REVA UNIVERSITY
Bengaluru, India

SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

Approved scheme and syllabus

B. Tech. in Electronics and Computer Engineering (ECM)

2020-24
(III Year)

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-66226622, Fax: 080-28478539

Rukmini Educational
Charitable Trust

www.reva.edu.in

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V semester

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0501	Embedded Systems	HC	3	0	0	3	3
2	B20EP0502	Machine Learning	HC	3	0	0	3	3
3	B20EP0503	Unix Shell Programing	HC	1	1	1	3	5
4	B20EP0504	Java Programming	HC	1	1	0	2	3
5	B20EPS5XX	Professional Elective-1	SC	3	0	0	3	3
6	B20EPS5XX	Professional Elective-2	SC	3	0	0	3	3
7	B20XXO5XX	Open Elective-1	OE	3	0	0	3	3
TOTAL				**17**	**2**	**1**	**20**	**23**
Practical /Term Work / Sessional								
8	B20EP0505	Embedded Systems Lab	HC	0	0	1	1	2
9	B20EP0506	Machine Learning Lab	HC	0	0	1	1	2
10	B20EP0507	Java Programming Lab	HC	0	0	1	1	2
11	B20EP0508	Technical Documentation	FC	1	0	0	1	1
12	B20EP0509	Research based project	HC	0	0	2	2	4
TOTAL				**1**	**0**	**5**	**6**	**11**
TOTAL SEMESTER CREDITS				**26**				
TOTAL CUMULATIVE CREDITS				**111**				
TOTAL CONTACT HOURS				**34**				

Course Title	Embedded Systems				Course Type		HC	
Course Code	B20EP0501	Credits	3		Class		V Semester	
Embedded Systems	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practical	0	0	0				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Embedded systems have become the next inevitable wave of technology, finding application in diverse fields of engineering. Microprocessors, together with sensors and actuators, have become embeddable in almost everything. The purpose of the course is to provide the students with the detailed information about embedded systems which can be defined as a control system or computer system designed to perform a specific task. The course prerequisites are Microprocessor/Microcontrollers, C Programming language, Digital Electronics.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.
2. Describe the hardware software co-design and firmware design approaches
3. Learn the internals of RTOS and the fundamentals of RTOS based ES design.
4. Illustrate the different scheduling algorithms and synchronization techniques.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze the basic building blocks of Embedded System hardware.	1,2,3,4	1,2,3
CO2	List the embedded system paradigms, characteristics, and attributes.	1,2,3,4	1,2,3
CO3	Ascertain the type of the Hardware/ Software Co-Design techniques for ES design.	1,2,3,4	1,2,3
CO4	Articulate the RTOS based ES concepts and the goal of ES in real time applications.	1,2,3,4	1,2,3
CO5	Apply the theoretical knowledge of design in building fully functional embedded system.	1,2,3,4	1,2,3

CO6	Interpret the different scheduling algorithms and synchronization techniques.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3		✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓	✓		✓
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2									2	2	
CO2	3	3	3	2									2	2	1
CO3	3	3	3	2									2	2	1
CO4	3	3	3	2									2	2	1
CO5	3	3	3	2									2	2	1
CO6	3	3	3	2									2	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Introduction To Embedded Systems:
What is an Embedded System? Embedded vs General computing system, classification, application, and purpose of ES. Typical Embedded Systems: Core of an Embedded System, Memory, Sensors, Actuators,

LED, Opto-Coupler, Communication Interface, Reset circuits, RTC, WDT, Application and Domain Specific ES examples.

UNIT – 2

Characteristics, Attributes, Hardware Software Co-Design and Program Modelling:

Characteristics and Quality Attributes of Embedded Systems. Hardware Software Co-Design Introduction, Fundamental Issues in Hardware Software Co-Design, Computational Models in Embedded Design, Introduction to UML, Hardware Software Tradeoffs.

UNIT – 3

Real Time Basics and Real Time Operating System:

Real time systems definition and Types of the Real Time Systems, Operating Systems Basics: The Kernel, Monolithic Kernel and Microkernel, Types of Operating Systems, General Purpose OS, Real-Time OS: The Real-Time Kernel, Hard Real-Time, Soft Real-Time.

Tasks, Process and Threads: Process, Structure of Process, Process State and State Transitions, Process Management,

Threads: Concept, Concept of Multithreading, Thread Standards: POSIX threads, Win32 Threads, Java Threads, Thread Pre-Emption, Types of Threads, Thread Binding, Thread vs Process.

UNIT - 4

Real Time Operating System Concepts:

Multiprocessing and Multitasking: Types of Multitasking.

Task Scheduling: Concepts, Non-Preemptive Scheduling: FCFS/FIFO Scheduling, LCFS/LIFO Scheduling, Shortest Job First Scheduling, Priority Based Scheduling.

Preemptive Scheduling: Shortest Remaining Time Scheduling, Round Robin Scheduling, Priority based Preemptive scheduling.

Putting them altogether, Task Communication, Task Synchronization, Device Drivers, How to Choose an RTOS(Self Study/Case Study).

TEXTBOOKS:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

REFERENCE BOOKS

1. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002.
2. Jonathan W. Valvano, Embedded Microcomputer Systems, 3rd. edition, Cengage Learning, 2011.
3. David E. Simon, An Embedded Software Primer, Pearson Ed., 2005.
4. Raj Kamal, Introduction to Embedded Systems, TMH, 2002.
5. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press, 2005.
6. Peter M, Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and Internet of Things, Springer, 3rd Edition, 2018
7. James K Peckol, "**Embedded Systems**", A contemporary Design Tool - John Weily, 2008

Course Title	Machine Learning				Course Type		HC	
Course Code	B20EP0502	Credits	3		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	0	0	0				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50 %**

COURSE OVERVIEW:

The course provides students with some knowledge on the basic principles of machine learning which is the study of computer algorithms that can improve automatically through experience and using data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

COURSE OBJECTIVES:

The objectives of this course are:

1. Discuss the basic theory underlying machine learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with Dimensionality reduction Techniques
4. Discuss the implementation of Machine learning algorithms and modules.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Comprehend statistical methods as basis of machine learning domain	1,2,3,4	1,2,3
CO2	Apply variety of learning algorithms for appropriate applications	1,2,3,4	1,2,3
CO3	Implement machine learning techniques to solve problems in applicable domains	1,2,3,4	1,2,3
CO4	Evaluate and compare algorithms based on different metrics and parameters.	1,2,3,4	1,2,3
CO5	Design application using machine learning techniques	1,2,3,4	1,2,3
CO6	Apply Dimensionality reduction techniques.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2									3	2	1
CO2	3	3	2	2									3	2	1
CO3	3	3	2	2									3	2	
CO4	3	3	2	2									2	2	1
CO5	3	3	2	2									3	2	1
CO6	3	3	2	2									3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Introduction to Machine Learning Machine Learning**, Types of Machine Learning, Issues in Machine Learning, Application of Machine Learning, Steps in developing a Machine Learning Application. Importance of Data Visualization, Basics of Supervised and Unsupervised Learning

UNIT – 2

Regression Techniques: Linear Regression, Logistic Regression. Learning with Trees: Decision Trees, Constructing Decision Trees using Gini Index, Classification and Regression Trees (CART). Hyperparameters tuning, Loss Functions, Evaluation Measures for Regression Technique.

UNIT – 3

Classification: Rule based classification, classification by Bayesian Belief networks, Hidden Markov Models. Support Vector Machine: Maximum Margin Linear Separators, Quadratic Programming solution to finding maximum margin separators, Kernels for learning non-linear functions.

Clustering: K-means Algorithms, Supervised learning after clustering, Radial Basis functions. Dimensionality Reduction Techniques, Principal Component Analysis.

UNIT – 4

Artificial Neural Networks: Biological Neurons and Biological Neural Networks, Perceptron Learning, Activation Functions, Multilayer Perceptrons, Back-propagation Neural Networks, Competitive Neural Networks

Textbooks:

1. Tom Mitchell: In Tom Mitchell, Machine Learning, TMH
2. C. Bishop, Pattern Recognition and Machine Learning, Springer
3. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification and Scene Analysis, Wiley
4. Kishan Mehrotra, Chilukuri Mohan and Sanjay Ranka, Elements of Artificial NeuralNetworks, Penram International
5. Rajjan Shinghal, Pattern Recognition, Techniques and Applications, OXFORD
6. Ethem alpaydin, Introduction to Machine Learning, PHI

Reference Books:

1. EthemAlpaydin: Introduction to Machine Learning, Second edition MIT press, 20l0. Chapters l, 2, 6, 7, l9.
2. Yoshua Bengio and Aaron Courville, Deep Learning -Ian Good fellow, MIT Press book,20l6
3. Richard O. Duda, Peter E. Hart and David G. Stork, pattern classification, John Wiley & Sons Inc., 200l
4. Chris Bishop, Neural Networks for Pattern Recognition, Oxford University Press, l995

Course Title	UNIX Shell Programming				Course Type		HC	
Course Code	B20EP0503	Credits	3		Class		V Semester	
UNIX Shell Programming	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	1	1	1				
	Tutorial	1	2	2	Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	**3**	**5**	**5**	**14+28**	**28**	**50%**	**50%**

COURSE OVERVIEW:

The course is aims to present the UNIX environment and to provide the most basic commands to students with UNIX knowledge. The course covers UNIX system and use different commands, UNIX directories and files, File attributes and permissions, changing file permissions. Course also provides basic knowledge about Vi Editor-Input mode commands. Command mode commands, the ex-mode commands, use of editors and regular expressions, Filters, File links – hard and soft links, the shells interpretive cycle, illustrating the mechanism of process creation and writing simple shell scripts.

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate the UNIX system architecture and use of basic Commands.
2. Categorize and compare different UNIX files.
3. Demonstrate the use of UNIX Directories.
4. Use of editors and different commands in Vi editor.
5. Demonstrate the writing of shell scripts.
6. Categorize, compare and make use of UNIX system calls.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe UNIX system and use of different commands.	1,2,3	1,2,3
CO2	Apprehend the organization of UNIX file system.	1,2,3	1,2,3
CO3	Explore the use of different files and directories.	1,2,3	1,2,3
CO4	Apply the usage of different commands in Vi editor.	1,2,3	1,2,3
CO5	Explore the File inodes, File links and pattern matching.	1,2,3	1,2,3

CO6	Design the shell scripts for various functions.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓	✓				
CO3			✓			
CO4			✓			
CO5		✓	✓			
CO6		✓	✓			

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2										2	1	1
CO2	3	2	2										2	1	1
CO3	3	2	2										2	1	1
CO4	3	2	2										2	1	1
CO5	3	2	2										2	1	1
CO6	3	2	2										2	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 **Introduction, UNIX Architecture:** Introduction, Brief history. UNIX Components/Architecture. Features of UNIX. Posix and Single Unix specification. Opensource licensing - History of Linux - Unix Vs Linux - Flavors of Linux - Benefits and characteristics of Linux, The login prompt. General features of Linux commands/ command structure. Command arguments and options. Understanding of some basic commands such as echo, printf, ls, who, date, passwd, cal, combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. Man command.
UNIT – 2 **UNIX Files and Directories:** Files, Naming files, Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands, pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc commands. File attributes and permissions and knowing them. The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.
UNIT - 3 **The Vi Editor:** The vi editor, Basics, Different modes of vi. Input mode commands. Command mode commands. The ex-mode commands. Illustrative examples Navigation commands. Repeat command. Pattern searching. The search and replace command. Simple examples using these commands. The shells interpretive cycle. Wild cards and file name generation. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Splitting the output: tee. Command substitution.
UNIT - 4 **Shell Programming:** Shell programming. Ordinary and environment variables. The .profile. Read and read only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options.

