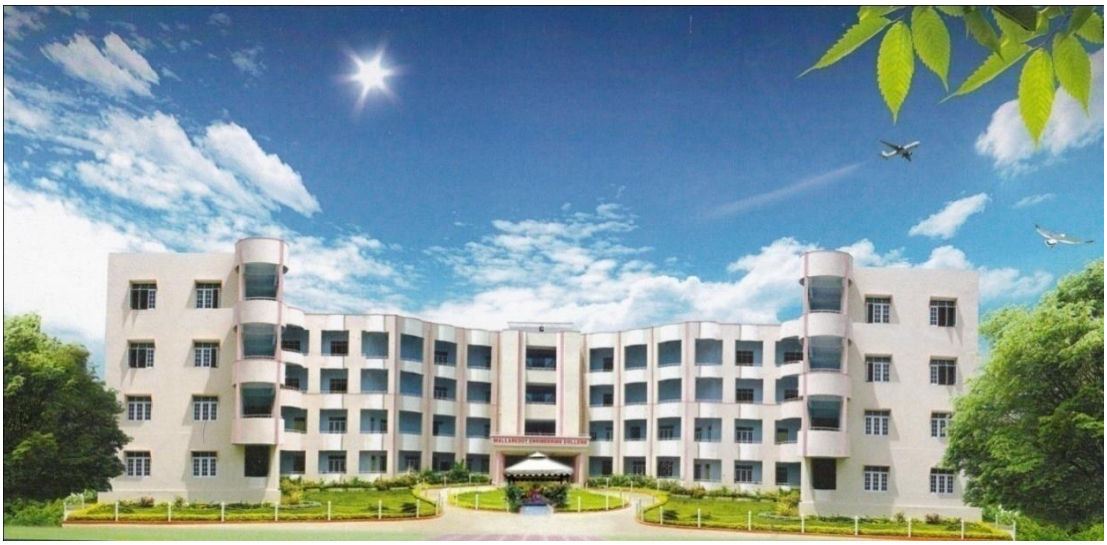
ACADEMIC REGULATIONS, COURSE STRUCTURE AND DETAILED SYLLABUS

Effective from the Academic Year 2021-22 onwards

Department of Electronics and Communication Engineering



For

B.Tech. - Four Year Degree Programme

(MR21 Regulations)

Department of Electronics and Communication Engineering

MALLA REDDY ENGINEERING COLLEGE

(Autonomous)

(An UGC Autonomous Institution, Approved by AICTE and Affiliated to JNTUH, Hyderabad)
Recognized under section 2(f) &12 (B) of UGC Act 1956, Accredited by NAAC with 'A' Grade (II Cycle) and NBA
Maisammaguda, Dhulapally (Post ViaKompally), Secunderabad - 500 100.
Website: www.mrec.ac.in E-mail: principal@mrec.ac.in

MALLA REDDY ENGINEERING COLLEGE (AUTONOMOUS)
MR21 – ACADEMIC REGULATIONS (CBCS)
for B.Tech. (REGULAR) DEGREE PROGRAMME

Applicable for the students of B.Tech. (Regular) programme admitted from the Academic Year ***2021-22*** onwards

The B.Tech. Degree of Jawaharlal Nehru Technological University Hyderabad, Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements for the award of the Degree.

VISION

To be a premier center of professional education and research, offering quality programs in a socio-economic and ethical ambience.

MISSION

- To impart knowledge of advanced technologies using state-of-the-art infrastructural facilities.
- To inculcate innovation and best practices in education, training and research.
- To meet changing socio-economic needs in an ethical ambience.

DEPARTMENT VISION

- To produce innovative, globally competent and ethical Electronics and communication Engineers to cater socio-economic needs.

DEPARTMENT MISSION

- To impart quality education in Electronics and Communication Engineering discipline and produce employable graduates
- To improve the thought process of students by exposing them to advanced technologies and make them innovative in their career
- To provide ethical and value-based education by encouraging activities addressing the societal needs.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: To impart with a sound knowledge in scientific and engineering technologies necessary to formulate, analyze, design and implement solutions to computer technology related problems.

PEO2: To carry out research in frontier areas of computer science and engineering with the capacity to learn independently throughout life to develop new technologies.

PEO3: To train to exhibit technical, communication and project management skills in their profession and follow ethical practices.

PEO4: To posses leadership and team working skills to become a visionary and an inspirational leader and entrepreneur.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Understand the problem and apply design and analysis tools to find solution in the domains of Structural, thermal and Fluid Mechanics.

PSO2: Engage professionally in industries or as an entrepreneur by applying Manufacturing concepts.

PSO3: Systemize the Engineering and manufacturing practices using TQM concepts and Optimization techniques.

PROGRAMME OUTCOMES (POs)

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MALLA REDDY ENGINEERING COLLEGE

COURSE STRUCTURE – B.Tech. Electronics and Communication Engineering Programme.(MR21 Regulations - Effective from Academic Year 2021 – 22 onwards)

SEMESTER – I							
S. No	**Category**	**Course Code**	**Name of the Subject**	**Contact hours/week**			**Credits**
				L	**T**	**P**	
1.	HSMC	B0H01	English	3	-	-	3
2.	BSC	B0B03	Linear Algebra and Applied Calculus	3	1	-	4
3.	ESC	B0501	Programming for Problem Solving	3	-	-	3
4.	ESC	B0201	Basic Electrical and Electronics Engineering	3	-	-	3
5.	ESC	B0502	Programming for Problem Solving Lab	-	-	2	1
6.	HSMC	B0H02	English Language and Communication Skills Lab	-	-	2	1
7.	ESC	B0302	Engineering Workshop	-	-	2	1
8.	ESC	B0202	Basic Electrical and Electronics Engineering Lab	-	-	2	1
			Total	**12**	**1**	**8**	**17**
			Total Contact Hours	**21**			

SEMESTER – II							
S. No	**Category**	**Course Code**	**Name of the Subject**	**Contact hours/week**			**Credits**
				L	**T**	**P**	
1.	BSC	B0B17	Engineering Chemistry	3	1	-	4
2.	ESC	B0301	Engineering Graphics	2	-	2	3
3.	BSC	B0B10	Applied Physics	3	1	-	4
4.	BSC	B0B04	Advanced Calculus	3	1	-	4
5.	ESC	B0401	Analog Electronics	3	-	-	3
6.	ESC	B0553	Basic Python Programming Lab	-	1	2	2
7.	BSC	B0B11	Applied Physics Lab	-	-	2	1
8.	BSC	B0B18	Engineering Chemistry Lab	-	-	2	1
9.	ESC	B0402	Analog Electronics Lab	-	-	2	1
			Total	**14**	**4**	**10**	**23**
			Total Contact Hours	**28**			

SEMESTER-III							
S.No	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1	BSC	B0B08	Complex Variables and Numerical Methods	3	-	-	3
2	PCC	B0403	Digital Electronics	3	-	-	3
3	PCC	B0404	Signal Theory and Stochastic Processes	3	-	-	3
4	PCC	B0405	Electromagnetic Waves & Transmission lines	3	-	-	3
5	PCC	B0406	Network Theory and Circuit Analysis	3	-	-	3
6	PCC	B0407	Digital Electronics Lab	-	-	2	1
7	PCC	B0408	Signals and Stochastic Processes Lab	-	-	2	1
8	ESC	**B0554**	Fundamentals of Data Structures Lab	-	-	4	2
9	MC	B00M2	Environmental Science	2	-	-	-
Total				**17**	**-**	**8**	**19**
Total contact hours				**25**			

SEMESTER-IV							
S.No.	**Category**	**Course Code**	**Name of the Subject**	**L**	**T**	**P**	**Credits**
1	HSMC	B0H08	Engineering Economics and Accountancy	3	-	-	3
2	PCC	B0409	Sensors & Devices	3	-	-	3
3	PCC	B0410	Microprocessor & Microcontroller	3	-	-	3
4	PCC	B0411	Analog and Digital Communications	3	-	-	3
5	PCC	B0412	Pulse and Linear Integrated Circuits	3	1	-	4
6	PCC	B0413	Analog and Digital Communications Lab	-	-	3	1.5
7	PCC	B0414	Electronic Circuits and Pulse Circuits Lab	-	-	3	1.5
8	ESC	B0555	Object Oriented Programming through JAVA Lab	-	-	4	2
9	MC	B00M1	Gender Sensitization	2	-	-	0
Total				**17**	**1**	**10**	**21**
Total contact hours				**28**			

SEMESTER-V							
S. No.	**Category**	**Course Code**	**Name of the course**	**Contact Hours/Week**			**Credits**
				L	**T**	**P**	
1.	HSMC	B0H05	Management Fundamentals	3	-	-	3
2.	PCC	B0415	Embedded Systems	3	-	-	3
3.	PCC	B0416	VLSI Design	3	-	-	3
4.	PEC-I	B0417	Electronic Measurements and Instrumentation	3	-	-	3
		B0418	Computer Organization and Operating Systems				
		B0419	Data Communications and Computer Networks				
		B0420	Advanced Programmable Logic Device Architectures				
		B0421	Control Systems				
5.	OEC-I		**Open Elective-I**	3	-	-	3
6.	PCC	B0422	Embedded Systems Lab	-	-	3	1.5
7.	PCC	B0423	VLSI Design Lab	-	-	3	1.5
8.	ESC	B0563	Fundamentals of Database Management Systems Lab	-	1	2	2
9.	MC	B00M3	Quantitative Aptitude & Verbal Reasoning -I	1	1	-	0
			Total	**16**	**2**	**8**	**20**
			Total Contact Hours	**26**			

SEMESTER-VI							
S.No.	**Category**	**Course Code**	**Name of the course**	**Contact Hours/Week**			**Credits**
				L	**T**	**P**	
1	PCC	B0424	Digital Signal Processing	3	-	-	3
2	PCC	B0425	Fundamentals of Mixed Signal Design	3	-	-	3
3	PCC	B0426	Antennas and Wave Propagation	3	1	-	4
4	PEC-II	B0427	Wireless and Mobile Communication	3	-	-	3
		B0428	Introduction to Artificial Intelligence				
		B0429	Digital Design using FPGA				
		B0430	Information Theory & Coding				
		B0431	Advanced Computer Architecture				
5	OEC-II		**Open Elective-II**	3	-	-	3
6	HSMC	B0H03	English Communication &Presentation Skills Lab	-	-	2	1
7	PCC	B0432	Digital Signal Processing Lab	-	-	3	1.5
8	PCC	B0433	Fundamentals of Mixed Signal Design Lab	-	-	3	1.5
9	MC	B00M4	Quantitative Aptitude & Verbal Reasoning -II	1	1	-	0
			Total	**16**	**2**	**8**	**20**
			Total Contact Hours	**26**			

SEMESTER VII							
S. No.	**Category**	**Course Code**	**Name of the course**	**Contact Hours/Week**			**Credits**
				L	**T**	**P**	
1	PCC	B0434	Digital Image Processing	3	1	-	4
2	PCC	B0435	IoT Architecture and its Applications	3	-	-	3
3	PEC-III	B0436	Principles of Optimization Techniques	3	-	-	3
		B0437	Low Power VLSI Design				
		B0438	Optical Communications				
		B0439	Embedded Real Time Operating Systems				
		B0440	Neural Networks and Fuzzy Logic				
4	PEC-IV	B0441	Smart Antennas	3	-	-	3
		B0442	Introduction to Machine Learning				
		B0443	5G Communications				
		B0444	System On Chip Architecture				
		B0445	Advance Digital System Design				
4	OEC-III		**Open Elective - III**	3	-	-	3
5	PCC	B0446	Digital Image Processing Lab	-	-	3	1.5
6	PCC	B0447	IoT Architecture and its Applications Lab	-	-	3	1.5
7	PROJ	B00P1	Internship /Mini project	-	-	4	2
			Total	**15**	**1**	**10**	**21**
			Total Contact Hours	**26**			

SEMESTER VIII							
S.No.	**Category**	**Course Code**	**Name of the course**	**Contact Hours/Week**			**Credits**
				L	**T**	**P**	
1	PEC-V	B0448	Computer Vision and Pattern Recognition	3	-	-	3
		B0449	Test and Testability				
		B0450	Satellite Communications				
		B0451	Deep Learning				
		B0452	Optical Networks				
2	PEC-VI	B0453	Wavelets & Its Applications	3	-	-	3
		B0454	ADHOC Wireless Sensor Networks				
		B0455	Microwave Communication Systems				
		B0456	Robotics and Automation				
		B0457	MEMS and Nano Electronics				
3	PROJ	B00P2	Seminar	-	-	2	1
4	PROJ	B00P3	Main Project	-	-	24	12
			Total	**6**	**-**	**26**	**19**
			Total Contact Hours	**32**			

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I / II Semester		
Code: B0H01	ENGLISH	L	T	P
Credits: 3	(Common for CE, EEE, ME, ECE, CSE, CSE (Cyber Security), CSE (AI and ML), CSE (DS), CSE (IOT), AI, IT and Mi.E)	3	-	-

Course Objectives:

The objective of this course is to improve the English Language and Literary competence of the students. The course provides requisite insights into grammar, vocabulary, prose, and short stories. Further, it also helps in developing the skills of Reading and Writing. The course also equips students to study their academic subjects more effectively using the theoretical and practical components of the English language and literature.

MODULE – I

Speech : "Go Kiss the World" by Subroto Bagchi
Poem : **"**Leisure" by W. H. Davies
Vocabulary : Formation of Words, Roots, Prefixes, Suffixes
Grammar : Articles and Prepositions
Reading : Skimming and Scanning
Writing : Introduction to Writing Skills, Characteristics of Effective Writing

MODULE – II

Short story : "Gift of Magi" by O' Henry
Poem : **"**No Man is an Island" by John Donne
Vocabulary : One Word Substitutions; Synonyms and Antonyms
Grammar : Degrees of Comparison, Active and Passive Voice
Reading : Intensive Reading and Extensive Reading
Writing : Paragraph Writing- Cohesive devices; Jumbled Sentences; Punctuation

MODULE – III

Essay : **"**Lucidity, Simplicity, Euphony" by W. Somerset Maugham
Poem : **"**We wear the Mask" by Paul Laurence Dunbar
Grammar : Tense and Aspect
Vocabulary : Homonyms, Homophones, Homographs
Reading : Reading for Topic and Theme
Writing : Letter Writing

MODULE – IV

Short story : "The Night Train at Deoli" by Ruskin Bond
Poem : **"**Gift of India" by Sarojini Naidu
Grammar : Question Tags; Concord
Vocabulary : Idiomatic Expressions; Phrasal Verbs
Reading : Reading for Interpretation

Writing : Essay Writing, Describing, Defining and Classifying

MODULE – V

Essay : "Toasted English" by R. K. Narayan
Poem : "If" by Rudyard Kipling
Grammar : Direct and Indirect Speech, Misplaced Modifiers
Vocabulary : Redundancies and Clichés
Reading : Reading for Specific Purposes, Reading Comprehension practice
Writing : Paraphrasing & Summarizing,

Prescribed Textbook:

Reference Books:

1. Azar, Betty and Stacy A, Hagen**.** *Understanding and Using English Grammar*. 4th edition, Foundation Books, 2009.
2. Chaudhuri, Santanu S. *Learn English: A Fun Book of Functional Language, Grammar and Vocabulary.* Tata McGraw Hill Education, New Delhi, 2013.
3. Eastwod, John. *Oxford Guide to English Grammar.* 4th edition, Oxford University Press, 1994.
4. Field, Marion**.** *Improve Your Written English.* 5th Edition. How to Books, UK, 2009.
5. Leech, Geoffrey and Svartvik, J. *A Communicative Grammar of English*. 3rd edition, Routledge, 2013.

Related Websites:

1. http://www.slideshare.net/aszardini/word-formationroot-words-prefixes-and-suffixes
2. http://www.scribd.com/doc/37085980/Circulars-Circular-Letters-Notices-Memo#scribd.
3. http://www.zsme.tarnow.pl/jezykiobce/wp-content/uploads/2013/11/writing-letters1.pdf.

Course Outcomes:

After completion of the course, students will be able to:

1. Use written and spoken English considerably well for academic purposes.
2. Communicate in Enrich accurately and fluently.
3. Employ extensive and intensive reading skills.
4. Gain confidence in writing for academic and real life situations.
5. Use standard grammar, punctuation, and spelling in technical documents.

CO-PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					1					2		2			
CO2										1		2			
CO3		1		1						2		2			
CO4					1	1			1	2		2			
CO5				1	1				1	2		2			

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: B0B03	**Linear Algebra and Applied Calculus (Common For ECE & EEE)**	**L**	**T**	**P**
Credits: 4		**3**	**1**	**-**

Prerequisites: Matrices, Differentiation and Integration.

Course Objectives:

1. To learn types of matrices, Concept of rank of a matrix and applying the concept of rank to know the consistency of linear equations and to find all possible solutions, if exist.
2. To learn concept of Eigen values and Eigen vectors of a matrix, diagonalization of a matrix, Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. To learn the concept of the mean value theorems, partial differentiation and maxima and minima.
4. To learn methods of solving differential equations and its applications to basic engineering problems.
5. To learn series solution of the given differential equations.

MODULE I: MATRIX ALGEBRA [12 PERIODS]

VECTOR SPACE, BASIS, LINEAR DEPENDENCE AND INDEPENDENCE (ONLY DEFINITIONS)

Matrices: Types of Matrices, Symmetric; Hermitian; Skew-symmetric; Skew- Hermitian; orthogonal matrices; Unitary Matrices; Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; solving system of Homogeneous and Non-Homogeneous linear equations, LU – Decomposition Method.

MODULE II: Eigen Values and Eigen Vectors [12 Periods]

Eigen values , Eigen vectors and their properties; Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); Finding inverse and power of a matrix by Cayley-Hamilton Theorem;.

Quadratic forms: Nature, rank, index and signature of the Quadratic Form, Linear Transformation and Orthogonal Transformation, Reduction of Quadratic form to canonical forms by Orthogonal Transformation Method. Singular Value Decomposition

Module -III: Differential Calculus [12 Periods]

Mean value theorems: Rolle's theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series.

Functions of Several Variables: Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers.

Module –IV: Ordinary Differential Equations [12 Periods]

First Order and First Degree ODE: Exact Differential Equations, Non Exact Differential Equations, Orthogonal trajectories, Newton's law of cooling, Law of natural growth and decay.

Second and Higher Order ODE with Constant Coefficients: Introduction-Rules for finding complementary function and particular integral. Solution of Homogenous, non-homogeneous differential equations, Non-Homogeneous terms of the type e^{ax} , sin(ax), cos (ax), polynomials in x, e^{ax} V(x), x V(x), Method of variation of parameters.

Module – V: Series Solutions to the Differential Equations [12 Periods]

Motivation for series solution, Ordinary point and regular singular point of a differential equation, series solution to differential equation around zero, Frobenious Method about zero.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain Srk Iyengar ,Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.
4. Richard Bellman, Introduction to matrix Analysis, Siam, second Edition.

References Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint,2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
3. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, AffiliatedEast–West press, Reprint 2005.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.

E – RESOURCES:

1. https://www.youtube.com/watch?v=sSjB7ccnM_I (Matrices – System of linear Equations)
2. https://www.youtube.com/watch?v=h5urBuE4Xhg (Eigen values and Eigen vectors)
3. https://www.youtube.com/watch?v=9y_HcckJ96o (Quadratic forms)
4. http://www.math.cmu.edu/~wn0g/noll/2ch6a.pdf(Differential Calculus)
5. https://www.intmath.com/differential-equations/1-solving-des.php(Differential Equations)

NPTEL:

1. https://www.youtube.com/watch?v=NEpvTe3pFIk&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2B_T&index=5 (Matrices – System of linear Equations)
2. https://www.youtube.com/watch?v=wrSJ5re0TAw (Eigen values and Eigen vectors)
3. https://www.youtube.com/watch?v=yuE86XeGhEA (Quadratic forms)

Course Outcomes:

1. The student will be able to find rank of a matrix and analyze solutions of system of linear equations.
2. The student will be able to find Eigen values and Eigen vectors of a matrix, diagonalization a matrix, verification of Cayley Hamilton theorem and reduce a quadratic form into a canonical form through a linear transformation.
3. The student will be able to verify mean value theorems and finding maxima and minima of function of two variables.
4. Formulate and solve the problems of first and higher order differential equations
5. The student will be able to solve series solution of given differential equation.

CO- PO Mapping

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	3	3				2			3
CO2	3	2	2	3	2				2			3
CO3	3	2	2	3	2				2			2
CO4	3	2	2	3	3				2			2
CO5	3	2	2	3	3				2			2

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: B0501	**Programming for Problem Solving** (Common for CE, EEE, ME, ECE, CSE, CSE (Cyber Security), CSE (AI and ML), CSE (DS), CSE (IOT), AI, IT and Mi.E)	L	T	P
Credits: 3		3	-	-

Prerequisites: NIL

Course Objectives:

Understand the basic terminology, write, compile and debug programs in computer programming
Implement different control statements for solving problems.
Understand the concept of structured program and arrays.
Implement the idea of strings and pointers.
Analyse the usage of structures and different file operations.

MODULE I: Fundamentals and Introduction to 'C' Language [10 Periods]

Introduction Fundamentals– Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development Method, Algorithms, Pseudo code, flow charts, applying the software development method.

Introduction to 'C' Language: – Background, C-tokens- Keywords, Identifiers, Basic data types, Variables, Constants, Preprocessor directives-include, define, Managing Input / Output functions - formatted input / output functions, Operators. Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Simple C Programming examples.

MODULEII: Conditional Statements and Repetition Statements [09 Periods]
Conditional Statements: Simple if statement, if-else statement, if-elseif- ladder, nested if- else, Dangling else problem, switch statements.

Repetition statements – while, for, do-while statements, nested looping, other statements related to looping – break, continue, goto, Simple C Programming examples.

MODULE III: Designing Structured Programs and Arrays [10 Periods]
Designing Structured Programs-Introduction to function, Advantages, user defined functions, inter function communication-call by value, Storage classes-auto, register, static, extern, scope rules, type qualifiers, recursion – recursive functions-Towers of Hanoi problem.

Arrays: Basic Concepts, Types of arrays, applications- Selection sort, Bubble sort, Insertion sort, Linear search and Binary search methods, arrays and functions.

MODULE IV: Strings and Pointers **[09 Periods]**

Strings: Concepts, String Input / Output functions, arrays of strings, string manipulation functions, string conversion, C program examples.

Pointers – Basic Concepts, Pointers for inter function communication-call by reference, pointers to pointers, Pointer arithmetic, array of pointers, pointers to array, applications, pointers to void, pointers to functions, Dynamic memory allocation functions.

MODULE V: Structures and File Handling **[10 Periods]**

Structures – Declaration, definition and initialization of structures, accessing structure elements, nested structures, arrays of structures, structures and functions, pointers to structures, self-referential structures, unions, difference between structures and union, typedef, bit fields, enumerated types, C programming examples.

Files – Basic Concept of a file, file input / output operations, text files and binary files, file status functions (error handling), Random file access functions, command –line arguments.
C program examples.

TEXTBOOKS

1. Computer Fundamentals and Programming in C, P. Dey, M Ghosh, Second edition, Oxford University Press.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Eighth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M. Ritchie, PHI/Pearson Education

REFERENCES

1. C Programming & Data Structures, B.A. Forouzan and R.F. Gilberg, Third Edition, Cengage Learning
2. C for Engineers and Scientists, H. Cheng, Mc. Graw-Hill International Edition
3. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

E–RESOURCES

1. http://oxford university press.ac.in/eBooks/ Programming in C.
2. https://www.journals.elsevier.com/science-of-computer-programming
3. http://www.ejournalofsciences.org
4. http://onlinecourses.nptel.ac.in/iiitk_cs-101
5. http://onlinevideolecture.com/ebooks/?subject=C-Programming

Course Outcomes:

At the end of the course, students will be able to

1. Write algorithms and to draw flowcharts for solving problems and translate the algorithms/flowcharts to programs (in C language).
2. Apply different types of control structures to code and test a given logic in C programming language.
3. Decompose a problem into functions and to develop modular reusable code and Use arrays to formulate algorithms and programs for Searching and sorting problems.
4. Develop programs that make use of concepts such as strings, pointers.
5. Analyze structures, file operations and command line arguments.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

Cos	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2										1	3	2	2
CO2	3	2	1									1	3	2	1
CO3	3	3	1									1	3	2	1
CO4	3	1										2	3	2	1
CO5	3	3	1									2	3	2	1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: B0201	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common for all branches)	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives: To introduce the concept of electrical circuits and its components. To introduce the characteristics of various electronic devices. To impart the knowledge of various configurations, characteristics and applications of electrical & electronic components.

MODULE I: DC Circuits **9 Periods**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws - Series, parallel, series-parallel, star-to-delta and delta-to-star transformation- analysis of simple circuits with dc excitation. Superposition, Thevenin's and Maximum Power Transfer Theorems with DC excitation.

MODULE II: AC Circuits **9 Periods**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel).

MODULE III: Introduction to Electrical Machines **10 Periods**

A: DC Machines : Construction & Principle of Operation of DC Generators – E.M.F Equation. Principle of operation DC Motors – Back E.M.F. - Torque equation – Brake Test -Characteristics.

B: AC Machines: Construction and Principle of operation of Transformer- EMF Equation. Construction and Principle of Operation of 3 Phase Induction Motors - Brake test on 3-Phase Induction Motor – Applications.

MODULE IV: P-N Junction Diode **10 Periods**

P-N Junction Diode: Diode equation, Energy Band diagram, Volt-Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Diffusion and Transition Capacitances. Zener diode operation, Zener diode as voltage regulator.

Rectifiers : P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier.

Filters : Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

MODULE V: Bipolar Junction Transistor (BJT): **10 Periods**

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Symbol, Amplifying Action, Common Emitter, Common Base and Common Collector configurations and Input-Output Characteristics, Comparison of CE, CB and CC configurations

Junction Field Effect Transistor and MOSFET: Construction, Principle of Operation, Symbol,

Pinch-Off Voltage, Volt-Ampere Characteristic, Comparison of BJT and FET.

Text Books

1. M.Surya Kalavathi, Ramana Pilla, Ch. Srinivasa Rao, Gulinindala Suresh, **" Basic Electrical and Electronics Engineering"**, S.Chand and Company Limited, New Delhi, 1st Edition, 2017.
2. R.L.Boylestad and Louis Nashlesky, **"Electronic Devices & Circuit Theory"**, Pearson Education, 2007.

References

1. V.K. Mehtha and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand & Co., 2009.
2. Jacob Milliman, Christos C .Halkias, Satyabrata Jit (2011), "Electronic Devices and Circuits", 3 rd edition, Tata McGraw Hill, New Delhi.
3. Thomas L. Floyd and R. P. Jain, "Digital Fundamentals", Pearson Education, 2009.
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 2008.
5. Nagrath I.J. and D. P. Kothari, "Basic Electrical Engineering", Tata McGraw Hill, 2001.
6. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Education, New Delhi, 2nd Edition, 2005.

E - Resources

1. https://www.electrical4u.com/ohms-law-equation-formula-and-limitation-of-ohms-law/
2. https://www.eeweb.com/passives
3. http://nptel.ac.in/courses/108108076/
4. http://nptel.ac.in/downloads/108105053/

Course Outcomes:

At the end of the course, students should be able to

1. Apply KCL, KVL and network theorems to analyse DC circuit.
2. Analyze the single-phase AC Circuits, the representation of alternating quantities and determining the power and power factor in these circuits.
3. Comprehend the construction and Operation of DC and AC machines.
4. Understand the operation of PN Junction diode and its application in rectifier circuits.
5. Compare the different configurations of BJT and draw the V-I characteristics of BJT, JFET and MOSFET.

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: B0502	Programming for Problem Solving Lab (Common for CE, EEE, ME, ECE, CSE, CSE (Cyber Security), CSE (AI and ML), CSE (DS), CSE (IOT), AI, IT and Mi.E)	L	T	P
Credits: 1		-	-	2

Prerequisites: NIL

Course Objectives:

1. Understand the various steps in Program development
2. Identify syntax and semantics of C Programming Language
3. Illustrate the usage of structured programming approach in solving problems.
4. Develop programs that make use of arrays, strings and pointers in C language
5. Analyse structures and different file operations

Software Requirements: C

List of Programs:

1. a. Practice various Internal and External DOS Commands.
   b. Write sample examples of C programs to implement basic operations.
2. a. Write a C program to find smallest and largest of given three numbers.
   b. Write a C program to find the roots of a quadratic equation.
   c. Write a C program to check whether given character is alphabet, digit or special symbol
3. a. Write a C program to find the sum of individual digits of a positive integer.
   b. Write a C program to generate the first 'n' terms of the sequence.
   [A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.]
4. a. Write a C program to find whether the given number is palindrome, perfect, Armstrong or strong.
   b. Write a C program to generate all the prime numbers between n1 and n2, where n1 and n2 are values supplied by the user.
5. Write C programs that use both recursive and non-recursive functions
   a. To find the factorial of a given integer.
   b. To find the GCD (greatest common divisor) of two given integers.
6. a. Write a C program to find both the largest and smallest number in a list of integers.
   b. Write a C program that uses non-recursive function to search for a Key value in a given list of integers using linear search.
   c. Write a C program that uses recursive and non -function to search for a Key value in a given sorted list of integers using Binary search.

7. a. Write a C program that implements the Bubble sort method to sort a given array of integers in ascending order.
   b. Write a C program that implements the Selection sort method to sort a given list of names in ascending order.
8. Write a C program to perform the following:
   a. Addition of Two Matrices
   b. Multiplication of Two Matrices.
9. Write a C program that uses functions to perform the following operations:
   a. To insert a sub-string into given main string from a given position.
   b. To delete n characters from a given position in a given string.
   c. To find substring in a given string
10. a. Write a C program to determine if the given string is a palindrome or not
    b. Write a C program to count the lines, words and characters in a given text.
11.
    a. Write a C program to swap two numbers, which implement call by value and call by reference.
    b. Write a C program to display the below student details using structures

Roll Number	Name	Gender	Branch	Attendance percentage
501	John	Male	CSE	77.3
502	Alice	Male	ECE	80.5
503	Sam	Female	IT	90.7

    c. Write a C program to find grade of a student using structures.
12.
    a. Write a C program which copies one file to another
    b. Write a C program to find sum of two numbers using command line arguments
13.
    a. Develop a mini project which implement the Library Management System
    b. Develop a mini project which implement the Student Record System

TEXT BOOKS:

a. Computer Fundamentals and Programming in C, P. Dey, M Ghosh, Second edition, Oxford University Press
b. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Eighth Edition, Pearson Education.
c. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education

REFERENCES:

a. C Programming & Data Structures, B.A. Forouzan and R.F. Gilberg, Third Edition, Cengage Learning
b. C for Engineers and Scientists, H. Cheng, Mc. Graw-Hill International Edition
c. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press

Course Outcomes:

At the end of the course, students will be able to

1. Make use various programming constructs and to develop C programs
2. Implement different Operations on arrays, strings, functions, pointers in C programming language.
3. Analyze structures, unions and file in C language to develop Programs.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**										**1**	**3**	**2**	
CO2	**3**	**2**	**1**									**1**	**3**	**3**	**1**
CO3	**2**	**3**	**1**									**1**	**3**	**2**	**1**

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I / II Semester		
Code: B0H02	**English Language and Communication Skills Lab**	**L**	**T**	**P**
Credits: 1	**(Common for CE, EEE, ME, ECE, CSE, CSE (C S), CSE (AI and ML), CSE (DS), CSE (IOT), AI, IT and Mi.E)**	**-**	**-**	**2**

The Language Lab focuses on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations and contexts.

Course Objectives:

The course aims to develop students' intelligibility in their pronunciation of English - speech Sounds, word accent, intonation and rhythm. It also helps to improve the fluency in spoken English and make them aware of nuances of major skills, namely, listening and speaking skills. It also trains students to understand nuances of both verbal and non-verbal communication During all activities. The course enables the learners to develop their confidence levels so as to Participate in discussions, debates and public speaking. Listening Skills:

Objectives:

1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
2. To equip students with necessary training in listening so that they can comprehend the speech of people of different backgrounds and regions

*Students should be given practice in listening to the sounds of the language to be able to recognize them, awareness regarding stress and recognize and use the right intonation in sentences.

- Listening for general content
- Listening to fill up information
- Intensive listening
- Listening for specific information

Speaking Skills:

Objectives:

1. To make students aware of the role of speaking in English and its contribution to their success.
2. To enable students to express themselves fluently and appropriately in social and professional contexts.

- Oral practice
- Describing objects/situations/people
- Just A Minute (JAM) Sessions.

Syllabus: English Language and Communication Skills Lab has two parts:
a. Computer Assisted Language Learning (CALL) Lab
b. Interactive Communication Skills (ICS) Lab
The following course content is prescribed for the English Language Communication Skills Lab

Module - I:
CALL Lab: Introduction to Phonetics – Speech Sounds – Vowels and Consonants
ICS Lab: Ice-Breaking activity and JAM session; Listening: listening for sounds in context, for ideas;Speaking: ideation and translation of ideas into sentences.

Module - II:
CALL Lab: Structure of Syllables - Past Tense Marker and Plural Marker – Weak Forms and Strong Forms - Consonant Clusters.
ICS Lab: Situational Dialogues – Role-Play- Expressions in Various Situations – Self-introduction and Introducing others – Greetings – Apologies – Requests – Social and Professional Etiquette - Telephone Etiquette; Listening: listening for specific purposes, for details; Speaking: speaking in the above situations with clarity, connectivity, maintaining voice characters.

Module - III:
CALL Lab: Word accent and Listening Comprehension-reading aloud meaningfully.
ICS Lab: Descriptions- Narrations- Giving Directions and guidelines; Listening: listening for intelligible English; Speaking: formal and informal conversations, register.

Module - IV:
CALL Lab: Intonation and Common errors in Pronunciation- reading aloud (evaluating through recording).
ICS Lab: Extempore- Public Speaking, Oral Presentation Skills; Listening: note taking and listening for speaker's tone/attitude; Speaking: organizing, connecting ideas and sentences, short forms in spoken English, errors in spoken English

Module - V:
CALL Lab: Reduction of Mother Tongue Interference and Conversation Practice
ICS Lab: Information Transfer, Debate
Minimum requirement of infrastructural facilities for EL Lab:
1. Computer Assisted Language Learning (CALL) Lab:
The Computer aided Language Lab for 40 students with 40 systems, one master console, LAN facility and English language software for self- study by learners.

System Requirement (Hardware component):
Computer network with Lan with minimum 60 multimedia systems with the following specifications:
a) P – IV Processor b) Speed – 2.8 GHZ c) RAM – 512 MB Minimum
d) Hard Disk – 80 GB e) Headphones of High quality
2. **Interactive Communication Skills (ICS) Lab:** The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V., a digital stereo –audio & video system and camcorder etc.
Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the textbook which are loaded on the systems):

Prescribed Lab Manual:
Rani, Sudha. *English Language Communication Skills Laboratory*. 5th edition, Pearson Publication, 2014.

Reference Books:

1. Roach, Peter. English Phonetics and Phonology. 4th edition, Cambridge University Press, 2009.
2. Hughes, John and Mallett, Andrew. *Successful Presentations DVD and Student's Book Pack*. Oxford University Press, 2013.
3. Hancock, Mark. *English Pronunciation in Use* (Intermediate). 2nd edition, Cambridge University Press, 2009.
4. Karia, Akash. *Public Speaking Mastery: Speak Like a Winner*. Kindle edition, 2013.
5. Lucas, Stephen. *The Art of Public Speaking***.** 11th edition, Tata McGraw Hill, 2011.

Websites:

1. http://www.mindtools.com/CommSkll/ActiveListening.htm
2. http://www.slideshare.net/alisonkis/dialogue-and-roleplay-activity
3. http://www.hse.ru/pubs/lib/data/access/ram/ticket/2/14309868938d576a532b71360b7354268380727a22/An%20article%20for%20Monika%20(2010).pdf

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

1. Understand the nuances of language through audio- visual experience and group activities.
2. Hone the accent for intelligibility
3. Realize the importance of listening skills and speaking skills and their application in real life situations.
4. Recognize significance of non-verbal communication and develop confidence to face audience and shed inhibitions.
5. Speak with clarity and confidence; thereby enhance employability skills of the students.

