-II **6**

Communication Protocols in WSN Physical Layer: Modulation and energy-efficient communication. MAC Layer Protocols: TDMA, FDMA, and CSMA; energy-efficient MAC protocols like SMAC. Routing Protocols: Flat-based, Hierarchical, and Location-based protocols (e.g., LEACH, PEGASIS, SPIN). Transport Layer: Protocols ensuring reliability and congestion control.

UNIT-III **6**

Data Management and Energy Efficiency Data Aggregation: Techniques for data collection and

aggregation. Energy Conservation: Energy-efficient design techniques; Duty cycling and Node sleep schedules. Localization: Node localization and positioning techniques. Security: Challenges and protocols for secure communication in WSNs.

UNIT-IV **6**

Advanced Topics and Applications Quality of Service (QoS): Parameters and trade-offs in WSNs. Mobile WSNs: Mobility models and dynamic network adaptation. IoT and WSN Integration: Role of WSN in IoT applications. Emerging Research Areas: Machine learning in WSNs, blockchain for secure WSNs. Case Studies: Real-world implementations and emerging trends.

LIST OF EXPERIMENTS:

1. Familiarization of various sensors used in wireless sensor networks
2. Familiarization with NS2 software.
3. Basic WSN Node Deployment: Simulate random deployment of sensor nodes in a 2D field
4. Energy Consumption Model: Simulate energy consumption for nodes transmitting data.
5. Connectivity Analysis: Check node connectivity based on communication range
6. LEACH ClusteringL Simulate LEACH protocol for cluster head selection.
7. Shortest path routing: Find shortest path from a node to sink using Dijkstra Algorithm
8. Energy-Aware Routing: Route data through nodes with highest remaining energy
9. Localization using Trilateration: Estimate node position using anchor nodes
10. Packet Loss Simulation: Simulate packet loss based in distance
11. Data Aggregation: Simulate data aggregation at cluster heads

Network Lifetime Simulation: Simulate network lifetime based on energy depletion

Text and Reference Books

1. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, Wiley, 2005.
2. Feng Zhao and Leonidas Guibas, Wireless Sensor Networks: An Information Processing Approach, Elsevier, 2004.
3. Kazem Sohraby, Daniel Minoli, and Taieb Znati, *Wireless Sensor Networks: Technology, Protocols, and Applications*, Wiley, 2007.
4. Anna Hac, *Wireless Sensor Network Designs*, Wiley, 2003.

Course Code: BEC-355 **Android Application and Development**

Course category	:	PC
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor test and One Major Theory Examination
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamentals of Android platform and application development.
2. Gain practical knowledge of designing and implementing Android user interfaces.
3. Learn to work with Android APIs for building interactive and efficient mobile applications.
4. Explore advanced features like data storage, networking, and services in Android.
5. Develop basic Android applications with functional user interfaces.
6. Implement advanced UI designs and interactive features in Android apps.

7. Utilize Android APIs for data storage, networking, and multimedia functionalities.
8. Design and deploy efficient, feature-rich Android applications using modern practices.

Topics Covered

UNIT-I **9**

Introduction to Android Development Introduction: Overview of mobile app development, Android platform features, Android architecture. Development Environment: Setting up Android Studio, SDK installation, and AVD configuration. Project Structure: Understanding Android project structure, AndroidManifest.xml, and Gradle. Basic Components: Activities, intents, and lifecycle of an Android application. UI Basics: XML-based layouts, Views, ViewGroups, and designing basic interfaces.

UNIT-II **9**

Advanced UI and User Interaction UI Widgets: Buttons, TextView, EditText, ListView, RecyclerView, and ScrollView. Event Handling: Handling user inputs and gestures. Fragments: Fragment lifecycle, communication between fragments, and designing dynamic UIs. Styles and Themes: Customizing UI with themes, styles, and animations. Material Design: Using Material Design components for advanced UI development.