PRACTICE SESSION:

Sl. No.	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill/Ability**
1	Getting Familiar with UNIX	UNIX OS/ Any Flavor of Linux	C Programming
2	Practice session on basic Unix Utilities, Practice Session on File related Utilities	UNIX OS/ Any Flavor of Linux	C Programming
3	Execution of various file/directory handling commands.	UNIX OS/ Any Flavor of Linux	C Programming
4	Execution of various Vi Mode editor input, command, and ex mode commands.	UNIX OS/ Any Flavor of Linux	C Programming
5	Demonstration of process, shell, kill commands.	UNIX OS/Any Flavor of Linux	C Programming
6	Demonstrating the regular expressions and filters.	UNIX OS/ Any Flavor of Linux	C Programming
7	Simple shell script for basic arithmetic and logical calculations.	UNIX OS/ Any Flavor of Linux	C Programming
8	Shell script to find factorial of a given integer.	UNIX OS/ Any Flavor of Linux	C Programming
9	C program to emulate the Unix ls -l command and program to list for every file in a directory, its inode number and file name.	UNIX OS/ Any Flavor of Linux	C Programming
10	C program to count the number of words, lines and characters of a given text file.	UNIX OS/ Any Flavor of Linux	C Programming

Textbooks and References:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill
2. Behrouz A. Forouzan, Richard F. Gilberg: UNIX and Shell Programming- Cengage Learning – India Edition. 2009
3. M.G. Venkatesh Murthy: UNIX & Shell Programming, Pearson Education.
4. Richard Blum, Christine Bresnahan: Linux Command Line and Shell Scripting Bible, 2nd Edition, Wiley,2014

Course Title	Java Programming				Course Type		HC	
Course Code	B20EP0504	Credits	2		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	CIE	SEE
	Practical	0	0	0				
	Total	**2**	**3**	**3**	**14+28**	**0**	**50%**	**50 %**

COURSE OVERVIEW:

Java is an object-oriented language that enables learners to create real-world applications. Java technology-based software works just about everywhere from the smallest devices to super computers! Java technology components are not impacted by the kind of computer, phone, smart device, or operating systems they are running on. The architecture-neutral nature of Java technology is important in a networked world where one cannot predict the kind of devices that partners, suppliers and employees use to connect to their organizations. The Java Programming in course is the first step for developing such applications. This course introduces object-oriented concepts and its implementation in Java technology programs. In addition, it covers syntax and semantics of the Java programming language.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Illustrate the creation of classes and objects in Java
2. Demonstrate concept reusing of code using inheritance and interfaces
3. Use proper program handling mechanism to write robust programs
4. Familiarize advance java concepts like threads, JDBC, Servlets, JSP

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Develop simple programs using Java language concepts such as variables, conditional, methods and constructure	1,3,5	1,2
CO2	Apply program structure like inheritance, interface to develop programs.	1,2,3,5	1,2
CO3	Build application using the concept of packages	1,2,3,4,5	2,3
CO4	Demonstrate the programs using concepts of exception handling and file handling	1,2,3,5	1,2
CO5	Create programs using thread concepts	1,2,3,5	1,2
CO6	Discuss the concepts like JDBC, Servlets, JSP	1,2,10,11,5	2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓	✓		
CO2			✓	✓		
CO3			✓			
CO4			✓			
CO5			✓			
CO6		✓				

COURSE ARTICULATION MATRIX:

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		1		2								1	2	
CO2	2	3	2		2								3	2	
CO3	2	2	3	1	2									2	1
CO4	2	3	2		2								3	2	
CO5	2	3	2		2								3	2	
CO6	2	2	3	1	2									2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT - 1
Java Revolution: Revolutionary programming language; **Object -Oriented Fundamentals:** Object oriented programming, how java is better than C++; **Java Language Introduction:** Hello World, Step by step, Variables; Types; Operators; Flow Control, Java User input, Input types. **Class:** Object references, Instance variables, the new operator, The Dot operator, Method declaration, Method calling, this, Constructors
UNIT - 2
Inheritance: Super, Method overloading, Method Overriding, Dynamic method dispatch; final, finalize, static, Abstract class and method.

Interfaces: The interface statement, The implement statement, Variables in interfaces.

String Handling: String constructors, Special string syntax, Character extraction, Comparison, String copy modification.

UNIT - 3

Package: The package statement, Compiling classes in packages, the import statement, Access protection.

Exception Handling: Fundamentals, Exception types, try and catch, Multiple catch clauses, Nested try statements.

Input/output: Files, Input Stream, Output Stream, File streams. IO streams

UNIT – 4

Threads: Single threaded event loop, The java thread model, Thread, Runnable, Thread priorities, Thread Synchronization.

Introduction to Advance Java: JDBC – Introduction, Architecture, Steps to create JDBC application, Java Servlets – Introduction, life cycle, Steps to create servlet, JSP – Introduction, Life cycle.

TEXTBOOKS:

1. Patrick Naughton, "The Java Handbook", Tata McGraw-Hill, 2006
2. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018.

REFERENCE BOOKS

1. Bruce Eckel, "Thinking in Java", III Edition, Pearson 2004.
2. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015
3. Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

Course Title	Embedded Systems Lab				Course Type		HC	
Course Code	B20EP0505	Credits	1		Class		V Semester	
Embedded Systems	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Practice	1	2	2	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**	**0**	**28**	**50%**	**50%**

COURSE OVERVIEW:

Embedded systems have become the next inevitable wave of technology, finding application in diverse fields of engineering. Microprocessors, together with sensors and actuators, have become embeddable in almost everything. The purpose of the course is to provide the students hands-on on Real Time operating Systems (RTOS) widely applied in Embedded Systems.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide insights into the basics of unix OS based GCC compiler
2. To teach hardware software co-design and firmware design approaches
3. To introduce the concepts POSIX thread libraries
4. Illustrate the different scheduling algorithms and synchronization techniques.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Implement required thread creations using Unix OS based GCC Compiler	1,2,3,5,9, 10	1,2,3
CO2	Acquire knowledge and understand fundamental embedded system paradigms, characteristics, and attributes.	1,2,3,5,9, 10	1,2,3
CO3	Design and execute a program using POSIX thread libraries	1,2,3,5,9, 10	1,2,3
CO4	Understand about the RTOS based ES concepts and the goal of ES in real time applications.	1,2,3,5,9, 10	1,2,3
CO5	Conduct the experiment for the given design parameters individually (and in a team) within the stipulated time	5,9,10,12	
CO6	Analyze the results, make relevant observations and measurements, and document the results in a form of report/journal.	5,9,10,12	

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO/ PO	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3		✓	✓			
CO4	✓	✓	✓			
CO5	✓	✓	✓	✓		✓
CO6	✓	✓	✓			

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		2				3	3		1	1	2	1
CO2	3	2	1		2				3	3		1	1	2	1
CO3	3	2	1		2				3	3		1	1	2	1
CO4	3	2	1		2				3	3		1	1	2	1
CO5					3				3	2		1			
CO6					3				3	2		1			

Note:1-Low,2-Medium,3-High

COURSE CONTENT

Sl. No.	Name of the Experiment	Tools and Techniques	Expected Skill /Ability
1	Write a program for singly Thread Creation and Termination using POSIX threads.	Unix OS based GCC Compiler	C programming language.
2	a) Write a program for creating independent threads each of which will execute some random function and use concept of Mutual Exclusion (Task Synchronization). b) Write a program to create N number of threads and to count how many threads are being executed. Use concept of Mutual Exclusion.	Unix OS based GCC Compiler	C programming language.

3	Write a program to create independent threads each of which will execute some function and wait till threads are complete before main continues. Unless we wait run the risk of executing an exit which will terminate the process and all threads before the threads have completed.	Unix OS based GCC Compiler	C programming language.
4	Write a program to create the N number of threads and find the how many threads are executed. Use concept of Mutual Execution.	Unix OS based GCC Compiler	C programming language.
5	Write a program to create two threads T1 and T2. Thread T1 should count numbers between 1-3 and 8-10 by calling the function FunctionCount1 and thread T2 should count numbers between 4-7 by calling the function FunctionCount2. Program should print the final count value.	Unix OS based GCC Compiler	C programming language.
6	Design and execute a program using POSIX thread library to create the number of threads specified by the user, each thread independently generates a random integer as an upper limit and then computes and prints the number of primes less than or equal to that upper limit, along with the upper limit.	Unix OS based GCC Compiler	C programming language.
7	Write a program to implement a process with a producer thread and a consumer thread which make use of a bounded buffer (Size can be prefixed at suitable value) for communication. Use any suitable synchronization construct.	Unix OS based GCC Compiler	C programming language.
8	Write a program to implement the usage of an Anonymous Pipe with size of 512bytes for data sharing between parent and child process using Inheritance Handling mechanism.	Unix OS based GCC Compiler	C programming language.

TEXTBOOKS:

1. K. V. Shibu, "Introduction to embedded systems", TMH education Pvt. Ltd. 2009.

REFERENCE BOOKS

1. Frank Vahid, Tony D. Givargis, Embedded System Design – A Unified Hardware/Software Introduction, John Wiley, 2002.
2. Jonathan W. Valvano, Embedded Microcomputer Systems, 3rd. edition, Cengage Learning, 2011.
3. David E. Simon, An Embedded Software Primer, Pearson Ed., 2005.
4. Raj Kamal, Introduction to Embedded Systems, TMH, 2002.

5. KVKK Prasad, Embedded / Real Time Systems, Dreamtech Press, 2005.
6. Peter M, Embedded System Design: Embedded Systems Foundations of Cyber-Physical Systems, and Internet of Things, Springer, 3rd Edition, 2018

Course Title	Machine Learning Lab				Course Type		HC	
Course Code	B20EP0506	Credits	1		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	22	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50 %**

COURSE OVERVIEW:

The course provides students with some knowledge on the basic principles of machine learning which is the study of computer algorithms that can improve automatically through experience and using data. It is seen as a part of artificial intelligence. Machine learning algorithms build a model based on sample data, known as "training data", to make predictions or decisions without being explicitly programmed to do so. Machine learning algorithms are used in a wide variety of applications, such as in medicine, email filtering, speech recognition, and computer vision, where it is difficult or unfeasible to develop conventional algorithms to perform the needed tasks.

COURSE OBJECTIVES:

The objectives of this course are:

1. Discuss the basic theory underlying machine learning.
2. Explain machine learning algorithms to solve problems of moderate complexity for data analysis.
3. Illustrate the concept of Genetic Programming and Artificial Neural Network.
4. Discuss the implementation of Machine learning algorithms and modules.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO/ PO	Course Outcomes	POs	PSOs
CO1	Explain the basics of machine learning concepts	1,2,3,5,9,1	1,2,3
CO2	Apply algorithmic topics of machine learning for understanding supervised learning	1,2,3,5,9,10	1,2,3
CO3	Evaluate learning algorithms and model selection	1,2,3,5,9,10	1,2,3
CO4	Implement machine learning applications.	1,2,3,5,9,10	1,2,3

CO5	Conduct the experiment for the given design parameters individually (and in a team) within the stipulated time	5,9,10,12	---
CO6	Analyze the results, make relevant observations ,measurements, and document the results in a form of report/journal.	5,9,10,12	---

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2				3	3		1	3	2	1
CO2	3	3	3		2				3	3		1	3	2	1
CO3	3	3	2		2				3	3		1	3	2	1
CO4	3	3	3		2				3	3		1	2	2	1
CO5					3				3	3		1			
CO6					3				3	3		1			

Note:1-Low,2-Medium,3-High

Sl. No.	Name of the Experiment	Tools and Techniques	Expected Skill /Ability

1	Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file	Python	ML Usage for real time
2	For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples	Python	ML Usage for real time
3	Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.	Python	ML Usage for real time
4	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets	Python	ML Usage for real time
5	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.	Python	ML Usage for real time
6	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task, - the program. Calculate the accuracy, precision, and recall for your data set.	Python	ML Usage for real time
7	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.	Python	ML Usage for real time
8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.	Python	ML Usage for real time
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.	Python	ML Usage for real time
10	Implement the non-parametric Locally Weighted Regression algorithm to fit data points. Select appropriate data set for your experiment and draw graphs.	Python	ML Usage for real time

Course Title	Java Programming Lab				Course Type		HC	
Course Code	B20EP0507	Credits	1		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	22	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50 %**

COURSE OVERVIEW:

Java is an object-oriented language that enables learners to create real-world applications. Java technology-based software works just about everywhere from the smallest devices to super computers! Java technology components are not impacted by the kind of computer, phone, smart device, or operating systems they are running on. The architecture-neutral nature of Java technology is important in a networked world where one cannot predict the kind of devices that partners, suppliers and employees use to connect to their organizations. The Java Programming in course is the first step for developing such applications. This course introduces object-oriented concepts and its implementation in Java technology programs. In addition, it covers syntax and semantics of the Java programming language.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Illustrate the creation of classes and objects in Java
2. Demonstrate concept reusing of code using inheritance and interfaces
3. Use proper program handling mechanism to write robust programs
4. Familiarize advance java concepts like threads, JDBC, Servlets, JSP

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Implement simple programs using Java language concepts such as variables, conditional, methods and constructure	1,3,5	1,2
CO2	Apply program structure like inheritance, interface to develop programs.	1,2,3	1,2
CO3	Build application using the concept of packages,	1,2,3,4	2,3
CO4	Demonstrate the programs using concepts exception handling and file handling	1,2,3	1,2
CO5	Conduct the software coding for the given design parameters individually (and in a team) within the stipulated time	5,9,10,12	1,2

