VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE

Effective from 2020-21

VR20

SCHEME OF INSTRUCTIONS

B.Tech. PROGRAMME [VR20]

B.Tech. Degree Programs Applicable for the batch of students admitted from the Academic Year 2020-21

VELAGAPUDI RAMAKRISHNA
SIDDHARTHA ENGINEERING COLLEGE
(Autonomous, Accredited with 'A' grade by NAAC)
Affiliated to Jawaharlal Nehru Technological University Kakinada
Approved by AICTE & ISO 9001: 2008 Certified
Kanuru, Vijayawada -520 007, Andhra Pradesh
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Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER I **CONTACT HOURS: 26**

S. No.	Course Code	Subject	L	T	P	Credits
1.	20BS1101	Matrices and Differential Calculus	3	0	0	3
2.	20BS1102	Engineering Physics	3	0	0	3
3.	20ES1103	Programming for Problem Solving	3	0	0	3
4.	20ES1104	Basics of Electrical Engineering	3	0	0	3
5.	20HS1105	Technical English and Communication Skills	2	0	0	2
6.	20BS1151	Engineering Physics Laboratory	0	0	3	1.5
7.	20ES1152	Programming for Problem Solving Laboratory	0	0	3	1.5
8.	20HS1153	Technical English and Communication Skills Laboratory	0	0	3	1.5
9.	20ES1154	Computing and Peripherals Laboratory	0	0	2	1
10.	20MC1106	Technology and Society	1	0	0	-
Total			**15**	**0**	**11**	**19.5**
11.	20MC1107	Induction Program				-

SEMESTER II **CONTACT HOURS: 27**

S. No.	Course Code	Subject	L	T	P	Credits
1.	20BS2101	Laplace Transforms and Integral Calculus	3	0	0	3
2.	20BS2102	Engineering Chemistry	3	0	0	3
3.	20ES2103	Object Oriented Programming using Python	3	0	0	3
4.	20ES2104B	Circuit Analysis	3	0	0	3
5.	20ES2105	Engineering Graphics	1	0	4	3
6.	20BS2151	Engineering Chemistry Laboratory	0	0	3	1.5
7.	20ES2152	Object Oriented Programming using Python Laboratory	0	0	3	1.5
8.	20ES2153	Engineering Workshop	0	0	3	1.5
9.	20MC2106	Professional Ethics and Practice	1	0	0	-
Total			**14**	**0**	**13**	**19.5**

SEMESTER III **CONTACT HOURS: 28**

S.No.	Course Code	Subject	L	T	P	Credits
1	20BS3101	Complex Analysis and Numerical Methods	3	0	0	3
2	20EC3302	Analog Electronics	3	0	0	3
3	20EC3303	Microcontrollers	3	0	0	3
4	20EC3304	Digital Circuit Design	3	0	0	3
5	20EC3305	Probability Theory & Random Processes	3	0	0	3
6	20EC3351	Analog Electronics Lab	0	0	3	1.5
7	20EC3352	Microcontrollers Lab	0	0	3	1.5
8	20EC3353	Digital Circuit Design Lab	0	0	3	1.5
9	20TP3106	Logic and Reasoning	0	0	2	1
10	20MC3107A	Environmental Studies	2	0	0	-
Total Credits			**17**	**0**	**11**	**20.5**

SEMESTER IV **CONTACT HOURS: 31**

S. No.	Course Code	Course Title	L	T	P	Credits
1.	20BS4101	Signals & Systems	3	0	0	3
2.	20ES4102	Control Systems	3	0	0	3
3.	20EC4303	Pulse and Switching Circuits	3	0	0	3
4.	20EC4304	Analog & Digital Communications	3	0	0	3
5.	20HS4105	Universal Human Values	3	0	0	3
6.	20EC4351	Signals & Systems Lab	0	0	3	1.5
7.	20EC4352	Pulse & Switching Circuits Lab	0	0	3	1.5
8.	20EC4353	Analog & Digital Communications Lab	0	0	3	1.5
9	20EC4106	English for Professionals	**0**	**0**	**2**	**1**
10	20EC4607	Skill Oriented Course 1	**1**	**0**	**2**	**2**
11	20MC4108B	Indian Constitution	**2**	**0**	**0**	**-**
		Total	**18**	**0**	**13**	**22.5**
Summer Internship six weeks (Mandatory) during summer vacation (EPICS)						
Honors/Minor Courses (the hours distribution can be 3-0-2 0r 3-1-0 also)			4	0	0	4

SEMESTER V **CONTACT HOURS:33**

S.No	Course Code	Subject	L	T	P	Credits
1	20EC5301	VLSI Design	3	0	0	3
2	20EC5302	Digital Signal Processing	3	0	0	3
3	20HS5103	Engineering Economics and Management	2	0	0	2
4	20EC5404	A. Information Theory & Coding B. Microwave Engineering C. Electronics Measurements & Instrumentation D. Computer Networks	3	0	0	3
5	20EC5205	A. Satellite communications B. Digital System Design Using Verilog C. Computer Organization	3	0	0	3
6	20EC5351	VLSI Design Lab	0	0	3	1.5
7	20EC5352	Digital Signal Processing Lab	0	0	3	1.5
8	20HS5153	Advanced Communication Skills Lab	0	0	2	1
9	20TP5106	Personality Development	0	0	2	1
10	20EC5354	EPICS/Internship	0	0	3	1.5
11	20EC5607	A. Networking Essentials B. Programming on ARM Cortex-M3 C. Graphical System Design D. Software Design Tools	1	0	2	2
12	20MC5108A	Biology for Engineers	2	0	0	-
		Total	16	0	17	22.5
Honors/Minor Courses (hours distribution can be 3-0-2 0r 3-1-0 also)			4	0	0	4

SEMESTER VI **CONTACT HOURS:30**

S.No	Course Code	Subject	L	T	P	Credits
1	20EC6301	Transmission Lines	3	0	0	3
2	20EC6302	Linear Integrated Circuits	3	0	0	3
3	20EC6303	Designing with PLDs	2	0	0	2
4	20EC6404	A. Mobile & Cellular Communications	3	0	0	3
		B. Embedded Systems & RTOS				
		C. Nano Electronics				
		D. Image & Video Processing				
5	20EC6205	A. Advanced Microcontrollers	2	0	2	3
		B. Neural Networks & Fuzzy Logic				
		C. High-Speed Communication Networks				
6	20EC6351	PLDs Lab	0	0	3	1.5
7	20EC6352	Linear Integrated Circuits Lab	0	0	3	1.5
8	20EC6353	Advanced Communications Lab	0	0	3	1.5
9	20TP6106	Quantitative Aptitude	0	0	2	1
10.	20EC6554	Mini Project-1	0	0	2	1
11	20MC6107B	Innovation, IPR and Entrepreneur ship	2	0	0	0
Industrial/Research Internship 2 Months (Mandatory) during summer vacation						
		Total	**15**	**0**	**15**	**20.5**
Honors /Minor Courses (the hours distribution can be 3-0-2 0r 3-1-0 also)			4	0	0	4

SEMESTER VII **CONTACT HOURS:29**

S.No	Course Code	Subject	L	T	P	Credits
1	20EC7301	Antennas & Wave Propagation	3	0	0	3
2	20EC7402	A. Introduction to Machine Learning	3	0	0	3
		B. Optical Communications				
		C. Wireless Networks				
		D. Signal Processing Architectures				
3	20EC7403	A. DSP Processors & Architectures	3	0	0	3
		B. Adhoc & Sensor Networks				
		C. Semiconductor Device Modeling				
		D. RADAR Principles				
4	20EC7404	A. Data Compression	3	0	0	3
		B. Satellite Communications				
		C. RF Circuit Design				
		D. System Design With Embedded Linux				
5	20EC7205	A. Remote Sensing & GIS	2	0	2	3
		B. 5G New Radio Architectures				
		C. MEMS and NEMS				
6	20EC7206	A. Computer Vision & Applications	2	0	2	3
		B. Global Navigational Satellite Systems				
		C. SDR				
7	20EC7107	PEGA	1	0	2	2
8	20EC7551	Mini Project - II	0	0	3	1.5
9	20EC7552	Industrial/Research Internship 2 Months (Mandatory) after 3rd year (to be evaluated during VII Semester	0	0	3	1.5
Total			**17**	**0**	**12**	**23**
Honors /Minor Courses (the hours distribution can be 3-0-2 0r 3-1-0 also)			**4**	**0**	**0**	**4**

*There is a provision for the Universities/Institutions to implement AICTE mandatory course

"Universal Human Values 2: Understanding Harmony" under Humanities and Social Science Elective in Seventh Semester for 3 Credits

Note: Open Elective Courses may opt as self-learning course. Students register and complete the opted course in approved MOOCS platform on or before last instruction day of VII Semester. They have to submit the certificate before the last instruction day of VII semester

SEMESTER VIII **CONTACT HOURS: 12**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	20EC8551	Major Project**	Project work	0	0	24	12
Internship (6 Months)							

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ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER I **CONTACT HOURS: 26**

S. No.	Course Code	Course	Subject	L	T	P	Credits
1.	20BS1101	Basic Science Course	Matrices and Differential Calculus	3	0	0	3
2.	20BS1102	Basic Science Course	Engineering Physics	3	0	0	3
3.	20ES1103	Engineering Science Course	Programming for Problem Solving	3	0	0	3
4.	20ES1104	Engineering Science Course	Basics of Electrical Engineering	3	0	0	3
5.	20HS1105	Humanities and Social Science	Technical English and Communication Skills	2	0	0	2
6.	20BS1151	Basic Science Course	Engineering Physics Laboratory	0	0	3	1.5
7.	20ES1152	Engineering Science Course	Programming for Problem Solving Laboratory	0	0	3	1.5
8.	20HS1153	Humanities and Social Science	Technical English and Communication Skills Laboratory	0	0	3	1.5
9.	20ES1154	Engineering Science Course	Computing and Peripherals Laboratory	0	0	2	1
10.	20MC1106	Mandatory Course	Technology and Society	1	0	0	-
Total				**15**	**0**	**11**	**19.5**
11.	20MC1107	Mandatory Course	Induction Program				-

20BS1101 – MATRICES AND DIFFERENTIAL CALCULUS

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Fundamentals of Matrices, Fundamentals of Calculus, Integration, Differentiation-1.0	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Determine Eigen values, Eigen vectors of a matrix											
	CO2	Estimate Maxima and Minima of Multivariable functions											
	CO3	Solve the Linear differential equations with constant coefficients.											
	CO4	Solve the Linear differential equations with variable coefficients-12											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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			1							
	CO2	3	2			1							
	CO3	3	2			1							
	CO4	3	2			1							

Course Content

UNIT- I

Matrices: Consistency of linear system of equations, Linear transformations, Vectors, Eigen values and Eigen vectors, Properties of Eigen values, Finding inverse and powers of a matrix by Cayley- Hamilton theorem. Reduction to diagonal form, Reduction of quadratic form to canonical form, Nature of a quadratic form, Complex matrices

UNIT- II

Differential Calculus: Fundamental theorems - Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem and Taylor's theorem, Expansions of functions- Maclaurin's series and Taylor's series

Application: Curvature, Radius of curvature**.**

Functions of Two or More Variables: Taylor's theorem for function of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers

UNIT- III

Differential Equations of First Order: Exact differential equations, Equations reducible to exact equations.

Applications: Orthogonal trajectories, Newton's law of cooling.

Linear Differential Equations of Higher Order: Definitions, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding particular integral, Working procedure to solve the equation

	UNIT- IV Method of variation of parameters, Method of undetermined coefficients, Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation, Legendre's linear equation, Linear dependence of solutions, Simultaneous linear equations with constant coefficients. **Application:** L-C-R Circuits.
Text books and Reference books	**Text Book:** 1. B.S.Grewal, Higher Engineering Mathematics, 44th Ed., Khanna Publishers, 2019. **Reference Books:** 1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015 2. B.V.Ramana, "Higher Engineering Mathematics", 1st Ed., Tata MC Graw Hill, 2007 3. N.P.Bali, Dr. Manish Goyal, "A Text Book of Engineering Mathematics, 9th Ed., Laxmi Publications, 2014
E-resources and other digital material	1. https://www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/122/104/122104017/ 3. https://nptel.ac.in/courses/111/105/111105035/

20BS1102 – ENGINEERING PHYSICS

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	10+2 level Physics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Employ physical laws of electrostatics and compute problems related to static electric fields											
	CO2	Illustrate the laws of magneto statics and solve various problems involving static magnetic fields											
	CO3	Describe various types of electric and magnetic materials											
	CO4	Understand the time varying electric and magnetic fields by applying appropriate Maxwell's equations											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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										
	CO2	3	2										
	CO3	3											
	CO4	3	1										
Course Content	**UNIT- I** **Electrostatics:** Coulomb's law and field intensity, Electric field due to continuous charge distributions, Electric flux density, Gauss's law, Applications of Gauss law - Line charge, Surface charge, Volume charge, Electric potential, Relation between E and V, Maxwell's equation for static electric fields (qualitative), Potential and field of electric dipole, Energy Density in electrostatic fields **UNIT- II** **Magnetostatics:** Biot-Savart's law, Ampere's circuit law - Maxwell's equation, Applications of Ampere's law - Infinite line current, Infinite sheet of current, Magnetic flux density - Maxwell's equation for static magnetic field, Magnetic vector and scalar potentials, Force due to magnetic fields - Force on a charged particle, Current element, Force between two current elements, Magnetic dipole, Magnetic energy **UNIT- III** **Types of Electric and Magnetic Materials:** Properties of electric materials - Conductors and dielectrics, Convection and conduction currents, Polarization in dielectrics, Dielectric constant and strength, Continuity equation and relaxation time, Poisson's and Laplace's equations,												

	Electro static boundary conditions, Dielectric - Dielectric, Conductor - Dielectric, Conductor - Free space. Types of magnetic materials, Magnetization in materials, Magnetic boundary conditions. **UNIT- IV** **Time Varying Fields and Electro Magnetic Waves** **Time Varying Fields:** Faraday's law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in final forms, Time harmonic fields. **Electro Magnetic Waves**: Wave propagation in lossy dielectrics, Lossless dielectrics, Free space, Good conductors, Poynting theorem
Text books and Reference books	**Text Book:** 1. Resnick, Halliday and Krane, "Physics", 5th Ed., Wiley India Pvt. Ltd, New Delhi, 2016. 2. Matthew.N.O.Sadiku,"Principles of Electromagnetics", 4th Ed., Oxford University Press, New Delhi,2009 **Reference Books:** 1. R.K.Gaurand, S.L.Gupta, "Engineering Physics", 8th Ed., Reprint, Dhanpat Rai Publications Ltd , New Delhi,2013 2. W.H.Hayt and J.A.Buck, "Engineering Electromagnetics", 7th Ed., Tata Mc Graw Hill, New Delhi, 2006 3. Joseph. A. Edminister, "Electromagnetics – Theory and problems", 2nd Ed., Schaum's outline series, MC Graw Hill, 1993
E-resources and other digital material	1. http://www.mike-willis.com/Tutorial/PF2.htm

20ES1103 – PROGRAMMING FOR PROBLEM SOLVING

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	10+2 level Physics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:											
	CO1	Understand the different types of problem solving approaches										
	CO2	Apply the selections, loops, arrays and string concepts in C to solve problems.										
	CO3	Apply functions and pointer concepts in C to solve problems.										
	CO4	Solve problems using num, structures, unions and file handling functions.										
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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	1										
	CO2		2	3									
	CO3		2	3									
	CO4		2	3									

Course Content

UNIT- I

Introduction to Computer – Based Problem Solving: Requirement of problem solving by computers, Problem definition, Use of examples for problem solving, Similarities between problems, Problem solving strategies, Steps involved in problem solving.

Program Design and Implementation Issues: Programs and algorithms, Top-down design and step-wise refinement, Construction of loops - Basic programming constructs, Implementation, Programming environment.

Algorithms for Problem Solving: Exchanging values of two variables, Summation of a set of numbers, Decimal to binary base conversion, Reversing the digit of an integer, To find greatest common divisor (GCD) of two numbers, To verify whether an integer is prime or not, Organize a given set of numbers in ascending order, Find the square root of an integer, Factorial of a given number, Generate the Fibonacci sequence for n terms, Evaluate sin(x) as sum of series, To find the value of the power of a number raised by another integer, Reverse order elements of an array, Find largest number in an array, Print elements of upper triangular matrix, Multiplication of two matrices, To compute to roots of a quadratic equation $ax^2+bx+c=0$.

UNIT- II

Introduction to the C Language: Background of C program, Identifiers, Types, Variables, Constants, Memory layout, Input/Output, Programming examples.

Structure of a C Program: Logical data and operators, Expressions, Precedence and associatively, Evaluating expressions, Type conversion, Statements, Storage class.

Selection: Two-way selection, Multi way selection, More standard functions.

Repetition: Concept of a loop, Loops in C, Loop examples, Recursion, The calculator

	program. **Arrays:** Array concepts in C, Inter function communication, Array applications, Two dimensional arrays, Multi dimensional arrays **UNIT- III** **Strings:** String concepts, C strings, String Input/Output functions, Arrays of strings, String manipulation functions, String – Data conversion. **Functions:** Functions in C, User defined functions; Call by value, Call value reference, Inter-Function communication, Standard functions, Scope. **Pointers*:*** Introduction to pointer, Pointers for inter-function communications, Pointers to pointers, Compatibility, L value and R value. **Pointer Applications:** Arrays and pointers, Pointer arithmetic and arrays, Passing an array to a function, Memory allocations Functions, Array of pointers. **UNIT- IV** **Enumerations:** The type definition (Typedef), Enumerated types: Declaring an enumerated type, Operations on enumerated types, Enumeration type conversion, Initializing enumerated constants, Anonymous enumeration constants, Input/Output operators. **Structures:** Structure type declaration, Initialization, Accessing structures, Operations on structures, Complex structures, Structures and functions, Sending the whole structure, Passing structures through pointers. **Unions:** Referencing unions, Initializers, Unions and structures, Internet address, Programming applications. **File Handling:** Files, Streams, Standard library input/output functions, Formatting input/output functions and character input/output functions, Command-Line arguments.
Text books and Reference books	**Text Book:** 1. Harsha Priya, R.Ranjeet, " Programming and Problem Solving Through "C" Language", Firewall media 2006 2. Behrouz.A.Forouzan, Richard.F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3rd Ed., Cengage Learning **Reference Books:** 1. Anil.B.Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020. 2. R.G.Dromey, "How to Solve it by Computer", Prentice – Hall International Series in Computer Science, 1982. 3. Yashwant Kanetkar,"Let us C", 16th Ed., BPB Publications, 2017. 4. Kernighan and Ritchie, "The C programming language", The (AnsiCVersion), 2nd Ed., PHI. 5. Paul.J.Dietel and Harvey.M.Deitel, "C : How to Program", Prentice Hall, 8th Ed., 2021. 6. K.R.Venugopal, Sundeep.R.Prasad, "Mastering C", 2nd Ed., McGraw Hill, 2015
E-resources and other digital material	1. ComputerScienceandEngineering-Noc:problemSolvingThroughProgramminginC https://nptel.ac.in/courses/106/105/106105171/ 2. Computer Science and Engineering- Noc: Introduction to Programming in C https://-nptel.ac.in/courses/106/104/106104128/ 3. C For Everyone: Structured Programming https://www.coursera.org/learn/c-structured-programming 4. Advanced C Programming Course Tim Academy-Jason Fedin https://www.udemy.com/-course/advanced-c-programming-course/

20ES1104 – BASICS OF ELECTRICAL ENGINEERING

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Analyze electric circuit fundamentals.											
	CO2	Understand the basic concepts of alternating quantities and magnetic circuits.											
	CO3	Analyze the basic concepts of electric machines											
	CO4	Understand measuring instruments & solar photo voltaic system concepts											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	3	3			2							
	CO2	3	3										
	CO3	2	1			2							
	CO4	2	1										
Course Content	**UNIT- I** **Introduction to Electrical Engineering:** Electric current, Electromotive force, Electric power and energy, Basic circuit components – Resistors – Inductors - Capacitors. Electromagnetic phenomenon and related laws, Kirchhoff's laws. **Network Analysis:** Network sources - Ideal independent voltage source, Ideal independent current source, Dependent sources, Practical voltage and current sources, Source conversion, Voltage and current division rule, Series and parallel connection of R, L and C, Star – Delta or Delta – Star transformation. Mesh and nodal analysis (with independent sources only). **UNIT- II** **Alternating Quantities**: Introduction, Generation of A.C voltages, Waveforms and basic definitions, Relationship between frequency, speed and number of poles, Root mean square and average values of alternating current and voltages, Form factor and peak factor, Phasor representation of alternating quantities **Magnetic Circuits:** Introduction, Magnetic circuits, Magnetic field strength (H), Magnetomotive force, Permeability, Reluctance, Analogy between electric and magnetic circuits, Magnetic potential drop, Magnetic circuit computations, Self and mutual inductance, Energy in linear magnetic systems (Derivation for pure inductor). **UNIT- III** **DC Machines:** Introduction, Construction of DC machines, Armature windings, Generation of DC voltage and Torque production in a DC machine, Operation of a DC machine as a generator, Operation of DC machine as a motor.												

