BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OF ENGINEERING, PUNE
B. Tech. (Electronics and Communication): Sem- III (CBCS 2023 COURSE)

Program: B. Tech (ECE)				**Sem-III**			**NEP CBCS 2023 Course**									
Sr. No.	Category	Cours eCode	Name of the course	**Teaching Scheme**			**Examination Scheme (Marks)**						**Credits**			
				L	P	T	ESE	IA	TW	PR	OR	Total	L	P	T	Total
1.	Department Core Course		Sensors & Control Systems	3	-	1	60	40	-	-	-	100	3	-	1	4
2	Department Core Course		Signals & Systems	3	2	-	60	40	25	-	25	150	3	1	-	4
3.	Department Core Course		Digital Electronics	3	2	-	60	40	25	-	25	150	3	1	-	4
4.	Department Application Course		Analog Circuits & Applications	3	2	-	60	40	25	25	-	150	3	1	-	4
5.	Interdisciplinary Course		Data Structures	3	-	-	60	40	-	-	-	100	3	-	-	3
6.	Skill based course III		Electronics Instrumentation & Measurement	-	2	-	-	-	25	-	25	50	-	1	-	1
			Total	15	08	1	300	200	100	25	75	700	15	4	1	20
	MOOC-I*			-	-	-	-	-	-	-	-	-	-	-	-	2
	Value Added Course*		Introduction to Arduino Framework	2	-	-	-	100	-	-		100	-	-	-	2

* Indicate this is mandatory but the credits will not be considered in SGPA/CGPA

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B. Tech. (Electronics & Communication Engineering) Sem III

Sensors and Control Systems

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits:**03
	Internal Assessment: 40 Marks	
Tutorial:01 Hrs. / Week		**Credit**:01
	Total:100 Marks	**Total Credits :**04

Course Pre-requisites:

The students should have basic knowledge of

1.	Engineering Physics.
2.	Engineering mathematics.

Course Outcomes: After successfully completing the course, the students will be able to:

1.	Identify the different types of resistive sensors, electromagnetic sensors.
2.	Illustrate the working principle, construction and applications of Self-Generating Sensors and Photo detectors.
3.	Identify various control systems and determine the 'transfer function' of System using 'Block diagram reduction' and 'Signal Flow Graph'.
4.	Determine the 'Static Error Coefficients' and 'Steady State Error' in various control systems.
5.	Evaluate the stability of a system using Routh's stability criteria, Root Locus and bode plot.
6.	Compare various control actions such as Proportional, Integral, Derivative and PID controller.

UNIT - I	**Introduction to Sensors**	**06 Hrs.**
	Resistive Sensors: Thermocouple, Thermistors, Strain gages, Resistive Temperature Detectors, light-dependent resistors**.** Reactance Variation and Electromagnetic Sensors**:** Capacitive sensors, Inductive sensors, Electromagnetic sensors.	
UNIT - II	**Self-Generating Sensors and Photo detectors.**	**06 Hrs.**
	Working principles of Thermoelectric sensors, Piezoelectric sensors, Electrochemical sensors. IR Sensor and Photo Detectors: photoconductive detectors, Photo diodes, Avalanche photodiodes.	
UNIT -III	**Control System Classification**	**06 Hrs.**
	Open loop, closed loop, Feedback and Non-feedback Systems, continuous, discrete, linear and non-linear control systems. Transfer Function, Analysis of Transfer Function using Block Diagram reduction technique and signal	

	flow graph.	
UNIT - IV	**Time Domain Analysis**	**06 Hrs.**
	Transient and steady state responses of first and second order systems, Static error Coefficients (K_p, K_v, K_a), steady state errors, control of transient response, Basic control actions and their effects on transient response.	
UNIT - V	**Stability**	**06 Hrs.**
	Stability concepts, Routh's stability criterion, Root loci, properties and construction of root loci, effects of adding of poles and zeros, Stability analysis using Root Locus and Bode plot, Nyquist stability criteria.	
UNIT - VI	**Controllers**	**06 Hrs.**
	Control actions: On/Off Controller, Proportional Controller, Integral Controller, Derivative Controller, Proportional-Integral(PI) Controller, Proportional-Derivative(PD) Controller, PID Controller.	

Project Based Learning: The **s**tudents are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per standard guidelines.

Tutorial: Students are expected to complete minimum six tutorial.

Text Books:

1. A. K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpt Rai and Co. Ltd.
2. K. Ogata, Modern Control Engineering –3rd Edition, Prentice Hall of India, 1997.

Reference Books:

1. J. Nagrath & M. Gopal, "Modern Control Engineering", New Age International, New Delhi New Age Int. Pvt. Ltd. Publishers, 5th Edition 2008.
2. H S Kalsi, Electronic Instrumentation, Tata McGraw-Hill.

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B. Tech. (Electronics & Communication Engineering) Sem- III

SIGNALS & SYSTEMS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits:** 03
Practical: 02 Hrs. / Week	**Internal Assessment:** 40 Marks	
	TW: 25 Marks	**Credit**:01
	OR: 25 Marks	
	Total:150 Marks	**Total Credits:** 04

Course Pre-requisites:

The students should have basic knowledge of

1.	Engineering Mathematics-I
2.	Engineering Mathematics-II

Course Outcomes: After successfully completing the course, the students will be able to:

1.	Differentiate various signals and perform operations on signals.
2.	Classify systems based on their properties & determine the response of LSI system using convolution.
3.	Apply Fourier Series and Fourier Transform concepts for continuous time signals.
4.	Analyze the continuous time systems with Laplace Transform.
5.	Apply Z-transform for the analysis of discrete time systems.
6.	Comprehend basic principles of probability, random variables and probability distributions.

UNIT - I	**Introduction to signals**	**06 Hrs.**
	Signals and Systems definition, Types of signals, continuous time(CT) and Discrete time (DT) signal operations, Amplitude scaling, Time shifting, Time reversal, Time scaling, Mathematical operations additions, subtraction, multiplication of signals, Classification of signals according to their property, Periodic/Aperiodic, Even/Odd, Energy/Power/Causal/Non causal, Deterministic/Random signals	
UNIT - II	**Time domain representation of LTI System**	**06 Hrs.**
	Introduction to systems, Classification of systems according to their properties, Linear/Nonlinear, Static /Dynamic, Time Invariant/Time-variant, Causal/non causal, Stable/Unstable, Invertible/Non-Invertible systems, LTI system: Causality, stability, step response, impulse response, Convolution Integral, convolution sum using graphical method, properties, and applications.	
UNIT-III	**Laplace Transform**	**06 Hrs.**