CO6	Analyze the results, make relevant observations and measurements, and document the results in a form of report/journal.	5,9,10,12	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			✓			
CO2				✓		
CO3			✓			
CO4			✓			
CO5			✓			
CO6		✓				

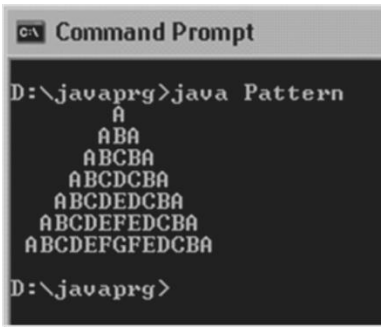
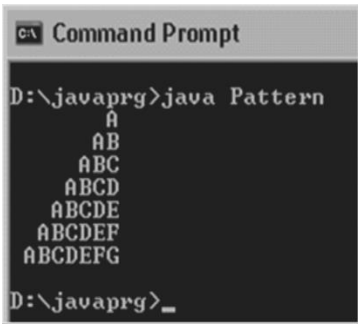
COURSE ARTICULATION MATRIX:

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1		2								1	2	
CO2	2	3	2		2								3	2	
CO3	2	2	3		2									2	1
CO4	2	3	2		2								3	2	
CO5					3				3	3		1			
CO6					3				3	3		1			

Note:1-Low,2-Medium,3-High

Couse Contents:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill/Ability
1	a) Introduction to Compiling and Executing a Java Program using command prompt. b) Program to illustrate Data Types and Variables c) Write a program to create three variables and find the number of distinct values using branching statements	Command Prompt/ Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs

2	a) Write a program to find the zodiac sign for the entered date & month using a branching statement b) Write a program to create the following pattern using the looping structures.  	Command Prompt/ Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
3	a) Write a program to create a BMI calculator that reads the user's weight in kilograms and height in meters, then calculates and displays the user's body mass index. Formula: BMI = weight (kg) / [height(m)]^2 [Reference Values: Underweight: less than 18.5, Normal: between 18.5 and 24.9, Overweight: between 25 and 29.9, Obese: 30 or greater] b) Write a program to calculate the value of π from the infinite series $\pi = 4 - \frac{4}{3} + \frac{4}{5} - \frac{4}{7} + \frac{4}{9} - \frac{4}{11} + \ldots$ Print a table that shows the value of π approximated by computing the first 200,000 terms of this series. How many terms do you have to use before you first get a value that begins with 3.14159?	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
4	a) Write a java program to find the area and perimeter of a rectangle using the concept of class and objects. b) Write a java program to demonstrate copy constructor and constructor overloading c) Write a java program to demonstrate function overloading and overriding	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
5	Write a java program to create a program to superclass **MotorVehicle** with instance variable **modelName, modelNumber, modelPrice,** parameterized constructor, and **display ()** method. Create a sub-class that inherits the features of the superclass and has its instance variable **discountRate**, parameterized constructor, and **display ()**, **discount ()** methods. Create an object for the car class and invoke all the methods using the object of that class. (Hint: Single Inheritance)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs

6	Write a java program to create an abstract class **Shape** which contains the abstract method **numberOfSides().** Create different sub-classes by the name **Trapezoid, Triangle, and Hexagon**, which extends the shape class. Develop a class **ShapeDemo** which contains the main method. Create the object for different subclasses with the main method and invoke the method **numberOfSides()** using the objects of classes. (Hint: Abstract Class)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
7	Write a program to create an interface **Calculator** which contains **add(), sub(), multiply(), divide(), remainder ()** abstract methods with two-parameter x and y. Develop a class **CalculatorDemo** which inherits the features of the interface. Create an object for the CalculatorDemo class and invoke all the methods of this class. (Hint: implementing interfaces/ multiple inheritances	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
8	Write a program to demonstrate the function on string like **toLowerCase(), toUpperCase(), length(), startsWith(), endsWith(),s ubstring(),** and string conversion using **String.valueOf()** (Hint: String Handling)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
9	Write a java program using the concept of packages. Create a class Trignometry which contain static method **sine (), cos (), tan (), cosec (), tan (), cosec (), sec (), cot ().** Print the value of a given angle in degree by calling these methods. (Hint: Implementing packages)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
10	a) Write a java class to demonstrate **ArithematicException**, **NullPointerException**, **ArrayIndexOutOfBoundsException** (Hint: Handling predefined exceptions) b) Write a java program to demonstrate working with files (Hint: Files & Exception)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
11	Write a Java Program using **the Runnable** interface to demonstrate the concepts of thread priorities. (Hint: Threads)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs
12	Write a java program to demonstrate the multithread and thread synchronization (Hint: Multithreading)	Eclipse IDE / BlueJ	Apply Java Programming concepts to write programs

TEXTBOOKS:

1. Patrick Naughton, “The Java Handbook”, Tata McGraw-Hill, 2006
2. Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, Tenth Edition, 2018.

REFERENCE BOOKS

1. Bruce Eckel, “Thinking in Java”, III Edition, Pearson 2004.
2. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Tenth Edition, Pearson ltd 2015
3. Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 9th edition , 2011
4. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.

Course Title	Technical Documentation				Course Type		FC	
Course Code	B20EP0508	Credits	1		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**1**	**1**	**1**	**14**	**-**	**50%**	**50 %**

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are to:

1. Acquire language skills
2. Develop linguistic and communicative competencies
3. Study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Produce effective engineering documents that enable readers to access relevant information.	6, 9,10,12	1
CO2	Learn to avoid communication problems that distract the readers, causing confusions, distrust, or misunderstanding.	6, 9,10,12	1
CO3	Learn to the practice of various verbal reasoning and grammar practice.	6, 9,10,12	1
CO4	To search engineering information, both in traditional ways and online.	6, 9,10,12	1
CO5	Write research/design reports with special emphasis on content and style.	6, 9,10,12	1
CO6	learn strategies for preparing and delivering presentations, single or in team	6, 9,10,12	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	√					
CO2	√					

CO3		√				
CO4		√				
CO5			√			
CO6			√			

COURSE ARTICULATION MATRIX:

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						1			2	2		2	1		
CO2						1			2	2		2	1		
CO3						1			2	2		2	1		
CO4						1			2	2		2	1		
CO5						1			2	2		2	1		
CO6						1			2	2		2	1		

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
Unit 1 **Information Design and Development**- Different kinds of technical documents, Information development life cycle, factors affecting information and document design, Technical Writing, Grammar, and Editing- Technical writing process, forms of discourse, writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style.
Unit 2 Introduction to advanced technical communication, Usability, managing technical communication projects, time estimation, Single sourcing, Localization, Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

TEXTBOOKS:

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843)
3. Shiv Khera, You Can Win, Macmillan Books, New York, 2003.
4. Raman Sharma, Technical Communications, Oxford Publication, London, 2004.

5. Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002. 7. Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213).

Course Title	Research Based Project				Course Type	HC	
Course Code	B20EP0509	Credits	2		Class	V Semester	
Embedded Systems	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester	Assessment in Weightage	
	Lecture	0	0	0			
	Tutorial	0	0	0	Practical	IA	SEE
	Practice	2	4	4			
	-	**2**	**4**	**4**	**56**	**50%**	**50%**

Mini-project course will prepare the students to take up Capstone projects in final year. It is an activity of a group of students with the intention to work on a "Specific Topic" of common interest which will give an experience of problem-solving along with group members, by using knowledge, facilities available and under the guidance of a faculty. Mini projects help students in different ways like the formation of groups, understanding group behavior, improving communication skills, learning in-depth with minimum time, interaction with the guide and outside world.

COURSE OBJECTIVES:

The objectives of this course are:

1. Integrate knowledge and skills learnt from theory concepts to build projects
2. Design solution to Engineering/real time problems

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Practice and strengthen the required knowledge in the chosen area of technology for project development.	1,2,3,4,5,9, 10,11,12	1,2,3
CO2	Identify, discuss, and justify the technical aspects of the chosen project with a systematic approach.	1,2,3,4,5,9, 10,11,12	1,2,3
CO3	Reproduce the technical features for Engineering projects.	1,2,3,4,5,9, 10,11,12	1,2,3
CO4	Work in a team in development of technical projects to solve real time problems	1,2,3,4,5,9, 10,11,12	1,2,3
CO5	Communicate and report effectively project related activities and findings.	1,2,3,4,5,9, 10,11,12	1,2,3
CO6	Inculcate innovative thinking and thereby preparing students for main project	1,2,3,4,5,9, 10,11,12	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	√	√	√	√	√	
CO2	√	√	√	√	√	
CO3	√	√	√	√	√	
CO4	√	√	√	√	√	
CO5	√	√	√	√	√	
CO6	√	√	√	√	√	

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	2				3	3	1	1	2	2	1
CO2	3	3	3	3	2				3	3	1	1	3	2	1
CO3	3	3	3	3	2				3	3	1	1	3	3	2
CO4	3	3	3	3	2				3	3	1	1	3	3	2
CO5	3	3	3	3	2				3	3	1	1	3	3	2
CO6	3	3	3	3	2				3	3	1	1	3	3	2

Note:1-Low,2-Medium,3-High

Execution:

1. The project is carried out by team of two or three students (student team).
2. Each Student team is guided and monitored by Faculty.
3. Identification of problem and plan of implementation of the project will be submitted by the team
4. The progress of the project activities will be monitored on weekly basis
5. Students carry out practices according to the project stages.

Assessment and Evaluation:

1. The Internal assessment is made in phase1 and phase2 stages based on written reports, oral presentation, and demonstration of project results with developed model by Faculty in charge.
2. The external evaluation is made on written reports, oral presentation, and demonstration of project results with developed model at the end of the semester by Examiner.

5th Semester
PROFESSIONAL ELECTIVE-1

Course Title	Sensors and Instrumentation				Course Type		Hardcore	
Course Code	B20EPS511	Credits	3		Class		V Semester	
Sensors and Instrumentation	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practical	-	-	-	Theory	Practical	IA	SEE
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are:

1. Present an outline in the measurement of different physical quantities.
2. Provide an understanding of measuring instruments and different types of sensors.
3. Provide an understanding of virtual instrumentation.
4. Illustrate the different methods of data acquisition.
5. Provide an understanding into the concepts of intelligent instrumentation.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply the use of sensors for measurement of displacement, force, and pressure.	1,2,3	1,2,3
CO2	Employ commonly used sensors in industry for measurement of temperature, position, accelerometer, and vibration sensor	1,2,3	1,2
CO3	Demonstrate measurement of flow and level.	1,2,3	1,2
CO4	Demonstrate the use of virtual instrumentation in automation industries.	1,2,3	1,2
CO5	Identify and use data acquisition methods.	1,2,3	1,2
CO6	Comprehend intelligent instrumentation in industrial automation.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

CO#	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓		✓			
CO3	✓					
CO4	✓		✓			
CO5	✓		✓			
CO6	✓					

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	3	2
CO4	3	3											3	3	
CO5	3	3											3	3	
CO6	3	3	2										3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor.
UNIT - 2
Measurement and Sensing: Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive.
UNIT - 3
Virtual Instrumentation and data acquisition: Introduction: Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays,

Clusters & graphs, Structures: Case, Sequence & Formula nodes. Basic block diagram of data acquisition, successive approximation ADC, Use of Data Sockets for Networked Communication.

UNIT - 4

Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.

TEXTBOOKS:

1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
4. Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.

REFERENCE BOOK:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
3. Hermann K.P. Neubert, "Instrument Transducers" 2nd Edition 2012, Oxford University Press.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/105/108105064/
2. https://nptel.ac.in/courses/108/108/108108147/
3. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

Course Title	Computer Organization and Operating Systems				Course Type		Hardcore	
Course Code	**B20EPS512**	**Credits**	**3**		**Class**		**V Semester**	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	**IA**	**SEE**
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course is descriptive in nature, which is designed to provide knowledge of the core concepts of computer architecture and operating systems. The conceptual skills gained by the subject serves as the basic platform for communication, networks, embedded systems, real time systems domains.

