REVA UNIVERSITY
Bengaluru, India

SCHOOL OF ELECTRONICS AND COMMUNICATION ENGINEERING

B. Tech. in Electronics and Computer Engineering

2021-25
(II Year)

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Rukmini Educational
Charitable Trust

www.reva.edu.in

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Detailed Syllabus

III 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	B20AS0305	Linear algebra and Partial Differential Equations	FC	3	0	0	3	3
2	B20EN0301	Linear Integrated Circuits	HC	3	0	0	3	3
3	B20EP0301	Digital Electronics and Verilog	HC	3	0	0	3	3
4	B20EP0302	Design and Analysis of Algorithms	HC	1	1	1	3	5
5	B20EN0304	Problem solving using C Programming	HC	1	1	0	2	3
TOTAL				**11**	**2**	**1**	**14**	**17**
Practical /Term Work / Sessional								
6	B20EN0306	Linear Integrated Circuits Lab	HC	0	0	1	1	2
7	B20EP0303	Digital Electronics and Verilog Lab	HC	0	0	1	1	2
8	B20EN0308	Problem Solving Using C Programming lab	HC	0	0	1	1	2
9	B20EN0305	Course Based Project on Linear Integrated Circuits	HC	0	0	1	1	2
10	B20AS0303	Environmental Science	FC	2	0	0	2	2
11	B20MG0301	Management Science	FC	2	0	0	2	2
12	B20AHM301/ B20AHM302	Advanced Kannada/Basic Kannada	MC	1	0	0	0	1
TOTAL				**5**	**0**	**4**	**8**	**13**
TOTAL SEMESTER CREDITS				**22**				
TOTAL CUMULATIVE CREDITS				**62**				
TOTAL CONTACT HOURS				**30**				

Course Title	Linear Algebra and Partial Differential Equations				Course Type		HC	
Course Code	B20AS0305	Credits	3		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3			IA	SEE
	Tutorial	-	-	-				
	Practical	-	-	-	Theory	Practical		
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50 %**

COURSE OVERVIEW:

Linear algebra is the study of linear systems of equations, vector spaces and linear transformations. Solving systems of linear equations is a basic tool of many mathematical procedures used for solving problems in Science and Engineering. The objective of the course is to give introduction to Partial Differential Equations for undergraduate students.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Understand the concepts of linear algebra and solving of system of equations Y = AX**.**
2. Understand the concepts of basis, dimension and linear transformation.
3. Understand vector differentiation, div, grad and curl.
4. learn about formation and solving partial differential equations

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply the knowledge of Linear Algebra in Image processing and digital signal processing.	1,2,3,4	1,2,3
C02	Solve Engineering problems using Rayleigh Power method to find largest Eigen value and Eigen vector	1,2,3,4	1,2,3
CO3	Apply the knowledge of vector spaces in engineering like digital communication.	1,2,3,4	1,2,3
CO4	Find Surface integral and volume integral of given function to prove Stokes and Divergence theorem	1,2,3,4	1,2,3
CO5	Apply the knowledge of vector calculus in engineering like field theory.	1,2,3,4	1,2,3
CO6	Apply the knowledge of PDE in solving heat equation, wave equation and Laplace equation	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	2	1									2	2	1
CO2	3	2	2	2									2	2	1
CO3	3	3	2	1									2	2	1
CO4	3	2	2	1									2	2	1
CO5	3	3	2	1									2	2	1
CO6	3	3	2	1									2	2	1

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

COURSE CONTENT
THEORY:

Contents
UNIT - 1
Linear Algebra: Rank of matrix, Echelon form, (*reference-Normal form: one example), Solution of a system of linear equations by Gauss elimination (*reference-Gauss –Jordan methods: one example), Gauss seidel iterative method, Rayleigh Power method to find the largest Eigen value and corresponding Eigen vector. Linear and Inverse transformation. Diagonalization of a matrix, Reduction of a quadratic form to canonical form by orthogonal transformation
UNIT - 2
Vector Space: Introduction to vector spaces and sub-spaces, definitions, illustrative examples and simple problems. Linearly independent and dependent vectors-definition and problems. Basis vectors, dimension of a vector space. Linear transformations- definition, properties and problems. Rank- Nullity theorem (without proof). Matrix form of linear transformations-Illustrative examples

UNIT - 3

Vector Calculus: Curves in space, tangents and normal, Velocity and acceleration related problems, scalar and vector point functions-Gradient, Divergence and curl, directional derivatives. Solenoidal and irrotational vector fields. Vector identities-div ($\emptyset A$), curl ($\emptyset A$), curl (grad$\emptyset$), div (curl A).

Line integral-Circulation-work, Surface integral: Green's Theorem, Stokes Theorem.

Volume integral: Divergence theorem. (**All theorems without proof, no verification, only evaluation)**

UNIT - 4

Partial differential equations: Formation of Partial differential equations by eliminating arbitrary constants and arbitrary variables. Equations solvable by direct integration , Solution of Lagrange's linear PDE. Method of variable separable-D heat equation, 1-D wave equation. Non-linear equations of the first order. Charpits method.

TEXT BOOKS:

1. 1.B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015.
2. 2.Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 10th edition, 2015.

REFERENCE BOOKS:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th edition, 2013.
2. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 5th edition, 2014.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.journals.elsevier.com/linear-algebra-and-its-applications/most-downloaded-articles
2. https://www.researchgate.net/publication/304178667_A_Study_on_the_Linear_Algebra_Matrix_in_Mathematics
3. https://www.sciencedirect.com/journal/linear-algebra-and-its-applications/vol/1/issue/1
4. http://vmls-book.stanford.edu/vmls.pdf
5. https://www.researchgate.net/publication/317685719_A_Study_of_General_First-order_Partial_Differential_Equations_Using_Homotopy_Perturbation_Method
6. https://www.journals.elsevier.com/partial-differential-equations-in-applied-mathematics/

SWAYAM/NPTEL/MOOCs:

1. https://www.youtube.com/watch?v=LJ-LoJhbBA4&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7
2. https://www.youtube.com/watch?v=9h_Q-R6sXbM&list=PL7oBzLzHZ1wXQvQ938Wg1-soq09GywgOw
3. https://www.youtube.com/watch?v=Kk5SEzASkZU&list=PL9m2Lkh6odgKbfY03TFRhwjOqW79UdzK8
4. https://www.youtube.com/watch?v=W3HXK1Xe4nc&list=PLbPn3CUduj5TPQtrwfI70F1SW4LvPf90d
5. https://www.youtube.com/watch?v=Nonfmx0-LQQ

Course Title	Linear Integrated Circuits				Course Type		HC	
Course Code	B20EN0301	Credits	3		Class		III Semester	
Course Structure	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:

Linear Integrated Circuits introduces the basic building blocks of Operational amplifiers, stabilization techniques, testing, and feedback techniques. The Course also introduces to the design of applications related to analog computation, measurements, rectification, active filtering, timers, Data Converters. This course supports acquiring of knowledge in analysis and design of IC based circuits.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand the internal components and characteristics and frequency response of Operational amplifier.
2. Explain the linear, non-linear applications of Op-Amp and active filters.
3. Comprehend the applications of Op-Amp as comparators, waveform generators, VCO and PLL operation and its application
4. Discuss various applications of special function Op-Amp ICs such as 555 IC, Voltage Regulator IC
5. Understand the performance of various types of ADC and DAC using Op-Amp

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the internal components, characteristics and frequency response of Op-Amp.	1,2,3,4,5,9,10	1,2,3
CO2	Identify the linear, non-linear applications of Op-Amp and active filters.	1,2,3,4,5,9,10	1,2,3
C03	Analyze the operational amplifier applications as Wave form generators.	1,2,3,4,5,9,10	1,2,3
CO4	Categorize Op-Amp based comparators, waveform generators, VCO and PLL operation and its application.	1,2,3,4,5,9,10	1,2,3
CO5	Design various applications of special function Op-Amp ICs such as 555 timer, Voltage Regulator IC.	1,2,3,4,5,9,10	1,2,3

CO6	List andcompare the performance of various types of ADC and DAC using Op-Amp	1,2,3,4,5,9,10	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	✓	✓	✓	✓		
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	1								3	3	1
CO2	3	3	3	2	1								3	3	1
CO3	3	3	3	2	1								3	3	1
CO4	3	3	3	2	1								3	3	1
CO5	3	3	3	2	1								3	3	1
CO6	3	3	3	2	1								3	3	1

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

COURSE CONTENT

THEORY:

Contents
UNIT – 1
OP-AMPS Frequency Response, Compensation and applications: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Block diagram of Op-Amp, Modes of Operation - Inverting, Non-Inverting, Circuit stability, frequency and phase response, frequency compensating methods, bandwidth, and slew rate effects, Zin mod compensation. Linear Applications: Voltage sources, current sources and current sinks, Current amplifiers, Instrumentation amplifier, precision rectifiers

UNIT – 2

Non-linear applications of OP-AMP

Clamping circuits, peak detectors, Sample and hold circuit, V-I and I-V converter, Log and Antilog amplifiers, Multiplier and Divider, Triangular/Rectangular waveform generators, waveform generator design. Crossing detectors, Inverting Schmitt trigger circuits, Active filters- first and second order low pass and high pass filters

UNIT – 3

Voltage regulators, 555 timer and PLL

Series op-amp regulator, IC voltage regulator, 723 general purpose regulators, 555 timer-basic timer circuit, 555timer used as Astable and Monostable multivibrator, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications

UNIT – 4

DATA CONVERTERS:

Introduction, DAC and ADC Specifications. Basic DAC techniques**,** Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Different Types of ADCs - Parallel Comparator Type ADC, Single and dual slope ADC, Successive Approximation ADC,

TEXTBOOKS:

1. David A Bell, "Operational amplifiers and Linear ICs", PHI/Pearson, 2nd edition, 2004
2. D. Roy Choudhury and Shail B Jain, " Linear Integrated Circuits", New Age International, 2nd edition, 2006
3. R. Gayakwad, "Op-amps and Linear Integrated Circuits" (4/e), PHID. A. Bell, Solid state Pulse Circuits (4/e), PHI, 2009

REFERENCE BOOK:

1. Thomas L. Floyd, David Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 1999
2. Bruce Carter," Op Amps for Everyone", ISBN: 978-0-12-391495-8, Fourth Edition.
3. BIS, ISO standards and Datasheet

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. IEEE transactions on Circuits and Systems
2. https://en.wikipedia.org/wiki/List_of_linear_integrated_circuits
3. http://www.fairchildsemi.com/an/AN/AN-88.pdf
4. https://www.onsemi.com/pub/Collateral/AN-118.pdf.pdf
5. https://www.onsemi.com/pub/Collateral/AN-140.pdf.pdf
6. https://web.archive.org/web/20130502174545/http://www.fairchildsemi.com/an/AN/AN-340.pdf

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/108/108108111/
2. https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2

3. https://www.coursera.org/lecture/electronics/2-5-active-filters-L2ASa
4. https://www.coursera.org/lecture/sensors-circuit-interface/3-basic-amplifiers-sojqu
5. https://www.coursera.org/lecture/internet-of-things-sensing-actuation/op-amps-kxEOi
6. https://static1.squarespace.com/static/60494675b50d044ae4a81842/t/604a10a95e0cc12e7de634d5/1615466669126/analog_circuit_design_coursera.pdf

Course Title	Digital Electronics and Verilog				Course Type		HC	
Course Code	B20EP0301	Credits	3		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	0	0	0				
	Total	**3**	**3**	**3**	**42**	**0**	**50%**	**50%**

COURSE OVERVIEW:

Electronics is classified based on the type of signal/information into Analog Electronics and Digital Electronics. Digital Electronics deals with signal/information represented using discrete values of 0's and 1's (Binary). Digital electronics are designed using logic gates/circuits and are usually represented using Boolean Equations. Digital Electronics is further classified into Combinational Logic/Circuits and Sequential Logic/Circuits.