	Introduction, Unilateral and Bilateral Laplace Transform of signals, Region of convergence (ROC) and its properties. Laplace transform of standard signals, Inverse Laplace Transform, Solution to differential equation, System transfer function, Poles and zeros representation.	
UNIT-IV	**Fourier Analysis of signals**	**06 Hrs.**
	Fourier Series: - Fourier series of CT and DT signals and its properties Exponential and Trigonometric Fourier series of periodic signals, amplitude and phase spectra of periodic signals, Fourier Transform, Fourier Transform of standard signals, Properties of Fourier Transform and its applications.	
UNIT - V	**Z-Transform**	**06 Hrs.**
	Z-transform, Region of convergence and its properties, Inverse Z-transform, properties of z transform, Z-transform pairs, relation between Z and Laplace Transform, Analysis, and characterization of discrete time LTI systems using Z-transform, solution of difference equations.	
UNIT-VI	**Principles of Probability**	**06 Hrs.**
	Introduction, sample space and events, Axioms of probability, Addition and multiplication theorems, conditional probability, Bayes' Theorem, Probability density function, cumulative distribution function, Random variables, Introduction to Autocorrelation & Cross correlation	

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Introduction to MATLAB and its basic functions.
2. Generation of Continuous and discrete time signals.
3. Perform signal operations on Continuous and discrete time signals.
4. Determine even and odd parts of the signal and find real and imaginary parts of signal.
5. Compute linear convolution and convolution integral of signals.
6. Compute Fourier Transform and Inverse Fourier Transform of a given signal and plot its Magnitude and Phase Spectra.
7. Solution of difference equations to find the zero input and the zeros state responses.
8. Compute and plot the impulse response and pole-zero diagram of transfer function
9. Determine Discrete time Fourier Transform (DTFT) a given signal. Verify its properties
10. Determine the impulse response and frequency response of a LTI system from its Z-Transform.
11. Compute autocorrelation & cross correlation of the signals.
12. Waveform Synthesis using Laplace Transform.

Project Based Learning: Students are expected to perform a project (in group) based on the course and prepare report for the same. The report should be as per the standard guidelines.

Text Books:

1. Oppenheim, Willsky, S. Hamid Nawab, "Signals and Systems", PHI.
2. M.J. Roberts, "Signals and Systems", McGraw-Hill.

3. B.P Lathi, “Principles of linear systems and signals”, Oxford.
4. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill,1st Reprint 2004.

Reference Books:

1. Simon Haykin and Bary Van Veen, “Signals and Systems”, Wiley- India Publications.
2. Michal J. Roberts and Govind Sharma, “Signals and Systems”, Tata Mc-Graw Hill.

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DIGITAL ELECTRONICS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs / Week	**End Semester Examination:** 60 Marks	**Credits :**03
Practical: 02 Hrs. / Week	**Internal Assessment:** 40 Marks	
	TW: 25Marks	**Credit**:01
	ORAL:25 Marks	
	Total:150 Marks	**Total Credits :**04

Course Pre-requisites:

The students should have basic knowledge of

1.	Electronic components and Devices

Course Outcomes: After successfully completing the course, the students will be able to:

1.	Perform number system conversion,study codes& to apply the knowledge of binary arithmetic's.
2.	Apply knowledge of Boolean algebra and other minimization techniques for digital circuit design.
3.	Identify, formulate and solve a problem based on combinational circuits.
4.	To apply the knowledge of flip-flops for designing sequential circuit.
5.	Analyze and design a simple sequential logic circuit using shift registers & Coumters.
6.	To differentiate between the PLDs and logic families TTL, CMOS.

UNIT - I	**Number system, Binary Arithmetic's& Codes**	**06 Hrs.**
	Analog System, digital system, numbering system, binary number system, octal number system, hexadecimal number system, conversion from one number system to another, Signed Magnitude representation, Binary Subtraction using 1's complement and 2's complement method, weighted codes binary coded decimal, non-weighted codes Excess – 3 code, Gray code, Alphanumeric codes – ASCII Code, EBCDIC.	
UNIT - II	**Boolean Algebra and Logic Gates**	**06 Hrs.**
	Introduction, Logic (AND OR NOT), exclusive OR and Exclusive NOR gates, Universal Logic gates, Boolean theorems, Boolean Laws, De Morgan's Theorem, Reduction of Logic expression using Boolean Algebra, Deriving Boolean expression from given circuit. **Minterm, Maxterm and Karnaugh Maps** Introduction, minterms and sum of Minterm form, Maxterm and Product of Maxterm form, Reduction technique using Karnaugh maps upto 4 variable Grouping of variables in K-maps, K-maps for product of sum form, minimize Boolean expression using K-map, Don't care conditions Quine Mc Cluskey Method.	
UNIT -III	**Combinational Logic Circuits**	**06 Hrs.**
	Arithmetic Circuits: Introduction, Adder & Subtractor (Half and Full),	

	Parallel Binary adder, Serial Adder, BCD Adder, Look-Ahead Carry Generator, ALU, Code Converters, parity bit generator & checker, 1bit,2-bit Comparators, Decoder, Encoders, Priority encoders, Multiplexers, De-Multiplexer.	
UNIT - IV	**Sequential Circuits Elements**	**06 Hrs.**
	Flip-flop & Timing Circuits: SR latch, Gated latch, level Triggered &Edge triggered flip-flop: - SR, D, JK, T Flip-flop, flip-flop asynchronous inputs, characteristic table of Flip-flop, excitation table of Flip-flop, master slave JK flip flop, inter conversion of Flip-flop. Introduction to Mealy and Moore machines, definition of State diagram, State table, State reduction, State assignment.	
UNIT - V	**Applications of Sequential circuits**	**06 Hrs.**
	Shift register, buffer register, Bidirectional shift register. Data transmission in shift register SISO, SIPO, PISO, PIPO, universal shift register, Shift Left, shift right register operation. Counter, Modulus of the counter, Classification Ripple or asynchronous counter, synchronous counter, up-down counter, Mod-n counter, Ring counter, Johnson counter, Designing counter with arbitrary sequence.	
UNIT - VI	**Programmable Logic Devices, Memory & Logic Families**	**06 Hrs.**
	Programmable logic devices Study of PROM, PAL, PLA, designing combinational circuits using PLDs. Semiconductor memories: Classification and characteristics of memories, RAM ROM, EPROM, EEPROM, NVRAM, SRAM, and DRAM. **Logic Families** Significance of families, Characteristic parameters, Types of Logic Families TTL, ECL, CMOS Comparison between various logic families Interfacing. between CMOS and TTL logic families	