CO-PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		1				1		1	2	2		1			
CO2										1		1			
CO3							1		1	2		2			
CO4								1	1	2		2			
CO5										2		2			

2021-22 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code:B0302	ENGINEERING WORKSHOP (Common for CE, EEE, ME,ECE and Min.E)	L	T	P
Credits: 1		-	-	2

COURSE OBJECTIVES:

To understand the usage of hand tools, acquire the skills in model / pattern making and familiarize with various work materials and tools.

I. TRADES FOR EXERCISES:

At least two exercises from each trade:

1. Carpentry 2.Fitting 3. Tin-Smithy
4. House-wiring 5.Foundry 6.Arc welding

II. TRADES FOR DEMONSTRATION & EXPOSURE

1. Machine shop
2. Plumbing
3. Wood working lathe
4. Identification of Electronic Components
5. Black smithy
6. Computer Peripherals

COURSE OUTCOMES

At the end of the course, students will be able to

1. Knowledge of carpentry process and methods used in the design and fabrication, installation, maintenance and repair of structures and fixtures (e.g., furniture, cabinets) to accomplish work assignments.
2. Assembling together of part and removing metals to secure the necessary joint by using fitting and welding.
3. Understand the hardware components of house wiring.
4. Understand the manufacturing process using machine shop.
5. Analyze the different types of computer Peripherals

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2	2	1		3			3		2	
CO2	3				2	2	1		3			3		2	
CO3	3				2	2	1		3			3		2	
CO4	3				2	2	1		3			3		2	

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I Semester		
Code: B0202	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB (Common for all branches)	L	T	P
Credits: 1		-	-	2

Course Objectives:

To get practical knowledge about basic electrical circuits, electronic devices like Diodes, BJT, JFET and also analyze the performance of DC Motors, AC Motors and Transformers.

List of Experiments:

1. Verification of Kirchhoff's Laws.
2. Verification of Maximum Power Transfer Theorem.
3. Determination of Phase Angle for RC series circuit.
4. Brake Test on DC-Shunt Motor. Determination of Performance curves
5. Load Tests on Single Phase Transformer
6. Brake Test on Three Phase Induction Motors. Determination of Performance curves
7. V-I Characteristics of PN junction Diode
8. V-I Characteristics of Zener Diode
9. Half Wave Rectifier and Full Wave rectifier.
10. Input and Output characteristics of BJT with CE configuration
11. Input and Output characteristics of BJT with CB configuration
12. Input and Output Characteristics of JFET.

Course Outcomes:

At the end of the course, students will be able to

1. Experimentally verify the basic circuit theorems, KCL and KVL
2. Measure power, power factor and phase angle in RC circuits experimentally.
3. Acquire hands on experience of conducting various tests on dc shunt motor, single phase transformers and three phase induction motors and obtaining their performance indices using standard analytical as well as graphical methods
4. Draw the characteristics of different semiconductor devices like PN junction Diode, Zener Diode, BJT and JFET by conducting suitable experiments.
5. Experimentally verify the working of half and full wave rectifier by using PN Junction diodes.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3		2		2		1	1	2	1	1	1	3	1	1
CO2	3		2		2		2	1	2	1	1	1	3	1	1
CO3	3	2	2	2	2		2	1	2	1	1	1	3	1	1
CO4	3	1	2		2		1	1	2	1	1	1	3	1	1
CO5	3	1	2		2		2	1	2	1	1	1	3	1	1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech II Semester		
Code: B0B17	Engineering Chemistry (Common for ALL)	L	T	P
Credits: 4		3	1	-

Course objectives:

The purpose of this course is to emphasize the relevance of fundamentals of chemical sciences in the field of engineering and to provide basic knowledge on atomic- molecular orbital's, electrochemistry, batteries, corrosion and the role of water as an engineering material in domestic-industrial use. They will also impart the knowledge of stereochemistry, understanding the chemical reaction pathway mechanisms and synthesis of drugs. Listing out various types of fuels and understanding the concept of calorific value and combustion.

Module I: Water and its treatment [10 Periods]

Introduction to water, hardness of water, causes of hardness, expression of hardness, units and types of hardness-Numerical Problems. Alkalinity of water, specifications of potable water (BIS); Estimation of temporary & permanent hardness of water by EDTA method. Boiler troubles - Scale &Sludge, Priming and foaming, caustic embrittlement and boiler corrosion; Treatment of boiler feed water - Internal treatment (colloidal, phosphate, carbonate and calgon conditioning). External treatment - Lime Soda process (cold & hot) and ion exchange process, Numerical Problems. Disinfection of water by chlorination and ozonization.Desalination by Reverse osmosis and its significance.

Module II: Molecular structure and Theories of Bonding: [10 Periods]

Introduction to Molecular orbital Theory. Linear Combination of Atomic Orbital's (LCAO), significance of bonding and anti-bonding molecular orbital, Conditions for the formation of molecular orbital's. Molecular orbital energy level diagrams of diatomic molecules -, N_2,$O_2$and F_2. Introduction to coordination compounds-ligand-coordination number (CN) - spectrochemical series. Salient features of crystal field theory, Crystal field splitting of transition metal complexes in octahedral ($[CoF_6]^{3-}$ and $[Co(CN)_6]^{3-}$) and tetrahedral ($[NiCl_4]^{2-}$ and $[Ni(CO)_4]$) fields - magnetic properties of complexes. Band structure of solids and effect of doping on conductance.

Module III: Electrochemistry and Corrosion [17 Periods]

A. Electrochemistry:

Introduction to Electrochemistry-Conductance(Specific and Equivalent) and units. Types of cells-electrolytic & electrochemical cells (Galvanic Cells)-Electrode potential-cell potential

(EMF).Electrochemical series and its applications,Nernst equation its applications and numerical problems. Reference electrodes - Calomel Electrode and Glass electrode-determination of pH using glass electrode. Batteries: Primary (dry cells) and secondary (Lead-Acid cell, Ni-Cd cell) - applications of batteries. Fuel cells: Hydrogen - Oxygen fuel cell and its applications.

B. Corrosion: [7 Periods]

Causes and effects of corrosion: Theories of corrosion - Chemical & Electrochemical corrosion, Pilling-Bedworth rule,Types of corrosion: Galvanic and Water-line corrosion. Factors affecting rate of corrosion-Nature of metal and Nature of Environment, Corrosion control methods - Cathodic protection (Sacrificial anodic and impressed current cathodic methods). Surface coatings: Methods of metallic coatings - hot dipping (Galvanization),Electroplating (Copper) andElectroless plating (Nickel).

Module IV: Stereochemistry, Reaction mechanism& synthesis of drug molecules and NMR spectroscopy: [12 Periods]

Introduction to Isomers - classification of isomers - structural (chain, positional & functional) and stereoisomerism-geometrical (cis-trans & E-Z system) - characteristics of geometrical isomerism, optical isomerism (chirality - optical activity, specific rotation, enantiomers and diastereomers) of tartaric acid and lactic acid. Conformational isomerism ofn-Butane. Introduction to bond cleavage (homo & hetero cleavage) - reaction intermediates and their stability. Types of organic reactions - Mechanism of substitution (SN^1& SN^2) and (E_1&E_2) reactions with suitable example. Ring opening (Beckmann rearrangement), oxidation and reduction (Cannizaro reaction), cyclization (Components of Diels-Alder reaction-Mechanism of Diels-Alder reaction with suitable example) reactions. Synthesis of Paracetamol, Aspirin and their applications.

Introduction to Spectroscopy, Basic concepts of nuclear magnetic resonance spectroscopy, chemical shift and spin-spin splitting.

UNIT-V FUELS AND COMBUSTION [08 PERIODS]

Fuels: Classification- solid fuels: coal – analysis of coal – proximate and ultimate analysis and their significance. Liquid fuels – petroleum and its refining, cracking – types – moving bed catalytic cracking. Knocking – octane and cetane rating, synthetic petrol - Fischer-Tropsch's process; Gaseous fuels – composition and uses of natural gas, LPG and CNG.

Combustion: Definition, Calorific value of fuel – HCV, LCV; Calculation of air quantity required for combustion of a fuel. Determination of calorific value by Junkers gas calorimeter-Numerical problems on combustion.

Text Books:

1. P.C.Jain and Monica Jain, "**A Text Book of Engineering Chemistry"**, DhanpatRai Publications, New Delhi, 16th Edition 2014.
2. S.S. Dara and S.S. Umare, "**A Text Book of Engineering Chemistry"**, S Chand Publications, New Delhi, 12th Edition 2010.

3. A.Jaya Shree, "Text book of Engineering Chemistry", Wiley, New Delhi, 2018.

Reference Books:

1. B.Rama Devi, Ch.VenkataRamana Reddy and PrasanthaRath,**"Text Book of Engineering chemistry"**,Cengage Learning India Pvt.Ltd,2016.
2. M.G. Fontana and N. D. Greene, "**Corrosion Engineering"**, McGraw Hill Publications, New York, 3rd Edition, 1996.
3. K. P. C. Volhardt and N. E. Schore, **"Organic Chemistry: Structure and Function"**, 5thEdition, 2006.

Course Outcomes with BLOOM's

At the end of the course, students will be able to:

	Course Outcome	Bloom's Taxonomy Level
CO1	Understand water treatment, specifically hardness of water and purification of water by various methods.	Understand**(L2)**
CO2	Analyze microscopic chemistry in terms of atomic and molecular orbital's splitting and band theory related to conductivity	Analyze**(L4)**
CO3	Apply knowledge of electrochemical cell concept with respect to fuel cells, batteries, theories of corrosion. Applications of corrosion control methods.	Apply**(L3)**
CO4	Acquire basic knowledge on the concepts of stereochemistry, chemical reaction mechanisms that are used in the synthesis of drug molecules, interpretation of NMR in organic molecules and their uses in medical field.	Analyze **(L4)**
CO5	Acquire the knowledge of various fuels and identify a better fuel source of less pollution.	Analyze **(L4)**

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	2	2										
CO2	2	1		2	1										
CO3	3	3	2	2	1		2								
CO4	3	1	1	1	2	1	3								
CO5	3	3	3	1			3								

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I /II Semester		
Code: B0301	ENGINEERING GRAPHICS (Common for All)	L	T	P
Credits: 3		2	-	2

PREREQUISITES: NIL

Course Objectives:

To develop in students, graphic skills for communication of concepts and ideas of engineering products.

MODULE I:

Introduction to Engineering Drawing, Principles of Engineering Graphics and their significance, Lettering.

Geometrical Constructions: Regular polygons only. Conic Sections: Ellipse, Parabola, Hyperbola– General method only Cycloidal Curves and Involute, tangents & normal for the curves.

Scales: Plane Scale, Diagonal scale, Vernier Scale.

MODULE II:

Orthographic Projections: Principles of Orthographic Projections – Conventions – First and Third Angle projections.

Projection of Points: Projection of points including all four quadrants.

Projection of Lines: Projection of Lines - parallel, perpendicular, inclined to reference planes and Traces.

MODULE III:

Projection of Planes: Axis inclined to both the reference plane.

Projection of Solids: Projections of regular solids like cube, prism, pyramid, cylinder and cone by rotating object method. Axis inclined to both the reference plane.

MODULE IV:

Section of Solids: Sectioning of single solid with the cutting plane inclined to one plane and perpendicular to the other - true shape of section.

Development of Surfaces: Development of lateral surfaces of Right Regular Solids – Prism, Cylinder, Pyramid and Cone.

MODULE V:

Isometric Projections: Principles of Isometric Projection – Isometric Scale, Isometric Views– Conventions –Plane Figures,Simple Solids.

Transformation of Projections: Conversion of Isometric Views to Orthographic Views and vice versa–simple objects.

TEXT BOOKS

1. K.L.Narayana, S. Bheemanjaneyulu "Engineering Drawing with Auto CAD-2016" New Age InternationalPublishers, 1st Edition, 2018.
2. N.D. Bhat, "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2014.

REFERENCES

1. K.L.Narayana, P.Kannaiah, "Engineering Drawing", SciTech Publishers. 2nd Edition, 2017
2. K.Venugopal,"Engineering Drawing",NewAge International Publishers, 3rd Edition, 2014.
3. K. V. Natarajan, "A text book of Engineering Graphics", Dhanalakshmi Publishers, 2015.
4. M.S. Kumar, "Engineering Graphics", D.D. Publications, 2011.
5. Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. international Publishing House, 3rdEdition, 2011.

E - RESOURCES

1. http://nptel.ac.in/courses/112103019/
2. https://www.slideshare.net/search/slideshow?searchfrom=header&q=engineering+drawing
3. https://www.wiziq.com/tutorials/engineering-drawing
4. http://freevideolectures.com/Course/3420/Engineering-Drawing
5. http://www.worldcat.org/title/journal-of-engineering-graphics/oclc/1781711
6. http://road.issn.org/issn/2344-4681-journal-of-industrial-design-and-engineering-graphics nit jalandhar (EG MECI102)

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: B0B10	**Applied Physics** (Common for ECE and EEE)	**L**	**T**	**P**
Credits: 4		**3**	**1**	**-**

Prerequisites: Fundamentals of Physics

Course Objectives:

1. To outline the dual nature of matter
2. To elaborate the significance of the Kronig-Penney model in classifying the materials
3. To illustrate the working of p-n junction diode, photodiode, LED and solar cell
4. To interpret the Maxwell equations.
5. To compare the working of Ruby laser, He-Ne laser and semiconductor laser, besides illustrating the working principle of optical fibre and elaborate its applications.

Module – I: Quantum mechanics [8 Periods]

Introduction, Plank's theory of black body radiation, deduction of Wien's displacement law and Ralygien's law; Louis de Broglie's concept of matter waves; Davisson and Germer experiment; G P Thomson Experiment; Heisenberg's uncertainty principle – and its application (electron cannot exist inside the nucleus); Schrodinger's time-independent wave equation; Physical significance and properties of wave function; Particle in a one-dimensional infinite potential well.

Module – II: Band theory of solids [8 Periods]

Introduction, Postulates and drawbacks' of Classical and Quantum free electron theory, Fermi Dirac distribution function; Density of energy states; Bloch theorem; Qualitative treatment of Kronig - Penney model; E Vs k relationship; Origin of energy band gap; Classification of materials into Conductors, Semiconductors and insulators; Concept of Effective mass.

Module –III: Semiconductor Physics [13 Periods]

A: Introduction, Intrinsic and Extrinsic Semiconductors; Expression for carrier concentration in intrinsic and extrinsic semiconductors; Variation of Fermi energy level in Intrinsic and extrinsic semiconductors with respect to temperature and doping concentration.

B: Direct and indirect bandgap semiconductors; Carrier generation and Recombination; Drift and Diffusion mechanisms; Equation of Continuity; P-N Junction diode, Energydiagram, V-I Characteristics; Construction and Working of Photodiode, LED & Solar cell and their applications.

Module – IV: Electromagnetic Theory [10 Periods]

Gradient of Scalar field; Divergence and Curl of Vector field and their Physical Significance; Gauss's Law of electrostatics and Gauss law of magnetostatics; Ampere's law and its modification; Faraday's law of electromagnetic induction; Induced E.M.F in a conductor; Lenz's Law; Maxwell equations in differential form; wave equation for free space

Module – V [12 Periods]

LASER: Introduction, Characteristics of LASER; Absorption, Spontaneous and Stimulated emission; Einstein's coefficients derivation; Population inversion; Pumping mechanisms; Basic components of a LASER system; Types of Laser systems; Ruby LASER, He-Ne LASER, Semiconductor diode LASER (Homo junction and hetero junction); Applications of LASER - Computers, Medical, Military.

Optical Fibers: Introduction to Optical fibers; Total Internal Reflection; Acceptance angle and acceptance cone, Numerical aperture; types of optical fibers; Losses in optical fibers - absorption

losses, scattering losses and bending losses; Applications of optical fibers - Communications, Level Sensor, LASER angioplasty.

Course Outcomes:

At the end of the course, the student will be able to

1. Explain the dual nature of the matter and evaluate the energy of a particle trapped in 1D infinite potential well.
2. Classify the materials into conductors, semiconductors and insulators based on the outcomes of Kronig - Penney model.
3. Analyze the working of semiconductor devices like PN junction diode, Photodiode, LED and Solar cell.
4. Deduce Maxwell equations in differential form.
5. Compare and contrast Ruby, He-Ne, Semiconductor Lasers and discover the working principle of optical fibers besides and elucidating their applications.

Text Books:

1. K Vijaya Kumar, S Chandralingam, "Modern Engineering Physics'' Volume I & II, S. Chand, 1st Edition, 2017.
2. Jasprit Singh, "Semiconductor Optoelectronics: Physics and Technology", McGraw-Hill, 1995.
3. B K Pandey and S. Chaturvedi, "**Engineering Physics**" Cengage Learning India Revised Edition, 2014.

Reference Books:

1. P K Palanisamy, **"Engineering Physics"**, SciTech Publication, 4th Edition, 2014.
2. R K Gaur and SL Gupta, "**Engineering Physics**" Dhanpat Rai Publications, Eighth Revised Edition, 2006.
3. D K Bhattacharya, Poonam Tandon, "**Engineering Physics**", Oxford University Press, 1st Edition, 2015.
4. P. Bhattacharya, "**Semiconductor Optoelectronic Devices**", Prentice hall of India,1997.
5. S J Adams, "Electromagnetic Theory", Adams Press, 2013.

e-RESOURCES

1. https://www.researchgate.net/publication/259574083_Lecture_Notes_on_Engineering_Physics
2. https://www.livescience.com/33816-quantum-mechanics-explanation.html
3. https://nptel.ac.in/courses/115/102/115102025/

Journals :

1. http://www.springer.com/physics/theoretical%2C+mathematical+%26+computational+physics/journal/40094
2. http://www.springer.com/physics/journal/340

NPTEL VIDEOS:

1. http://nptel.ac.in/courses/113104012/
2. https://www.youtube.com/watch?v=9seDKvbaoHU&list=PLzJaFd3A7DZse2tQ2qUFChSiCj7jBidO0&index=29
3. https://nptel.ac.in/courses/108/108/108108122/
4. https://nptel.ac.in/courses/115/101/115101005

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code:B0B04	Advanced Calculus (Common for EEE & ECE)	L	T	P
Credits:4		3	1	-

Pre-requisites: Differentiation and integration,

Course Objectives: To Learn

1. The Methods of solving Partial differential equations.
2. The Beta and Gamma functions.
3. The Evaluation of multiple integrals and their applications in the allied fields.
4. The physical quantities involved in engineering problems related to vector valued functions.
5. The basic properties of vector valued functions and their applications to line, surface and volume integrals.

MODULE -I: Partial Differential Equations [12 Periods]

Formation of partial differential equations by eliminating arbitrary constants or arbitrary function, solutions of first order linear(Lagrange) equations, solutions of non linear first order equations (four standard types). Equations reducible to linear, Charpits Method.

MODULE – II: Beta and Gamma Functions [12 Periods]

Introduction to Improper Integrals, Definition of Beta and Gamma function, properties and other forms. Relation between Beta and Gamma function, Evaluation of Improper Integrals.

MODULE - III: Multiple Integrals [12 Periods]

(A) Evaluation of Double Integrals (Cartesian and polar coordinates); change of order of integration (only Cartesian form),.

(B) Evaluation of Triple Integrals. Change of variables (Cartesian to polar) for double and (Cartesian to Spherical and Cylindrical polar coordinates) for triple integrals. Finding areas using double integrals and Volumes using double and triple integrals.

MODULE - IV: Vector Differentiation [12 Periods]

Vector point functions and scalar point functions. Gradient, Divergence and Curl. Directional derivatives, Scalar potential functions. Solenoidal and Irrotational vectors. Vector Identities.

MODULE – V: Vector Integration [12 periods]

Line, Surface and Volume Integrals. Green Theorem, Gauss Divergence Theorem and Stokes Theorem (without proofs) and their applications.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain Srk Iyengar ,Advanced engineering mathematics, Narosa publications.
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.

Reference Books:

1. Kanti B.Datta, **Mathematical Methods of Science and Engineering**, Cengage Learning
2. Alan Jeffrey, **Mathematics for Engineers and Scientists**, 6th Ed, 2013, Chapman & Hall.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Ed, Pearson, Reprint, 2002.
4. S. L. Ross, **Differential Equations**, 3rd Ed., Wiley India, 1984.
5. ***Amarnath*** T, **An Elementary Course in** *Partial Differential Equations*, Narosa

Publishing House 2nd Ed, 2012.

Course Outcomes: After learning the contents of this paper the student must be able to

1. Identify whether the given partial differential equation can be solvable with the methods or not.
2. Solve the problems which are not solvable with the usual methods and solve using Beta and Gamma functions.
3. Evaluate the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelepiped.
4. Finds the directional derivatives, angle between vectors understands the physical interpretation of vector, solenoidal and irrotational vectors.
5. Evaluate the line, surface and volume integrals and converting them from one to another.

E-Resources:

a. Concerned Website links

1. https://mat.iitm.ac.in/home/sryedida/public_html/caimna/pde/first/partial.html
2. https://homepage.tudelft.nl/11r49/documents/wi4006/gammabeta.pdf
3. https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(OpenStax)/15%3A_Multiple_Integration/15.2%3A_Double_Integrals_over_General_Regions
4. https://math.libretexts.org/Bookshelves/Calculus/Book%3A_Calculus_(Apex)/12%3A_Functions_of_Several_Variables/12.06%3A_Directional_Derivatives
5. https://learn.lboro.ac.uk/archive/olmp/olmp_resources/pages/workbooks_1_50_jan2008/Workbook29/29_3_int_vec_thms.pdf

b. NPTEL :

1. https://www.digimat.in/nptel/courses/video/111105093/L01.html (PDE)
2. https://www.youtube.com/watch?v=JoyvDWZ0aMY (Beta & Gamma Functions)
3. https://www.youtube.com/watch?v=mIeeVrv447s (Multiple Integrals)
4. https://www.youtube.com/watch?v=M_Irtxhbq3E (Vector Differentiation)
5. https://www.youtube.com/watch?v=EtA0CK8SwkI (Vector Integral Theorems)

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	3	2	2	3	3				2			3
CO2	3	2	2	3	2				2			3
CO3	3	2	2	3	2				2			2
CO4	3	2	2	3	3				2			2
CO5	3	2	2	3	3				2			2

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: B0401	ANALOG ELECTRONICS	L	T	P
Credits: 3	(Common for EEE & ECE)	3	-	-

Pre-Requisites: Applied Physics, Basic Electrical and Electronic Engineering.

Course Objectives: This course provides the knowledge of Transistor and FET Biasing Techniques, Amplifiers particularly Single Stage Amplifiers and also provides knowledge of study about different amplifiers and understands small signal analysis of different transistor configurations andstudy about feedback and oscillators.

MODULE I: BJT Biasing & FET Biasing [10 Periods]

BJT Biasing: Need for biasing, operating point, load line analysis, bias stabilization techniques: fixed bias, collector to base bias, self - bias, Stabilization against variations in I_{CO}, V_{BE} and β for the self -bias circuit, bias compensation techniques, thermal runaway and thermal stability.

FET Biasing: Biasing techniques: Fixed bias, Source self - bias, Voltage divider bias.

MODULE II: BJT Small Signal Analysis [10 Periods]

Small signal low frequency transistor Amplifier circuits: h-Parameter representation of a Transistor, Analysis of single stage transistor Amplifier (CE, CB, & CC) using h-parameters: voltage gain, current gain, input impedance and output impedance. Comparison of transistor configurations in terms of Ai,Ri, Av, Ro. Analysis of CE Amplifier with Emitter resistance and Emitter follower, Millers theorem and its Dual. Simplified h-parameter Model.

MODULE III: Single Stage Amplifiers [10 Periods]

A: Classification of Amplifiers, Distortion in Amplifiers, Low Frequency response of common emitter Amplifiers, Common Base Amplifiers and Common Collector Amplifier.

B: Small signal JFET model, JFET Amplifiers: Common Drain Amplifier, Common Source Amplifier and Common Gate Amplifier. Gain band width product. Analysis of Common Source Amplifier with resistive load.

MODULE IV: Feedback Amplifiers [10 Periods]

Feedback concept and types, Transfer Gain with feedback, General Characteristics of Negative Feedback Amplifiers, Types of Negative Feedback Connections, Method of Identifying Feedback Topology, Stability of Feedback Amplifier.

MODULE V: Oscillators [10 Periods]

Constituents of an Oscillator, Barkhausen Criterion, Classification of Oscillators, Sine Wave Feedback Oscillators of LC Type - General Form of Oscillator Circuit, Hartley Oscillator, Colpitts Oscillator Sine Wave Feedback Oscillator of RC type - RC Phase Shift Oscillator, Wein Bridge Oscillator, Crystal Oscillator, Frequency Stability. Design of an RC Phase - Shift Oscillator.

Text Books:

1. Jacob Milliman, Christos C. Halkias, SatyabrataJit, “Electronic Devices and Circuits”, McGraw Hill (India), 3rd edition, 2013.
2. Shalivahana N. Suresh Kumar, A. Vallavaraj, “Electronic Devices and Circuits”, Tata McGraw Hill (India), 3rd edition, 2007.

Reference Books:

1. Robert Boylestad, LowisNashelsky, “Electronic Devices and Circuit Theory”, Prentice Hall of India, 5th Edition, 1993.
2. G. K. Mithal, “Electronic Devices and Circuits”, Khanna Publications, 22nd Edition, 1999.

E-Resources:

1. http://electronicsforu.com/
2. https://www.elektormagazine.com/
3. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?reload=true&punumber=101
4. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=16
5. http://nptel.ac.in/courses/117101106/6

Course Outcomes:

At the end of the course, students will be able to:

1. Study different biasing techniques and design the DC bias circuits using BJT & FET
2. Understand the small signal analysis of different transistor configurations.
3. Understand the design of single stage Amplifiers
4. Understand the design of Feedback amplifiers and their frequency response.
5. Understand the design of various oscillators such as RC Phase Shift Oscillator, Wein Bridge Oscillator, Crystal Oscillator, LC Oscillator etc

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	2	1		1		3	2	3	3	2
CO2	2	3	1	2	2		2		2		1	1	3	2	2
CO3	3	2		1	1	2	1		2		2	2	2	3	2
CO4	2	3	2	1	2	2	1		3		2	3	3	2	2
CO5	1	2	2	3	2	3	3		2		2	3	2	2	3

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: B0553	**Basic Python Programming Lab** (Common for CE, EEE, ME, ECE, MiE)	L	T	P
Credits: 2		-	1	2

Prerequisites: NIL

Course Objectives: To be able to introduce core programming basics and program design with functions using Python programming language, understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.

Software Requirements: Python

List of Programs:

1. a) Write a program to demonstrate different number data types in Python.
   b) Write a program to perform different Arithmetic Operations on numbers in Python.
2. a) Write a program to create, concatenate and print a string and accessing sub-string from a given string.
   b) Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
3. Write a program to create, append, and remove lists in python.
4. Write a program to demonstrate working with tuples in python.
5. Write a program to demonstrate working with dictionaries in python.
6. a) Write a python program to find largest of three numbers.
   b) Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula : c/5 = f-32/9]
7. a) Write a Python script that prints prime numbers less than 20.
   b) Write a python program to find factorial of a number using Recursion.
8. a) Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
   b) Write a python program to define a module and import a specific function in that module to another program.
9. a) Write a program that defines and print a matrix.
   b) Write a program to perform addition of two square matrices.
   c) Write a program to perform multiplication of two square matrices.
10. a) Write a function dups to find all duplicates in the list.
    b) Write a function unique to find all the unique elements of a list.
11. a) Write a program to print each line of a file in reverse order.
    b) Write a program to compute the number of characters, words and lines in a file.
12. Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.

TEXT BOOKS:

1. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson Publications.
2. Mark Lutz," Learning Python", Orielly Publishers

REFERENCES:

1. Allen Downey, "Think Python", Green Tea Press
2. W. Chun, "Core Python Programming", Pearson.
3. Kenneth A. Lambert, "Introduction to Python", Cengage

Course Outcomes:

At the end of the course, students will be able to

1. **Develop** simple applications using python.
2. **Make use of** functions in python scripts.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1			1	1							1	1		
CO2		1	2	3								3		1	1
CO3	1	1	1	1	2	1	1					3		2	3

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. I/II Semester		
Code: B0B11	**Applied Physics Lab (Common for EEE, ECE,AI&ML, CSE (AI & ML), CSE (Cyb. Sec.), CSE (IoT), CSE (Data Science) ,CSE and IT)**	**L**	**T**	**P**
Credits: 1		**-**	**-**	**2**

Course objectives:

The main objective of this course is to provide the necessary exposure to the practical aspects, which is an essential component for learning science.

List of Experiments:

1 **Planck's constant**
To determine Planck's constant using Photo electric effect.

2 **Energy band –gap of a semiconductor**
To determine the energy band gap of a semiconductor.

3 **V-I and P-I characteristics of light emitting diode**
Plot V-I and P-I characteristics of light emitting diode.

4 **Laser diode**
To study the Characteristics of Laser diode.

5 **Solar Cell**
To study the V-I Characteristics of solar cell.

6 **LCR Circuit**
To determination of resonant frequency, bandwidth and quality factor of RLC circuit.

7 **Numerical Aperture of an Optical fiber**
To determine the Numerical aperture of the given fiber.

8 **Bending Loss of a Fiber**
To determine the bending loss of the given fiber.

9 **Light Dependent Resistance (LDR)**
To determine the characteristics of a LDR.

10 **Stewart and Gee's experiment**
Determination of Magnetic field along the axis of current carrying circular coil.

11 **B-H Curve**
To study the magnetization of ferromagnetic material in presence of magnetic field.

12 **Sonometer**
To verify the frequency of AC Supply.

13. Construction of fundamental logic gates using discrete components and verification of truth tables

14. Verification of truth tables of fundamental logic gates using ICs

15. Construction of fundamental logic gates using universal logic gates.

Course Outcomes:

At the end of the course, students will able to

1. Develop skills to impart practical knowledge in real time solution.
2. Understand principle, concept, working, application and comparison of results with theoretical calculations.
3. Design new instruments with practical knowledge.
4. Understand measurement technology.
5. Use new instruments and real time applications in engineering studies.

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech.		
Code: B0B18	Engineering Chemistry Lab (Common for ALL)	L	T	P
Credits: 1		-	-	2

Course objectives:

To provide the students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence.

List of Experiments:

1. Calibration of Volumetric apparatus.
2. Estimation of Total Hardness of water by EDTA Method.
3. Estimation of an acid by P^Hmetry.
4. Estimation of alkalinity of water.
5. Estimation of strength of an acid by Conductometry.
6. Estimation of strength of an acid by Potentiometry.
7. Estimation of Mn^{+2}ion in $KMnO_4$ by Colorimetry.
8. Determination of viscosity of given liquids by Ostwald's viscometer.
9. Determination of surface tension of given sample using stalagmometer.
10. Estimation of iron (II) by dichrometry.
11. Determination of rate constant of hydrolysis of methyl acetate.
12. Preparation of Aspirin.

COURSE OUTCOMES:

At the end of the course, students will be able to:

1. Acquire knowledge about the chemistry lab, kind of experiments that can be performed and the precautions to perform four types of titrations & understand the principle involved in the applications of the method.
2. Learn and apply basic technique used in chemistry laboratory for estimation hardness & alkalinity of water.
3. Understand about mineral analytic technique for estimation of ions/metal ions in minerals.
4. Apply instrumental techniques such as colorimetry, conductometry & potentiometry.
5. Learn to determine physical properties like free chlorides in water, viscosity & surface tension.

CO- PO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1											
CO2	2	1	2												
CO3	2	2		1											
CO4	2	2	1												
CO5	2	1	2												

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. II Semester		
Code: B0402	ANALOG ELECTRONICS LAB (Common for EEE & ECE)	L	T	P
Credits: 1		-	-	2

Course Objectives: To design different amplifiers, Feedback amplifiers and Oscillator circuits according to the given specifications.

PART - A: Implement the following Simulation using Multisim or Any equivalent open source software

1. Common Source Amplifier.
2. Common Gate Amplifier.
3. Voltage Shunt Feedback Amplifier
4. Wein Bridge Oscillator using Transistors.
5. Hartley Oscillator Using Transistors.
6. Colpitt's Oscillator Using Transistors.

PART - B: To be performed Using Discrete Electronic Components

1. Common Emitter Amplifier.
2. Common Collector Amplifier.
3. Common Drain Amplifier.
4. Voltage Series Amplifier.
5. Current Series Amplifier
6. RC Phase Shift Oscillator using Transistors.

Course Outcomes:

At the end of the course, students will be able to

1. Design Amplifiers Circuits.
2. Design Oscillator Circuits.
3. Analyze Feedback topology for amplifiers.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO 1	PSO2	PSO3
CO1	2	3	3	3	3		2			1	1	2	3	3	1
CO2	2	3	3	3	3		2			1	1	2	3	3	1
CO3	2	3	3	3	2		1			1		2	3	3	1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0B08	**COMPLEX VARIABLES AND NUMERICAL METHODS (Common for ECE & EEE)**	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Prerequisites: Differentiation, Partial differentiation, Integration

Course Objectives:

1. To learn the concept of analyticity of a function
2. To learn the concept of evaluation of Integrals
3. To learn the Power series expansions of complex functions and evaluation of contour integrals.
4. The various numerical techniques which are indispensable tools to solve many algebraic and transcendental equations and Interpolation.
5. Numerical methods of solving the ordinary differential equations and Numerical Integration.

MODULE I: Functions of Complex variable [12 Periods]

Introduction, Complex functions and its representation on Argand plane, Concepts of limit, Continuity, Differentiability, Analyticity, Cauchy-Riemann conditions, Harmonic functions, Milne – Thompson method.

MODULE II: Complex Integration [9 Periods]

Line integral, Evaluation along a path and by indefinite integration, Cauchy‟s integral theorem, Cauchy‟s integral formula, Generalized integral formula.

MODULE III : Power series expansions of complex functions& Contour Integration [13 periods]

(A) Radius of convergence, Expansion in Taylor‟s series, Maclaurin‟s series and Laurent series. Singular point, Isolated singular point, pole of order m, essential singularity.

(B) Residue, Evaluation of residue by formula and by Laurent series, Residue theorem, Evaluation of integrals by indentation Improper real integrals (a) $\int_{-\infty}^{\infty} f(x)dx$

(a) $\int_{0}^{2\pi} f(\cos\theta, \sin\theta)d\theta$

MODULE IV: Algebraic and Transcendental equations and Interpolation [14 periods]

(A) Solution of Algebraic and Transcendental Equations: Introduction-Errors, types of errors. Bisection Method, Method of False Position. The Iteration Method – Newton-Raphson Method

(B) Interpolation: Introduction- Errors in Polynomial Interpolation – Finite differences-Forward Differences-Backward differences – Symbolic relations and separation of symbols, Differences of a polynomial-Newton‟s formulae for interpolation, Central difference interpolation Formulae – Gauss Central Difference Formulae –Interpolation with unevenly spaced points-Lagrange’s Interpolation formula.

MODULE – V: Numerical solution of Ordinary Differential Equations and Numerical Integration [12 periods]

Numerical solution of Ordinary Differential Equations: Introduction, Solution by Taylor‟s series method, Picard‟s Method of successive Approximations, Euler‟s Method, Modified Euler‟s Method, Runge-Kutta Methods.

Numerical Integration: Trapezoidal Rule, Simpson‟s 1/3rd Rule, Simpson‟s 3/8 Rule.

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R K Jain SRK Iyengar, Advanced engineering mathematics, Narosa publications.
3. M. K Jain, S R K Iyengar, R.K Jain, Numerical Methods for Scientific and Engineering Computation, New age International publishers.