COURSE OBJECTIVES:

The objectives of this course are:

1. Present an outline in the fundamental concepts of computer system architecture.
2. Provide an understanding of memories in computer, basic structure, I/O organization.
3. Provide an understanding of interrupts, direct memory access and other aspects.
4. Illustrate the different components and functions related to design of operating systems.
5. Illustrate the different components and methodology related to memory management.
6. Provide an understanding into the concepts and types of virtual memories.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Define and describe the role of an operating system and issues in the management of resources like processor, memory, and input-output.	1,2,3	1,2,3
CO2	Distinguish between the different components and functions related to design of operating systems	1,2,3	1,2
CO3	Analyze with examples the various operations and types related to processes.	1,2,3,4	1,2
CO4	Distinguish the different components and methodology related to memory management, scheduling, and page replacement policies	1,2,3,4	1,2
CO5	Define & describe the I/O concepts, machine instructions, sequencing etc.	1,2,3	1,2
CO6	Analyze the complete concept of binary addition, subtraction, multiplication, floating point numbers, numbering sequences etc.	1,2,3,4	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓				
CO2	✓			✓		
CO3	✓					
CO4	✓			✓		
CO5	✓			✓		
CO6	✓					

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	1
CO2	3	3	3										3	2	1
CO3	3	3	2										3	3	2
CO4	3	3											3	3	
CO5	3	3											3	3	
CO6	3	3	2										3	3	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Basic Structure of Computers: Computer types, Functional units, Basic operational concepts, Bus structures, Performance-processor clock, Basic performance equation, clock rate, performance measurement.
Machine Instructions and Programs: Numbers, arithmetic operations and characters, Memory location and Addresses, Memory operations, Instructions, and instruction sequencing, Addressing modes, Assembly language, Stack and Queues and Subroutines.

UNIT - 2
Input/ Output Organization: Accessing I/O Devices; Interrupts; enabling and disabling interrupts, Handling multiple devices, Device requests, Exceptions, Direct Memory Accesses; Buses; Interface Circuits, standard I/O interface.
UNIT - 3
Introduction to Operating Systems and System Structures : Introduction: Computer-System Organization, Computer System Architecture, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security, Distributed Systems, Special-Purpose Systems, Computing Environments; System Structures: Operating System Services, User Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating System Structure, Virtual machines.
UNIT - 4
Memory Management: Memory-Management Strategies: Swapping, Contiguous Memory Allocation, Paging, Structure of the page table, Segmentation. Virtual Memory Management: Demand Paging, Page Replacement policies, Allocation of frames, Fundamentals of Scheduling policies.

TEXTBOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Principles”, Seventh Edition, John Wiley and Sons 2006.
2. Roger L Tokheim, “Digital Electronics Principles and Applications”, Sixth Edition, McGraw Hill, 2004.
3. Carl Hamacher, Z Varnesic and S Zaky, “Computer Organization”, Fifth Edition, McGraw Hill 2002.

REFERENCE BOOK:

1. Milan Milenkovic, “Operating Systems - Concepts and Design”, Second Edition, Tata McGraw-Hill.
2. Harvey M. Deitel, “Operating Systems”, Addison Wesley
3. D.M. Dhamdhere : Operating Systems- A Concept-based Approach, Tata McGraw Hill
4. Morris Mano, “Digital Logic and Computer Design”, Pearson Education Asia.
5. Morris Mano and Charles R Kime, “Logic and Computer Design Fundamentals”, Second Edition, Pearson Education Asia.

SWAYAM/NPTEL/MOOCs:

1. https://onlinecourses.nptel.ac.in/noc20_cs64/preview
2. https://onlinecourses.nptel.ac.in/noc21_cs37/preview
3. https://onlinecourses.swayam2.ac.in/cec20_cs06/preview
4. https://onlinecourses.nptel.ac.in/noc19_cs50/preview

Course Title	Mechatronics				Course Type		Professional Elective	
Course Code	B20EPS513	Credits	3		Class		V Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The course consists of foundations of interdisciplinary domain of mechatronics. The course gives a brief roundup of Sensors and Transducers, actuation systems, System Models and Controllers and programmable logic controllers.

COURSE OBJECTIVES:

The objectives of this course are:

1. To understand the requirements of Mechatronics systems and recognize its various elements.
2. To understand the actuation systems and signal conditioning circuits.
3. To understand the concepts of system models and controllers
4. To understand the implementation of programmable logic controllers for Mechanical drives.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Define Mechatronics systems and recognize its various elements.	1,2,3	1,2
CO2	Compile the key elements of electrical actuation systems and signal conditioning circuits.	1,2,3	1,2
CO3	Demonstrate the concepts of system models and controllers.	1,2,3	1,2
CO4	Analyze the processing of logic controllers.	1,2,3	1,2
CO5	Design the programmable logic controller for applications	1,2,3	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓		✓			

CO3	✓					
CO4	✓		✓			
CO5	✓		✓			
CO6	✓					

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	
CO2	3	3	3										3	2	
CO3	3	3	2										3	3	
CO4	3	3											3	3	
CO5	3	3											3	3	

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
Unit-1
Sensors and Transducers: Introduction to Mechatronics Systems, Measurement Systems, control Syste ms, Microprocessor basd Controllers. Sensors and Transducers, Performance, Terminology, Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, Liquid Level, Temperature, Light Sensors Selection of Sensors.
Unit-2
Actuation System: Rotary Actuators, Mechanical Actuation Systems, Cams, Gear Trains, Ratchet and pawl Beltand Chain Drives, Bearings. Electrical Actuation Systems, Mechanical Switches Solid State Switches, Solenoids Construction and working principle of DC and AC Motors, speed control of AC and DC drives, Stepper Motors switching circuitries for stepper motor, AC & DC Servo motors
Unit-3
System Models and Controllers: Building blocks of Mechanical, Electrical, Fluid and Thermal systems, Rotational, Translation systems, electromechanical systems, Hydraulic Mechanical Systems. Continuous and discrete process Controllers, Control Mode, Step mode, Proportional Mode, Derivative Mode, Integral Mode, PID Controllers, Digital Controllers, Velocity Control, Adaptive Control, Digital logic control, Microprocessors control.
Unit-4:

Programming Logic Controllers: Programmable Logic Controllers, Basic Structure, Input / Output Processing, Programming, Mnemonics, Timers, Internal relays and counters, Shift Registers, Master and Jump Controls, Data Handling, Analogs Input / Output, Selection of a PLC.

TEXTBOOKS:

1. Mechatronics- W. Bolton, Longman, 2nd Pearson Publications, 2007
2. Microprocessor Architecture, programming and applications with 8085.8085A- R.S. Ganokar, Wiley Eastern

REFERENCE BOOK:

1. Mechatronics Principles & applications by Godfrey C. Canwerbolu, Butterworth- Heinemann 2006.
2. Mechatronics- danNecsulescu, Pearson Publication, 2007
3. Introduction Mechatronics & Measurement systems, David. G. Aliciatore & Michael B. Bihistand, tata McGraw Hill, 2000.
4. Mechatronics: Sabricentinkunt, John wiley & sons Inc. 2007

5th Semester
PROFESSIONAL ELECTIVE-2

Course Title	Networks and Signals				Course Type		Integrated	
Course Code	B20EPS521	Credits	3		Class		V Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The course covers the fundamentals of signal and system analysis tackling both continuous-time (CT) and discrete-time (DT) systems. Fourier analysis in the course includes Fourier series for periodic continuous-time signals, the continuous-time Fourier transform (CTFT) and the discrete-time Fourier transform (DTFT). This course introduces the concepts to determine voltage, current and power in branches of any circuits excited by dc and ac voltages and current sources by simplifying techniques to solve dc circuit problems using basic circuit theorems and structured methods like node voltage and mesh current analysis. The goal also includes derivation of the transient responses of RC, RL and RLC circuits, steady state response of circuits and application of Laplace transform in network theory.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide insight into fundamentals of Continuous and Discrete-time signals and systems, their properties and representations.
2. To provide understanding of signal representation in Fourier domain such as Fourier series, Fourier transform, discrete time Fourier transform.
3. Introduce the fundamental concepts of electrical circuit analysis with active and passive energy sources,
4. Study and analyse circuit using network theorems, transforms, and circuit resonance,
5. Select an analysis strategy to determine a response

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the operations on Signals	1,2,3,4	2,3
CO2	Classify the signals into even-odd, energy-power signals	1,2,3,4	3
CO3	Represent continuous time periodic signals in frequency domain using Fourier technique.	1,2,3,9,10	1,2,3
CO4	Analyze the concepts of super mesh, super node, and network		

CO5	Analyze transient behavior of RLC Circuits by applying Laplace Transforms.	1,2,3,9,10, 11	1,2,3
CO6	Calculate the impulse response of the series and parallel RLC circuits		

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓		✓	✓	
CO2	✓			✓	✓	
CO3	✓		✓	✓	✓	
CO4	✓		✓	✓	✓	

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1										2	3
CO2	3	2	1	1											3
CO3	3	3	3						3	1			1	1	2
CO4	3	3	3						3	1	1		1	1	2

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 **Introduction to Signals and Systems:** Definitions of a signal and system, Elementary signals, Basic operations on signals, Classification of signals, Properties of systems.
UNIT - 2 **Fourier Representation for Aperiodic signals:** FT representation of aperiodic CT signals - FT, definition, FT of standard CT signals, Properties and their significance, Inverse Fourier Transform. FT representation of aperiodic discrete signals-DTFT, definition, DTFT of standard discrete signals.
UNIT - 3 **Circuit Analysis Techniques:** Practical sources, Source transformations, Concepts of super node and super mesh, Network Theorems: Superposition theorem, Thevenin's & Norton's theorem, Maximum power transfer theorem.

UNIT - 4

Applications of LT technique in circuit analysis: A procedure for evaluating initial conditions, Initial & Final State of a network element. Time-domain to s-domain transformation of R-L-C circuits, step response of series R-L & series R-C circuit, impulse response of series R-L & series R-C network.

TEXTBOOKS:

1. Simon Haykins, "Signals and Systems", John Wiley, India Pvt Ltd, Second Edition, 2008
2. W H Hayt, J E Kemmerly, S M Durbin, "Engineering Circuit Analysis", 6th Edition, Tata McGraw-Hill Publication.

REFERENCE BOOK:

1. Allan V. Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson Education, Second Edition, 1997.
2. Nahvi and Edminister, "Electric Circuits" Schaum's Outline Series, McGraw Hill, 2003.
3. J. David Irwin and R. Mark Nelms, "Basic Engineering Circuit Analysis", 8th Edition, John Wiley, 2006.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

- https://www.tutorialspoint.com/signals_and_systems/index.htm
- https://www.tutorialspoint.com/network_theory/index.htm

SWAYAM/NPTEL/MOOCs:

- https://www.udemy.com/course/signals-and-systems-from-basics-to-advance/
- https://nptel.ac.in/courses/108/105/108105159/

Course Title	Cloud Computing				Course Type		Softcore	
Course Code	B20EPS522	Credits	3		Class		V Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-				
	Practical	-	-	-	Theory	Practical	IA	SEE
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The course is designed to provide a wide knowledge and deep understanding of installing, configuring, and managing cloud infrastructure for an organization

COURSE OBJECTIVES:

The objectives of this course are:

1. learning the principles of virtualization technologies and cloud computing
2. Introduce the concepts how virtual machines, hypervisors, virtual networks and virtual storage work together.
3. Emphasizes on how to apply and build cloud infrastructure in practice.
4. Introduce actual approaches in virtual machine management and troubleshooting.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Describe the evolution of the paradigm, its applicability, benefits, as well as current and future challenges	1,2,3,5	1
CO2	Explain the economics of outsourcing IT to the cloud software deployment considerations	1,2,3,5	1,2
CO3	Discuss system, network and storage virtualization and outline their role in enabling the cloud computing system model	1,2,3,5	1,2
CO4	Demonstrate how to build secure networks in the cloud	1,2,3,5	1,2
CO5	Discover a variety of managed big data services in the cloud	1,2,3,5	1,2
CO6	Explain what machine learning is, the terminology used, and its value proposition	1,2,3,5	1,2

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1		✓	✓	✓		
CO2			✓			✓
CO3		✓				✓
CO4		✓				
CO5		✓	✓			✓
CO6		✓	✓			✓

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2								3	2	1
CO2	3	3	3		2								3	2	1
CO3	3	3	2		2								3	2	
CO4	3	3	3		2								2	2	1
C05	3	3	2		3								3	2	1
CO6	3	3	3		3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Cloud Computing: Cloud versus traditional architecture, IaaS, PaaS, and SaaS. Google Cloud architecture, Cloud computing characteristics, IT infrastructure, Cloud Versus Traditional Architecture. Creating a Virtual Machine, Compute Engine: Qwik Start – Windows, Getting Started with Cloud Shell and gcloud, Kubernetes Engine: Qwik Start, Set Up Network and HTTP Load Balancers
UNIT - 2
Networking in the Cloud: Introduction to networking in the cloud, defining a Virtual Private Cloud, Public and private IP address basics, Google's network architecture, Routes and firewall rules in the cloud, User Authentication: Identity-Aware Proxy, Multiple VPC networks, VPC Networks - Controlling Access, HTTP Load Balancer with Cloud Armor, Create an Internal Load Balancer, Google Cloud Packet Mirroring with Opensource IDS
UNIT - 3
Infrastructure as Code: Cloud Deployment Manager, Public and private IP address basics, Monitoring and managing your services, applications, and infrastructure.