UNIT-III **9**

Data Storage and Networking Data Persistence: SharedPreferences, SQLite, and Room database. Files and Content Providers: Reading/writing files and using content providers. Networking: HTTP requests, REST APIs, and JSON parsing. Firebase Integration: Real-time database and authentication. Multimedia: Audio, video playback, and working with Camera APIs.

UNIT-IV **9**

Advanced Android Development Background Services: Services, foreground services, and background tasks. Broadcast Receivers: Using broadcast receivers for notifications. Sensors and Location: Accessing device sensors, GPS, and location services. Publishing Applications: Preparing apps for deployment and publishing on Google Play Store. Emerging Topics: Introduction to Jetpack Compose, MVVM architecture, and Kotlin Coroutines.

List of Experiments

1. To study and draw the architecture of the Android operating system and understand its key components such as Activities, Services, Broadcast Receivers, and Content Providers.
2. To install and set up Android Studio and create a basic “Hello World” application to understand the project structure and emulator setup.
3. To develop an Android application demonstrating the activity lifecycle using log messages (Logcat).
4. To create a simple login screen using EditText, Button, and Toast for basic user input validation.
5. To design and implement a basic calculator app to perform arithmetic operations using buttons and text views.
6. To implement navigation between two screens using explicit intents in an Android application.
7. To use implicit intents to open system applications like the phone dialer, web browser, and camera.
8. To design a form using basic UI widgets such as CheckBox, RadioButton, and Spinner, and handle user selections.

To store and retrieve simple user data (e.g., username) using SharedPreferences in Android.

Text and Reference Books

1. 1. Ian F. Darwin, *Android Cookbook: Problems and Solutions for Android Developers*, O'Reilly Media, 2017.
2. Dawn Griffiths and David Griffiths, *Head First Android Development*, O'Reilly Media, 2017.
3. Wei-Meng Lee, *Beginning Android Programming with Kotlin*, Wiley, 2020.
4. Reto Meier, *Professional Android*, Wrox, 2018.

Course Code: BEC-356 **Digital and Wireless Communication**

Course category		Program Core (PC)
Pre-requisite Subject	:	**Principles of Communication**
Contact hours/week	:	Lecture:3, Tutorial:1, Practical:2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessments through teaching assessment, attendance, home assignments, quizzes, two minor tests and one major theory examination.
Course Objective		The aim of this course is to give basic concepts and advance issues relating to digital and wireless mobile communications and the development of cellular communication infrastructure.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.

1: Understand the system level aspects of cellular network design and planning with a special focus on GSM, WCDMA, UMTS, 4G and 5G standards.
2: Understand the basic aspects of wireless propagation models and analyse their performance like link budget, coverage, BER etc
3: Understanding of 5G on systems level along with core technologies and signal waveform
4: Understanding of advanced PHY layer technologies for 5G Radio access network (RAN) like OFDM, MIMO etc.
5: Apply the concepts of digital modulation to wireless communication
6: contribute to the research in the various protocol stack of wireless communication.

Topics Covered

UNIT-I **9**

Wireless Communication Systems & Standards

Evolution of Mobile Radio Communications, Cellular telephone systems, Different generations (1G to 6G) of Cellular Networks, Recent advances in mobile communication, Overview of Channel Impairments.

UNIT-II **9**

Cellular Communications

Introduction to Cellular Communications, Cell structure, Frequency Reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, power control, Wireless Standards:

Overview of 2G, 3G and 4G cellular standards.

UNIT-III **9**

5G Network:

New Radio (NR), Standalone and non-standalone mode, non-orthogonal multiple access(NOMA),

massive MIMO, beam formation, PHY API Specification, flexible frame structure, Service Data Adaptation Protocol (SDAP), centralized RAN, open RAN, multi-access edge computing (MEC);Introduction to software defined networking (SDN), network function virtualization (NFV), network slicing; restful API for service-based interface, private networks.