Reference Books:

1. Murray Spiegel, Complex variables by Schamus outlines series.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley publications.
3. S.S.Sastry, **Introductory Methods of Numerical Analysis**, 5th Edition, PHI LearningPrivate Limited

E – RESOURCES:

1. http://nptel.ac.in/courses/104101002/downloads/lecturenotes/module1/chapter6.pdf (Numerical Differentiation and Integration)
2. https://www.youtube.com/watch?v=6vs-pymcsqk (Regula Falsi Method and Newton Raphson Method)
3. https://www.youtube.com/watch?v=1pJYZX-tgi0 (Interpolation)
4. https://www.youtube.com/watch?v=Atv3IsQsak8&pbjreload=101 (Numerical Solution of ODE)
5. https://www.youtube.com/watch?v=iviiGB5vxLA (Numerical Integration)
6. https://www.youtube.com/watch?v=HVHtGVOQySI (Functions of Complex Variables)
7. https://www.youtube.com/watch?v=v4yV2t4KBhs (Complex Integration)

NPTEL:

4. https://www.youtube.com/watch?v=WbmLBRbp0zA (Bisection Method)
5. https://www.youtube.com/watch?v=0K6olBTdcSs (Regula Falsi and Newton Raphson Method)
6. https://www.youtube.com/watch?v=KSFnfUYcxoI (Interpolation)
7. https://www.youtube.com/watch?v=QugqSa3Gl-w&t=2254s (Numerical Solution of ODE)
8. https://www.youtube.com/watch?v=NihKCpjx2_0&list=PLbMVogVj5nJRILpJJO7KrZa8Ttj4_ZAgl (Numerical Solution of ODE)
9. https://www.youtube.com/watch?v=hizXlwJO1Ck (Numerical Integration)
10. https://www.youtube.com/playlist?list=PLNKx0RorxX44HBsItvZP5CzFX1qCQOwp5 (Complex Analysis)

Course Outcomes:

1. The student will be able to apply the concept of analyticity of a function
2. The student will be able to evaluate of Integrals
3. The student will be able to find Power series expansions of complex functions and evaluation of contour integrals.
1. The student will be able to find the root of a given equation by various methods and estimate the value for the given data using interpolation.
2. The student will be able to find the numerical solutions for a given ODE‟s and evaluations of integrals using numerical techniques.

CO- PO Mapping

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak												
COS	**Programme Outcomes(POs)**											
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**
CO1	3	2	2	3	3				2			1
CO2	2	2	2	3	2				2			1
CO3	2	2	2	3	2				2			1
CO4	3	2	2	3	3				2			2
CO5	2	2	2	3	3				2			2

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0403	DIGITAL ELECTRONICS	L	T	P
Credits: 3	(Common for EEE & ECE)	3	-	-

Pre-Requisites: Nil

Course Objectives: This course introduces various number systems and conversion from one number system to other and also to understand different binary codes**,** the theory of Boolean algebra and to study representation of switching functions using Boolean expressions and their minimization techniques. Understanding the combinational logic design of various logic and switching devices and their realization**,** the basic flip flops and sequential logic circuits design both in synchronous and Asynchronous modes for various complex logic and switching devices, their minimization techniques and their realizations and to analyze a given sequential circuit by using state tables and state diagrams.

MODULE I: Number systems& Binary codes [8 Periods]

Number systems: Number Systems, Radix conversions, complement of numbers.

Binary codes: Binary codes, Weighted and non-Weighted codes, BCD code, gray code, excess 3 codes - Error detecting code, Error Correcting code, Hamming Code.

MODULE II: Boolean Algebra & Boolean functions [10 Periods]

Boolean Algebra: Postulates and Theorems - Canonical and Standard forms: SOP and POS forms, Minterms and Maxterms –

Simplification of Boolean functions: Simplification of functions: Karnaughmap (2,3,4,5,6 Variables) and Quine McCluskey method (Tabular Method) - Prime implicants, essential prime implicants.

Logic gates: NOT, OR, AND, NOR, NAND, XOR, XNOR- Universal gates

MODULE III: Combinational Logic Circuits [10 Periods]

A: Arithmetic circuits: Half adder, full adder, half subtractor, full subtractor, binary adder, Carry look ahead adder, BCD adder

B: Code conversion circuits, Comparator, Decoder, Encoder, Priority Encoder, Multiplexers and Design, De – Multiplexers, ROM, PLA, PAL.

MODULE IV: Sequential Logic Circuits - I [10 Periods]

Introduction –Latches and Flip flops: Basic Flip flop circuit, RS, D, JK and T Flip-flops – Triggering of Flip flops: Master Slave Flip flop, edge triggered flip flop – Conversion of one type of Flip flop to another, Setup time, hold time.

Analysis of Sequential Logic circuit: State Diagram, state table, reduction of state table, state Assignment –- Design procedure of sequential circuits using state diagram, state table and Flip flops. Example design Sequence detector.

MODULE V: Sequential Logic Circuits - II [10 Periods]

Registers and Counters: Shift Register, Universal Shift Register, Applications of Registers, Asynchronous counter, Synchronous counter, Mod-N Counter, binary up/down counter, Ripple counter, Johnson counter.

Finite State Machine: Introduction, FSM capabilities and Limitations, Mealy and Moore models – minimization of completely specified and incompletely specified sequential

Machines. Partition techniques and Merger charts

Text Books:

5. ZviKohavi, "Switching and Finite Automata Theory",TMH, 2nd edition, 2006.
6. Morris Mano, "Digital Design", PHI, 3rd Edition, 2009.
7. A.Anand Kumar, "Switching Theory and Logic Design", PHI 2nd Edition, 2014.
8. John F.Wakerly, "Digital Design Principles & Practices", PHI/ Pearson Education Asia, 3rd Ed., 2005.

Reference Books:

3. Stephen Brown and Zvonka Vramesic, "Fundamentals of Digital Logic with VHDL Design", McGraw Hill, 2nd Edition, 2008.
4. William I. Fletcher, "An Engineering Approach to Digital Design", PHI, 1st Edition, 2009.

E-Resources:

5. https://www.researchgate.net/publication/264005171_Digital_Electronics
6. https://www.cl.cam.ac.uk/teaching/0708/DigElec/Digital_Electronics_pdf.pdf
7. http://ieeexplore.ieee.org/abstract/document/753678/
8. http://docshare01.docshare.tips/files/20257/202573063.pdf
4. http://nptel.ac.in/courses/117106086/1
5. http://nptel.ac.in/courses/117105080/
6. http://nptel.ac.in/courses/117106114/

Course Outcomes:

At the end of the course, students will be able to

6. Perform radix conversions
7. Minimize a given boolean function by using k-map or tabular method
8. Design a combinational circuit
9. Design a sequential circuit by using various flipflops
10. Analyze and minimize the circuitry of a given sequential circuit and will be able to design a sequence detector

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO S	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1		1	1								2	2	1
CO2	2	3	3	1	1					1			3	2	2
CO3	3	2	3	2		1	1			1	2	1	3	3	2
CO4	2	2	3	3	1	1	1			1	3	1	2	2	2
CO5	1	1	3	3	1	1	1			1	3	1	3	2	2

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0404	SIGNAL THEORY & STOCHASTIC PROCESSES	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Nil

Course Objectives: This course is introducing the basic concepts of signals and this course also introduces the LTI system. Introduces the Fourier series for the analysis of periodic signals, the Fourier transform for the analysis of non-periodic signals. The concept of Laplace transforms and its properties. To build an understanding of the concept of random variables, multiple random variables, random processes and their operations and To familiarize the student with the spectral characteristics of random processes and to determinelinear system response.

MODULE I: Signal Analysis: [10 Periods]

Signal Analysis: Introduction to signals and systems, Classification of signals and systems (both continuous and discrete); Operations on Signals, Approximation of a function by a set of mutually orthogonal functions, Evaluation of mean square error, Orthogonality in complex functions.

Properties of LTI systems, Transfer function of an LTI system, linear systems response to Deterministic signals and Distortion less transmission..

MODULE-II: Continuous-Time Fourier series and Fourier transform: [10 Periods]

Fourier series: Representation of periodic signals, Convergence of Fourier series, Trigonometric, Exponential forms, Properties of Fourier series.

Fourier Transforms: Representation of non-periodic signals. Fourier transform of periodic signals, Inverse Fourier transforms, Properties of the Continuous-Time Fourier transforms, Convolution and multiplication properties and their effect in the frequency domain, magnitude and phase response.

MODULE-III: **Laplace Transform and Random Variables** [15 Periods]

Laplace Transform: Definition , Properties of Laplace Transform, The Laplace Transform of different signals, Region of convergence, System functions, Poles and zeros of system, Solutions to differential equations, Inverse Laplace Transform.

Random Variables: Review of Probability theory, Definition of Random Variable, Classification of Random Variables, Cumulative Distribution Function (CDF) and its properties, Probability Density function (PDF) and its Properties, Types of CDF & PDF - Uniform, Gaussian and Rayleigh.

MODULE-IV: Multiple Random Variable & Operations [10 Periods]

Multiple Random variables: Joint Distribution and its Properties, Joint Density and its Properties, Conditional Distribution and Density, Statistical Independence, Sum of Two Random Variables, Central Limit Theorem (Without Proof).

Operations on Single & Multiple Random Variables: Expectation, Moments, Variance and

Skew, Characteristic Function, Moment Generating Function, Transformations of a Random Variable

MODULE-V: Stochastic Processes & Linear systems response to random inputs: [10 Periods]

Temporal Characteristics: The Stochastic Processes concept, classification of Processes, Deterministic and non-Deterministic Processes, Autocorrelation function and its properties, Cross correlation and its properties.

Spectral Characteristics: Power spectrum, Power spectrum density, Properties, Cross Power spectrum, Cross Power spectrum density, Properties, Relationship between Power spectrum and Autocorrelation function.

Linear systems response to random inputs: Linear System Response of Mean and Mean-squared Value, Autocorrelation Function, Cross-Correlation Functions. Power Density Spectrum, and Cross-Power Spectral Density of random inputs.

Text Books:

1. B. P. Lathi, "Signals Systems & Communications", BSP, 2nd Edition, 2013.
2. Peyton Z. Peebles, **"Probability, Random Variables & Random Signal Principles"**, TMH, 4th Edition, 2001.
3. P Ramakrishna Rao and Shankar Parkriya, "Signals and Systems", MGH International, 2nd Edition, 2013.

Reference Books:

1. A.V. Oppenheim, A. S. Willsky, S.H. Nawab, "Signals and Systems", PHI, 2nd Edition, 2014.
2. A. Anand Kumar, "Signals and Systems", PHI, 3rd Edition, 2013.
3. Simon Haykin and Van Veen, "Signals & Systems", Wiley, 2nd Edition, 2007.
4. Y. Mallikarjuna Reddy, **"Probability Theory and Stochastic Process"**, University Press, 4th Edition, 2013.
5. Athanasius Papoulis and S. Unnikrishna Pillai, **"Probability, Random Variables and Stochastic Processes"**, TMH, 4th Edition, 2002.

E-Resources:

1. http://www.tutorialspoint.com/signals_and_systems/
2. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
3. http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?reload=true&punumber=78
4. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8919
5. https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/lecture-notes/
6. http://nptel.ac.in/courses/IIT- MADRAS/Principles of_Communication1/Pdfs/1_5.pdf
7. http://pages.ucsd.edu/~ssaiegh/Slides8.pdf

Course Outcomes:

At the end of the course, students will be able to:

1. Represent any arbitrary signals in terms of complete sets of orthogonal functions and understand the principles of impulse functions, step function and signum function.
2. Express periodic signals in terms of Fourier series and aperiodic signals in terms of Fouriertransform.
3. Express continuous time domain signals in terms of Laplace Transform ie. Complex frequency domain (s-plain) and waveform synthesis.
4. Analyze that the random variable is always a numerical quantity and will know the importance of cdf, pdf in characterizing random variables; they can also perform all the statistical operations on single random variables
5. Understand power density spectrum and its properties and its relation with correlation.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	2	3	3	1	1	1					1	3	1	1
CO2	3	2	1	3	2	2	1					1	3	2	1
CO3	2	2	3	3	1	1	1					1	2	1	1
CO4	2	2	3	2	2	2	1					1	3	2	1
CO5	3	3	3	1	1	1	1					1	3	2	1

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0405	Electromagnetic Waves and Transmission Lines	L	T	P
Credits: 3		3	-	-

Pre-Requisites: vector Calculus, Engineering Physics, Applied Physics

Course Objectives: Analyze fundamental concepts of vector analysis, electrostatics and magneto statics law and their applications. Formulate the basic laws of static electricity and magnetism. Derive the wave equations for conducting and di-electric mediums to analyze the wave propagation characteristics. Analyze fundamental concepts of Transmission lines To understand the concepts of RF Lines and their characteristics, Smith Chart.

MODULE I: **[10 Periods]**

Review of coordinate systems. Coulomb's Law, Electric field due to various Charge configurations and Electric flux density. Gauss's Law and its applications. Work, Potential and Energy, The dipole. Current and Current density, Laplace and Poisson's equations. Calculation of capacitance for simple configurations.

MODULE II: **[14 Periods]**

Steady magnetic-Biot-Savart's law, Ampere's law. Stoke's theorem, Magnetic flux and magnetic flux density. Scalar and vector magnetic potentials. Electric and Magnetic fields boundary conditions. Maxwell's equations for static and time varying fields.

MODULE III: **[12 Periods]**

Uniform plane waves in free space and in conducting medium, Polarization. Instantaneous, average and complex Poynting theorem and its applications.

Reflection and Refraction: Normal and Oblique incidence on dielectrics and conducting medium.

MODULE IV: **[12 Periods]**

Overview of T and π networks. Types of Transmission Lines-Two wire lines. Primary and secondary constants. Transmission Line equations. Infinite line and characteristic impedance-Open and short circuit lines and their significance. Distortion less transmission line, Concept of loading of a transmission line, Campbell's formula.

MODULE V: **[10 Periods]**

Impedance at any point on the transmission line- Input impedance. RF and UHF lines, transmission lines as circuit elements. Properties of λ/2, λ/4 and λ/8 Lines. Reflection coefficient and VSWR. Matching: Stub matching. Smith chart and its applications.

Text Books:

1. Matthew N.O. Sadiku, Principles of Electro-magnetics, 6th edition, Oxford University Press, 2016.

2. William H. Hayt Jr. and John A. Buck, Engineering Electromagnetics, 7th edition, Tata McGraw Hill, 2006.

3. John D. Ryder, Networks Lines and Fields, 2nd edition, Pearson, 2015.

Reference Books:

4. E.C. Jordan and K.G. Balmain, Electromagnetic Waves and Radiating Systems, 2nd edition, Pearson, 2015

5. K.D. Prasad, Antennas and Wave Propagation, Khanna Publications.

E-Resources:

1. https://ocw.mit.edu/courses/mathematics/18-440-probability-and-random-variables-spring-2014/lecture-notes/
2. http://nptel.ac.in/courses/IIT- MADRAS/Principles of_Communication1/Pdfs/1_5.pdf
3. http://pages.ucsd.edu/~ssaiegh/Slides8.pdf
4. http://nptel.ac.in/courses/117105085/
5. http://nptel.ac.in/courses/111104032/
6. http://www.nptelvideos.in/2012/12/probability-random-variables.html

Course Outcomes:

At the end of the course, students will be able to

1. Understand the different coordinate systems, vector calculus, coulombs law and gauss law for finding electric fields due to different charges and to formulate the capacitance for different capacitors.
2. Learn basic magnetostatics concepts and laws such as Biot-Savarts law and Amperes law, their application in finding magnetic field intensity, inductance and magnetic boundary conditions.
3. Distinguish between the static and time-varying fields, establish the corresponding sets of Maxwell's Equations and Boundary Conditions, and use them for solving engineering problems.
4. Determine the Transmission Line parameters to characterize the distortions and estimate the characteristics for different lines.
5. Study the Smith Chart profile and stub matching features, and gain ability to practically use the same for solving practical problems.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	2					1				2	2	1
CO2	3	3	2	2	2	1	1			1	1	1	3	3	2
CO3	3	3	3	2		2	2		1	1	1	2	3	3	2
CO4	3	3	2	1	3	3	2			2	1	2	2	3	2
CO5	3	3	3	2	3	3	3	1		2	1	3	3	2	3

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0406	NETWORK THEORY AND CIRCUIT ANALYSIS	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Basic Electrical and Electronics Engineering

Course Objectives: This course introduces the basic concepts of transient analysis of the circuits, the basic two port network parameters. It also introduces the students the multistage Amplifier analysis and frequency response.

MODULE I: Network Theorems & Transient Analysis [11 Periods]

Network Theorems (A.C. & D.C): Norton‟s Theorem, Reciprocity Theorem, Tellegen‟s Theorem, Milliman‟s and Compensation theorems for A.C & D.C excitations.

Transient Analysis (First and Second Order Circuits): Transient Response of RL, RC Series, RLC Circuits for DC excitations, Initial Conditions, Solution using Differential Equations approach and Laplace Transform Method.

MODULE II: Two Port Networks [9 Periods]

Impedance Parameters, Admittance Parameters, Hybrid Parameters, Transmission (ABCD) Parameters, Conversion of one Parameter to another, Conditions for Reciprocity and Symmetry, Interconnection of Two Port networks in Series, Parallel and Cascaded configurations, Image Parameters, Illustrative problems.

MODULE III: Locus Diagrams, Resonance and Magnetic Circuits: [10 Periods]

A: Locus Diagrams, Resonance: Locus diagrams- Series and Parallel RL, RC and RLC circuits with variation of various parameters- Resonance-series and parallel circuits, concepts of Bandwidth and Quality factor.

B: Magnetic Circuits: Faraday‟s laws of electromagnetic induction, concept of self and mutual inductance, Dot convention coefficient of coupling, composite magnetic circuits, Analysis of series and parallel magnetic circuits.

MODULE IV: Multistage Amplifiers [9 Periods]

Multistage Amplifiers: Different Coupling Schemes used in Amplifiers, General Analysis of Cascaded RC Coupled BJT Amplifiers Choice of Transistor configuration in a Cascade Amplifier, RC Coupled Amplifier, Transformer Coupled Amplifier, Direct Coupled (DC) Amplifiers and Darlington Pair.

MODULE V: Frequency Response [9 Periods]

Frequency Response: General Frequency Considerations, High Frequency Hybrid π Model for Common Emitter Transistor Model, Emitter Follower at Higher Frequencies, Analysis and design of single tuned and double tuned amplifiers with BJT, Comparison of multistage, single tuned amplifiers and double tuned amplifiers.

Text Books:

1. William Hayt and Jack E. Kemmerly, "Engineering circuit analysis", Mc Graw Hill Company, 7th Edition.
2. B.L.Theraja and A.K. Theraja, "A Textbook of Electrical Technology Volume I", S.Chand publications.
3. S. Salivahanan, N Suresh Kumar, "Electronic Circuit Analysis", Tata McGraw Hill Education Private Limited, New Delhi, 2nd Edition, 2012..

Reference Books:

1. Electrical Circuits - A. Chakrabarhty, Dhanipat Rai & Sons.
2. S.N. Singh, "Basic Electrical Engineering", PHI.
3. K. S. Suresh Kumar, "Electric Circuit Analysis", Pearson Education.
3. G. K. Mithal, "Electronic Devices and Circuits", Khanna Publishers, New Delhi, 2nd Edition, 1998.

E-Resources:

1. http://nptel.ac.in/courses/108108076/
2. https://www.electrical4u.com/electrical-power-transformer-definition-and-types-oftransformer/
3. www.dannex.se/theory/1.html
4. ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-013-electromagnetics-and-applications-spring-2009\
5. www.tandfonline.com/toc/uemg20/current6.nptel.ac.in/courses/108104087
7. nptel.ac.in/courses/115101005

Course Outcomes:

At the end of the course, students will be able to:

1. Apply network theorem to analyze the various electrical circuits.
2. Determine the transient behavior of first and second order circuits.
3. Differentiate various types of transmission lines and its parameters
4. Understand the use of transmission lines with different lengths and also about smith chart.
5. Analyze the two port networks by determining the various parameters.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2			1					1	3	2	2
CO2	3	3	2			2			2				3		2
CO3	3	3	2	2		2			2	2			3	2	1
CO4		3			2	2					1			3	1
CO5	3	2			2	1					1		2	1	

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0407	DIGITAL ELECTRONICS LAB (Common for EEE & ECE)	L	T	P
Credits: 1		-	-	2

Course Objectives: To get programming knowledge on Verilog/VHDL programming of different digital circuits and CMOS circuits

Implement the following using Verilog/VHDL or any equivalent software

1. Introduction to Verilog/VHDL and Design of all the logic gates
2. Design of Half adder, Full adder using 3 modeling styles
3. Design of Half Subtractor, Full Subtractor using 3 modeling styles
4. Design of 4X16 Decoder using two 3x8 Decoders
5. Design of 8-to-3 encoder (without and with priority).
6. Design of Multiplexer & Demultiplexer.
7. Design of comparator
8. Design of 4-bit binary to gray converter vice versa
9. Design of BCD to Excess-3 code converter and vice versa
10. Design of flip flops: SR, D, JK, T.
11. Design of 4-bit binary up/down counter.
12. Design of Johnson counter.

Equipment required for laboratory

1. Computers – Dual Core.
2. Software – Verilog/VHDL or any equivalent software

Course Outcomes:

At the end of the course, student will be able to

1. Design and verify the functionality of various combinational circuits using Verilog/VHDL coding.
2. Design and verify the functionality of various flipflops and basic sequential circuits using Verlog/VHDL coding.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3		1		1	2	2	3	3	3	2
CO2	3	3	3	3	3		1		1	2	2	3	3	3	2

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0408	**SIGNALS AND STOCHASTIC PROCESSES LAB**	**L**	**T**	**P**
Credits: 1		**-**	**-**	**2**

Course Objectives: To get knowledge on how to write program for various operation on signals, to verify various functions of random process.

Implement the following Programs using MATLAB/Octave/Equivalent Software

PART – A (Signals)

1. Generation of Various Signals and Sequences (Periodic and Aperiodic), such as Unit impulses, Unit Step, Square, Saw tooth, Triangular, Sinusoidal, Ramp, Sinc.
2. Operation of Signals and Sequences such as Addition, Multiplication, Scaling, Shifting, Folding, Computation of Energy and Average Power.
3. Verification of Linearity and Time-Invariance properties of a given continuous /discrete system.
4. Finding the Fourier Transform of a given signal and plotting its magnitude and phase spectrum.
5. Convolution between Signals and Sequences.
6. Waveform Synthesis using Laplace Transform.

PART – B (Stochastic Process)

7. Generation of random variables and plot the PDF and CDF of the following distributions
   a) Uniform, Gaussian, Rayleigh,
8. Operations on Single Random Variable: Mean, Variance, Skew of different distributions.
9. Operations on Multiple Random Variables- Correlation and Covariance of any given two random variables
10. A) Calculation of Autocorrelation Function and Power-Spectral Density of a Given Random Process
    B) Calculation of Cross-Correlation Function and Cross-Power-Spectral Density of Two Random Processes
11. Calculation of Temporal Characteristics of Response of Linear-Time Invariant Systems when input is a WSS random process.
12. Calculation of Spectral Characteristics of Response of Linear-Time Invariant Systems when input is a WSS random process..

Course Outcomes:

At the end of the course student will be able to:

1. Generate different signals with different parameters.
2. Do operations on random variables.
3. Verify & do the calculation on various random process.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	2	3	3				1	2		1	2	3	2
CO2	3	3	2	3	3				2	2		2	2	3	2
CO3	3	3	2	3	3				2	2		2	2	3	2

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. III Semester		
Code:B0554	FUNDAMENTALS OF DATA STRUCTURES LAB (Common for CE, EEE, ME, ECE, MiE)	L	T	P
Credits: 2		-	-	4

Prerequisites: C Programming.

Course Objectives:

This course will deliver the knowledge in introducing the concepts of various data structures such as linked lists, stacks, queues, trees and graphs along with the applications.

Software Requirements: C

List of Programs:

1 Write a program to create one dimensional array, with the following operations:
   a) Insertion
   b) Deletion
   c) Display the elements
   d) Count number of elements

2 Write a program to create a single linked list, with the following operations:
   a) Insertion
   b) Deletion
   c) Display the elements
   d) Count number of elements.

3 Write a program to create a circular linked list, with the following operations:
   a) Insertion
   b) Deletion
   c) Display the elements
   d) Count number of elements.

4 Write a program to create a double linked list, with the following operations:
   a) Insertion
   b) Deletion
   c) Display the elements
   d) Count number of elements.

5 Write a program to implements stack operations using:
   a) Arrays
   b) Linked list

6 Write a program to:
   a) Evaluate Postfix expression.
   b) Convert infix expression into postfix expression

7 Write a program to implements Linear Queue operations using:
   a) Arrays
   b) Linked list

8 Write a program to implements Circular Queue operations using Arrays

9 Write a program to implements Double-ended Queue operations using Arrays

10 Write a recursive program to create a Binary Tree of integers, traverse the tree in preorder, in order and post order of the tree.

11 Write a program to create a Binary Search Tree (BST) and perform insert and search operations on it.

12 Write a program for implementing the following graph traversal algorithms:
a) Breadth First Search (BFS)
b) Depth First Search (DFS)

TEXTBOOKS

1. Jean Paul Tremblay, Paul G Sorenson, "**An Introduction to Data Structures with Applications**", Tata McGraw Hills, 2nd Edition, 1984.

2. Richard F. Gilberg, Behrouz A. Forouzan, "**Data Structures: A Pseudo code approach with C** ", Thomson (India), 2nd Edition, 2004.

REFERENCES

1. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan, "**Fundamentals of Data Structure in C**", University Press (India), 2nd Edition, 2008..

2. A. K. Sharma, "**Data Structures using C**", Pearson, 2nd Edition, June, 2013.

3. R. Thareja, "**Data Structures using C**", Oxford University Press, 2nd Edition, 2014.

Course Outcomes:

At the end of the course, students will be able to

1. Identify the appropriate recursive algorithms and analyze the performance of algorithms.

2. Understand and implement single, double, and circular linked-lists.

3. Implement linear data structures such as Stacks and Queues using array and linked-list representations.

4. Implement non-linear data structures such as trees and graphs.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	2										3	2	
CO2	2	2	3										2	3	
CO3		2	3											3	1
CO4		2	3										2	3	

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech III Semester		
Code:B00M2	ENVIRONMENTAL SCIENCE (Common for ALL)	L	T	P
Credits: Nil		2	-	-

Pre-Requisites: Nil

Course Objectives: An interdisciplinary approach to complex environmental problems using basic tools of the natural and social sciences, including geo systems, biology, chemistry, economics, political science and international processes. The ability to work effectively as a member of an interdisciplinary team on complex problem of environment.

MODULE I: Ecosystems: [5 Periods]

Definition, Scope and Importance of ecosystem, Concept of ecosystem, Classification of ecosystems, Structure and Structural Components of an ecosystem, Functions of ecosystem, Food chains, food webs and ecological pyramids. Flow of energy.

Activity: Plantation.

MODULE II: Natural resources, Biodiversity and Biotic resources: [9 Periods]

A: Natural Resources: Classification of Resources: Living and Non-Living resources, Renewable and non-renewable e-resources. Water resources: use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources–case studies. Energy resources: growing energy needs introduction to renewable and non renewable energy sources.

B: Biodiversity and Biotic resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and intrinsic values. Threats to Biodiversity (habitat loss, poaching of wildlife, man-wild life conflicts). Conservation of Biodiversity (In-situ and Ex-situ conservation),

Activity: case studies.

MODULE III: ENVIRONMENTAL POLLUTION AND CONTROL: [7 Periods]

A: Classification of pollution and pollutants, Causes, effects and control technologies. Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. Water pollution: Point and non-point sources of pollution, Major pollutant of water and their sources, drinking water quality standards.

B: Soil Pollution, Soil as sink for pollutants, Impact of modern agriculture on soil, degradation of soil. Marine Pollution: Misuse of International water for dumping of hazardous waste, Coastal pollution due to sewage and marine disposal of industrial effluents. E-waste and its management.

Activity: Field visit.

MODULE IV: Global Environmental Problems and Global effects: [6 Periods]

Greenhouse effect, Green House Gases (GHG), Global Warming, Sea level rise, climate change and their impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions/Protocols: Earth summit, Kyoto protocol and Montréal Protocol.
Activity: Poster Making.

MODULE V: Towards sustainable future: [5 Periods]

Concept of Sustainable Development, Threats to Sustainability, Population and its explosion, Crazy Consumerism, Over-exploitation of resources, Strategies for Achieving Sustainable development, Environmental Education, Conservation of Resources, Urban Sprawl, Sustainable Cities and Sustainable Communities, Human health, Role of IT in Environment, Environmental Ethics, Environmental Economics, Concept of Green Building, Clean Development Mechanism(CDM).

Text Books:

1. R.Rajagopalan,"Environmental Studies from crisis to cure", Oxford University Press 2nd Edition, 2005.
2. Anubha Kaushik, C.P.Kaushik, "Environmental studies" New age International Publishers,4th Edition,2012

Reference Books:

1. Erach Bharucha,"Environmental studies" University Grants Commission, and University Press,I Edition, 2005.
2. M. Anji Reddy "Text book of Environmental Science and Technology" 3rd Edition, 2007
3. Richard T.Wright,"Environmental Science: towards a sustainable future" PHL Learning, Private Ltd. New Delhi, 2nd Edition., 2008
4. Gilbert McMasters and Wendell P.Ela,"Environmental Engineering and science", 3rd Edition, PHI Learning Pvt. Ltd.,2008.

E-Resources:

1. Journal of earth science and climatic change (OMICS International Journal).
2. Journal of pollution effects & control (OMICS International Journal).
3. nptel.ac.in/courses/120108004/ (Principles of Environment Management Lectures).
4. http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html (NPTEL online video courses IIT lectures).

Course Outcomes:

After completion of the course, students will be able to:

1. To enable the students to realize the importance of ecosystem, its structure, services. To make the students aware of Different natural functions of ecosystem, which helps to sustain the life on the earth.
2. To use natural resources more efficiently.
3. To make the students aware of the impacts of human actions on the environment, its effects and minimizing measures to mitigate them.
4. To educate the students regarding environmental issues and problems at local, national and international level.
5. To know more sustainable way of living

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3		1		1	2	1								
CO2	2	3	2	3	1	3		2							
CO3	3	3	2	3	2	2		1							
CO4	3	2	2	1	2	1									
CO5	2	1	1			1	3	3							

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech IV Semester		
Code:B0H08	ENGINEERING ECONOMICS AND ACCOUNTANCY	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Nil

Course Objectives: EEA is a think beyond program which will make the student to examine the application of microeconomics theory as applied to the manager‟s responsibilities in an organization. To explain the basic principles of managerial economics, accounting and current business environment underlying business decision making. This course should emphasize the quantitative and qualitative applications of economic principle to business analysis

MODULE-I Business Environment and Managerial Economics [10 Periods]

A: Business Environment: Characteristic features of Business, Features and evaluation of Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types, Latest trends in Business Environment (Entrepreneurship).

B: Managerial Economics: Definition, Nature and Scope of Managerial Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand, Types, Significance of Elasticity of Demand, Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

MODULE II: Theory of Production and Cost Analysis [10 Periods]

A: Theory of Production: Production Function – ISOquants and ISOcosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale.

B: Cost Analysis: Cost concepts, Opportunity cost, fixed vs. Variable costs, explicit costs Vs. Implicit costs, Out of pocket costs vs. Imputed costs. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Managerial Significance and limitations of BEA.

MODULE III: Market structures and Pricing Policies [9 Periods]

A: Introduction to Markets & Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.

B: Pricing Policies & Methods: Cost plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, PLC based pricing methods.

MODULE IV: Capital and Capital Budgeting [9 Periods]

A: Capital: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of rising finance.

B: Capital Budgeting: Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)

MODULE V: Financial Accounting and Ratios [10 Periods]

A: Financial Accounting: Introduction, Accounting principles, Accounting Cycle, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments).

B: Financial Analysis Through Ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

Text Books:

1. Aryasri, "Managerial Economics and Financial Analysis", TMH, 2nd edition, 2005.
2. Varshney & Maheswari, "Managerial Economics", 5th edition Sultan Chand, 2003.

Reference Books:

1. H. Craig Peterson & W. Cris Lewis, "Managerial Economics", PHI, 4 Ed.
2. Domnick Salvatore, "Managerial Economics In a Global Economy", Thomson, 4th Edition.
3. Raghunatha Reddy & Narasimhachary, "Managerial Economics& Financial Analysis", 4TH edition Scitech.
4. S.N.Maheswari & S.K. Maheswari, "Financial Accounting", 6th edition Vikas.
5. Dwivedi, "Managerial Economics", Vikas, 6th Edition.

E-Resources:

1. http://www.learnerstv.com/Free-Economics-video-lecture-courses.htm
2. http://nptel.ac.in/courses/110105067/
3. http://nptel.ac.in/courses/110107073/
4. http://nptel.ac.in/courses/110101005/
5. http://nptel.ac.in/courses/109104073/

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the concepts of managerial economics and their application in evaluating the demand.

2. Evaluate the production function and identifies the least cost combination to control the costs of production.

3. Understand the structures of various market types and their pricing policies.

4. Understand the types of business forms and also be able to evaluate the investments using capital budgeting techniques.

5. Understand the basic concepts of financial accounting and evaluation of company performance using ratio analysis.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1		2							1		3				
CO2	3			2	1										
CO3		1			2						3				
CO4	2	1			3										
CO5		1			2						3				

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0409	SENSORS & DEVICES	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Nil.

Course Objectives: To introduce the terminology, technology and its applications of sensors , To introduce Arduino which is used in many IoT devices, To introduce the Raspberry PI platform, that is widely used in IoT applications. To introduce the basics of IoT devices

MODULE I: Introduction to Sensors [10 Periods]

Introduction to Sensors, classification of Sensors, Criteria to choose a Sensor, Sensors (Light sensor, temperature sensor, force sensor, weight sensor, position sensor, Hall Effect Sensor, sound sensor, ultrasonic sensor, touch sensor, gas sensor, IR sensor, level sensor and soil moisture sensor) and its working principles.

MODULE II: Arduino & NodeMCU [10 Periods]

Introduction to Arduino, Arduino IDE, Basic Commands for Arduino, Connecting LED with Arduino, Arduino with sensors (Ultrasonic Sensor, PIR Motion Sensor, DHT11 sensor, soil moisture sensor, Gas/Smoke Sensor, LDR Sensor), RFID Reader, Introduction to Node MCU, Connecting Node MCU Board with Arduino IDE, NodeMCU with sensors (Ultrasonic Sensor, PIR Motion Sensor, DHT11 sensor, LDR sensor, soil moisture sensor).

MODULE III: Interfacing with Arduino & Node MCU [10 Periods]

Interfacing of Buzzer with Arduino, controlling servo motor with Arduino, controlling DC Motor with Arduino, Controlling Stepper motors with Arduino, Interfacing LCD with Arduino, Controlling High Power devices with Arduino using transistors, Controlling AC Power devices with Arduino using Relays, Interfacing servo motor with NodeMCU, Control DC Motor via NodeMCU, Controlling Stepper motors with NodeMCU.

MODULE IV: Raspberry Pi [10 Periods]

Introduction to Raspberry pi, Installation of libraries, Configuring Raspberry Pi, Raspberry Pi commands, Enabling SSH, Connecting Raspberry Pi using remote access, getting the static IP address of Raspberry Pi, Introduction to Python, Run a python program on Raspberry Pi, Interfaces of raspberry Pi, Programming a Raspberry Pi for connecting (LED, DHT11, Ultrasonic Sensor, LDR Sensor).

MODULE V: Introduction to IoT [10 Periods]

Introduction to Internet of Things- Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs, IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

TextBooks:

1. Rui Santos, 18+ Arduino Projects, 2nd edition, random nerdtutorial.blog
2. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh,Mahendra Swain, Internet of Things with Raspberry Pi and Arduino, CRC Press
3. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547 2.