Hardware Description Language (HDL) is a computer –Aided Design tool for modern design and synthesis of digital systems. Due to the complexity in design of digital systems, such systems cannot be realized using discrete integrated circuits. They are usually realized using high density, programmable chips, such as Field programmable Gate Arrays (FPGAs). The two widely used hardware description languages are VHDL and Verilog. This course develops students' ability to understand and design the basic building blocks of modern digital systems and provides them with a fundamental knowledge for complicated digital hardware design

COURSE OBJECTIVES:

The objectives of this course are:

1. Provide the basics behind the digital circuit design in terms of all the necessary building blocks.
2. Illustrate Boolean laws and systematic techniques for minimization of expressions.
3. Introduce the Basic concepts of combinational and sequential logic.
4. Provide foundations of different styles of descriptions in HDLs.
5. Highlight the Design techniques of digital modules by using different styles of HDL descriptions.

COURSE OUTCOMES:

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

CO#	Course Outcomes	POs	PSOs
CO1	Define a Boolean term, expression, SOP, POS, Min-term etc.	1,2,3	1,3
CO2	Construct the K-map from a Boolean expression and to find the minimal SOP/POS forms	1,2,3,4,5	1,3

CO3	Design digital circuits using gates, encoders, decoders, multiplexers, and de-multiplexers	1,2,3,4,5, 10,11	1,3
CO4	Interpret the output and performance of given combinational and sequential circuits.	1,2,3,4,5, 10,11	1,3
CO5	Summarize the different styles of Verilog programming and its applications.	1,2,3,4,5, 10,11	1,3
CO6	Distinguish Verilog models for realizing combinational and sequential circuits	1,2,3,4,5, 10,11	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

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

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

COURSE CONTENT

THEORY:

Contents

UNIT - 1

Principle and Minimization Techniques of combinational: Introduction to combinational logic circuits, generation of switching equation from truth table. Minimization Techniques: Boolean algebra, expression minimization. Min-term, Max-term, Sum of Products (SOP), Product of Sums (POS), Karnaugh map, incompletely specified functions, Introduction to Digital Logic Families.

Analysis and Design of Combinational Circuits: Adder/Subtractor, Carry Look Ahead adder, BCD adder. Principle of Encoder and Decoder with cascading of decoders. Principle of Multiplexers and Demultiplexer with cascading of Mux and Boolean function implementation using Mux and decoders, Comparators.

UNIT – 2

Introduction to Sequential circuit: Basic bi-stable element, S R Latch, Flip-flops - SR, JK, D, T, and Master-Slave – Characteristic table and equation. Registers, Shift Register, Counters: Binary Ripple Up/Down Counter, Design of synchronous Mod- n counter using flip-flop.

Design & Applications of Digital Circuits: Sequential Design: Introduction to Mealy and Moore Model circuits. State machine notation, Synchronous sequential circuit analysis and construction of state table and diagram. Case study: sequence generator.

UNIT - 3

Verilog Programming concepts: Structure of Verilog Program, Operators, Data types.

Data Flow Description: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type –Vectors, Introduction to signal declaration and assignment statements, assigning delays to signal assessment statement, Programs based on Data Flow Description.

Case Study: 1. Ripple carry adder and 2. Carry look ahead adder

UNIT - 4

Introduction to Behavioral Description: Highlights and Structure of HDL Behavioral Description, Introduction to formats of sequential statements with examples. Programs Based on Behavioral Description.

Structural Description: Highlights of Structural Description, Organization of the Structural Description

Case Study:

1. Design of Shift register module using behavioral description
2. Booth algorithm implementation using behavioral description
3. Design of four-bit ripple carry adder using structural description.

TEXTBOOKS:

1. John M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning, 1st Edition, 2001.
2. Nazeih M Botros,“HDL Programming : VHDL and Veriolog” Dreamtech Press, 6th Edition 2006.

REFERENCE BOOK:

1. Samir Palnitkar “Verilog HDL” Pearson Education
2. Donald D Givone, “Digital Principles and Design”, Tata McGraw-Hill 1st Edition, 2002.
3. D P Leach, A P Malvino, &GouthamSaha, “Digital Principles and applications”, Tata McGraw-Hill, 7th Edition, 2010.

4. Moshe Morris Mano, “Digital Design” Prentice Hall, 3rd Edition, 2008.
5. Chales H Roth,Jr., “Fundamentals of Logic Design”, Cengage learning, 5th Edition, 2004

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://ieeexplore.ieee.org/document/1085417
2. https://www.sciencedirect.com/book/9780340645703/introduction-to-digital-electronics
3. http://ecc.journalspub.info/index.php?journal=IJDE
4. https://learnabout-electronics.org/Digital/dig20.php

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/117/106/117106086/
2. https://nptel.ac.in/courses/108/105/108105132/
3. https://nptel.ac.in/courses/106/105/106105165/
4. https://www.coursera.org/lecture/cs-algorithms-theory-machines/digital-circuits-91A4N
5. https://www.coursera.org/learn/digital-systems

Course Title	Design and Analysis of Algorithms				Course Type		HC	
Course Code	B20EP0302	Credits	3		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2				
	Practice	1	2	2	Theory	Practical	**IA**	**SEE**
	Total	**3**	**5**	**5**	**14+28**	**28**	**50%**	**50%**

COURSE OVERVIEW:

Course describes the various techniques for designing algorithms and for analyzing the time and space efficiency of algorithms. The algorithm design techniques include divide-and-conquer, Decrease-and-Conquer Approach, Greedy algorithms, Dynamic programming and Space and Time Trade-Offs. The algorithm analysis includes computational models, Best/Average/Worst case analysis, and computational complexity (including lower bounds and NP-completeness).

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide an understanding of algorithmic way to solve Engineering challenges and describe basics of algorithms in various domains.
2. To provide and understanding the use of appropriate algorithmic design techniques for a given problem.
3. To design of algorithms using the dynamic programming; greedy method, Backtracking, Branch and Bound strategy, and recite algorithms that employ this strategy.
4. To discuss the various design approaches based on time and space efficiency.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Determine various aspects of algorithm development of engineering challenge.	1,2,3	1,3
CO2	Determine the right combination of data structures that need to be used for solving the algorithm using a typical computer system.	1,2,3	1,3
CO3	Analyze divide and conquer approach algorithms	1,2,3	1,3
CO4	Apply the algorithmic way of solutions development for typical challenges.	1,2,3,5	1,3
CO5	Design the pseudo code level of solution and optimum utilization of computing system.	1,2,3,5	1,2

CO6	Design and analyze backtracking algorithms	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	2	3		1								3	2	3
CO2	3	2	1		1								2	1	3
CO3	3	1	2		1								3	2	3
CO4	3	2	1		1								3	2	1
CO5	3	2	1		1								3	2	1
CO6	3	2	1		1								2	1	3

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

COURSE CONTENTS:

CONTENTS
UNIT - 1
Introduction-Notion of an Algorithm and Brute Force Approach: Fundamentals of Algorithmic Problem Solving; Fundamentals of the Analysis of Algorithm Efficiency- The Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms. Brute Force Approach: Selection sort, Bubble sort, Sequential search, and String Matching.
UNIT - 2

Divide-and-Conquer and Decrease-and-Conquer Approach: Divide and Conquer: Mergesort, Quicksort, Binary Search; Decrease-and-Conquer: Insertion Sort, Topological Sorting, Depth-First Search and Breadth-First Search.
UNIT - 3
Greedy Approach and Dynamic programming: Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman trees and codes. Dynamic Programming: Fibonacci numbers, The Knapsack Problem, Warshall's Algorithm and Floyd's Algorithm for the all-pairs shortest paths problem.
UNIT - 4
Space and Time Trade-Offs: Sorting by Counting, Input Enhancement in String Matching, Coping with the Limitations of Algorithm Power. Backtracking: N-Queens Problem, Subset-Sum Problem, and Hamiltonian Circuit Problem. Branch-and-Bound: Assignment Problem, Knapsack Problem, Travelling Salesman Problem.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill/Ability
1	Selection Sort Algorithm Linear Search Algorithm	Brute force Technique	Basic Programming skills
2	Bubble Sort Algorithm String Matching	Brute force Technique	Basic Programming skills
3	Matrix Multiplication Binary Search Algorithm	Divide-and-Conquer Approach	Basic Programming skills
4	Quicksort and Merge sort Algorithm	Divide-and-Conquer Approach	Basic Programming skills
5	DFS and BFS Algorithm	Decrease-and-Conquer Approach	Basic Programming skills
6	Insertion Sort Algorithm	Decrease-and-Conquer Approach	Basic Programming skills
7	Prim's and Kruskal's Algorithm	Greedy Technique	Basic Programming skills
8	Dijkstra's Algorithm	Greedy Technique	Basic Programming skills
9	Warshall's Algorithm Floyd's Algorithm	Dynamic Programming	Basic Programming skills
10	Subset-Sum Problem	Backtracking	Basic Programming skills

TEXTBOOKS:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd Edition, 2012.

2. Ellis Horowitz, Satraj Sahni and Rajasekaran, Computer Algorithms/C++, Universities Press, 2nd Edition, 2014.

REFERENCE BOOK:

1. Michael Goodrich, Roberto Tamassia, Algorithm Design and Applications, Wiley Publishers, 1st Edition, 2014

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.mdpi.com/journal/algorithms/sections/algorithms_analysis_complexity_theory
2. https://www.mdpi.com/journal/algorithms

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://onlinecourses.nptel.ac.in/noc19_cs47/preview
3. https://www.coursera.org/learn/analysis-of-algorithms

Course Title	Problem Solving Using C Programming				Course Type		HC	
Course Code	B20EN0304	Credits	2		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	IA	SEE
	Practical	-	-	-				
	Total	**2**	**3**	**3**	**14+28**	**-**	**50%**	**50%**

COURSE OVERVIEW:

C is a general-purpose, high-level language that was originally developed by Dennis M. Ritchie to develop the UNIX operating system at Bell Labs. C programming is a general-purpose, procedural programming language used to develop software like operating systems, databases, compilers, and so on. The main features of C language include low-level access to memory, a simple set of keywords, and clean style. Many later languages have borrowed syntax/features directly or indirectly from C language. Like syntax of Java, PHP, JavaScript, and many other languages are mainly based on C language.

COURSE OBJECTIVES:

The objectives of this course are:

1. Provide exposure to problem solving through C programming
2. Explore the structure and syntax of C programming language
3. illustrate the applications of data types, operators, arrays, and control flow statements in problem solving.
4. Demonstrate the usage of procedure-oriented programming.
5. Provide insight into concepts like pointers, structures, and unions

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Develop an algorithm/flowchart to solve the computational problems	1,2,3,4,5,10	1,2,3
CO2	Solve data processing applications using appropriate data types, operators, and flow control statements.	1,2,3,4,5,10	1,2,3
CO3	Write C programs using derived data types like arrays and strings to operate on block of data.	1,2,3,4,5,10	1,2,3
CO4	Solve complex problems using procedure-oriented (modular) programming approach	1,2,3,4,5,10	1,2,3
CO5	Design and develop computer programs using the concept of pointers,	1,2,3,4,5,10	1,2,3

	structures, and unions		
C06	Demonstrate the creation of file and file operations in C-language	1,2,3,4,5,10	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	✓	✓	✓		✓	
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	1	2					1			2	2	1
CO2	3	3	2	1	3					1			3	2	1
CO3	3	3	2	1	3					1			3	3	2
CO4	3	3	3	1	3					1			3	3	2
CO5	3	3	3	1	2					1			3	2	3
CO6	3	3	3	1	2					1			3	2	3

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

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to C-language: Algorithms and flowcharts with some conceptual examples. Program development: Editor, compiler, interpreter, loader, linker, Integrated Development Environment (IDE).
C language and its features, Structure of C program, C tokens, Keywords and Identifiers, Variables, constants, Data types, Input / output functions. Operators and Expressions: Arithmetic Operators, Operators Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional, Special Operators, Evaluation of expressions, Precedence of arithmetic operators.

UNIT - 2

Flow control statements and Arrays: Conditional branching: if, if-else, nested if, else if, switch statements.

Unconditional branching: break, continue, goto, and return statements.

Looping statements: while, do-while and for loops, Loops with break and continue.

Arrays: Single dimensional and two-dimensional arrays, Strings as array of characters, String operations using library functions.

UNIT - 3

Functions, Structures & Union: Function declaration, definition, and calling, Parameter passing mechanisms, call by value & call by reference, Recursion and related examples, Scope of variables: Global, local, and static variables.