UNIT-IV **9**

Grand Challenges:

5G penetration in developed countries; deployment challenges in low-middle income countries, stronger backhaul requirements, dynamic spectrum access and usage of unlicensed spectrum, contrasting radio resource requirements, large cell usage, LMLC, possible solutions for connectivity in rural areas (BharatNet, TVWS, Long-range WiFi, FSO); non-terrestrial fronthaul / backhaul solutions: LEOs, HAP/UAV.

LIST OF EXPERIMENTS:

1. Hardware based experiment on assessment of path loss coefficient in indoor environment.
2. Hardware experiment on hands-off of cellular communication system
3. SDR/MATLAB based implementation of a digital wireless communication system with different modulation formats (QPSK, QAM, 64-QAM).
4. Experiment and Simulation of various fading channels and Analyze their SNR vs. BER performance in MATLAB/SDR platform.
1. Experiment on various diversity techniques like selection combining, equal gain combining and MRC in MATLAB and their BER analysis in a fading environment. Show the capacity improvement as well.
2. Implement linear adaptive equalization for a digital wireless communication system and analyze the BER performance.
3. Performance analysis of space-time coding (Alamouti Coding for 2X1 and 2X2 MIMO) overfading channel in MATLAB.
4. Experiment on MIMO-OFDM systems over fading channel in MATLAB and analyze its capacity.
5. Experiment with wide band real time signals related to different communication standards like WLAN and LTE in MATLAB/LabVIEW.
6. Signal Processing for MIMO Systems.
7. Digital Beamforming.
8. Massive MIMO Channel Model– Large/ Small Scale Fading
9. Transmitter and Receiver Schemes with Imperfect CSI
10. Multi-Cell Massive MIMO Model.

Fixed NOMA Protocol for UL/ DL – Performance Analysis

Text and Reference Book

1. Mobile Communications by Jochen Schiller Pub: Financial Times / Imprint of Pearson.
2. Mobile Cellular Telecommunications: Analog and Digital Systems by William Lee, Pub: McGraw Hill Education
3. Mobile Communications Design Fundamentals by William Lee, Pub: Wiley India Pvt. Ltd.
4. Wireless Communications: Principles and Practice by Theodore S. Rappaport, Pub: Pearson.

PE1 (BEC-333) Fundamental of AIOT

Course category	:	Program Elective
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce, and Minor test and one Major Theory.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the concepts of AIoT and their significance in modern industries.
2. Apply techniques to connect mobile devices to IoT gateways, bridging the gap between different networks.
3. Analyze sensor technologies in IoT and their academic foundations to showcase practical understanding.
4. Develop and Evaluate AIoT applications to address real-world challenges.
5. Gain Understanding of AIOT applications.
6. Develop and collect real time data from sensors.

Topics Covered

UNIT-I

Introduction to AIoT: Overview of Artificial Intelligence (AI) and its applications across various industries. 9
Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration. Connecting Mobile Devices to IoT Gateways: networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile-to-IoT connections.

UNIT-II

Sensor Technologies and Academic Concepts: Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. 9
Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.

UNIT-III

AIoT Application Development: Introduction to tools and platforms essential for building AIoT applications. 9
Practical Aspects of AIoT applications, including: Smart Traffic Signal System for Color Blind Individuals Plant Health Analysis Smart Door Access Control System. Weather Forecasting with AIoT: Design and implementation of a weather forecasting system leveraging AIoT technologies. Integration of real-time weather data from sensors with AI algorithms for accurate predictions. Hands-on exercises for building, testing, and refining weather forecasting systems.

UNIT-IV

Smart Solutions Development: Development and deployment of smart solutions utilizing AIoT principles. 9
Case studies and real-world examples of successful smart solutions in various domains. Project-based learning allowing students to conceptualize, design, and implement their own AIoT solutions.