ReferenceBooks:

1. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759 3.
2. Raspberry Pi Cookbook, Software and Hardware Problems and solutions, Simon Monk, O'Reilly (SPD), 2016, ISBN 7989352133895

E-Resources:

1. https://www.edx.org/course/iot-sensors-and-devices
2. https://behrtech.com/blog/top-10-iot-sensor-types/
3. http://nptel.ac.in/courses/108101037/

Course Outcomes:

At the end of the course, students will be able to:

1. Understanding of IoT value chain structure (device, data cloud), application areas and technologies involved.
2. Understand IoT sensors and technological challenges faced by IoT devices, with a focus on wireless, energy, power, and sensing modules.
3. Market forecast for IoT devices with a focus on sensors.
4. Explore and learn about Internet of Things with the help of preparing projects designed for Raspberry Pi.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3								3	1		1
CO2	3	3	3	3								3	1		1
CO3	3	3	3	3								3	1		1
CO4	3	3	3	3								3	1		1
CO5	3	3	3	3								3	1		1

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0410	MICROPROCESSOR AND MICROCONTROLLERS	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Digital Electronics.

Course Objectives: :This course provides the students to understand operation and programming of 8085 Microprocessor, develops real time applications using 8086 processor, understand the basic concepts of 8051 Microcontroller and interfacing with I/O devices.

MODULE I: 8085 Architecture [8 Periods]

Introduction to Microprocessors, Architecture of 8085, registers & flag register, Pin Configuration and Functions, Generation of Control Signals: Bus Timings: De-multiplexing of address/ data bus. Instruction Set and Programming with 8085.

MODULE II: 8086 Architecture [10 Periods]

8086 Architecture: 8086 Architecture-Functional diagram, Register Organization, Memory Segmentation, Programming Model, Physical Memory Organization, Signal descriptions of 8086, interrupts of 8086.

Instruction Set and Assembly Language Programming of 8086: Instruction formats, Addressing modes, Instruction Set, Assembler Directives, Macros, and Simple Programs involving Logical, Branch and Call Instructions, Sorting, String Manipulations.

MODULE III: Introduction to Microcontrollers: [10 Periods]

A: Overview of 8051 Microcontroller, Architecture, I/O Ports, Memory Organization, Addressing Modes and Instruction set of 8051.

B: 8051 Real Time Control: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.

MODULE IV: I/O and Memory Interface [10 Periods]

I/O And Memory Interface: LCD, Keyboard, External Memory RAM, ROM Interface, ADC, DAC Interface to 8051.

Serial Communication and Bus Interface: Serial Communication Standards, Serial Data Transfer Scheme, On board Communication Interfaces-I2C Bus, SPI Bus, UART; External Communication Interfaces-RS232,USB.

MODULE V: ARM Architecture [10 Periods]

A: ARM Processor fundamentals, ARM Architecture – Register, CPSR, Pipeline, exceptions and interrupts interrupt vector table, ARM instruction set – Data processing, Branch instructions, load store instructions, Software interrupt instructions, Program status register instructions, loading constants, Conditional execution, Introduction to Thumb instructions.

B: **Advanced ARM Processors:** Introduction to CORTEX Processor and its architecture, OMAP Processor and its Architecture. Introduction to Intel i3, i5 and i7 Processors.

Text Books:

1. Ramesh Gaonkar, "Microprocessor Architecture, Programing and Application with 8085"Penram,5th Edition, 2002.
2. A. K.Ray, "Advanced Micro processors and Peripherals" 3 rdTata McGraw-Hill, Edition.
3. Mazidi, Mazidi&McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C" 2 ndEdition, PHI .
4. ARM System Developers guide, Andrew N SLOSS, Dominic SYMES, Chris WRIGHT, Elsevier, 2012.

Reference Books:

1. The 8051 Microcontroller, Kenneth. J. Ayala, Cengage Learning, 3rd Ed, 2004.
2. Microprocessors and Interfacing, D. V. Hall, TMGH, 2nd Edition 2006.
3. The 8051 Microcontrollers, Architecture and Programming and Applications -K. Uma Rao, AndhePallavi, Pearson, 2009

E-Resources:

1. https://www.tutorialspoint.com › Microprocessor › Microprocessor - 8085 Architecture
2. http://www.cpu-world.com/CPUs/8086/
3. https://www.journals.elsevier.com/microprocessors-and-microsystems/
4. http://rtcmagazine.com/technologies/view/Microcontrollers
5. http://nptel.ac.in/courses/106108100/
6. http://nptel.ac.in/courses/108107029/
7. nptel.ac.in/courses/106108100/

Course Outcomes:

At the end of the course, students will be able to:

1. Explain 8085 microprocessor features..
2. Develop programs using 8085 instruction set.
3. Identify peripheral devices to interface with 8086 microprocessor.
4. Get Summarize different 8051 family microcontrollers.
5. Design to interface input and output devices with 8051 microcontroller.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	1									1	3		
CO2	3	2	1	1	2							1	3	2	2
CO3	3	2	2	2	2							2	3	2	2
CO4	3	1	1										3		
CO5	3	3	3	2	2							2	3	2	3

2021-22 Onwards (MR 21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0411	ANALOG AND DIGITAL COMMUNICATIONS	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Signals Theory and Stochastic Processes.

Course Objectives: This course introduces the concept of modulation and various techniques for amplitude modulation of analog signals. This course also introduces the concept of angle modulation techniques for Frequency modulation of analog signals. This course also introduces sampling, the effect of noise on communication systems and various pulse analog & digital binary modulation techniques.

MODULE I: Amplitude Modulation [10 Periods]

Introduction to communication system, Need for modulation, Amplitude Modulation, Time domain and frequency domain description of AM system, single tone modulation, power relations in AM waves, Generation of AM waves - Switching modulator, Detection of AM Waves - Envelope detector , Applications , advantages and limitations of AM.

MODULE II: DSBSC Modulation [13 Periods]

DSBSC modulation - time and frequency domain description, Generation of DSBSC Waves - Balanced Modulators, Coherent detection of DSB-SC Modulated waves, SSB modulation - time and frequency domain description, frequency discrimination and Phase discrimination methods for generating SSB, Demodulation of SSB Waves, principle of Vestigial side band modulation. Comparison of AM Techniques, AM transmitter and Super heterodyne Receiver

MODULE III: Angle Modulation [12 Periods]

Phase and frequency modulation, Narrow Band and Wide band FM – Modulation index, Spectra, Power relations and Transmission Bandwidth, Generation of FM Signal- Armstrong Method, Detection of FM Signal: Balanced slope detector, Phase locked loop, Comparison of FM and AM, FM Transmitter and Receiver

MODULE IV: Noise and Elements of Digital Communication Systems [13 Periods]

A. Noise: Noise sources – Noise figure, noise temperature and noise bandwidth – Noise in cascaded systems. Noise performance analysis in AM & FM systems.

B. Sampling : Sampling theorem, types of sampling-Natural and flat-top sampling

C. Pulse Analog Modulation: Introduction, PAM, PWM, PPM Modulation and Demodulation Techniques

MODULE V: PCM and Digital Binary Carrier Modulation Schemes [12 Periods]

Pulse Digital Modulation: PCM Generation and Reconstruction, Quantization Noise, Non Uniform Quantization and Companding, DPCM, Adaptive DPCM, DM, Noise in PCM and DM.

Digital Binary Carrier Modulation Schemes :Introduction, ASK -Modulator, Coherent ASK Detector, FSK- Modulator, Non Coherent FSK Detector, BPSK-Modulator, Coherent BPSK Detection.

Text Books:

1. H Taub& D. Schilling, GautamSahe, "Principles of Communication Systems", TMH, 3rd Edition, 2007.
2. Sam Shanmugam, "Digital and Analog Communication Systems", John Wiley, 2005

Reference Books:

2. Simon Haykin, John Wiley, "Digital Communication", 1st Edition, 2005.
3. B.P. Lathi, "Communication Systems", BS Publication, 2006.

E-Resources:

1. https://courses.engr.illinois.edu/ece458/comms2.pdf
2. http://www.ece.lehigh.edu/~jingli/teach/F2005CT/notes/AnalogCommunication.pdf
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450-principles- of-digital-communications-i-fall-2006/
4. International Journal of Communication Systems - http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-1131
5. Lecture Series - http://nptel.ac.in/courses/117102059/
6. Lecture Series - http://nptel.ac.in/courses/117101051/

Course Outcomes:

After completion of the course, students will be able to:

1. Understand the concepts of modulation, demodulation of various analog modulationtechniques i.e., AM, DSB and SSB.
2. Analyze the Frequency Modulation signal transmission and reception and calculate theNarrowband FM, Wideband FM.
3. Understand the concepts and working of radio transmitters, radio receivers and noiseanalysis of analog communication systems.
4. Understand the basic components of digital communication systems.
5. Understand the concepts and working of various digital binary modulation techniques.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	2	1	2	1	1	1					1	3	2	1
CO2	3	2	2	2	1	1	1					1	2	2	1
CO3	2	2	1	1	1	1	1					1	2	2	1
CO4	3	2	1	2	2	1	1					1	2	3	1
CO5	3	2	2	2	2	1	1					1	3	3	1

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0412	Pulse and Linear Integrated Circuits	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Basic Electrical and Electronic Engineering, Analog Electronics.

Course Objectives: Analyse the behavior of Linear and non-linear wave shaping circuits Analyse and design of Multivibrators¬ Understand the operation of OP-AMP and its internal circuits¬ Analyse the applications of OPAMP and 555 Timer¬ Explain the operation of various data converter circuits and PLL¬

MODULE I: [12Periods]

Linear Wave Shaping: High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square and ramp inputs. RC network as differentiator and integrator, attenuators.

Non-Linear Wave Shaping: Diode clippers, Transistor clippers, clipping at two independent levels, Comparators,Clamping operation,clamping circuits using diode with different inputs, practical clamping circuits, Clamping circuit theorem.

MODULE II: [12Periods]

Multivibrators: Analysis and Design of fixed bias Bistable, Monostable, Astable Multivibrators.Introduction to Schmitt trigger using transistors.

Time Base Generators: General features of a time base signal, methods of generating voltage time base waveform.

MODULE III: [12Periods]

Integrated Circuits & Operational Amplifier: Introduction, Classification of IC's, IC chip size and circuit complexityOp-Amp Block diagram, ideal Op-amp, Op-amp and its features,AC and DC characteristics of Op-amp: Input and Output Offset voltages and currents, Slew rate, CMRR, PSRR. Frequency response and Compensation Techniques.

MODULE IV: [12Periods]

OPAMP Applications: Inverting and Non-Inverting Amplifiers, Adder, Subtractor, Integrator and differentiator,Comparator.

Active filters: Introduction, Butterworth filters – 1st order low pass and high pass filters, band pass, band reject and all pass filters.

MODULE V: [12Periods]

555 Timer: Functional Diagram, Monostable, Astable and Schmitt Trigger.PLL- introduction, basic principle.

Data Converters: Digital-to-analog converters (DAC): Weighted resistor DAC,R-2R ladder DAC, inverted R-2R ladder, Analog-to digital converters (ADC): parallel comparator type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

TextBooks:

1. Anand Kumar A, "Pulse and Digital Circuits", Prentice-Hall of India private Limited, New

Delhi, 2007
2. David A. Bell, Solid State Pulse circuits - PHI, 4th Edn., 2002.
3. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New Age International (P) Ltd., 2008.

ReferenceBooks:

1. J. Millman and H. Taub, Pulse, Digital and Switching Waveforms - McGraw-Hill, 1991.

2. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits" Pearson,2018, 4th edition

Reference Books:

1. Ramakanth A. Gayakwad, "Op-Amps and Linear Integrated Circuits" Pearson,2018, 4th edition
2. D.Roy Chowdhury, Shail B.Jain, "Linear Integrated Circuits", 4/e, New Age International (P) Ltd., 2008.
3. Anand Kumar A, "Pulse and Digital Circuits", Prentice-Hall of India private Limited, New Delhi, 2007

E-Resources:

1. http://sureshq.blogspot.in/2015/12/pulse-and-digital-circuits-unit-2-and-3.html
2. http://wps.pearsoned.com/wps/media/objects/10581/10835513/Chapter4.pdf
3. http://www.radio-electronics.com/info/circuits/
4. http://electronicsforu.com/
5. http://www.serialsjournals.com/journal-detail.php?journals_id=315

Course Outcomes:

At the end of the course, students will be able to:

1. Construct different linear networks and analyse their response to different input signals.
2. Understand, Analyse and design multi vibrators and sweep circuits using transistors
3. Distinguish different types of rectifying circuits and amplifier circuits and their performance parameters.
4. Analyse DC and AC characteristics for Single/Dual input Balanced/Unbalanced output configurations using BJTs
5. Distinguish various linear and non-linear applications of Op-Amp. Analyse the operation of the most commonly used D/A and A/D converter types.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	3	2	1	2		1	2	2	1	3	2	2
CO2	3	2	3	1	2		2		2	2	3	1	3	2	3
CO3	3	3	3	3	2	1	2	1	2	2	1		2	2	2
CO4	3	3	3	3	2	3			3	2	2	3	3	2	3
CO5	3	3	3	2	1	1			1	1	2	1	3	2	1

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0413	ANALOG AND DIGITAL COMMUNICATIONS LAB	L	T	P
Credits: 1.5		-	-	3

Course Objectives: To get practical knowledge on analog and digital communication concepts.

List of Experiments:

PART A: Analog Communications (AC)

1. Amplitude modulation and demodulation.
2. DSB-SC Modulator & Detector
3. SSB-SC Modulator & Detector (Phase Shift Method)
4. Pre-emphasis & de-emphasis.
5. Time Division Multiplexing & De multiplexing
6. AGC Characteristics
7. Radio Receiver

PART B: Digital Communications (DC)

1. Pulse Amplitude Modulation and Demodulation
2. Pulse Width Modulation & Demodulation
3. Pulse Position Modulation & Demodulation
4. PCM Generation and Detection
5. Frequency shift keying. Generation and Detection
6. Phase shift keying. Generation and Detection
7. DPSK: Generation and Detection

Course Outcomes:

At the end of the course, students will be able to

1. Perform analog modulation techniques like AM, DSB-SC & SSB-SC
2. Analyze the AGC Characteristics of Radio receiver.
3. Perform Pulse and Digital Modulation techniques

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3	2	2	2	2	1	1	1	3	3	3	2
CO2	3	3	3	3	2	1	1	1		1		3	3	3	1
CO3	3	3	3	3	2	2	2	2	1	1	1	3	3	3	2

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0414	**ELECTRONIC CIRCUITS AND PULSE CIRCUITS LAB**	**L**	**T**	**P**
Credits: 1.5		**-**	**-**	**3**

Course Objectives:

To design Multistage and Power amplifiers, linear, non-linear wave shaping circuits and multivibrators according to given specifications.

List of Experiments:

PART-A Electronic Circuits

1. Two Stage RC Coupled Amplifiers
2. Darlington Pair
3. Class A Power Amplifier (Transformer less).
4. Class B Complementary Symmetry Amplifier.

PART-B Pulse Circuits

1. Linear wave shaping.
2. Non Linear wave shaping – Clippers.
3. Non Linear wave shaping - Clampers.
4. Transistor as a switch.
5. Astable Multivibrator.
6. Monostable Multivibrator.
7. Bistable Multivibrator.
8. Schmitt Trigger.

Course Outcomes:

At the end of the course, students will be able to

1. Understand the design of Multistage amplifiers
2. Design and calculate the efficiency of power amplifiers
3. Understand the different Pulse Circuits
4. Design and Applications of Multivibrators.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	3	3	3				2		1	2	3	3	
CO2	3	2	3	3	3				2		1	2	3	3	
CO3	1	1	2	3	3				1			2	2	2	
CO4	3	2	3	3	3				2		1	2	3	3	

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. IV Semester		
Code:B0555	OBJECT ORIENTED PROGRAMMING LAB (Common for CE, EEE, ME, ECE, MiE)	L	T	P
Credits: 2		-	-	4

Prerequisites: NIL

Course Objectives:
This course will make students able to learn and understand the concepts and features of object oriented programming and the object oriented concept like inheritance and will know how to make use of interfaces and package, to acquire the knowledge in Java‟s exception handling mechanism, multithreading.

Software Requirements: Java

List of Programs:

1. Write a Java Program to implement

a) Default Constructor

b) Parameterized constructor

2. Write a Java Program to implement

a) Method overloading

b) Constructor overloading

3. Write a Java program to implement

a) Single Inheritance

b) Multilevel Inheritance

c) Hierarchical Inheritance

4. Write Java programs that uses the following keywords…

a) this

b) super

5. Write Java programs that uses the following keywords…

a) static

b) final

6. Write a Java program to implement

a) Method overriding.

b) Dynamic method dispatch.

7. Write a Java program to implement

a) abstract method

b) Interfaces

8. Write a Java program to create user defined packages.

9. Write a Java program to implement Exception Handling using

a) try-catch clause

b) Multiple Catch clauses

c) Nested try blocks

10. Write a Java program that

a) create user defined Thread by extending Thread class.
b) create user defined Thread by implementing Runnable Interface
c) create two user defined Threads i.e. Multi Threading using Thread

11. Write a Java program

a) checks whether a given string is a palindrome or not.

b) for sorting a given list of names in ascending order.

c) that reads a line if integers and then displays each integer and the sum of all integers (use string tokenizer class of java.util).

12. Write a Java program that

a) reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.

b) reads a file and displays the file on the screen, with a line number before each line.

TEXT BOOKS:

1. Herbert Schildt, "**Java The complete reference**", TMH, 8th edition, 2011.
2. T. Budd, "**Understanding OOP with Java**", Pearson Education, updated edition, 1998.

REFERENCES:

1.P.J. Deitel and H.M. Deitel, "**Java for Programmers**", Pearson education.

2.P. Radha Krishna, "**Object Oriented Programming through Java**", Universities Press.

3.Bruce Eckel," **Programming in Java**", Pearson Education.

4.S. Malhotra and S. Choudhary," **Programming in Java**", Oxford Univ. Press.

Course Outcomes:

Course Outcomes:

At the end of the course, students will be able to

1. Differentiate structured programming and object oriented programming and know the concepts of classes, objects, members of a class.
2. Apply object oriented programming features and concepts for solving given problems using inheritance and will know how to organize files in packages and concept of interface.
3. Capable of handling run time errors using Exceptional Handling and exploring strings.
4. Develop applications for concurrent processing using Thread Concept.
5. Capable of handling IO operations using Files.

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	ProgrammeOutcomes(POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1		2	3										3	2	
CO2			3		2								2	3	
CO3		2	2		2									2	
CO4			3		3									2	
CO5		2	2		3								2	2	

2021-22 Onwards (MR 20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. IV Semester		
Code:B00M1	**GENDER SENSITIZATION**	**L**	**T**	**P**
Credits: NIL	(Common for EEE, ECE, CSE and IT)	**2**	**-**	**-**

Course Objectives: To develop students' sensibility with regard to issues of gender in contemporary India. To provide a critical perspective on the socialization of men and women. To introduce students to information about some key biological aspects of genders. To expose the students to debates on the politics and economics of work. To help students reflect critically on gender violence. To expose students to more egalitarian interactions between men and women.

MODULE I: Understanding Gender [6 Periods]

Gender: Why Should We Study It? *(Towards a World of Equals:* Unit -1) Socialization: Making Women, Making Men *(Towards a World of Equals:* Unit -2) Introduction. Preparing for Womanhood. Growing up Male. First Lessons in Caste. Different Masculinities. Just Relationships: Being Together as Equals *(Towards* a *World of Equals:* Unit -*12) Mary* iKorn and Onler. Love and Acid just do not Mix. Love Letters. Mothers aniJ Fathers. Further Reading: Rosa Parks-The Brave Heart.

MODULE II: Gender and Biology [6 Periods]

Missing Women: Sex Selection and Its Consequences *(Towards a World of Equals:* Unit -4) Declining Sex Ratio. Demographic Consequences. Gender Spectrum: Beyond the Binary *(Towards* a *World of Equals:* Unit -10) Two or Many? Struggles with Discrimination. Additional Reading: Our Bodies, Our Health *(Towards a World of Equals:* Unit -13)

MODULE III: Gender and Labour [7 Periods]

A: Housework: The Invisible Labour *(Towards a World* of *Equals:* Unit -3) "My Mother doesn't Work." "Share the I.oad." Women's Work: Its Politics and Economics *(Towards a* **B:** *World of Equals:* Unit -7) Fact and Fiction. Unrecognized and Unaccounted work. Further Reading: Wages and Conditions of Work.

MODULE IV: Issues of Violence [7 Periods]

Sexual Harassment: Say Nol *(Towards a World of Equals:* Unit -6)

Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: *"Chdpulum.*

Domestic Violence: Speaking Out *(Towards a World of Equals:* Unit -5)

Is Home a Safe Place? When Women Unite (Film" Rebuilding Lives. Further Reading: New Forums for Justice. Thinking about Sexual Violence *(Towards a World of Equals:* Unit -11) Blaming the Victim-1 Fought for my Life " - Further Reading: The Caste Face of Violence.

MODULE V: Gender Studies [6 Periods]

Knowledge: Through the Lens of Gender *(Towards a Work/ of Equals:* Unit -5)

Point of View. Gender and the Structure of Knowledge. Further Reading: Unacknowledged Women Artists of Telangana. Whose History? Questions for Historians and Others *(Towards a World of Equals:* Unit -9) Reclaiming a Past. Writing other Histories. Further Reading: Missing Pages from Modern Telangana History.

Essential Reading: All the Units In the Textbook, *"Towards a World of Equals: A Bilingual Textbook on Gender"* written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Mina Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Thant
Note: Since it Is Interdisciplinary Course, Resource Persons can be drawn from the fields of English Literature or Sociology or Political Science or any other qualified faculty who has expertise in this field.

Text Books: -

1. Towards a World of Equals: A bilingual Textbook on Gender , A Suneetha -etall

Reference Books: -

1. Sen, Amartya. "More than One Million Women are Missing.' New York Review of Books 37.20 (20 December 1990). Print. We *Were Making History...' Life Stories of Women in the ToIrmgana People's Struggle.* New Delhi: Kali for Women, 1989.
2. Tripti Lahiri. "By the Numbers: Where Indian Women Work." Women's Studios Journal (14 November 2012) Available online at: http:// blogs.visj.com/ India real time/2012/11/14/by -the-numbers-where-Indan-womenworkP
3. K. Satyanarayana and Susie Thant (Ed.) Steel Nibs Are Sprouting: New Dalit Writing From South India, Dossier 2: Telugu And Kannada. http://harooreollins.co.in/BookDetailasp?Flook Cndet,3732
4. Vimata. "Vantillu (The Kitchen)". Women Writing in India: 600 BC to the Present. Volume II: The 20th Century. Ed. Susie Thaw and K. Lalita. Delhi: Oxford University Press 1995. 599-601.
5. Shatrughna, Veena et al. Women's Work and its Impact on Child Health end Nutrition, Hyderabad, National Institute of Nutrition, Indian Council of Medical Research. 1993.
6. Stree Shakti Sanghatana. 'We Were Making I listory ' Life Stories of Women in the Telangana People's Struggle. New Delhi: Kali for Women, 1989.

E-Resources:

1. http://www.actforyouth.net/resources/rf/rf_gender1_1213.cfm(UNDERSTANDING GENDER)
2. https://www.simplypsychology.org/gender-biology.html(GENDERAND BIOLOGY)
3. http://www.yourarticlelibrary.com/essay/essay-on-gender-issues-in-labour-market-in-india/40442/ (GENDER AND LABOUR)
4. http://journals.sagepub.com/doi/abs/10.1177/107780120000600700 4(ISSUES OF VIOLENCE)
5. http://www.nordiclabourjournal.org/emner/likestilling (GENDER AND BIOLOGY)

Course Outcomes:

After completion of the course, students will be able to:

1. Develop a better understanding of important issues related to gender in contemporary India.
2. Sensitize about the basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Acquire insight into the gendered division of labour and its relation to politics and economics.
5. Develop a sense of appreciation of women in all walks of life.

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1						3		3	3		3	3			
CO2						3		3	3		3	3			
CO3						3		3	3		3	3			
CO4						3		3	3		3	3			
CO5						3		3	3		3	3			

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. V Semester		
Code:B0H05	MANAGEMENT FUNDAMENTALS (Common for EEE, ECE, CSE and IT)	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Nil

Course Objectives: Through reading the text, references and discussion of cases students should be able to understand the fundamentals underlying the management of an organization.

MODULE I: Management and Principles of Management [9 Periods]

A. Introduction to Management: Concepts of Management and organization-nature, importance and Functions of Management, Taylor's Scientific Management Theory, Fayol's Principles of Management.

B. Management Theories: Mayo's Hawthorne Experiments, Maslow's Theory of Human Needs, Douglas McGregor's Theory X and Theory Y, Herzberg's Two-Factor Theory of Motivation, Systems Approach to Management, Leadership Styles, Corporate Social responsibility.

MODULE II: Planning, Organization and types of Structures [10 Periods]

A. Planning: Need for planning- -Steps in the process of Planning-Advantages and limitation of planning. Types of planning - Vision, Mission, Goals, Objectives, Policy, Strategy, Programmes, Elements of Corporate Planning Process, Management by Objectives (MBO).

B. Organization and types of Structures: Basic concepts related to Organization – Departmentation and Decentralization, Types of Organizations- Line organization, Line and staff organization, functional organization, committee organization, matrix organization, Virtual Organization, Cellular Organization, boundary less organization, inverted pyramid structure, lean and flat Organization structure.

MODULE III: Staffing and Controlling [10Periods]

A. Staffing: Basic concepts of HRM, functions of HR Manager: Manpower planning, Recruitment, Selection, Training and Development. Performance Appraisal, Job Evaluation and Merit Rating.

B. Controlling: process of controlling, types of controlling, managing productivity, Quality Control: chart, R chart, C chart, P chart, (simple Problems), Deming's contribution to quality.

MODULE IV: Operations and Materials Management [9 Periods]

A. Operations 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.

B. Materials Management: Objectives, need for Inventory control, EOQ, ABC Analysis, Purchase Procedure, Stores Management and Stores Records.

MODULE V: Project Management and Contemporary Practices [10 Periods]

A. Project Management (PERT/CPM): Network Analysis, Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Identifying critical path, Probability of Completing the project within given time, Project Cost Analysis, Project Crashing. (Simple problems)

B. Contemporary Management Practices: Basic concepts of ERP, Just-In-Time (JIT) System, Total Quality Management (TQM), six sigma and Capability Maturity Model (CMM) Levels, Bench marking, Balanced Score card.

Text Books:

1. Aryasri, Management Science, 4th edition TMH, 2004.
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 6th Ed, 2004.

Reference Books:

1. Kotler Philip & Keller Kevin Lane, "Marketing Management", PHI, 12th edition, 2005

2. Koontz &Weihrich, "Essentials of Management", TMH, 6th edition, 2005.
3. Thomas N.Duening& John M. Ivancevich "Management - Principles and Guidelines", Biztantra, 5thedition 2003.
4. Memoria & S.V. Gauker, "Personnel Management", Himalaya, 25th edition, 2005
5. Samuel C. Certo, "Modern Management", PHI, 9th edition, 2005.

E-Resources:

1. http://freevideolectures.com/Course/2689/Management-Science
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=human-resource-management
3. http://www.onlinevideolecture.com/?course=mba-programs&subject=marketing-fundamental
4. http://freevideolectures.com/Course/2371/Project-and-Production-Management
5. http://nptel.ac.in/courses/110105034/

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand the various concepts, principles and theories of management.	Understand
CO2	Understand the basic concepts of planning and various structures of organizations.	Understand
CO3	Understand the process of staffing and controlling	Understand
CO4	Understand the process of operations management. Also learn the concepts of materials management and marketing management at an organization.	Understand
CO5	Understand the various contemporary management practices. Also the project management techniques.	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1						1	1	2	3	1	3				
CO2						1	1	2	2	1	3	1			
CO3						1	1	2	2	1	3	2			
CO4			2	1		1	1	2	1		3	2			
CO5			2			1	1	2	1	1	3	2			

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: B0415	EMBEDDED SYSTEMS	L	T	P
Credits: 3		3	-	-

Course Objectives:

- To present the characteristics, Quality Attributes and design lifecycle of Embedded Systems,
- To highlight the principles of processor technologies, IC technologies, general- purpose processors and Memory selection,
- To know the Embedded Programming methods.
- To Know about the Operating system basics, principles and its functionalities,
- To know about the task communication and the methods in choosing the Real time operating system.

Module –I

Introduction to Embedded Systems: Definition of Embedded System, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Module-II

Typical Embedded System: Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS). **Memory:** ROM, RAM, Memory according to the type of Interface, Memory Shadowing, Memory selection for Embedded Systems, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Module – III

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Embedded Firmware Design Approaches and Development Languages

Module – IV

RTOS Based Embedded System Design: Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Module – V

Task Communication: Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:

1. Introduction to Embedded Systems - Shibu K.V, Mc Graw Hill

Reference Books:

1. Embedded Systems - Raj Kamal, MC GRAW HILL EDUCATION.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013 4. An Embedded Software Primer - David E. Simon, Pearson Education2017, 3rd edition, reprint, McGraw Hill Education, India.
4. Steve Heath, Embedded Systems Design, 2013, 3rd edition, EDN Series, United States.
5. Jane W. S. Liu, Real time systems, 2013, reprint, Pearson Education, UK

Course Outcomes: After the completion of the course the students will be able to

Co-Po

COs	Description	Blooms Taxonomy Level
CO1	Comprehend the applications, examples, characteristics, design challenges related to Embedded Systems.	Analyze
CO2	Understand general-purpose processing and its principles; select a microprocessor/Microcontroller for a particular application.	Apply
CO3	Understand the process of programming with the Embedded Systems.	Apply
CO4	Design and implement Real time operating system for embedded systems.	Apply
CO5	Develop real-time working prototypes and procedure to choose an Real time Operating System.	Understand

Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	3	2	-	-	-							-	3	-	-
CO2	3	-	-	3	-							2	-	-	3
CO3	3	2	3	3	3							-	-	3	-
CO4	2	-	-	-	3							-	2	2	-
CO5	2	3	3	2	3							3	-	3	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: B0416	VLSI DESIGN	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Analog Circuits, Switching Theory & Logic Design / Digital Logic Design

Course Objectives: The course aims to enable the students

- To visualize IC Fabrication steps and various IC technologies
- To understand electrical properties of MOS, CMOS and Bi CMOS circuits.
- To draw integrated circuit layouts following design rules.
- To understand Basic Circuit Concepts, Gate Level Design, Basic architectures of Data path subsystems, Application Specific Integrated Circuits, of CPLDs and FPGAs.

MODULE I: IC Fabrication and Technologies [8 Periods]

IC Fabrication: Steps in Fabrication-Oxidation, Lithography, Diffusion, Ion implantation, Encapsulation and Metallization.

IC Technologies – Review of Enhancement and Depletion MOS transistors, NMOS, PMOS & CMOS fabrications, Comparison of NMOS, CMOS & BiCMOS technologies.

MODULE II: Basic Electrical Parameters [10 Periods]

I_{ds}-V_{ds} relationships, MOS transistor threshold Voltage (V_t), transconductance (g_m), output conductance(g_{ds}) & figure of merit(w_o),Pass transistor, NMOS Inverter, Determination of pull-up to pull-down ratios, various pull ups, CMOS Inverter analysis and design, Bi-CMOS Inverters, Latch-up in CMOS circuits.

MODULE III: VLSI Circuit Design Processes [10 Periods]

A. VLSI Design Flow, MOS Layers, Stick Diagrams, Lambda based Design Rules and Layout, 2 µm CMOS Design rules for wires, Contacts and Transistors.

B. Layout Diagrams for NMOS and CMOS Inverters and Gates, Scaling of MOS circuits- Scaling models, Scaling function for device parameters, Limitations of Scaling.

MODULE IV: Basic Circuit Concepts and Gate Level Design [10 Periods]

Basic Circuit Concepts: Sheet Resistance R_s and Gate Capacitance C_g, Wiring Capacitances, Fan-in and fan-out, Choice of layers.

Gate Level Design: Logic Gates using CMOS and complex gates, Switch logic, Alternate gate circuits – Pseudo NMOS logic, Dynamic CMOS logic, Clocked CMOS logic(C^2MOS) and Cascaded Voltage Switch logic(CVSL).

MODULE V: Data Path Subsystems, ASIC's and PLD's [10 Periods]

Data Path Subsystems: Subsystem Design – Barrel Shifter, Carry Select and Carry look Ahead Adder, Serial-Parallel and Braun Array Multiplier.

Application Specific Integrated Circuits – Channel gate array, Channel less gate array and structured gate array.

Programmable Logic Devices - Architectures of CPLDs and FPGAs.

Text Books:

1. Kamran Eshraghian, Douglas A. Pucknell, "Essentials of VLSI circuits and systems", PHI, 1st Edition, 2005.
2. K. Lal Kishore, VSV. Prabhakar, "VLSI Design", I. K international Publishing House Private Ltd, 2009.

Reference Books:

1. Neil H. E Weste, David Harris, Ayan Banerjee, "CMOS VLSI Design - A circuits and systems perspective", Pearson Education, 3rd Edition, 2009.

E-Resources:

1. https://www.ece.uic.edu/~dutt/courses/ece565/lect-notes.html

2. http://www.egr.msu.edu/classes/ece410/mason/files/Ch2.pdf
3. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=92
4. https://www.journals.elsevier.com/integration-the-vlsi-journal/
5. http://nptel.ac.in/courses/117106093/
6. http://nptel.ac.in/courses/117101058/

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand the Enhancement and Depletion mode transistors and describe the steps involved in IC fabrication.	Understand
CO2	Know the electrical properties of MOS Transistors and analyze the inverters in MOS transistors	Understand
CO3	Illustrate any circuit using stick diagrams and layouts for NMOS, CMOS and BiCMOS and draw different types of logic gates using CMOS inverter and their transfer characteristics	Apply
CO4	Describe Basic Circuit Concepts like resistance, capacitance and the effect of it, various Gate Level Designs.	Analyze
CO5	Design building blocks of data path using gates and Design simple memories using MOS transistors and the architectures of Application Specific Integrated Circuits, of CPLDs and FPGAs.	Analyze

CO-PO-PSO's mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	3	2	2	1	3							2	2	2	3
CO2	3	2	1	1	2							1	2	2	3
CO3	3	2	2	1	2							2	3	3	3
CO4	3	2	2	1	2							2	3	3	3
CO5	3	1	1	1	3							2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech V Semester		
Code: B0417	ELECTRONIC MEASUREMENTS AND INSTRUMENTION *(Professional Elective-I)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Basic Electrical and Electronics Engineering

Course Objectives:

- This course introduces measurement techniques
- Different types of instruments and their operation like signal generators, wave analyzers, cathode ray oscilloscope
- Special purpose oscilloscopes, different types of transducers, DC & AC bridges.

MODULE I: Measurement Errors and Measuring Instruments [10 Periods]

Measurements and Errors: Block Schematics of Measuring Systems, Performance Characteristics, Static Characteristics, Accuracy, Precision, Resolution, Types of Errors, Root Sum Squares formula, Dynamic Characteristics, Repeatability, Reproducibility, Fidelity, Lag.

Measuring Instruments: D' Arsonval Movement, DC Voltmeters, DC Current Meters, AC Voltmeters and Current Meters, Ohmmeters, Multimeters, Meter Protection, Extension of Range, True RMS Responding Voltmeters, Electronic Voltmeters, Digital Voltmeters: Ramp type, Staircase Ramp, Dual Slope Integrating type, Integrating type, Successive Approximation type.

MODULE II: Signal Generators and Analyzers [10 Periods]

Signal Generators: AF, RF Signal Generators, Sweep Frequency Generators, Pulse and Square wave Generators, Function Generators, Arbitrary Waveform Generator, Video Signal Generators, and Specifications.

Signal Analyzers: AF, HF Wave Analyzers, Harmonic Distortion, Heterodyne wave Analyzers, Spectrum Analyzers, Power Analyzers, Logic Analyzer.

MODULE III: Oscilloscopes [10 Periods]

A. CRT, Block Schematic of CRO, Time Base Circuits, Lissajous Figures, CRO Probes, High Frequency CRO Considerations, Delay lines, Applications: Measurement of Time, Period and Frequency Specifications.