	Induction Motors: Introduction, Constructional features of three phase induction motors, Principle of operation of three phase induction motor - Slip and rotor frequency, Voltage and current equations and Equivalent circuit of an induction motor. **UNIT- IV** **Measuring Instruments:** Introduction, Classification of instruments, Operating principles, Essential features of measuring instruments, Ammeters and voltmeters, Measurement of power. **Solar Photo Voltaic Systems:** Solar cell fundamentals, Characteristics, Classification, module, Panel and array construction, Maximizing the solar PV output and load matching, Maximum power point tracker basic algorithm and flowchart, PV system components, Solar PV systems and solar PV applications
Text books and Reference books	**Text Book:** 1. T.K.Nagasarkar and M.S.Sukhja, "Basic Electric Engineering", 2nd Ed., Oxford University Press 2011 **Reference Books:** 1. B.H.Khan,"Non Conventional Energy Resources", 2nd Ed., Mc.Graw Hill Education Pvt Ltd., NewDelhi, 2013. 2. Ashfaq Hussain, Haroon Ashfaq, "Fundamentals of Electric Engineering", 4th Ed., Dhanpat Rai & Co, 2014. 3. I.J.Nagarath and Kothari, "Theoy and Problems of Basic Electric Engineering", 2nd Ed., PHI Pvt. Ltd., 2016.
E-resources and other digital material	1. https://nptel.ac.in/courses/108/108/108108076/

20HS1105 – TECHNICAL ENGLISH AND COMMUNICATION SKILLS

Course Category:	Humanities and Social Science	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:											
	CO1	Develop administrative and professional compilations with felicity of expression										
	CO2	Demonstrate proficiency in advanced reading and context oriented writing										
	CO3	Apply the elements of functional English with sustained understanding for authentic use of language in any given academic and/or professional environment										
	CO4	Execute tasks in technical communication with competence										
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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						2				3		
	CO2						2			2	3		
	CO3						2			2	3		
	CO4										3		
Course Content	**UNIT- I** **Professional Writing Skills** **Professional Letters:** Business complaint and transmittal – Purpose, Style and format with special reference to block format and modified block format **Paragraph and Essay Writing: Linkers, Descriptive and Analytical with Illustrations** **Effective Writing Practice:** Appropriateness, Brevity, Clarity, Cogency and coherence with guided and semi-controlled compilations including the use of idiomatic expressions. **UNIT- II** **Reading Comprehension and Discourse Development Skills** **Analytical and Critical Reading:** Critical, Creative and lateral thinking – Language and thinking – Thinking process and language development. **Effective Reading Strategies:** Skimming, Scanning, Eye span, Fixation, Taming regression, Issues and challenges of vocalization and sub-vocalization. **Context-Oriented Dialogue/Argument Writing:** Extending invitation, Reciprocation, Acceptance, Concurrence, Disagreeing without being disagreeable - Discourse/Dialogue, Development and identification of inconsistencies in pre-prepared dialogues											

	UNIT- III **Vocabulary and Functional English** **Vocabulary for Competitive Examinations:** (A list of 500 high frequency words) Synonyms, Antonyms, Matching homonyms, Homophones and nearer words along with root words. **Verbal Analogies: (**Single Unit) – Synonym relation, Antonym relation, Object- Operator relation, Object - Obstacle/Obstruction relation, Sequence relation, Place – Monument relation, Science – Area of activity relation, Profession – Tool relation, Gender relation, Diminutive relation, etc. **Functional Grammar:** With special reference to tense, Concord, Articles, Pronoun referent, Prepositions, Use of Gerund, Parallelism etc (A representative collection of 100 sentences). **UNIT- IV** **Technical Communication Skills:** **Technical Proposal Writing:** Characteristics, Proposal, Superstructure, Checklist, Formal proposal **Technical Vocabulary**: Basic explanations and description **Technical Report Writing:** Informational reports and feasibility report - Types, Components, Style and formats
Text books and Reference books	**Text Book:** 1. Martin Cutts, "Oxford Guide to Plain English", 7th Impression, Oxford University Press, 2011 2. M.Ashraf Rizvi, "Effective Technical Communication", Tata Mc Graw-Hill, New Delhi, 2005. 3. John Langan, " College Writing Skills", 9th Ed., Mc Graw Hill, 2014 4. Eclectic Learning Materials Offered by the Department **Reference Books:** 1. Erwin Kreyszig, Randolph Quirk, "Use of English Longman", 1st Ed., 2004. 2. Thomson.A.J and A.V,Martinet, "Practical English Grammar", 3rd Ed., Oxford University Press, 2001. 3. V.Sethi and P.V.Dhamija, "A Course in Phonetics and Spoken English", 2ND Ed., PHI, 2006
E-resources and other digital material	Learn English | British Council 1. www.natcorp.ox.ac.uk/Wkshops/Materials/specialising.xml?ID=onlin 2. www.uni-marburg.de/de/sprachenzentrum

20BS1151 – ENGINEERING PHYSICS LABORATORY

Course Category:	Basic Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Test optical components using principles of interference and diffraction of light											
	CO2	Use spectrometer, travelling microscope and function generator in various experiments											
	CO4	Determine the V-I characteristics of photocells and appreciate the accuracy in measurements											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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				1								
	CO2				1								
	CO3	2			1								
	CO4				1								
Course Content	**List of Experiments:** 1. Figure of merit of a galvanometer 2. LCR circuit – Study of resonance 3. Variation of magnetic field along the axis of current – Carrying circular coil 4. Wedge method – Measurement of thickness of a foil 5. Solar cell – Determination of Fill factor 6. AC Sonometer – Verification of vibrating laws 7. B – H curve unit – Determination of hysteresis loss 8. Hall effect – Hall coefficient measurement 9. Diffraction grating – Measurement of wavelength 10. Torsional pendulum – Measurement of rigidity modulus 11. Photocell – Study of V-I characteristics, Determination of work function 12. Optical fiber – Determination of numerical aperture												
Text books and Reference books	**Text Books:** 1. Madhusudhan Rao,"Engineering Physics Lab Manual", ist Ed., Scitech Publications, 2015 2. Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics", 5th Ed., Excell Books,2010												

E-resources and other digital material	1. www.physicsclassroom.com/The-Laboratory 2. http://facstaff.cbu.edu/~jvarrian/physlabs.html 3. https://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1 4. https://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1 5. https://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1

20ES1152 – PROGRAMMING FOR PROBLEM SOLVING LABORATORY

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Implement the use of programming constructs in a structural programming language.											
	CO2	Apply the selections, loops, arrays and string concepts in C to solve problems.											
	CO3	Apply functions, pointer and Enum concepts in C to solve problems.											
	CO4	Solve problems using structures, unions and file handling functions.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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	1		3									
	CO2		1	3									
	CO3		1	3									
	CO4		1	3									

Course Content

List of Experiments

Week–1: Introduction to C Programming

a) The structure of C program with a sample program
b) Use identifiers, data types, format specifiers, constants and variables declaration and initialization to write simple c programs
c) Write simple C programs using preprocessor commands and simple I/O statements

Week–2: Data Types and Variable Declarations

a) Use void, integral and floating point data types in different scenarios to write programs.
b) Use various primitive data types for performing different mathematical operations
c) Programs to perform mathematical operations using various operators in C

Week–3: Selection Making Decisions

a) Write Programs using the If...Else selection statements
b) Use nested If...Else statement to solve problems that need multi-level selection making decisions**.**
c) Write programs that use Switch...Case and Else...If multiway statements to select one out of several options

	Week–4: Looping Constructs and Their Applications a) To have a clear idea on loop initialization, validation and updation b) Write programs using the While, For or Do...While loops c) To understand the logic and adopt best looping construct for different kinds of problems d) Design and develop programs based on iterative loops using While, Do While, For, Nested For **Week–5: Unconditional Control Transfer Statements** a) Write programs using of (break and continue) unconditional control transfer statements b) Use the Go To statement to transfer the control from one part to another part of a program and the use of return statement to end the execution of a called function **Week–6: Arrays and Their Applications** a) To utilize one dimensional and multi-dimensional arrays to solve problems that use set(s) of similar type input data b) To write programs that performs multiple classical operations like searching, sorting, updation or deletion on array elements**.** **Week–7: Strings, String I/O and Manipulation Functions** a) To write programs that work on read, write and manipulate fixed length and variable-length strings and/or arrays of strings b) To write programs that use predefined string i/o functions c) To write programs that use string manipulation functions from the string library **Week–8: Concepts of User Defined Functions** a) Design and develop programs depending on functions both user defined and standard library functions in c with different approaches. b) To write a program using more than one function with or without parameters and function return type **Week–9: Pointers and Their Applications** a) Programs on declaration of pointers and their usage in c. b) Programs to relate between arrays and pointers and use them efficiently in a program c) To pass pointers as an argument to a function and use it efficiently in a program. d) To write programs using static and dynamic memory allocation. **Week–10: Structure, Union and Enumeration** a) Programs to define, declare and access structure and union variables b) Design and develop programs to work with pointers to access data within a structure c) Programs to pass structure as an argument to a function d) To write c programs using enumeration data types, an easiest way of mapping symbolic names to integer values**.**

	Week–11: File Handling Operations a) Programs to open and close text and binary files using file i/o commands. b) Write programs to perform read and write operations using the formatting i/o and character i/o functions. c) Apply file positioning, status and system commands based on a problem requirements **Week–12: Command Line Arguments** a) To use command line arguments to pass inputs in a single line while executing a program through the dos command prompt or linux terminal. b) To use ATOI function to convert a default string value argument to an integer value inside the main function in a program. c) To use ATOF function to convert a default string value argument to a float value inside the main function in a program
Text books and Reference books	**Text Book:** 1.Behrouz.A.Forouzanand, Richard.F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3rd Ed., Cengage Learning. **Reference Books:** 1. Anil B. Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020. 2. R.G.Dromey, "How to Solve it by Computer", Prentice-Hall International Series in Computer Science, 1982. 3. Yashwant Kanetkar, "Let Us C", 16th Ed., BPB Publications, 2017. 4. Kernighan and Ritchie, "The C Programming Language", The (Ansi C Version), 2nd Ed., PHI. 5. Paul.J.Dietel and Harvey.M.Deitel, "C: How to Program", 8th Ed., Prentice Hall, 2021. **6.** K.R.Venugopal, Sundeep.R.Prasad, "Mastering C", 2nd Ed., Mc Graw Hill, 2015.
E-resources and other digital material	1. Computer Science and Engineering -Noc: Problem Solving Through Programming in C https://nptel.ac.in/courses/106/105/106105171/ 2. Computer Science and Engineering - Noc: Introduction to Programming in C https://-nptel.ac.in/courses/106/104/106104128/ 3. C For Everyone: Structured Programming https://www.coursera.org/learn/c-structured-programming 4. Advanced C Programming Course Tim Academy – Jason Fedin. https://www.udemy.com/-course/advanced-c-programming-course/

20MC1106 – TECHNOLOGY AND SOCIETY

Course Category:	Mandatory	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 - 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Understand the origins of technology and its role in the history of human progress.											
	CO2	Know the industrial revolution and its impact on society											
	CO3	Interpret the developments in various fields of technology till twentieth century.											
	CO4	Distinguish the impacts of technology on the environment and achievements of great scientists.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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							1				
	CO2	3				2		1					
	CO3	3							1				
	CO4	3				2		1					
Course Content	**UNIT- I** **Introduction**: Origins of technology, The agriculture revolution, Technological contributions of ancient civilizations - Mesopotamians, Egyptians, Greeks, Romans, Indians and Chinese. **UNIT- II** **Industrial Revolution**: The social and political background, The technical background, Steam: The power behind the industrial revolution, The revolution in textile industry, The impact of industrial revolution on society **UNIT- III** **The Flowering of Modern Technology:** Manufacturing technologies, Prime movers, Internal combustion engines, Production of metals and alloys, The birth of electrical technology, Twentieth century: The flowering of modern technology like information technology and biotechnology and its implications on society. **UNIT- IV** **Technology, Science and Society**: Impact of technology on society, The impacts of technology on the environment, Sustainable development.												

	Achievements of Famous Scientists: (**World**): Einestein, Newton, Faraday, GrahamBell, Edison, S.Hawking (**India**):CVRaman, S.Chandrasekhar, Aryabhatta, Homi.J.Bhabha, Vikram Sarabhai, APJ Abdul Kalam, S.Ramanujan, M.Visweswarayya
Text books and Reference books	**Text Book:** 1. Dr.R.V.G Menon,"Technology and Society", PearsonEducation,2011. **Reference Books:** 1. Quan-Haase, A, "Technology and Society: Inequality, Power and Social Networks", Oxford University Press, 2013
E-resources and other digital material	

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER II **CONTACT HOURS: 27**

S. No.	Course Code	Course	Subject	L	T	P	Credits
1.	20BS2101	Basic Science Course	Laplace Transforms and Integral Calculus	3	0	0	3
2.	20BS2102	Basic Science Course	Engineering Chemistry	3	0	0	3
3.	20ES2103	Engineering Science Course	Object Oriented Programming using Python	3	0	0	3
4.	20ES2104B	Engineering Science Course	Circuit Analysis	3	0	0	3
5.	20ES2105	Engineering Science Course	Engineering Graphics	1	0	4	3
6.	20BS2151	Basic Science Course	Engineering Chemistry Laboratory	0	0	3	1.5
7.	20ES2152	Engineering Science Course	Object Oriented Programming using Python Laboratory	0	0	3	1.5
8.	20ES2153	Engineering Science Course	Engineering Workshop	0	0	3	1.5
9.	20MC2106	Mandatory Course	Professional Ethics and Practice	1	0	0	-
Total				**14**	**0**	**13**	**19.5**

20BS2101 – LAPLACE TRANSFORMS AND INTEGRAL CALCULUS

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Vectors, Integration, Curve Tracing	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Solve the linear differential equations using Laplace Transforms.											
	CO2	Evaluate areas and volumes using double, triple integrals.											
	CO3	Evaluate Grad, Div & Curl of scalar and vector point functions.											
	CO4	Convert line integrals to area integrals and surface integrals to volume integrals.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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			1							
	CO2	3	2			1							
	CO3	3	2			1							
	CO4	3	2			1							

Course Content

UNIT- I

Laplace Transforms: Introduction, Definition, Conditions for the existence, Transforms of elementary functions, Properties of Laplace transforms, Transforms of periodic functions, Transforms of derivatives, Transforms of integrals, Multiplication by t^n, division by 't', Inverse transforms – Method of partial fractions, Other methods of finding inverse transform, Convolution theorem, Unit step and unit impulse functions.

Applications: Evaluation of integrals, Solving differential equations by Laplace transforms.

UNIT- II

Integral Calculus: Double integrals, Change of order of integration, Double integrals in polar coordinates, Triple integrals, Change of variables.

Applications: Area enclosed by plane curves, Volumes of solids

UNIT- III

Vector Differential Calculus: Scalar and vector point functions, Del applied to scalar point functions - Gradient, Del applied to vector point functions, Physical interpretation of divergence and curl, Del applied twice to point functions, Del applied to products of point functions

UNIT- IV

Vector Integral Calculus: Integration of vectors, Line integral, Surface integral, Green's theorem in the plane, Stokes's theorem, Volume integral, Gauss divergence theorem, Irrotational fields.

Text books and Reference books	**Text Book:** 1. B.S.Grewal, Higher Engineering Mathematics, 44th Ed., Khanna Publishers, 2019. **Reference Books:** 1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015 2. B.V.Ramana, "Higher Engineering Mathematics", 1st Ed., Tata MC Graw Hill, 2007 3. N.P.Bali, Dr. Manish Goyal, "A Text Book of Engineering Mathematics, 9th Ed., Laxmi Publications, 2014
E-resources and other digital material	1. https://www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/122/104/122104017/ 3. https://nptel.ac.in/courses/111/105/111105035/

20BS2102 – ENGINEERING CHEMISTRY

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Chemistry knowledge at Intermediate level	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:											
	CO1	Analyze various water treatment methods and boiler troubles.										
	CO2	Apply the concept of phase equilibrium to different materials and the knowledge of working of electrodes and batteries in various technological fields.										
	CO3	Evaluate corrosion processes as well as protection methods.										
	CO4	Apply the knowledge of conventional fuels and mechanistic aspects of conducting polymers for their effective and efficient utilization.										
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1		3										
	CO2	2											
	CO3			3									
	CO4					2							

Course Content

UNIT- I

Water Technology - I: WHO Standards – Water treatment for drinking purpose - Sedimentation, Coagulation, Filtration, Disinfection by chlorination, Breakpoint chlorination and its significance – Desalination of brackish water – Principle and process of electro dialysis and reverse osmosis, Advantages and disadvantages.

Water Technology - II: Boiler troubles – Scales - Formation, Disadvantages and internal conditioning methods – Phosphate conditioning, Calgon conditioning and sodium aluminate, Caustic embrittlement - Reasons, Mechanism and its control and boiler corrosion causes and control

UNIT- II

Phase Rule and Applications: Definition and explanation of the terms – Phase, component and degree of freedom, Phase rule equation, Phase equilibria of single component system – Water system, Two component system – Silver – Lead system, Applications of phase rule.