Google Cloud's operations suite: Cloud Storage: Qwik Start - Cloud Console, Cloud IAM: Qwik Start, Cloud Monitoring: Qwik Start, Cloud Functions: Qwik Start – Console, Google Cloud Pub/Sub: Qwik Start – Console,
UNIT – 4
Big Data and Machine Learning Fundamentals in Cloud: Big data managed services in the cloud. Leverage big data operations with Dataproc. Build Extract, Transform, and Load pipelines using Dataflow.BigQuery, Google's Enterprise Data Warehouse Introduction to machine learning in the cloud. Building bespoke machine learning models with Vertex AI. AutoML.Google's pre-trained machine learning APIs

TEXTBOOKS:

1. Cloud Computing Bible by Barrie Sosinsky John Wiley & Sons 2011 ISBN13: 9780470903568

REFERENCE BOOK:

1. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) Michael J. Kavis John Wiley & Sons 2014 978-1-118- 61761-8
2. Mastering VMware vSphere 6.7: Effectively deploy, manage, and monitor your virtual datacenter with VMware vSphere 6.7, 2nd Edition by Martin Gavanda(Author), Andrea Mauro(Author), Paolo Valsecchi(Author), Karel NovakPackt Publishing 2019 978-1-78961-337

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. Google Cloud -GCP Course-Google Cloud for Education - Curriculum

Course Title	Research Methodology & IPR				Course Type		Integrated	
Course Code	B20EPS523	Credits	3		Class		V Semester	
Research Methodology & IPR	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	-	-	-				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

COURSE OBJECTIVES:

This course objective is:

1. To provide insights into research methodology for their research studies, irrespective of their discipline.
2. Enhance the research skills and equip them to carry out individual or team research work according to scientific/technology requirements.
3. Introduce different IPR Legislations and IPR filing procedures.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Formulate research problem.	1,2,3,8,10	1,2,3
CO2	Develop the most appropriate methodology for their research studies, irrespective of their discipline.	1,2,3,8,10	1,2,3
CO3	Analyze literature review and find research gaps to finalize research objectives	1,2,3,8,10	1,2,3
CO4	Identify the need of ethics in research	1,2,3,8,10	1,2,3
CO5	Identify the need of IPR of research projects for economic growth and social benefits	1,2,3,8,10	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓			
CO2	✓					
CO3	✓		✓			

CO4	✓		✓			
CO5		✓	✓			

COURSE ARTICULATION MATRIX

CO / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2					3		1					
CO2	2	2	2					3		1					
CO3	2	2	2					3		1					
CO4	2	2	2					3		1					
CO5	2	2	2					3		1					
CO6	2	2	2					3		1					

Note:1-Low,2-Medium,3-High

COURSE CONTENT
THEORY:

Contents
Unit-1
Research and Types of research Meaning of Research- Objectives of Research- Motivation in Research. Research methods v/s Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical. Research Process. Criteria of good Research. Defining the Research Problem - Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem, Technique Involved in Defining a Problem, Research design – Basic Principles- Need of research design — Features of good design – Important concepts relating to research design, Different Research Designs.
Unit-2
Tthesis writing and Ethics. Structure and components of scientific reports - Types of report – Technical reports and thesis, Significance –Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes - Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication. **LATEX**: Introduction to LATEX and it's usage in documentation, preparation of thesis, technical papers, and articles.
Unit- 3
Intellectual Property Rights

Intellectual Property Rights: Introduction, Legislations covering IPR in INDIA; Patents: Conditions to be satisfied by an invention to be patentable, Patentable inventions under patent Act 1970,Types of patents which are not patentable in INDIA, Term of patent in INDIAN system, Essential patent documents to be submitted, Criteria for naming inventors in an application of patent, Where to apply ?How to apply?, Why provisional specification, Complete specification, Hierarchy of officers in patent office, Register of patents ,working of patents and company licensing, Revocation of patents, Term of patents, Patent of addition

Unit-4

Other Intellectual Property Rights

Copy Right; Trademarks; Geographical Indications; Industrial Designs; Layout Design of Integrated designs; Plant verity; International Patenting; Case studies

TEXTBOOKS:

1. Kothari, C. R. **"**Research methodology: Methods & techniques". New Delhi: New Age International (P) Ltd, 2004.

REFERENCE BOOK:

1. "LATEX Documentation" available at http://www.latex-project.org/
2. "Patent Manual", available at http://www.bits-pilani.ac.in/uploads/Patent_ManualOct_25th _07.pdf

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Credit Pattern & Credit Value				Contact Hours/ Week
				L	T	P	Total	
1	B20EP0601	UI/UX Design	HC	1	1	1	3	5
2	B20EP0602	Web Technologies	HC	1	1	0	2	3
3	B20EN0603	Computer Networks	HC	3	0	0	3	3
4	B20EP0604	Basic VLSI Design	HC	3	0	0	3	3
5	B20EPS6XX	Professional Elective-3	SC	3	0	0	3	3
6	B20XXO6XX	Open Elective-2	OE	3	0	0	3	3
TOTAL				**14**	**2**	**1**	**17**	**20**
Practical /Term Work / Sessional								
7	B20EP0605	Web Technologies Lab	HC	0	0	1	1	2
8	B20EN0606	Computer Networks Lab	HC	0	0	1	1	2
9	B20EP0606	Basic VLSI Design Lab	HC	0	0	1	1	2
10	B20EP0607	Mini Project/Internship	HC	0	0	2	2	4
11	B20PA0501	Indian Tradition and Culture	FC	1	0	0	1	2
TOTAL				**1**	**0**	**5**	**6**	**12**
TOTAL SEMESTER CREDITS				**23**				
TOTAL CUMULATIVE CREDITS				**134**				
TOTAL CONTACT HOURS				**32**				

Course Title	UI/UX Design				Course Type		HC	
Course Code	B20EP0601	Credits	3		Class		V Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**3**	**5**	**5**	**14+28**	**28**	**50%**	**50%**

COURSE OVERVIEW:

The course is organized around a practical project with iterative design of a graphical user interface to organize information about users into useful summaries with affinity diagrams, to convey user research findings with personas and scenarios and to learn the skill of sketching as a process for user experience design. The students will be given exposure to wireframing and Prototyping software in the various UI/UX Design tools.

COURSE OBJECTIVES:

The objectives of this course are:

1. The aim of the UI/UX course is to provide students with the knowledge of user- centered design,
2. User -centered methods in design, graphic design on screens, simulation and prototyping techniques, usability testing methods, interface technologies and
3. User centered design in corporate perspective

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Understand iterative user-centered design of graphical user interfaces	1,2,3,5,9	1,2,3
CO2	Apply the user Interfaces to different devices and requirements	1,2,3,5,9	1,2,3
CO3	Create high quality professional documents and artifacts related to the design process.	1,2,3,5,9	1,2,3
CO4	Develop the complete design process.	1,2,3,5,9	1,2,3
CO5	Apply implementation of GUI to different devices.	1,2,3,5,9	1,2
CO6	Create Graphically User Interface for applications	1,2,3,5,9	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

	Bloom's Level					
	Remember	**Understand**	**Apply**	**Analyze**	**Evaluate**	**Create**

CO#	(L1)	(L2)	(L3)	(L4)	(L5)	(L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2				1				3	2	1
CO2	3	3	3		2				1				3	2	1
CO3	3	3	2		2				1				3	2	
CO4	3	3	3		2				1				2	2	1
CO5	3	3	2		3				1				3	2	1
CO6	3	3	3		3				1				3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS

THEORY:

Contents
UNIT – 1
Introduction to the UI: What is User Interface Design (UI) -The Relationship Between UI and UX, Roles in UI/UX, A Brief Historical Overview of Interface Design, Interface Conventions, Approaches to Screen Based UI, Template vs Content, Formal Elements of Interface Design, Active Elements of Interface Design, Composing the Elements of Interface Design, UI Design Process, Visual Communication design component in Interface Design
UNIT-2
Introduction to UX: UX Basics- Foundation of UX design, Good and poor design, Understanding Your Users, Designing the Experience, Elements of user Experience, Visual Design Principles, Functional Layout, Interaction design, Introduction to the Interface, Navigation Design, User Testing, Developing and Releasing Your Design

UNIT – 3
UI/ UX Design Tools: User Study- Interviews, writing personas: user and device personas, User Context, Building Low Fidelity Wireframe and High-Fidelity Polished Wireframe Using wireframing Tools, Creating the working Prototype using Prototyping tools, Sharing and Exporting Design
UNIT - 4
Web Design: Wireframes to Prototypes: Responsive web design and mobile web challenges: Mobile-first approach, Web typography, The relationship between design and programming and whether it is important to know how to code the different web technologies that make the web work, such as HTML, CSS, JavaScript, server-side coding, and databases.

Practice Sessions

Contents
1. Introduction to Figma Design tools (All basic Componets)
2.Design backgrounds in Figma and Blending Modes
3.Incoroprate Google Fonts and Gradients Colors
4.Design Layout Grids and Responsive Design
5.Create Apple Watch Ring Using Figma
6.To create simple Blob background in Figma
7.Desiging using UIKits in Figma
8.Design an Icons using Tools provided
9.Publishing Design styles and components
10.3D Mock-ups to design

TEXTBOOKS:

1. A Project Guide to UX Design: For user experience designers in the field or in the making (2nd. ed.). Russ Unger and Carolyn Chandler. New Riders Publishing,USA, 2012.
2. The Elements of User Experience: User-Centered Design for the Web and Beyond, Second Edition Jesse James Garrett, Pearson Education. 2011.
3. The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, Third Edition Wilbert O. Galitz , Wiley Publishing, 2007.
5. The UX Book Process and Guidelines for Ensuring a Quality User Experience, Rex Hartson and Pardha S. Pyla, Elsevier, 2012

Course Title	Web Technologies				Course Type		HC	
Course Code	B20EP0602	Credits	2		Class		VI Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	CIE	SEE
	Practical	0	0	0				
	Total	**2**	**3**	**3**	**14+28**	**0**	**50%**	**50 %**

COURSE OVERVIEW:

Web Technologies. Enable the students to know techniques involved to support real-time Software development. To highlight the features of different technologies involved in Web Technology and various Scripting Languages.

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate the Semantic Structure of HTML and CSS.
2. Compose forms and tables using HTML and CSS.
3. Design Client-Side programs using JavaScript.
4. To impart skills required to develop web applications and services.
5. To provide students with conceptual and practical knowledge of web applications.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply XHTML and CSS syntax and semantics to build web pages.	1,2,3,4,5	1,2,3
CO2	Identify tools and technologies for Web applications.	1,2,3,4,5	1,2,3
CO3	Apply appropriate user experience and interactive design concepts to custom websites.	1,2,3,4,5	1,2,3
CO4	Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student-designed projects.	1,2,3,4,5	1,2,3
CO5	Design and build applications using Android and or iOS UI Paradigms	1,2,3,4,5	1,2
CO6	Apply Reactive and Functional programming concepts	1,2,3,4,5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2								3	2	1
CO2	3	3	3	2	2								3	2	1
CO3	3	3	2	2	2								3	2	
CO4	3	3	3	2	2								2	2	1
CO5	3	3	2	2	2								3	2	1
CO6	3	3	3	2	2								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
UNIT – 1 **Introduction HTML and XHTML:** WWW architecture, Fundamentals of HTML Introduction to Computers and Internet, World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, MIME, Hypertext Transfer Protocol. Text formatting tags, marquee, inserting images, Links, Lists, creating tables, Frames, Working with form elements. Syntactic differences between HTML and XHTML.
UNIT – 2

Cascading Style Sheets: : Introduction, Levels of Style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, The Box Model, Background Images, The and tags
UNIT – 3
JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic characteristics, Screen output and keyboard input, Control statements, Functions, Arrays in JavaScript, Constructors, Pattern Matching using Regular Expressions, Events and Event handling.
UNIT - 4
React Native: React, JSX ,Components ,Props,State, Style,Components, Views, User Input, Debugging, Data, Navigation, Expo Components, Creating Custom Cards, Touchable Opacity, Reusing Components, Communicating with child from parent, Handling Text Inputs,Working with Scroll View,App Build

TEXTBOOKS:

1. Robert W. Sebesta, "Programming the World Wide Web", 7th Edition. Addison-Wesley, 2012.
2. Kogent Learning Solutions Inc., "Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML Black Book", Dream tech Press, ISBN-13: 978-9351192510, Paperback – 19 Dec 2013
3. Bonnie Eisenman "Learning React Native: Building Native Mobile Apps with JavaScript" : O'Reilly Media, Inc. ISBN: 9781491989142

REFERENCE BOOKS

1. Gi Houssein Djirdeh , Anthony Accomazzo , Sophia Shoemaker-" Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native"
2. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999.
3. Aferganatel, "Web Programming: Desktop Management", PHI, 2004.
4. Rajkamal, "Web Technology", Tata McGraw-Hill, 2001.