Structures & Union: Introduction, Structure definition, declaring and initializing Structure variables, accessing structure members, Arrays of structures, Arrays within structures, Structures and functions, Unions.

UNIT - 4

Pointers and File **Operations:** Introduction to pointers, Accessing the address of variable, Declaring, and initializing pointers, accessing a variable through its pointer, Pointer types, Pointer expressions, Accessing arrays through pointers.

File Operations: Open, close, read, write, and append operations, reading from file and writing into files using programs, File positioning and built-in file handling functions.

TEXTBOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, Pentice Hall Software Series, 2005.
2. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata McGraw Hill, 2000.
3. Nanjesh Bennur, Dr. C. K. Subbaraya, "Programming in C", 2nd Edition, Excellent Publishing House, 2015.

REFERENCE BOOK:

1. E. Balaguruswamy," Programming in ANSI C", 4th edition, Tata McGraw Hill, 2008.
2. Donald Hearn, Pauline Baker, "Computer Graphics C Version", second edition, Pearson Education, 2004.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. *Web:* https://www.tutorialspoint.com/cprogramming/index.htm
2. *Journal:* "The C programming language and a C compiler", by IBM;
3. link: https://ieeexplore.ieee.org/document/5387762
4. Journal: "Research and Development of C Language Programming Experiment Assistant Management Platform Based on Hybrid Architecture", by Elsevier;

5. link: https://www.sciencedirect.com/science/article/pii/S1877705811020534

SWAYAM/NPTEL/MOOCs:

1. SWAYAM/NPTEL: “Introduction to Programming in C”
2. link: https://onlinecourses.nptel.ac.in/noc19_cs42/preview
3. link: https://nptel.ac.in/courses/106/104/106104128/
4. MOOC: “Introductory C Programming”
5. link: https://www.coursera.org/specializations/c-programming

Course Title	Linear Integrated Circuits Lab				Course Type		HC	
Course Code	B20EN0306	Credits	1		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture							
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

This laboratory course is introduced for the students to explore the applications in linear ICs. The students will learn filtering concepts of various filters. Precision rectifier concepts are also introduced. Fundamental concepts in system design is introduced by designing waveform generators and PLL. The students also design the applications using industry standard simulators.

COURSE OBJECTIVES:

The objectives of this course are:

1. Understand and design various applications of Op-Amp and measure the physical Parameters.
2. Structured systematically to upgrade graduates' skills and knowledge to the more advanced in- depth skills and knowledge in electronics.
3. Infer the DC and AC characteristics of operational amplifiers and design the linear and non-linear applications using operational amplifiers.
4. Simulation and design of electronic circuits using SPICE or other analog simulators.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Design and test Op-amp Instrumentation amplifier	1,2,3,4,5,9,10	1,2,3
CO2	Design and test second order low pass and high pass filters using op-amp	1,2,3,4,5,9,10	1,2,3
C03	Design and test Schmitt Trigger for different values of UTP and LTP	1,2,3,4,5,9,10	1,2,3
CO4	Design and test the waveform generators using op-amp	1,2,3,4,5,9,10	1,2,3
CO5	Construct op-voltage regulators and test for line and load regulations	1,2,3,4,5,9,10	1,2,3
CO6	Demonstrate linear and nonlinear applications using simulator tools.	1,2,3,4,5,9,10	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	2	2	2	2	2				2	2			3	3	1
CO2	2	2	2	2	2				2	2			3	3	1
CO3	2	2	2	2	2				2	2			3	3	1
CO4	2	2	2	2	2				2	2			3	3	1
CO5	2	2	2	2	2				2	2			3	3	1
CO6	2	2	2	2	2				2	2			3	3	1

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

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Study the characteristics of negative feedback amplifiers	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
2	Design and Test Instrumentation amplifier	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
3	Design and testing of second order low pass filter and high pass filter	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
4	Design of second order band pass.	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team

5	Design and testing of Schmitt Trigger circuit for the given values of UTP and LTP	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
6	Design and testing of Astable multi-vibrator circuits using IC 555 for given frequency and duty cycle	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
7	Design and testing of PLL	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
8	Design and testing of a rectangular and triangular wave generator	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
9	Design and testing of integrator and differentiator circuit	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team
10	Design and testing of a voltage regulator circuit using op-Amp	CRO, Function Generator, and design equations	Design and circuit debugging. Working in a team

TEXTBOOKS:

1. David A Bell, "Operational amplifiers and Linear ICs", PHI/Pearson, 2nd edition, 2004
2. D. Roy Choudhury and Shail B Jain, " Linear Integrated Circuits", New Age International, 2nd edition, 2006
3. R. Gayakwad, "Op-amps and Linear Integrated Circuits" (4/e), PHID. A. Bell, Solid state Pulse Circuits (4/e), PHI, 2009

REFERENCE BOOK:

1. Thomas L. Floyd, David Buchla, "Basic Operational Amplifiers and Linear Integrated Circuits", Prentice Hall, 1999
2. Bruce Carter," Op Amps for Everyone", ISBN: 978-0-12-391495-8, Fourth Edition.
3. BIS, ISO standards and Datasheet

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. IEEE transactions on Circuits and Systems
2. https://en.wikipedia.org/wiki/List_of_linear_integrated_circuits
3. http://www.fairchildsemi.com/an/AN/AN-88.pdf
4. https://www.onsemi.com/pub/Collateral/AN-118.pdf.pdf
5. https://www.onsemi.com/pub/Collateral/AN-140.pdf.pdf
6. https://web.archive.org/web/20130502174545/http://www.fairchildsemi.com/an/AN/AN-340.pdf

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/108/108/108108111/
2. https://www.coursera.org/lecture/electronics/2-1-introduction-to-op-amps-and-ideal-behavior-Q5Di2

3. https://www.coursera.org/lecture/electronics/2-5-active-filters-L2ASa
4. https://www.coursera.org/lecture/sensors-circuit-interface/3-basic-amplifiers-sojqu
5. https://www.coursera.org/lecture/internet-of-things-sensing-actuation/op-amps-kxEOi
6. https://static1.squarespace.com/static/60494675b50d044ae4a81842/t/604a10a95e0cc12e7de634d5/1615466669126/analog_circuit_design_coursera.pdf

Course Title	Digital Electronics and Verilog Lab				Course Type		HC	
Course Code	B20EP0303	Credits	1		Class		III Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**		**28**	**50%**	**50%**

COURSE OVERVIEW:

Electronics is classified based on the type of signal/information, in to Analog Electronics and Digital Electronics. Digital Electronics deals with signal/information represented using discrete values of 0's and 1's (Binary). Digital electronics are designed using logic gates/circuits and are usually represented using Boolean Equations. Digital Electronics is further classified in to Combinational Logic/Circuits and Sequential Logic/Circuits. This course develops students' ability to understand and design the basic building blocks of modern digital systems and provides them with a fundamental knowledge for complicated digital hardware design

COURSE OBJECTIVES:

The objectives of this course are:

1. Illustrate Boolean laws and systematic techniques for minimization of expressions.
2. Demonstrate the methods for simplifying Boolean expressions.
3. Familiarize the commonly used terms like min-term, max-term, canonical expression, SOP,POS etc.
4. Introduce the Basic concepts of combinational and sequential logic.
5. Present real-world examples for making the learners attuned to Logic concepts.
6. Highlight the formal procedures for the analysis and design of combinational circuits and sequential circuits.
7. Introduce the concept of memories, programmable logic devices and digital ICs.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Verify Demorgan's theorem for 2 variables	1,2,3,4,5,9, 10	1,2,3
CO2	Realize Half adder, Full adder , Half subtractor and Full subtractor using basic gates	1,2,3,4,5,9, 10	1,2,3
CO3	Realize binary to Grey conversion and Grey to binary conversion practically	1,2,3,4,5,9, 10	1,2,3
CO4	Construct and realize 4:1 MUX and DEMUX circuits	1,2,3,4,5,9, 10	1,2,3

CO5	Construct and verify the truth table of of JK master slave, T, D flip flops	1,2,3,4,5,9, 10	1,2,3
CO6	Construct and verify the truth table of counters and shift registers	1,2,3,4,5,9, 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	✓	✓	✓	✓		
CO6	✓	✓	✓	✓		

COURSE ARTICULATION MATRIX

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

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

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Realization of parallel Adder and Subtractor.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team
2	Realization of 3 bit Binary to Grey code conversion and vice versa using basic/Universal gates.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team

3	Realization of 4:1 MUX and 1:4 DEMUX using basic/universal gates.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team
4	Arithmetic circuit realization (Half/Full, Adder/Subtractor) using MUX.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team
5	Construction and verification of JK master slave, T, D flip flop using logic gates.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team
6	Construction and realization of n- bit ripple up/down counter using IC 7476 and other logic gates.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team
7	Design and verification of n-bit synchronous counter using 7476 JK, T and D flip flops.	Trainer Kit, IC's, patch cords	Design and circuit debugging. Working in a team
8	Write a Verilog program for the following modules – Decoder, Encoder with and without priority, Multiplexer, De-multiplexer, Comparator	Xilinx Software, FPGA Board	Design and circuit debugging. Working in a team
9	Write a Verilog code to describe function of full adder in data flow, behavioral and structural style	Xilinx Software, FPGA Board	Design and circuit debugging. Working in a team
10	Write Verilog code for a 4-bit binary, BCD counters with synchronous and asynchronous reset	Xilinx Software, FPGA Board	Design and circuit debugging. Working in a team
11	Write a Verilog code to control speed and directions of a Stepper motor	Xilinx Software, FPGA Board, Stepper Motor	

(All the above experiments have to be supported by suitable simulation tool)

TEXTBOOKS:

1. John M Yarbrough, "Digital Logic Applications and Design" Thomson Learning,2001.
2. Donald D. Givone, "Digital Principles and Design", McGraw Hill, 2002.
3. Morris Mano, "Digital design‖, Prentice Hall of India" Third Edition.

REFERENCE BOOK:

1. Charles H Roth Jr., Larry L. Kinney "Fundamentals of Logic Design" Cengage Learning, 7th Edition.
2. Samuel C Lee, "Digital Circuits and Logic Design" PHI learning, 1st Edition, 2009

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://en.wikipedia.org/wiki/Digital_electronics
2. https://learnabout-electronics.org/Digital/dig10.php

3. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials
4. https://www.youtube.com/watch?v=CeD2L6KbtVM
5. https://www.youtube.com/watch?v=BqP6sVYlrr0
6. https://www.youtube.com/watch?v=ibQBb5yEDlQ

Course Title	Problem Solving Using C Programming Lab				Course Type		HC	
Course Code	B20EN0307	Credits	1		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	-	-	-				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	1	2	2				
	Total	**1**	**2**	**2**	**-**	**28**	**50%**	**50%**

COURSE OVERVIEW:

C is a general-purpose, high-level language that was originally developed by Dennis M. Ritchie to develop the UNIX operating system at Bell Labs. C programming is a general-purpose, procedural programming language used to develop software like operating systems, databases, compilers, and so on. The main features of C language include low-level access to memory, a simple set of keywords, and clean style. Many later languages have borrowed syntax/features directly or indirectly from C language. Like syntax of Java, PHP, JavaScript, and many other languages are mainly based on C language.