Electrochemistry: Construction and working of Calomel electrode, Silver-Silver Chloride electrode and principle, Construction and working of glass electrode, Determination of ph using glass electrode. Chemistry of modern batteries - $LI/SOCL_2$ battery and $LI_XC/LICOO_2$ battery – Construction, Working and advantages. Fuel cells: General working principle of a fuel cell, Examples, Chemistry of H_2-O_2 fuel cell.

	UNIT- III **Corrosion Principles:** Introduction, Definition, Reason for corrosion, Examples – Types of electrochemical corrosion – Hydrogen evolution and oxygen absorption –Corrosion due to dissimilar metals, Galvanic series – Differential aeration corrosion – Pitting corrosion and concept of passivity. **Corrosion Control Methods:** Cathodic protection - Principle and types - Impressed current method and sacrificial anode method, Anodic protection – Principle and method, corrosion inhibitors – Types and mechanism of inhibition – Principle, Process and advantages of electroplating and electroless plating. **UNIT- IV** **Conducting Polymers:** Definition, Examples, Classification – Intrinsically conducting polymers and extrinsically conducting polymers – Mechanism of conduction of undoped polyacetylene, Doping of conducting polymers - Mechanism of conduction of p-doped and n-doped polyacetylenes – Applications of conducting polymers. **Fuel Technology:** Fuel - Definition, Calorific value - Lower and higher calorific values and numericals on calculation of HCV and LCV relation, Analysis of coal – Proximate analysis and ultimate analysis, Flue gas analysis by orsat's apparatus, Numericals based on calculation of air required for combustion.
Text books and Reference books	**Text Book:** 1. Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", 1st Ed., Cambridge University Press, New Delhi, 2015. **Reference Books:** 1. Sunita Rattan, "A Text Book of Engineering Chemistry", 1st Ed., S.K.Kataria & Sons, New Delhi, 2012. 2. P.C.Jain, "Engineering Chemistry", 15th Ed., Dhanpat Rai Publishing Company (P) Limited, NewDelhi. 3. B.S.Bahl, G.D.Tuli and Arun Bahl, "Essentials of Physical Chemistry", S. Chand and Company Limited, NewDelhi. 4. O.G.Palanna, "Engineering Chemistry", Tata Mc Graw Hill Education Pvt .Ltd., NewDelhi.
E-resources and other digital material	1. http://nopr.niscair.res.in/bitstream/123456789/5475/1/JSIR%2063%289%29%20715-728.pdf 2. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry/Basics_of_Electrochemistry 3. https://www.filtronics.com/blog/tertiary-treatment/stages-in-typical-municipal-water-treatment/

20ES2103 – OBJECT ORIENTED PROGRAMMING USING PYTHON

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Programming for Problem Solving Programming for Problem Solving Laboratory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:											
	CO1	Interpret the python syntax and semantics of control flow statements										
	CO2	Apply functions and modules in python to solve a problem										
	CO3	Apply 3rd party packages for developing solutions for real time problems										
	CO4	Implement the problems in terms of real world objects using OOPs concept										
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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						2			3
	CO2	2	2	2						2			3
	CO3	2	2	2						2			3
	CO4	2	2	2						2			3

Course Content

UNIT- I

Introduction: History - Origins of Python, Features of Python - Why choose Python, What can I do with Python, Installing, Python 2 & 3 installation on windows

Variables, Expressions & Statements: Variables, Variable names & keywords, Operators & operands, Expressions, Order of operations, Modulus operator, String operations.

Conditional Execution: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Exceptions using try and except, Short circuit evaluation of logical expressions.

Iterations: The while statement, Infinite loops, "Infinite loops" and break, Finishing iterations with continue, Definite loops using for.

UNIT- II

Functions: Function calls, Built-in functions, Type conversion functions, Random numbers, Math functions, Adding new functions, Definition and uses, Flow of Execution, Parameters & arguments, Fruitful and void functions, Why functions?, Recursion, Scope of a variable.

Modules: Packages small description about modularity, Third party packages, A brief tour of standard library, Command line arguments, Error output redirection and program termination, String pattern matching, Mathematics, Internet access, Dates & times, Data Compressions

	UNIT- III **Lists**: Syntactically, Accessing element from list, Slicing a list, Lists are mutable sequences, Deleting items in a list and deleting list, Methods, Searching **Dictionaries:** Creating a dictionary, Dictionary operations, Dictionary methods, Aliasing and copying **Tuples:** Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignment with dictionaries, Using tuples as keys in dictionaries **Strings**: A string is a sequence, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, String methods **Sets**: Modifying a set, Removing items from set, Set operations. **UNIT- IV** **Object Oriented Programming in Python**: Python classes, Methods, Constructors, Class variables & instance variables, Basic inheritance, Special methods, Data hiding
Text books and Reference books	**Text Books:** 1. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017. 2. Charles Severance, "Python for Informatics –Exploring Information", 1st Ed., Shroff Publishers, 2017. **Reference Books:** 1. Mark Lutz, "Learning Python", 5th Ed., Orielly, 2013. 2. Allen Downey "Think Python, How to Think Like a Computer Scientist", 2nd Ed., Green Tea Press, 2015. 3.W.Chun, "Core Python Programming", 2nd Ed., Prentice Hall, 2006. 4. Kenneth.A.Lambert, "Introduction to Python", 1st Ed., Cengage Learning, 2011
E-resources and other digital material	1. Charles Severance: University of Michigan, "Python for Everybody"- Coursera https://www.coursera.org/ 2. Prof. Sudarshan Iyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, "The Joy of Computing using Python–Nptel https://nptel.ac.in/courses/106/106/106106182/#

20ES2104B CIRCUIT ANALYSIS

Course	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	-	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze the AC and DC circuits by applying appropriate theorems													
	CO2	Analyze two-port network parameters													
	CO3	Design different resonant circuits for the given specification													
	CO4	Analyze the DC transient response of RL, RC and RLC circuits													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
	CO1	3													2
	CO2	3		1											2
	CO3	3		2											2
	CO4	3													2

Course Content

UNIT I

D.C Circuits & Network Theorems: Superposition theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Tellegen's theorem, Millman's theorem and Maximum Power Transfer Theorem.

A.C Circuits & Network Theorems: Nodal and Loop methods of analysis, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer Theorem.

(12Hrs)

UNIT II

Two Port Network: Relationship of two port variables, Short circuit admittance parameters, Open circuit impedance parameters, Transmission parameters, Hybrid parameters, Relation between parameter sets, Parallel connection of two port networks.

(12Hrs)

UNIT III

Steady State Analysis of AC Circuits: Response to sinusoidal excitation – series RL, RC and RLC circuits, parallel RL, RC and RLC with complex impedance and phasor notation

	Resonance: Series resonance, Parallel resonance, concept of band width and Q factor. (12Hrs) **UNIT IV** **Transient Analysis :** First order differential equations, definition of time constant, RL circuit, RC circuit with DC excitation, evaluating initial condition procedure, second order differential equations, homogeneous and non-homogeneous problem solving using RLC elements with DC excitation. (10Hrs)
Text books and Reference books	**Text Books:** 1. Jr William H Hayt & Jack Kemmerly "Engineering Circuit Analysis", 6th edition, McGraw-Hill, 2000. **Reference Books:** 1. M. E.Van Valkenburg "Network Analysis" 3rd edition, PHI, 2009. 2. A Sudhakar and SP Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", 4th edition, TMH, 2002.
E-resources and other digital material	1. http://nptel.iitm.ac.in/courses/webcoursecontents/IIT%20kharagpur/basic%20electrical% 2. http://nptel.iitm.ac.in/video.php?subjectId=108102042 3. http://www.ece.umd.edu/class/enee204.../LectureNotes/LectureM ain.htm

20ES2105 – ENGINEERING GRAPHICS

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory & Practice	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Understand the scales and conics											
	CO2	Draw orthographic projections of points, lines and planes											
	CO3	Draw orthographic projections of solids and to understand basics of AutoCAD											
	CO4	Understand the sections, development of solids and draw isometric views using AutoCAD											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	3		3				3					
	CO2	2		3				3					
	CO3	2		3				3					
	CO4	1		3				3					

Course Content

UNIT- I

Introduction to Engineering Drawing: Principles of engineering graphics and their significance

Scales: Construction of plain and diagonal scales

Conic Sections: Construction of ellipse, parabola and hyperbola (Treatment is limited to eccentricity or general method only)

UNIT–II

Orthographic Projections: Principles of orthographic projections –projections of points, Lines (Treatment is limited to first angle projection) and projections of plane regular geometric figures (Upto plane inclined to both of the reference planes)

UNIT–III

Projections of Solids: Projections of simple solids such as cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to solid inclined to one of the reference planes)

Introduction to AutoCAD: Basic introduction and operational instructions of various commands in AutoCAD. **(**Internal evaluation only**)**

UNIT–IV

Sections and Development of Surfaces of Right Angular Solids: Sections and sectional views of right angular solids of Prism, Pyramid and Cone, Development of surfaces of right regular solids of prism, Pyramid and cone.

Isometric Projections: Conversion of isometric views into orthographic projections of simple

	castings using AutoCAD. (Treatment is limited to simple objects only, Internal Evaluation only).
Text books and Reference books	**Text Books:** 1. Basanth Agrawal & C.M.Agrawal, "Engineering Drawing", McGraw Hill Education Private Limited, New Delhi. 2. N.D.Bhatt "Engineering Drawing", 53rd Ed., Charotar Publishing House, Anand, 2019 **Reference Books:** 1. K.L.Narayana & P.Kannaiah, "Text Book on Engineering Drawing", 2nd Ed., Scitech publications (India) Pvt.Ltd., Chennai, 2006. 2. K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International, New Delhi. 3. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, Delhi, 2013.
E-resources and other digital material	1. http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html#isodrawing. 2. https://onlinecourses.nptel.ac.in/noc20_me79/preview 3. https://nptel.ac.in/courses/112/103/112103019/

20ES2152 – OBJECT ORIENTED PROGRAMMING USING PYTHON LABORATORY

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	Programming for Problem Solving, Programming for Problem Solving Laboratory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:											
	CO1	Implement python programming constructs to build small to large applications.										
	CO2	Implement the problems in terms of real world objects using OOPs concept										
	CO3	Evaluate and handle the errors during run time involved in a program										
	CO4	Extract and import packages for developing different solutions for real time problems										
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	3		2						2			3
	CO2	3	2	2						2			3
	CO3	2	2	2						2			3
	CO4	2	2	2						2			3
Course Content	**List of Experiments:** **Week 1: Fundamental Programs** Running instructions in interactive interpreter and a Python script Write a program to purposefully raise indentation error and correct it **Week 2: Operations** Develop Python programs using basic operations in Python **Week 3 & 4 : Conditional & Control Flow** Develop Python programs that make use of conditional and control flow structures. **Week 5: Functions** Develop Python programs using recursive and non-recursive functions **Week 6, 7 & 8: Data Structures** Develop Python programs using suitable data structures **Week 9: Modules** Illustrate installing packages via PIP and develop Python programs using modules											

	Week 10& 11: Application oriented case studies **Week 12: Classes, Inheritance** Illustrate class variables and instance variable Develop Python programs to exemplify the concepts of inheritance and overloading
Text books and Reference books	**Text Books:** 1. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017. 2. Charles Severance, "Python for Informatics – Exploring Information", 1st Ed., Shroff Publishers, 2017 **R eference Books:** 1. Mark Lutz, "Learning Python", 5th Ed., Orielly, 2013. 2. Allen Downey "Think Python, How to Think Like a Computer Scientist", 2nd Ed., Green Tea Press, 2015. 3. W.Chun, "Core Python Programming", 2nd Ed., Prentice Hall, 2006. 4. Kenneth.A.Lambert, "Introduction to Python", 1st Ed., Cengage Learning, 2011.
E-resources and other digital material	1. Charles Severance: University of Michigan, "Python for Everybody", Coursera https://www.coursera.org/ 2. Prof .Sudarshan Iyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, "The Joy of Computing Using Python" NPTEL https://nptel.ac.in/courses/106/106/106106182/# 3. Charles Russell Sevarance, University of Michigan, "Python for Everybody", 2019. https://www.coursera.org/learn/python

20ES2153 – ENGINEERING WORKSHOP

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0- 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:											
	CO1	Understand the basic joints using wood and familiarize with various fundamental aspects of house wiring.										
	CO2	Prepare basic models using sheet metal and practice joining of metals using arc welding technique.										
	CO3	Familiarize with various manufacturing processes such as injection moulding and 3D printing										
	CO4	Understand the preparation of PCB										
	CO5	Understand simple IOT applications using Arduino										
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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			2					1			3	2
	CO2			2					1			3	2
	CO3			2					1			3	2
	CO4						1						
	CO5							2					

Course Content

List of Experiments:

Part-A

Carpentry:

Demonstration of cross half lap and T joints. (1class)

Demonstration of power tools.

Electrical Wiring:

Fundamentals of electric wiring and practice of series wiring. (1class)

Practice of staircase wiring and connecting a fluorescent tube.

Sheet Metal & Soldering:

Preparation of complete funnel using sheet metal and practice of soldering. (2classes)

Preparation of a square box using sheet metal and practice of soldering.

	Welding: Preparation of corner joint using arc welding process. (1class) Preparation of "T" joint using arc welding process. **Manufacturing Processes:** Preparation of a small plastic part using injection moulding process. (1class) Demonstration of manufacturing a simple model using 3D printing process. **Electronic Circuits:** **To prepare PCB for the given electronic circuit** To prepare the layout and printing it on copper clad board To etch and drill the holes on PCB (2classes) **To solder the components on the PCB prepared and test the circuit** To identify and solder the components on the PCB prepared To test the operation of the circuit. **Basic IOT:** **Demonstration of Arduino board** Demonstrate different components & pin configuration of Arduino To set up Arduino IDE for programming. **To measure Temperature & Humidity** Interfacing of temperature & humidity sensor with Arduino. (2classes) Execute the program on Arduino IDE & display the measured values. T**o measure Distance** Interfacing of ultrasonic sensor with Arduino Execute the program on Arduino IDE & display the measured value. **Part-B** **Group Activity** (4classes) Students must prepare a working model / assembly using the knowledge gained from the above trades.
Text books and Reference books	**Text Books:** 1. Kannaiah.P & Narayana.K.C, "Manual on Workshop Practice", Scitech Publications, Chennai, 1999. 2. Venkatachalapathy.V.S., " First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999. **Reference Books:** 1. Gopal.T.V, Kumar.T and Murali.G, " A First Course on Workshop Practice – Theory, Practice and Work Book", Suma Publications, Chennai, 2005

E-resources and other digital material	1. https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17-1.pdf 2. https://www.protosystech.com/rapid-prototyping.htm 3. https://www.arduino.cc/en/Tutorial/Foundations 4. https://www.tutorialspoint.com/arduino/index.htm

20MC2106 – PROFESSIONAL ETHICS & PRACTICE

Course Category:	Mandatory	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 0- 0
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Know the moral autonomy and uses of ethical theories.											
	CO2	Understand engineering as experimentation											
	CO3	Understand about safety, risk and professional rights.											
	CO4	Know the ethics regarding global issues related to environment, computers and weapons development. Understand general principles of contracting.											
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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												
	CO2												
	CO3												
	CO4												
Course Content	**UNIT- I** **Engineering Ethics**: Senses of 'Engineering Ethics' - Variety of moral issues- Types of inquiry – Moral dilemmas – Moral autonomy - Kohlberg's theory - Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action –Self interest – Customs and religion – Uses of ethical theories. **UNIT- II** **Engineering as Social Experimentation**: Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law –The challenger case study **UNIT- III** **Safety, Responsibilities and Rights:** Safety and risk-assessment of safety and risk-risk benefit analysis and reducing risk – The three mile island and chernobyl case studies. Collegiality and loyalty – Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime – Professional rights – Employee rights-Intellectual Property Rights (IPR) - Discrimination **UNIT- IV** **Global Issues**: Multinational corporations – Environmental ethics – Computer ethics – Weapons development - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership – Sample code of ethics (Specific to a particular												

	engineering discipline). **General Principles of Contracts Management:** Indian contract act, 1972 and amendments covering general principles of contracting.
Text books and Reference books	**Text Books:** 1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, NewYork (1996). 2. Govindarajan.M, Natarajan.S, Senthil Kumar.V.S., "Engineering Ethics", Prentice Hall of India, New Delhi (2004). **Reference Books:** 1. Baum, R.J. and Flores, A., "Ethical Problems in Engineering, Center for the study of the Human Dimensions of Science and Technology", Rensellae Polytechnic Institute, Troy, New York, 1978. 2. Beabout.G.R, Wennemann.D.J, "Applied Professional Ethics: A Developmental Approach for Use with Case Studies", University Press of America Lanham, MD, 175pp , 1994. 3. Dutt, "Indian Contract Act", Eastern Law House, 1994.
E-resources and other digital material	

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER III **CONTACT HOURS: 28**

S.No.	Course Code	Subject	L	T	P	Credits
1	20BS3101	Complex Analysis and Numerical Methods	3	0	0	3
2	20EC3302	Analog Electronics	3	0	0	3
3	20EC3303	Microcontrollers	3	0	0	3
4	20EC3304	Digital Circuit Design	3	0	0	3
5	20EC3305	Probability Theory & Random Processes	3	0	0	3
6	20EC3351	Analog Electronics Lab	0	0	3	1.5
7	20EC3352	Microcontrollers Lab	0	0	3	1.5
8	20EC3353	Digital Circuit Design Lab	0	0	3	1.5
9	20TP3106	Logic and Reasoning	0	0	2	1
10	20MC3107A	Environmental Studies	2	0	0	-
Total Credits			**17**	**0**	**11**	**20.5**

20BS3101: COMPLEX ANALYSIS & NUMERICAL METHODS

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture-Tutorial-Practice:**	3-0-0
Prerequisites:	Algebra of Complex numbers, convergence of infinite series, theory of equations	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Determine analytic, non-analytic functions and evaluate complex integrals.													
	CO2	Analyze Taylor, Laurent series and evaluate real definite integrals using residue theorem.													
	CO3	Solve algebraic, transcendental, system of equations and estimate functions using polynomial interpolation.													
	CO4	Solve initial value problems numerically.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High		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
	CO1	3				2		2							3
	CO2	3				2		2							3
	CO3	3	2			3							2		3
	CO4	3	2			3							2		3

Course Content

UNIT I

Complex Analysis:

Introduction, Continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Application to flow problems, Complex integration, Cauchy's integral theorem, Cauchy's integral formula.

UNIT II

Taylor's series, Laurent's series, Zeros and Singularities of an analytic function, Residue theorem, Calculation of Residues, Evaluation of real definite integrals:(i) Integration around the unit circle (ii) Integration around a small semi-circle, Bilinear transformation.

UNIT III

Numerical Methods:

Solution of Algebraic and Transcendental Equations with Newton - Raphson method, Solution of Simultaneous linear equations with Gauss - Seidel iterative method.