B. Special Purpose Oscilloscopes: Dual Trace, Dual Beam CROs, Sampling Oscilloscopes, Storage Oscilloscopes, Digital Storage CROs. Recorders:Strip Chart, X-Y Oscillographic recorders

MODULE IV: Transducers [10 Periods]

Definition, Classification, Principle of Analogue transducer: Resistive (Strain Gauge, POT, Thermistor and RTD), Capacitive, Piezoelectric, Thermocouple and Inductive (LVDT) and RVDT) transducer, Working principle of Digital Transducer and Optical transducer.Photo sensitive Transducer.Applications of transducers - Velocity, Force, Pressure Measurement.Data Acquisition Systems.

MODULE V: DC and AC Bridges [8 Periods]

Wheat stone Bridge, Kelvin Bridge, AC Bridges, Maxwell, Hay, Schering, Wien, Anderson Bridges, Resonance Bridge, The Owen Bridge, De'Sauty Bridge, Wagner's Earth (Ground) Connection, and Types of Detectors.

Text Books:

1. H. S. Kalsi, "Electronic Instrumentation", TMH, 2nd Edition 2004.
2. A.K. Sawhney, "Electrical and Electronic Measurements and Instrumentation".

Reference Books:

1. K. Lal Kishore, "Electronic Measurements and Instrumentation", Pearson Education, 2010.
2. David A. Bell, "Electronic Instrumentation and Measurements", Oxford Univ. Press, 1997.

E-Resources:

1. https://docs.google.com/file/d/0B21HoBq6u9TsMlFHYVpUbjJYdzQ/view
2. https://www.slideshare.net/saurabhmaheshwari944/seminar-ppt-on-transducer
3. https://rodzah.files.wordpress.com/2011/07/topic_4_dc_bridges.pdf

4. https://www.mepits.com/tutorial/303/Instrumentation/Sensors
5. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5289
6. http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=19

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Outline the characteristics, errors in measurement systems and different types of basic measuring instruments.	Understand
CO2	Infer the types, specifications and applications of signal analyzers and generators	Understand
CO3	Interpret the internal blocks of CRO and operation ,applications of different CRO's.	Understand
CO4	Classify the different types of transducers and their applications	Understand
CO5	Identify the values of R,L,C components in bridge circuits.	Applying

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3		2	2							1	3		2
CO2	3	2	3	3	2							1	3		2
CO3	3	2	1	1								1	3	2	
CO4	3	1	2	1									3	2	
CO5	3	2	1									1	3	2	

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: B0418	COMPUTER ORGANIZATION AND OPERATING SYSTEMS *(Professional Elective-I)*	L	T	P
Credits: 3		3	-	-

Course Objectives: This course will make students

- To understand the basic structure and operation of digital computer,
- To study the micro programmed control, I/O organizations and serial communication of peripheral devices
- To study the overview of operating systems & memory management components,
- To demonstrate the knowledge of functions of management scheduling, file system and interfaces, security and deadlocks.

MODULE I **[10 Periods]**

Basic Structure of Computers: Computer Types, Functional UNIT, Basic Operational Concepts, Bus Structures, Software, Performance, Multiprocessors and Multi Computers, Register Transfer Language and Micro Operations: Register Transfer Language, Register Transfer Bus and Memory Transfers, Arithmetic Micro Operations, Logic Micro Operations, Shift Micro Operations, Arithmetic Logic Shift Unit, Memory – Reference Instructions, Input – Output and Interrupt, STACK Organization, DATA Transfer and Manipulation, Program Control, Reduced Instruction Set Computer.

MODULE II **[09 Periods]**

Micro Programmed Control: Control Memory, Address Sequencing, Micro program Examples, Design of Control Unit, Hard Wired Control, The Memory System: Basic Concepts of Semiconductor RAM Memories, Read-Only Memories, Cache Memories Performance Considerations, Virtual Memories, Secondary Storage, Introduction to RAID - RAID 0 to RAID 6.

MODULE III **[10 Periods]**

A. **Input-Output Organization:** Peripheral Devices, Input-Output Interface, Asynchronous Data Transfer Modes, Priority Interrupt, Direct Memory Access, Input –Output Processor (IOP)
B. **Serial Communication:** Introduction to Peripheral Components, Interconnect (PCI) Bus, Introduction to Standard Serial Communication Protocols - RS232, USB, IEEE1394.

MODULE IV **[10 Periods]**

Operating Systems Overview: Overview of Computer Operating System Functions, Protection and Security, Distributed Systems, Special Purpose Systems, Operating System Structures, Operating System Services and Systems Calls, System Programs, Operating System Generation, Memory Management: Swapping, Contiguous Memory Allocation, Paging, Structure of The Page Table, Segmentation, Virtual Memory - Demand Paging, Page-Replacement Algorithms, Allocation of Frames, Thrashing, Principles of Deadlock - System Model, Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Deadlock Recovery.

MODULE V **[9 Periods]**

File System Interface: The Concept of a File, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.

Text Books:

1. Carl Hamacher, ZvonksVranesic, SafeaZaky, "Computer Organization", McGraw Hill, 5th Edition
2. M.Moris Mano, "Computer Systems Architecture", Pearson Education,3rd Edition
3. Abraham Silberchatz,Peter B. Galvin, Greg Gagne, "Operating System Principles" 8th Edition, John Wiley.

Reference Books:

1. William Stallings, "Computer Organization and Architecture", Pearson Education,6th Edition
2. Andrew S. Tanenbaum, "Structured Computer Organization",PHI,4th Edition
3. SivaraamaDandamudi, "Fundamentals of Computer Organization and Design", Springer Int. Edition.
4. Stallings, "Operating Systems – Internals and Design Principles", Pearson Education,6th Edition 2009
5. Andrew S Tanenbaum, "Modern Operating Systems", Pearson/PHI, 2nd edition
6. B.L.Stuart, "Principles of Operating Systems", Cengage Learning, India Edition

E-Resources:

1. https://www.scribd.com/doc/129430301/Hamacher-Computer-Organization-5th-Ed
2. https://archive.org/details/2005OperatingSystemConcepts7thEditionAbrahamSilberschatz
3. http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY7-Eh9eBOsT1ELoYpKlg_xngrkluevXOJL-s1TbxS8q2icgUs3hL4_KAi5So5FgXcVg
4. http://ndl.iitkgp.ac.in/document/yVCWqd6u7wgye1qwH9xY7xAYUzYSlXl4znudlsolr-e7wQNrNXLxbgGFxbkoyx1iN3YbHuFrzI2jc_70rWMEwQ
5. http://nptel.ac.in/courses/106106092/
6. http://nptel.ac.in/courses/106108101/

Course Outcomes:

After the completion of the course the students will be able to

Cos	Description	Blooms Taxonomy Level
CO1	Develop the structure of digital computer Arithmetic operations of binary number system	Analyze
CO2	Classify the micro programmed control and memory operations	Apply
CO3	Design input & output organization serial communication	Analyze
CO4	Understand the operating systems overview and memory management techniques impact of instruction set architecture of computer design	Understand
CO5	Examine various file systems interfaces and implementation	Analyze

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO 5**	**PO6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO1 1**	**PO12**	**PS0 1**	**PS02**	**PS0 3**
CO1	2	2	1	1									3	1	1
CO2	2	2	1	1								1	3	3	1
CO3	2	1	2	1								2	3	1	2
CO4	1	1	2	1	1							2	3	1	1
CO5	1	2	2	1	1							2	3	3	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. V Semester		
Code: B0419	DATA COMMUNICATIONS AND COMPUTER NETWORKS	L	T	P
Credits: 3	*(Professional Elective-I)*	3	-	-

Pre-Requisites: Nil

Course Objectives: This course provides students

- To understand the fundamental concepts of computer networking and communications make use of IEEE standards in the construction of LAN,
- Build the skills of subnetting and supernetting,
- To explain the concepts of protocols of Transport Layer, QoS and Congestion control mechanisms and demonstrate different protocols of Application Layer.

MODULE I: Basics of Networking and Physical layer [10 Periods]

Basics of Networking - Components – Direction of Data flow – Networks – Components and Categories – Types of Connections – Topologies –Protocols and Standards – ISO / OSI model, TCP/IP model.

Physical layer - Transmission Media, Switching, Circuit Switched Networks, Datagram Networks, Virtual Circuit Networks**.**

MODULE II: Data link layer [11 Periods]

Functionalities of Data link layer - Introduction, Framing, Error Detection and Correction – Parity – LRC – CRC- Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC,Point to Point Protocols. Random access, Controlled access, Channelization, Collision Free Protocols.

LAN - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11

MODULE III: Network Layer [09 Periods]

A. **Basics of Network Layer -** Logical Addressing, Internetworking, Tunneling, Address mapping,
B. **Communication Protocols -** ICMP, IGMP, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols.

MODULE IV: Transport Layer [09 Periods]

Connection Oriented and Connectionless Protocols - Process to Process Delivery, UDP and TCP protocols, SCTP.

Congestion Control - Data Traffic, Congestion, Congestion Control, QoS, Integrated Services, Differentiated Services, QoS in Switched Networks**.**

MODULE V: Application layer [09 Periods]

DNS - Domain name space, DNS in internet, Electronic mail

Protocols and Network Security - FTP, WWW, HTTP, SNMP, Network Security, Cryptography.

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition, TMH, 2006.
2. Andrew S Tanenbaum, "Computer Networks", 4th Edition, Pearson Education/PHI.

Reference Books:

1. P.C.Gupta, "Data communications and computer Networks", PHI.
2. S.Keshav, "An Engineering Approach to Computer Networks", 2nd Edition, Pearson Education.
3. W.A. Shay, "Understanding communications and Networks", 3rd Edition, Cengage Learning.
4. James F.Kurose& Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", 3rd Edition, Pearson Education.

‘

E-Resources

1. https://www.saylor.org/site/wp-content/uploads/2012/02/Computer-Networking- Principles-Bonaventure-1-30-31-OTC1.pdf
2. http://ebook-dl.com/downloadbook/230
3. https://doi.org/10.1016/0169-7552(89)90019-6
4. http://nptel.ac.in/courses/106105081/

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Interpret the basic computer network terminology, functionalities of layers in ISO-OSI and TCP/IP reference model and different switching techniques in communication networks	Understand
CO2	Select various datalink layer design issues and compare MAC layer protocols	Apply
CO3	Compare and select suitable routing algorithm for a given computer network	Analyze
CO4	Analyze transport layer protocols for a given application and provide QoS	Analyze
CO5	Outline the application layer protocols and network security issues & techniques	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS0 1	PS0 2	PS0 3
CO1	3	2	2	1		2	3	3				1	3	2	1
CO2	3	3	3	2	1	2	3	3				2	3	3	2
CO3	3	3	3	2	1	2	3	3				2	3	3	2
CO4	3	2	2	1		2	3	3				2	3	3	2
CO5	3	1	1			2	3	3				2	3	3	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. V Semester		
Code: B0420	Advanced Programmable Logic Device Architectures	L	T	P
Credits: 3	*(Professional Elective-I)*	3	-	-

Pre-Requisites: Digital Electronics

Course Objectives:

- Students learn about the architecture and different technologies of programmable logic devices (FPGAs).
- Students develop and understanding of the available prefabricated IP blocks on modern FPGAs and learn how to use them in their designs.
- Students learn how to write hardware descriptions for combinational blocks and sequential units including state machines in Verilog.

UNIT I Programmable Logic Device [9 Periods]

Introduction, ROM, PLD, PLA, PAL, GAL– Features, CPLD- Commercially available CPLD - Altera series – Max 5000/7000 series - Cypres FLASH 370 Device Technology, Lattice LSI's Architectures – 3000 Series –Applications of CPLDs, Speed Performance and in system programmability.

UNIT II Field Programmable Gate Arrays [9 Periods]

FPGAs- Logic blocks, Routing architecture, programmable interconnect, Mapping for FPGAs, Xilinx FPGA Architecture: Xilinx XC3000, XC4000 – Altera Architecture: FLEX 8000, One hot encoding, Case studies: Xilinx Virtex II Pro.

UNIT III Finite State Machines [9 Periods]

Top down Approach to Design, State diagram, State Transition Table, State assignments for FPGAs, Case study Mealy & Moore Machines, Pipelining, FSM issues-Starring state, Power on Reset, State diagram optimization, fault Tolerance.

UNIT IV VHDL for Synthesis [9 Periods]

Introduction, data flow, behavioral, structural models, operators, process, concurrent statements, Sequential Statements, Loops, Modeling Delays, Sequential Circuits, FSM Coding, Library, Packages, Functions, Procedures, Test bench.

UNIT V Digital Front End Design Tools [9 Periods]

Digital Front End Design Tools for FPGAs & ASICs: Using Mentor Graphics EDA Tool ("FPGA Advantage") – Design Flow Using FPGAs – Guidelines and Case Studies of paraller adder, multiplexers, counters, CMOS design using Mentor graphics Tools.

Text Books:

1. P.K.Chan& S. Mourad, Digital Design Using Field Programmable Gate Array, Prentice Hall (Pte), 1994.
2. M. J. S. Smith, "Application Specific Integrated Circuits," Addition – Wesley Longman Inc., 1997.
3. VHDL Primer, J. Bhasker, American Telephone and Telegraph Company, Bell Laboratories Division, P T R Prentice Hall, Englewood Cliffs, New Jersey07632
4. Douglas L. Perry, VHDL: Programming by Example, McGraw-Hill Education, Fouth Edition.
5. S.Trimberger, Edr., Field Programmable Gate Array Technology, Kluwer, Academic Publications, 1994.

Reference Books

1. Jon F Wakerly, Digital Design: Principles and Practices, Prentice Hall.
2. Kevin Skahil, VHDL for programmable logic, Addison Wesley.

3. J. Old Field, R.Dorf, Field Programmable Gate Arrays, John Wiley & Sons, Newyork, 1995.
4. S.Brown, R.Francis, J.Rose, Z.Vransic, Field Programmable Gate Array, Kluwer Pubin, 1992.

COURSE OUTCOMES:

CO Nos.	Description	Bloom Taxonomy Level
CO1	Illustrate the features of Programmable Logic Devices, CPLD, performance and its applications.	Understanding
CO2	Summarize the various FPGA architectures, programmable interconnects and one hot encoding.	Understanding
CO3	Explain the VLSI system design experience using FSM.	Applying
CO4	Account for the syntax and behavior of the VHDL language	Understanding
CO5	Explain the Digital Front End Digital Design Tools for FPGAs & ASICs	Understanding

CO-PO MAPPING :

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

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. V Semester		
Code: B0421	Control Systems	L	T	P
Credits: 3	*(Professional Elective-I)*	3	-	-

Pre-Requisites: Nil.

Course Objectives: This course introduces different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response. It also emphasis on analysis of system performance in time and frequency domain and techniques for improving the performance.

MODULE I: Introduction [10 Periods]

Concepts of Control Systems - Open Loop and closed loop control systems and their differences -Different examples of control systems - Classification of control systems, Feedback Characteristics, Effects of feedback, Mathematical models – Differential equations, Impulse Response and transfer functions.

Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples - Block diagram algebra – Representation by Signal flow graph - Reduction using Mason's gain formula.Synchros, AC & DC servo motors and stepper motor.

MODULE II: Time Response Analysis [9 Periods]

Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.

MODULE III: Stability Analysis in S-Domain [9 Periods]

A. The concept of stability – Routh's stability criterion – Qualitative stability and conditional stability – Limitations of Routh's stability.

B. Root Locus Technique: The root locus concept - Construction of root loci - Effects of addingpoles and zeros to G(s) H(s) on the root loci.

MODULE IV: Frequency Response Analysis [10 Periods]

Introduction, Frequency domain specifications - Bode diagrams - Determination of frequency domain specifications and Phase margin and Gain margin - Stability analysis from Bode Plots - Polar Plots - Nyquist Plots

Compensation Techniques: Lag, Lead and Lead -Lag Controllers design in frequency Domain.

MODULE V: State Space Analysis of Continuous Systems [10 Periods]

Concepts of state, state variables and state model, derivation of state models from block diagrams, diagonalization - Solving the Time invariant state equations - State Transition Matrix and it's Properties – Concepts of Controllability and observability.

Text Books:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", New Age International Publishers, 5 th Edition, 2007.
2. Benjamin.C. Kuo, "Automatic Control Systems", Prentice Hall of India, 7 th Edition, 1995.

Reference Books:

1. A.Nagoorkani, "Control Systems", RBA Publications, 2nd Edition, 2006.
2. M.Gopal, "Control System: Principles and Design", Tata McGraw Hill, 2 nd Edition, 2002.
3. Joseph J Distefano, "Schaum's Outline Series of Feedback and Control Systems", Tata McGraw Hill, 2 nd Edition, 2014.
4. K. Ogata, "Modern Control Engineering", Pearson Education, New Delhi, 5 th Edition, 2010.
5. M. Gopal, "Control Systems, Principles & Design", Tata McGraw Hill, 4 th Edition, 2012.

E-Resources:

1.https://www.electrical4u.com/control-engineering-historical-review-and-types-ofcontrol-engineering/
2. http://ieeecss.org/CSM/library/2011.html 3. http://nptel.ac.in/courses/108101037/

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)			B.Tech. VI Semester
Code: B0422	EMBEDDED SYSTEMS LAB	L	T	P
Credits: 1.5				3

Course Objectives: To introduce programming skills Embedded Systems and Real Time Operating Systems

List of Experiments

1. MCU-DAC interfacing and generation of ramp wave
2. Interfacing of ADC and data transfer by software polling, study of aliasing
3. ADC triggering through timer(On Chip Timer)
4. Interrupt driven data transfer from ADC
5. LCD - MCU interfacing and displaying a string
6. Keyboard-MCU interfacing take a input from keypad and display on LCD
7. Interface a LED matrix and display a number on the matrix.
8. Serial Communication between micro controller and PC.
9. Interfacing 4x4 switch matrix with the microcontroller
10. Temperature control using microcontroller
11. RTOS Based Parameter Monitoring and Controlling System.
    a. Collecting the data from sensor interfaced with microcontroller.
    b. Interfacing display devices/actuators with microcontroller.
    c. Inter task/process communication between task/process.
12. RTOS Based Data transfer between microcontrollers using Communication Protocol.
    a. Creating tasks for interfacing sensors with microcontroller.
    b. Creating tasks for interfacing display unit/actuators with microcontroller. (can be implemented by I2C protocol
    c. CAN Bus communication between controllers

COs	Outcomes	Blooms Taxonomy Level
CO1	Understand and the fundamentals of Embedded C	Understand
CO2	Apply the programming knowledge for interfacing	Apply
CO3	Develop the programs for Serial Communication	Apply
CO4	Develop the programs for Real Time Operating systems	Apply

CO-PO,PSO mapping

2: Moderate (Medium) **3**: Substantial (High) -: None

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	1	1									1	3		
CO2	3	2	1	1	2							1	3	2	2
CO3	3	2	2	2	2							2	3	2	2
CO4	3	1	1										3		

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2020-21 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: B0423	VLSI DESIGN LAB	L	T	P
Credits: 1.5		-	-	3

Course Objectives : To get programming knowledge on Verilog /VHDL programming of different digital circuits and CMOS circuits, Design of Digital Circuits using CADANCE, SYNOPSIS, mentor graphics or any equivalent software.

List of Experiments:

1. Design of Sequence Detector using Melay Machines on FPGA Board Using Verilog HDL.
2. Design and Implementation of SIPO shift registers on FPGA Board Using Verilog HDL.
3. Design of Sequence Detector using Moore Machines on FPGA Board Using Verilog HDL.
4. Design of Barrel shifter.
5. Design of Carry select adder using Verilog HDL.
6. Design of Serial Multiplier
7. Design of Booth Multiplier
8. Schematic and Layout of CMOS Inverter.
9. Schematic and Layout of CMOS NOR Gates.
10. Schematic and Layout of CMOS NAND Gates.
11. Schematic of CMOS 1-bit Full Adder.

Software required

1. Verilog/VHDL or any equivalent software
2. Mentor Graphics, CADENCE, SYNOPSIS or any equivalent software.

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Write Verilog programs for Combinational and sequential logics.	Apply
CO2	Perform simulation, synthesis and implementation of various digital logics Circuits	Analyze
CO3	Write Verilog Codes and implement various logic circuits on FPGA boards	Apply
CO4	Design Schematic for logic circuits and perform physical verification	Apply
CO5	Design layouts for logic circuits and perform physical verification.	Apply

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	1			3			2	3	2		1	3	2	1
CO2	3	1			3			2	3	2		1	3	2	1
CO3	3	1			3			2	3	2		1	3	3	1
CO4	3	1			3			2	3	2		1	3	3	1
CO5	3	1			3			2	3	2		1	3	3	1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: B0563	Fundamentals of Database Management Systems Lab (Common for CE, EEE, ME, ECE, MiE)	L	T	P
Credits: 2		-	1	2

Prerequisites: Database Management Systems

Course Objectives: This course enables the students to practice the concepts learnt in the subject DBMS by developing a database for an example project. The student is expected to practice the querying a relational database i.e., "Mysql" with various functionalities of SQL and PL/SQL statements using a sample database.

Sample Database: Railway Reservation System -(Redesigning IRCTC database)

Train (train Number, name, source, destination, start_time, reach_time, traveltime, distance, class, days, type)

Ticket (PNRNo, Transactionid, from_station, To_station, date_of_journey, class date_of_booking, total_ticket_fare, train number)

Passenger (PNR No, Serial no, Name, Age, Reservation_status)

Train_Route(Train_No, route_no, station_code, name, arrival_time, depart_time, distance, day)

Train_Ticket_fare(Train_No, class, base_fare, reservation_charge, superfast_charge, other_charge, tatkal_charge, service_tax)

List of experiments:

1	SQL Data Definition Language Commands: Create all the tables specified above. Make underlined columns as primary key. (use number, number(m,n), varchar(n), date, time, timestamp data types appropriately) Insert at least 5 rows to each table. (Check www.irctc.co.in website for actual data)
2	SQL Data Manipulation Language Commands: 1. Change the name of the Passenger table to Passenger_Details. 2. List all train details. 3. List all passenger details. 4. Give a list of trains in ascending order of number. 5. List the senior citizen passengers details. 6. List the station names where code starts with 'M'. 7. List the trains details within a range of numbers. 8. Change the super fast charge value in train fare as zero, if it is null. 9. List the passenger names whose tickets are not confirmed. 10. Remove all the rows from Passenger table permanently.
3	Create (Alter table to add constraint) the necessary foreign keys by identifying the relationships in the table. 1) Add a suitable constraint to train table to always have train no in the range 10001 to 99999. 2) Add a suitable constraint for the column of station name, so that does not take duplicates. 3) Change the data type of arrival time, depart time (date -> timestamp or timestamp to date), and do the necessary process for updating the table with new values. 4) Add a suitable constraint for the class column that it should take values only as 1A, 2A, 3A, SL, C. 5) Add a not null constraint for the column distance in train_route.
4	Designing Employee Database with MySQL (Create and insert data in EMP table, DEPT table and SALGRADE table)
5	Multi row functions, GROUP By clause, HAVING clause, ORDER BY clause in SQL on sample database.
6	Use Join Query 1. Find the train names that stop in 'Katpadi'. 2. Find the train names that are superfast and the service tax is zero.

	3. Find the Passenger name (and train name) who have booked for the train that starts from 'Chennai'. 4. Display the trains names, each type of class and the total fare for each type of class. 5. Display all the train details and the ticket details (if booked any).
7	Use Nested Query(in Operators) 1. Find the train names that stop in 'Warangal'. 2. Find the train names that are superfast and the service tax is zero. 3. Find the Passenger name who has booked for the train that starts from 'Secunderabad'. 4. Find the trains names that have all the AC coaches and the base fare is less than 3000 for each case.
8	Create sample Views and practice basic operation
9	Write a PL/SQL procedures to practice Conditional Statements
10	Write a PL/SQL procedures to practice Iterative Statements
11	Implementing simple trigger
12	Implementing simple cursor

Equipment required for laboratory

i. Computers
ii. Mysql software

Course Outcomes: After successful completion of this course, student will be able to

COs	Description	Blooms Taxonomy Level
CO 1	Understand the components of DBMS & design database using ER model	Understand
CO 2	Construct database using SQL and extract data from database using Relational algebra & SQL queries	Create
CO 3	Apply the normalization process for effective database design	Apply
CO 4	Analyze components of transaction processing, recovery strategies of DBMS	Analyze
CO 5	Examine different Concurrency control Mechanisms of DBMS	Evaluate

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	3	2	-	-	-	-	-	3	3		3	2
CO2	3	3	-	2	3	-	-	-	-	-	3	3	2	3	2
CO3	3	2		2	3	-	-	-	-	-	3	3	2	3	2
CO4	2	1	2	2	3	-	-	-	-	-	3	3	1	3	2
CO5	2	1	2	2	3	-	-	-	-	-	3	3	1	3	2

2020-21 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. V Semester		
Code: B00M3	Quantitative Aptitude and Verbal Reasoning-I	L	T	P
Credits: 0		1	1	-

Course objectives:
The Quantitative Aptitude course is designed to equip students with essential mathematical and analytical skills required for various competitive exams, academic pursuits, and real-world problem-solving scenarios. The primary objective of this course is to enhance participants' numerical ability and logical reasoning, enabling them to tackle quantitative questions with confidence and efficiency.

MODULE – I **[8 Periods]**

Quants: Percentages, Profit and Loss. Percentages- Percentage Increase/Decrease; Results on Population; Results on Depreciation. Profit & Loss- Cost Price; Selling Price: Profit or Gain; Gain Percentage; Loss Percentage.
Verbal: **Sentence Completion:** Sentence Completion- Formats of Question; Strategies to solve sentence completion questionsProactive and reactive solving, Identifying clues- Signposts, Types of signposts, Root words, Sentence structure clues.
Logical: Blood Relation Blood Relations- Classification of blood relations, Pointing a person, Equation related problems.

MODULE - II **[6 Periods]**

Quants: Interests Interests- Types of interest; Simple interest; principle; Rate of interest; compound interest; interest is compounded Annually; interest is compounded Half-yearly; interest is compounded Quarterly; Rates are different for different years, say R1%, R2%, R3% for 1st, 2nd and 3rd year respectively; Present worth of Rs. x due n years. **Verbal: Articles, Interrogatives Articles**- Types of articles, Countable nouns, Uncountable nouns, Usage of articles, Omission of articles. Interrogatives- Definition, Types of Interrogatives, Question Tags.
Logical: Clocks : Clocks: Introduction, Derivation of angles, Angles between hands of the clock, Hands together, Hands at angular distance, Gain & Loss problems.

MODULE – III **[6 Periods]**

Quants: Ratio and Proportion, Averages : Ratios & Proportion- The ratio of two quantities a and b in the same units; Proportion; The equality of two ratios is called proportion; Fourth Proportional; Mean Proportional; Comparison of Ratios; Duplicate Ratios; Variations. Averages- Average Speed, Weighted average.
Verbal: Idioms and Miscellaneous Vocabulary Idioms- Idioms and phrasal verbs, Word Analogy, Patterns of questions on Word Analogy; Miscellaneous Vocabulary**.**
Logical: Coding and Decoding Coding and Decoding- Number Series, Alphabet Series, Analogy, Odd Man Out, Visual Reasoning.

MODULE - IV **[6 Periods]**

Quants: Time and Work; Time & Work- Work from Days: Calculate the one-day work; Days from Work: Shortcut to calculate the work in given time.
Verbal: Voices and Speech Voices- Introduction- Sentence, Parts of a sentence, Voice of a sentence, Types of voices, Identifying the voice of a sentence, Changing the voice of a sentence. Speech- Direct & Indirect, Identifying the speech, Change of Speech.
Logical: Directions Directions - Introduction, Direction based questions, Shadow based problems.

MODULE - V **[6 Periods]**

Quants: Mixtures and Alligations
Alligation- Mean Price; Rule of Alligation; a container contains x of liquid from which y units are taken out and replaced by water;
Verbal: Reading Comprehension Reading Comprehension- Speed reading strategies; Reading Comprehension - types of questions, tackling strategies.
Logical: Cubes Cubes- Cube & cuboid concepts, 3-2-1-0 faced problems.

Text Books:

1. "Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal
2. "How to Prepare for Quantitative Aptitude for the CAT" by Arun Sharma
3. "Fast Track Objective Arithmetic" by Rajesh Verma

Reference Books:

1. "Magical Book on Quicker Maths" by M. Tyra
2. "Quantitative Aptitude Quantum CAT" by Sarvesh K. Verma

e-Resources:

Concerned Website links:

1. Khan Academy (https://www.khanacademy.org/):
2. MathIsFun (https://www.mathsisfun.com/) 3. GMAT Club (https://gmatclub.com/)
4. IndiaBIX (https://www.indiabix.com/)
5. Studytonight (https://www.studytonight.com/)

Course Outcomes:

After completion of the course students will be able to:

1. Develop Strong Mathematical Foundations: Gain a comprehensive understanding of fundamental mathematical concepts, including arithmetic, algebra, geometry, and data interpretation, providing a solid basis for tackling quantitative problems.
2. Enhance Problem-Solving Skills: Learn diverse problem-solving techniques and strategies to approach quantitative questions in a systematic manner, enabling efficient and accurate solutions.
3. Improve Speed and Accuracy on Averages: Practice through a variety of exercises and timed quizzes to enhance computational speed and precision, vital for competitive exams and time-sensitive tasks.
4. Master Time and work: Acquire skills in interpreting data from time and work scenarios decisions based on the given information.
5. Build Allegation and mixtures: Strengthen logical reasoning abilities to analyze and deduce patterns, aiding in solving complex quantitative problems.

CO-PO MAPPING

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	**Programme Outcomes (POs)**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2							2					
CO2	1	2	2							2					
CO3	1	2	2							2					
CO4	1	2	2							2					
CO5	1	2	2							2					

2020-21 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: B0424	DIGITAL SIGNAL PROCESSING	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Signals & Systems.

Course Objectives: This course introduces the processing of Discrete time signals using various transforming techniques and structures of IIR and FIR filters and also the concept of Multi-rate Digital signal Processing.

MODULE I: Discrete Time Signals, Systems and DTFT [12 Periods]

Discrete Time Signals, Systems: Discrete time signals & discrete time systems, time response & frequency response analysis of Discrete Time Linear time invariant Systems, Discrete time systems described by difference equations. Convolution of Discrete Time sequences.

Discrete Time Fourier Transform: Introduction to DTFT and Properties of DTFT

MODULE II: Transforms [8 Periods]

Discrete Fourier Transform (DFT): Definition and Properties of Discrete Fourier Transform, Inverse DFT, Linear Convolution of sequences using DFT/IDFT and Circular Convolution, Problems on DFT.

Fast Fourier Transforms (FFT): Definition, Radix-2 Decimation in Time (DIT) and Decimation in Frequency (DIF) FFT Algorithms and Inverse FFT, Problems on FFT.

MODULE III: IIR Digital Filters [10 Periods]

A. Analog Filter Approximation: Analog filter design, Butterworth and Chebyshev Approximation techniques

B. IIR Digital filter Techniques: Impulse Invariant and Bilinear Transformation Methods, Design of IIR Digital filters from Analog filters and Spectral Transformations, Realization of IIR filters.

MODULE IV: FIR Digital Filters [10 Periods]

Characteristics of FIR Digital Filters, Frequency Response, Design of Linear phase FIR Digital Filters using Fourier series and Window Techniques- Rectangular, Triangular, Blackman, Hamming and Hanning Windows, Comparison of IIR & FIR filters.

MODULE V: Multirate DSP and DSP Processors [8 Periods]

Multirate Digital Signal Processing: Definition and Applications of Multirate DSP, Decimation, Interpolation, Sampling rate conversion by a rational Factor I/D, Multi Stage Implementation of Sampling rate Conversion

DSP Processors: Introduction, Special Features of Digital Signal Processors, Architecture and features of TMS320C54XX processor.

Text Books:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications", Pearson Education / PHI, 4th Edition, 2007.
2. A.Nagoorkani, "Digital signal processing", Tata McGraw Hill, 2nd Edition, 2012.
3. Avtar Singh and S. Srinivasan, Digital Signal Processing Implementations Using DSP Microprocessors – with Examples from TMS320C54xx, CENGAGE Learning, India, 1st Edition, 2008.

Reference Books:

1. Shalivahana, VallavaRaju,GnanaPriya, "Digital Signal Processing", TATA McGraw Hill, 2nd Edition, 2010.

2. Alan V. Oppenheim, Ronald W. Schafer, “Digital Signal Processing”, PHI Education, 2006.

E-Resources:

1. https://archive.org/details/DIGITALSIGNALPROCESSING.
2. http://freevideolectures.com/Course/2339/Digital-Signal-Processing-IITKharagpur
3. https://www.journals.elsevier.com/digital-signal-processing/
4. https://www.journals.elsevier.com/signal-processing/
5. https://www.youtube.com/watch?v=6dFnpz_AEyA
6. http://nptel.ac.in/courses/117102060/

Course Outcomes:

After the completion of the course the students will be able to

COs	Outcomes	Blooms Taxanomy Level
CO1	Analyze the linear discrete time systems in time domain and frequency domain using difference equations.	Analyze
CO2	Exploit the properties of discrete Fourier transforms and implement DFT using fast Fourier transform	Apply
CO3	Design and realize Infinite Impulse Response Filters	Apply
CO4	Design and realize Finite Impulse Response Filters	Apply
CO5	Discuss the Architecture of TMS320CXX Processor and multirate signal processing operations	Understand

CO-PO-PSO’s Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	1	1	1	1								3	3	1
CO2	2	2	2	2	2							2	3	3	1
CO3	3	2	2	2	3							2	3	3	2
CO4	3	2	2	2	3							2	3	3	2
CO5	3	2	2	2	3							2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2020-21 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: B0425	Fundamentals of Mixed Signal Design	L	T	P
Credits: 3		3	-	-

PREREQUISITES: Electronic Devices & Circuits, VLSI Design

OBJECTIVE: To understand the design of circuits in both digital and analog designs, to understand the design of specific circuits like A/D, D/A and over sampling converters starts with Switched Capacitor circuits, to understanding the circuits by considering so many parameters may arises problems which need to be solved to get optimization

Module-I: INTRODUCTION TO ANALOGCIRCUIT DESIGN [8 Periods]

Common Source Amplifier with resistive load(Only Voltage Gain and Output impedance of circuits), NMOS current mirror, Single ended differential amplifier operation, basic differential pair, common mode response

Module–II: SWITCHEDCAPACITORCIRCUITS [8 Periods]

Basic Building Blocks- Op-Amps, Capacitors, Switches, Non-overlapping Clocks, Resistor Equivalence of a Switched Capacitor, Parasitic-Sensitive Integrator, Parasitic-Insensitive Integrators, Noise in Switched-Capacitor Circuits, First-Order Filters- First-order switched-capacitor filter, Switch Sharing

Module-III: DATACONVERTERFUNDAMENTALS [9Periods]

Ideal D/A Converter, Ideal A/D Converter, Quantization Noise, Signed Codes, Performance Limitations- Resolution, Offset and Gain Error, Accuracy and Linearity, Nyquist-rate D/A converters- Resistor String Converters, Folded Resistor-String Converters, Binary-Weighted Resistor Converters

Module-IV: NYQUISTRATE A/DCONVERTERS [8Periods]

Successive-Approximation Converters- DAC-Based Successive Approximation, Charge-Redistribution A/D, Resistor-Capacitor Hybrid, Speed Estimate for Charge-Redistribution Converters, Error Correction in Successive-Approximation Converters, Flash Converters, Issues in Designing Flash A/D Converters, Two-Step A/D Converters

Module-V: OVERSAMPLINGCONVERTERS [7Periods]

Oversampling without Noise Shaping, Oversampling with Noise Shaping, System Architecture of Delta-Sigma A/D Converters and D/A Converters, Digital Decimation Filters- Multi-Stage

TEXTBOOKS:

1. Tony Chan Carusone David A. Johns Kenneth W. Martin,**Analog Integrated Circuit Design**,WileyStudentEdition, 2013
2. BehzadRazavi, **Design of Analog CMOS Integrated Circuits,** TMHEdition,2002
3. PhilipE.AllenandDouglasR.Holberg,**CMOSAnalogCircuitDesign**,OxfordUniversityPress,InternationalSecond Edition/IndianEdition,2010.