COURSE OBJECTIVES:

The objectives of this course are:

1. Provide exposure to problem-solving through C procedural programming
2. Explore the structure and syntax of the C programming language
3. illustrate the applications of data types, operators, arrays, and control flow statements in problem-solving.
4. Provide insight into concepts like pointers, structures, unions and records.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Develop algorithms/flowcharts to solve computational problems.	1,2,3,5	1,2,3
CO2	Solve data processing applications using appropriate data types, operators and control flow statements.	1,2,3,5,10	1,2,3
CO3	Write C programs using derived data types like arrays and strings to operate on block of data.	1,2,3,5,10	1,2,3
CO4	Solve complex problems using procedure-oriented (modular) programming approach	1,2,3,5,10	1,2,3
CO5	Design and develop computer programs using the concept of pointers, structures, unions and records.	1,2,3,5,10	1,2,3

C06	Demonstrate the creation of file and file operations in C-language	1,2,3,5,10	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	✓	✓	✓			
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	1	2					1			2	2	1
CO2	3	3	2	1	3					1			3	2	1
CO3	3	3	2	1	3					1			3	3	2
CO4	3	3	3	1	3					1			3	3	2
CO5	3	3	3	1	2					1			3	2	3
CO6	3	3	3	1	2					1			3	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 to calculate and display the volume of a CUBE by reading its height, width and depth from keyboard.	Algorithm, Flowchart, C compiler.	Reading values from input device, calculating and writing results on output device.
2	Write a program to take input of name, rollno and marks obtained by a student in 4 subjects of 100 marks each and display the name, rollno with percentage score secured. NOTE: Also write same program for three	Algorithm, Flowchart, C compiler.	Reading values from input device, calculating and writing results on output device.

	students.		
3	a. Write a program to print whether a given number is even or odd. b. Write a program to print even numbers from 1 to 10.	Algorithm, Flowchart, C compiler.	Writing program skills with conditional statements.
4	a. Write a Program to Check Whether a Number is Prime or not. b. Write a program to find the factorial of a number.	Algorithm, Flowchart, C compiler.	Writing program skills with conditional & looping statements.
5	a. Write a program to find whether a character is consonant or vowel using switch statement. b. Write a program to print the sum of numbers from 1 to 10 using for loop.	Algorithm, Flowchart, C compiler.	Writing program skills with conditional & looping statement.
6	a. Write a program to create an integer array of size 5, read values from input device and print the values of the array. b. Write a Program to Search an element in array.	Algorithm, Flowchart, C compiler.	Writing program skills with array creation and operations on it.
7	a. Write a program to calculate factorial of a number using recursion. b. Write a program to add, subtract, multiply and divide two integers using user-defined type function with return type. c. Write a program to swap two integers using call by value and call by reference methods of passing arguments to a function.	Algorithm, Flowchart, C compiler.	Writing program skills with function declaration and definition.
8	a. Write a C program to create, declare and initialize structure. b. Write a program to declare, initialize an UNION.	Algorithm, Flowchart, C compiler.	Writing program skills with structure and union.
9	a. Write a program to find biggest among three numbers using pointer. b. Write a program to swap value of two variables using pointer. c. Write a program to swap to array using pointers.	Algorithm, Flowchart, C compiler.	Writing program skills with pointers.
10	a. Write a program to create a file called ‘record’ and store information about a person, in-terms of his name, age, and	Algorithm, Flowchart, C compiler.	Writing program skills with file handling.

	salary. b. Write a program to illustrate how a file stored on the disk is read.		

TEXTBOOKS:

1. B.W. Kernighan & D.M. Ritchie, "C Programming Language", 2nd Edition, Pentice Hall Software Series, 2005.
2. Herbert Schildt, “C: The Complete Reference”, 4th edition, Tata McGraw Hill, 2000.
3. Nanjesh Bennur, Dr. C. K. Subbaraya, “Programming in C”, 2nd Edition, Excellent Publishing House, 2015.

REFERENCE BOOK:

1. E. Balaguruswamy,” Programming in ANSI C”, 4th edition, Tata McGraw Hill, 2008.
2. Donald Hearn, Pauline Baker, “Computer Graphics C Version”, second edition, Pearson Education, 2004.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. Web: https://www.tutorialspoint.com/cprogramming/index.htm
2. Journal: “The C programming language and a C compiler“, by IBM;
3. link: https://ieeexplore.ieee.org/document/5387762
4. Journal: “Research and Development of C Language Programming Experiment Assistant Management Platform Based on Hybrid Architecture”, by Elsevier;
5. link: https://www.sciencedirect.com/science/article/pii/S1877705811020534

SWAYAM/NPTEL/MOOCs:

1. SWAYAM/NPTEL: “Introduction to Programming in C”;
2. link: https://onlinecourses.nptel.ac.in/noc19_cs42/preview
3. link: https://nptel.ac.in/courses/106/104/106104128/
4. MOOC: “Introductory C Programming”
5. link: https://www.coursera.org/specializations/c-programming

<table>
<tr><td>Course Title</td><td colspan="4">Course Based Project on Linear Integrated Circuits</td><td colspan="3">Course Type</td><td colspan="2">HC</td></tr>
<tr><td>Course Code</td><td>B20EN0305</td><td>Credits</td><td colspan="2">1</td><td colspan="3">Class</td><td colspan="2">III Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="3" rowspan="2">Total Number of Classes Per Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">IA</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>1</td><td>2</td><td>2</td><td>-</td><td>28</td><td>50%</td><td>50%</td></tr>
</table>

Course Based Project/Project Based Learning has been considered a good approach in improving education in Engineering, because this approach facilitates learning difficult subjects, encourages active learning, and allows developing both the Engineering skills and transversal skills by using a 'learning environment that simulates a real professional challenge'.

Execution:

1. The project is carried out by team of two or three students (student team).
1. 2. Each Student team is guided and monitored by Faculty, the Course coordinator for Linear Integrated Circuits will be the Coordinator for Course based Project (CBP) Course.
2. The problem is the trigger of the learning process. The CBP approach is based on open problems, which are defined by faculty in context of Industry needs and current situation. The problems are assigned randomly to student teams.
3. The activities for each week will be assigned.
4. The Hands-On activities, along with short lectures, are included to facilitate learning key concepts, present the main aspects of the theory, and improve the background theory of students.
5. In the laboratory training, students carry out practices according to the project stages.

Assessment and Evaluation:

1. The Internal assessment is made on written reports, oral presentation and demonstration of project results with developed model in phase wise 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.

Course Title	Environmental Science				Course Type		FC	
Course Code	B20AS0303	Credits	2		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	-	-	-				
	Total	**2**	**2**	**2**	**28**	**-**	**50%**	**50%**

COURSE OBJECTIVES:

The objectives of this course are:

1. Graduates will be familiar with current and emerging environmental engineering and global issues and have an understanding of ethical and societal responsibilities.
2. Graduates will have the ability to obtain the knowledge and will recognize the need for engaging in life-long learning.
3. Will find the need of various types of energy (conventional & non-conventional) resources and natural resources.
4. Acquire knowledge with respect to biodiversity, threats, conservation and appreciate the concept of ecosystem.
5. Acquire knowledge about sources, effects and control measures of environmental pollution, degradation, and waste management
6. Explore the ways for protecting the environment

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand, analyse and execute favourable environmental conditions and the role of individual, government and NGO in environmental protection	6,7,9	1
CO2	List the causes, effects & remedial measures and find ways to overcome them by suggesting the pollution-controlled products.	6,7,9	1
CO3	Classify different wastes, sources of waste and their effect on population	6,7,9	1
CO4	Demonstrate various water conservation methods and suggest appropriate technique for conservation of water	6,7,9	1

CO5	Get motivation to find new renewable energy resources with high efficiency through active research and innovation.	6,7,9	1
C06	Critically analyze the ecological imbalances and provide recommendations to protect the environment.	6,7,9	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						2	3		1				1		
CO2						2	3		1				1		
CO3						2	3		1				1		
CO4						2	3		1				1		
CO5						2	3		1				1		
CO6						2	3		1				1		

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

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Basics of environment: Introduction & definition to Environment, objectives and guiding principles of environmental education, Components of environment, Structure of atmosphere, Sustainable

environment/Development, Impact of technology on the environment in terms of modern agricultural practices and industrialization, Environmental Impact Assessment.

Environmental protection: Role of Government - Assignments of MOEF, Functions of central and state boards, Institutions in Environment and People in Environment, Environmental Legislations, Initiative and Role of Non-government organizations in India and world.

Self-study: Need for public awareness on the environment, Gaia Hypothesis

UNIT – 2

Environmental Pollution: Definition, sources and types, Pollutant-Definition & classification, Concepts of air pollution, water pollution, Soil pollution, Automobile Pollution-Causes, Effects & control measures.

Environmental degradation: Introduction, Global warming and greenhouse effect, Acid rain-formation & effects, Ozone depletion in stratosphere and its effect.

Waste management: Municipal solid waste, Biomedical waste and electronic waste (E-Waste).

Self-study: Case studies of London smog, Bhopal gas tragedy, marine pollutions and study of different wastewater treatment processes, Disaster management, early warning systems-bio indicators for Tsunami and other natural disasters.

UNIT – 3

Energy: Definition, classification of energy resources, electromagnetic radiation-features and applications, Conventional/Non-renewable sources – Fossil fuels based (Coal, petroleum & natural gas), nuclear energy, non-conventional/renewable sources – Solar, wind, hydro, biogas, biomass, geothermal, ocean thermal energy, Hydrogen as an alternative as a future source of energy.

Natural resources: Water resource - Global water resource distribution, Water conservation methods, Water quality parameters, Uses of water and its importance. Mineral resources - Types of minerals, Methods of mining & impacts of mining activities. Forest wealth - Importance's, Deforestation-Causes, effects and controlling measu

Self-study: Hydrology & modern methods adopted for mining activities, Remote sensing and its applications, Chernobyl (USSR) nuclear disaster and Fukushima (Japan) nuclear disaster.

UNIT – 4

Ecology: Definition, branches, objectives and classification, Concept of an ecosystem – Structure and functions, Characteristics of an Ecosystem - Ecosystem Resilience, Ecological succession and productivity, Balanced ecosystem, Components of ecosystem-abiotic and biotic, biological diversity.

Biogeochemical cycles and its environmental significance – Carbon and nitrogen cycle, Energy flow in ecosystem, food chains –types, food web & Ecological Pyramids.

Field work: Visit to waste water treatment and biogas plant at REVA university campus, and/or

Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

Self-study: Need for balanced ecosystem and restoration of degraded ecosystems.

REFERENCE BOOK:

1. 1.R.J. Ranjit Daniels and Jagadish Krishnaswamy, "Environmental Studies",
2. Wiley India Private Ltd., New Delhi, Co-authored & Customised by Dr.MS Reddy & Chandrashekar, REVA University, 1st Edition, 2017.

3. R.J. Ranjit Daniels and Jagadish Krishnaswamy, “Environmental Studies”, Wiley India Private Ltd., New Delhi, 2nd Edition, 2014.
4. Benny Joseph, “Environmental Studies”, Tata McGraw – Hill Publishing
5. Company Limited, New Delhi, 2nd Edition, 2008.
3. Dr.S.M.Prakash, “Environmental Studies”, Elite Publishers, Mangalore, 2nd Edition, 2009.
4. Rajagopalan R, “Environmental Studies – from Crisis to cure”, Oxford University Press, New Delhi, 3rd Edition, 2016.
5. Anil Kumar Dey and Arnab Kumar Dey, “Environmental Studies”, New age international private limited publishers, New Delhi, 2nd Edition, 2007.
6. Michael Allaby, “Basics of environmental Science”, Routledge-Tayler & Francis
6. e-library, New York, 2nd Edition, 2002.
7. Dr.Y.K Singh, “Environmental Science”, New age international private limited publishers, New Delhi, 1st Edition, 2006.