Course Title	Computer Networks				Course Type		HC	
Course Code	B20EN0603	Credits	3		Class		VI Semester	
Embedded Systems	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	0	0	0	Theory	Practical	IA	SEE
	Practice	0	0	0				
	Total	**3**	**3**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The main objective of this course is to provide a foundational view of communication networks: the principles upon which the Internet and other computer networks are built; how those principles translate into deployed protocols and hands-on experience on solving challenging problems with network protocols. Computer communication networks course will include topics such as link-layer technology, switching, routing protocols, the Internet Protocol, reliability, flow control, congestion control, and their embodiment in TCP and UDP, Quality of Service and application layer protocols such as HTTP, etc. The course will involve a significant amount of network simulator tool to design the basic network topologies and protocols.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the basics of data communication and networking.
2. Classify multiple access methods and identify different LANs.
3. Illustrate functions of network layer and demonstrate different routing protocols
4. Discuss transport layer and application layer protocols

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Explain the fundamental concepts of basic networking, Protocols, Standards and Layered models	1,2,3	1,2,3
CO2	Compare OSI Model & TCP/IP Suite	1,2,3	1,2,3
CO3	Differentiate multiple access methods and LANs	1,2,3	1,2,3
CO4	Demonstrate the concepts of network layer and build sub-nets and routing mechanism.	1,2,3,5	1,2,3
CO5	Evaluate different transport layer protocols	1,2,3,5	1,2,3
CO6	Evaluate different application layer protocols	1,2,3,5	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	
CO6	✓	✓	✓	✓	✓	

COURSE ARTICULATION MATRIX

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1										1	2	1
CO2	3	2	1										1	2	1
CO3	3	2	1		3								3	2	1
CO4	3	2	1		3								3	2	1
CO5	3	2	1		3								3	2	1
CO6	3	2	1		3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to Data Communication and Networking: Layered tasks, OSI Model, TCP/IP Suite, and Comparison of OSI Model & TCP/IP Suite. Addressing of TCP/IP Model. Framing, Flow and Error Control, Protocols: Noiseless channels and noisy channels, HDLC
UNIT - 2
Multiple Access &LANs: Random access, Controlled access, Channelization. Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN IEEE 802.11
UNIT - 3
Network Layer: Logical addressing, Ipv4 addresses, Ipv6 addresses, Internetworking, Ipv4 Header Format and Ipv6 Header Format, Transition from Ipv4 to Ipv6. Distance vector routing, link state routing.
UNIT - 4

Transport layer & Application Layer: Process to Process Delivery, UDP, TCP, SCTP, Domain Name System, Resolution

TEXTBOOKS:

1. B Forouzan "Data Communication and Networking", 4th Ed, TMH 2006.

REFERENCE BOOK:

1. James F. Kurose, Keith W. Ross "Computer Networks", Pearson Education, 2nd Edition, 2003.
2. Wayne Tomasi "Introduction to Data communication and Networking" Pearson Education 2007
3. S. Keshav, "An Engineering Approach to Computer Networking", Pearson Education

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch01.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch02.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch11.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch12.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch13.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch14.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch19.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch20.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch22.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch23.ppt

http://highered.mheducation.com/sites/dl/free/0072967757/281735/ch25.ppt

Course Title	Basic VLSI Design				Course Type		HC	
Course Code	B20EP0604	Credits	3		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	0	0	0				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

This course provides fundamental concepts, basic theory, and design methodologies of VLSI design technology. Furthermore, the structures of designing VLSI systems include MOS devices and circuits, fabrication process, MOS design rules, physical design of MOS circuits. Development of arithmetic building blocks and memories using MOS circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. To acquire the knowledge of different types of MOSFETS, electrical properties of MOS circuits, and Fabrication process.
2. To introduce the physical design of MOS circuits.
3. To present the fundamental concept of CMOS logic gates design techniques.
4. To illustrate the arithmetic building blocks and memories using MOS circuits.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Differentiate the Enhance type MOSFET and Depletion type MOSFET	1,2,3,4	1,2,3
CO2	Analyze the various types of MOS circuits, design equations, and Fabrication processes	1,2,3,4	1,2,3
CO3	Sketch the stick diagram and physical design of MOS circuits	1,2,3,4	1,2,3
CO4	Design and analyze the CMOS logic circuits, and CMOS Pass transistor logic	1,2,3,4	1,2,3
CO5	Design and development of arithmetic building blocks	1,2,3,4	1,2
CO6	Differentiate SRAM and DRAM semiconductor memory technologies	1,2,3,4	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2										2	1
CO2	3	3	2	2										2	1
CO3	3	3	2	2										2	
CO4	3	3	2	2										2	1
CO5	3	3	2	2										2	1
CO6	3	3	2	2										2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

THEORY:

Contents
Unit 1
Introduction to MOS Circuits: Introduction to Integrated circuit Technology, Basic IC design flow chart, Basic MOS transistors: Enhancement mode transistor action, Depletion mode transistor action, Basic steps of fabrication process of NMOS, PMOS, CMOS. Introduction to BiCMOS Technology. **MOS Device Design Equations:** Ids versus V_{ds}, Non-Saturated Region, Saturated Region, MOS Transistor threshold voltage, Tansconductance g_m and output conductance g_{ds}, nMOS Inverter, CMOS Inverter.
Unit 2
VLSI Circuit Design Processes: Stick diagrams, Stick diagrams of standard gates, Design Rules, Physical Design (Layout) of Logic gates and Logic Functions.
Unit 3

CMOS Logic Gates Design: NAND and NOR gates, Complex Logic gates, CMOS Full Adder Circuit, Pass transistors transmission Gate, CMOS Transmission Gates, Complementary Pass Transistor Logic (CPL).
Unit 4
Arithmetic Building Blocks and Memories: Design of arithmetic building blocks: Adders, Multipliers, shifters, Semiconductor Memories: SRAM, and DRAM.

TEXTBOOKS:

1. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", 3rd Edition, PHI, 2017.
2. Sung-Mo Kang and Yusif Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, 3rd Edition, 2007.
3. Neil H. E Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 4th Edition, 2011.

REFERENCE BOOKS

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, "Digital Integrated Circuits: A Design Perspective", 2nd Edition, Pearson, 2016.
2. John. P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley, 1st Edition, 2009.

Course Title	Web Technologies Lab				Course Type		HC	
Course Code	B20EP0605	Credits	1		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	0	0	0				
	Tutorial	0	0	0	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50 %**

COURSE OVERVIEW:

Web Technologies. Enable the students to know techniques involved to support real-time Software development. To highlight the features of different technologies involved in Web Technology and various Scripting Languages.

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate the Semantic Structure of HTML and CSS.
2. Compose forms and tables using HTML and CSS.
3. Design Client-Side programs using JavaScript.
4. 4.To impart skills required to develop web applications and services.
5. To provide students with conceptual and practical knowledge of web applications.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Apply XHTML and CSS syntax and semantics to build web pages.	1,2,3,5	1,2,3
CO2	Identify tools and technologies for Web applications.	1,2,3,5	1,2,3
CO3	Apply appropriate user experience and interactive design concepts to custom websites.	1,2,3,5	1,2,3
CO4	Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student-designed projects.	1,2,3,5	1,2,3
CO5	Design and build applications using Android and or iOS UI Paradigms	1,2,3,5	1,2
CO6	Apply Reactive and Functional programming concepts	1,2,3,5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2								3	2	1
CO2	3	3	3		2								3	2	1
CO3	3	3	2		2								3	2	
CO4	3	3	3		2								2	2	1
CO5	3	3	2		3								3	2	1
CO6	3	3	3		3								3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

LAB EXPERIMENTS

Contents

1. Write a javascript to design a simple calculator to perform the following operations:sum, product, difference and quotient.

2. Write a javascript that calculates the squares and cubes of the numbers from 0 to 10 and outputs html text that displays the resulting values in an html table format.

3. Write a javascript code that displays text "text-growing" with increasing font size in the interval of 100ms in red color, when the font size reaches 50pt it displays "text-shrinking" in blue color. Then the font size decreases to 5pt.

4. Develop and demonstrate a html5 file that includes javascript script that uses functions for the following problems:
   a. Parameter: a string
   b. Output: the position in the string of the left-most vowel
   c. Parameter: a number
   d. Output: the number with its digits in the reverse order

5. Create the google logo using text attributes using react native.

6. Create a mobile applications connecting components to the stylesheet using react native.

7. To recreate the snapchat login page using the design layout practices.

8. Create an iphone call app navbar using react native.

9. Create an app that provides some information on one of your role models.

10. Create app that will take a monetary value in united states dollar (usd) from a user and convert it to various currencies

TEXTBOOKS:

1. Robert W. Sebesta, "Programming the World Wide Web", 7th Edition. Addison-Wesley, 2012.
2. Kogent Learning Solutions Inc., "Web Technologies HTML, CSS, JavaScript, ASP.NET, Servlets, JSP, PHP, ADO.NET, JDBC and XML Black Book", Dream tech Press, ISBN-13: 978-9351192510, Paperback – 19 Dec 2013
3. Bonnie Eisenman "Learning React Native: Building Native Mobile Apps with JavaScript" : O'Reilly Media, Inc. ISBN: 9781491989142

REFERENCE BOOKS

1. Gi Houssein Djirdeh , Anthony Accomazzo , Sophia Shoemaker-" Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native"
2. Eric Ladd, Jim O' Donnel, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999

3. Aferganatel, “Web Programming: Desktop Management”, PHI, 2004.
4. Rajkamal, “Web Technology”, Tata McGraw-Hill, 2001.

Course Title	Computer Networks Lab				Course Type		HC	
Course Code	B20EN0606	Credits	1		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-			Theory	Practical	IA	SEE
	Practice	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are:

1. Identify the necessary software and hardware to constitute a designed computer network
2. Implement a simple LAN Network
3. Describe, Analyze and evaluate a number of datalink, network, and transport layer protocols
4. Describe routing protocols

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Write and debug the code for various error detection, Congestion Control Techniques		
CO2	Write and test the code using different security techniques to secure the messages,		
CO3	Write the program and evaluate different network layer and transport layer protocols		
CO4	Write the code for different wired and wireless network scenarios and test the performance using simulators		
CO5	Evaluate various design parameters such as latency, error rate, throughput, and their influence on node/link utilization and performance		

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1	✓	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	

COURSE ARTICULATION MATRIX

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2		3				2	2			1	2	3
CO2	2	2	2		3				2	2			1	2	3
CO3	2	2	2		3				2	2			1	2	3
CO4	2	2	2		3				2	2			1	2	3
CO5	2	2	2		3				2	2			1	2	3

Note:1-Low,2-Medium,3-High

PRACTICE SESSION:

Sl. No.	**Name of the Practice Session**	**Tools and Techniques**	**Expected Skill /Ability**
1	Write a program for bit stuffing & de-stuffing using HDLC.	C/C++ Software	Identify bit stuffing and destuffing
2	Write a program for character stuffing & de-stuffing using HDLC.	C/C++ Software	Identify byte stuffing and destuffing
3	Perform the Encryption and Decryption of a given message using substitution method.	C/C++ Software	Analyze the Encryption and Decryption of a given message using substitution method.
4	Choose the two prime numbers, p=17 and q=11.Write a program for public key encryption system using RSA algorithm to encrypt and decrypt the message.	C/C++ Software	Understand the key concept of public key encryption system using RSA algorithm to encrypt and decrypt the message.
5	Write a program to implement the congestion control b using the leaky bucket algorithm. Examine node transmitting/receiving packets to/from other nodes. Using a random function; vary the packet size.	C/C++ Software	Analyze the leaky bucket algorithm for congestion control

6	Write a program for distance vector algorithm to find the shortest path for transmission.	C/C++ Software	Analyze to find the shortest path using the distance vector algorithm
7	Create a three node network topology and connect the duplex links between them. Tcl script to observe the packet flow for the given network in network animator (NAM)	NS2 Simulator Software	Understand the concept of duplex link in a given three node topology, and analyze the packet flow.
8	Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply TCP agent between n0-n3, n1-n3. Apply relevant applications over TCP agents by changing the parameters and hence determine the number of packets transmitted.	NS2 Simulator Software	Analyze the concept of TCP agent for a given four node network and determine the number of packets transmitted
9	Simulate a four node point-to-point network, and connect the links as follows: n0-n2, n1-n2 and n2-n3. Apply UDP agent between n0-n3, n1-n3. Apply relevant applications over UDP agents by changing the parameters and hence determine the number of packets transmitted.	NS2 Simulator Software	Analyze the concept of UDP agent for a given four node network and determine the number of packets transmitted
10	Simulate a three nodes point-to point network and connect the duplex links between them. Set the queue size, vary the transmission speeds (bandwidth)and find the number of packets dropped.	NS2 Simulator Software	Evaluate the concept of duplex link in a given three node topology, and analyze queue size, the transmission speeds (bandwidth)and the number of packets dropped.
11	Simulate an Ethernet LAN using N-nodes (6-10) with UDP/TCP connection. Apply relevant applications over UDP/TCP agents by changing the parameters and hence determine the number of packets transmitted.	NS2 Simulator Software	Analyze packet transmission in 802.3 Ethernet using UDP/TCP
12	Simulate a wireless network for n nodes. For a wireless network consisting of three mobile nodes (n0-n2), Nodes are configured with the specific parameters of a wireless node. Initial location of the node is fixed. Nodes are given mobility with fixed speed and fixed destination location. TCP agent is attached to node0 and TCP sink agent is attached to node1. Both the agents are connected and FTP application is attached to TCP agent. Write a Tcl script and make an ad-hoc simulation to analyze the output in the trace file. Use the routing protocol as Adhoc on demand distance vector (AODV).	NS2 Simulator Software	Design and analyze AODV protocol for wireless networks.