Books & References

1. " Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson Education, 2021.
2. Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016.
3. Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024

PE1 (BEC-334) Computer Vision for IoT

Course category	:	Program Elective
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce, and Minor test and one Major Theory.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamental concepts of computer vision and its integration with IoT systems.
2. Identify and apply key image processing techniques for feature extraction and object detection.
3. Gain understanding of computer vision and its applications in IoT.
4. Comprehend the role of machine learning and deep learning models in vision-based IoT applications.
5. Implement vision solutions on embedded IoT platforms using sensors, cameras, and lightweight AI models.
6. Analyze real-world use cases and develop practical vision-enabled IoT systems for smart applications.

Topics Covered

UNIT-I

Introduction to computer vision and its applications in IoT, image formation and representation including pixels and color spaces such as RGB, HSV, and grayscale, image processing operations like filtering, edge detection using Sobel and Canny operators, histogram equalization, feature extraction techniques including Harris corners, SIFT, SURF, and ORB, basic object detection using contours and bounding boxes, and implementation using OpenCV with Python. 9

UNIT-II

Introduction to machine learning techniques used in computer vision, comparison between supervised and unsupervised learning with examples, fundamentals of deep learning including convolutional neural networks (CNNs), operations like convolution and pooling, exploration of pre-trained models such as VGG, ResNet, and MobileNet suitable for embedded devices, and transfer learning techniques for vision tasks on edge devices using frameworks like TensorFlow. 9

UNIT-III

Overview of IoT architecture and communication protocols including MQTT, HTTP, and CoAP, introduction to embedded platforms for vision applications such as Raspberry Pi, Jetson Nano, and ESP32-CAM, methods to interface cameras and auxiliary sensors like PIR, DHT, and ultrasonic sensors, techniques for capturing and streaming images or video on IoT devices, and deployment of lightweight AI models using TinyML and TensorFlow Lite. 9

UNIT-IV

Development of smart surveillance and security systems using vision, vision-based traffic monitoring and vehicle counting, industrial IoT use cases such as visual inspection and defect detection, agricultural applications including crop monitoring and disease detection with UAV or IoT devices, healthcare solutions such as fall detection and patient monitoring through vision, real-time project discussions on design, deployment, and optimization challenges for IoT-based vision systems. 9

Books & References

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Neural Networks and Learning Machines by Simon Haykin,
2. Practical Python and OpenCV by Adrian Rosebrock,
3. Signals and Systems by Alan V. Oppenheim (for signal and image basics),

4. OpenCV documentation, TensorFlow Lite guides, and Nvidia Jetson developer tutorials.

PE1 (BEC-335) Data Analytics for IOT

Course category	:	Program Elective
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce, and Minor test and one Major Theory.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Understand the fundamentals of IoT Analytics and Challenges
2. Understand and analyze IoT Devices and Networking Protocols
3. To Analyze the IoT data to infer the protocol and device characteristics
4. Apply IoT Analytics for the Cloud
5. Understand exploring and visualizing data
6. Gain use cases for deep learning with IoT data.

Topics Covered

UNIT-I

Defining IoT Analytics and Challenges: Introduction to IoT, applications, IoT architectures, introduction to analytics, IoT analytics challenges. 9

UNIT-II

IoT Devices and Networking Protocols: IoT devices, Networking basics, IoT networking connectivity protocols, IoT networking data messaging protocols, Analyzing data to infer protocol and device characteristics. 9

UNIT-III

IoT Analytics for the Cloud: Introduction to elastic analytics, Decouple key components, Cloud security and analytics, Designing data processing for analytics, Applying big data technology to storage. Exploring IoT Data: Exploring and visualizing data, Techniques to understand data quality, Basic time series analysis, Statistical analysis. 9

UNIT-IV

Data Science for IoT Analytics: Introduction to Machine Learning, Feature engineering with IoT data, Validation methods, Understanding the bias–variance tradeoff, Use cases for deep learning with IoT data. 9

Books & References

1. Minteer, Andrew, Analytics for the Internet of Things (IoT), Packt Publishing Ltd. July 2017, ISBN 9781787120730.
2. Huaiyu Geng, Internet of Things and Data Analytics Handbook, Wiley.
3. Practical Python and OpenCV by Adrian Rosebrock,