Term Work:
The term work shall consist of record of minimum eight experiments.
1. Implementation of Boolean functions using logic gates.
2. Study of characteristics of typical 74 TTL / 74 CMOS family like: fan in, fan out standard load , noise margin & interfacing with other families,
3. Half, Full Adder and Subtractor using gates and IC's.
4. Code conversion using digital IC's.
5. To implement 1-bit and 2-bit comparator using gates and IC's.
6. Function implementation using Multiplexer and Demultiplexer.
7. BCD Adder/Subtractor using IC7483.
8. Study of counters:Ripple,Synchronous,Ring,Johnson using IC's.
9. Study of counters: Up-down counter Decade counter and Mod-16 counter.
10. Study of shift registers : Shift left , Shift right , parallel loading
Project Based Learning: Thestudents are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per standard guidelines.
Text Books:
1. R.P. Jain, "Modern digital electronics" , 3rd edition , 12th reprint TMH Publication,2007
2. Anand Kumar 'Fundamentals of Digital Circuits'--. PHI

3. Morris Mano ‘Digital Design’-- (Third Edition),.PHI
Reference Books:
1. J.F.Wakerly “Digital Design: Principles and Practices”, 3rd edition, 4th reprint, Pearson Education, 2004.
2. A.P. Malvino, D.P. Leach ‘Digital Principles & Applications’’ –Vith Edition-Tata McGraw Hill, Publication
3. Thomas L Floyd & R.P Jain, “Digital Fundamentals” (Eight editions), Pearson

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B. Tech. (Electronics & Communication Engineering) Sem-III **ANALOG CIRCUITS AND APPLICATIONS**		
TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs. / Week	End Semester Examination: 60 Marks	Credits: 03
Practical:02 Hrs. / Week	Internal Assessment: 40 Marks	
	TW: 25 Marks	Credit: 01
	Practical: 25 Marks	
	Total: 150 Marks	Total Credits: 04

Course Pre-requisites:	
1	Electronic components and devices.

Course Outcomes: After successfully completing the course, the students will be able to:

1	Demonstrate BJT single stage amplifier, its hybrid equivalent and hybrid models.
2	Analyze multistage amplifiers using BJT.
3	Analyze the importance of negative feedback in amplifiers.
4	Demonstrate and analyze power amplifier circuits in different modes of operation.
5	Design various oscillator circuits using BJT.
6	Design and analyze transistorized series and shunt voltage regulators.

UNIT – I	**Single stage Amplifiers**	**06 Hrs.**
	Classification of Amplifiers – Distortion in Amplifiers, Analysis of CE, CC, and CB Configurations with simplified Hybrid Model, Analysis of CE amplifier with and without Emitter Resistance, Square wave testing	
UNIT – II	**Multi Stage Amplifiers**	**06 Hrs.**
	Need of Multistage amplifiers, methods of coupling-RC coupling Direct coupling and Transformer coupling, Miller's Theorem and its dual, Parameter evaluation such as Ri, Ro, Av, Ai & Bandwidth for general multi stage amplifier, Analysis of CE-CE cascade amplifier, and cascode amplifier, various configurations techniques for improving input impedance for CC stage (Darlington connection, boot	

	strapping), Analysis of Darlington amplifier.	
UNIT - III	**Feedback Amplifiers**	**06 Hrs.**
	Concept of feedback, classification of amplifiers, Negative feedback topologies with their block diagram representation, Effect of negative feedback on Input impedance, Output impedance, Gain and Bandwidth with derivation, method of analysis of feedback amplifier, analysis of all feedback topologies.	
UNIT -IV	**Power Amplifiers**	**06 Hrs.**
	Classification of power amplifiers - Class A, Class B, Class C, and Class AB. Operation of - Class A with resistive load, Transformer coupled class A Amplifier; Class B Push – pull amplifier, Class B Complementary symmetry amplifier. Efficiency analysis for Class A amplifier and Class B amplifier, cross over distortion in power amplifiers, Class AB Complementary symmetry amplifier, harmonic analysis	
UNIT -V	**Oscillators**	**06 Hrs.**
	Positive feedback, Barkhausen criterion, Classification of oscillators, derivation and analysis of RC oscillators, Wien bridge Oscillators, LC Oscillators for frequency of oscillation, Piezo-electric effect in crystals and Crystal Oscillator	
UNIT -VI	**Regulator**	**06 Hrs.**
	Block schematic of linear regulators, Performance parameters –Output resistance, Voltage and temperature stability factor, Ripple rejection, Load and Line regulations. Emitter follower regulator, Transistor series regulator, shunt regulator Study and design of regulators using IC's:78XX,79XX, LM317, LM2596, LM 337 Negative Regulator, Method of boosting output current using external series pass transistor. Protection circuits – Reverse polarity protection, over circuit, fold back current limiting, over voltage protection.	

Project Based Learning: The **s**tudents are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per standard guidelines.

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Analysis of single stage amplifier, verification with theoretical values of A_i, A_v, R_i, R_o and find the bandwidth using square wave testing.
2. Analysis of multistage LF amplifier, verification with theoretical values of A_i, A_v, R_i, R_o and find the bandwidth square wave testing.
3. Input impedance improvement technique for emitter follower.
4. Analysis of LF amplifier with negative feedback in voltage series topology.
5. Analysis of LF amplifier with negative feedback in current series topology.
6. Analysis of LF amplifier with negative feedback in voltage shunt topology.
7. Analysis of LF amplifier with negative feedback in current shunt topology.
8. Measurement of frequency of oscillations of RC Oscillators - phase shift and wien bridge

9. Measurement of frequency of oscillations of LC oscillators – Hartley, Colpitt
10. Biasing analysis of BJT power amplifier in class A, B, C.
11. Regulation characteristic of series and shunt regulators and calculation of S_v and R_o.
Text Books:
1. Electronic devices and circuits by S. Salivahanan, Suresh Kumar Vallavaraj, of Mc Graw Hill Publication
2. Robert Boylestad, Electronic Devices and Circuit Theory, Pearson Publication
Reference Books:
1. Electronic Devices and Circuits by Allen Mottershed- PHI Publication
2. Electronic Devices and Circuits by J.B. Gupta

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DATA STRUCTURES

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits:** 03
	Internal Assessment: 40 Marks	**Total Credits :**03
	Total:100 Marks	

Course Pre-requisites:

The students should have basic knowledge of

1	Computer Programming I

Course Outcomes: After successfully completing the course, the students will be able to:

1	Student will be able to choose appropriate data structure as applied to specified problem Definition.
2	Understand basic data structures such as arrays, strings, and linked lists.
3	Apply the different linear data structures like stack and queue to problem solutions.
4	Interpret concepts of graphs and trees.
5	Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
6	Students will be able to write the programs using data structures in C.