Interpolation: Introduction, Finite Differences-Forward, Backward and Central differences, Symbolic Relations, Newton's interpolation formulae-forward and backward differences, Central difference interpolation formulae-Gauss's, Stirling's, Bessel's formulae Interpolation with unequal intervals - Lagrange's and Newton's divided difference formulae.

	UNIT IV Numerical Differentiation-First and second order derivatives using Newton's forward and backward difference formulae, Numerical integration with Trapezoidal rule and Simpsons 1/3 Rule, Numerical Solutions of Differential Equations-Taylor's series method, Euler's method, Modified Euler's method and Runge - Kutta method of 4th order.
Textbooks and Reference books	**Text Book:** 1. B.S.Grewal, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2019. **Reference Book(s):** 1. ErwinKreyzig, "Advanced Engineering Mathematics", 10th Edition, John Wiley & Sons, 2015. 2. R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publishers, 2016. 3. N.P.Bali, Manish Goyal, "A Textbook of Engineering Mathematics", 9thEdition, Lakshmi Publications (P) Limited, 2016. 4. H. K. Das, Er. Rajnish Verma, "Higher Engineering Mathematics", 3rdRevised Edition, S.Chand & Co., 2014. 5. S. S. Sastry, "Introductory Methods of Numerical Analysis", 5th Edition PHI Learning, 2012.
E-resources and other digital material	1. Prof. Pranav Haridas,Kerala School of Mathematics, Complex Analysis, Available:https://onlinecourses.nptel.ac.in/noc21_ma39/preview 2. Prof. Ameeya Kumar Nayak,Prof. Sanjeev Kumar, IIT Roorkee, Numerical methods, Available:https://onlinecourses.nptel.ac.in/noc21_ma45/preview 3. Jeremy Orloff, Massachusetts Institute of Technology: MIT OpenCourseWare, *Complex Variables with Applications,* Available:https://ocw.mit.edu. 4. Henrik Schmidt, Massachusetts Institute of Technology: MITOpenCourseWare,*Introduction to Numerical Analysis for Engineering,* Available:https://ocw.mit.edu.

20EC3302: ANALOG ELECTRONICS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	20PH1102-Engineering Physics, 20EE1104-Basics of Electrical Engineering	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Develop the ability to understand, analyze and design practical circuits based on Diodes and BJTs.
	CO2	Able to design amplifier circuits using MOSFET and also will be able to understand the frequency response of the amplifiers.
	CO3	Able to design multistage amplifier and power amplifier circuits using BJTsand also will be able to understand the frequency response of the amplifiers.
	CO4	Understand the effect of positive and negative feedback on different parameters of amplifiers and able to design oscillator circuits using BJTs.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High

	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
CO1	1		2											
CO2		2		2										
CO3		2			2									
CO4	2			2										

Course Content

UNIT I:
Diode Circuits: P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers. Input output characteristics of BJT in CB, CE, CC configurations, biasing circuits, Load line analysis, common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits.
(12 Hrs)

UNIT II:
MOSFET Circuits: MOSFET structure and I-V characteristics. MOSFET as a switch. small signal equivalent circuits - gain, input and output impedances, small-signal model and common-source, common-gate and common-drain amplifiers, trans conductance, high frequency equivalent circuit. **(12 Hrs)**

UNIT III:
Multi-Stage and Power Amplifiers: Direct coupled and RC Coupled multi-stage amplifiers; Differential Amplifiers, Power amplifiers - Class A, Class B, Class C. **(10 Hrs)**

	UNIT – IV: **Feedback Amplifiers:** Concepts of feedback – Classification of feedback amplifiers – General characteristics of Negative feedback amplifiers – Effect of Feedback on Amplifier characteristics – Voltage series, Voltage shunt, Current series and Current shunt Feedback configurations – Simple problems. **Oscillators:** Condition for Oscillations, RC type Oscillators-RC phase shift and Wien-bridge Oscillators, LC type Oscillators –Generalized analysis of LC Oscillators, Hartley and Colpitts Oscillators. **(11 Hrs)**
Text books and Reference books	**Text Books:** 1. Integrated Electronics, Jacob Millman, Christos C Halkias, McGraw Hill Education, 2nd edition 2010 2. Microelectronic Circuits: Theory and Applications, Adel S. Sedra and K . C. Smith, 7th edition, Oxford University Press. **Reference Books:** 1. Electronics circuits and applications , Md H Rashid, Cengage 2014 2. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, A Vallvaraj, 5th Edition, MC Graw Hill Education 3. Electronic Devices and Circuits, David A. Bell – 5th Edition, Oxford. 4. Electronic Devices and Circuits theory– Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson.
E-resources and other digital material	1. https://onlinecourses.nptel.ac.in/noc20_ee45/preview 2. https://nptel.ac.in/courses/117/101/117101106/

20EC3303: MICROCONTROLLERS

Course Category:	**Program Core**	**Credits:**	3
Course Type:	**Theory**	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	**---**	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apprehend the internal architecture of 8051microcontroller													
	CO2	Implement application logic in assembly language for 8051													
	CO3	Develop C programs for applications using 8051.													
	CO4	Design a system for basic embedded applications													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1		2											2	
	CO2	2		1										2	
	CO3		2	2										2	
	CO4			2										2	
Course Content	**UNIT I:** Inside the Computer, Microcontrollers and Embedded Processors, Overview ot the 8051 Family, Pin description of the 8051, 8051 Addressing modes, Immediate and Register Addressing modes, Accessing Memory using Various Addressing Modes, Bit Addresses for I/O and RAM, Inside the 8051, Introduction to 8051 assembly programming, Assembling and running an 8051 program, Program Counter and ROM space in the 8051,8051 data types and directives, Flag bits and PSW register, Register Banks and Stack. (**10 Hrs)** **UNIT II:** Arithmetic Instructions, Signed number concepts and Arithmetic Operations, Logic and compare Instructions, Rotate Instruction and Data serialization, BCD, ASCII, and other application programs, Loop and Jump Instructions, Call Instructions 8051 I/O programming, I/O bit manipulation programming, Data types and Time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C**. (13 Hrs)**														

	UNIT III: Programming 8051 Timers, Counter programming, Programming timers0 & 1 in 8051C, Basics of serial communication, 8051 serial port programming in assembly, serial port programming 8051 in C, 8051 Interrupts, programming Timer interrupts, programming the serial communication interrupt, interrupt priority in the 8051. Interrupt programming in C. (**12 Hrs)** **UNIT – IV:** Semiconductor memory, Memory address decoding, 8031/51 Interfacing with external ROM, Parallel and ADC, DAC interfacing, Sensor interfacing and signal conditioning, LCD interfacing, keyboard interfacing. (**10 Hrs)**
Text books and Reference books	**Text Books:** *1.* Muhammad Ali Mazidin, Janice GillispieMazidi and Rolin D. McKinlay, "The 8051 Microcontroller and Embedded systems using assembly and C". 2/e Pearson Education, 2007. 2. Kenneth J Ayala, "The 8051 Microcontroller", 3rd edition, 2004, Cengage Learning. **Reference Books:** 1. Rajkamal "Microcontrollers, Architecture, Programming and system design", Pearson Education, 2007. 2. Ajay V Deshmukh, "Microcontrollers Theory and Applications", Tata McGraw-Hill, 2005.
E-resources and other digital material	1. https://nptel.ac.in/courses/108105102/ 2. http://www.datasheetarchive.com/8051-datasheet.html-(8051 datasheet). 3. www.8052.org

20EC3304: DIGITAL CIRCUIT DESIGN

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	Electronic Devices	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply the map method for simplifying Boolean expressions and construct digital circuits with AND- OR, NAND, or NOR gates.													
	CO2	Design various combinational circuits and use Verilog HDL for the description of behavioral model of circuit's functionality.													
	CO3	Analyze and design various sequential circuits.													
	CO4	Assess the performance of different logic families and use Verilog HDL for the description of behavioral model of circuit's functionality.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1	1	1												1
	CO2	2													2
	CO3	2													2
	CO4		2												1

Course Content

UNIT I:

Boolean Algebra: Basic theorems and properties of Boolean functions, canonical and standard forms, digital logic gates.

Gate level minimization: The map method, four variable map, product of sums simplification, don't care conditions, NAND and NOR implementation. **(11 Hrs)**

UNIT II:

Combinational Logic: Combinational circuits, analysis procedure, design procedure, binary adder-subtractor, magnitude comparator, decoders, encoders and multiplexers

HDL Models for Combinational Circuits: Module declaration, Gate level modeling, dataflow modeling, and Behavioral modeling. **(11 Hrs)**

UNIT III:

Synchronous Sequential logic: Sequential circuits, storage elements: latches, flip-flops, analysis of clocked sequential circuits, design procedure and synthesis using D-flip-flops.

Registers and counters: Registers, shift registers, ripple counter, synchronous counters. **(12 Hrs)**

	UNIT – IV: **Synthesizable HDL Models of Sequential Circuits:** Behavioral modeling of flip flops, latches, state diagrams. **Digital Integrated Circuits**: Special Characteristics, Transistor-Transistor Logic, Emitter Coupled Logic, Metal Oxide Semiconductor, Complementary MOS. **(11 Hrs)**
Text books and Reference books	**Text Books:** 1. M. Morris Mano, Michael D. Ciletti, "Digital Design", 4th edition, Prentice Hall, 2013. **Reference Books:** 1. Brown, Stephen D. "Fundamentals of digital logic with Verilog design". Tata McGraw-Hill Education, 2007. 2. Thomas L. Floyd "Digital Fundamentals", 11th Edition, Pearson Education India, 2015.
E-resources and other digital material	1. http://www.ece.ubc.ca/~saifz/eece256.html 2. https://nptel.ac.in/courses/117/106/117106086/

20EC3305: PROBABILITY THEORY AND RANDOM PROCESSES

Course Category:	Basic Science	**Credits:**	3
Course Type:	Practical	**Lecture - Tutorial-Practice:**	3-0-0
Prerequisites:	20EC3305: Signals and Systems	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Develop the probability distribution and density functions of random variables and compute the statistical parameters.
	CO2	Develop the Joint probability distribution and Joint Probability density functions of random variables and compute the statistical parameters.
	CO3	Characterize systems driven by a stationary random process using autocorrelation and power spectral density functions.
	CO4	Analyze and model random noise processes in typical communication systems

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)	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
CO1	3													1
CO2	3													1
CO3	3													1
CO4	3	3												1

Course Content

UNIT-I

Probability: Probability introduced through Sets and Relative Frequency, Joint Probability and Conditional Probability, Independent Events, Combined Experiments, Bernoulli trials

Random Variables: The Random Variable Concept, Distribution Function and Density function, Q Function, Error Function, The Gaussian Random Variable, Other Distribution and Density Examples. Conditional Distribution and Density Functions.

Operations on One Random Variable: Expectation, Moments, Functions that give Moments, Transformations of a Random Variable.

(12Hrs)

UNIT-II

Multiple Random Variables: Vector Random Variables, Joint Distribution and its Properties, Joint Density and its Properties, Conditional Distribution and Density, Statistical Independence, Distribution and Density of Sum of Random Variables, Central Limit Theorem (Proof not expected).

Operations on Multiple Random Variables: Expected Value of a Function of Random Variables, Joint Characteristic Functions, Jointly Gaussian Random Variables. **(12Hrs)**

	UNIT-III **Random Process**: Random Process Concept, Stationary and Independence, Correlation Functions, Gaussian Random Process, Poisson Random Process**.** **Random Process Spectral Characteristics**: Linear system with random inputs**,** Power Density Spectrum and its properties, Relationship between Power Spectrum and Auto Correlation Function, Cross Power Density Spectrum and its properties, Relationship between Cross-Power Spectrum and Cross-Correlation Function. Random signal response of linear systems, Spectral characteristics of system response. **(12 Hrs)** **UNIT – IV** **Noise:**Shot Noise, Thermal Noise, Noise Calculations: Single Noise Source, Multiple Sources: Superposition of Power Spectra, Noise Calculations in Passive Circuits, Equivalent. Noise Bandwidth, Noise Figure of an Amplifier, Power Density and Available Power Density, Effective Noise Temperature, Noise Figure in Terms of Available Gain, Cascaded Stages. **(9 Hrs)**
Text books and Reference books	Text Book: 1. Peyton Z. Peebles, "Probability, Random Variables & Random Signal Principles", 4th Edition, TMH, 2002. (Units - I, II, III) 2. B.P. Lathi, "Signals, Systems & Communications", B.S. Publications, 4th Edition, 2009. (Unit - IV). Reference Books: 1. Athanasios Papoulis, S.Unnikrishna Pillai, "Probability, Random Variables and Stochastic Processes", 4rd Edition, TMHl, 2002. (UNITS –I,II,III) 2 R.P. Singh and S.D. Sapre, "Communication Systems: Analog & Digital", 3rd Edition, TMH, 2012. (Units –I,II,IV)
E-resources and other digital material	1. http://nptel.ac.in/courses/117105085/ 2. https://www.stat.berkeley.edu/~aldous/134/gravner.pdf

20EC3351: ANALOG ELECTRONICS LAB

Course Category:	Core	**Credits:**	1.5
Course Type:	LAB	**Lecture - Tutorial -Practice:**	0-0-3
Prerequisites:	Semiconductor Physics, Analog Devices.	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design and test practical electronic circuits using Diodes, BJTs, MOSFETs.													
	CO2	Able to design amplifier circuits using BJT and MOSFET also will be able to understand the frequency response of the amplifiers.													
	CO3	Design and analyze various transistor power amplifier circuits, feedback circuits and oscillators.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1			2	3										2
	CO2			2	3										2
	CO3			2	3										2

Lab Content

1. Understand the PN Junction and Zener diode characteristics
   (a) Circuit Simulation Tutorials for P-N diodes (LTspice) & Experimental
   (b) Circuit Simulation Tutorials for Zener diodes (LTspice) & Experimental
2. Understand the BJT and MOSFET characteristics
   (a) Circuit Simulation Tutorials for BJT (LTspice) & Experimental
   (b) Circuit Simulation Tutorials for MOSFET (LTspice) & Experimental
3. Design and Implementation of Diode Rectifier Circuits.
4. Design and Analysis of BJT CE Fixed, Self-bias Circuits.
5. Design and Frequency Analysis of BJT CE Amplifier.
6. Design and Analysis of MOSFET CS Self Bias Circuits.
7. Design and Frequency Analysis of MOSFET CS Amplifier.
8. Design and analysis of transistor Class-A power amplifier.
9. Analysis of Feedback circuits with MOSFETs.
10. Design and Analysis of Voltage regulator circuits
11. Design and Analysis of Wien Bridge oscillator.
12. Design and Analysis of RC phase shift, LC oscillators.

	***Course based project** To implement the course project, following are the example circuits to be executed: Water Level Alarm Circuit, Street Light Circuit, Low Cost Fire Alarm Circuit etc..
Text books and Reference books	1. Jacob Millman and Christos C Halkias, "Integrated Electronics:Analog and Digital Circuits and Systems", TMH, 2003. 2. Jacob Millman and Herbert Taub, "Pulse, Digital and Switching Waveforms, 3rd Edition, TMH, 2003. 3. Rajesh Singh, Anita Gehlot, and Bhupendra Singh, "Arduino-Based Embedded Systems: Interfacing, Simulation, and LabVIEW GUI ", Taylor and Francis, CRC press, 2018. 4. Arduino and Raspberry Pi lab manuals
E-resources and other digital material	1. https://dspace.mit.edu/bitstream/handle/1721.1/45581/6-101Fall-2002/OcwWeb/Electrical-Engineering-and-Computer-Science/6-101Introductory-Analog-Electronics-LaboratoryFall2002/Labs/index.htm 2. https://newhorizonindia.edu/nhengineering/analog-electronics-circuits-lab/

NB: Eligibility for External Practical Examination:

1. A minimum of 10(Ten) experiments to be performed and recorded by the candidate.
2. Execute and submit a course-based project

20EC3352: MICROCONTROLLERS LAB

Course Category:	**Program Core**	**Credits:**	1.5
Course Type:	**Lab**	**Lecture - Tutorial -Practice:**	0-0-3
Prerequisites:	**---**	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Develop assembly and C language programs on 8051.													
	CO2	Interface the peripherals to 8051 and program using assembly and C Language.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1				3	3								3	
	CO2				3	3								3	
Course Content	List of experiment to be implemented on 8051 using both assembly and C language. 1. Basic programs on Microcontroller Instruction set. 2. Programs on Serial Communications. 3. Programs on Timer operation. 4. Programs on counter operation. 5. Programs on Interrupt Mechanism. 6. Programs on LCD Display interfacing. 7. Programs on ADC interfacing 8. Programs on DAC interfacing. 9. Programs on Keyboard interfacing. 10. Programs on stepper motor interfacing 11. Programs on memory interfacing 12. Programs on I2C bus interfacing **Course based Project** 1. Design and development a digital thermometer. 2. Design and development of Bluetooth Controlled Home Automation System using 8051 3. Design and development of line follower robot.														