REFERENCEBOOKS:

1. RudyVanDePlassche,**CMOSIntegratedAnalog-to-DigitalandDigital-to-Analogconverters,**Kluwer Academic Publishers,2003
2. RichardSchreier,**Understanding Delta-Sigma Data converters,** Wiley Interscience,2005.
3. R.JacobBaker, **CMOSMixed-SignalCircuitDesign,**WileyInterscience,2009.

COURSEOUTCOMES:

After completion of the course, students will be able to:

1. In a Position that he/she can design mixed signal-based circuits starting from basic constraints to advanced constraints
2. Design circuits like switched capacitor circuits, A/D and D/A converter
3. Understandthedesignofoversamplingcircuitsandhigherordermodulators

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand common source amplifier and nmos current mirror	Understand
CO2	Know the electrical properties switched capacitors circuits	Understand
CO3	Describe about data converter fundamentals	Apply
CO4	Know about nyquist rate A/D Converters	Analyze
CO5	Know about oversampling Converters	Analyze

CO-PO-PSO's mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	2	2	1	3							2	2	2	3
CO2	3	2	1	1	2							1	2	2	3
CO3	3	2	2	1	2							2	3	3	3
CO4	3	2	2	1	2							2	3	3	3
CO5	3	1	1	1	3							2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VI Semester		
Code: B0426	ANTENNAS & WAVE PROPAGATION	L	T	P
Credits: 4		4	-	-

Pre-Requisites: Electromagnetic wave theory

Course Objectives: This course introduces

- Basic concepts of Antennas, its radiation mechanism and its fields
- VHF, UHF and Microwave Antennas with the design structures and operation
- Procedure to measure various Antenna parameters
- Different EM wave propagation techniques in free space.

MODULE I: Antenna Basics [8 Periods]

Introduction: Antenna Radiation Mechanism, Radiation Field Zones, Antenna Theorems, Basic Antenna Parameters – Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity - Gain-Resolution, Antenna Aperture Area, Effective Height. Front-to-back Ratio, Antenna Impedance, Antenna Efficiency, FriisTransmission formula, Illustrative Problems.

MODULE II: Thin Linear Wire Antennas [14Periods] Maxwell's equations, Retarded Potentials – Helmholtz Theorem. Radiation from Small Electric Dipole, Quarter Wave Monopole and Half Wave Dipole – Current Distributions, Field Components, Radiated Power, Radiation Resistance, Beam Width, Directivity, Effective Area and Effective Height.

Natural Current Distributions, Far Fields and Patterns of Thin Linear Centre - fed Antennas of Different Lengths. Loop Antennas - Introduction, Small Loop, Comparison of Far Fields of Small Loop and Short Dipole, RadiationResistances and Directivities of Small and Large Loops (Qualitative Treatment) - Illustrative Problems.

MODULE III: Antenna Arrays and Non resonant Radiators [14 Periods]

A: Antenna Arrays: Point Sources – Definition, Patterns, arrays of 2 Isotropic Sources – Uniform and Non Uniform Excitations, Uniform Linear Arrays – BroadsideArrays, End fire Arrays, EFA with Increased Directivity, Derivation of theirCharacteristics and Comparison, Principle of Pattern Multiplication, Binomial Arrays, Illustrative Problems.

B: VHF & UHF Antennas: Yagi - Uda Array, Folded Dipoles, and their Characteristics, V-antennas, Helical Antennas - Helical Geometry, Helix Modes, Practical Design Considerations for Mono filar, Illustrative Problems.

MODULE IV: Microwave Antennas [14Periods] Microstrip Antennas – Introduction, Features, Advantages and Limitations, Rectangular Patch Antennas – Geometry and Parameters, Characteristics of Microstrip Antennas.

Impact of Different Parameters on Characteristics.

Reflector Antennas – Introduction, Flar Sheet and Corner Reflectors, Paraboloidal Reflectors – Geometry, Pattern Characteristics, Feed Methods, Reflector Types – Related Features, Illustrative Problems.

Horn Antennas: Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems.

Antenna Measurements: Introduction, Types of Measurement - Near and Far Fields, Sources of Errors, Pattern Measurement, Directivity Measurement, Gain Measurement (by Comparison, Absolute and 3 - Antenna Methods).

MODULE V: Wave Propagation [14 Periods] Introduction, Definitions, Categorizations and General Classifications, Different Modesof Wave Propagation, Ray/Mode Concepts, Ground Wave Propagation (QualitativeTreatment) – Introduction, Plane Earth Reflections, Space and Surface Waves, Wave Tilt, Curved Earth Reflections.

Space Wave Propagation – Introduction, Field Strength Variation with Distance and Height, Effect of Earth's Curvature, Absorption, Super Refraction, M-Curves and Duct Propagation, Scattering Phenomena, Tropospheric Propagation.

Sky Wave Propagation – Introduction, Structure of Ionosphere, Refraction and Reflection of Sky Waves by Ionosphere, Ray Path, Critical Frequency, MUF, LUF, Virtual Height and Skip Distance, Relation between MUF and Skip Distance, Multi-hop Propagation.

Text Books:

1. J. D. Kraus, R. J. Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation",TMH, New Delhi, (Special

Indian Edition), 4th Edition, 2010.

Reference Books:

1. C. A. Balanis, John Wiley & Sons, "Antenna Theory", 3rd Edition, 2005.
2. John D. Kraus, "Antennas", McGraw-Hill (International Edition), 2nd Edition, 1988.
3. E. C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems",PHI, 2nd Edition, 2000.

E-Resources:

1. http://www.radio-electronics.com/info/antennas/
2. https://www.tutorialspoint.com/antenna_theory/
3. http://www.bookrix.com/_ebook-prabhakar-sharma-antenna-and-wave-propagation/
4. http://www.creativeworld9.com/2011/02/learn-antennas-and-wave-propagation.html
5. http://nptel.ac.in/courses/117101056/48
6. http://nptel.ac.in/courses/117107035/

Course Outcomes: After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand the basic antenna terminology and significance of different parameters in antenna design.	Understanding
CO2	Analyze the working of wire antennas such as half wave, quarter wave and loop antennas.	Analyzing
CO3	Analyze the types of antenna arrays and quantitative analysis of their radiated electric field.	Analyzing
CO4	Analyze the characteristics, features and applications of various microwave antennas.	Analyzing
CO5	Outline the factors and their effects involved in the propagation of radio waves.	Understanding

CO- PO, PSO Mapping:

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Programme Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3			3	2								3		
CO2	3			1	2								2	3	
CO3	3	2	2	2	2								3	3	1
CO4	3	2	2	2	2		1						3	3	1
CO5	3	2	2	2	2	2							2		1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VI Semester		
Code: B0427	WIRELESS AND MOBILE COMMUNICATION *(Professional Elective -II)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Analog & Digital Communications, Cellular and mobile communication.

Course Objectives: This course provides

- UnderstandingtheBasicsofcurrentandfuturegenerationWirelesscommunication systems.
- Describesthevariousmultiplexingtechniquesusedinwirelesscommunication systems.
- Study of fundamentals of multi antenna architecture in advanced communication systems.
- Providingabasicunderstandingofthekeytechnologiesof5Gand beyond 5G communication systems.
- Discussthechallengesof5Gsystemsandsystemimplementationusingmachine learning techniques.

MODULEI:Evolution of Wireless Communication [9 Periods]

Overview of wireless communication, cellular communication, goals, and vision of the current(3G,4G)andnextgenerationwirelesscommunicationsystems(5G,6G),Radio wave propagation: Flat fading and Frequency selective fading, Performance metrics.

MODULE II: Multiplexing Techniques [10 Periods]

Orthogonal frequency division multiplexing (OFDM), FFT/IFFT processing in OFDM, Cyclic Prefix in OFDM, Single Carrier Frequency Division Multiple Access (SCFDMA), Non Orthogonal Multiple Access (NOMA), Resource allocation.

MODULEIII:**Multiple Antenna Techniques [10 Periods]**

The crowded spectrum, need for high data rate, Multiple input multiple output (MIMO) systems – Array Gain, Diversity Gain,Spatial multiplexing, Beamforming, Space Time Block Codes (STBC), diversity- multiplexing trade-off, Massive MIMO.

MODULE IV:Future Generation Challenges and Applications [10 Periods]

Cognitive radio, Spectrum sensing, Spectrum sharing ,mm Wave Communication, Relay Communication, Channel estimation: SISO, MISO, MIMO.

MODULEV: Fundamentals of 5G Architecture [10 Periods]

Differencebetween4Gand5G,5GArchitecture,Planningof5GNetwork,QualityofService, Radio Network, Requirements, Security, SIM in 5G Era, Specifications, Standardization, Terminal States, Machine Learning in 5G, Future Generations (where is the6G?).

Text Books:

1. R.VannithambyandS.Talwar,Towards5G:Applications,Requirementsand CandidateTechnologies.JohnWilley&Sons,WestSussex,2017.
2. Manish,M.,Devendra,G.,Pattanayak,P.,Ha,N.,5GandBeyondWirelessSystems PHY Layer Perspective, Springer Series in WirelessTechnology.

3.Aditya K Jagannathm, "Principles of Modern Wireless Communications", McGrawHill, 2017.

Reference Text Books:

1. T.S.Rappaport,R.W.HeathJr.,R.C.Daniels,andJ.M.Murdock,MillimeterWave Wireless Communication., Pearson Education,2015.
2. M.Vaezi,Z.Ding,andH.V.Poor,MultipleAccesstechniquesfor5GWireless Networks and Beyond., Springer Nature, Switzerland,2019.

E-Resources:

1. https://www.digimat.in/nptel/courses/video/108105134/L01.html
2. https://www.youtube.com/watch?v=U6WMPXwCKHs
3. https://www.youtube.com/watch?v=E0pVWF1mJOM

Course Outcomes: At the end of the course, students will be able to

COs	**Description**	Blooms Taxonomy level
CO1	Distinguishandunderstandthemajorcellularcommunicationstandards (3G/4G/5G/6Gsystems).	Understand
CO2	Characterizeandanalyzevariousmodulationandmultiplexing techniques e.g. OFDMA, NOMAetc.	Understand
CO3	Understanding of multiple antenna trans receiver systems and its inherent challenges.	Analyze
CO4	Understanding of advanced communication technologies for design of future generation systems.	Analyze
CO5	Explore the future generation 5G techniques e.g. Radio Network, Requirements, Security etc.	Apply

CO-PO Mapping:

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Program Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	1									3	1	1
CO2	3	2	1	2	2		1					1	3	1	1
CO3	3	2	2	3	3		1	1					3	2	3
CO4	3	3	2	3	3		1	1		2	1	1	3	2	3
CO5	3	3	2	3	3		1	1		3	1	1	3	2	3

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: B0428	**Introduction to Artificial Intelligence** (*Professional Elective -II*)	**L**	**T**	**P**
Credits: 3		**3**		**-**

Pre-Requisites: Nil

Course Objectives:

- To learn the difference between optimal reasoning Vs human like reasoning
- To understand the notions of state space representation, exhaustive search, heuristic search along with the time and space complexities.
- To learn different knowledge representation techniques
- To understand the applications of AI namely, Game Playing, Theorem Proving, Expert Systems, Machine Learning and Natural Language Processing

MODULE I: [10 Periods]

Foundations of AI: What is AI, History of AI, Strong and weak AI, The State of the Art.
Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, the Structure of Agents.

MODULE II: [10 Periods]

Solving Problems by Searching: Problem – Solving Agents, Example Problems, Searching for Solutions, uniformed search Strategies, Informed (Heuristic) Search Strategies, and Heuristic Functions.

MODULE III: [9 Periods]

Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, the Internet Shopping World.

MODULE IV: [10 Periods]

Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Learner Models, Nonparametric Models, Support Vector Machines, Ensemble Learning, Practical Machine Learning.

MODULE V: [9 Periods]

Learning Probabilistic Models: Statistical Learning, Learning with Complete data, learning with Hidden variables: The EM Algorithm.

Text Books:

1. Stuart J. Russell & Peter Norvig "Artificial Intelligence A Modern Approach" Pearson.
2. Elaine Rich, Kevin Knight &Shivashankar B Nair "Artificial Intelligence", McGraw HillEducation.

Reference Books:

1. "Artificial Intelligence: A New Sythesis" by Nils J Nilsson
2. "Artificial Intelligence" by Negnevitsky

E-Resources:

1. https://www.springer.com/in/book/9783540167822
2. https://www.e-booksdirectory.com/listing.php?category=28
3. https://nptel.ac.in/courses/109101003/downloads/Lecture.../Lecture-19-20-21.pd
4. https://onlinecourses.nptel.ac.in/noc18_cs51
5. https://nptel.ac.in/courses/106106140

Course Outcomes: After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations	Understand
CO2	Estimate the algorithm for a problem solving and characterize its time and space complexities	Evaluate
CO3	Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, and learning.	Apply
CO4	Ability to Analyze the problem into a suitable form of learning and solve it	Analyze
CO5	Demonstrate awareness and a fundamental understanding of various applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	3	3	3	2								2	2		1
CO2	3	3	3	3	3							1	3	2	2
CO3	2	2	2	2	2								2		1
CO4	2	2	3	2	3							1	2	2	3
CO5	3	3	3	3	3							2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: B0429	DIGITAL DESIGN USING FPGA	L	T	P
Credits: 3	*(Professional Elective -II)*	3	-	-

Pre-Requisites: Digital Electronics, Verilog

Course Objectives:

- This course provides the knowledge and hands-on experience in designing digital logic blocks in FPGA.
- To meet design requirements, designers must understand the FPGA fabric and how they affect the actual design of the logic functions.

MODULE I **[8 Periods]**

FPGA-Based Systems - Digital Design and FPGAs, FPGA-Based System Design, VLSI Technology-Manufacturing Processes, Transistor Characteristics, Packages and Pads.

MODULE II **[8 Periods]**

FPGA Fabrics- Introduction, FPGA Architectures, SRAM-Based FPGAs, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA Fabrics.

MODULE III **[12 Periods]**

Combinational Logic- Logic Design Process, Hardware Description Languages- Verilog, Combinational Network Delay, Power and Energy Optimization, Arithmetic Logic, Logic Implementation for FPGAs, Physical Design for FPGAs.

MODULE IV **[12 Periods]**

Sequential Machines, Sequential Machine Design Process, Sequential Design Styles, Rules for Clocking, Performance Analysis of Flip-Flop-Based Systems, Latch-Based Systems, Clock Skew, Retiming

MODULE V **[8 Periods]**

Large-Scale Systems- Introduction, Busses, Platform FPGAs, Multi-FPGA Systems, Novel Architectures.

Text Books:

1. FPGA based System Design - Wayne Wolf, Prentice Hall Modern Semiconductor Design Series.
2. Morris Mano, Logic and computer design fundamentals‖,4-edition,Pearson education,2008.
3. Samir Palnitkar, ―Verilog HDL: A guide to digital design and synthesis‖ Pearson Education India, 2010.

Reference Books:

1. M.J.S. Smith, "Application Specific Integrated Circuits", Pearson, 2000.
2. Peter Ashenden, "Digital Design using VHDL", Elsevier, 2007.
3. Peter Ashenden, "Digital Design using Verilog", Elsevier, 2007. 4. W. Wolf, "FPGA based system design", Pearson, 2004.

E-Resources:

1. https://nptel.ac.in/courses/117/108/117108040/
2. http://www.nitttrc.edu.in/nptel/courses/video/117108040/L40.html
3. https://www.coursera.org/learn/digital-design-with-fpgas
4. https://digilent.com/reference/learn/programmable-logic/courses/intro-to-digitaldesign/start#:~:text=A%20major%20revolution%20in%20digital,of%20thousands%20of%20flip%2Dflops.

Course Outcomes: At the end of the course, students will be able to

COs	Description	Blooms Taxonomy level
CO1	Explain the design process using FPGA.	Understand
CO2	Explain various architectures of FPGA.	Understand
CO3	Design combinational logics.	Apply
CO4	Design sequential machines.	Apply
CO5	Explain various Large-Scale Systems.	Analyze

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	3									3	3	3	2
CO2	3	3	3									3	3	1	1
CO3	3	3	3									3	3	3	2
CO4	3	3	3									3	3	2	2
CO5	2	3	3									3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: B0430	**Information Theory & Coding** *(Professional Elective –II)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Signal Theory and Stochastic Processes.

Course Objectives:

- To introduce the concept of information content of a message /source
- To differentiate between the information content available with the source and the information gained by the observer
- To differentiate between source coding and channel coding
- To introduce the principles of Error detection and Error correction

MODULEI: Information Theory and Source Coding [10Periods]

Introduction to Information Theory, Source Coding Theorem, Huffman Coding, Shannon-Fano-Elias Coding, Arithmetic Coding, The Lempel-Ziv Algorithm, Run Length Encoding, Channel Models, Channel Capacity, Channel Coding, Information Capacity Theorem.

MODULEII: Linear Block Codes for Error Correction [9 Periods]

Error Correcting Codes, Matrix Description of Linear Block, decoding of a Linear Block Code, Error Probability after Coding, Hamming Codes, Low Density Parity Check (LDPC) Codes, Maximum Distance Separable (MDS) Codes, Space Time Block Codes

MODULEIII: Cyclic Codes [9Periods]

Introduction to Cyclic Codes,A Method for Generating Cyclic Codes, Matrix Description of Cyclic Codes, Quasi-Cyclic Codes and Shortened Cyclic Codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check (CRC) Codes.

MODULEIV: Bose–Chaudhuri Hocquenghem (BCH) Codes [10Periods]

Introduction to BCH Codes, Primitive Elements, Minimal Polynomials, Generator Polynomials in Terms of Minimal Polynomials, Some Examples of BCH Codes, Decoding of BCH Codes, Reed-Solomon Codes, Implementation of Reed-Solomon Encoders and Decoders

MODULEV: Convolutional Codes [10Periods]

Introduction to Convolutional Codes, Tree Codes and Trellis Codes,Polynomial Description of Convolutional Codes, Matrix Description of Convolutional Codes, Viterbi Decoding of Convolutional Codes, Distance Bounds for Convolutional Codes, Turbo Codes, Turbo Decoding.

TextBooks:

1. Ranjan Bose, "Information Theory, Coding and Cryptography", Tata McGraw-Hill, Second Edition, 2002.
2. P. S. Satyanarayana, "Concepts of Information Theory and Coding", Dynaram Publication, 2005.

ReferenceBooks:

1. Richard B. Wells, "Applied Coding and Information Theory for Engineers", Pearson Education, LPE, First Indian Reprint, 2004.
2. Richard E. Blahut, "Algebraic Codes for Data Transmission", Cambridge University Press, 2003.

3. Shu Lin and Daniel J.Costello, “Error Control Coding – Fundamentals and Applications”, Second Edition, 2004.
4. Thomas M Cover and Joy A Thomas, “Elements of Information Theory” MGH 2006.

E-Resources:

1. https://www.edx.org/course/information theory

CourseOutcomes:

At the end ofthecourse,studentswillbeable to:

1. Learn measurement of information and errors.
2. Obtain knowledge in designing various source codes and channel codes
3. Design encoders and decoders for block and cyclic codes
4. Understand the significance of codes in various applications

CO-PO,PSOMapping (3/2/1indicatesstrengthofcorrelation)3-Strong, 2-Medium,1-Weak															
COS	**ProgrammeOutcomes(POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	3	3	3	3								3	1		1
CO2	3	3	3	3								3	1		1
CO3	3	3	3	3								3	1		1
CO4	3	3	3	3								3	1		1
CO5	3	3	3	3								3	1		1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code: B0431	**Advanced Computer Architecture** *(Professional Elective –II)*	L	T	P
Credits: 3		3	-	-

Pre-Requisite: Computer Organization and Operating Systems

Course Objectives: To make students know about the Parallelism concepts in Programming

- To give the students an elaborate idea about the different memory systems and buses
- To introduce the advanced processor architectures to the students.
- To make the students know about the importance of multiprocessor and multi-computers.
- To study about data flow computer architectures

Unit-I Theory of Parallelism **[8 Periods]**

Theory of Parallelism, Parallel computer models, The State of Computing, Multiprocessors and Multicomputers, Multivector and SIMD Computers, PRAM and VLSI models, Architectural development tracks, Program and network properties, Conditions of parallelism, Program partitioning and Scheduling, Program flow Mechanisms, System interconnect Architectures.

Unit-II Principals of Scalable performance **[8 Periods]**

Principals of Scalable performance, Performance metrics and measures, Parallel Processing applications, Speed up performance laws, Scalability Analysis and Approaches, Hardware Technologies, Processes and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Memory Hierarchy Technology, Virtual Memory Technology.

Unit-III Bus Cache and Shared memory **[8 Periods]**

Bus Cache and Shared memory, Backplane bus systems, Cache Memory organizations, Shared-Memory Organizations, Sequential and weak consistency models, Pipelining and superscalar techniques, Linear Pipeline Processors, Non-Linear Pipeline Processors, Instruction Pipeline design, Arithmetic pipeline design, superscalar pipeline design.

Unit-IV Parallel and Scalable Architectures **[8 Periods]**

Parallel and Scalable Architectures, Multiprocessors and Multicomputers, Multiprocessor system interconnects, cache coherence and synchronization mechanism, Three Generations of Multicomputers, Message-passing Mechanisms, Multivetor and SIMD computers, Vector Processing Principals, Multivector Multiprocessors, Compound Vector processing, SIMD computer Organizations, The connection machine CM-5,

Unit-V Scalable **[8 Periods]**

Scalable, Multithreaded and Dataflow Architectures, Latency-hiding techniques, Principals of Multithreading, Fine-Grain Multicomputers, Scalable and multithreaded Architectures, Dataflow and hybrid Architectures.

TEXT BOOK:

1. Advanced Computer Architecture Second Edition, Kai Hwang, Tata McGraw Hill Publishers.

REFERENCE BOOKS:

1. Computer Architecture, Fourth edition, J. L. Hennessy and D.A. Patterson. ELSEVIER.
2. Advanced Computer Architectures, S.G. Shiva, Special Indian edition, CRC, Taylor &Francis.
3. Introduction to High Performance Computing for Scientists and Engineers, G. Hager and G. Wellein, CRC Press, Taylor & Francis Group.
4. Advanced Computer Architecture, D. Sima, T. Fountain, P. Kacsuk, Pearson education.
5. Computer Architecture, B. Parhami, Oxford Univ. Press.

Course Outcomes: At the end of the course Student able to analyze

CO	Description	Blooms Taxonomy level
CO1	Demonstrate concepts of parallelism in hardware/software	Understand
CO2	Discuss memory organization and mapping techniques	Understand
CO3	Describe architectural features of advanced processors.	Apply
CO4	Interpret performance of different pipelined processors	Apply
CO5	Explain data flow in arithmetic algorithms.	Analyze

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	2	1	1									3	1	1
CO2	2	2	1	1								1	3	3	1
CO3	2	1	2	1								2	3	1	2
CO4	1	1	2	1	1							2	3	1	1
CO5	1	2	2	1	1							2	3	3	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. VI Semester		
Code: B0H03	ENGLISH COMMUNICATION AND PRESENTATION SKILLS LAB (Common for EEE, ECE, CSE and IT)	L	T	P
Credits: 1		-	-	2

Course Objectives: The learners need to be aware of the characteristics of technical communication in their workplaces; as a result, they are exposed to different channels of technical communication. Hence the acquired skills make the learners effective communicators using persuasive language. Besides the above said, one of the major objectives is to maintain objectivity in writing documents and to produce professional quality documents using different components of the language.

Methodology: Facilitator's role: Since classroom learning augments thinking process, helping them to develop written, spoken and non-verbal communication, the facilitator / Faculty would briefly discuss the topics with the students and later on guide them while the students involved in activities, writing work and while making presentations. The facilitator is required to design a lot of practical/industry oriented project works for the students

*Students are required to participate, perform, write and submit the work in the form of written documents or Power Point Presentations to hone their spoken written and non-verbal communication skills. Students are to take up field work and submit the project work.

MODULE I: Oral Presentations

Mechanics of Presentations – Methodology of Presentation, Importance of Non-verbal communication during presentations– Nuances of Presentation.

*This particular Module is for internal evaluation purpose(s).

MODULE II: E - Correspondence and Social Media Etiquette

Common web mail services, yahoo, gmailetc, fields to pay attention- To:, Cc:, Bcc:, Reply All, Subject, Salutation, Body, Signature, Font, Caps Lock , Highlight, The 'KISS' strategy (Keep It Simple and Short,)Points to remember while signing off, Introduction to Technical Vocabulary, Cultural Differences

- This Module is purely for internal assessment/evaluation

MODULE III: Group Discussion

Initiators- Contributor-Informer-Team Leader-Motivator-Creative Contributor, Importance of, Nonverbal communication -eye contact, voice characters, posture, gestures, do's and don'ts, Role play and Simulation- Learners assuming the roles of characters and participating in Group discussion, analysis, or prediction with strictly defined goals.

MODULE IV: Interview Skills & Office Etiquette

Preparing for the interview, types of interviews, interview session, importance of non-verbal communication during the interview, do's and don'ts of interview, follow up and thanking letter. FAQ's. Formal Conversation, office attire- do's and don'ts, greetings and meetings, speaking to seniors and handshakes, offering and taking visiting cards, asking questions and Seeking Clarifications.

MODULE V: Career Progression

Job Hunt Process-SWOT analysis, correspondence and browsing the internet to search for a suitable job(s), job application-cover letter drafting, drafting a winning resume', types of resume's -electronic, video and printed resume's

- Instruction: Students are required to prepare their video resume which will be assessed by the faculty member.

Reference Books:

1. Chrissie: Handbook of Practical Communication Skills: Jaico Publishing house, 1999.
2. Daniels, Aubrey: Bringing Out the Best in People: Tata McGraw-Hill: New York, 2003.
3. Wright, Goulstone, Mark: Just Listen: Discover the Secret to getting through to absolutely anything : American Management Association, 2010.

4. Leslie. T. Giblin: Skill with people Publication details not known
5. Lewis, Norman: Word Power Made Easy: Goyal Publications: New Delhi, 2009.
6. Murthy, A.G, Krishna: Ten Much: Tata McGraw-Hil:New Delhi, 2010.

E-Resources:

1. http://www.mindtools.com/pages/article/newTMC_05.htm
2. http://www.kent.ac.uk/careers/intervw.htm
3. http://www.wikihow.com/Write-a-Report

Course Outcomes: After the completion of the course the students will be able to

COs	Description	Blooms Taxanomy Level
CO1	Understand the requisites to successfully deliver as professionals and the challenges they need to encounter	Understand
CO2	Learn a transition from the academic world to the professional world	Understand
CO3	Understand the style of individual communication	Understand
CO4	Get the awareness about the dynamics of communication in the work environment	Understand
CO5	Integrate the learning experience with the functional areas of communication	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	1					2		1	2	3		3			
CO2						2		1	2	3		3			
CO3						2		1	2	3		3			
CO4						2		1	2	3		3			
CO5						2		1	2	3		3			

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code:B0432	DIGITAL SIGNAL PROCESSING LAB	L	T	P
Credits: 1.5				3

Course Objectives: To learn programming for various digital signal processing concepts.

List of Experiments:

1. Verification of linearity and Time Invariance Properties of a given Discrete-Time System
2. Generation of Sinusoidal waveform / signal based on recursive difference equation.
3. Computation of Unit Sample, Unit Step and Sinusoidal responses of the given LTI Discrete-Time System
4. To find frequency response of a given first order Discrete-Time system.
5. To find DFT / IDFT of given Discrete-Time signal.
6. Linear convolution using DFT & IDFT method.
7. Circular Convolution using Matrix Method.
8. Implementation of FFT and Power spectrum of given sequence.
9. Implementation of IIR Low pass & High Pass filter for a given sequence
10. Implementation of FIR Low pass filter for a given sequence.
11. Implementation of FIR High Pass filter for a given sequence.
12. Implementation of Decimation and Interpolation Process.

Software Required:

MATLAB / Lab view / OCTAVE / Equivalent Software

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Identify the Signals/Sequences or other parameters need to be generated to accomplish the LTI System	Apply
CO2	Demonstrate the program with syntax and framing of procedure	Analyze
CO3	Examine the observation made by execution of written program	Analyze
CO4	Illustrate the results with neat sketches	Understand
CO5	Understand the concepts of transforms and filter design techniques, by attempting the quiz or viva.	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	2	2	1	3							2	3	3	3
CO2	3	2	2	1	3							2	3	3	3
CO3	3	2	3	2	3							2	3	3	3
CO4	3	3	2	3	3							2	3	3	3
CO5	3	3	2	3	3							3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI Semester		
Code:B0433	**Fundamentals of Mixed Signal Design Lab**	**L**	**T**	**P**
Credits: 1.5				**3**

Course Objectives: Design of various Mixed Signal Circuits.

List of Experiments:

1. Inverter
2. XOR gate
3. 2:1 Multiplexer
4. Full adder
5. General logical Expression
6. Current Mirror
7. Common Drain Amplifier
8. Differential Amplifier
9. Operational Amplifier
10. Class AB Amplifier
11. R-2R DAC
12. CMOS Comparator

Software Required:

Mentor Graphics

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Write Verilog programs for Combinational and sequential logics.	Apply
CO2	Perform simulation, synthesis and implementation of various digital logics Circuits	Analyze
CO3	Write Verilog Codes and implement various logic circuits on FPGA boards	Apply
CO4	Design Schematic for logic circuits and perform physical verification	Apply
CO5	Design layouts for logic circuits and perform physical verification.	Apply

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	1			3			2	3	2		1	3	2	1
CO2	3	1			3			2	3	2		1	3	2	1
CO3	3	1			3			2	3	2		1	3	3	1
CO4	3	1			3			2	3	2		1	3	3	1
CO5	3	1			3			2	3	2		1	3	3	1

2020-21 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B. Tech. VI Semester		
Code: B00M4	QUANTITATIVE APTITUDE AND VERBAL RESONING - II	L	T	P
Credits: 0		1	1	-

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0434	DIGITAL IMAGE PROCESSING	L	T	P
Credits: 4		3	1	-

Pre-Requisites: Digital Signal Processing.

Course Objectives: This course introduces

- The fundamentals of digital image processing,
- The concept of two dimensional transformations on spatial images,
- Application of various filtering methods for image enhancement, various image segmentation algorithms, concepts of color image processing and different image compression techniques.

MODULE I: **[10 Periods]**

Digital Image Fundamentals

Fundamental Steps in Digital Image Processing, Components of an Image Processing System, A Simple Image Formation Model, Image Sampling and Quantization, Relationships Between Pixels, Imaging Geometry, Applications of Image processing.

MODULE II: **[10 Periods]**

Image Transforms: 2-D Fourier Transform, Properties, FFT, Walsh Transform, Hadamard Transform, Discrete Cosine Transform, Haar transform, Slant transform, Hotelling transform, Properties of all the transforms.

MODULE III: **[8 Periods]**

Image Enhancement

A: Spatial Domain: Introduction, Gray Level Transformations, Histogram Processing, Arithmetic and Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, High Boost Filtering.

B: Frequency Domain: Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.

MODULE IV: **[10 Periods]**

Image Restoration and Color Image Processing

A: Image Restoration: Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filters.

B: Color Image Processing: Color Models, Pseudo-color Image Processing, Full-color Image Processing.

Module - V: **[10 Periods]**

Image Compression and Segmentation

A: **Image Compression**: Fundamentals, Data Redundancies, Image Compression Models, Elements of Information Theory, Error Free Compression techniques, Lossy Compression techniques, Image Compression Standards.

B: Image Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds

Text Books:

1. R. C. Gonzalez, R. E. Woods, "Digital Image processing", Addison Wesley/ Pearson education, New Delhi, India, 3rd edition, 2002.

Reference Books:

1. K. Jain, "Fundamentals of Digital Image processing", Prentice Hall of India, New Delhi, 2nd Edition, 1997.
2. Rafael C. Gonzalez, "Digital Image processing using MATLAB", Richard E. Woods and Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.
3. William K. Pratt, "Digital Image Processing", John Wiley & Sons, New Delhi, India, 3rd edition, 2004.
4. Arthur R. Weeks, Jr, "Fundamentals of Electronic Image Processing", SPIEOptical Engineering Press, New Delhi, India, 2nd Edition, 1996.

Course Outcomes*:* After completion of the course, students will be able to:

S.No	**Description**	**BLOOMS LEVEL**
CO1	Have an appreciation of the fundamentals of Digital image processing including the simple image formation and relationship between pixels	L2
CO2	Implement basic DFT transform and image transforms using Image Processing Tools	L3
CO3	Implement basic image processing algorithms like enhancement in spatial and frequency domain.	L3
CO4	Analyze the different types of image degradation like linear image restoration techniques and nonlinear image restoration techniques	L4
CO5	Understand the need for image compression like lossy and loss less image compression techniques and the need of image segmentation.	L2

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
	Programme Outcomes(POs)												**PSOs**		
COS	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	1					3							3	3	3
CO2					2	2			1			2	3	2	
CO3			3		2	3	2					2		2	
CO4			3						2			3	1		3
CO5			3		3				3			3	3	3	3

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VII Semester		
Code:B0435	IoT Architecture and its Applications	L	T	P
Credits:3		3	-	-

Pre-requisite of Course: Python Programming

Objective: This course aims to

- Explore various components of Internet of things such as Sensors, internetworking cyberspace.
- Design and implement IoT circuits and solutions.

Module I: Introduction to IoT [9Periods]

Sensors and Actuators, Wireless Sensor Networks, Machine-to-Machine Communications, IoT Definition and Characteristics, Physical design of IoT, Logical design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates.

Module II: IoT Devices and Endpoints [10Periods]

Arduino UNO: Introduction, Pin layout, Installing the Software, Fundamentals of Arduino Programming.

Raspberry Pi: Introduction, Pin Layout, Operating Systems on Raspberry Pi, Installing Raspberry Pi, Connecting Raspberry Pi via SSH. Raspberry Pi Interfaces, Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access and "headless mode", Bash Command line.

Module III: [10Periods]

Part A: Interfacing: Programming Raspberry Pi / Arduino for LED blinking, LDR, Temperature/Humidity Sensor and Ultrasonic Sensor,

Part B : M2M to IoT : M2M vs IoT, , IoT Building architecture, Main design principles, An IoT architecture outline, IoT Design Methodology, Use case example-Stress Management

Module IV: M2M and IoT Technology Fundamentals
[10Periods]

Devices and gateways, Local and wide area networking , Data management, Steps towards a Secure Platform -Privacy Preserving sharing of IOT Data, Secure Authentication and Access Control in Constrained Devices, Smarties Approach.

Module V: IoT Applications [9Periods]

IoT Applications—home automation, infrastructures, Industries, Industry 4.0 concepts, Smart City, Environment, Energy, Logistics, Agriculture ,Health, IoT for Retailing Industry.

Text Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on Approach)", 1stEdition,VPT,2014.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos,David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",1stEdition,AcademicPress,2014.
3. FrancisdaCosta,"RethinkingtheInternetofThings:AScalableApproachtoConnectingEverything",1stEdition,ApressPublications,2013
4. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN:978-1-4493-9357-1.

Reference Books:

1. HonboZhou,"The Internet of Things in the Cloud: A Middleware Perspective", CRCPress, 2012.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols",Wiley,2012.