UNIT – I	**Introduction to Data Structures**	**06 Hrs.**
	Introduction and Definition of Data Structure, Classification of Data, Various types of Data Structure, DS Operations, Static and Dynamic Memory Allocation, Function, Recursion.	
UNIT – II	**Arrays and Linked list**	**06Hrs.**
	Arrays: Introduction to Arrays, Definition, One Dimensional Array and Multidimensional Arrays. **Linked Lists** : Introduction, singly linked list implementation, insertion, deletion and searching operations on linear list, circularly linked lists-Operations for Circularly linked lists, doubly linked list implementation, Applications: Polynomial Representation, Implementation of Stack and Queue using linked list.	
UNIT -III	**Stack and Queue**	**04Hrs.**
	Stack: Introduction, Definition, Stack Operations, Applications: Infix to Postfix Conversion, Evaluation of Postfix Expression. **Queues**: Introduction, Operations on queues, Circular queues, Priority queues, Applications of Queue	
UNIT -IV	**Trees**	**08Hrs.**
	Definitions, tree representation, properties of trees, Binary tree, Binary tree representation, binary tree properties, binary tree traversals, binary tree implementation, applications of trees.	
UNIT -V	**Graphs**	**06Hrs.**

	Representation Of Graphs, Elementary Graph operations (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree).	
UNIT -VI	**Searching and Sorting**	**06Hrs.**
	Searching: Introduction, Linear search, Binary search, Fibonacci search. Sorting: Introduction, Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Heap Sort.	

Project Based Learning: The **s**tudents are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per standard guidelines.

Text Books:

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan Anderson Freed, Universities Press.
2. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.
3. G.A.V PAI, Data Structures and Algorithms, Concepts, Techniques and Applications, Volume1, 1stEdition, Tata McGraw-Hill, 2008.
4. Richard F. Gilberg& Behrouz A. Forouzan, Data Structures, Pseudo code Approach with C, 2ndEdition, Cengage Learning India Edition, 2007.
5. Reema Thareja, "Data Structures Using C", Oxford Universities Press 2014, 2nd Edition.

Reference Books:

1. Data structures: A Pseudo code Approach with C, 2nd edition, R.F.Gilberg And B.A.Forouzan, Cengage Learning.
2. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.
3. Data Structures using C, A.M.Tanenbaum,Y. Langsam, M.J.Augenstein, Pearson.
4. Data structures and Program Design in C, 2nd edition, R.Kruse, C.L.Tondo and B.Leung,Pearson

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B. Tech. (Electronics & Communication Engineering) Sem III

ELECTRONICS INSTRUMENT & MEASUREMENT

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Practical: 02 Hrs/week	**TW:** 25 Marks	
	ORAL: 25 Marks	**Credit:** 01
	Total: 50 Marks	**Total Credits:** 01

Course Pre-requisites:

The students should have knowledge of

1	Electronic Component and Devices

Course Outcomes: After learning this course students will be able to

1	Measure of True R.M.S. and LCR values.
2	Use the Digital storage oscilloscope for electronic circuit applications.
3	Intrepret the performance characteristics of transistor using curve tracer.
4	Analyse the signals using spectrum analyser.
5	Analyse the digital signals using logic analyser.

Term Work:

The term work shall consist of record of eight experiments

1. Peak, average and R.M.S. value of signal measurement using True RMS meter.
2. Measurements of passive components on L-C-R Q meter.
3. Measurements on DSO:
   i) Observation & measurement of different signals.
   ii) Storing and retrieving number of different signals.
4. Measurements with Universal counter (Frequency, Period, frequency ratio, Period Averaging and Time interval).
5. Study of characteristics of Diode, Transistors using Curve Tracer.
6. Measurement of total harmonic distortion using Distortion Factor Meter.
7. Measurement and analysis of signals using Logic Analyzer.
8. Measurement using Spectrum Analyser. Observing spectrum of AM and FM waveforms for different modulation indices.

Textbook:

1. Oliver-Cage, “Electronic Measurements and Instrumentation”, TATA McGraw Hill, 1975.
2. Albert D. Helfrick and William D. Cooper, “Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2010.

Reference Books:

1. H. S. Kalsi, “Digital Instrumentation”, Tata McGraw Hill
2. Clyde F. Coombs “Electronic Instrumentation Handbook” McGraw Hill
3. Cooper Helfric, “Electronic Instrumentation & Measurement Techniques”, Prentice Hall Publication.

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B. Tech. (Electronics & Communication Engineering) Sem III

Introduction to Arduino Framework

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 02 Hrs. / Week	**End Semester Examination:** -	**Credits:** 02
	Internal Assessment: 100 Marks	**Total Credits :**02
	Total:100 Marks	

Course Pre-requisites:	
The students should have basic knowledge of	
1	Computer Programming I

Course Outcomes: After successfully completing the course, the students will be able to:	
1	Understand the basic principles of electronics and programming.
2	Explain the role and significance of Arduino in the maker community and IoT (Internet of Things) landscape.
3	Navigate the Arduino IDE (Integrated Development Environment) and utilize its basic features.
4	Write simple Arduino sketches (programs) to control hardware components such as LEDs, motors, sensors, etc.
5	Design and implement basic circuits using Arduino boards.
6	Troubleshoot common issues encountered during Arduino projects.
7	Demonstrate proficiency in creating at least three practical Arduino projects.
8	Exhibit confidence in exploring and experimenting with Arduino for personal or professional projects.

UNIT – I	**Introduction to Arduino Framework**	**5 Hrs**
	-Overview of Arduino: History, features, and applications. - Understanding the Arduino ecosystem: Boards, shields, sensors, actuators, etc - Introduction to the Arduino IDE.	
UNIT – II	**Electronics Fundamentals**	**5 Hrs**
	- Basic concepts of electricity: Voltage, current, resistance. - Understanding Ohm's law. - Introduction to electronic components: Resistors, capacitors, LEDs, etc.	
UNIT -III	**Programming Basics**	**5 Hrs**
	- Introduction to programming concepts: Variables, data types, control structures. - Basics of C/C++ programming language. - Writing your first Arduino sketch.	
UNIT -IV	**Digital and Analog Input/Output**	**5 Hrs**
	- Digital vs. analog signals. - Using digital pins for input and output. - Analog input/output with Arduino.	