Course Title	Management Science				Course Type		FC	
Course Code	B20MG0301	Credits	2		Class		III Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	2	0	0				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practical	-	-	-				
	Total	2	0	0	26	-	50%	50%

COURSE OBJECTIVES:

The course intends to familiarize students to understand the management principles and applications, which lays a strong foundation for managers and leaders in critical thinking and decisions making process. The course emphasizes on giving an overview of the functional area of management

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Plan organizational structure for a given context in the organization	1,2,3	1
CO2	Carry out production operations through Work-study.	1,2,3	1
CO3	Apply various principles in quality control.	1,2,3	1
CO4	Understand the market, customers and competition to fix better price for the given product appropriately.	1,2,3	1
CO5	Plan and control the HR function better.	1,2,3	1
C06	Evolve a strategy for a business or service organization.	1,2,3	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	3		1		
CO2									1	2	3		1		
CO3									1	2	3		1		
CO4									1	2	3		1		
CO5									1	2	3		1		
CO6									1	2	3		1		

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

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Introduction to Management and Organization: Concepts of Management and organization- nature, importance and Functions of Management. Systems Approach to Management - Taylor's Scientific Management Theory- Taylor's Principles of Management, Maslow's theory of Hierarchy of Human Needs- Douglas McGregor's Theory X and Theory - Hertzberg Two Factor Theory of Motivation - Leadership Styles, Social responsibilities of Management. Designing Organizational Structures: Basic concepts related to Organization Depart mentation and Decentralization.
UNIT – 2
Operations and Marketing Management: Principles and Types of Plant Layout-Methods of Production(Job, batch and Mass Production), Work Study --Basic procedure involved in Method Study and Work Measurement - Business Process Reengineering(BPR) Statistical Quality Control: control charts for Variables and Attributes (simple Problems) and Acceptance Sampling, TQM, Six Sigma, Deming's contribution to quality. Objectives of Inventory control, EOQ, ABC Analysis. Purchase Procedure, Stores Management and Store Records - JIT System, Supply Chain Management, Functions of Marketing, Marketing Mix. And Marketing Strategies based on Product Life Cycle. Channels of distribution.
UNIT – 3
Human Resources Management (HRM): Concepts of HRM. HRD and Personnel Management and Industrial Relations (PMIR), HRM vs PMIR.. Basic functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development. Placement, Wage and Salary Administration, Promotion. Transfer, Separation, Performance Appraisal, Grievance Handling and Welfare Administration, Job Evaluation and Merit Rating -Capability Maturity Model (CMM) Levels - Performance Management System.
UNIT - 4

Strategic Management and Contemporary strategic Issues: Mission, Goals, Objectives, Policy, Strategy. Programmes, Elements of Corporate Planning Process, Environmental Scanning. Value Chain Analysis, SWOT Analysis. Steps in Strategy Formulation and implementation, Generic. Strategy alternatives. Bench Marking and Balanced Score and as Contemporary Business Strategies.

REFERENCE BOOK:

1. Kotler Philip and Keller Kevin Lane, Marketing Management, Pearson, New York, 15th Edition, 2012.
2. Koontz and Weihrich: Essentials of management, McGraw Hill, New Delhi, 11th Edition, 2012.
3. Thomas N. Duening and John M. Ivancevich, Management - Principles and Guidelines, Dreamtech Press; 1st Edition, 2012.
4. Samuel C. Certo, Modern Management, Prentice Hall, New York, 9th Edition, 2012.
5. Schermerhorn, Capling, Poole and Wiesner, Management, Wiley, New York, 6th Edition, 2012.
6. John A. Parnell, Strategic Management – Theory and Practice, Cengage Publications, 2018.
7. Lawrence R Jauch, R. Gupta and William F. Glucek: Business Policy and Strategic Management Science, McGraw Hill, New York, 5th Edition, 2012.

REVA UNIVERSITY
Bengaluru, India

ರುಕ್ಮಿಣಿ ಜ್ಞಾನವನ, ಕಟ್ಟಿಗೇನಹಳ್ಳಿ, ಯಲಹಂಕ, ಬೆಂಗಳೂರು – 560064

ಕನ್ನಡಿಗರಿಗೆ ಇಂಜಿನಿಯರಿಂಗ್ ಪ್ರಥಮ ಪದವಿ ಪಠ್ಯ

ಪರಿವಿಡಿ

ಘಟಕ – 1 : **ಕವಿತೆಗಳು**

1. ಬೆಳಗು – ದ ರಾ ಬೇಂದ್ರೆ
2. ಕಲ್ಕಿ – ಕುವೆಂಪು

ಘಟಕ – 2 : **ಕಥೆಗಳು**

3. ಗಾಂಧಿ – ಬೆಸಗರಹಳ್ಳಿ ರಾಮಣ್ಣ
4. ಸೆರೆ – ಯಶವಂತ ಚಿತ್ತಾಲ

ಘಟಕ – 3 : **ವಿಜ್ಞಾನ ಲೇಖನಗಳು**

5. ಆನೆಹಳ್ಳದಲ್ಲಿ ಹುಡುಗಿಯರು – ಬಿ ಜಿ ಎಲ್ ಸ್ವಾಮಿ
6. ವೃತ್ತಿಶಿಕ್ಷಣದಲ್ಲಿ ಕನ್ನಡ ಮಾಧ್ಯಮ – ಎಸ್ ಸುಂದರ್

ಘಟಕ – 4 : ಪರಿಸರ ಲೇಖನಗಳು

7. ಚೀಂಕ್ರ ಮೇಸ್ತ್ರಿ ಮತ್ತು ಅರಿಸ್ಟಾಟಲ್ – ಕೆ ಪಿ ಪೂರ್ಣಚಂದ್ರ ತೇಜಸ್ವಿ
8. ಗುಬ್ಬಚ್ಚಿಯ ಗೂಡು – ಪಿ ಲಂಕೇಶ್

- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡಿಗರಿಗೆ **'ಕನ್ನಡ ಕಲಿ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಕನ್ನಡಿಗರಿಗೆ **'ಸಾಹಿತ್ಯ ಸಿಂಚನ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡಿಗರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

- ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ ಕನ್ನಡೇತರರಿಗೆ **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಬಿ ಎಂ ಎಸ್ ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು ಕನ್ನಡೇತರರಿಗೆ **'ಕನ್ನಡ ಮನಸ್ಸು'** ಪಠ್ಯ ಪುಸ್ತಕ
- ಕರ್ನಾಟಕ ತಾಂತ್ರಿಕ ಶಿಕ್ಷಣ ವಿಭಾಗ ಇವರು **'ಬಳಕೆ ಕನ್ನಡ'** ಪಠ್ಯ ಪುಸ್ತಕ ತಂದಿದ್ದಾರೆ.

ಹಲವಾರು ಪಠ್ಯಪುಸ್ತಕಗಳು ಇಂಜಿನಿಯರಿಂಗ್ ವಿಭಾಗದಲ್ಲಿ ಕನ್ನಡ ಬೋಧನೆಗೆ ಬಳಕೆಯಲ್ಲಿದ್ದು ಜೊತೆಗೆ ಬಿಎಡ್ ಕನ್ನಡ ಕಲಿಕೆಯ ಪಠ್ಯಪುಸ್ತಕಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ರೇವಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ತಾಂತ್ರಿಕ ವಿಭಾಗದ ಕನ್ನಡಿಗರು ಮತ್ತು ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಗಮನದಲ್ಲಿಟ್ಟುಕೊಂಡು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಇಷ್ಟವಾಗುವ ಮತ್ತು ಪ್ರಯೋಜನಕಾರಿಯಾಗುವ ಪಠ್ಯ ಪುಸ್ತಕವನ್ನು ತರಗತಿಗಳು ಪ್ರಾರಂಭವಾಗುವುದರ ಒಳಗೆ ಸಿದ್ಧಪಡಿಸಲಾಗುವುದು.

IV 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	B20EP0401	Discrete Mathematics and Graph Theory	FC	3	1	0	4	5
2	B20EP0402	Relational Database Management Systems	HC	3	0	0	3	3
3	B20EP0403	Control Systems Engineering	HC	1	1	1	3	3
4	B20EN0403	Microcontroller and Applications	HC	3	0	0	3	3
5	B20EN0404	Object Oriented Programming and Data Structures using C++	HC	1	1	0	2	3
TOTAL				**11**	**3**	**1**	**15**	**17**
Practical /Term Work / Sessional								
6	B20EP0404	RDBMS Lab	HC	0	0	1	1	2
7	B20EN0407	Microcontroller and Applications	HC	0	0	1	1	2
8	B20EN0408	Object Oriented Programming and Data Structures using C++	HC	0	0	1	1	2
9	B20EN0405	Course Based project on Microcontroller and Applications	HC	0	0	1	1	2
10	B20AH0301	Communication Skills	FC	2	0	0	2	2
11	B20LS0301	Indian Constitution and Professional Ethics	FC	2	0	0	2	2
12	B20AHM401	Universal Human Values	MC	1	0	0	0	1
		TOTAL		**5**	**0**	**4**	**8**	**13**
TOTAL SEMESTER CREDITS				**23**				
TOTAL CUMULATIVE CREDITS				**85**				
TOTAL CONTACT HOURS				**30**				

Course Title	Discrete Mathematics and Graph theory				Course Type		HC	
Course Code	B20EP0401	Credits	3		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	1	2	2				
	Practical	-	-	-	Theory	Practical	IA	SEE
	Total	4	5	5	42+14	-	50%	50%

COURSE OVERVIEW:

This is an introductory course in discrete mathematics and graph theory. The goal of this course is to introduce students to ideas and techniques from discrete mathematics and elements of graph theory that are widely used in science and engineering. This course teaches the students techniques in how to think logically and mathematically and apply these techniques in solving problems. To achieve this goal, students will learn logic and proof, sets, functions, as well as algorithms and mathematical reasoning. Key topics involving relations, graphs, trees, and formal languages and computability are covered in this course.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Provide information related to operations on discrete structures such as sets, relations and functions.
2. Illustrate the use of Algebraic structures and how to carry out operations on them.
3. Provide insights into induced subgraphs, cliques, matchings, covers in graphs
4. Illustrate the different types of graphs viz. Hamiltonian and/or Eulerian
5. Introduce the techniques or proofs and analysis.
6. Model real world problems in the form of algorithmic steps using graph theory.
7. Provide insights graph theory based tools in solving practical problems

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Discuss diagram strategies for potential proofs in logical sequential order without mathematical symbols (plain English). Construct mathematical arguments using logical connectives and quantifiers	1,2,3,4	1,2,3
CO2	classify different types of relations and functions and be able to summarize their properties.	1,2,3,4	1,2,3

CO3	Use graphs as a tool to visualize and simplify situations.	1,2,3,4	1,2,3
CO4	Apply algorithm to solve problems, (Critical Thinking)	1,2,3,4	1,2,3
CO5	Translate real-world problems into probability mode	1,2,3,4	1,2,3
CO6	Apply Sampling distribution to solve Engineering problems	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	2	1									2	2	1
CO2	3	2	2	2									2	2	1
CO3	3	3	2	1									2	2	1
CO4	3	2	2	1									2	2	1
CO5	3	3	2	1									2	2	1
CO6	3	3	2	1									2	2	1

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

COURSE CONTENT

THEORY:

Contents

UNIT - 1
Set Theory & Logic: Set theory fundamental operations; propositions; negation; disjunction and conjunction; implication and equivalence; truth tables; laws of Logic; predicates; quantifiers; rules of Inference; methods of proofs.
UNIT - 2
Relations and Functions: representation of relations by graphs; properties of relations; equivalence relations and partitions; Functions, Composition, and Inverse Functions.
UNIT - 3
Introduction to Graph theory: Konigsberg's Bridge problem, Utilities problem, Seating Problems, graphs, Representation of graphs, Directed graphs, incidence, adjacency, degree, Indegree , out degree, regular graphs, complete graphs, Null graphs, Bipartite graphs, Isomorphism, Directed graphs, Sub graphs, Walk, Trail, Path, Cycle, Connected and Disconnected graphs, Weakly Connected and Strongly Connected, Components, Complement of Graph, Partition , Decomposition
UNIT - 4
Eulerian , Hamiltonian Graph and Graph coloring: Operation on graphs, Definition of Euler Trail, Euler graph, Standard theorems on Euler graphs Hamiltonian Path, Hamiltonian Cycle and Hamiltonian Graph, Standard theorems on Hamiltonian Graph, Planar graph, Detection of Planarity, Geometric dual, Euler formula, Graph coloring, Chromatic polynomial, Map coloring, Four color theorem, Five Color theorem,, Matching, Network flow and its applications, Cut set, Cut vertex, Chord, Properties of Cut set, Max flow Min cut theorem.

Self-learning component: Application of concepts to Data mining techniques like Classification, Association, Clustering, Regression Analysis.

TEXTBOOKS:

1. Kenneth H Rosen , Discrete mathematics and its application, McGraw Hill, Sept. 2002
2. Englewood cliffs, Graph theory and its applications tp Engineering and computer science, Prentice Hall, 1974.
3. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice-Hall, 2014. 2. Ralph P Grimaldi, Discreteand Combinatorial mathematics, Pearson Education, 5th edition, 2014.

REFERENCE BOOKS:

1. V.Krishnamurthy, Combinatorics: Theory and Applications, East-West Press Pt. Ltd., Delhi, 1986.
2. J. Tremble, Manohar, Discrete Mathematical Structures with applications to computer Science McGraw Hill pub. 1975.
3. Richard Kohar, Basic Discrete Mathematics: Logic, Set Theory, and Probability, World Scientific Publishing Company, 1st Edition, 2017
4. Oscar Levin, Discrete mathematics: An Open Introduction, CreateSpace Independent Publishing Platform, 2nd edition, 2016
5. Springer Journal of Number Theory and Discrete Mathematics.
6. Frank Harary, "Graph Theory", Narosa, 2013.