E-resources and other digital material	1. www.8052.org 2. www.datasheetarchive.com/8051-datasheet.html

NB: Eligibility for external practical examination

1. A minimum of 10(Ten) experiments to be performed and recorded by the candidate.
2. Execute and submit a course-based project

20EC3353: DIGITAL CIRCUITS DESIGN LAB

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial-Practice:**	0-0-3
Prerequisites:	Digital Circuits and Systems	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design simple logic circuits and verify their functionality.													
	CO2	Develop skill to design simple digital circuits using Verilog HDL .													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3 – High)		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
	CO1	2	2												2
	CO2	2	2												2
Course Content	1. Verification of the following logic gates using discrete components a. NAND Gate b. NOR Gate c. Inverter 2. Design and implement the following a. Half adder using NAND/NOR Gates b. Full adder using Decoder IC 3. Design and implement subtractor using multiplexer IC 4. Design and implement 2-bit counter using JK flipflop IC 5. Implement ring counter using JK flipflop IC 6. Design and verify the operation of XOR gate using Verilog HDL in gate level, dataflow and behavioural modeling. 7. Design and verify the operation of an 8x3 Encoder using Verilog HDL 8. Design and verify the operation of a 1x8 demultiplexer using Verilog HDL 9. Design and implement the following code converters using Verilog HDL i. BCD to excess-3 code and vice versa ii. Binary to gray and vice-versa 10. Design and verify the operation of D-flipflop using Verilog HDL 11. Design and verify the operation of a universal shift register using Verilog HDL 12. Design a 3-bit odd number counter using Verilog HDL 13. Course Based Projects a. Develop a system to count no of students entering the lab and display the count on seven segment using digital ICs b. Simulate a simple microprocessor circuit and verify its functionality using Verilog HDL														

Text books and Reference books	**Reference Books:** 1. Palnitkar, Samir. "Verilog HDL: A guide to digital design and synthesis". Prentice Hall, 2003. 2. M. Morris Mano, Michael D. Ciletti, "Digital Design", 4th edition, Prentice Hall, 2013. 3. Brown, Stephen D. "Fundamentals of digital logic with Verilog design". Tata McGraw-Hill Education, 2007. 4. Thomas L. Floyd "Digital Fundamentals", 11th Edition, Pearson Education India, 2015.
E-resources and other digital material	1. https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/index.html 2. http://vlabs.iitkgp.ernet.in/dec/# 3. http://cse15-iiith.vlabs.ac.in 4. http://classweb.ece.umd.edu/enee359a/verilog_tutorial.pdf

Eligibility for External Practical Examination:

1. A minimum of 10(Ten) experiments to be performed and recorded by the candidate.
2. Execute and submit a course-based project

17HS3106: LOGIC & REASONING

Course Category:	Humanities & Social Sciences	**Credits:**	1
Course Type:	Learning by Doing	**Lecture -Tutorial-Practice:**	1 - 0 - 1
Prerequisites:	-	**Continuous Evaluation:**	100
		Semester end Evaluation:	0
		Total Marks:	100

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1	Think reason logically in any critical situation
CO2	Analyze given information to find correct solution
CO3	To reduce the mistakes in day to day activities in practical life
CO4	Develop time management skills by approaching different shortcut methods
CO5	Use mathematical based reasoning to make decisions
CO6	Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	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
CO1						**2**								
CO2		**2**												
CO3								**2**						
CO4									**2**					
CO5	**2**													
CO6	**1**													

COURSE CONTENT

UNIT I:

1. Series Completion
2. Coding-Decoding
3. Blood Relation Blood
4. Puzzles test
5. Direction sense test

UNIT II:

1. Logical Venn diagrams
2. Number test, Ranking test
3. Mathematical operations
4. Arithmetical Reasoning
5. Syllogism

UNIT III:

1. Binary Logic
2. Inserting missing character
3. Data sufficiency
4. Analogy
5. Classification

UNIT IV: Non – Verbal:

1. Water images,
2. Mirror images,
3. Paper folding,
4. Paper cutting,
5. Embedded Figures,
6. Dot situation,
7. Cubes & Dice

TEXT BOOKS

[1]. R. S. Aggarwal, " Verbal and non-verbal reasoning", Revised Edition, S Chand publication, 2017 ISBN:81-219-0551-6

e-Reference:
[1]. Indiabix.com, treeknox.com ,examveda

20MC3107A: ENVIRONMENTAL STUDIES

Course Category:	Mandatory Course	**Credits:**	-
Course Type:	Theory	**Lecture-Tutorial-Practice:**	2-0-0
Prerequisites:	Consciousness of Environment	Continuous Evaluation: Semester end Evaluation: Total Marks:	100 0 100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify various factors causing degradation of natural resource and control measures
	CO2	Identify various ecosystem and need for biodiversity
	CO3	Realize and explore the problems related to environmental pollution and its management
	CO4	Apply the information and technology to analyze social issues, use acts associated with environment

Contribution of Course Outcomes towards achievement of Program Outcomes (1-Low, 2-Medium, 3-High)

	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
CO1	1							1					1	
CO2		1	1							1			1	
CO3				1	1							1	1	
CO4						1	1	1					1	

Course Content

UNIT I

The Multidisciplinary Nature of Environmental Studies Definition, scope and importance Need for public awareness.

Natural Resources :

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a)Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forests and tribal people.

(b)Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

(c)Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

(d)Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

(e)Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.

(f)Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

	UNIT II **Ecosystems** Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b)Grassland ecosystem (c)Desert ecosystem (d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and Its Conservation** Introduction, definition: genetic, species and ecosystem diversity. Biogeographically classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.
	UNIT III **Environmental Pollution** Definition ,Causes, effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards **Solid waste management:** Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. **Disaster management:** Floods, earthquake, cyclone and landslides.
	UNIT IV **Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. **Environmental ethics** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. **Environment Protection Act** Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. **Public awareness** Human Population and the Environment, Population growth, variation among nations, Population explosion—Family Welfare Programme. **Environment and human health** Human rights, Value education,HIV/AIDS,Women and Child Welfare,Role of Information Technology in environment and human health.

	Field Work/ Case Studies Visit to a local area to document environmental assets—river/forest/grassland/hill/ mountain. Visit to a local polluted site—Urban/Rural/Industrial/Agricultural.Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc.
Self-Study	Water resources, Threats to biodiversity, Solid waste management, Role of Information Technology in environment and human health.
Text books and Reference books	**Text Book(s):** 1. ErachBharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, BharatiVidyapeeth Institute of Environment Education and Research. **Reference Books:** 1. AnjaneyuluY. Introduction to Environmental sciences, B S Publications PVT Ltd, Hyderabad 2. Anjireddy.M Environmental science & Technology, BS Publications PVT Ltd, Hyderabad. 3. Benny Joseph, 2005, Environmental Studies, The Tata McGraw- Hill publishing company limited, New Delhi. 4. Principles of Environmental Science. &Engg. P.VenuGopalaRao, 2006, Prentice-Hall of India Pvt. Ltd., New Delhi. 5. Ecological and Environmental Studies – Santosh Kumar Garg, RajeswariGarg (or) RajaniGarg, 2006, Khanna Publishers, New Delhi. 6. Essentials of Environmental Studies, Kurian Joseph & R Nagendran, Pearson Education publishers, 2005. 7. A.K Dee – Environmental Chemistry, New Age India Publications. 8. BharuchaErach- Biodiversity of India, Mapin Publishing Pvt.Ltd..
E-resources and other digital material	1. Erach Bharucha. 2004, Environmental Studies for undergraduate courses, University Grants Commission, New Delhi, Bharati Vidyapeeth Institute of Environment Education and Research. https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf 2. NPTEL Courses - Environmental Studies By Dr.Tushar Banerjee | Devi AhilyaViswavidyalaya, Indore.

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER IV **CONTACT HOURS: 31**

S. No.	Course Code	Course Title	L	T	P	Credits
1.	20BS4101	Signals & Systems	3	0	0	3
2.	20ES4102	Control Systems	3	0	0	3
3.	20EC4303	Pulse and Switching Circuits	3	0	0	3
4.	20EC4304	Analog & Digital Communications	3	0	0	3
5.	20HS4105	Universal Human Values	3	0	0	3
6.	20EC4351	Signals & Systems Lab	0	0	3	1.5
7.	20EC4352	Pulse & Switching Circuits Lab	0	0	3	1.5
8.	20EC4353	Analog & Digital Communications Lab	0	0	3	1.5
9	20EC4106	English for Professionals	**0**	**0**	**2**	**1**
10	20EC4607	Skill Oriented Course 1	**1**	**0**	**2**	**2**
11	20MC4108B	Indian Constitution	**2**	**0**	**0**	-
Total			**18**	**0**	**13**	**22.5**
Summer Internship six weeks (Mandatory) during summer vacation (EPICS)						
Honors/Minor Courses (the hours distribution can be 3-0-2 0r 3-1-0 also)			**4**	**0**	**0**	**4**

20BS4101: SIGNALS & SYSTEMS

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0 - 0
Prerequisites:	20BS2101:Linear Algebra and Differential Equations	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Classify the signals and systems based on their properties.													
	CO2	Analyze the spectral characteristics of signals using Fourier series and Fourier transforms.													
	CO3	Analyze the frequency response of linear systems and apply the concepts of convolution and correlation operations on different signals.													
	CO4	Apply the Transform techniques to analyze the discrete time signals & systems.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3– High)		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
	CO1	3												3	
	CO2	3												3	
	CO3	3	1											3	
	CO4	3												3	
Course Content	**UNIT I:** **Introduction to Signals:** Continuous-Time and Discrete-Time signals, Transformation of the Independent variable, Exponential and Sinusoidal signals, unit Impulse and Unit Step functions. **Introduction to Systems:** Continuous-time and Discrete-time systems, Basic system properties. Discrete time LTI Systems: The Convolution sum, Continuous Time LTI Systems: Convolution integral, Properties of Linear Time Invariant systems**.** **(12Hrs)** **UNIT II:** **Fourier series:** Fourier series representation of Continuous-time periodic signals, Convergence of the Fourier Series, Properties of Continuous time Fourier Series. **Fourier transform:** Representation of periodic signals: The Continuous-time Fourier transform, The Fourier transform for periodic signals, Properties of the continuous time Fourier transform. Relationship between Fourier transform and Laplace transform. **(12Hrs)**														

	UNIT III: **Frequency Analysis of Linear Systems:** Distortion less Transmission, Ideal filters, Causality and Physical reliability, Paley-Wiener criterion, Relation between Bandwidth and Rise time. **Correlation:** Signal Comparison, Correlation, Properties of Correlation functions, Correlation functions for Non-finite Energy Signals, Properties of Energy and Power spectral density spectrums. **(10Hrs)** **UNIT IV** **Sampling Theorem:** Introduction, sampling theorem, Reconstruction of a signal from its samples using Interpolation, The effect of Under sampling: Aliasing **Z Transforms:** Introduction, Z-transform, region of convergence for the Z-transform, Inverse Z-transform: Properties of Z-transform, Analysis and characterization of LTI systems using Z-transform. **(11Hrs)**
Text books and Reference books	**Text Books:** 1. Alan V.Oppenheim, Alan S. Willisky, "Signals & Systems", 2nd edition, Prentice-Hall of India Private Limited, 2015. (Units: 1,2 & 4) 2. B. P. Lathi, "Signals and Systems and Communications", BS Publications, 2008. (Unit: 3) **Reference Books:** 1. Simon Haykin and Barry Van Veen, 2nd edition, John Wiley, 2008. 2. Tarun Kumar Rawat, "Signals & Systems" Oxford University Press, 2010
E-resources and other digital material	1. https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/video-lectures/ 2. http://www.nptelvideos.in/2012/12/signals-and-system.html 3. http://www.thefouriertransform.com/ 4. https://www.youtube.com/watch?v=c_9JxwuEdqE&feature=emb_title

20ES4102: CONTROL SYSTEMS

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Co requisites:	20EC4101:Signal and systems	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the concepts of feedback control systems and model the physical systems
	CO2	Determine and analyze the linear systems using time domain analysis.
	CO3	Determine and analyze the linear systems using frequency response plots.
	CO4	Design and evaluate the compensators for linear systems to meet the desired specifications using bode-plots and understands the state space approaches.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3– High)

	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
CO1	2	1	2										2	
CO2	3	2											3	
CO3		2	3										2	
CO4	3	2	2										2	

Course Content

UNIT I:

Introduction: Basic Components of a Control System, Examples of Control System Applications, Open Loop Control Systems, Closed Loop Control Systems, Effect of Feedback on System Parameters, Types of Feedback Control Systems - Linear Versus Nonlinear Control Systems, Time Invariant Versus Time Varying Systems.

Mathematical Modeling of Physical Systems: Introduction, Equations of Electric Networks, Modeling of Mechanical System Elements, Impulse Response and Transfer Functions of Linear Systems, Block Diagrams, Signal Flow Graphs. **(11 Hrs)**

UNIT II:

Time Domain Analysis of Control Systems: Time Response of Continuous Data Systems, Typical Test Signals for the Time Response of Control Systems, Steady State Error, Unit Step Response and Time Domain Specifications, Transient Response of Prototype Second Order System, Effect of Adding Poles and Zeros to Transfer Functions, Dominant Poles of Transfer Function.

Stability of Linear Control Systems: Introduction Bounded Input – Bounded Output Stability, Zero Input and Asymptotic Stability of Continuous Data Systems, Methods of

	Determining Stability Routh-Hurwitz Criterion. **(11Hrs)** **UNIT III:** **Root-Locus Technique:** Introduction, Basic Properties of the Root Loci, Properties and Construction of the Root Loci, Some Important Aspects of the Construction of the Root Loci. **Frequency-Domain Analysis:** Introduction, $M_{r,}$, $W_{r,}$ Bandwidth of the Prototype Second-Order System, Effect of adding Poles and Zeros to the Forward-Path Transfer Function, Nyquist Stability Criterion, Nyquist Criterion for Systems with Minimum-Phase Transfer Functions, Relative Stability, Stability Analysis with the Bode Plot. **(12 Hrs)** **UNIT – IV:** **Design of Control Systems**: Introduction, Design with the Phase-Lead Controller, Design with the Phase-Lag Controller, Design with the Lead-Lag Controller. **State Variable Analysis**: Introduction, State Transition Matrix, State Transition Equation, Relation Between State Equations and Transfer Functions, Characteristic Equation, Eigen Values and Eigen Vectors, Controllability of Linear Systems, Observability of Linear Systems, Relationship among Controllability, Observability and Transfer Functions. **(11 Hrs)**
Text books and Reference books	**Text Books:** 1. Benjamin C. Kuo, "Automatic Control Systems", 7th edition, PHI, 2013. **Reference Books:** 1. J Nagrath& M Gopal, "Control Systems Engineering", 3rd edition, New Age International, 2003. 2. K Ogata, Modern Control Engineering, 4th edition, Pearson Education, 2003.
E-resources and other digital material	1. https://nptel.ac.in/courses/108101037/ 2. https://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/Control%20system%20design%20n%20principles/index.htm 3. http://en.wikibooks.org/wiki/Control_Systems 4. http://www.ebookpdf.net/linear-control-systems-ppt_ebook

20EC4303: PULSE AND SWITCHING CIRCUITS

Course Category:	Programme Core	**Credits:**	4
Course Type:	Theory	**Lecture - Tutorial -Practice:**	4-0-4
Prerequisites:	20EC3302: Analog Electronics	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design and analyze the response of Linear Wave Shaping circuits to different inputs.
	CO2	Design and analyze the response of Non Linear Wave Shaping circuits under different biasing conditions.
	CO3	Analyze, design and verify the states of Multivibrator Circuits.
	CO4	Analyze, design and verify the outputs of time based generators and blocking oscillators.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3– High)

	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
CO1	1	2	1	1								1	1	1
CO2	1	3	2	2									1	1
CO3	1	3	2	1									1	1
CO4	1	2	1	2								1	1	1

Course Content

UNIT I:

Linear Wave Shaping:

High pass RC Circuit: High pass RC Circuit: Step voltage input, Pulse input, Square wave input, Exponential & Ramp Inputs, The High pass RC Circuit as a Differentiator.

Low pass RC Circuit: The Low pass RC Circuit: Step voltage input, Pulse input, Square wave input, Exponential & Ramp Inputs, the Low Pass RC Circuit as a Integrator, Attenuators.

(11Hrs)

UNIT II:

Non-Linear Wave Shaping:

Clippers: Clipping Circuits, Diode Clippers, The transistor clipper, Clipping at Two Independent Levels.

Clampers: The Clamping Operation, Clamping Circuits Taking Source and Diode Resistances into Account (The transient waveform & Study state output wave form for

	square wave input), A Clamping Circuit Theorem and Practical Clamping Circuits. (11 Hrs) **UNIT-III** **Multivibrators:** **Bistable Multivibrator:** The Stable States of a Binary, A Fixed Bias Transistor Binary, Self Bias Transistor Binary, Commutating Capacitors, An emitter coupled binary. **Monostable and Astable Multivibrators:** Gate Width of a Collector Coupled Monostable Multivibrator, Waveforms of the Collector Coupled Monostable Multivibrators, The Astable Collector Coupled Multivibrator. **(12 Hrs)** **UNIT IV:** **Time Base Generators:** **Voltage Time Base Generators:** General Features of a Time Base Signal, Methods of Generating a Time Base Waveform, Exponential Sweep Circuit, Miller and Boot Strap Time Base Generators-General Considerations, The Transistor Miller Time Base Generator, Bootstrap time base generators-basic principles, The Transistor Boot Strap Time Base Generator. **Current Time Base Generators**: A Simple Current Sweep, Linearity Correction through Adjustment of Driving Waveform, A Transistor Current Time Base Generator. **(11 Hrs)**
Text Books and References Books	**Text Books:** 1. Jacob Millman and Herbert Taub, "Pulse, Digital and Switching Waveforms", TMH, 1999. (UNIT I, II, III & IV). Reference Books: 1. Robert L Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory", 8th Edition, 2002, PHI. 2. Deshpande, "Electronic Devices and Circuits", Tata McGraw-Hill. 3. A. Anand Kumar, "Pulse and Digital Circuits", 2nd Edition, PHI, 2008.
E-resources and other digital material	1. http://nptel.iitm.ac.in/courses.php?branch=Ece. 2. http://web.cecs.pdx.edu/~ece2xx/ECE221/Lectures/ 3. http://newton.ex.ac.uk/teaching/CDHW/Electronics2/ElectronicsRe sources.html.

20EC4304: ANALOG AND DIGITAL COMMUNICATION

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	20EC3305: Probability Theory and Random Processes, 20EC4101:Signals and System	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze AM and FM waves in time and frequency domains
	CO2	Analyze various methods of baseband digital transmission and Detection methods.
	CO3	Understand geometric representation of signals and methods to detect signals in noise
	CO4	Analyze various methods of band pass digital transmission and Detection methods.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	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
CO1	3	2	1											1
CO2	3	2												1
CO3	3	2												1
CO4	3	2	1											1

Course Content

UNIT I

Amplitude Modulation: Time, Frequency Domain Description, Generation of AM waves, Detection of AM waves. Double Side Band-Suppressed Carrier Modulation: Time and Frequency Domain Description, Generation of DSBSC waves, Coherent detection of DSBSC Modulated Waves, Single Side Band Modulation: Frequency Domain Description, Vestigial Side-Band Modulation: Frequency Domain Description

Angle Modulation: Frequency Modulation: Single Tone Frequency Modulation, Spectrum Analysis, Narrow Band FM, Wideband FM, Transmission Bandwidth of FM, Applications of AM &FM. Comparison of AM and FM.

(12 Hrs)

UNIT II

Pulse Modulation: Quantization Process, Pulse Code Modulation, Delta Modulation.

Baseband Pulse Transmission: Matched filter, Properties, Inter symbol Interference, Nyquist's criterion for Distortion less Baseband Binary Transmission, Correlative Level Coding.