UNIT -V	**Sensors and Actuators**	**5 Hrs**
	- Introduction to various sensors: Light, temperature, motion, etc. - Controlling actuators: Servo motors, DC motors, LEDs, etc. - Interfacing sensors and actuators with Arduino.	
UNIT -VI	**Communication Protocols**	**5 Hrs**
	- Introduction to serial communication. - Basics of I2C and SPI protocols. - Interfacing with external devices using communication protocols.	
Assessment: Assessment will be based on: - Participation in theory and practical sessions. - Completion and demonstration of practical projects. - Understanding demonstrated through quizzes or small assignments. - Overall engagement and willingness to learn throughout the course.		
Reference Books:		
1) A Beginner's Guide to Arduino Programming, George Gibson, Rivercat Books LLC, 2023		
2)Essentials of Arduino™ Boards Programming-Step-by-Step Guide to Master Arduino Boards Hardware and Software,Farzin Asadi,Apress Media LLC, 2023		
3)Programming Arduino® Getting Started with Sketches, Simon Monk, McGraw Hill, Third Edition, 2023		
4)A Hands-On Course in Sensors Using the Arduino and Raspberry Pi, Volker Ziemann, CRC Press, 2023		

B. Tech. (Electronics and Communication): Sem-IV (NEP CBCS 2023 COURSE)

Program		B. Tech		Sem-IV			NEP CBCS 2023 Course									
Sr. No	Category	Subject Code	Subject	Teaching Scheme			Examination Scheme (Marks)						Credits			
				L	P	T	ESE	IA	TW	PR	OR	Total	L	P	T	Total
1.	Department Core Course		Electromagnetic Waves & Propagation	3	-	1	60	40	-	-	-	100	3	-	1	4
2.	Department Core Course		Digital Communication	3	2	-	60	40	25	-	25	150	3	1	-	4
3.	Department Core Course		Embedded Systems	3	2	-	60	40	25	-	25	150	3	1	-	4
4.	Department Application Course		Integrated Circuits & Applications	3	2	-	60	40	25	25	-	150	3	1	-	4
5.	Interdisciplinary Course		Database Management System	3	-	-	60	40	-	-	-	100	3	-	-	3
6.	Skill based Course -IV		Java programming	-	2	-	-	-	25	-	25	50	-	1	-	1
				15	08	1	300	200	100	25	75	700	15	4	1	20
	Indian Knowledge System*			2	-	-	-	100	-	-	-	100	-	-	-	2
	Social Activity*			-		-		-	-	-	-	-	-	-	-	2

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B. Tech. Sem-IV Electronics & Communication Engineering

Electromagnetic Waves & Propagation

TEACHING SCHEME:	EXAMINATION SCHEME:	CREDITS ALLOTTED:
Theory: 03 Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits:** 03
Tutorial: 01 Hrs/week	**Internal Assessment:** 40 Marks	**Credit:** 01
	Total:100 Marks	**Total Credits :**04

Course Pre-requisites:	
The students should have basic knowledge of	
1.	Vector calculus and coordinate systems.
2.	Curl, Divergence and Gradient.
3.	Partial differential equations.
Course Objectives:	
	• Provide fundamentals of Static Electromagnetic Fields. • Explain basics of the vector Differential, Integral operators to Electromagnetic theory & Electrostatic & Electromagnetic fields. • Define and derive different laws in Electrostatic & Electromagnetic fields. • Explain Maxwell's equations and concepts of transmission lines. • Analyze techniques for formulating and solving problems in Electrostatic & Electromagnetic fields. • Develop mathematical skills related with differential, integral and vector calculus.
Course Outcomes: After learning this course students will be able to	
1	Apply fundamental concepts of static electric fields, including Coulomb's law, Gauss's law, electric potential, and polarization in dielectrics, to analyze and solve problems involving electric field distributions and boundary conditions.
2	Analyze static magnetic fields using Biot-Savart law, Ampere's Circuital law, magnetic flux density, and magnetic boundary conditions, in order to understand magnetic field distributions and their applications in magnetic materials.
3	Demonstrate comprehension of time-varying fields and Maxwell's equations.
4	Apply wave propagation principles to analyze and solve problems related to uniform plane waves, including wave equations, propagation through different mediums, polarization, reflection, and transmission of plane waves, to understand the behavior of electromagnetic waves in different environments.
5	Analyze parameters of transmission lines, including transmission line equations, reflection coefficient, VSWR, and transient analysis, to understand the characteristics and performance of transmission lines and their applications in communication systems.
6	Apply principles of waveguides and antenna fundamentals, including waveguide analysis, antenna specifications, radiation principles, antenna arrays, and radar equations, to design and analyze basic antenna systems and understand their role in wireless communication

UNIT – I	**Static Electric Fields**	**06 Hrs.**
	Review of Co-ordinate systems, Coulomb's law, line, Surface & Volume Charge distribution. Electric Field Intensity, Electric Field due to infinite line and surface charges, Electric Flux Density, Gauss law (differential and integral form) and its applications, Divergence Theorem, Electric Potential and gradient, Poisson's and Laplace Equations, Work done, Energy Density, Electric Dipole and moment. Polarization in Dielectrics, Boundary conditions for Dielectric and Dielectric, boundary conditions for Conductor and Dielectric, boundary conditions for Conductor and free space.	
UNIT – II	**Static Magnetic Fields**	**06 Hrs.**
	Biot - Savart law, Magnetic Field Intensity due to infinite and finite line. Ampere's Circuital Law in integral and differential form, Applications of Amperes Circuital law, Magnetic flux density, Stokes Theorem, vector magnetic potential, Magnetic force, Magnetic Torque, moment and dipole, nature of magnetic material, magnetization, Magnetic boundary conditions.	
UNIT - III	**Time Varying Fields & Maxwell's Equations**	**04 Hrs.**
	Faradays law of induced emf, displacement current, Maxwell's Equations in point form & Integral form for various fields.	
UNIT -IV	**Wave Propagation and Uniform Plane waves**	**08 Hrs.**
	Wave equations, wave propagation through free space , wave propagation through dielectric, wave propagation through conductors- skin depth, Poynting theorem, wave polarization, Reflection of plane wave from conducting medium, perfect dielectric., reflection of plane waves at normal incidence, reflection of plane waves at oblique incidence angles.	
UNIT -V	**Transmission Lines**	**06 Hrs.**
	Physical Description of Transmission line propagation, Transmission Line equations & their solutions in phasor form, transmission line parameters, reflection coefficient, VSWR, smith chart (Numerical expected) and applications, transient analysis of transmission lines.	
UNIT -VI	**Waveguides & Antenna Fundamentals**	**06 Hrs.**
	Plane wave analysis of parallel-plate waveguide, rectangular waveguides, TE and TM modes, wave impedance, wave velocities, attenuation in waveguide, EMI/EMC concepts, basic radiation principles, antenna specifications, antenna arrays, Effective Area and the Friis Equation, The Radar Equation , Monopole Antenna, Loop Antenna, Slot Antenna, Microstrip Antenna, Horn Antenna, reflector Antenna.	