7. J.A Bondy and U.S.R Murthy, Graph Theory with applications, Macmillan, 2013
8. GeirAgnarsson and Raymond Geenlaw ; Graph Theory modeling, Applications and algorithms, Pearson Education, 2007.
9. Douglas B, "Introduction to Graph Theory", Prentice Hall of India, 2nd edition, 2015.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. http://pfister.ee.duke.edu/courses/ece586/notes_ch1.pdf
2. https://www.researchgate.net/publication/332254891_Relations_and_Functions
3. https://www.researchgate.net/publication/314062405_Discrete_Mathematics_Sets_Relations_and_Functions
4. https://dgtstudy.com/media/media/study_material/2020-04-06/DGT_Sets_Relations_and_Functions.pdf
5. https://www.maths.ed.ac.uk/~v1ranick/papers/wilsongraph.pdf
6. https://www.researchgate.net/publication/317895972_Introduction_to_Graph_Theory
7. https://www.math.utah.edu/mathcircle/notes/MC_Graph_Theory.pdf
8. http://faculty.nps.edu/rgera/MA4027/A%20First%20Course%20in%20Graph%20Theory%20-%20Gary%20Chartrand.pdf

SWAYAM/NPTEL/MOOCs:

1. https://www.youtube.com/watch?v=xlUFkMKSB3Y
2. https://www.youtube.com/watch?v=0uTE24o3q-o
3. https://www.youtube.com/watch?v=E40r8DWgG40&list=PLEAYkSg4uSQ2fXcfrTGZdPuTmv98bnFY
4. https://www.youtube.com/watch?v=xlUFkMKSB3Y&list=PL0862D1A947252D20
5. https://www.youtube.com/watch?v=0wfLKljzatA&list=PLYrahs7hsYIQiSNxTfZndQz7jWPXsA1ur

Course Title	Relational Database Management Systems (RDBMS)				Course Type		HC	
Course Code	B20EP0402	Credits	3		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	0	0	0				
	Total	**3**	**3**	**3**	**42**		**50%**	**50%**

COURSE OVERVIEW:

This course introduces topics such as conceptual data modeling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques and applications in database.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide a knowledge of Database architecture
2. To provide students to understand and use a relational database system
3. To introduction to Databases, Conceptual design using ERD, Functional dependencies and Normalization, Relational Algebra.
4. To introduce about concepts of creating a good database and use various SQL operations

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Define and understand basic terminologies of DBMS.	1,2,3	1,2,3
CO2	Differentiate between File and Database and identify Database users, Administrators & Designers	1,2,3	1,2
CO3	Explain DBMS architecture and ER Model	1,2,3	1,2
CO4	Distinguish Attributes and Entity	1,2	1,2
CO5	Draw ER diagram for the given example and identify the constraints used in ER diagram	1,2,3,4	1,2,3
CO6	Explain Hashing techniques, Index structures, Relational Model & Joint operations	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									1	2	
CO2	3	1	1	1									3	1	
CO3	3	2		1									3	3	2
CO4	3	2		1									3	2	
CO5	3	2	1	1									3	2	
CO6	3	1	2	1									3	1	2

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

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Introduction to databases and Conceptual Modelling
Introduction, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues.
UNIT - 2
Relational Data Model and Relational algebra

Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational operations, examples of queries in relational algebra

UNIT - 3

SQL

SQL data definition and data types, specifying constraints in SQL, basic retrieval queries in SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.

UNIT - 4

Database Design Theory and Normalization Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms.

Transactions and Recovery: The ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions. Introduction to recovery, Recovery Concepts, Shadow Paging, The Aries Recovery Algorithm

TEXTBOOKS:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2003
3. Phill Pratt, "Concepts of Database Management, Cengage Learning", 8th Edition, 2014.
4. Jeffrey A Hoffer, "Modern Database Management, Pearson", 12th Edition, 2015.

REFERENCE BOOK:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: "Database System Concepts", 6th Edition, McGraw Hill, 2010.
2. C J Date, "Database Design and Relational Theory: Normal Forms and All that Jazz", O 'Reilly, April 2012.
3. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
4. IEEE Transactions on Knowledge and Data Engineering
5. Elsevier Data and Knowledge Engineering
6. ACM Transactions on Database Systems

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://ieeexplore.ieee.org/document/1456366
2. https://ieeexplore.ieee.org/abstract/document/1054507
3. https://onlinelibrary.wiley.com/toc/10991131a/4/1

4. https://www.youtube.com/watch?v=00ZbuhPruJw
5. https://www.youtube.com/watch?v=beFoCZ7oMyY
6. https://www.youtube.com/watch?v=A6BRXPqxya0

Course Title	Control Systems Engineering				Course Type		HC	
Course Code	B20EP0403	Credits	3		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	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:

In this course covers the transfer function modelling and state space modelling of electrical and mechanical system. The dynamic and steady state time domain response system is discussed. This course also covers stability criteria and stability analysis of system by root locus, RH criteria, Bode plot and Nyquist plot. The state space modelling methods in different canonical form and transformation from transfer function model to state space and vice versa and different methods of calculating state variable and calculating output variable is covered. The concept of controllability and observability and control system design using state space is briefly discussed.

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide an understanding of system modeling.
2. To provide and understanding on the system response with and without feedback.
3. To provide a detailed understanding of time domain and frequency domain behavior of a system
4. To have an understanding of stability analysis of the system and its significance
5. To introduce the state variable approach for linear invariant system in both continuous time and discrete time for the analysis and design of system.
6. To design stable system in state space by pole placement method.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Apply the concept of modeling of systems for simple mechanical and electrical system.	1,2,4,10	1, 2
CO2	Write the Transfer function using various techniques like using differential equations, Block diagrams, signal flow graphs.	1,2,3,4,10	1
CO3	Apply time domain and frequency domain analyses technique to determine stability of system.	1,2,4,10	1,2
CO4	Design and verify the stability of a system	1,2,3,4,10	1, 3

CO5	Model a system in state space and solve state space equation.	1,2,4,10	1, 3
CO6	Identify the control solution possibility by applying controllability test and observability test.	1,2,4,10	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

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

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

COURSE CONTENT

THEORY:

Contents
UNIT - 1
Modeling of Systems: Modeling and writing Transfer function (Both Electrical & Mechanical), Block Diagram reduction, Signal flow graph. Performance of feedback control system, Test input signals,

performance of second order system, S-plane Root location and Transfer function, steady state errors, case study.
UNIT - 2
Stability of linear feedback system: Concept of stability, RH Criteria, Relative Stability, RH Application. Case study Root locus: Introduction to root locus, Procedure and problems, Effect of addition of pole zero to open loop systems. Case study
UNIT - 3
Frequency Response method: Introduction to Bode plots Performance measurement from Bode plots, problems on Bode plots case study. Introduction to Nyquist criteria, Relative Stability, Comparison (Time domain & frequency domain), Problems on Time domain & frequency domain, case study
UNIT - 4
State space analysis: Introduction, concept of state variable and state model, state model for linear continuous time systems, state variable and linear discrete-time systems, Diagonalization, solution of state equation, concept of controllability and observability, pole placement by state feedback, problems.

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Time response of first order system	MATLAB Software	Apply and test concepts of control system
2	Time response of second order system	MATLAB Software	Apply and test concepts of control system
3	Steady-state Error	MATLAB Software	Apply and test concepts of control system
4	Stability of system based on pole position	MATLAB Software	Apply and test concepts of control system
5	Root Locus Analysis.	MATLAB Software	Apply and test concepts of control system
6	Stability analysis of a system based using Bode Plot	MATLAB Software	Apply and test concepts of control system
7	Time response of PID controller.	MATLAB Software	Apply and test concepts of control system
8	Stability analysis of a system using Nyquist Plot	MATLAB Software	Apply and test concepts of control system
9	Design of control system in state space using pole placement.	MATLAB Software	Apply and test concepts of control system

TEXTBOOKS:

1. J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, Fourth edition – 2005
2. K. Ogata, "Modern Control Engineering ", Pearson Education Asia/ PHI, 4thEdition, 2002

REFERENCE BOOK:

1. W.Bolton, "Instrumentation and control Systems", Addison Wesley Publishing, ISBN: 0 2 -0 1997.
2. Richard Dorf& Robert H Bishop, "Modern Control Systems", Addison Wesley Publishing; ISBN: 0-201-32677-9, 2008.
3. Benjamin C. Kuo and Farid Golnaagi, "Automatic Control Systems", Wiley Student 8th Edition, 2009.
4. Joseph J Distefano III et al., Schaum'sOutlines, "Feedback and Control System", TMH, 2nd Edition 2007.

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://www.controleng.com/magazine/
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=37
3. http://ieeecss.org/publication/ieee-control-systems-magazine
4. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=87
5. http://ieeecss.org/publication/transactions-control-systems-technology

SWAYAM/NPTEL/MOOCs:

1. https://nptel.ac.in/courses/107/106/107106081/
2. https://nptel.ac.in/courses/108/106/108106098/
3. https://www.udemy.com/course/control-systems-engineering/

Course Title	Microcontrollers and Applications				Course Type		HC	
Course Code	B20EN0403	Credits	3		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	3	3	3				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	**3**	**-**	**3**	**42**	**-**	**50%**	**50%**

COURSE OVERVIEW:

This course introduces 8051 microcontrollers to provide basic understanding of architecture, instruction set, assembly level programming, interfacing to various sensors, relays, motors, actuators through various types of serial and parallel communication. Timers and interrupt functions are illustrated through the selection and control activities using suitable programming platforms such as Assemblers, C compilers, Kiel etc. This fundamental knowledge on microcontrollers lead to explore large number of controller families like ATMEGA, TI and PIC that are used in industrial and automation applications.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce Microcontroller 8051 Architecture.
2. Give an insight into instruction set of microcontrollers 8051.
3. Introduce assembly and C programming for 8051.
4. Provide insight into timer, serial communication, and interrupts modules of 8051.
5. Interface a microcontroller with peripheral devices.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Describe the Architecture of 8051 microcontroller.	1,2,4	1,3
CO2	Describe Instruction Set of 8051	1,2,4	1,3
CO3	Write Assembly and C Programs for 8051.	1,2,4,5	1,2,3
CO4	Design Timer applications	1,2,3,4	1,2,3
CO5	Implement serial communication applications	1,2,3,4	1,2,3
CO6	Interface various peripherals.	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		2									3		2
CO2	3	3		2									3		2
CO3	3	3		2									3	2	2
CO4	3	3	1	1									3	2	2
CO5	3	3	1	1									3	2	2
CO6	3	3	1	1									3	2	2

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

COURSE CONTENT

THEORY:

Contents
UNIT – 1
8051 Architecture, Addressing Modes and Instruction Set: Introduction to Microprocessors and Microcontrollers, The 8051 Architecture, Memory organization, Addressing Modes, Data transfer Instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instruction. Assembler Directives, Stack, Assembly language programs
UNIT – 2
Timers/Counters, Serial Communication, and Interrupts: Basics of interrupts, 8051 interrupt structure. Timers and Counters, Timer delay calculations, Serial Communication, connections to RS-232, UART. Programming in Assembly and C Language

UNIT – 3
Interfacing and Applications: 8051 Memory Interfacing, Interfacing 8051 to LCD, parallel and serial ADC, DAC, Stepper motor and DC Motor, MAX232, Interfacing Programming in C Language.
UNIT – 4
Advanced microcontrollers: Architecture and memory organization: PIC16F877A, MSP430, ARM Cortex-3, AtMega32

TEXTBOOKS:

1. Kenneth J. Ayala, "The 8051-microcontroller architecture, programming and applications" Thomson publication, 3rd edition, 2007
2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, McKinlay "The 8051 Microcontroller and Embedded Systems using assembly and C" PHI, 2006/Pearson 2006.
3. Sandhu, Harprit singh. "Making PIC microcontroller instruments and controllers / Harprit Singh Sandhu." McGraw-Hill (2009).