Course Outcomes: After successful completion of this course, student will be able to

Course Outcome	Description	BloomsLevel
CO 1	Understand general concepts of Internet of Things(IoT).	Understand
CO 2	Analyze various devices and endpoints.	Analyze
CO 3	Analyze various M2M and IoT architectures.	Analyze
CO 4	Evaluate design issues in IoT applications.	Evaluate
CO 5	Create IoTsolutions using sensors, actuators and Devices	Create

Co-Po mapping:

CO- PO, PSO Mapping (3/2/1indicates strength of correlation)3-Strong, 2-Medium,1-Weak															
COs	**Programme Outcomes(POs)**												**PSOs**		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2			3				2		3	3	3	
CO2	3	3	3			3				3		3	3	3	
CO3	3	3	3			2				3		2	3	3	
CO4	3	2	1			1				1		1			
CO5	3	1	1			1						1			

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0436	**Principles of Optimization Techniques** *(Professional Elective-III)*	L	T	P
Credits: 3		3	-	-

Pre-requisite: Knowledge about engineering mathematics and problem-solving skills with programming languages

Course Objectives: This course aims to:

1. Understand LPP and NLP techniques.
2. Understand the difference between local and global optimization methods.
3. Compare different optimization methods.

UNIT-I Introduction to Optimization Techniques [8 Periods]

Introduction to Optimization, Applications of optimization techniques, statement of the problem, linear programming-standard form of LPP, Motivation of the simplex method, simplex algorithm, two phases of simplex method, sensitivity Analysis.

UNIT-II Non-Linear Programming (NLP): One Dimensional [8 Periods]

Unrestricted search, exhaustive search, Fibonacci method, golden section method-Newton and secant methods. Unconstrained optimization: direct search method, simplex method. Gradient of a function, steepest Descent search method (Cauchy) method, Conjugate gradient method.

UNIT-III NLP-Constrained Optimization [8 Periods]

Characteristic of a constrained problem, Direct Methods-Random search methods, Sequential linear programming method. Indirect methods: Transformation techniques, interior and exterior penalty function methods.

UNIT-IV Further Topics in Optimization [8 Periods]

Multi objective Optimization-Utility function method, Invent and utility function methods, global criterion method. Simulated Annealing, Optimization of Fuzzy systems.

UNIT-V Genetic Algorithm (GA) [8 Periods]

Introduction, optimization of a simple function- Representation, Initial population, Genetic operators: Crossover and Mutation. Travelling salesman problem (TSP), Comparison between Hill climbing, Simulated annealing and Genetic algorithms. How do GAs work-Chromo some selection, Selection process, Recombination operators, Example of maximization of a nonlinear function.

TEXT BOOKS:

1. SingiresuS.Rao, "Engineering Optimization: Theory and Practice", 3rd edition, New Age International(P) Limited, 2013.
2. Zbigniew Michalewicz, "Genetic Algorithms + Data structures = Evolution Programs", Third Revised and Extended Edition, Springer, 2013.

Reference Books:

1. Kalyanmay Deb, "Optimization for Engineering Design-Algorithms and Examples", Second edition, PHI, 2012.
2. Merrium C.W," Optimum theory and the design of feedback control systems", McGraw Hill,1964.
3. A.Ravindran, K.M.Ragsdell, G.V.Reklaitis, "Engineering Optimization –Methods and Applications", Second Edition, Wiley Publication.

Course Outcomes: Upon completion of the course, the students will be able to:

COs	Description	Blooms Taxonomy Level
CO1	Understand importance of optimization of industrial process management.	Understand
CO2	Illustrate the basic concepts of linear programming and application to real life problems	Understand
CO3	Demonstrate the principles of nonlinear programming to one dimensional problem .	Analyze
CO4	Apply basic concepts of mathematics to formulate an optimization problem	Apply
CO5	Examine the working of Genetic Algorithm for nonlinear function	Evaluate

CO-PO- Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	3	2	3	2								1	3	3	2
CO2	1	2	2									1	2	2	2
CO3	2	3	1									2	2	2	1
CO4	1	2	2									1	2	2	2
CO5	3	3	3	2								3	3	3	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0437	Low Power VLSI Design	L	T	P
Credits: 3	*(Professional Elective –III)*	3	-	-

Pre-requisites: VLSI DesignCourse Objectives:

- Known the low power low voltage VLSI design
- Understand the impact of power on system performances.
- Known about different Design approaches.
- Identify suitable techniques to reduce power dissipation in combinational and sequential circuits.

MODULE - I: Fundamentals: Need for Low Power Circuit Design, Sources of Power Dissipation – Switching Power Dissipation, Short Circuit Power Dissipation, Leakage Power Dissipation, Glitching Power Dissipation. Low Power Design Techniques-Clock Gating, Multi Voltage, Power Gating.

MODULE- II: Low-Power Design Approaches: Low-Power Design through Voltage Scaling – VTCMOS circuits, MTCMOS circuits, Architectural Level Approach –Pipelining and Parallel Processing Approaches. Switched Capacitance Minimization Approaches: System Level Measures, Circuit Level Measures, and Mask level Measures.

MODULE - III: Low-Voltage Low-Power Adders: Introduction, Standard Adder Cells, CMOS Adder's Architectures – Ripple Carry Adders, Carry Select Adders, Carry Save Adders.

MODULE - IV: Low-Voltage Low-Power Multipliers: Introduction, Overview of Multiplication, Types of Multiplier Architectures- Vedic Multiplier, Baugh-Wooley Multiplier, Booth Multiplier.

MODULE V: Low-Voltage Low-Power Memories: Basics of SRAM, Memory Cell, Precharge and Equalization Circuit, Low-Power SRAM Technologies, Basics of DRAM, Self-Refresh Circuit, Future Trend and Development of DRAM.

TEXT BOOKS:

1. CMOS Digital Integrated Circuits – Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 2011.
2. Low-Voltage, Low-Power VLSI Subsystems – Kiat-Seng Yeo, Kaushik Roy, TMH Professional Engineering.

REFERENCE BOOKS:

1. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRCPress, 2011
2. Low Power CMOS VLSI Circuit Design – Kaushik Roy, Sharat C. Prasad, John Wiley & Sons,2000.
3. Practical Low Power Digital VLSI Design – Gary K. Yeap, Kluwer Academic Press, 2002.
4. Leakage in Nanometer CMOS Technologies – Siva G. Narendran, Anatha Chandrakasan, Springer, 2005.

Course Outcomes: Upon completing this course, the student will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand the need of Low power circuit design.	Understand
CO2	Apply the various low power design methods	Apply
CO3	Attain the knowledge of architectural approaches. .	Knowledge
CO4	Analyze and design Low-Voltage Low-Power combinational circuits	Analyze
CO5	Known the design of Low-Voltage Low-Power Memories	Knowledge

Co-Po Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	2	2	1	3							2	2	2	3
CO2	3	2	1	1	2							1	2	2	3
CO3	3	2	2	1	2							2	3	3	3
CO4	3	2	2	1	2							2	3	3	3
CO5	3	1	1	1	3							2	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VII-SEMESTER		
Code:B0438	OPTICAL COMMUNICATIONS	L	T	P
Credits: 3	*(Professional Elective-III)*	3	-	-

Pre-Requisites: Engineering Physics, Applied Physics, Analog & Digital Communications.

Course Objectives: This course introduces the significance of optical fiber communications, characteristics and signal distortion in optical fiber cable. This course develops the knowledge of various optical detector devices, fiber splicing techniques and launching power. This course also helps to design an optical system.

MODULE I: Overview of Optical Fiber Communication [11 Periods]

Historical development, the general system, Advantages of Optical Fiber Communications, Optical Fiber Wave Guides- Introduction, Ray Theory Transmission, Total Internal Reflection, Acceptance Angle, Numerical Aperture, Skew Rays, Cylindrical Fibers- Modes, Vnumber, Mode Coupling, Step Index Fibers, Graded Index Fibers. Single Mode Fibers - Cut Off Wavelength, Mode Field Diameter, Effective Refractive Index, Fiber Materials Glass, Halide, Active Glass, Chalgenide Glass, Plastic Optical Fibers.

MODULE II: Signal Distortion in Optical Fibers [10 Periods]

Attenuation, Absorption, Scattering and Bending Losses, Core and Cladding Losses, Information Capacity Determination, Group Delay, Types of Dispersion - Material Dispersion, Wave-Guide Dispersion, Polarization Mode Dispersion, Intermodal Dispersion, Pulse Broadening, Optical Fiber Connectors- Connector Types, Single Mode Fiber Connectors, Connector Return Loss.

MODULE III: Fiber Splicing and Power Launching [10 Periods]

A. Fiber Splicing: Splicing Techniques, Splicing Single Mode Fibers, Fiber Alignment and Joint Loss- Multimode Fiber Joints, Single Mode Fiber Joints, Optical Sources- LEDs, Structures, Materials, Quantum Efficiency, Power, Modulation, Power Bandwidth Product, Injection Laser Diodes- Modes, Threshold Conditions, External Quantum Efficiency, Laser Diode Rate Equations, Resonant Frequencies, Reliability of LED & ILD.

B. Source to Fiber Power Launching: Output Patterns, Power Coupling, Power Launching, Equilibrium Numerical Aperture, Laser Diode to Fiber Coupling.

MODULE IV: Optical Detectors [9 Periods]

Physical Principles of PIN and APD, Detector Response Time, Temperature Effect on Avalanche Gain, Comparison of Photo Detectors, Optical Receiver Operation- Fundamental Receiver Operation, Digital Signal Transmission, Error Sources, Receiver Configuration, Digital Receiver Performance, Probability of Error, Quantum Limit, Analog Receivers.

MODULE V: Optical System Design [8 Periods]

Considerations, Component Choice, Multiplexing, Point-to- Point Links, System Considerations, Link Power Budget with Examples, Overall Fiber Dispersion in Multi-Mode and Single Mode Fibers, Rise Time Budget with Examples.

Transmission Distance, Line Coding in Optical Links, WDM, Necessity, Principles, Types of WDM, Measurement of Attenuation and Dispersion, Eye Pattern.

Text Books:

1. Gerd Keiser, "Optical Fiber Communications", TMH, 4th Edition, 2008.
2. John M. Senior, "Optical Fiber Communications", Pearson Education, 3rd Edition, 2009.

Reference Books:

1. K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Fiber "Optic Communications", PearsonEducation, 2005.

2. S. C. Gupta, Text Book on "Optical Fiber Communication and its Applications", PHI, 2005.
3. Govind P. Agarwal, John Wiley, "Fiber Optic Communication Systems", 3rd Edition, 2004.
4. Donald J. Sterling Jr, "Introduction to Fiber Optics", Cengage learning, 2004.
5. John Gowar, "Optical Communication Systems", PHI, 2nd Edition, 2001.

E-Resources:

1. http://www.optics.rochester.edu/users/gpa/opt428a.pdf
2. https://www.slac.stanford.edu/slac/sass/talks/opticalfiber.pdf
3. http://www.cse.wustl.edu/~jain/tutorials/ftp/t_3opt.pdf
4. http://nptel.ac.in/courses/117104127/
5. https://www.osapublishing.org/jocn/home.cfm
6. http://nptel.ac.in/courses/117104127/

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand significance of Optical communication and fundamental operating principles	Understand
CO2	Estimate the signal distortion phenomena by various parameters like losses and pulse broadening	Evaluate
CO3	Acquire knowledge on light sources and power launching techniques	Analyze
CO4	Acquire knowledge on structural features of receivers and its performance as well as error estimations	Understand
CO5	Differentiate various optical system components and get knowledge on link power budget and able to give measures for attenuation	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	2	1	2	1		2						3	3		2
CO2	2	1	1	3		3						2	3		2
CO3	1	1	2	3		3						2	3		2
CO4	1	1	2	2								3	3		2
CO5	2	1	3	2								3	3		2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0439	EMBEDDED REAL TIME OPERATING SYSTEMS *(Professional Elective-III)*	L	T	P
Credits: 3		3	-	-

Course Objectives:

- To learn the Concepts of Embedded Real Time Operating Systems.
- To understand the commonalities and differences in the operating systems available off the shelf.
- To gain the knowledge on shell programming and system level programming in Linux environment.
- To understand the architecture of RT Linux.
- To understand the process of creating a target image and gain knowledge of porting a real time operating system.

Module –I

Embedded/Real Time Operating System Concepts: Architecture of the Kernel, Task and Task Scheduler, Interrupt Service Routines, Semaphores,Mutex, Mailboxes, Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority Inversion Problem.

Module-II

Overview of Embedded/Real Time Operating Systems: Off-the-Shelf Operating Systems,EmbeddedOperating Systems,Real Time Operating Systems, Handheld Operating Systems.

Module – III

Programming in Linux: Overview of Unix/Linux, Features of Linux, Editors, Shell Programming, Shell Variables, System Programming.

Module – IV

Programming in RTLinux: Overview ofRTLinux, Core RTLinux,Program to Display a Message Periodically, Semaphore Management, MutexManagement Case Study.

Module – V

Embedded Systems Applications Using Intel(R) Strong ARM Platform: Architecture of Prayog, PrayogFeatures,Prayog Software,Prayog Block Diagram,Applications,Advanced Applications

Text Books:

1. Embedded /Real-Time Operating Systems –Dr.K.V.K.K.Prasad.

Reference Books:

1. Embedded Systems - Raj Kamal, MC GRAW HILL EDUCATION.
2. Embedded System Design - Frank Vahid, Tony Givargis, John Wiley.
3. Embedded Systems – Lyla, Pearson, 2013 4. An Embedded Software Primer - David E. Simon, Pearson Education2017, 3rd edition, reprint, McGraw Hill Education, India.
4. Steve Heath, Embedded Systems Design, 2013, 3rd edition, EDN Series, United States.
5. Jane W. S. Liu, Real time systems, 2013, reprint, Pearson Education, UK

Course Outcomes: After the completion of the course the students will be able to

Co-Po Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	2	-	-	-							-	3	-	-
CO2	3	-	-	3	-							2	-	-	3
CO3	3	2	3	3	3							-	-	3	-
CO4	2	-	-	-	3							-	2	2	-
CO5	2	3	3	2	3							3	-	3	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

COs	Description	Blooms Taxonomy Level
CO1	Able to Understand the Concepts of Embedded Real Time Operating Systems	Analyze
CO2	Understand the commonalities and differences in the operating systems available off the shelf.	Apply
CO3	Able to gain the knowledge on shell programming and system level programming in Linux environment.	Apply
CO4	Understand the architecture of RT Linux.	Apply
CO5	Understand the process of creating a target image and gain knowledge of porting a real time operating system.	Understand

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VI1 Semester		
Code: B0440	**Neural Networks and Fuzzy Logic** *(Professional Elective-III)*	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

PRE–REQUISITE: Control Systems, Power Systems, Mathematics, Physics.

COURSE OBJECTIVES: The objective of the course is to provide the student

- To introduce the students with the concepts of learning methods.
- To provide students with the artificial neural networks and their architecture.
- To familiarize the students with the various applications of artificial neural networks.
- To introduce the concepts of the fuzzy logic control and their real time applications.

UNIT-I Introduction to Neural Networks [8 periods]

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT-II Essentials of Artificial Neural Networks [10 periods]

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application Feed Forward Neural Networks Introduction.Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications**.**

UNIT-III Multilayer Feed forward Neural Networks [10 periods]

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. Associative Memories, Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory (Associative Matrix, Association Rules, Hamming Distance, The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network.

UNIT-IV Self-Organizing Maps (SOM) and Adaptive Resonance Theory (ART) [8periods]

Introduction, Competitive Learning, Vector Quantization, Self-Organized Learning Networks, Kohonen Networks, Training Algorithms, Linear Vector Quantization, Stability-Plasticity Dilemma, Feed forward competition, Feedback Competition.

UNIT-V Classical and Fuzzy Sets and Fuzzy Logic System Components [10periods]

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Applications Neural network applications: Process identification, Function Approximation, control and Process Monitoring, fault diagnosis and load forecasting.Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOKS

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and G.A.VijayalakshmiPai – PHI Publication.

REFERENCE BOOKS

1. Introduction to Artificial Neural Systems - Jacek M. Zuarda, Jaico Publishing House, 1997.
2. Neural Engineering by C.Eliasmith and CH.Anderson, PHI
3. Neural Networks and Fuzzy Logic System by Bork Kosko, PHI Publications

COURSE OUTCOMES: At the end of the course the student will be able to

CO No.	Description	Bloom Taxonomy level
CO1	Define the advances in neural networks, Evaluate the design and control of fuzzy systems.	Understanding
CO2	Articulate the applications of fuzzy control block sets.	Analyze
CO3	Evaluate the design of various models in neural networks	Evaluate
CO4	To analyze the techniques of various types of neural networks	Analyze
CO5	Evaluate the design and control of associative memories, Techniques to Design fuzzy logic system	Evaluate

CO-PO MAPPING:

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	Program Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	1	1			1	2	2	2	3	3
CO2	3	2	3	3	3	2	1				1	2	1	2	3
CO3	3	3	3	3	3						1	3	2	3	3
CO4	3	3	3	3	3						1	3	2	3	3
CO5	3	3	3	3	3	1	1			2	2	3	2	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0441	**SMART ANTENNAS**	**L**	**T**	**P**
Credits: 3	*(Professional Elective-IV)*	**3**	**-**	**-**

Pre-Requisites: Antennas and wave propagation

Course Objectives:

- To introduce the theory of smart antennas.
- To familiarize the basic concepts of DOA estimation
- To learn different adaptive algorithms for beam formation
- To learn integration and simulation techniques
- To learn the fundamental of space time processing

MODULE I: Introduction to Smart Antennas [8 Periods]

Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Accesses (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects.

MODULE II: DOA Estimation Fundamentals [10 Periods]

Introduction, The Array Response Vector, Received Signal Model, The Subspace-Based Data Model, Signal Auto covariance Matrices ,Conventional DOA Estimation Methods, Conventional Beam forming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation ,The MUSIC Algorithm, The ESPRIT Algorithm, Uniqueness of DOA Estimates.

MODULE III: Beam forming Fundamentals [10 Periods]

The Classical Beam former-Statistically Optimum Beam forming Weight Vectors, The Maximum SNR Beam former, The Multiple Side lobe Canceller and the Maximum, SINR Beam former-Minimum Mean Square Error (MMSE),Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV) , Adaptive Algorithms for Beam forming ,The Least Mean-Square (LMS) Algorithm, The Recursive Least-Squares (RLS) Algorithm.

MODULE IV: Integration and Simulation of Smart Antennas [10 Periods]

Overview, Antenna Design, Mutual Coupling, Adaptive Signal Processing Algorithms, DOA, Adaptive Beam forming, Beam forming and Diversity Combining for Rayleigh-Fading, Channel, Trellis-Coded Modulation (TCM) for Adaptive Arrays, Smart Antenna Systems for Mobile Adhoc Networks (MANETs), Protocol, Simulations, Discussion.

MODULE V: Space–Time Processing [10 Periods]

Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beam forming, Inter symbol and Co-Channel Suppression, ISI Suppression, CCI Suppression, Joint ISI and CCI Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Single-User Data Rate Limits, Multiple-Users Data Rate Limits, Data Rate Limits Within a Cellular System, MIMO in Wireless Local Area Networks.

Text Books:

1. Constantine A. Balanis & Panayiotis I. Ioannides, "Introduction to Smart Antennas", Morgan & Claypool Publishers' series-2007
2. Joseph C. Liberti Jr., Theodore S Rappaport, "Smart Antennas for Wireless Communications IS-95 and Third Generation CDMA Applications", PTR – PH publishers, 1st Edition, 1989.
3. Ahmed El Zooghby, Smart Antenna Engineering, Artech House

Reference Books:

1. T.S Rappaport, "Smart Antennas Adaptive Arrays Algorithms and WirelessPosition Location", IEEE press 1998, PTR – PH publishers 1999.
2. Lal Chand Godara, "Smart Antennas", CRC Press, LLC-20

E-Resources:

1. https://nptel.ac.in/courses/117/107/117107035/
2. https://en.wikipedia.org/wiki/Smart_antenna
3. https://www.youtube.com/watch?v=l407WVsfiW8&t=5s

Course Outcomes:

At the end of the course, students will be able to

CO	Description	Blooms Taxonomy level
CO1	Understand the fundamentals of smart antennas	Understand
CO2	Understand the fundamentals of DOA and it's estimation methods	Understand
CO3	Analyze various adaptive beam forming algorithms	Analyze
CO4	Apply the concepts in integration and simulation of smart antenna	Apply
CO5	Analyzing the space time processing techniques for smart antennas	Analyze

CO-PO-PSO's mapping:

CO	Program Outcomes												PSO	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	3	3	1	1	1	1	1	1		1		3	3	3
CO2	3	3	1	1	1	1	1	1		1		3	3	2
CO3	3	3	2	2	1	1	1	1		1		2	2	1
CO4	3	3	2	1	2	1	1	1		1		2	1	1
CO5	2	3	1	1	1	1	1	1		1		2	1	1

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0442	**Introduction to Machine Learning** *(Professional Elective-IV)*	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Pre-Requisites: Probability Theory and Stochastic Processes, Engineering Mathematics

Course Objectives: This course covers a wide variety of topics in machine learning. The primary goal is for students to gain a deep understanding of the concepts, techniques, and mathematical frameworks used by experts in machine learning.

MODULE I: Introduction to Machine Learning [9 Periods]

Introduction to Artificial Intelligence and Machine Learning, Machine Learning Techniques, Examples of ML Applications, Learning associations - Apriori Algorithm, Data Preprocessing.

MODULE II: Supervised Learning [10 Periods]

Regression: Linear Regression, Logistic Regression, Regularization, SVM, Maximum Marginal classifier, kernels, Introduction to a decision tree, random forests, and Boosting.

Classification: Naïve Bayes, Evaluating a Classification model- Cross-Entropy Loss, Confusion Matrix, Classification errors.

MODULE III: Unsupervised learning [10 Periods]

A: Introduction to-Clustering, K-means, Expectation Maximization-EM, Hierarchical Clustering, other forms of clustering.

B: Mixture of Gaussians-Factor analysis- PCA (Principal components analysis)-ICA (Independent components analysis)

MODULE IV:Semi-Supervised learning [10 Periods]

Types of SSL (introduction only), Generative Model- Generative Model for Text, Low Density Separation- Transductive SVM, Self-training, Co-training, Graph-Based Methods, Large Scale Algorithms, Risks of semi-supervised learning.

MODULE V: Reinforcement Learning and Control [10Periods]

MDPs, Bellman equations- Value iteration and policy iteration- Linear quadratic regulation (LQR) LQG- Q-learning- Value function approximation. Current problems in machine learning.

Text Books:

1. EthemAlpaydin, "Introduction to Machine Learning", 3rd Edition, MIT Press,2014.
2. Chapelle, Olivier, Bernhard, Zien Alexander "Semi-supervised learning" Cambridge, MIT Press 2006.

Reference Books:

1. MacKay, David. Information Theory, Inference, and Learning Algorithms. Cambridge, UK: Cambridge University Press, 2003.
2. Tom M. Mitchell. "Machine Learning" McGraw-Hill, 1997.

E-Resources:

1. https://onlinecourses.nptel.ac.in/noc17_cs26/
2. https://www.springer.com/computer/ai/journal/10994.
3. https://mitpress.mit.edu/books/fundamentals-machine-learning-predictive-data-analytics.

4. https://www.javatpoint.com/machine-learning.

Course Outcomes: At the end of the course, students will be able to

COs	**Description**	**Blooms Taxonomy level**
CO1	Develop competence in the understanding of machine learning techniques and explore types of ML techniques and applications.	Understand
CO2	Describes the various regression and classification techniques to solve supervised learning problems.	Apply
CO3	Associate the basic concepts of unsupervised learning and explore fundamental techniques.	Analyze
CO4	Understanding of various semi-supervised learning algorithms.	Understand
CO5	Defines major concepts of reinforcement learning and their applications	Analyze

CO-PO Mapping:

CO	**Program Outcomes**												**PSO**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	3	1	1	1		1						3	3	1	
CO2	3	3	2	3		1						3	3	2	
CO3	3	3	2	3		1						3	3	2	
CO4	3	3	2	3		1						3	3	2	
CO5	3	3	2	3		1						3	3	2	

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0443	**5G Communications** *(Professional Elective-IV)*	**L**	**T**	**P**
Credits: 3		**3**	**-**	**-**

Pre-requisite: Knowledge of Mobile Cellular Communication

Course Objectives: This course aims to:

- Understand the requirements & concepts of 5G.
- Expose the architecture and radio access technologies of 5G.
- Learn Massive MIMO concepts.

Unit-I Overview of 5G [8 Periods]

Introduction , Historical trends of Wireless Communications , Evolution of LTE Technology to beyond 4G , 5G Road map , 10 pillars of 5G, 5G in Europe, 5G in North America, 5G in Asia , 5G Architecture

Unit- II The 5G Internet [10 Periods]

Introduction , Internet of Things and Context Awareness , Networking Reconfiguration and Virtualization support, Mobility , Quality of Service Control , Emerging Approach for Resource Over Provisioning

Unit-III Small Cells for 5G Mobile Networks and Mobile Clouds [8Periods]

Introduction , What are small cells ? , Mobile Data Demand , Demand Vs Capacity, Small Cell Challenges . The Mobile Cloud : User Resources , Software Resources , Hardware Resources , Networking Resources , Mobile Cloud Enablers

Unit - IV Cognitive Radio for 5G Wireless Network [10Periods]

Introduction , Overview of Cognitive Radio Technology in 5G Wireless , Spectrum Optimization using Cognitive Radio, Relevant Spectrum Optimization Literature in 5G, Cognitive Radio and Carrier Aggregation, Energy Efficient Cognitive Radio Technology , Key Requirements and Challenges for 5G Cognitive Terminals

Unit-V Massive Multiple-Input Multiple-Output (MIMO) Systems [8 Periods]

Introduction, Theoretical background: single user and multi-user MIMO, capacity of massive MIMO, Resource allocation and transceiver algorithms for massive MIMO, Fundamentals of baseband and RF implementations in massive MIMO

Text Books:

1. Wei Xiang, Kan Zheng, Xuemin (Sherman) Shen, "5G Mobile Communications", Springer publications-2016.

2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, "5G Mobile and Wireless Communications Technology"Cambridge University Press-2016.

References:

2. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks" first edition, John Wiley & Sons, 2015.

3. Saad Z. Asif, "5G Mobile Communications Concepts and Technologies" CRC Press, 2019.

4. Angeliki Alexiou, "5G Wireless Technologies", IET Publications, 2017.

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

Course Outcome	Description	Blooms Level
CO 1	Recall the requirements and used cases of 5G technology.	Understand
CO 2	Illustrate the architecture of 5G.	Understand
CO 3	Apply the 5G concepts to D2D communications	Apply
CO 4	Compare various Radio-Access Technologies.	Analyze
CO 5	Explain the concept of massive MIMO.	Understand

CO- PO Mapping:

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	**Program Outcomes(POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	3	2								3	1	1
CO2	3	2	1	2	2								3	1	1
CO3	3	2	2	3	3		1	1		1	1	1	3	2	3
CO4	3	3	2	3	3		1	1		3	1	1	3	2	3
CO5	3	3	2	3	3	1	1	1		2	1	1	3	2	3

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0444	SYSTEM ON CHIP ARCHITECTURE *(Professional Elective-V)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Computer Architecture, Digital circuits and Embedded Systems.

Course Objectives: This course introduces

- Computer system design with emphasis on fundamental ideas,
- Analytical techniques & architectures,
- Hardware and software programmability Vs performance,

MODULE I: Introduction to the System Approach [8 Periods]

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, an approach for SOC Design, System Architecture and Complexity.

MODULE II: Processors [10 Periods]

Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling. Buffers: minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors.

MODULE III: Memory Design for SOC [10 Periods]

A. Overview of SOC external memory, Internal Memory, Size, Scratchpads and Cache memory, Cache Organization, Cache data, Write Policies, Strategies for line replacement at miss time,

B. Types of Cache, Split – I, and D – Caches, Multilevel Caches, Virtual to real translation, SOC Memory System, Models of Simple Processor – memory interaction.

MODULE IV: Interconnects Customization and Configuration [12 Periods]

Inter Connect Architectures, Bus: Basic Architectures, SOC Standard Buses , Analytic Bus Models, Using the Bus model, Effects of Bus transactions and contention time. SOC Customization: An overview, Customizing Instruction Processor, Reconfiguration Technologies, Mapping design onto Reconfigurable devices, Instance- Specific design, Customizable Soft Processor, Reconfiguration - overhead analysis and trade-off analysis on reconfigurable Parallelism.

MODULE V: Application Studies / Case Studies [8 Periods]

SOC Design approach, AES algorithms, Design and Evaluation, Image compression – JPEG compression.

Text Books:

1. Michael J. Flynn and Wayne Luk, "Computer System Design System on Chip", Wiely India Pvt. Ltd., 2012.

Reference Books:

1. Steve Furber, "ARM System on Chip Architecture", Addison Wesley Professional, 2nd Edition, 2000.
2. Ricardo Reis, "Design of System on a Chip: Devices and Components", Springer, 1st Edition, 2004.

E-Resources:

1. https://ieeexplore.ieee.org/document/1652898/
2. https://ieeexplore.ieee.org/document/5196691
3. https://dl.acm.org/citation.cfm?id=557024
4. https://nptel.ac.in/courses/108102045/10
5. https://freevideolectures.com/course/2341/embedded-systems/10

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand how the system forms with the lot of component and has majority about system level interconnections.	Understand
CO2	Analyze hardware and software programmability versus performance	Analyze
CO3	Understand about entire memory organization, starch pads, cache memories and objective in cache data how to deal the write polices.	Understand
CO4	Interpret sequential language and concurrent language.	Understand
CO5	Understand different algorithms used for Image compression.	Understand

CO-PO-PSO's mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	2	3	2	2								1	2	3	3
CO2	1	3	1										2	3	2
CO3		2	3	3								2	2		3
CO4	1	3											1	3	2
CO5	2		2									3	3		3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VII Sem		
Code: B0445	ADVANCE DIGITAL SYSTEM DESIGN	L	T	P
Credits: 3		3	-	-

PREREQUISITES: VLSI and STLD

OBJECTIVE: To impart knowledge on the theory of Sequential machines and minimization of it. to design digital circuits for various applications. Thorough understanding of VHDL and modeling of digital systems using VHDL

MODULE – I : Minimization And Transformation Of Sequential Machines

[8 Periods]

The Finite State Model – Capabilities and limitations of FSM – State equivalence and machine minimization – Simplification of incompletely specified machines.
Fundamental mode model – Flow table – State reduction – Minimal closed covers – Races, Cycles and Hazards.

MODULE – II : Digital Design [9 Periods]

Digital Design Using ROMs, PALs and PLAs, BCD Adder, 32 – bit adder, State graphs for control circuits, Scoreboard and Controller, A shift and add multiplier, Array multiplier, Keypad Scanner, Binary divider.

MODULE – III: SM Charts [7 Periods]

State machine charts, Derivation of SM Charts, Realization of SM Chart, Implementation of Binary Multiplier, dice game controller.

MODULE – IV: Hardware Description Language [9 Periods]

Review of Verilog HDL, Modelling styles: Behavioural, Dataflow, and Structural Modelling, gate delays, switch-level Modelling, Hierarchal structural modelling, Design environment and constraints logic synthesizers, Language structure synthesis, coding guidelines for clocks and reset.

MODULE – V: Verification [8 Periods]

Functional verification, simulation types, Test Bench design, Dynamic timing analysis, static timing analysis. Design Examples-Adders and Subtractors, Multiplication and Division Algorithms, ALU.

TEXT BOOKS:

1. Charles H. Roth, **Fundamentals of Logic Design, Cengage** Learning,5th Ed.
2. Ming-Bo Lin., **Digital System Designs and Practices Using Verilog HDL and FPGAs,** Wiley, 2008.
3. J.Bhasker, **Verilog HDL Primer Hardcover,** 2nd Edition, Star Galaxy Publishing ,1999

REFERENCE BOOKS:

1. Michael D. Ciletti, **Advanced Digital Design with the Verilog HDL**", PHI, 2005.
2. Samir Palnitkar, "**Verilog HDL: A Guide to Digital Design and Synthesis**", Pearson Education, 2005.
3. John F Wakerley**, Digital Design Principles and Practice** ,4th Edition, Pearson education, 2006

COURSE OUTCOMES:

1. To expose the students to the fundamentals of sequential system design.
2. To enable the students to formulate and solve problems in Digital Systems design and implementation.
3. To develop Digital Systems design skills.
4. To make the students technically competent in design and implementation using VHDL

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VII Sem		
Code:	OPEN ELECTIVE-III	L	T	P
Credits: 3		3	-	-

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0446	DIGITAL IMAGE PROCESSING LAB	L	T	P
Credits: 1.5		-	-	3

Objectives: To learn programming for various digital Image processing concepts.

List of Programs:

1. Write program to read, display, resize and perform various conversions on digitalimage.
   a. Read and display image
   b. Resize given image
   c. Convert given color image into gray-scale image
   d. Convert given color/gray-scale image into black & white image
   e. Generation of histogram of a given gray-scale image
   f. Separate color image in three R G & B planes
   g. Create color image using R, G and B three separate planes
2. To write and execute image processing programs using point processing method.
   a. Obtain Negative image
   b. Obtain Flip image
   c. Thresholding
   d. Contrast stretching
3. To write and execute programs for image arithmetic operations.
   a. Addition of two images
   b. Subtract one image from other image
   c. Calculate mean value of image
   d. Different Brightness by changing mean value
4. To write and execute programs for image logical operations.
   a. AND operation between two images
   b. OR operation between two images
   c. Calculate intersection of two images
5. To write a program for histogram calculation and equalization.
6. To write and execute programs for any two Image transforms.
7. To write and execute programs to remove noise using spatial filters.
   a. Understand 1-D and 2-D convolution process
   b. Use 3x3 Mask for low pass filter and high pass filter
8. To write and execute programs for image frequency domain filtering.
   a. Apply FFT on given image
   b. Perform low pass and high pass filtering in frequency domain
   c. Apply IFFT to reconstruct image
9. To write a program for edge detection using different edge detection mask.
10. To write a program for morphological Image processing operations
    Dilation
    Erosion
    Opening
    Closing
11. To write and execute program for converting from RGB to HSI.
12. Image compression Using Discrete Cosine Transform

Software Required:

1. Computers with MATLAB / OCTAVE/ Equivalent Software

Note: The programs shall be implemented in software (Using MATLAB / Lab view / C programming / OCTAVE Equivalent).

Course Outcomes: After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy
CO1	Identify the various operations of image processing	Apply
CO2	Demonstrate the program with syntax and framing ofprocedure	Analyze
CO3	Examine the observation made by execution of writtenprogram	Analyze
CO4	Illustrate the results with neat sketches	Understand
CO5	Understand the concepts of transforms and filter designtechniques, by attempting the quiz or viva.	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	2	3						2			2	3	3	2
CO2	3	2	3			3	2		2			3	3	3	2
CO3	3	2	3				2		2			3	3	3	2
CO4	3	2	3			2			2			3	3	3	2
CO5	3	2	3			2	1					2	3	3	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None :

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VII Semester		
Code: B0447	IoT architecture and its Applications Lab	L	T	P
Credits: 1.5		-	-	3

Objectives: To learn programming for various IoT related concepts.

List of Programs:

1. Demonstrate Arduino Uno, Node MCU and Raspberry Pi.
2. Write a program to turn ON/OFF built-in LED, external LED and traffic light system using arduino.
3. Write a program to control the brightness of an LED using Arduino.
4. Perform Experiment using Arduino Uno to measure the distance of any object using Ultrasonic Sensor.
5. Perform experiment using Arduino to learn the working of Servo Motor.
6. Interface DHT sensor with Arduino and write a program to print temperature and humidity readings in serial monitor.
7. ON/OFF Control Based On Light Intensity: Using the light sensors, monitor the surrounding light intensity & automatically turn ON/OFF the high intensity LED's by taking some pre-defined threshold light intensity value.
8. Write an Arduino sketch to
   i. Blink an LED and a buzzer if the distance measured is less than a threshold value
   ii. Illustrate the working of PIR Sensor with an example.
   iii. Illustrate the IR and DHT Sensor.
9. To interface DHT sensor with Node MCU and write a program to print temperature and humidity readings on web page.
10. Controlling LED with python programming using Raspberry Pi and Interfacing Led and switch with python programming using Raspberry Pi.
11. Write a python program for pub/sub communication using mqtt application layer protocol.
12. OPEN Ended problem: Students are required to submit an IOT based project using the Microcontroller or a Raspberry Pi and connecting various sensors and actuators. The data for the same should be displayed via a webpage or a web app.