List of Tutorials:

1. Find the Electric field intensity and electric flux density at a given point due to following charge distributions. (In all coordinate systems)
   - Point charges
   - Line charges (finite and infinite)
   - Surface charges (finite and infinite)
   - Mixed charges (Point charge, Line charge, Surface charge)

2. Application of Gauss's law • Given ρv (volume charge density) in a particular region, find $\bar{D}$ (electric flux density) using Law at the given location. • Given ρS(surface charge density), find $\bar{D}$ (electric flux density) using Gauss's Law at the given location. • Given $\bar{D}$ (electric flux density), find total charge enclosed by the surface (Q), ρv (volume charge density) using Gauss's Law.(In all coordinate systems)
3. Find the electrostatic fields (Tangential and Normal) at the boundary between, • Free space and dielectric medium • Free space and conductor • Dielectric medium and conductor • Two dielectric media.
4. Find $\bar{H}$ (Magnetic field intensity) and $\bar{B}$ (Magnetic flux density) at a given point due to, • Infinitely long current carrying conductor • Finite current carrying conductor • Infinite conducting surface • Finite conducting surface • Different current carrying configurations (i.e. thin conductor, surface all together)
5. For the following current carrying configurations, find the $\bar{H}$ (Magnetic field intensity) in a given region (or point) using Ampere's circuital law. • Infinitely long current carrying conductor • Infinite cylindrical surfaces of different radii all centered at the same axis. • Spherical surfaces of different radii all centered at a given point.
6. Given $\bar{H}$ (or $\bar{E}$) and the region properties (like ε, μ, σ etc.), find $\bar{B}$, $\bar{D}$ and $\bar{E}$ (or $\bar{H}$) using Maxwell's equations. (In all coordinate systems).
7. Find attenuation constant, propagation constant, intrinsic impedance, values of E/H for different mediums like free space, conductors, and dielectrics.
8. Given the primary constants (R, L, G, C) along with the generator specifications and termination, find secondary constants (α, β, γ, Z0) and other parameters like Velocity, wavelength, received voltage, received power, reflection coefficient etc.
9. Problems on Impedance matching and design of stub matching using Smith Chart.
10. Find cut-off frequency or waveguide dimensions or phase velocity for rectangular waveguides.
11. Perform antenna measurements on Antenna Test bench or design and simulate antenna in any simulation platform.
Text Books:
1. A. Murthi, "Electromagnetic fields", S. Chand.
2. Edminister J.A, "Electromagnetics", Tata McGraw-Hill.
Reference Books:
1. Hayt & Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill
2. Matthew N.O. Sadiku, "Principles of Electromagnetics", 6th edition, Oxford
3. Kraus, Fleisch, "Electromagnetics with applications", 5th Edition, McGraw Hill.
4. Jordan & Balmain, "Electromagnetic waves & radiating systems", 2nd edition, PHI.

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B. Tech. Electronics & Communication Engineering Sem-IV

DIGITAL COMMUNICATION

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits:** 03
PR : 2 Hrs./Week	**Internal Assessment:** 40 Marks	
	TW: 25 Marks	**Credit :** 01
	OR: 25 Marks	
	Total:150 Marks	**Total Credits :**04

Course Pre-requisites:

The students should have basic knowledge of

1.	Signals & Systems
2.	Introduction to Electronics Communication

Course Outcomes: After successfully completing the course, the students will be able to:

1.	Apply sampling theorem to convert an analog signal into a discrete sequence.
2.	Describe Continuous wave modulation methods.
3.	Compare the approaches used to generate and detect bandpass modulation techniques.
4.	Comprehend the necessity of multiplexing and synchronization for effective digital communication.
5.	Compare the error probability for digital modulation schemes such as BPSK, BFSK, QPSK.
6.	Explain the principle of spread spectrum communication, FHSS, and DSSS Techniques.

UNIT - I	**Basics of Digital Communication**	**06 Hrs.**
	Fundamentals of Digital communication system, analog vs. digital communication, Pulse Modulation, Sampling Theorem (time domain analysis) ideal sampling, Natural sampling, Flat top sampling, aliasing effect and aperture effect. Nyquist criteria, Pulse Amplitude Modulation (PAM), Pulse Width Modulation, Pulse Position Modulation, generation and demodulation.	
UNIT - II	**Digital transmission of analog signals**	**06 Hrs.**
	Quantization–Uniform, Non-Uniform, Companding, A-Law, μ Law, Pulse code modulation Delta Modulation, Adaptive Delta Modulation, Differential Pulse Code Modulation.	
UNIT -III	**Band pass Modulation Techniques**	**06 Hrs.**
	ASK, PSK, FSK, Binary Phase shift keying, Differential Phase shift keying, Differential encoded PSK, Quadrature PSK, M-ary PSK, Quadrature	

	Amplitude shift keying (QASK), Binary frequency shift keying, Minimum shift keying (MSK), G-MSK, signal space representation and constellation diagram.	
UNIT - IV	**Digital Transmission**	**06 Hrs.**
	Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization Inter-symbol, Interference, Equalization.	
UNIT - V	**Baseband Receivers**	**06 Hrs.**
	Base band signal receiver, Probability of error, Optimum filter, White noise-Matched filter, probability of error of matched filter, correlation, FSK, PSK, non-coherent detection of FSK, DPSK, QPSK, Calculation of error probability for BPSK &BFSK, Signal space to calculate Pe.	
UNIT - VI	**Spread Spectrum Techniques**	**06 Hrs.**
	Introduction, Generation of PN Sequences and its properties, Direct Sequence Spread Spectrum Signals, Frequency Hopped Spread Spectrum Signals, Introduction to Multiple Access Techniques: CDMA, TDMA, FDMA. An overview of Mobile Communication, Introduction to 4G and 5G networks.	

Term Work:

The term work shall consist of minimum eight experiments.

1. Generate the Sampled signal and observe the effect of variations in sampling frequency.
2. Convert of analog signal into PCM format and its study (PCM) System.
3. Implement Delta modulation system and interpret the modulated and demodulated waveforms.
4. Implement Adaptive Delta modulation system and compare the modulated and demodulated waveforms.
5. Study of Amplitude Shift Keying (ASK) System and observe the waveforms.
6. Study of carrier Modulation techniques by phase shift keying method.
7. Generate FSK Modulation (Frequency Shift Keying) & Demodulate the FSK signals.
8. Study of Quadrature Phase Shift Keying (QPSK) with waveforms.
9. Simulate any digital modulation scheme using MATLAB.
10. Generate Unipolar NRZ, Polar NRZ, Unipolar RZ and Polar RZ, Manchester and AMI line codes.
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Project Based Learning: Students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per the standard guidelines.

Text books:

1. B. Sklar, “Digital Communications: Fundamentals and Applications”, Prentice Hall.
2. B.P. Lathi and Z. Ding, “Modern Digital and Analog Communication Systems”, Oxford University Press.

Reference Books:

1. John G. Proakis, “Digital Communication”, Pearson Education.
2. Leon W. Couch, “Digital and Analog Communication Systems”, Pearson Education.
3. Haykin Simon, “Digital Communication Systems”, John Wiley and Sons.