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://e2echina.ti.com/group/c8df485b47/m/msp430/11060/download
2. https://www.arm.com/zh/files/word/Yiu_Ch1.pdf
3. http://ce.sharif.edu/~pourmohammadi/AVR%20Microcontroller%20and%20Embedded%20Systems/AVR%20Microcontroller%20and%20Embedded%20Systems.pdf

Course Title	**Object Oriented Programming and Data Structures using C++**				Course Type		HC	
Course Code	**B20EN0404**	**Credits**	**2**		**Class**		**IV Semester**	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	1	1	1				
	Tutorial	1	2	2	Theory	Practical	**IA**	**SEE**
	Practice		-	-				
	Total	**2**	**3**	**3**	**14+28**	**-**	**50%**	**50%**

COURSE OVERVIEW:

The purpose of this course is to provide the solid foundations in the basic concepts of data structures algorithms and C++ programming language. The Data Structures and C++ Programming Language are a very important to develop Application Software, System Software, Operating Systems, and Network Simulators as it employees Object Oriented Programming (OOP) aspect. This course has important features of OOP like Polymorphism, Inheritance which are not present in C Programming Language. Survey of fundamental data structures (array, linked lists, queue, stack) and how to use them in C++. This course then delves deeper into the design, analysis and implementation of such data structures.

COURSE OBJECTIVES:

The objectives of this course are:

1. Provide insights into the role of programming Languages like C and C++ in design and development.
2. Provide a concise but through introduction to the fundamental concepts of Classes, Objects, Inheritance and polymorphism in C++.
3. Discuss insights into the basic concepts of data structures and algorithms.
4. Implement basic concepts about arrays, stacks, queues, and linked lists.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Explain C++ data types and operators	1,2,3,5	1,2,3
CO2	Explain object-oriented software engineering and Use concept of classes and objects in writing object-based programs	1,2,3,5	1,2,3
CO3	Use the concept of inheritance in writing object-oriented programs. Apply the concept of run time polymorphism	1,2,3,5	1,2,3

CO4	Identify and classify various types of data structures	1,2, 3,5	1,2,3
CO5	Write C++ programs to implement data structures like array, stack, queue, and linked list.	1,2,3,5	1,2,3
CO6	Write C++ program to demonstrate the concept of files	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	3	2		2								2	2	
CO2	3	3	2		3								3	2	
CO3	3	3	2		3								3	3	2
CO4	3	3	3		3								3	3	2
CO5	3	3	3		2								3	2	3
CO6	3	3	2		2								2	2	

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

COURSE CONTENT

THEORY:

Contents
UNIT - 1

The Basic C++ Language, Concepts of Object-Oriented Programming: The General Form of a C++ Program, Datatypes, Operators, Branching and Looping Statements, Dynamic Memory Allocation. OOP Concepts: Procedure Oriented vs Object-Oriented Programming, Features of Object-Oriented Programming, Class, Object, Data Member, Member Functions.
UNIT - 2
OOP Concepts and Features: Constructors and its Types, Destructors. Inheritance: Different types of Inheritances, Single Inheritance – Public, Private and Protected. Multiple Inheritance. Polymorphism: Introduction, Compile Time Polymorphism (function overloading) and Run Time Polymorphism (Virtual Functions). Operator Overloading: + operator
UNIT - 3
Introduction and Linear Data Structures: Stack & Queues: Introduction to Data Structure: Types of Data Structure, Arrays: Single Dimensional Array and its operations, Stack: Concept, operations, Array Representation of Stack, Applications; Queues: Concept, Operations, Array Representation of Simple Queue, Circular Queue, Applications;
UNIT - 4
Linear Data Structure: Linked List Array Vs Linked List, Linked List concept, Operations on Linked List, Types of Linked List, Application of Linked List. Concept of Files.

TEXTBOOKS:

1. Stanley B. Lippmann, Josee Lajore: "C++ Primer", 4th Edition, Pearson Education, 2005
2. Langsam, Augenstein, Tenenbaum, "Data Structures Using C and C+", 2nd edition, Pearson Education India, 2015.

REFERENCE BOOK:

1. Herbert Schildt , "The Complete Reference C++", Fourth Edition, McGraw-Hill, 2003.
2. Bjarne Stroustrup, " The C++ Programming Language", 4th Edition, Pearson Education, 2003
3. Seymour Lipschutz, "Data Structure with C", TMH.
4. A. V. Pai, "Data Structures and Algorithms", TMH, 2008

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. Web: https://www.tutorialspoint.com/cplusplus/index.htm
2. Journal: "A Study of Course Assessment on C++ Programming", by Spinger;
3. link: https://link.springer.com/chapter/10.1007/978-3-642-35452-6_39

SWAYAM/NPTEL/MOOCs:

1. SWAYAM/NPTEL: "Programming in C++ and Data Structures";
    a. link: https://onlinecourses.nptel.ac.in/noc21_cs02/preview
    b. link: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/
2. MOOC: Programming in C++ and Data Structures.

a. link: https://www.coursera.org/specializations/hands-on-cpp
b. link: https://www.coursera.org/learn/cs-fundamentals-1

Course Title	RDBMS Lab				Course Type		HC	
Course Code	B20EP0404	Credits	1		Class		IV 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:

This course introduces topics such as conceptual data modeling, relational data model, relational query languages, and relational database design. It helps the students to gain fundamental concepts, techniques, and applications in database.

COURSE OBJECTIVES:

1. To provide a knowledge of Database architecture
2. To provide students to understand and use a relational database system
3. To introduction to Databases, Conceptual design using ERD, Functional dependencies and Normalization, Relational Algebra.
4. To introduce about concepts of creating a good database and use various SQL operations

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Define and understand basic terminologies of DBMS.	1,2,3	1,2,3
CO2	Differentiate between File and Database and identify Database users, Administrators & Designers	1,2,3	1,2
CO3	Explain DBMS architecture and ER Model	1,2,3	1,2
CO4	Distinguish Attributes and Entity	1,2	1,2
CO5	Draw ER diagram for the given example and identify the constraints used in ER diagram	1,2,3,4	1,2,3
CO6	Explain Hashing techniques, Index structures, Relational Model & Joint operations	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									1	2	
CO2	3	1	1	1									3	1	
CO3	3	2		1									3	3	2
CO4	3	2		1									3	2	
CO5	3	2	1	1									3	2	
CO6	3	1	2	1									3	1	2

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

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Creation of COMPANY database	MySQL software	Familiarization of SQL Commands
2	Creation of INSURANCE database	MySQL software	Familiarization of SQL Commands
3	Creation of BANK database	MySQL software	Familiarization of SQL Commands
4	Creation of Order Processing database	MySQL software	Familiarization of SQL Commands

5	Creation of STUDENT database	MySQL software	Familiarization of SQL Commands
6	Create a Library Database for the given Schema and attributes	MySQL software	Familiarization of SQL Commands
7	Create an Order Database for the given Schema and attributes	MySQL software	Familiarization of SQL Commands

TEXTBOOKS:

1. Elmasri and Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education, 2007.
2. Raghu Ramakrishnan and Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2003
3. Phill Pratt, "Concepts of Database Management, Cengage Learning", 8th Edition, 2014.
4. Jeffrey A Hoffer, "Modern Database Management, Pearson", 12th Edition, 2015.

REFERENCE BOOK:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: "Database System Concepts", 6th Edition, McGraw Hill, 2010.
2. C J Date, "Database Design and Relational Theory: Normal Forms and All that Jazz", O 'Reilly, April 2012.
3. James Martin, "Principles of Database Management Systems", 1985, Prentice Hall of India, New Delhi
4. IEEE Transactions on Knowledge and Data Engineering
5. Elsevier Data and Knowledge Engineering
6. ACM Transactions on Database Systems

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. https://ieeexplore.ieee.org/document/1456366
2. https://ieeexplore.ieee.org/abstract/document/1054507
3. https://onlinelibrary.wiley.com/toc/10991131a/4/1

Course Title	Microcontrollers and Applications Lab				Course Type		HC	
Course Code	B20EN0407	Credits	1		Class		IV 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:

This course introduces 8051 microcontroller to provide basic understanding of architecture, instruction set, assembly level programming, interfacing to various sensors, relays, motors, actuators through various types of serial and parallel communication. Timers and interrupt functions are illustrated through the selection and control activities using suitable programming platforms such as Assemblers, C compilers, Kiel, , etc. This fundamental knowledge on microcontrollers lead to explore large number of controller families like ATMEGA, TI and PIC that are used in industrial and automation applications.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Introduce Microcontroller 8051 Architecture.
2. Give an insight into instruction set of microcontroller 8051.
3. Introduce assembly and C programming for 8051.
4. Provide insight into timer, serial communication and interrupts modules of 8051.
5. Interface a microcontroller with peripheral devices.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Describe the Architecture of 8051 microcontroller	1,2,4	1,3
CO2	Describe Instruction Set of 8051	1,2,4	1,3
CO3	Write Assembly and C Programs for 8051	1,2,4,5	1,2,3
CO4	Design Timer applications	1,2,12	1,2,3
CO5	Implement serial communication applications	1,2,12	1,2,3
CO6	Interface various peripherals.	1,2,12	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	2		2									3		2
CO2	3	3		2									3		2
CO3	3	3		2	2								3	2	2
CO4	3	3										2	3	2	2
CO5	3	3										2	3	2	2
CO6	3	3										2	3	2	2

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

PRACTICE SESSION:

Sl. No.	Name of the Practice Session	Tools and Techniques	Expected Skill /Ability
1	Data Transfer Instructions: Block Data Transfer without overlap, Sorting	Keil uVision3	Writing programs for a given task
2	Arithmetic Instructions: 32-bit multi-precision Addition, Subtraction, square and cube of 8-bit number and 8-bit Division.	Keil uVision3	Writing programs for a given task
3	Logical Instructions: ASCII to packed BCD and Vice versa, Implementation of Boolean expressions (Bit Manipulation).	Keil uVision3	Writing programs for a given task
4	Timers: Wave form generation with varying Duty	Keil uVision3	Writing programs

	Cycle using Interrupt and Polling Techniques.		for a given task
5	Serial Communication: Serial data transmission with Polling and Interrupt technique (Regular and Look up table).	Keil uVision3	Writing programs for a given task
6	Interfacing DAC to generate various waveforms with output voltage varying between -12V to 12V with Amplitude and Frequency control.	Keil uVision3	Writing programs for a given task
7	DC Motor speed control using external interrupt.	Keil uVision3	Writing programs for a given task
8	Stepper motor interfacing by controlling the steps and direction.	Keil uVision3	Writing programs for a given task
9	Display the ASCII value of Key pressed on LCD.	Keil uVision3	Writing programs for a given task

TEXTBOOKS:

4. Kenneth J. Ayala, "The 8051-microcontroller architecture, programming and applications" Thomson publication, 3rd edition, 2007
5. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D, McKinlay "The 8051 Microcontroller and Embedded Systems using assembly and C" PHI, 2006/Pearson 2006.
6. Sandhu, Harprit singh. "Making PIC microcontroller instruments and controllers / Harprit Singh Sandhu." McGraw-Hill (2009).

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

4. https://e2echina.ti.com/group/c8df485b47/m/msp430/11060/download
5. https://www.arm.com/zh/files/word/Yiu_Ch1.pdf
6. http://ce.sharif.edu/~pourmohammadi/AVR%20Microcontroller%20and%20Embedded%20Systems/AVR%20Microcontroller%20and%20Embedded%20Systems.pdf

Course Title	Object Oriented Programming and Data Structures using C++ Lab				Course Type		HC	
Course Code	B20EN0408	Credits	1		Class		IV 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:

The purpose of this course is to provide the solid foundations in the concepts of data structures algorithms and OOP using C++ programming language. The concepts of Data Structures and C++ Programming Language are very important to developing Application Software, System Software, Operating Systems, and Network Simulators as it employs Object-Oriented programming (OOP) aspect. This course has important features of OOP like Encapsulation, Data Abstraction, Polymorphism and Inheritance which are not present in C Programming Language. Survey of fundamental linear data structures (array, linked lists, queue, stack) and how to use them in C++. This course then delves deeper into the design, analysis and implementation of such data structures.