Course Outcomes: After successful completion of this course, student will be able to

CO	Description	Blooms Level
CO 1	Understand general concepts of Internet of Things (IoT).	Understand
CO 2	Apply design concept to IoT solutions.	Apply
CO 3	Analyze various M2M and IoT architectures.	Analyze
CO 4	Evaluate design issues in IoT applications.	Evaluate
CO 5	Create IoT solutions using sensors, actuators and Devices	Create

Co-Po mapping:

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2									3	3	2
CO2	3	3	3	3									3	2	1
CO3	3	3	3	2									3	2	2
Co4	2	1	2	1									2	1	3
Co5	1	2	1	3									1	2	3

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VII Semester		
Code:B00P1	INTERNSHIP/MINI PROJECT	L	T	P
Credits: 2		-	-	4

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0448	Computer Vision and Pattern Recognition *(Professional Elective V)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Digital Image Processing, Deep Learning

Course Objectives:

The objective of this course is to

1. Understand the basics of image formation models.
2. Describes the major concepts and techniques in computer vision.
3. Explains the elementary notions in pattern recognition.
4. Demonstrate computer vision and pattern recognition knowledge by designing and implementing algorithms to solve practical problems
5. Understand current research in the fields and apply them properly using modern computing tools such as Matlab, python etc..

MODULE I: Image Formation Models [10 Periods]

Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading, Photometric Stereo, Depth from Defocus, Construction of 3D model from images.

MODULE II: Introduction to computer vision [10Periods]

Image Processing, Computer Vision and Computer Graphics,What is Computer Vision - Low-level, Mid-level, High-level, Video Processing: video filtering, video compression, video coding standards, Motion detection and tracking.

MODULE III: Pattern Recognition [8 Periods]

Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches.

MODULE IV: Convention computer vision and pattern recognition algorithms[10 Periods]

Object detection and segmentation: Edge, texture, region, detection of sliding windows, Feature extraction, linear binary pattern, principal component analysis, Gabor filters, bags of features, Matching and recognition, Bayesian classifier, support vector machine, fusion.

MODULE V: Deep learning for computer vision and pattern recognition [11Periods]

Key components and basic architecture of deep neural network, Overview of Diverse Computer Vision Applications: Document Image Analysis, Medical Image Analysis, Content-Based Image Retrieval, Multimedia, Virtual Reality and Augmented Reality.

Text Books:

1. Digital Image Processing – Ganzalez and Wood, Addison Wesley, 1993.
2. Pattern Classification – R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006.
3. Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
4. Introductory Techniques for 3D Computer Vision, by E. Trucco and A. Verri, Publisher: Prentice Hall.
5. Pattern Recognition and Machine Learning – C. M. Bishop, Springer, 2009.

Reference Books:

1. Digital Picture Processing – Rosenfeld and Kak, vol.I & vol.II, Academic,1982

2. Computer Vision – Ballard and Brown, Prentice Hall, 1982
3. An Introduction to Digital Image Processing – Wayne Niblack, Prentice Hall, 1986
4. Pattern Recognition – S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009.

E-Resources:

1. https://www.javatpoint.com/digital-image-processing-tutorial
2. https://onlinecourses.nptel.ac.in/noc21_ee23
3. https://onlinecourses.nptel.ac.in/noc20_cs88
4. https://www.tutorialspoint.com/biometrics/pattern_recognition_and_biometrics.html

Course Outcomes:

At the end of the course, students will be able to

Course Outcomes:

At the end of the course, students will be able to

CO	Description	Blooms Taxonomy level
CO1	Understand the basic concepts of image formation models	Understand
CO2	Develop competence in the understanding of computer vision and explore fundamental image processing techniques required for computer vision	Understand
CO3	Associate the basic concepts of pattern recognition and explain different feature types and classification techniques	Analyze
CO4	Describes basic components of computer vision and pattern recognition algorithms	Apply
CO5	Design and develop a computer vision and pattern recognition application prototype	Analyze

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0449	TEST AND TESTABILITY *(Professional Elective V)*	L	T	P
Credits: 3		3	-	-

Prerequisite: Switching Theory and Logic Design, Digital System Design with PLDS

Course Objectives:

- To provide or broad understanding of fault diagnosis.
- To illustrate the framework of test pattern generation.
- To understand design for testability in Digital Design

MODULE-I [10 Periods]

Need for testing, the problems in digital Design testing, the problems in Analog Design testing, the problems in mixed analog/digital design testing, design for test, printed-circuit board (PCB) testing, software testing,

Fault in Digital Circuits:

General Introduction, Controllability and Observability, Fault Models, stuck at faults, bridging faults, CMOS technology considerations, intermittent faults**.**

MODULE – II [8 Periods]

General Introduction, to test pattern genration, Test Pattern generation for combinational logic circuits, Manual test pattern generation, automatic test pattern generation, boolen difference method, Roth's D- algoritham, Developments following Roth's D-algoritham, Pseudorandom test pattern generation.

MODULE – III [8 Periods]

Pseudorandorn test pattern generators, Design of test pattern generator usingLinear feedback shift registers (LFSRs) and cellular automata(CAs).

MODULE – IV [8 Periods]

Design for Testability for combinational circuits: Basic Concepts of testability, controllability and observability, the Reed Muller's expansion techniques, use of control logic and syndrome testable designs**.**

MODULE – V [10 Periods]

Making sequential circuits testable, testability insertion, full scan DFT technique-Full scan insertion, flip- flop structures, Full scan design and test, scan architectures-full scan design, shadow register DFT, partial scan methods, multiple scan design, other scan designs

TEXT BOOKS

1. Fault Tolerant and Fault Testable Hardware Design-Parag K. Lala, 1984, PHI.
2. VLSI Testing digital and Mixed analogue/digital techniques- Stanley L. Hurst, IEE Circuits, Devices and Systems series 9, 1998.

REFERENCE BOOKS

1. Digital Systems Testing and Testable Design-Miron Abramovici, Melvin A. Breuer and Arthur D. Friedman, Jaico Books
2. Esstentials of Electronic Testing-Bushnell and Vishwani D.Agarwal, Springers.
3. Design for test for Digital IC's and Embedded Core Systems-Alfred L. Crouch, 2008, Pearson Education.

Course Outcomes: On completion of this course the student will be able to

CO No.	Description	Bloom Taxonomy level
CO1	Apply the concepts in testing which can help them design a better yield in IC design	Apply
CO2	Analyze the problems associated with testing of semiconductor circuits at earlier design levels so as to significantly reduce the testing costs.	Analyze
CO3	Analyze the various test generation methods for static & dynamic CMOS circuits.	Analyze
CO4	Identify the design for testability methods for combinational & sequential CMOS circuits.	Understanding
CO5	Recognize the BIST techniques for improving testability.	Apply

CO-PO Mapping:

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

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0450	SATELLITE COMMUNICATIONS *(Professional Elective V)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Analog & Digital Communications.

Course Objectives:

- To prepare students to excel in basic knowledge of satellite communication principles
- To know link design of satellite with design examples multiple access systems

MODULE -I: [10 Periods]

Communication Satellite: Orbit and Description: A Brief history of satellite Communication, Satellite Frequency Bands, Satellite Systems, Applications, Kepler's Laws, Newton's law, Orbital Period and Velocity, effects of Orbital Inclination, station keeping, geo stationary and non-Geo-stationary orbits, Azimuth and Elevation, Coverage angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit, Launching Procedures - launch vehicles and propulsion.

MODULE -II: [10 Periods]

Satellite Sub-Systems: Attitude and Orbit Control system, Thermal control and Propulsion, communication Payload and supporting subsystems, TT&C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment.

Satellite Link: Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use), Link Budget, system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System reliability and design lifetime.

MODULE -III: [10 Periods]

Propagation Effects: Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionosphere Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference, System noise – Antenna noise – Amplifier noise temperature – Amplifiers in cascade – Noise factor – Noise temperature of absorptive networks – Overall system noise temperature.

Multiple Access: Frequency Division Multiple Access (FDMA) – Inter modulation, Calculation of C/N, Time Division Multiple Access (TDMA) - Frame Structure, Burst Structure, Satellite Switched TDMA, On-board Processing, Demand Assignment Multiple Access (DAMA) – Types of Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.

MODULE -IV: [10 Periods]

Earth Station Technology: Transmitters, Receivers, Antennas, Tracking Systems, Terrestrial Interface, Power Test Methods, Lower Orbit Considerations.

Satellite Navigation and Global Positioning Systems: Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers, GPS C/A Code Accuracy, Differential GPS.

MODULE V: [8 Periods]

Satellite Packet Communications: Message Transmission by FDMA: M/G/1 Queue, Message Transmission by TDMA, PURE ALOHA-Satellite Packet Switching, Slotted Aloha, Packet Reservation, Tree Algorithm. Progress of Indian Satellite Communication

Text Books:

1. Timothy Pratt, Charles Bostian, Jeremy Allnutt, "Satellite Communications"2ndEdition, 2003, John Wiley & Sons.
2. Wilbur, L. Pritchand, Robert A. Nelson and Heuri G. Suyderhoud, "Satellite Communications Engineering" 2nd Ed., Pearson Publications.
3. Tri.T.Ha, "Digital Satellite Communications" 2nd Edition, 1990, McGrawHill.

Reference Books:

2. Dennis Roddy, "Satellite Communications" 2nd Edition, 1996, McGraw Hill.
3. Design Principles – M. Richcharia, "Satellite Communications"2nd Ed., BSP,2003.
4. N. Raja Rao, "Fundamentals of Satellite Communications"PHI, 2004.

E-Resources:

- https://books.google.co.in/books/about/Satellite_Communication.html?id
- https://www.springer.com/gp/book/9781461419938
- https://onlinecourses.nptel.ac.in/noc17_ec14
- https://nptel.ac.in/courses/106105082/33
- https://nptel.ac.in/courses/106105081/18

Course Outcomes: After the completion of the course the students will be able to

COs	Description	Blooms Taxonomy Level
CO1	Understand the historical background, basic concepts and frequency allocations for satellite communication	Understand
CO2	Understand the orbital mechanics, launch vehicles and launchers	Understand
CO3	Understand the design of satellite links for specified C/Nwith system design examples.	Understand
CO4	Analyze satellite sub systems like Telemetry, tracking, command and monitoring power systems etc.	Analyze
CO5	Understand the various multiple access systems for satellite communication systems and satellite packet communications.	Understand

CO-PO Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	2	-	-	-	-	1	-	-	-	-	1	3	-	-
CO2	3	3	2	1	-	-	1	-	-	-	-	2	3	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	2	2	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0451	DEEP LEARNING *(Professional Elective V)*	L	T	P
Credits: 3		3	-	-

Prerequisite: Fundamentals of Machine Learning, Artificial Intelligence

Course Objectives: This course aims to

- Introduce major deep learning algorithms, the problem settings, and
- Applications to solve real world problems.

MODULE 1

Introduction to Deep Learning: What is Deep Learning, History and revolution of Deep Learning, Perspectives and Issues in deep learning framework, Applications and Limitations of deep learning, Math behind deep Learning: Gradient Descent, maximum likelihood, Classification of deep neural networks.

MODULE 2

Artificial Neural Networks: Introduction to Perceptrons, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Neural Network Architecture, Activation functions, Feed forward Neural Networks, Vectorized feed forward Algorithm, Back propagation, sigmoid back propagation, Thresholding, cost function.

MODULE 3

Convolutional Neural Networks: Building blocks of CNNs, Architectures, CNN models, convolution / pooling layers, feature maps, Padding, Strided convolutions, Convolutions over volumes, Softmax regression, Deep Learning frameworks, Transfer learning, Multi-task learning, end-to-end deep learning.

MODULE 4

Recurrent Neural Networks: Recurrent Neural Network Architecture, feeding sequences to RNN, Vanishing gradients with RNNs, Gated Recurrent Unit (GRU): Structure, characteristic and Network, LSTM (long short term memory): Structure, characteristic and Network, Encoder Decoder architectures.

MODULE 5

Other variants of RNN and Applications of Deep Learning: Auto encoders, Variational Auto encoders, Adversarial Generative Networks, Radial Basis Function Networks, Self Organizing Maps, Deep Belief Networks, Deep Boltzmann Machine.

Applications: Image segmentation, object detection, automatic image captioning.

References:

1. Bengio, Yoshua, Ian J. Goodfellow, and Aaron Courville. "Deep Learning." An MIT Press book in preparation. (2015).
2. Fundamentals of Deep Learning: Designing Next-generation Machine Intelligence Algorithms by Nicholas Locascio and Nikhil Buduma O'Reilly Media; 1 edition (June 29,
3. 2017)
4. Deep Learning: A Practitioner's Approach by Adam Gibson and Josh Patterson Shroff/O'Reilly; First edition (2017)
5. Python Deep Learning by Daniel Slater and Gianmario Spacagna, Packt Publishing; 2/e (January 16, 2019)
6. Hochreiter, Sepp, and Jargen Schmidhuber. "Long short-term memory." Neural computation 9.8 (1997): 17351780.
7. Bishop, C., M., Pattern Recognition and Machine Learning, Springer, 2006.
8. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
9. https://www.javatpoint.com/deep-learning-algorithms

Course Outcomes: After successful completion of this course, student will be able to

Course Outcome	Description	Blooms Level
CO 1	Identify the issues in deep learning Framework and learning the math behind deep learning.	Understand
CO 2	Examine the significant features of neural networks.	Create
CO 3	Explore the architecture of various neural networks.	Evaluate
CO 4	Analyze the strategy for Recurrent Neural Networks	Analyze
CO 5	Elaborate the various deep learning applications	Understand

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	2								3	3	3	
CO2	3	3	3	2								3	3	3	
CO3	3	3	2	3								3	3	3	
CO4	3	3	3	2								3	3	3	
CO5	3	2	2	1		2				1	1	3	3	2	

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0452	OPTICAL NETWORKS *(Professional Elective V)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Nil

Course Objectives: This course aims

- To understand the optical networks, optical amplifiers and multiplexers.
- To impart the knowledge of client layers of optical layer, WDM network design and access network.

MODULE I: Introduction to Optical Network [8 Periods]

Introduction to Optical Network: Services, Circuit switching, Packet switching, Optical networks, Optical layer, Transparency and all optical networks, Optical packet switching, Transmission basics, Network evolution.

MODULE II: Optical Amplifiers [9 Periods]

Optical Amplifiers: Emission, Spontaneous emission, Erbium doped fiber amplifiers, Raman amplifiers, Semiconductor optical amplifiers, Cross talk in SOAs;

MODULE III: Multiplexers and Filters to Wavelength Converters [12 Periods]

Multiplexers and Filters to Wavelength Converters: Gratings, Diffraction pattern, Bragg gratings, Fiber gratings, Fabry–Perot filters, Multilayer dielectric thin-film filters, Mach–Zehnder interferometers, Arrayed waveguide grating, Acousto–optic tunable filter, High channel count multiplexer architectures, Optoelectronics approach, Optical gating, Interferometric techniques, Wave mixing;

MODULE IV: Transmission System and Client Layers [10 Periods]

Transmission System Engineering: System model, Power penalty, Transmitter, Receiver, Optical amplifiers, Cross talk, Dispersion, Fiber nonlinearities, Wavelength stabilization design of Soliton systems, Client Layers of the Optical Layer: SONET/SDH, ATM, IP, Storage area networks, Gigabit and 10–Gigabit Ethernet;

MODULE V: WDM Network Elements & Design [10 Periods]

Optical line terminals, Optical line amplifiers, Optical add/drop multiplexers, Optical cross connects, Cost trade–offs: A detailed ring network example, LTD and RWA problems, Dimensioning wavelength–routing networks, Statistical dimensioning models, Maximum load dimensioning models;

Access Networks: Network architecture overview, Enhanced HFC, Fiber to the Curb (FTTC).

Text Books:

1. Optical Networks: A Practical Perspective by R. Ramaswami, K. Sivarajan and G. Sasaki, Morgan Kaufmann Publication.
2. Fiber-Optic Communication Systems by G. P. Agarwal, John Wiley & Sons, New York.

Reference Books:

1. Optical Communications: Components and Systems by J. H. Franz and V. K. Jain, Narosa Publications.

2. Optical Fiber Communication by G. Keiser, McGraw Hill Education.

E-Resources:

1. https://www.technologyreview.com/2002/01/22/235271/overview-of-optical-networking/
2. https://circuitglobe.com/optical-network.html
3. https://nptel.ac.in/courses/108106167
4. https://www.smartoptics.com/this-is-wdm/the-basics-of-wavelength-division-multiplexing-wdm/

Course Outcomes: After successful completion of the course , students will be able to

CO Nos.	Description	Bloom Taxonomy
CO1	Understand the basics of optical network, optical network and optical packet switching	Understand
CO2	Analyze the different types optical amplifier.	Analyze
CO3	Understand the multiplexer and filters to wavelength converters.	Understand
CO4	Understand the optical transmission system engineering and client layer of the optical layer	Understand
CO5	Understand the WDM network elements, design and network architecture overview.	Understand

CO- PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak															
COS	Programme Outcomes(POs)												PSOs		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3								3	1		1
CO2	3	3	3	3								3	1		1
CO3	3	3	3	3								3	1		1
CO4	3	3	3	3								3	1		1
CO5	3	3	3	3								3	1		1

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0453	WAVELETS AND ITS APPLICATIONS *(Professional Elective VI)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Digital Signal Processing, Digital Image Processing.

Course Objectives: This course will provide an introduction to the theory of wavelets and its applications in mathematics and signal processing.

MODULE I: Introduction to Time-Frequency Analysis [10 Periods]

Fourier basis & Fourier Transform – failure of Fourier Transform – Need for Time-Frequency Analysis –Heisenberg's Uncertainty principle – Short time Fourier transform (STFT) - short comings of STFT- Need for Wavelets

MODULE II: CWT and MRA [10 Periods]

Wavelet basis – Continuous time Wavelet Transform (CWT) – need for scaling function – Multi-Resolution, Analysis (MRA) – important wavelets: Haar, Mexican hat, Meyer, Shannon, Daubachies.

MODULE III: Construction of Wavelets & Multirate Systems [10 Periods]

A. Necessary ingredients of wavelets, construction- semi orthogonal, orthogonal and biorthogonal wavelets, graphical display of wavelets

B. Decimation and Interpolation in Time domain - Decimation and Interpolation inFrequency domain – Multi rate systems for a rational factor

MODULE IV: Filter Banks, DWT & Special Topics [10 Periods]

A. Two channel filter bank – Perfect Reconstruction (PR) condition – relationship between filter banks and wavelet basis – DWT – Filter banks for Daubachies wavelet function

B. **Special Topics (Only Introductory Level):**Multiwavelets, Multidimensional wavelets – wavelet packet transform.

MODULE V: Applications [8 Periods]

Feature extraction using wavelet coefficients, Image compression, Wavelet based denoising

Text Books:

1. Jaideva C Goswami and Andrew K Chan, "Fundamentals of Wavelets – Theory, Algorithms and Applications", John Wiley &Sons, Inc. Singapore, 2011.
2. Soman K P and Ramachandran K I, "Insight into wavelets from Theory to practice", Prentice Hall, New Delhi, 2010.

Reference Books:

2. Sidney Burrus C, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, New Delhi, 2002.
3. Stephane G Mallat, "A Wavelet Tour of Signal Processing", Academic Press, 2009.
4. Raghuveer M Rao and Ajit S Bopardikar, "Wavelet Transforms: Introduction to Theory & Applications", Pearson Education Asia, New Delhi, 2003

E-Resources:

1. https://ieeexplore.ieee.org/document/5067402/
2. https://epubs.siam.org/doi/book/10.1137/1.9781611971385
3. https://nptel.ac.in/courses/117101001/downloads/Lec-38_Script.pdf
4. https://onlinecourses.nptel.ac.in/noc17_ee09/

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxanomy Level
CO1	Analyze Time- frequency analysis	Analyze
CO2	Analyze principles of wavelet design	Analyze
CO3	Analyze multi resolution analysis	Analyze
CO4	Analyze scaling functions, wavelets and filters	Analyze
CO5	Understand the different applications of wavelets	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	3	3										2	1		
CO2	2	2										2	1		
CO3	3	2										2	2		
CO4	3	2	3	2								2	1		3
CO5	3	2										2	1		3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0454	ADHOC Wireless Sensor Networks *(Professional Elective VI)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Computer Networks

Course Objectives:

- To study the fundamentals of wireless Ad-Hoc Networks, operation and performance of various ADHOC wireless network protocols.
- To study the architecture and protocols of Wireless sensor networks.

MODULEI: Wireless LANs and PANs [9 Periods]

Introduction, Fundamentals of WLANS, IEEE 802.11 Standards, HIPERLAN Standard, Bluetooth, Home RF.

ADHOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks.

MODULEII: MAC Protocols [10 Periods]

Introduction, Issues in Designing a MAC protocol for Ad Hoc WirelessNetworks, Design goals of a MAC Protocol for Ad Hoc WirelessNetworks, Classifications of MAC Protocols, Contention – BasedProtocols, Contention - Based Protocols with reservation Mechanisms,Contention – Based MAC Protocols with Scheduling Mechanisms, MACProtocols that use Directional Antennas, Other MAC Protocols.

MODULE III: Routing Protocols [9 Periods]

A. Introduction, Issues in Designing a Routing Protocol for ADHOC WirelessNetworks, Classification of Routing Protocols, Table –Driven RoutingProtocols, On – Demand Routing Protocols,

B. Hybrid Routing Protocols,Routing Protocols with Efficient Flooding Mechanisms, HierarchicalRouting Protocols, Power – Aware Routing Protocols.

MODULE IV: Transport Layer Protocols [12 Periods]

Introduction, Issues in Designing a Transport Layer Protocol for ADHOC Wireless Networks, Design Goals of a Transport Layer Protocol for ADHOC Wireless Networks, Classification of Transport Layer Solutions, TCP Over ADHOC Wireless Networks, Other Transport Layer Protocol for ADHOC Wireless Networks.

MODULEV: Wireless Sensor Networks [8 Periods]

Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

Text Books:

1. Ad Hoc Wireless Networks: Architectures and Protocols - C. SivaRam Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance andControl – JagannathanSarangapani, CRC Press.

Reference Books:

1. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh, 1st Ed. Pearson Education.
2. Wireless Sensor Networks - C. S. Raghavendra, Krishna M.Sivalingam, 2004, Springer

E-Resources:

2. https://ebooks.benthamscience.com/book/9781608050185
3. https://www.springer.com/la/book/9780387685656
4. https://onlinecourses.nptel.ac.in/noc17_cs07
5. textofvideo.nptel.ac.in/106105160/lec1.pdf
6. https://nptel.ac.in/noc/individual_course.php?id=noc17-cs07
7. https://publons.com/journal/334/ad-hoc-sensor-wireless-networks

Course Outcomes:

After the completion of the course the students will be able to

COs	Outcomes	Blooms Taxonomy
CO1	Understand the wireless ADHOC Networks	Understand
CO2	Understand the wireless Network Protocols	Understand
CO3	Explain various routing protocols	Analyze
CO4	Knew various transport layer protocols	Understand
CO5	Understand the wireless sensor networks	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS01	PS02	PS03
CO1	3	3	3	3	1		3					3	3	3	3
CO2	3	3	3	3	1		3					3	3	3	3
CO3	3	3	3	3	1		3					3	3	3	3
CO4	1	1	1	3	3	3				3		1	3	3	3
CO5	3	3	3	3	3	3						1	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0455	Microwave Communication Systems *(Professional Elective VI)*	L	T	P
Credits: 3		3	-	-

Pre-Requisites: Electromagnetic theory &Waves, Network Theory &Transmission Lines.

Course Objectives: This course aims to

- Introduces the, microwave components, microwave tubes, microwave solid state devices
- The various metrics / parameters used in microwave measurement and its requirement,
- The basics of Radars and its types.

MODULE I: [11 Periods]

Introduction of Microwave: - Introduction, Microwave Spectrum and Bands, Applications of Microwaves, Advantages and Limitations of Microwave Systems;

Microwave Transmission Lines: Rectangular Waveguide - Solutions of wave equations in Rectangular Coordinates, TE, TM Modes, Power Transmission, Power loss in rectangular waveguide. Micro strip Lines – Introduction, Z_o Relations, Effective Dielectric Constant, Losses, Q factor.

Waveguide Components – Probe, Loop Bends and Twist, Tuning Screws and Posts, Matched Loads. Waveguide Attenuators – Different Types, Waveguide Phase Shifters – Different Types

MODULE II: [11 Periods]

Waveguide Multiport Junctions & Scattering Matrix– E plane and H plane Tees, Magic Tee. Directional Couplers – 2 Hole, Isolator, Circulator, Gyrator. Significance, Formulation and properties of S-matrix. S-matrix calculation of 2 port Junctions, E, H plane, Magic Tee, Directional Coupler Illustrative Problems.

Conventional Tubes: Limitations and Losses of conventional Tubes at Microwave Frequencies, Microwave Tubes – O Type and M Type Classifications

O-type Tubes: 2 Cavity Klystrons –Structure, Reentrant Cavities, Reflex Klystrons – Structure, Velocity Modulation and Applegate Diagram (Qualitative Analysis)

MODULE III: [10 Periods]

A. **M-Type Tubes**: Introduction, Cross-field Effects, Magnetrons – Different Types, Cylindrical Traveling Wave Magnetron – Hull Cut-off and Hartee Conditions, Modes of Resonance and PI-Mode Operation (Qualitative Analysis).
B. **Microwave Solid State Devices:** Introduction, Classification, Applications. TED's-introduction, Gunn Diode, Gunn Effect: Principle and Mode of Operation, RWH Theory.
C. **Microwave Measurements:** Description of Microwave Bench – Different Blocks and their Features, Microwave Power Measurement, Bolometers Measurement of Attenuation, Frequency measurements, Measurement of Low and High VSWR, Cavity Q, Impedance Measurements

MODULE IV: [8 Periods]

Basics of Radar: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems.

Radar Equation: SNR, Envelope Detector – False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets - sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.

MODULE V: [8 Periods]

CW Modulated Radar: Doppler Effect, CW Radar – Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems

MTI Radar: Introduction, Principle, MTI Radar with - Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancellers – Filter Characteristics, Blind Speeds, Double Cancellation, MTI Radar Parameters, Limitations to MTI Performance,

Text Books:

1. Microwave Devices and Circuits- Samuel Y. Liao, Pearson, 3rd Edition,
2. Microwave Semiconductor Devices - Roy & Mitra, PHI
3. Microwave and Radar Engineering – M Kulkarni , Umesh Publications , 5th Edition
4. Introduction to Radar Systems- Merrill I. Skolnik, Special Indian Edition, TMH, 2nd Edition, 2007.

Reference Books:

2. R. E. Collin, "Foundations for Microwave Engineering"2nd Edition, 2005.
3. G S Raghuwanshi, "Microwave Engineering" Cengage Publication 1st edition (2012)
4. Annapurna Das and Sisir K. Das, "Microwave Engineering"TMH, 2nd Edition, 2000.
5. D. M.Pozar, "Microwave Engineering" 2nd Edition, John Wiley.
6. Peter A. Rizzi, "Microwave Engineering Passive Circuits"PHI, 1999
7. M. L Sisodia, Vijay Laxmi Gupta, "Microwaves: Introduction to Circuits, Devices and Antennas"1stEdition (2001), New Age International Publishers.

Course Outcomes:

After the completion of the course the students will be able to

COs	Description	Blooms Taxanomy Level
CO1	Understand the significance of microwaves and microwave transmission lines.	Understand
CO2	Estimate the S parameters for different microwave components.	Create
CO3	Analyze the characteristics of microwave tubes and compare them.	Analyze
CO4	Understand the basics of Radar system.	Understand
CO5	Understand the different types of Radars	Understand

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	2	2	1	2									3	2	
CO2	3	2	2	1	2								3	2	
CO3	2	2	2	1								2	3	2	
CO4	3	2	1	2								2	3	2	2
CO5	1	2	1	2	1							2	3	2	2

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) **-**: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0456	**Robotics and Automation** *(Professional Elective VI)*	L	T	P
Credits: 3		3	-	-

Prerequisites: Nil

Course Objectives: This course introduces basic concepts of Robotics, Classification of sensors and actuators. Acquire Knowledge on Manufacturing of Robots. Understand the visionary concept of robots. Understand how to programme robots and acquire Knowledge on applications of different Industrial, Non-industrial Robots.

MODULE I: Basic Concepts of Robotics and Actuators [10 Periods]

An over view of Robotics, classification of Robots, Robot Components, Robot degrees of freedom Robot Joints, Robot Coordinates, Robot reference frames, Programming modes, Robot characteristics.

Actuators: Characteristics of activating system, comparison of activating system Hydraulic devices, Pneumatic devices, electric motors, magnetostrictive actuators.

MODULE II: Sensors and Grippers [10 Periods]

Sensors: Sensors characteristics, Position sensors, velocity sensors, acceleration sensors, torque sensors, micro switches, lighten infrared sensors, touch and tactile sensors, proximity sensors, range finders.

Grippers: Robot end effectors, Classification, drive system for Gripper, Mechanical Grippers, Magnetic Grippers, Vacuum Grippers, Adhesive Grippers, Hooks, Scoops and other Miscellaneous Devices, Gripper force Analysis and Gripper Design, Active and passive Grippers.

MODULE III: Assembly and Inspection: [10 Periods]

Assembly and Robot Assembly automation, Parts Presentation methods, Assembly operations, compliance and the Remote Center Compliance (RCC) Device, Assembly system configuration, Adaptable-Programmable assembly system, Designing for Robotic Assembly, Inspection Automation.

MODULE IV: Low level and high-level vision [10 Periods]

Image acquisition, Illumination Techniques, Imaging Geometry, Some Basic Relationships between Pixels, Segmentation, Description, Segmentation and Description of 3-D Structures, Recognition, Interpretation.

MODULE V: Robot Programming and Applications [10 Periods]

Robot Programming: Methods of programming requirements and features of programming languages, software packages, problems with programming languages.

Robot Applications:

Mobile robotics, sensing, control, navigation, path planning algorithms (holonomic, non-holonomic) Industrial application of robots: material handling, processing, assembly, inspection, welding, and painting. Non industrial applications of robots: domestic, medical, military operations, children toys, humanoids, Robot safety.

Text Books:

1. Mikell. P, Weiss.G. M, Nage. l R. N and Odraj .N.G, WIndustrial Robotics, McGraw Hill Singapore,1996.
2. Ghosh, WControl in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
3. R. K. Mittal, I. J. Nagrath, "Robotics and Control", McGraw Hill Education, 2017.

References Books:

1. Deb. S.R, WRobotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl. C.R, Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter. R. D, Chimielewski. T. A, Negin. M, Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.

E-Resources:

1. http://www.learnerstv.com/Free-Engineering-Video-lectures-ltv071-Page1.htm
2. http://www.cadcamfunda.com/cam_computer_aided_manufacturing
3. http://academicearth.org/courses/introduction-to-roboticsVideo
4. http://nptel.iitm.ac.in/Video.php?courseId=1052
5. http://nptel.iitm.ac.in/and iitb.ac.in
6. https://www.youtube.com/watch?time_continue=36&v=IbXRiTbuDvY

Course Outcomes: At the end of the course, students will be able to

CO	Description	Blooms Taxonomy level
CO1	Understand basics of Robotics and Actuators.	Understand
CO2	Analyze various types of sensors and Grippers.	Analyze
CO3	Analyze Robot assembly operations and automation.	Analyze
CO4	Make use of Image acquisition, Illumination Techniques for Low level and High level vision of Robots.	Apply
CO5	Understand Robot programming and various applications of Robots	Analyze

CO-PO-PSO's Mapping:

CO	Program Outcomes												PSO		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PS01	PS02	PS03
CO 1	3	3	3	2								3	3	3	2
CO 2	3	3	3	2								2	3	2	2
CO 3	3	3	3	2								3	3	3	2
CO 4	3	3	3	2								2	3	2	2
CO 5	3	3	3	2								3	3	3	3

1: Slight (Low) **2**: Moderate (Medium) **3**: Substantial (High) -: None

2021-22 Onwards (MR-21)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech. VIII Semester		
Code:B0456	MEMS and Nano Electronics *(Professional Elective VI)*	L	T	P
Credits: 3		3	-	-

Prerequisites: Applied Electronics, Microelectronics Circuits Design, Electronics Devices, Solid State Physics

Course Objectives: The course is intended

- To cover deep understanding of micro and Nano electromechanical systems their design
- Various applications as well as micro and Nano fabrication techniques.

Module I: Introduction to MEMS: MEMS and NEMS

working principles- MEMS processes & features, various components of MEMS, applications and standards, micromachining, basic process tools- epitaxy, sputtering, chemical vapor deposition and spin on methods, oxidation, evaporation, lithography and etching, advanced process tools, sol gel process, EFAB.

Module II: **Materials for MEMS and Engineering aspects**: Silicon, Silicon oxide and nitride, Thin metal films, Polymers, Other materials and substrates, polycrystalline materials, mechanics of Microsystems, static bending, mechanical vibrations, thermo mechanics, fracture mechanism, fatigue, stress and strain, young's modulus and modulus of rigidity, scaling laws in miniaturization.

Module III: **Free Electron Theory & The New Ohm's Law**: Why Electrons flow, Classical free electron theory, Sommerfeld's theory, The quantum of conductance, Coulomb blockade, Towards Ohm's law. The Elastic Resistor: Conductance of an Elastic Resistor, Elastic Resistor- Heat dissipation.

Module IV: **Materials for nano electronics**: Semiconductors, Crystal lattices: bonding in crystals, Electron energy bands, Semiconductor hetero structures , Lattice-matched and pseudomorphic heterostructures, Inorganic nano wires, Organic semiconductors , Carbon nanomaterials: nanotubes and fullerenes

Module V: **Ballistic and Diffusive Transport**: Ballistic and Diffusive Transfer Times, Channels for Conduction Conductivity, Conductivity: E(p) or E(k) Relations, Counting States, Drude Formula, Quantized Conductance, Electron Density –Conductivity.

TEXT BOOK:

1. An introduction to Micro electro mechanical systems Engineering‖ by NadimMalut and Kirt Williams – Second edition – Artech House, Inc, Boston
2. Micro electro mechanical systems Design‖. by James J Allen- CRC Press – Taylor and Francis Group
3. Mechanics of micro electro mechanical systems by NicolaeLobontiu and Ephrahim Garcia Kluwer. Academic Publishers – Boston
4. Introduction to Nano Science and Technology by S.M. Lindsay.
5. Supriyo Dutta -Lessons from Nanoscience: A Lecture Note Series, World Scientific (2012).

References Books:

2. Springer Hand Book of Nano Technology — by Bharath Bhushan – Springer
3. Nano and Micro electro Mechanical systems‖ by Sergey Edward Lysherski – CRC Press.

Course Outcomes: After successful completion of this course, student will be able to

Course Outcome	Description	Blooms Level
CO 1	Understanding of MEMS/NEMS applications specially sensors, Micro machining tools	Understand
CO 2	Evaluate the scaling of transistors and other devices to smaller and smaller sizes.	Apply
CO 3	To Analyze the capacity for mass production of high-quality Nano-devices.	Analyze
CO 4	Evaluate the scaling and packaging issues of physical system	Evaluate
CO 5	Create solutions for silicon micro fabrication techniques etc.,	Create

CO- PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	3	2	-	-	2	-	3	3	3	2
CO2	3	3	3	-	-	3	-	-	-	3	-	3	3	3	2
CO3	3	3	3	1	3	2	-	-	-	3	-	2	3	3	2
CO4	3	2	1	1	3	1	2	-	-	1	-	1	2	3	2
CO5	3	1	1	3	3	1	2	-	-	-	-	1	2	3	2

2021-22 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VIII Semester		
Code:B00P2	Seminar	L	T	P
Credits: 1		-	-	2

2020-21 Onwards (MR-20)	MALLA REDDY ENGINEERING COLLEGE (Autonomous)	B.Tech VIII Semester		
Code:A00P3	MAIN PROJECT	L	T	P
Credits: 12		-	-	24