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B. Tech. (Electronics & Communication Engineering) Sem IV

EMBEDDED SYSTEMS

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits :**03
Practical: 02 Hrs. / Week	**Internal Assessment:** 40 Marks	
	TW: 25Marks	**Credit**:01
	ORAL:25 Marks	
	Total:150 Marks	**Total Credits :**04

Course Pre-requisites:

The students should have basic knowledge of

- Digital Electronics.

Course Outcomes: After successfully completing the course, the students will be able to:

1.	Classify the memory devices, microcontrollers and their architecture.
2.	Comprehend the architecture and basic concepts of 8051 microcontroller.
3.	Write the programs for 8051 microcontroller using arithmetic, logical, branching instructions.
4.	Interface peripheral devices with 8051 microcontroller for different applications.
5.	Distinguish different types of serial & parallel communication protocols.
6.	Write the programs for interfacing of Arduino&Raspberry Pi with peripheral devices for various applications.

UNIT - I	**Review of Processor and Memory**	**06 Hrs**
	Comparison of Microprocessor & Micro controller. Difference between RISC & CISC microcontrollers, Harvard & Von Neumann Architectures, 8/16-bit microcontrollers, General-purpose processors, single-purpose processors, application specific processors. Memory and I/O devices, processor and memory selection for an embedded system, interfacing processor, I/O mapped I/O,Memory mapped I/O.	
UNIT - II	**Architecture of 8051 Microcontroller**	**06 Hrs**
	Selection criteria for microcontrollers, variants of MCS-51 family and their features. Applications of microcontrollers. Architecture of 8051 and its pin details. PC, DPTR, A & B registers, PSW register-flag bits, Memory organization, register banks, 8051 timers, counter and related SFR's	
UNIT -III	**8051 Instructions and Serial Communication**	**06Hrs**
	Addressing Modes: Immediate, Register, Direct, Indirect, Indexed, Relative and bit addressing, Instruction set: Data Transfer, Arithmetic, Logical, Branching, and Machine Control, Looping Serial Communication of 8051, Basics, SBUF register, SCON and PCON registers, Modes of operation	

UNIT - IV	**8051 I/O ports & Interfacing to 8051**	**06 Hrs**
	Features of I/O ports. I/O, bit addressability and configuring I/O ports, interface I/O devices such as buzzer, relay, example programs with assembly & C. Different types of interrupts, IE and IP registers. Interfacing of 8051 with devices: LED, LCD, keyboard, LM35 temperature sensor & A/D converter	
UNIT - V	**Communication Protocols**	**06 Hrs**
	Use of communication protocols, need of communication Serial communication protocols: I2C, CAN, USB, UART, Serial peripheral interface (SPI), synchronous serial protocol (SSP). Parallel communication protocol: PCI, PCI-X RS232C, RS485/422.	
UNIT - VI	**Interfacing to the real world**	**06 Hrs**
	Arduino: Introduction to Arduino UNO, Pin configuration and architecture, Concept of digital and analog ports, Introduction to Embedded C and Arduino platform Raspberry Pi – Introduction-Basics, Specifications, Basic Architecture, Raspberry Pi GPIO, Raspberry Pi pin configuration, Interfacing to LED, buzzer, and potentiometer & temperature sensor, Applications.	

Term Work:

The term work shall consist of record of minimum eight experiments.

1.Addition / subtraction / multiplication / division of 8/16 bit data using 8051

2.Largest/smallest from a series using 8051.

3.Generate different waveforms: Sine, Square, Triangular, Ramp using DAC interface.

4. To write an ALP for arranging numbers in ascending/descending order stored in external memory location.

5. To write a C program to demonstrate LED using 8051 Micro-controller development kit.

6.To write a C program to demonstrate Seven Segment using 8051 Micro-controller development kit

7.To write a program to demonstrate LCD using 8051 Micro-controller development kit.

8.Interfacing of LED to Arduino/ Rasberry pi.

9..Interfacing of Buzzer to Arduino/ Rasberry pi.

10.Interfacing of Potentiometer to Arduino/ Rasberry pi.

11. Interfacing of Temperature sensor to Arduino/ Rasberry pi.

12. To transmit and receive the data using any protocol.

Project based learning: The students are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per standard guidelines.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillespie Mazidi, “The 8051 Microcontroller and Embedded System” Pearson Education.

2. Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”, McGraw Hill Education

Reference Books:

1. Kenneth J. Ayala, “The 8051 Micro-controller – Architecture, Programming & Applications”, Second Edition Penram International & Thomson Asia

2. Rajkamal, “Embedded System-Architecture, Programming and Design”, TMH Publications, Edition 2003

3. Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, “ The AVR Microcontroller and Embedded Systems Using Assembly and C”, Pearson Education

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B. Tech. Sem-IV Electronics & Communication Engineering

DATABASE MANAGEMENT SYSTEM

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory: 03 Hrs. / Week	**End Semester Examination:** 60 Marks	**Credits:** 03
	Internal Assessment: 40 Marks	**Total Credits :**03
	Total:100 Marks	

Course Pre-requisites:

The student should have basic knowledge of
1. Data structures and
2. Computer programming I.

Course Outcomes: After learning this course students will be able to

1	Identify the characteristics of database and describe the architecture and languages of Database system.
2	Identify the elements used in Entity Relationship diagram and sketch a simple diagram.
3	Summarize relational model concept and illustrate the relational constraints.
4	Describe Structured Query Language (SQL)and apply to query a database.
5	Write SQL code using operators and Inbuilt functions for given database.
6	Apply Joins to database and also create procedures and views according to conditions.

UNIT – I	**Introduction to Database Management System**	**06 Hrs.**
	Concept of Data, Database, DBMS, Advantages of DBMS over file processing, DBMS Architecture, Classification of DBMS, Data abstraction, Data independence, Database users, Over all structure of DBMS.	
UNIT – II	**Data Modelling**	**06Hrs.**
	The importance of data models, Record based logical model- Relational , Network, Hierarchical Data modelling using the E-R model: Entity types, entity set, keys, Entity relationship model, Strong entity set, Weak entity set, Types of attributes and E-R diagram.	
UNIT -III	**Relational Data Model**	**06Hrs.**
	Fundamentals of RDBMS- Records, Fields, data types, tables and database Concept of RDBMS, E.F. Codd's Rule for RDBMS, Key Concept- Candidate Key, Primary Key, Foreign Key Normalization- Concept, Need of Normalization, Types: 1NF, 2NF, 3NF.	
UNIT -IV	**Structured Query Language**	**06Hrs.**
	Introduction to SQL, Data types in SQL, Components of SQL, Data integrity constraints, SQL Commands :DDL(Create, Drop, Alter, Truncate, Rename), DML(Insert, Update, Delete), DCL(commit, Savepoint ,Rollback ,Grant ,Revoke), DQL(Select).	
UNIT -V	**Interactive and Advance SQL I**	**06Hrs.**

	SQL Operators: Arithmetic, Comparison, Logical, Set and Range searching operators Inbuilt Functions: String and Arithmetic, Date and time , Aggregate functions: min, max, count, average, sum, nested sub-queries, group by, having, order by.	
UNIT -VI	**Interactive and Advance SQL II**	**06Hrs.**
	Join operations - inner, left join, right join, natural join and Cartesian product. Views: Concept of view, Create view, Updating views, Dropping views Sequences: Creating sequences, Altering sequences, Dropping sequences Indexes: Index types, Creating indexes, Dropping indexes.	