TEXTBOOKS:

1. B Forouzan “Data Communication and Networking”, 4th Ed, TMH 2006.

REFERENCE BOOK:

1. James F. Kurose, Keith W. Ross “Computer Networks”, Pearson Education, 2nd Edition, 2003.
2. Wayne Tomasi ”Introduction to Data communication and Networking” Pearson Education 2007
3. S. Keshav, “An Engineering Approach to Computer Networking”, Pearson Education

Course Title	Basic VLSI Design Lab				Course Type		HC	
Course Code	B20EP0606	Credits	3		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	0	0	0				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**0**	**28**	**50%**	**50 %**

COURSE OVERVIEW:

This course provides fundamental concepts, basic theory, and design methodologies of VLSI design technology. Furthermore, the structures of designing VLSI systems include MOS devices and circuits, fabrication process, MOS design rules, physical design of MOS circuits. Development of arithmetic building blocks and memories using MOS circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. To acquire the knowledge of different types of MOSFETS, electrical properties of MOS circuits, and Fabrication process.
2. To introduce the physical design of MOS circuits.
3. To present the fundamental concept of CMOS logic gates design techniques.
4. To illustrate the arithmetic building blocks and memories using MOS circuits.

COURSE OUTCOMES (COs):

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate a clear Understanding in hardware design language Verilog HDL	1,2,3,5	1,2,3
CO2	Model a Combinational circuit using hardware description language Verilog HDL and validate its functionality	1,2,3,5	1,2,3
CO3	Implement various combinational and sequential circuits using Verilog	1,2,3,5	1,2,3
CO4	Describe the physical design process of Digital Integrated Circuits	1,2,3,5	1,2,3
CO5	Demonstrate the ability to use various EDA tools for digital system design	1,2,3,5	1,2

CO6	Implement schematic and layout of various digital CMOS logic circuits using EDA tools.	1,2,3,5	1,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES:

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2		2							1	3	2	1
CO2	3	3	3		2							1	3	2	1
CO3	3	3	2		2							1	3	2	
CO4	3	3	3		2							1	2	2	1
CO5	3	3	2		3							1	3	2	1
CO6	3	3	3		3							1	3	2	1

Note:1-Low,2-Medium,3-High

COURSE CONTENTS:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Write a Verilog HDL program with a suitable test bench to simulate an Inverter and buffer using switch level description	HDL Switch level modelling, Test bench verification, Cadence NCSim	HDL Programming skills/Design and Analysis of MOSFET circuits
2	Write a Verilog HDL program with a suitable	HDL Switch level	HDL Programming

	test bench to simulate a CMOS Transmission gate and basic logic gates using switch level description	modelling, Test bench verification, Cadence NCSim	skills/Design and Analysis of MOSFET circuits
3	Write a Verilog HDL program with a suitable test bench to simulate a 32-bit ALU using behavioural description. Four logical and arithmetic operations need to be considered.	HDL behavioural level modelling, Test bench verification, Cadence NCSim	HDL Programming skills/Design and Analysis of ALU
4	Write a Verilog HDL program with a suitable test bench to simulate a SR and JK Flip-flops using behavioural description. Synthesize the design with the given constraints and generate the synthesis report	HDL behavioural level modelling, Test bench verification, Cadence NCSim, RTL compliier	HDL Programming skills/Design and Analysis of sequential circuits
5	Write a Verilog HDL program with a suitable test bench to simulate a D and T Flip-flops using behavioural description. Synthesize the design with the given constraints and generate the synthesis report	HDL behavioural level modelling, Test bench verification, Cadence NCSim, RTL compliier	HDL Programming skills/Design and Analysis of sequential circuits
6	Draw the CMOS Inverter schematic and perform the transient analysis, and DC analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
7	Draw the CMOS NAND gate schematic and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
8	Draw the CMOS NOR gate schematic and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
9	Draw the CMOS schematic of 2:1 Multiplexer and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits
10	Draw the CMOS schematic of Half-Adder and perform the transient analysis. Draw the layout and verify the design	CMOS logic circuits design, analysis, and verification of layout, Cadence virtuoso	Design, analysis, and verification of digital MOS circuits

TEXTBOOKS:

1. Douglas A. Pucknell and Kamran Eshraghian, “Basic VLSI Design”, 3rd Edition, PHI, 2017.
2. Sung-Mo Kang and Yusif Leblebici, “CMOS Digital Integrated Circuits: Analysis and Design”, Tata McGraw-Hill, 3rd Edition, 2007.

3. Neil H. E Weste and Kamran Eshraghian, Principles of CMOS VLSI Design, Pearson Education, 4th Edition, 2011.

REFERENCE BOOKS

1. Jan M. Rabaey, A. Chandrakasan, B. Nikolic, “Digital Integrated Circuits: A Design Perspective”, 2nd Edition, Pearson, 2016.
2. John. P. Uyemura, “Introduction to VLSI Circuits and Systems”, John Wiley, 1st Edition, 2009.

Course Title	Mini Project/ Internship				Course Type		FC	
Course Code	B20EN0607	Credits	2		Class		VI Semester	
Research based project	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	0	0	0				
	Tutorial	0	-	-	Theory	Practical	CIE	SEE
	Practical	2	4	4				
	Total	**2**	**4**	**4**	**0**	**52**	**50%**	**50%**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Make students to observe research in the real world
3. Make a presentation of research methods and approaches
4. Show experimental procedures and real exercises of computational issues in scientific disciplines.
5. Ask students to read and perform searches from the bibliography of a research paper, analyzing figures, diagrams, tables and simulators presented in the paper
6. Introduce students to a peer review of a research process

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Practice acquired knowledge within the chosen area of technology for project development.	7,8,9,10,11,12	1,2,3,
CO2	Identify, discuss and justify the technical aspects of the chosen project with a comprehensive and systematic approach	7,8,9,10,11,12	1,2,3,
CO3	Reproduce, improve and refine technical aspects for engineering projects.	7,8,9,10,11,12	1,2,3,
CO4	Work as an individual or in a team in development of technical projects.	7,8,9,10,11,12	1,2,3,
CO5	Communicate and report effectively project related activities and findings	7,8,9,10,11,12	1,2,3,

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1	✓	✓	✓	✓		
CO2	✓	✓	✓	✓		
CO3	✓	✓	✓	✓		
CO4	✓	✓	✓	✓		
CO5	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	2	2	2	2	2	3	3	3	3	1	1	
CO2	2	2	2	2	2	2	2	2	3	3	3	3	1	1	
CO3	2	2	2	2	2	2	2	2	3	3	3	3	1	1	
CO4	2	2	2	2	2	2	2	2	3	3	3	3	1	1	
CO5	2	2	2	2	2	2	2	2	3	3	3	3	1	1	

Note:1-Low,2-Medium,3-High

Course Title	Indian Traditions and Culture				Course Type		FC	
Course Code	B20PA0501	Credits	1		Class		VI Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment Weightage	
	Lecture	1	1	1				
	Tutorial	-	-	-	Theory	Practical	CIE	SEE
	Practical	-	-	-				
	Total	**1**	**1**	**1**	**13**	**-**	**50%**	**50 %**

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide conceptual knowledge of Indian culture and traditions
2. Introduce students to the science and technological advancements related to Indian culture
3. Help students understand the Indian spiritual aspects of Indian culture
4. Help learners understand the factors which unite the diverse cultures of India

COURSE OUTCOMES (COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Gain conceptual understanding of Indian culture and traditions.	6	1
CO2	Describe various ancient theories in treatment of any disease.	6	1
CO3	Appreciate the science and technological advancements in ancient India	6	1
CO4	Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation and nirvana.	6	1
CO5	Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food	6	1
CO6	Understand India as a land united by cultural diversity.	6	1

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1	✓	✓				
CO2	✓	✓				

CO3	✓	✓				
CO4	✓	✓				
CO5	✓	✓				
CO6	✓	✓				

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1						2							1		
CO2						2							1		
CO3						2							1		
CO4						2							1		
CO5						2							1		
CO6						2							1		

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
Unit 1 **Indian Tradition** Culture – Indus Valley Civilization and early cultural practices, The Vedic culture, Influence of Buddhism and Jainism on Indian Culture, Influence of Islam and Christianity, Indian Cultural Renaissance of the 19th Century Religion – Pre-vedic and Vedic religion, Jainism, Buddhism, Hinduism, Religious Reform Movements, Advent of Christianity Art – Introduction to Natyashastra, classical and contemporary art forms (dance and music), regional art forms (dance and music), Folk art, puppetry Architecture – Engineering and Architecture in Ancient India; Evolution of Hindu Temple Structures, Sculptures, Coins and Pottery from Ancient India Literature- Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.
Unit 2 **Contribution of ancient India to Science and Maths** i. Development of Science in Ancient India- Astronomy, Mathematics, Medicine, Metallurgy.

ii. Scientists of Ancient India - Mathematics and Astronomy- Baudhayan, Aryabhata, Brahmagupta, Bhaskaracharya, Mahaviracharya

Science- Kanad, Varahamihira, Nagarjuna
Medical Sciences (Ayurveda and Yoga)- Susruta, Charaka, Yoga and Patanjali

iii. Science and Scientists in Medieval India- Mathematics, Biology, Chemistry, Astronomy, Medicine, Agriculture.

iv. Scientists in Modern India- Srinivas Ramanujan, Chandrasekhara V Raman, Jagadish Chandra Bose, Homi Jehangir Bhabha, Dr, Vikram Ambalal Sarabhai, Dr. APJ Abdul Kalam

Unit 3

Indian Spiritual Aspects

I. Hindu Spirituality based on shruti and smriti- Hinduism in General, Basic notions of Vedas, Upanishads, Ramayana, Mahabharata & Bhagavat Gita.

ii. Hata Yoga and Pranayama- Main Features, Basics of Yoga –Different kinds of Yoga; Raja Yoga (Ashtanga yoga); Karma yoga; Bhakti Yoga – yoga of Loving Devotion; Jnana yoga – Yoga of Knowledge; Hatha Yoga (Asana/ Pranayamas); Kundalini Yoga; Nada Yoga; Sannyasa Yoga

iii. Buddhist, Jaina Spiritualities- Main Doctrines of Buddhism: Four Noble Truths (Arya Satya), Concept of Nirvana - Ashtanga Marga

Unit 4

Unity in Diversity

Commensality and the Significance of Food – Eating Together as Family and as a Society, Food at Rituals; annaprasan, marriage and funeral, Kitchen as Shared Space for Women, Food and Nationalist Response of Indian Community, Visibility of Indian Cuisine in the World
Celebrating Diverse Festivals – Festival Types: Religious and Seasonal, Religious - Holi, Diwali, Ganesh Chaturthi, Janmashtami, Mahavir Jayanthi, Ramadan, Christmas, Buddha Purnima; Seasonal (harvest festivals) - Baisakhi, Pongal, Sankranti
Attire - Indus Valley Civilization, Vedic period, Modern India

TEXTBOOKS

1. Sundararajan K.R., “Hindu Spirituality - Vedas through Vedanta, Cross Road Publications”, New York, 1997.
2. Griffiths Bede, “Yoga and the Jesus Prayer Tradition, Asian Trading Corporation”, Bangalore, 1992
3. Ansh Mishra, Science in Ancient India, Indian Corporation, New Delhi, 1998
2. Sen Taylor, Collen. Feasts and Fasts: A History of Food in India. Reaktion Books, New Delhi, 2014.
3. Thapar, Romila, Readings in Early Indian History. Oxford University Press. New Delhi, 2018

6th Semester

PROFESSIONAL ELECTIVE-3

Course Title	Fundamentals of Analog and Digital Communication				Course Type		Softcore	
Course Code	B20EPS631	Credits	3		Class		6 Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**45**	**0**	**50%**	**50%**

COURSE OVERVIEW:

To study about the various modulation techniques like amplitude and angle modulation, that is used for data transmission and reception of analog signals and to understand about the modulation techniques used for digital transmission along with spread spectrum and multiple access techniques.