(11 Hrs)

	UNIT III: **Signal Space Analysis:** Introduction, Geometric Representation of Signals, Gram-Schmidt Orthogonalization Procedure, Likelihood Functions, Coherent Detection of Signals in Noise - Maximum Likelihood Decoding, Correlation Receiver. **(11 Hrs)** **UNIT IV:** **Pass band Data Transmission:** Introduction, Passband Transmission Model, Coherent Phase Shift Keying – BPSK, QPSK, M-ary PSK, Coherent Frequency Shift Keying - Binary FSK, Comparison and Applications of Digital Modulation Schemes. **(11 Hrs)**
Text books and Reference books	**Text Books:** 1. Simon Haykin. " An introduction to Analog and Digital Communication Systems", 3rd edition, 2009, John Wiley and Sons.(Units - I) 2. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th edition, 2007.(Units - II,III & IV) **Reference Books:** 1. George Kennedy, Electronic Communication Systems, sixth edition, Tata McGraw Hill Edition -2017 2. Bernard Sklar, "Digital Communication", 2nd edition, Pearson Education, 2013. 3. Taub and Schilling, "Principles of Communication Systems", 2nd edition, TMH, 1986
E-resources and other digital material	1. https://nptel.ac.in/courses/117/105/117105143/ 2. https://nptel.ac.in/courses/117101051/ 3. https://web.stanford.edu/class/ee179/lectures/notes06.pdf 4. http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf

20HS4105: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Course Category:	Humanities and Social Sciences	**Credits:**	3
Course Type:	Mandatory course	**Lecture -Tutorial - Practice:**	2-1-0
Prerequisites:	None. Universal Human Values 1 desirable.	**Continuous Evaluation:**	50
		Semester end Evaluation:	50
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the students will be able to:													
	CO1	Understand and aware of themselves and their surroundings (family, society and nature).												
	CO2	Handle problems with sustainable solutions, while keeping human relationships and human nature in mind.												
	CO3	Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society.												
	CO4	Apply what they have learnt to their own self in different day-to-day settings in real life.												
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1						1			2					
	CO2			3											
	CO3						2								
	CO4								3				2		
Course Content	**UNIT – I**: **Course introduction, need, basic guidelines, content and process for value education:** **Part-1**: Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: what is it?, its content and process, 'Natural acceptance' and experiential validation- as the process for self-exploration. Continuous Happiness and Prosperity – A look at basic Human Aspirations. **Part-2**: Right understanding, Relationship and Physical Facility – the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels. (Practice sessions are to be included to discuss natural acceptance in human being as the													

	innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking). **(12Hrs)**
	UNIT – II: **Understanding Harmony in the Human Being – Harmony in Myself:** **Part-1**: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' – happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). **Part-2**: Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health. (Practice sessions are to be included to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease). **(11Hrs)**
	UNIT – III: **Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** **Part-1:** Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship. **Part-2**: Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society–Undivided Society, Universal Order–from family to world family. (Practice sessions are to be included to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives). **(11Hrs)**
	UNIT – IV: **Part-1: Understanding Harmony in Nature & Existence – Whole existence as Coexistence:** Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of Nature – recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. **Part-2: Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, humanistic constitution and humanistic universal order,

	Competence in professional ethics: a) ability to utilize the professional competence for augmenting universal human order, b) ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) at the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) at the level of society: as mutually enriching institutions and organizations. (Part-1:Practice sessions are to be included to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc. Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.) **(11Hrs)**
Text books and Reference books	**Text Books:** 1. Human values and professional ethics, R. R. Gaur, R. Sangal and G. P. Bagaria, Excel Books Private Limited, New Delhi (2010). **Reference books:** 1. Jeevan Vidya: EkParichaya, A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak (1999). 2. Human Values, A. N. Tripathi, New Age International Publishers, New Delhi (2004). 3. The Story of Stuff: The impact of overconsumption on the planet, our communities, and our health and how we can make it better, Annie Leonard, Free Press, New York (2010). 4. The story of my experiments with truth: Mahatma Gandhi Autobiography, Mohandas Karamchand Gandhi, B. N. Publishing (2008). 5. Small is beautiful: A study of economics as if people mattered, E. F. Schumacher, Vintage Books, London (1993). 6. Slow is beautiful: New Visions of Community, Cecile Andrews, New Society Publishers, Canada (2006). 7. Economy of Permanence, J. C. Kumarappa, Sarva-Seva-Sangh Prakashan, Varanasi (2017). 8. Bharat Mein Angreji Raj, Pandit Sunderlal, PrabhathPrakashan, Delhi (2018). 9. Rediscovering India, Dharampal, Society for Integrated Development of Himilayas (2003). 10. Hind Swaraj or Indian Home Rule, M. K. Gandhi, Navajivan Publishing House, Ahmedabad (1909). 11. India Wins Freedom: The Complete Version, Maulana Abul Kalam Azad, Orient Blackswan (1988). 12. The Life of Vivekananda and the Universal gospel, Romain Rolland, Advaitha Ashrama, India (2010). 13. Mahatma Gandhi: The Man who become one with the Universal Being, Romain Rolland, Srishti Publishers & Distributors, New Delhi (2002).

E-resources and other digital material	1. AICTE – SIP Youtube Channel: https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ 2. AICTE – UHV Teaching Learning Material: a. https://fdp-si.aicte-india.org/download.php#1

20EC4351: SIGNALS AND SYSTEMS LAB

Course Category:	Programme core	**Credits:**	1.5
Course Type:	Practical Lab	**Lecture - Tutorial -Practice:**	0-0-3
Prerequisites:	20EC4101:Signals and Systems	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Generate and perform the basic operations on continuous and discrete time signals												
	CO2	Analyze the continuous and discrete time signals and systems using Fourier Series and Fourier Transform												
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1				2	2									2
	CO2				2	2									2
Course Content	**Perform the following using simulation software (Matlab/Labview/Scilab)** 1. Generation and plotting of Trigonometric and Exponential functions. 2. Generation of standard signals (Impulse, Unit step, Ramp, Sinc functions). 3. Operation on signals (Folding, time shifting, time scaling, amplitude scaling). 4. Generation of periodic and Non-periodic signals. 5. Analysis of Periodic signals using Fourier series. 6. Analysis of Non-periodic signals using Fourier Transform 7. Designing and Simulation of Transfer function. 8. Design of System and analysis by using poles and zeros 9. Verification of Sampling theorem 10. Write a program to find the correlation and convolution of sequences **Course-based Project** 11. Implementation of a voiced/unvoiced classifier based on spectral analysis 12. Design of volume control with fade in and fade out													
Text books and Reference books	1. Alan Oppenheim, Signals and Systems, Prentice Hall, 2009. 2. Simon Haykin, Signals and Systems, Wiley Publications,2007 3. John.G.Proakis, Contemporary Communication Systems, Cengage Learning, 2013.													
E-resources	1. https://in.mathworks.com/academia/books/contemporary-communication-systems-													

and other digital material	using-matlab-proakis.html 2. https://web.stanford.edu/~boyd/ee102/ 3. https://in.mathworks.com/academia/books/signals-and-systems-using-matlab-chaparro.html

NB: Eligibility for External Practical Examination:

1. A minimum of 10(Ten) experiments to be performed and recorded by the candidate.
2. Execute and submit a course-based project

20EC4352: PULSE AND SWITCHING CIRCUITS LAB

Course Category:	**Programme Lab**	**Credits:**	1.5
Course Type:	**Theory**	**Lecture - Tutorial -Practice:**	0-0-3
Prerequisites:	20EC3302:Analog Electronics	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Design various linear & non-linear circuits and analyze their response.
	CO2	Design various switching logic circuits.
	CO3	Design and generate various types of non-sinusoidal waveforms using multivibrators.
	CO4	Design current and voltage sweep circuits based on given specifications.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	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
CO1			2	2										2
CO2			2	2										2
CO3			2	3										2
CO4			2	2										2

Lab Content

1. Linear Wave shaping (RC Low pass & High pass circuits with different time constants)
2. Design of Clippers using diode and BJT
3. Design of Clampers using diode and BJT
4. Design of Astable Multivibrator
5. Design of Collector Coupled Astable Multivibrator
6. Design of Monostable Multivibrator
7. Design of Bistable Multivibrator
8. Design of Bistable fixed bias transistor binary
9. Design of Boot strap voltage sweep circuit
10. Design of transistor Miller Sweep circuit
11. Design of current time base generator
12. Design of Current sweep circuit

NB: A minimum of 10(Ten) experiments, have to be performed and recorded by the candidate to attain eligibility for Practical Examination

Additional Experiments

	14. Design of RC Band pass circuit 15. Wave form generator (square wave and triangular wave) ***Course based project** To implement the course project, following are the example circuits to be executed: LED Flasher Circuit, Battery Charger circuit using SCR, 555 Timer IC testing circuit etc..
Text books and Reference books	1. Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit theory", 5th Edition, Prentice-Hall of India Private Limited, New Delhi, 1995. Morris Mano M.: Digital Design, Prentice Hall of India,2001 2. David A.Bell, "Laboratory Manual for Electronic Devices and Circuits", 4th Edition, Prentice-Hall of India Private Limited, New Delhi, 2004.
E-resources and other digital material	1. http://vlabs.iitkgp.ac.in/psac/# 2. https://www.tutorialspoint.com/pulse_circuits/index.htm

NB: Eligibility for External Practical Examination:

1. A minimum of 10(Ten) experiments to be performed and recorded by the candidate.
2. Execute and submit a course-based project

20EC4353: ANALOG AND DIGITAL COMMUNICATIONS LAB

Course Category:	Programme Core	**Credits:**	1.5
Course Type:	Practical	**Lecture-Tutorial-Practice:**	0-0-3
Prerequisites:	20EC4304: Analog & Digital Communications	**Continuous Evaluation: Semester end Evaluation: Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Experimentally verify the working of AM and FM techniques using hardware and simulation													
	CO2	Experimentally verify the working of Digital modulation techniques and pulse transmission using hardware and simulation													
Contribution of Course Outcomes towards achievement of Program Outcomes (1–Low,2 -Medium, 3–High)		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
	CO1				1	2									2
	CO2				1	2									2

Course Content

Experiments using Hardware (using Discrete Components):

1. Generation and detection of Amplitude Modulated signal
2. Generation and detection of Frequency Modulated signal
3. Generation and detection of DSB SC Modulated signal
4. Generation and Detection of PCM signal
5. Generation and Detection of DM signal
6. Generation and Detection of ASK, FSK and PSK signal

Experiments using Software: - (Matlab, Labview, Scilab , Any Opensource)

1. Simulation of Amplitude Modulation and Demodulation
2. Simulation of Frequency Modulation and Demodulation
3. Simulation of DSB SC Modulation and Demodulation
4. Simulation of various Line codes generation.
5. Simulation of Matched Filter for a rectangular pulse.
6. Simulation of ASK, FSK and PSK modulation and Demodulation

Course-based project:

1. Real time implementation of capturing of speech signal and its transmission and reception with Analog/ Digital Modulation technique

	2. Transmission and Reception of Text/Music/Voice with AM/FM – Implementation using LabVIEW
Reference books	1. Simon Haykin. "Introduction to Analog and Digital Communication Systems", 3rd edition, 2009, John Wiley and Sons 2. George Kennedy, Electronic Communication Systems, sixth edition, Tata McGraw Hill Edition -2017 3. Simon Haykin, "Communication Systems", John Wiley & Sons, 4th edition, 2007.
E-resources and other digital material	1. https://www.vlab.co.in/broad-area-electronics-and-communications 2. http://www.commsp.ee.ic.ac.uk/~kkleung/Intro_Signals_Comm_2019/Matlab_for_students_2018.pdf 3. https://scilab.in/lab_migration/generate_lab/16/1

NB: Eligibility for External Practical Examination:

1. A minimum of 10(Ten) experiments to be performed and recorded by the candidate.
2. Execute and submit a course-based project

17HS4106: ENGLISH FOR PROFESSIONALS

Course Category:	Humanities & Social Sciences	**Credits:**	1
Course Type:	Learning by Doing	**Lecture -Tutorial-Practice:**	0 - 0 - 2
Prerequisites:	-	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course Outcomes

Upon successful completion of the course, the students will be able to:

CO1	Present themselves effectively in the professional world by shedding off their inhibitions about communicating in English
CO2	Introduce themselves as well as others appropriately.
CO3	Use vocabulary to form sentences and narrate stories by using creative thinking skills
CO4	Involve in practical activity-oriented sessions and respond positively by developing their analytical thinking skills.
CO5	Learn about various expressions to be used in different situations.

Contribution of Course Outcomes towards achievement of Program Outcomes
(1 – Low, 2 - Medium, 3 – High)

	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
CO1										3	3			
CO2									3	3	3			
CO3										3	3			
CO4								2		3	3			
CO5										3	3			

Course Content:

UNIT-I

1. Beginners, Functional, Situational Conversations
2. Practicing on Functional Conversations.

UNIT-II

1. Errors in usage of Parts of Speech with a thrust on Verbs, Adjectives and Conjunctions, Idioms/Phrases.

2. B. Introducing Basic Grammar
3. C. Practicing on Functional Conversations.

UNIT-III

1. Introducing Self & Others
2. Structures and Forming Sentences
3. Telephonic Etiquette, Social Etiquette and Table Manners
4. Practicing on Functional Conversations.

UNIT-IV

1. Direct, Indirect/Reporting Speech
2. Public Speaking Basics
3. Versant Test Preparation
4. Practicing on Situational Conversations.

Standard Reference

[1]. Swaroopa, Polineni, "Strengthen Your Communication Skills", I ed., Maruthi Publications, 2013. ISBN:978-81-907052-2-6

[2] Mamta Bhatnagar & Nitin Bhatnagar, "Communicative English", I ed., Pearson India, 2010. ISBN:8131732045

20MC4108B – INDIAN CONSTITUTION

Course Category:	Humanities elective	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2- 0 - 0
Prerequisites:	-	**Continuous Evaluation:**	100

Course outcomes		Upon successful completion of the course, the student will be able to:													
	CO1	Know the fundamental law of the land													
	CO2	Understand how fundamental rights are protected													
	CO3	Perceive the structure and formation of the Indian Government System													
	CO4	Explain when and how an emergency can be imposed and what are the consequences.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 - High)		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
	CO1						2								
	CO2						2								
	CO3						2								
	CO4						2								
Course Content	**UNIT I:** **Introduction to Constitution of India:** Meaning of the Constitution Law and Constitutionalism, Historical perspective of constitution of India, Salient features of Constitution of India. **UNIT II:** **Fundamental rights**: Scheme of the fundamental rights, scheme of the fundamental right to equality, scheme of the fundamental right to certain freedoms under Article 19, scope of the right of life and personal liberty under Article 21, writs jurisdiction. **UNIT III: Nature of the Indian constitution:** Federal structure and distribution of legislative and financial powers between the Union and states. **Parliamentary form of government in India:** The Constitution powers and status of the President of India, Amendment of the Constitutional powers and Procedure, Historical Perspectives of the constitutional amendments in India. **Local Self Government:** Constitutional Scheme in India. **UNIT IV:** **Emergency Provisions:** National Emergency, President rule, financial emergency.														

Text books and Reference books	**Text Book(s):** [1] Dr. J.N. Pandey, Constitutional Law of India published by Central law Agency, Allahabad, Edition 2018 **Reference Books**: [1] V.N Shukla's, Constitution of India Eastern Book Company, Lucknow. [2] M.P. jain, Indian Constitution Law, Wadhwa and Company, Nagpur. [3] D.D. basu, Constitution of India, Wadhwa and Company, Nagpur
E-resources and other digital material	

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTER V **CONTACT HOURS: 33**

S.No	Course Code	Subject	L	T	P	Credits
1	20EC5301	VLSI Design	3	0	0	3
2	20EC5302	Digital Signal Processing	3	0	0	3
3	20HS5103	Engineering Economics and Management	2	0	0	2
4	20EC5404	A. Information Theory & Coding B. Microwave Engineering C. Electronics Measurements & Instrumentation D. Computer Networks	3	0	0	3
5	20EC5205	A. Satellite communications B. Digital System Design Using Verilog C. Computer Organization	3	0	0	3
6	20EC5351	VLSI Design Lab	0	0	3	1.5
7	20EC5352	Digital Signal Processing Lab	0	0	3	1.5
8	20HS5153	Advanced Communication Skills Lab	0	0	2	1
9	20TP5106	Personality Development	0	0	2	1
10	20EC5354	EPICS/Internship	0	0	3	1.5
11	20EC5607	A. Networking Essentials B. Programming on ARM Cortex-M3 C. Graphical System Design D. Software Design Tools	1	0	2	2
12	20MC5108A	Biology for Engineers	2	0	0	-
		Total	16	0	17	22.5
Honors/Minor Courses (hours distribution can be 3-0-2 0r 3-1-0 also)			4	0	0	4

Note: Open Elective Courses may opt as self-learning course. Students register and complete the opted course in approved MOOCS platform on or before last instruction day of V Semester. They have to submit the certificate before the last instruction day of V semester

20EC5301: VLSI DESIGN

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	20EC3302:Analog Electronics, 20EC3304:Digital Circuit Design	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Analyze VLSI fabrication processes and CMOS Logic Design.
	CO2	Identify the physical circuit parameters and analyze the effects of parasitics on overall performance of the circuit.
	CO3	Design and test digital subsystem blocks using structured design.
	CO4	Design and analyze single stage amplifiers using MOS transistors.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2-Medium, 3 – High)

	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
CO1	2		2											2
CO2			2	2										2
CO3		2	3	3										2
CO4	2		3	3										2

Course Content

UNIT-I

Introduction to MOS Technology: NMOS fabrication, CMOS fabrication.

Basic Electrical Properties Of MOS Circuits: Drain-to-Source Current I_{ds} versus Voltage V_{ds} relationships, Aspects of MOS Transistor Threshold voltage V_t, MOS Transistor Trans conductance g_m and Output Conductance g_{ds}, MOS Transistor Figure of Merit, Pass Transistor, NMOS inverter, Pull-Up to Pull- Down Ratio for and NMOS Inverter driven by another NMOS Inverter, Pull-up to pull- down ratio for and NMOS Inverter Driven by one or more Pass Transistors, Alternative forms of Pull-up, CMOS Inverter, Latch-up in CMOS Circuits. (15 Hrs)

UNIT-II

MOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout; **Basic Circuit Concepts**: Sheet Resistance R_s, Standard Unit of Capacitance, The Delay Unit, Inverter Delays, Driving Large Capacitive Loads, and Propagation Delays.

	Scaling of MOS Circuits: Scaling Models and Scaling Factors, Scaling Factors for Device Parameters. (15 Hrs) **UNIT-III** **Subsystem Design**: Architectural Issues, Switch Logic, Gate Logic, Examples of Structured Design (Combinational Logic): A parity generator, Bus arbitration logic for n-line Bus, Multiplexers, A General Logic Function Block, A four line Gray code to Binary Code Converter. **Test and Testability** – Fault types and Models, Design for Testability, Controllability and Observability, Testing Combinational and Sequential Logic, Introduction to CAD Tools. (15 Hrs) **UNIT-IV** **Basic Building Blocks of Analog IC Design**: **Single stage Amplifiers:** Basic concepts, Common-source stage, source follower, Common-gate stage, Cascode stage, choice of device models, Single ended and differential operation, Basic differential pair, differential pair with MOS Loads, Basic Current Mirrors. (15 Hrs)
Text books and Reference books	**Text books:** 1. Douglas A. Pucknell, Kamran Eshraghian "Basic VLSI Design", Prentice Hall of India, 3rd Edition, reprint 2009. **2.** Design of Analog CMOS Integrated Circuits by BehzadRazavi , McGraw Hill, 2003. **References:** 1. Weste&Eshraghian, "Principles of CMOS VLSI Design: A systems Perspective", Addison Wesley, 2nd Edition, 2008. 2. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Reprint 2009. 3. Allen, Phillip E, Holberg, Douglas R," CMOS Analog Circuit Design" Oxford University Press, USA, 2011.
E- resources and other digital material	1. https://www.cdac.in/index.aspx?id=DVLSI_modules&courseid=20 2. https://nptel.ac.in/courses/117106030 3. The domain certification for VLSI: https://vlsiresources.com/nptel/

20EC5302::DIGITAL SIGNAL PROCESSING

Course Category:	Programme Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	20BS1101: Matrices and Differential Calculus, 20BS2101: Laplace transforms and Integral Calculus 20EC4301:Signals and Systems	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply DIT and DIF FFT algorithms for efficient computation of the DFT													
	CO2	Design and verify the frequency response of Digital IIR Filters.													
	CO3	Design and verify the frequency response of Digital FIR filters													
	CO4	Understand the concept of Multi-rate Digital Signal Processing													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
	CO1	3												2	
	CO2	3				2								2	
	CO3	3				2								2	
	CO4	1												1	

Course Content

UNIT I

The Discrete Fourier Transform - Its Properties and applications: Overview of DTFT, Frequency Domain Sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform (DFT), The DFT as a Linear Transformation, Relationship of the DFT to Other Transforms, Properties of the DFT, Linear Filtering methods based on the DFT.