Project Based Learning:

The **s**tudents are expected to perform a project (in a group) based on the course and prepare a report for the same. The report should be as per standard guidelines.

Text/Reference books

1. Elmsasri, R., & Navathe, S. Fundamentals of Database Systems. 7th edition. Pearson Education.
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81
3. Bayross, I. SQL, Pl/SQL the Programming Language of Oracle. 4th edition. BPB Publications.
4. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN
5. Silberschatz, A., Korth, H. F., & Sudarshan, S. (2011), Database System Concepts. 6th edition. Tata McGraw-Hill Education.

Suggested software/ Learning Websites

1. www.tutorialpoint.com
2. wielyindia.com or dreamtechpress.com

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B. Tech. Sem-IV Electronics & Communication Engineering

JAVA PROGRAMMING

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Practical : 02 Hrs. / Week	**End Semester Examination:** --	
	Internal Assessment: --	
	TW: 25 Marks	**Credit**:01
	PRACTICAL: 25 Marks	
	Total: 50 Marks	**Total Credits :**01

Course Pre-requisites:

The students should have basic knowledge of

1.	Computer Programming-I
2.	Computer Programming-II

Course Outcomes: After learning this course students will be able to

1.	Apply basic knowledge of object oriented programming concepts to solve given problem.
2.	Implement concept of arrays, static variables and static methods in Java programs.
3.	Develop Java programs using abstract classes and understand use of String and String Buffer classes.
4.	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
5.	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.

Term Work:

The term work shall consist of record of minimum eight experiments.

1. Write a Java Program to demonstrate the use of OOP features.
2. Write a Java Program to display pattern (Triangle, Pyramid) using different loops.
3. Write a Java Program using Array.
4. Java program to demonstrate example of static variable, static method and static block.
5. Implementation of different String functions by using switch case.
6. Write a Java program to understand the use of String buffer class.
7. Write a Java program to differentiate between method overloading and method overriding.
8. Write a Java Program to implement concept of abstract class.
9. Write a Java Program to implement multiple inheritances by using Interface.
10. Write a Java program to implement the concept of Package.
11. Write a Java program to implement concept of Exception Handling.
12. Write a program to implement multithreading.

Text Books:

1. “Programming with Java: A Primer”, E Balagurusamy, Tata McGraw Hill Publishing Company.
2. “Java: The Complete Reference”, Herbert Schildt, McGraw Hill Publishing Company
Reference Books:
1. “Understanding OOP with Java”, T. Budd, Pearson Education
2. “Java: How to Program” by Deitel and Deitel
3. “Core Java Volume 1”, Cay Horstmann, Kindle

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B. Tech. Sem. IV: Electronics & Telecommunication Engineering

SUBJECT: - Indian Knowledge System

TEACHING SCHEME:	**EXAMINATION SCHEME:**	**CREDITS ALLOTTED:**
Theory:02 Hrs/week	**End Semester Examination: --**	
Practical: 00	**Internal Assessment:**100 Marks	**Credits:** 02
Tutorial: 00		
	Total: 100 Marks	**Total Credits**: 02

Course Objectives:

1.	To sensitize the students about Indian culture and civilization including its Knowledge System and Tradition.
2.	To help student to understand the knowledge, art and creative practices, skills, and values in ancient Indian system
3.	To help to study the enriched scientific Indian heritage.
4.	To introduce the contribution from Ancient Indian system & tradition to modern science & Technology

Course Outcomes: After learning this course students will be able to understand

1	Concepts of Indian Knowledge System
2	India's contribution in Philosophy and Literature
3	India's involvement in Mathematics and Astronomy
4	India's role in Medicine and Yoga
5	India's influence in Sahitya
6	Concepts of Indian Shastra

UNIT – I	**Introduction to Indian Knowledge System**	**04 Hours**
	Definition, Concept and Scope of IKS, IKS based approaches on Knowledge Paradigm, IKS in ancient India and in modern India	
UNIT – II	**Philosophy and Literature**	**04 Hours**
	Contributions by Maharishi Vyas, Manu, Kanad, Pingala, Parasar, Banabhatta, Nagarjuna and Panini in Philosophy and Literature	
UNIT - III	**Mathematics and Astronomy**	**04 Hours**
	Contribution of Aryabhatta, Mahaviracharya, Bodhayan, Bhashkaracharya, Varahamihira and Brahmgupta in Mathematics and Astrononmy	
UNIT -IV	**Medicine and Yoga**	**04 Hours**
	Major contributions of Charak, Susruta, Maharishi Patanjali and Dhanwantri in Medicine and Yoga	

UNIT -V	**Sahitya**	**04 Hours**
	Introduction to Vedas, Upvedas, Upavedas (Ayurveda, Dhanurveda, Gandharvaveda) Puran and Upnishad) and shad darshan (Vedanta, Nyaya.Vaisheshik, Sankhya, Mimamsa, Yoga, Adhyatma and Meditation)	
UNIT -VI	**Shastra**	**04 Hours**
	Introduction to Nyaya, vyakarana, Krishi, Shilp, Vastu, Natya and Sangeet	

Reference Books

1.Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru

2. Kapur K and Singh A.K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.

3. The Cultural Heritage of India. Vol.I. Kolkata:Ramakrishna Mission Publication, 1972.

4. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.

5. Dr. R. C. Majumdar, H. C. Raychaudhuri and Kalikinkar Datta: An Advanced History of India (Second Edition) published by Macmillan & Co., Limited, London, 1953.

6. Rao, N. 1970. The Four Values in Indian Philosophy and Culture. Mysore: University of Mysore.

7. Avari, B. 2016. India: The Ancient Past: A History of the Indian Subcontinent from c. *7000* BCE to CE 1200. London: Routledge.

8. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan,

9. Histrory of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

10. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).

12. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).

13. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

14.Kapoor, Kapil, Avadesh Kr. Singh (eds.) *Indian Knowledge Systems* (Two Vols), IIAS, Shimla, 2005