COURSE OBJECTIVES:

The objectives of this course are:

1. Provide insights into the role of programming languages like C and C++ in design and development.
2. Provide a concise introduction to the fundamental concepts of Classes, Objects, Inheritance, and polymorphism in C++.
3. Discuss insights into the basic concepts of data structures and algorithms.
4. Implement basic concepts about arrays, stacks, queues, and linked lists.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Illustrate the use of C++ Procedural Programming.	1,2,3,5,9,10	1,2,3
CO2	Apply the concept of classes and objects in writing object-based programs	1,2,3,5,9,10	1,2,3
CO3	Apply the concept of inheritance and polymorphism in writing object-oriented programs.	1,2,3,5,9,10	1,2,3
CO4	Identify and classify various types of data structures	1,2,3,5,9,10	1,2,3
CO5	Implement data structures like an array, stack, queue, linked list and File Handling using C++ programs.	1,2,3,5,9,10	1,2,3

CO6	Evaluate the knowledge gained on Procedural and Object-Oriented programming concepts of C++ using the appropriate IDE.	1,2,3,5,9,10	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			✓	✓		
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				2	2			2	2	1
CO2	4	3	2		3				2	2			3	2	1
CO3	3	3	2		3				2	2			3	3	2
CO4	3	4	3		3				2	2			3	3	2
CO5	3	3	4		2				2	2			3	2	3
CO6	3	2	3		2				2	2			3	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	a. Write a C++ program to generate all the prime numbers between 1 to 20. b. Write a C++ program to find both the largest and smallest number in an array of size 10. c. Write a Program to illustrate New and Delete Keywords for dynamic memory allocation.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with conditional & looping statements.
2	Write a C++ Program to display Names, Roll No., and	Algorithm,	Writing program

	grades of 3 students who have appeared in the examination. Declare the class of name, Roll No. and grade. Create an array of class objects. Read and display the contents of the array.	Flowchart, & C++ compiler.	skills with declaring & defining 'Class, Data Members, & Member Functions'.
3	Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with member function all.
4	Write a C++ Program to illustrate default constructor, parameterized constructor and copy constructors.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with constructors.
5	a. Write C++ program to illustrate single Inheritance. b. Write C++ program to illustrate single Inheritance.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with class inheritance.
5	a. Write C++ program to implement compile-time polymorphism. b. Write C++ program to implement run-time polymorphism.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with polymorphism.
6	Write C++ program to implement Stack and perform push, pop, & display operation on it.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Stack.
7	Write C++ program to implement Queue and perform enqueue, dequeue, & display operation on it.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Queue.
8	Write C++ program to implement Singly Linked List and perform operation 'adding new node at the beginning of Linked List' & display node values.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Linked List.
9	Write C++ program to implement Singly Linked List and perform operation 'adding new node at the end of Linked List' & display node values.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Linked List.
10	a. Write C++ program to implement Singly Linked List and perform operation 'deleting a last node from the Linked List' & display node values. b. Write C++ program to implement Singly Linked List and perform operation 'deleting a first node from the Linked List' & display node values.	Algorithm, Flowchart, & C++ compiler.	Writing program skills with Linked List.

TEXTBOOKS:

1. Stanley B. Lippmann, Josee Lajore: "C++ Primer", 4th Edition, Pearson Education, 2005
2. Langsam, Augenstein, Tenenbaum, "Data Structures Using C and C+", 2nd edition, Pearson Education India, 2015.

REFERENCE BOOK:

1. Herbert Schildt , "The Complete Reference C++", Fourth Edition, McGraw-Hill, 2003.
2. Bjarne Stroustrup, " The C++ Programming Language", 4th Edition, Pearson Education, 2003
3. Seymour Lipschutz, "Data Structure with C", TMH.
4. G. A. V. Pai, "Data Structures and Algorithms", TMH, 2008

JOURNALS/MAGAZINES/ ADDITIONAL SOURCES:

1. *Web:* https://www.tutorialspoint.com/cplusplus/index.htm
2. *Journal:* "A Study of Course Assessment on C++ Programming", by Spinger;
3. link: https://link.springer.com/chapter/10.1007/978-3-642-35452-6_39

SWAYAM/NPTEL/MOOCs:

3. SWAYAM/NPTEL: "Programming in C++ and Data Structures";
    a. link: https://onlinecourses.nptel.ac.in/noc21_cs02/preview
    b. link: https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs25/
4. MOOC: Programming in C++ and Data Structures.
    a. link: https://www.coursera.org/specializations/hands-on-cpp
    b. link: https://www.coursera.org/learn/cs-fundamentals-1

Course Title	Course based project on Microcontrollers and Applications				Course Type		HC	
Course Code	B20EN0405	Credits	1		Class		IV Semester	
	LTP	Credits	Contact Hours	Work Load	Total Number of Classes Per Semester		Assessment in Weightage	
	Theory	0	0	0				
	Tutorial	-	-	-				
	Practice	1	2	2	Theory	Practical	IA	SEE
	-	-	-	-				
	Total	**1**	**2**	**2**		**28**	**50%**	**50 %**

Course Based Project/Project Based Learning has been considered a good approach in improving education in Engineering, because this approach facilitates learning difficult subjects, encourages active learning, and allows developing both the Engineering skills and transversal skills by using a 'learning environment that simulates a real professional challenge'.

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	Build hardware to solve real time /Engineering problems using microcontrollers	1,2,3,4,5,9, 10,11,12	1,2,3
CO2	Apply appropriate technique to solve microcontroller-based engineering problems	1,2,3,4,5,9, 10,11,12	1,2,3
CO3	Present the innovative ideas in building microcontroller-based projects	1,2,3,4,5,9, 10,11,12	1,2,3
CO4	Develop an individual as responsible team member	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	✓	✓	✓	✓	✓	

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

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, the Course coordinator for Microcontrollers and Applications will be the Coordinator for Course based Project(CBP) Course.
3. The problem is the trigger of the learning process. The CBP approach is based on open problems, which are defined by faculty in context of Industry needs and current situation. The problems are assigned randomly to student teams.
4. The activities for each week will be assigned.
5. The Hands-On activities, along with short lectures, are included to facilitate learning key concepts, present the main aspects of the theory, and improve the background theory of students.
6. In the laboratory training, students carry out practices according to the project stages.

Assessment and Evaluation:

1. The Internal assessment is made on written reports, oral presentation and demonstration of project results with developed model in phase wise 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.

Course Title	Communication Skills				Course Type		FC	
Course Code	B20AH0301	Credits	2		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	**2**	**2**	**2**	**28**		**50%**	**50%**

COURSE OVERVIEW:

This course is aimed to develop basic communication skills in English in the learners, to prioritize listening and reading skills among learners, to simplify writing skills needed for academic as well as workplace context, to examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Develop basic communication skills in English.
2. Emphasize on the development of speaking skills amongst learners of Engineering and Technology
3. Impart the knowledge about use of electronic media such as internet and supplement the learning materials used in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).	10,12	1
CO2	Build inferences from the text	10,12	1
CO3	Make use of accurate writing skills using different components of academic writing.	10,12	1
CO4	Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic	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	✓	✓	✓			

COURSE ARTICULATION MATRIX

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

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

COURSE CONTENT

THEORY:

Contents
UNIT – 1
Functional English: Grammar: Prepositions; Modal Auxiliaries, Reading Comprehension, Active and passive voice, Giving Instructions.
UNIT – 2
Interpersonal Skills: Grammar: Tenses; Wh-questions, Compound words; Phrasal verbs, Recommendations
UNIT - 3
Multitasking Skills Grammar: Conditional Sentences, Homonyms; homophones, Subject-verb agreement.
UNIT – 4
Communication Skills Grammar: Direct and indirect speech, Interpreting visual materials (line graphs, pie charts etc.), Single word substitutes.

TEXTBOOKS:

1. Green, David. Contemporary English Grammar Structures and Composition. New Delhi: MacMillan Publishers, 20l0.
2. Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 20l2. 3.Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.

REFERENCE BOOK:

1. Murphy, Raymond. Murphy's English Grammar with CD. Cambridge University Press, 2004.
2. Rizvi, M. Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill, 2005.
3. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 20ll.
4. Sen et al. Communication and Language Skills. Cambridge University Press, 20l5.

Course Title	Indian Constitution and Professional Ethics				Course Type		FC	
Course Code	B20LS0301	Credits	2		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	2	2	2				
	Tutorial	-	-	-	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	**2**	**2**	**2**	**28**		**50%**	**50%**

COURSE OBJECTIVES:

The objectives of this course are:

1. To provide conceptual knowledge of Indian culture and traditions
2. To introduce students to the science and technological advancements related to Indian culture
3. To help students understand the Indian spiritual aspects of Indian culture
4. To 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.	6,8,9	1
CO2	Describe various ancient theories in treatment of any disease.	6,8,9	1
CO3	Appreciate the science and technological advancements in ancient India.	6,8,9	1
CO4	Comprehend the Indian spiritual aspects of Indian culture like yoga, meditation, and nirvana.	6,8,9	1
CO5	Demonstrate the theory behind celebrating Hindu festivals and concept of making varieties of food	6,8,9	1
CO6	Understand India as a land united by cultural diversity.	6,8,9	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						3		3	2				1		
CO2						3		3	2				1		
CO3						3		3	2				1		
CO4						3		3	2				1		
CO5						3		3	2				1		
CO6						3		3	2				1		

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

COURSE CONTENT

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 **Development of Science in Ancient India**- Astronomy, Mathematics, Medicine, Metallurgy. **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

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

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

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

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

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

Unit IV: 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

Course Title	Universal Human Values				Course Type		MC	
Course Code	B20AHM401	Credits	0		Class		IV Semester	
Course Structure	LTP	Credits	Contact Hours	Work Load	Total Number Of Classes Per Semester		Assessment in Weightage	
	Lecture	-	1	1				
	Tutorial	-	1	1	Theory	Practical	IA	SEE
	Practice	-	-	-				
	Total	**2**	**2**	**2**	**26**		**50%**	**50%**

COURSE OBJECTIVES:

The objectives of this course are:

1. Development of a holistic perspective based on self- exploration about themselves (human being), family, society, and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
4. Strengthening of self-reflection.
5. Development of commitment and courage to act

COURSE OUTCOMES(COs)

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

CO#	Course Outcomes	POs	PSOs
CO1	Understand the significance of value inputs in a classroom and start applying them in their life and profession	6,9,10	1
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc	6,9,10	1
CO3	Understand the role of a human being in ensuring harmony in society and nature.	6,9,10	1
CO4	Demonstrate the role of human being in the abetment of pollution	6,9,10	1
CO5	Describe appropriate technologies for the safety and security of the society as responsible human being	6,9,10	1
CO6	Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	6,9,10	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						3			1	1			1		
CO2						3			1	1			1		
CO3						3			1	1			1		
CO4						3			1	1			1		
CO5						3			1	1			1		
CO6						3			1	1			1		

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

COURSE CONTENT

Contents
UNIT – 1 Happiness and Prosperity
A look at basic Human Aspirations. Right understanding, Relationship, basic requirements for fulfilment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly, Method to fulfil human aspirations: understanding and living in harmony at various levels, Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility. Understanding the Body as an instrument of 'I' (I being the doer, seeker and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

UNIT - 2 Understanding values in human-human relationship
meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship. Understanding the meaning of Trust; Difference between intention and competence. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family
UNIT – 3 Understanding the harmony in the Nature
Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.
UNIT – 4 Natural acceptance of human values
Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations

TEXTBOOKS:

1. R R Gaur, R Sangal, G P Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010
2. A.N Tripathy, Human Values, New Age Intl. Publishers, New Delhi, 2004.
3. R.R. Gaur, R. Sangal and G.P. Bagaria, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2010
4. Bertrand Russell, Human Society in Ethics & Politics, Routledge Publishers, London, 1992

REFERENCE BOOK:

1. Corliss Lamont, Philosophy of Humanism, Humanist Press, London, 1997
2. I.C. Sharma, Ethical Philosophy of India Nagin & co Julundhar, 1970
3. Mohandas Karamchand Gandhi, The Story of My Experiments with Truth, Navajivan Mudranalaya, Ahmadabad, 1993
4. William Lilly, Introduction to Ethics, Allied Publisher, London, 1955