Efficient Computation of the DFT- Fast Fourier Transform Algorithms: Efficient Computation of the DFT: FFT Algorithms - Direct Computation of the DFT, Divide-and-Conquer approach to Computation of the FFT, Radix-2 FFT Algorithms. Applications of FFT Algorithms – Use of the FFT Algorithm in Linear Filtering and Correlation. (12 Hrs)

UNIT II

Design of IIR Filters from analog Filters: IIR filter Design by Approximation of Derivatives, IIR Filter Design by Impulse Invariance, IIR filter Design by the Bilinear Transformation, Characteristics of commonly used Analog Filters. Frequency Transformations - Frequency Transformations in the Analog Domain and Frequency transformations in digital domain. (12 Hrs)

	UNIT III **Design of FIR Filters:** General Conditions, Design of FIR Filters - Symmetric & Anti-symmetric FIR filters, Design of Linear-phase FIR filters using Windows, Design of Linear Phase FIR filters by the Frequency-Sampling Method, Comparison of Design methods for Linear-Phase FIR filters. (12 Hrs) **UNIT-IV** **Structures for IIR Systems:** Direct-Form Structures, Signal Flow Graph and Transposed Structures, Cascade Form Structures and Parallel-Form Structures **Structures for FIR Systems:** Direct Form Structures, **Linear Phase Structures** and Cascade Form Structures. **Introduction to Multirate Digital signal Processing:** Introduction, Decimation by a Factor D, Interpolation by a Factor I, Sampling rate conversion by a Rational Factor I/D. (12 Hrs)
Text books and Reference books	**Text Books:** 1. John G. Proakis, & Dimitris G. Manolakis, "Digital Signal Processing : Principles, Algorithms and Applications", 4th Edition, 2007, Prentice-Hall of India Private Limited, (Units - I, II, III & IV) 2. Oppenheim, Alan V., Ronald W. Schafer, and John R. Buck. Discrete-time signal processing, 2nd edition, Pearson Education. **Reference Books:** 1. Ifeacher E.C. & Jervis B.W, "Digital Signal Processing, A Practical Approach", 3rd edition, 2003, Addison Wesley. 2. Lonnie C Ludeman, "Fundamentals of Digital Signal Processing", John Wiley & Sons, 2003. 3. S K Mitra, "Digital Signal Processing: A Computer Based Approach", 2nd edition, 2003, TMH.
E-resources and other digital material	1. https://nptel.ac.in/courses/117102060 2. https://archive.nptel.ac.in/courses/108106151 3. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/ 4. http://www.ece.cmu.edu/~ee791/ 5. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/ notes.html

20HS5103: ENGINEERING ECONOMICS AND MANAGEMENT

Course Category	Humanities & Social Sciences	**Credits**	2
Course Type:	Theory	**Lecture - Tutorial-Practice:**	2-0-0
Prerequisites:	20BS4101: Signal and Systems 20EC5302: Digital Signal Processing	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand various forms of organizations and principles of management.													
	CO2	Understand the various aspects of business economics.													
	CO3	Perceive the knowledge on Human resources and Marketing functions.													
	CO4	Evaluate various alternatives economically.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 Medium, 3 – High)		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
	CO1	2											2		2
	CO2	2				3							2		2
	CO3	2											2		2
	CO4	2				3							2		2

Course Content

UNIT - I

Forms of Business Organization: Salient Features of Sole Proprietorship, Partnership, Joint Stock Company, Co-operative Society and Public Sector.

Management: Introduction to Management, Functions of Management, Principles of Scientific Management, Modern Principles of Management. (12 Hrs)

UNIT - II

Introduction to Economics: Introduction to Basic Economic Concepts, Utility Analysis: Marginal Utility and Total Utility, Law of Diminishing Marginal Utility, Law of Equi Marginal Utility.

Demand Analysis: Theory of Demand: Demand Function, Factors Influencing Demand, Demand Schedule and Demand Curve, Shift in Demand, Elasticity of Demand: Elastic and Inelastic Demand, Types of Elasticity.

Supply Analysis: Supply Schedule and Supply Curve, Factors Influencing Supply, Supply Function. (12 Hrs)

	UNIT – III **Human Resource Management:** Meaning and difference between Personnel Management and Human Resource Management, Functions of Human Resource Management. **Marketing Management:** Concept of Selling And Marketing – Differences, Functions of Marketing, Product Life Cycle, Concept of Advertising, Sales Promotion, Types of Distribution Channels, Marketing Research, Break-Even Analysis. (12 Hrs) **UNIT – IV** **Financial Management:** Functions of Financial Management, Time value of money with cash flow diagrams, Concept of Simple and Compound Interest. **Depreciation:** Causes of depreciation, Factors influencing depreciation, common methods of Depreciation: Straight Line Method, Declining Balance Method, Sum of Year's Digits Method –Problems. **Economic Alternatives:** Methods of Evaluating Alternatives under Present worth method, Future worth method, Annual Equivalent method - Problems. (12 Hrs)
Text books and Reference books	**Text Books:** 1. M. Mahajan: Industrial Engineering and Production Management@, 2nd Edition, Dhanpat Rai Publications 2. Martand Telsang" Industrial & Business Management", S.Chand publications **Reference books:** 1. R.Paneerselvam "Production and Operations Management" PHI 2. Philip Kotler & Gary Armstrong "Principles of Marketing" ,pearson prentice Hall,NewDelhi,2012 Edition. 3. IM Pandey, "Financial Management" Vikas Publications 11th Edition 4. B.B Mahapatro, "Human Resource Management"., New Age International, 2011
E- resources and other digital material	1. https://www.toppr.com/guides/fundamentals-of-economics-and-management/supply/supply-function/ 2. https://keydifferences.com/difference-between-personnel-management-and-human-resource-management.html 3. http://productlifecyclestages.com/ 4. https://speechfoodie.com/cash-flow-diagrams/

20EC5404A: INFORMATION THEORY AND CODING

Course Category:	Programme Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	20EC3305- Probability Theory & Random Processes 20EC4304- Analog and Digital Communications	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand Information theory and error control strategies in channel coding													
	CO2	Apply linear block codes and cyclic codes for error detection and correction													
	CO3	Analyze Convolutional codes and Maximum likelihood decoding													
	CO4	Analyze Turbo Codes and Low Density Parity Check codes													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 -Medium, 3 – High)		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
	CO1	2	2												2
	CO2	2	2												2
	CO3	2	2												2
	CO4	2	2												2
Course Content	**UNIT I** **Fundamental limits in Information theory:** Introduction, uncertainty, information and entropy, source-coding theorem, data compaction – prefix coding, Huffman Coding, Shannon-Fano coding, Lempel-Ziv coding, discrete memory less channels, Binary symmetric channel, binary erasure channel, mutual information, channel capacity, channel coding theorem, information capacity theorem(statement). (15 Hrs) **UNIT II** **Linear Block Codes:** Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Hamming Codes **Cyclic Codes:** Description of cyclic code, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding. (12 Hrs) **UNIT III** **Convolutional Codes:** Encoding of Convolutional Codes, Code Tree, Trellis and State Diagram. **Maximum likelihood decoding of Convolutional Codes**: The Viterbi Algorithm, Free distance of a Convolutional Code. (10 Hrs)														

	UNIT IV **Turbo Codes:** Turbo Coding, Performance of Turbo Codes, Turbo Decoding – BCJR Algorithm. **Low Density Parity Check (LDPC) Codes:** Construction of LDPC codes, Minimum Distance of LDPC Codes, Probabilistic decoding of LDPC Codes. (10 Hrs)
Text books and Reference books	**Text Books:** 1 Simon Haykins, "Communication Systems", 4th edition, John Wiley & Sons Inc. **Reference Books:** 1. Bernard Sklar "Digital Communications-Fundamental and Application", 2nd edition, PE. 2. John G. Proakis , "Digital Communications" , 5th ed., 2008, TMH. 3. Ranjan Bose, Information Theory, Coding and Cryptography, 2015, 1st Edition, McGraw Hill Education (India) Pvt. Ltd., India.
E-resources and other digital material	1. https://nptel.ac.in/courses/108102117 2. http://www-math.ucdenver.edu/~wcherowi/courses/m7823/codln.html 3. https://www.ics.uci.edu/~magda/Courses/netsys270/ch10_2_v1

20EC5404B:MICROWAVE ENGINEERING

Course Category:	Program Elective 1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	20BS1102:Engineering Physics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Comprehend the basic principle of operation of microwave sources.
	CO2	Analyze the performance of different microwave components and ferrite devices using scattering parameters.
	CO3	Design and analyze the filters at microwave frequencies
	CO4	Demonstrate microwave bench setup for measuring various parameters

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	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
CO1		2												1
CO2				2										1
CO3				2										1
CO4		2												1

Course Content

UNIT-I

MICROWAVE SOURCES: Two-cavity Klystron: Velocity Modulation, Output Power and Beam Loading, Reflex Klystron: Velocity Modulation, Power Output and Efficiency, Helix Traveling Wave Tube Amplifiers- principle of operation. Cylindrical Magnetron, π-mode oscillations**.** (12 Hrs)

UNIT-II

PASSIVE COMPONENTS AND SOLID-STATE DEVICES

Passive Components: Basic properties of 3-port and 4-port parameters, Power dividers, Couplers, Directional coupler, E-plane Tee, H-plane Tee, Magic Tee, Phase Shifter, attenuators, and circulators, isolators, S-matrix representation.

Solid State Devices: Tunnel diode, Varactor diodes, PIN diodes, Gunn Diodes, IMPATT, TRAPATT diodes. (12 Hrs)

UNIT – III

MW Filters: Microwave Transmission lines, Strip lines, Low pass Filter design by Insertion loss method, (Butterworth and Chebyshev) Filter Transformations: Richards Transformation, Kuroda's Identities- stepped impedance. (10 Hrs)

	UNIT-IV **MICROWAVE MEASUREMENTS:** Power Measurement, Insertion Loss and Attenuation Measurement, Impedance Measurement, Slotted line VSWR measurement, Frequency Measurement, Network Analyzer and measurement of scattering parameters. (10 Hrs)
Text books and Reference books	**Text Books:** 1. Samuel Y.Liao: Microwave Devices and Circuits - Prentice Hall of India - 3rd Edition, 2003. 2. David M. Pozar: Microwave Engg. - John Wiley & Sons - 2nd Edition (2003). **Reference Books:** 1. E. Collin: Foundations for Microwave Engg. - IEEE Press 2nd Edition (2007). 2. Annapurna Das and Sisir K.Das: Microwave Engineering - Tata McGraw-Hill, 2000.
E-resources and other digital material	1. http://technology.niagarac.on.ca/courses/elnc1730/microsolid.ppt 2. http://www.intechopen.com/-/passive_microwave_components_ana_antenna 3. http://home.sandiego.edu/~ekim/e194rfs01/ 4. http://www.slideshare.net/sarahkrystelle/lecture-notes-microwaves.

20EC2504C: ELECTRONIC MEASUREMENTS & INSTRUMENTATION

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 -0-0
Prerequisites:	20EC3302: Analog Electronics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30M 70M 100M

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Emphasize the basic electronics measurement concepts & Design the different analog and digital electronics voltmeters.													
	CO2	Design the Measurement of different bridges.													
	CO3	Identify and use different analyzers oscilloscopes & generators to make measurements and analyze measurement													
	CO4	Analyze the basic concepts of Transducers and Signal conditioning based on application													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2- Medium, 3– High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSPO 1	PSPO 2
	CO1	2		3										3	3
	CO2	2												3	3
	CO3	2	2											3	3
	CO4			3	2									3	3

Course Content

UNIT- I

Basic Electronic Measurement Concepts: Introduction Performance characteristics-Static & Dynamic Measurement, Error Analysis, Statistical Analysis, Limiting error.

Indicating Instruments: DC Ammeter, Multi-range Ammeter, Aryton shunt, DC Voltmeter, Multi-range voltmeter, , Ohm meter – Series and Shunt type

Instruments for Measuring Basic Parameters- AC Voltmeters Using Rectifiers, Multi-range AC voltmeters, True RMS voltmeter, Peak responding voltmeters, Average responding voltmeters. (12 Hrs)

UNIT-II

Bridges: Introduction to Bridge Measurements – Wheatstone, Kelvin, Maxwell, Hay, Schering, Wien Bridge, , Resonance Bridge, Anderson bridge, The Owen bridge, De Sauty bridge

Digital Voltmeters: - Introduction to DVM, Ramp, Stair Case Ramp, Integrating, Continuous Balance, Successive Approximation Resolution and Sensitivity of Digital Meters**.** (12 Hrs)

UNIT- III

Oscilloscopes: Basic principle of Oscilloscope, Block diagram, Cathode Ray Tube, Time-frequency – phase angle measurements using CRO, Dual beam

	CRO, Dual Trace CRO, Digital Storage Oscilloscope, Sampling Oscilloscope, CRO and its applications **Signal Generator** – AF Oscillator, Function Generator, Square and Pulse generator. **Signal Analysis**: Wave Analyzers, Harmonic Distortion Analyzers, Spectrum Analyzer, Logic Analyzer, Network analyzer (14 Hrs) **UNIT – IV** **Transducers as Input Elements to Instrumentation Systems**: Classification of Transducers, Selecting a Transducer, Resistive Transducers, Strain gauges, Potentiometer, Inductive and Capacitive Transducers, Linear variable differential transducer, Temperature Measurements – Resistance thermometer, Thermistor, Thermocouple: Photovoltaic, Photoconductive, Photo emissive transducer, Piezoelectric Transducer, Mechanical transducers **Signal conditioning**: Introduction, Operational amplifier, Basic instrumentation amplifier, Applications of instrumentation amplifiers (specific bridge) (14 Hrs)
Text books and Reference books	**Text Books**: 1. H S Kalsi, "Electronics Instrumentation, Tata McGraw-Hill, 2004. (Units I, II, III, IV) **Reference Books:** 1. Albert D. Helfrick and William D .Cooper "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2003. 2. A K Sawahney, "Electrical and Electronics Measurement and Instrumentation", DhanpatRai, 2000. 3. Ernest O. Doebelin, "Measurement Systems- Application and Design" Tata McGrawHill-2004.
E-resources and other digital material	1.https://nptel.ac.in/courses/108106070 2.https://nptel.ac.in/courses/108106070

20EC5404D: COMPUTER NETWORKS

Course Category:	Programme Elective-1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	None	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Identify and explain the fundamental concepts of computer networks, models and The Physical Layer.
	CO2	Design a data communication link considering fundamental concepts of stop & wait, go-back-n link layer concepts and framing.
	CO3	Interpret Network layer design issues, Routing algorithms and addressing.
	CO4	Understand Transport protocols and important aspects of application layer protocols

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	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
CO1	2	1											2	2
CO2	2		1										3	2
CO3	2	1											3	3
CO4	2												3	3

Course Content

UNIT-I

Introduction: Network Hardware, Network Software, The OSI Reference Model, The TCP/IP Reference Model.

The Physical Layer: Guided Transmission Media, Wireless Transmission. (10 Hrs)

UNIT-II

The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols.

Medium Access Control Sub Layer: The Channel Allocation Problem, Multiple Access Protocols, Ethernet, Data Link Layer Switching. (12 Hrs)

UNIT-III

The Network Layer: Network Layer Design Issues, Routing Algorithms, Congestion Control Algorithms, Internet working, The Network Layer in the Internet. (12 Hrs)

	UNIT-IV **The Transport Layer**: The Transport Service, Elements of Transport Protocols, The Internet Transport Protocols: UDP, TCP. **Application Layer**: Domain Name System, Electronic Mail, The World WEB. (11 Hrs)
Text books and Reference books	**Text Books:** 1. Andrew S Tanenbaum, "Computer Networks", 5th edition, Pearson Education. **Reference Books:** 1. Kurose, J. F., & Ross, K. W. "Computer networking: A top-down approach", 7th edition, Peason Education. 2. Behrouz A. Forouzan "Data Communications and Networking". 4th edition, TMH.
E-resources and other digital material	1. http://home.iitk.ac.in/~navi/sidbinetworkcourse/ 2. https://nptel.ac.in/courses/106105081

20EC5205A: SATELLITE COMMUNICATION

Course Category:	**Open Elective-1**	**Credits:**	3
Course Type:	**Theory**	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	None	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Realize the orbital and functional principles of satellite communication systems.
	CO2	Design a satellite communication link under specified characteristics.
	CO3	Understand the multiple access techniques in satellite communication.
	CO4	Design very small aperture terminals and familiar with earth station technology.

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1	2	2	1										2	2
	CO2	2	2	1										2	2
	CO3	2	2	1										2	2
	CO4	2	2	1										2	2

Course Content

UNIT I:

Orbital Mechanics and Launchers: Overview of Satellite Communications, Orbital Mechanics, Look Angle Determination, Orbital Perturbations, Orbit Determination, Launches and Launch Vehicles, Orbital Effects in Communications Systems Performance. (10 Hrs)

UNIT II:

Satellites: Satellite subsystems, Attitude and Orbit Control System (AOCS), Telemetry, Tracking, Command, and Monitoring, Satellite antennas, Satellite Link Design, Basic transmission theory, System noise temperature and G/T ratio, down link design, up link design, Satellite Systems Using Small Earth Stations, Design for Specified C/N.