COURSE OBJECTIVES:

The objectives of this course are:

1. To develop ability to analyze system requirements of analog and digital communication systems.
2. To understand the generation, detection of various analog and digital modulation techniques.
3. To acquire theoretical knowledge of each block in AM, FM transmitters and receivers.
4. To understand the concepts of baseband transmissions.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Analyze and design of various continuous wave and angle modulation and demodulation techniques	1,2,3	1,2,3
CO2	Understand the effect of noise present in continuous wave and angle modulation techniques.	1,2,3	1,2,3
CO3	Attain the knowledge about AM, FM Transmitters and Receivers	1,2,3	1,2,3
CO4	Analyze and design the various Pulse Modulation Techniques.	1,2,3	1,2,3
CO5	Understand the concepts of Digital Modulation Techniques and Baseband transmission.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

	Bloom's Level

	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2		✓				
CO3			✓			
CO4			✓			

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1										1	1	1
CO2	2	2	3										1	2	2
CO3	2	2	3										1	2	2
CO4	1	2	1										1	1	1
CO5	2	2	2										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1 **Introduction to Communication Systems**: Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems (AM – FM – PM).
UNIT - 2 **Pulse Communication:** Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System (PAM – PTM – PCM). Data Communication: History of Data Communication – Standards Organizations for Data Communication- Data Communication Circuits – Data Communication Codes – Data communication Hardware – serial and parallel interfaces.
UNIT - 3 **Shift Keying:** Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM – 16 QAM – Bandwidth Efficiency– Comparison of various Digital Communication System (ASK – FSK – PSK – QAM).

UNIT - 4

Access Schemes: Global System for Mobile Communications (GSM) – Code division multiple access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

TEXTBOOKS:

1. Analog and Digital Communications – Simon Haykin, John Wiley, 2005.
2. Electronics Communication Systems-Fundamentals through Advanced-Wayne Tomasi, 5th Edition, 2009, PHI.

REFERENCE BOOKS:

1. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.
2. Martin S.Roden, "Analog and Digital Communication System", 3rd Edition, PHI, 2002.

Course Title	Agile Software Development and Devops				Course Type		Softcore	
Course Code	B20EPS632	Credits	3		Class		5 Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**39**	**0**	**50%**	**50%**

COURSE OVERVIEW:

The course provides students with a knowledge on the basic principles of software development life cycle, activities involved in software requirements engineering, software development, testing, evolution and maintenance. It introduces concepts such as software processes and agile methods, and essential software development activities

COURSE OBJECTIVES:

The objectives of this course are:

1. Discuss the importance of the software development process.
2. Explain the workflow of Automating process.
3. Illustrate with case study, the importance of DevOps.
4. To provide insights Describe the software life cycle using a case study.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Outline the importance of the software development process.	1,2,3	1,2,3
CO2	Design the workflow of Automating process.	1,2,3	1,2,3
CO3	Make use of DevOps.	1,2,3	1,2,3
CO4	Describe the software life cycle	1,2,3	1,2,3
CO5	Develop an application using software life cycle.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**

CO1			✓			
CO2		✓				
CO3			✓			
CO4			✓			

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1										1	1	1
CO2	2	2	3										1	2	3
CO3	2	2	3										1	1	3
CO4	1	2	1										1	1	1
CO5	1	2	1										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Defining the Software Development Process: Goals of Defining the Software Development Process , Why Is Defining the Software Development Process Important? , Where Do I Start?, Explaining the Software Development Lifecycle , Systems versus Software Development Lifecycle, Defining Requirements, Managing Complexity and Change, Validity of Requirements, Testing Requirements ,Functional Requirements, Nonfunctional Requirements, Epics and Stories, Planning for Changing Requirements , Workflow for Defining Requirements ,Test-Driven Development , Designing Systems ,Software Development ,Testing , Testing the Application ,Testing the Process Itself , Continuous Integration , Continuous Delivery and Deployment , Defining Phases of the Lifecycle ,Documentation Required , DevOps , Communicating with All Stakeholders, Production Support ,Maintenance and Bugfixes, Lifecycle in the Beginning ,Maintenance of the Lifecycle, Creating the Knowledge Base.
UNIT - 2
Agile Application Lifecycle Management: Goals of Agile Application Lifecycle Management, Why Is Agile ALM Important? Where Do I Start? Understanding the Paradigm Shift, Rapid Iterative Development, Remember RAD? , Focus on 12 Agile Principles, Agile Manifesto, Fixed Timebox Sprints, Customer Collaboration, Requirements, and Documentation.

UNIT - 3

Automating the Agile ALM: Goals of Automating the Agile ALM, Why Automating the ALM Is Important, Where Do I Start? Tools, Do Tools Matter? Process over Tools, Understanding Tools in the Scope of ALM, Staying Tools Agnostic, Commercial versus Open Source, What Do I Do Today? ,Automating the Workflow , Process Modeling Automation ,Managing the Lifecycle with ALM, Broad Scope of ALM Tools ,Achieving Seamless Integration ,Managing Requirements of the ALM, Creating Epics and Stories, Systems and +Driven Development ,Environment Management ,Gold Copies ,Supporting the CMDB, Driving DevOps ,Supporting Operations ,Help Desk ,Service Desk ,Incident Management , Problem Escalation ,Project Management, Planning the PMO ,Planning for Implementation, Evaluating and Selecting the Right Tools ,Defining the Use Case ,Training Is Essential, Vendor Relationships, Keeping Tools Current.

UNIT - 4

DevOps: Goals of DevOps, Why Is DevOps Important? Where Do I Start? How Do I Implement DevOps? Developers and Operations Conflicts, Developers and Operations Collaboration, Need for Rapid Change, Knowledge Management, the Cross-Functional Team, Is DevOps Agile? The DevOps Ecosystem, Moving the Process Upstream, Left-Shift, Right-Shift, DevOps in Dev, DevOps as Development, Deployment Pipeline, Dependency Control, Configuration Control, Configuration Audits, QA and DevOps, Information Security, Infrastructure as Code, Taming Complexity, Automate Everything, Disaster Recovery and Business Continuity, Continuous Process Improvement.

TEXTBOOKS:

3. Bob Aiello and Leslie Sachs, “Agile Application Lifecycle Management Using DevOps to Drive Process Improvement”, Addison Wesly, First printing, June 2016.

REFERENCE BOOK:

1. Roger S, “Software Engineering – A Practitioner's Approach”, seventh edition, Pressman, 2010.
2. Roger Pressman, Ian Summerville, “Software Engineering”, 9th edition, 2010.
3. Hans Van Vliet, “Software Engineering: Principles and Practices”, 2008.
4. Richard Fairley, “Software Engineering Concepts”, 2008.
5. ACM Transactions on Software Engineering and Methodology (TOSEM).
6. IEEE Transactions on Software Engineering.

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/101/106101061/
2. https://nptel.ac.in/courses/106/105/106105182/
3. https://www.coursera.org/specializations/agile-development
4. https://www.coursera.org/courses?languages=en&query=agile%20development

Course Title	Robotics and Automation				Course Type		Softcore	
Course Code	B20EPS633	Credits	3		Class		6 Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	0	0	0	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**3**	**3**	**3**	**45**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Robotics is the interdisciplinary branch of engineering and science that includes mechanical engineering, electrical engineering, computer science, and others. Robotics deals with the design, construction, operation, and use of robots as well as computer systems for their control, sensory feedback, and information processing. Automation and Robotics are two closely related technologies. Automation as the technology that is concerned with the use of mechanical, electronic, and computer-based systems in the operation and control of production. The course provides robot classification and anatomy, Robot kinematics, Trajectory Planning and control, Sensors and vision systems used in robots and Robot Programming

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide insights into Robots and anatomy.
2. To Understand Robot kinematics
3. To introduce the concepts of Sensors and vision systems used in robots.
4. To give details of writing Robot Program.

COURSE OUTCOMES(COs)

On successful completion of this course; the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the basic applications and advantages of using robots in the industry.	1,2,3	1,2,3
CO2	Do the robot motion analysis.	1,2,3	1,2,3
CO3	Relate mathematical modeling and trajectory planning scheme in robots.	1,2,3	1,2,3
CO4	Recognize the different types of sensors and cameras used in the field of robotics.	1,2,3	1,2,3
CO5	Write robot programs and upgrade knowledge on different types of cell layout applicable in robotics.	1,2,3	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			✓			
CO2		✓				
CO3			✓			
CO4			✓			
CO5			✓			

COURSE ARTICULATION MATRIX:

Mapping of Course Outcomes with Program Outcomes

CO/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1										1	1	1
CO2	2	2	3										1	2	2
CO3	2	2	3										1	2	2
CO4	1	2	1										1	1	1
CO5	2	2	2										1	1	1

Note:1-Low,2-Medium,3-High

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to robotics: Definition, anatomy of robot, classification configurations, robot links and joints, robot specifications, resolution accuracy and repeatability, simple numerical problems, robot drive systems, hydraulic, pneumatic and electric drive systems, wrist and its motions, end effectors, types of end effectors, mechanical grippers, methods of constraining parts in grippers, types of gripper mechanisms, simple numerical problems, vacuum cups, magnetic grippers, adhesive grippers, hooks, scoops and other gripper devices, tool as end effectors, examples.
UNIT - 2
Robot motion analysis & Robot control: Direct kinematics and inverse kinematics, 3D homogeneous transformations, rotation, translation and displacement matrix, composite rotation matrix, rotation matrix about an arbitrary axis, links, joints and

their parameters, Denavit-Hertenberg (D-H) representation, application of D-H matrices to different robot configurations.

Basic control systems and models, transfer function with examples, transfer function for spring-mass-damper system, transient response of a second order system, transfer function of a robot joint, different types of controllers, proportional (P) controller, integral (I) controller, derivative (D) controller, PID controller, simple numerical problems

UNIT - 3

Robot trajectory planning & Robot sensors:

Trajectory planning, definition, steps in trajectory planning, joint space techniques, use of a p-degree polynomial as interpolation function, cubic polynomial trajectories, linear function with parabolic blends, joint space verses Cartesian space trajectory planning, simple numerical problems on joint space trajectory planning. Classification of robot sensors and their functions, touch sensor, tactile sensor, binary sensor, analog sensor, proximity sensor, range sensor, force, and torque sensor

UNIT - 4

Robot sensors and Machine Vision & Robot programming

Machine vision, functions of machine vision system, sensing and digitizing, imaging devices, analog to digital signal conversion, quantization and encoding, simple numerical problems, image storage, image processing and analysis, image data reduction, segmentation, feature extraction, object recognition, robotic machine vision applications, inspection, identification, visual serving, and navigation.

Introduction to robot programming, robot cell layout, work cell control and interlocks, manual programming, lead through and walkthrough programming, off-line programming, VAL programming language, example, AML and VAL-II robot programming languages, examples, Programming with graphics, example.

TEXTBOOKS:

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey: Industrial Robotics, McGraw-Hill Publications, International Edition, 2008.
2. James G. Keramas: Robot Technology Fundamentals, Cengage Learning, International Edition 1999.

Reference Books:

1. Fu K. S., Gonzelez R. C., Lee C. S. G: Robotics: Control, Sensing, Vision, IntelligenceMcGraw Hill Book Co., International edition, 2008.
2. Yorem Koren,: Robotics for Engineers, McGraw-Hill Publication, International edition, 1987
3. Craig, J. J: Introduction to Robotics: Mechanics and Control, Pearson Prentice-Hall Publications, 3rd edition, 2005.
4. Schilling R. J: Fundamentals of Robotics, Analysis and Control, Prentice-Hall Publications, Eastern Economy edition, 2007
5. Appu Kuttan K. K: Robotics, International Publications, First Edition, 2007
6. R. K. Mittal, I. J. Nagrath: Robotics and Control Tata-McGraw-Hill Publications, 2007.