(12 Hrs)

UNIT III:

Multiple Access: Introduction, Frequency Division Multiple Access, Calculation of C/N with Intermodulation, Time Division Multiple Access, TDMA Frame Structure,

	Synchronization in TDMA Networks, Onboard Processing, Code Division Multiple Access, Spread Spectrum Transmission and Reception, DS-SS CDMA Capacity. (12 Hrs) **UNIT – IV:** **VSAT Systems:**Overview of VSAT Systems, Network Architectures, Access Control Protocols, Basic Techniques, VSAT Earth Station Engineering, Calculation of Link Margins for a VSAT Star Network, System Design Procedure. (11 Hrs)
Text books and Reference books	**Text Books:** 1. Timothy Pratt, Charles Bostian, Jeremy Allnut, "Satellite Communications", Second edition, John Willey & Sons. **Reference Books:** 1. Dennis Roddy, "Satellite Communications", 4th edition, TMH.
E-resources and other digital material	1. https://www.coursera.org/learn/satellite-communications 2. https://nptel.ac.in/courses/117105131

20EC5205B: DIGITAL SYSTEM DESIGN USING VERILOG

Course Category:	Programme Elective 1	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3-0-0
Prerequisites:	Digital Circuit Design	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Develop and test Verilog models for digital logic blocks using structural modelling													
	CO2	Design of combinational and sequential logic circuits in behavioral modelling													
	CO3	Synthesize combinational logic and sequential machines using Verilog HDL													
	CO4	Model the Digital Interfacing Systems using Verilog and analyze the case studies													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 -Medium, 3 – High)		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
	CO1		2	2									2		2
	CO2		3	2	2								2		2
	CO3		3	2	3								2		2
	CO4		3	3	3								3		3

Course Content

UNIT I

Introduction to Logic Design with Verilog: Structural Models of Combinational Logic, Logic System, Verification and Test Methodology, Propagation Delay, Truth Table Models of combinational and sequential logic with Verilog. (15 Hrs)

UNIT II

Logic Design with Behavioral Models of Combinational and Sequential Logic: Behavioral Modelling, Data Types of Behavioral Modelling, Propagation Delay and Continuous Assignments, Latches and Level Sensitive Circuits in Verilog, Behavioral Models of Multiplexers, Encoders and Decoders, Data Flow Models of a Linear Feedback Shift Registers, Modelling Digital Machines with Repetitive Algorithms. (15 Hrs)

UNIT III

Synthesis of Combinational and Sequential Logic: Introduction to synthesis, Synthesis of Combinational Logic, Synthesis of Sequential Logic with Latches, Synthesis of Sequential Logic with flipflops, Synthesis of Implicit State Machines, Registers and

	Counters. (15 Hrs) **UNIT IV** **Digital Interfacing Using Verilog: -**Universal Asynchronous Receiver/Transmitter, Serial Peripheral Interface, Inter-Integrated Circuit,Video Graphics Array, Universal Serial Bus, Ethernet. **Advanced Applicatons using Verilog:**Vending Machine, Digital Clock, Moving Wave via LEDs, Translator, Air Freshener Dispenser, Obstacle-Avoiding Tank,Car Parking Sensor System, Digital Table Tennis Game (15Hrs).
Text books and Reference books	**Text Books:** 1. Michael D. Ciletti, "Advanced digital design with the Verilog HDL", Eastern economy edition, 2002, PHI. 2. Palnitkar, S. Verilog HDL: a guide to digital design and synthesis (Vol. 1). 2003, Prentice Hall Professional. **Reference Books:** 1. John Michael Williams, Digital VLSI Design with Verilog, Springer Publication, 2nd Edition, 2014. 2. Sameer Palnitkar, Verilog HDL: A guide to digital Design and Synthesis, 2nd Edition, Pearson, 2003.
E-resources and other digital material	1. http://www.eecg.toronto.edu/~jayar/pubs/brown/survey.pdf 2. Prentice Hall Xilinx design series 3. https://www.pearsoned.co.in/prc/book/michael-d-ciletti-advanced-digital-design-with-verilog-hdl-2e--2/9789332584464

20EC5205C: COMPUTER ORGANIZATION

Course Category:	Open Elective	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial -Practice:**	3 - 0 - 0
Prerequisites:	20EC3304:Digital Circuits and Systems	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Conceptualize the basics of computer organization and data representation methods in digital computer.
	CO2	Analyze the design and implementation of various arithmetic algorithm's architectures in a digital computer.
	CO3	Understand typical control unit implementation techniques in digital computer.
	CO4	Recognize the memory design and data transfer techniques in digital computer

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1	3	2											2	3
	CO2		2	3										3	2
	CO3		2	3										3	2
	CO4	3	2											2	3

Course Content

UNIT I

Introduction of Computer Organization and Architecture.

Basic organization of computer and block level description of the functional units. Introduction to bus structure and connecting I/O devices to CPU and Memory. Data Representation-Number representation: Binary Data representation, two's complement representation (12 Hrs)

UNIT II

Arithmetic Algorithms Architectures:

Integer Data computation: Addition, Subtraction. Multiplication: Unsigned multiplication, Signed Multiplication-Booth's algorithm. Division of integers: Restoring and non-restoring division.

Floating-point representation. IEEE 754 floating point number representation. Floating point arithmetic: Addition, subtraction. (11 Hrs)

	UNIT III **Control Unit:** Pipeline basic concepts: processing, instruction pipelining, pipeline stages, Pipeline Hazards. Instruction formats- Addressing modes, Basic Instruction cycle, Micro-operations & control signals, Hardwired control unit design methods, Micro programmed control, Micro instructions, Micro instructions with next address field, Nano-programming (11 Hrs) **UNIT – IV** **Memory:** Memory Hierarchy, Memory characteristics, Virtual memory management, paging and segmentation, Page replacement policies, Interleave memories, Cache memory, Cache mapping techniques, **Data Transfer Techniques and I/O organization:** Bus arbitration, DMA and transfer techniques, I/O Addressing: Memory mapped I/O, I/O mapped I/O, Interrupt driven I/O (11 Hrs)
Text books and Reference books	**Text Books:** 1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", Fifth Edition, Tata McGraw-Hill. 2. John P. Hayes, "Computer Architecture and Organization", Third Edition. **Reference Books:** 1. William Stallings, "Computer Organization and Architecture: Designing for Performance", Eighth Edition, Pearson. 2. M. Moris Mano. (2007), "Computer System Architecture" 3rd edition, Pearson/ PHI. 3. Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085, Fifth Edition, Penram.
E-resources and other digital material	1. http://nptel.iitk.ac.in/courses/Webcourse-contents /IITKANPUR/ CompArchitecture/ page2.htm 2. http://nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/ comp_org_arc/web/ 3. http://williamstallings.com/ComputerOrganization/styled-7/

20EC5351: VLSI DESIGN LAB

Course Category:	Core	**Credits:**	1.5
Course Type:	Practical	**Lecture - Tutorial -Practice:**	0-0-3
Prerequisites:	20EC3352: Digital Circuit Design Lab	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course Outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design, synthesize and analyze Digital Circuits using Verilog HDL.													
	CO2	Design combinational and sequential circuits at circuit level, verify DCand transient analysis.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 - High)		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
	CO1			2	3	2							2	2	
	CO2			2	3	2							2	2	
Course Content	**PART-A**: Design, Simulate, Synthesize the following experiments using Verilog HDL 1. 4-bit Ripple carry adder 2. 8 to 3 Priority Encoder 3. 8-bit parity generator and checker 4. Modulo-N up-down counter 5. Universal Shift register 6. 16-Bit ALU with 8 Arithmetic Operations, 4 Logic Operations and 2 Shift Operations 7. 4-bit Magnitude Comparator 8. Sequence detector using FSM. **PART-B:** Design circuits using the flow of the Full Custom IC design cycle at schematic level using CMOS logic(Minimum 4). 1. An Inverter 2. 2-input NAND Gate Design 3. 2-input XOR Gate Design 4. A Full adder design														

	5. A Latch Design 6. 4-bit Gray to Binary code Converter 7.Differential amplifier 8.Common Source Amplifier
	*Course based Projects: Design and simulation of 1. Design of PLL 2. Two-Stage CMOS Opamp Design

NB: Eligibility for External Practical Examination:

1. A minimum of 10(Ten) experiments have to be performed and recorded by the candidate.
2. Execute and submit a course-based project

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20EC5352::DIGITAL SIGNAL PROCESSING LAB

Course Category	Programme core	**Credits**	1.5
Course Type:	Practical Lab	**Lecture -Tutorial-Practice:**	0-0-3
Prerequisites:	20BS4101: Signal and Systems 20EC5302: Digital Signal Processing	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Design and analyze various DSP Algorithms for signal and image processing applications using MATLAB Software.												
	CO2	Implement DSP algorithms using Code Composer Studio with TMS320C67XX floating point Processor.												
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 -Medium, 3 – High)		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
	CO1	2			2							2		1	2
	CO2	2			2							2		1	2

Course Content

LIST OF EXPERIMENTS USING MATLAB:

1. Computation of DFT using DIT and DIF FFT algorithms
2. Design of Butterworth and Chebyshev digital IIR filters using Impulse Invariance method
3. Design of Butterworth and Chebyshev digital IIR filters using Bilinear transformation method.
4. Design of digital FIR filters using windowing technique
5. Decimation and Interpolation of a discrete time sequence
6. Power spectrum estimation of the discrete time signal
7. Realization of short time Fourier transform using FFT
8. Image enhancement and smoothing operations
9. Feature extraction from 1D and 2D signals
10. Signal processing using multiresolution analysis (EMD, EEMD, VMD, DWT, SWT)

Code Composer Studio

11. Compute the N-point DFT of a given sequence
12. linear convolution using circular convolution of two signals

Course-based Project

13. Design of IIR digital filter for filtering out female voice from a signal consists of both male and female voices together.

	14. For a given input signal and a moving average filter, analyse the filtered output signal showing spectrum of it. Compute energy content of the filtered signal and compare it with actual energy content of the input signal.
Text books and Reference books	**Text Book:** 1. John G. Proakis, & Dimitris G. Manolakis, "Digital Signal Processing : Principles, Algorithms and Applications", 4th Edition, 2007, Prentice-Hall of India Private Limited, (Units - I, II, III & IV) 2. Oppenheim, Alan V., Ronald W. Schafer, and John R. Buck. Discrete-time signal processing, 2nd edition, Pearson Education. **Reference Books:** 1. Ifeacher E.C. & Jervis B.W, "Digital Signal Processing, A Practical Approach", 3rd edition, 2003, Addison Wesley. 2. Lonnie C Ludeman, "Fundamentals of Digital Signal Processing", John Wiley & Sons, 2003. 3. S K Mitra, "Digital Signal Processing: A Computer Based Approach", 2nd edition, 2003, TMH.
E-resources and other digital material	1. http://nptel.ac.in/courses/117105085/ 2. https://www.stat.berkeley.edu/~aldous/134/gravner.pdf

20HS5153: ADVANCED COMMUNICATION SKILLS LAB

Course Category:	Programme Core	Credits:	1
Course Type:	lab	Lecture - Tutorial - Practice:	0-0-2
Prerequisites:	Considerable semi-advanced proficiency in language skills viz Listening, Speaking, Reading and Writing, including Sentence construction abilities	Continuous Evaluation: Semester end Evaluation: Total Marks:	30 70 100

Course outcomes	Upon successful completion of the course, the student will :	
	CO1	Apply elements of listening comprehension relevant for professional environments
	CO2	Apply rational spoken communication with authentic accentuation in connected speech complemented by the abilities of argumentation and skills of public speaking
	CO3	Understand the nuances of requisite Advanced Reading Skills for transnational techno-professional communication
	CO4	Produce Higher order Written Communication required for administrative and corporate compilations

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)	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
CO1										3				
CO2						1		1	2	3	2	2		
CO3								1	2	3	2			
CO4				1		1			2	3	2	1		

Course Content

UNIT-I

Advanced Listening Skills

TED TALKS- Listening involving 5R Method

ELEVATOR PITCH: Pitches for technical audience and administrators- exposure through soft components and illustrations.

UNIT – II

Advanced Spoken Communication Skills

- **INTERPERSONAL COMMUNICATION** -Individual and Group - Pyramid discussion- Conceptual framework and practice
- **DYNAMICS OF TECHNICAL AND PROFESSIONAL PRESENTATIONS-**

	Illustrations and Practice including paralinguistic elements **UNIT – III** **Advanced Reading and interpretation skills** ➢ **EFFECTIVE READING-** SQ3R Method, ERRQ Method and SPE Method with textual practice ➢ **LOGICAL READING**- Syllogisms -illustrations and practice ***UNIT – IV*** **Advanced Writing ad other professional communication skills** ➢ **ADVANCED COMPILATION AND DRAFTING SKILLS** - Minuets, Résumé& Video profile, Review and case writing ➢ **LIFE SKILLS FOR WORK PLACE COMMUNICATION** including Sensitivity towards gender and diversity in communication- Multi-genre Activity
Text books	1. Lokesh Mehra, Sanjiva Dubey, S. P. Singh (Ed.) "Corporate Employability skills" , 1st edition, CEGR, New Delhi, 2016 2. Brent C. Oberg.C. , Interpersonal Communication , 1st Impression , Jaico Publishing, Mumbai, 2005 3. Eclectic materials offered by the Department of English
Reference books	1. Chauhan, Gajendra Singh, Smitha Kashiramka, "Technical Communication", Cengage , Delhi, 1st Impression ,2018 2. Quintanilla Kelly M , Shan T Wahl, " Business and Professional Communication: Keys for Workplace Excellence", SAGE , New Delhi, 2nd Impression 2012 3. Selinkar, Larry et al, English for Academic and Technical Purposes, I edition, Newbury House Publishers, 1981. 4. John Langan, College Writing Skills, McGraw Hill, IX Edition, 2014 5. Martin Cutts, Oxford Guide to Plain English, 7th Impression, OUP, 2011
E-resources and other digital material	1. ODll Language Learner's Software, Aug 2021 Orell Techno Systems , Visionet Spears Digital Language Lab software Advance Pro , Feb 2021 2. www.britishcouncil.org/learning-english-gateway. 3. the-oxford-guide-to-english-usage-pdf. 4. www.cambridgeapps.org/

20TP5106: PERSONALITY DEVELOPMENT

Course Category	Institutional Core	**Credits**	1
Course Type:	Learning by Doing	**Lecture - Tutorial-Practice:**	0-0-2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the corporate etiquette.
	CO2	Make presentations effectively with appropriate body language
	CO3	Be composed with positive attitude
	CO4	Understand the core competencies to succeed in professional and personal life

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)

	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
CO1								2		3				
CO2									2	3				
CO3										3				
CO4									2	3				

Course Content

Unit-I

1. Analytical Thinking & Listening Skills Self-Introduction, Shaping Young Minds - A Talk by Azim Premji (Listening Activity), Self – Analysis, Developing Positive Attitude, Perception. 2. Communication Skills Verbal Communication; Non Verbal Communication (Body Language)

Unit-II

3. Self-Management Skills Anger Management, Stress Management, Time Management, Six Thinking Hats, Team Building, Leadership Qualities 4. Etiquette Social Etiquette, Business Etiquette, Telephone Etiquette, Dining Etiquette

Unit-III

5. Standard Operation Methods Note Making, Note Taking, Minutes. Preparation, Email& Letter Writing

6. Verbal Ability Synonyms, Antonyms, One Word Substitutes-Correction of Sentences Analogies, Spotting Errors, Sentence Completion, Course of Action Sentences Assumptions, Sentence Arguments, Reading Comprehension, Practice work

UNIT-IV

7.Job-Oriented Skills -I Group Discussion, Mock Group Discussions

	8.Job-Oriented Skills –II Resume Preparation, Interview Skills, Mock Interviews
Text books and Reference books	1. Barun K. Mitra, Personality Development and Soft Skills, Oxford University Press, 2011. 2. S.P. Dhanavel, English and Soft Skills, Orient Black swan, 2010. 3. R.S.Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S.Chand& Company Ltd., 2018. 4. Raman, Meenakshi& Sharma, Sangeeta, Technical Communication Principles and Practice, Oxford University Press, 2011.
E-resources and other digital material	1. www. Indiabix.com 6. www.freshersworld.com

20EC5607/A: Networking Essentials - CISCO Networking Academy

Course Category:	Skill Oriented Course	**Credits:**	2
Course Type:	Lab Oriented	**Lecture -Tutorial-Practice:**	1-0-2
Prerequisites:	No prerequisites	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	- - 100

Course Outcomes	Upon successful completion of the course, the students will be able to:														
	CO1	Comprehend the basics of networks and communication principles.													
	CO2	Infer networking protocols and routing between networks.													
	CO3	Understand various addressing schemes and network services													
	CO4	Realize a small CISCO network with basic switch & router configuration.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1	2	1			1								1	1
	CO2	1												1	2
	CO3	1		1										1	2
	CO4		1	1		2								2	2
Course Content:	**UNIT-I** **INTRODUCTION TO NETWORKS** Communications in a connected world, Online connections, Explore networks with packet tracer, Build a simple network **UNIT-II** **NETWORING PROTOCOLS AND ARCHITECTURE** Communication principles, Network protocols, Network design and the access layer, Routing between networks, The internet protocol														

	UNIT-III **DATA COMMUNICATION AND NETWORK SERVICES** Dynamic addressing with DHCP, IPV6 addressing and IPV4 and IPV6 address management, Transport layer services, Application layer services **UNIT-IV** **BASICS OF HOME NETWORK & CISCO NETWORKING** Build a Home network, Virtualization, Security considerations, Configure network and device security, Cisco switches and routers, The cisco IOS command line and Build a small cisco network.
E-References	1. https://skillsforall.com/course/networking-essentials?userLang=en-US 2. https://www.netacad.com/sites/default/files/ss-netess.pdf

20EC5607B: PROGRAMMING ON ARM CORTEX-M3

Course Category:	Skill Oriented Course	**Credits:**	2
Course Type:	Lab Oriented	**Lecture -Tutorial-Practice:**	1-0-2
Prerequisites:	Programming in C, Digital Electronics	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	- - 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Attain the basic knowledge on ARM Cortex-M microcontroller and also on IDE (Keil).												
	CO2	Understand the GPIO Pins and their modes												
	CO3	Gain the knowledge on different clock sources.												
	CO4	Understand the Peripherals (Timers, PWM& UART) and their initialization												
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1		2											2	2
	CO2			2										2	2
	CO3			2										2	2
	CO4			2										2	2
Course Content	**UNIT-I** **INTRODUCTION** Introduction to Embedded Systems and PDLC, ARM Cortex-M3 processor, LPC17xx Introductory information, LPC17xx architecture, introduction to Keil. (12 Hrs) **UNIT-II** **GPIO PINS & MODES** LPC176x/5x General Purpose Input/ Output (GPIO), GPIO port Direction register, GPIO port output Set/clear register, GPIO port status register and GPIO interrupt registers. Programming exercises on GPIO pins. (12 Hrs) **UNIT-III** **CLOCKING& POWER CONTROL** LPC17xx Clocking and power control, Clock source selection multiplexer, PLL0 & PLL1, PLL block diagram, CPU clock generation. Programming exercises on selection													

	of different clock sources. (12 Hrs) **UNIT-IV** **PERIPHERALS** LPC17xx Timer 0/1/2/3, LPC17xx Pulse Width Modulator (PWM), UART, Programming exercises on Timers, PWM with ISR & UART. (11 Hrs)
Text books and Reference books/ E-resources and other digital material	1. https://www.keil.com/dd/docs/datashts/philips/lpc17xx_um.pdf 2. .https://www.nxp.com/docs/en/data-sheet/LPC1769_68_67_66_65_64_63.pdf 3. https://www.nxp.com/downloads/en/schematics/LPCXpresso-LPC1769-CMSIS-DAP.pdf 4. Introduction to ARM@ Cortex-M Microcontrollers Fifth Edition by *Valvano*, Jonathan W

20EC5607C: GRAPHICAL SYSTEM DESIGN

Course Category:	Skill Oriented course	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial -Practice:**	1-0-2
Prerequisites:	-	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	- - 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the basics of graphical programming.													
	CO2	Understand the Error Handling functions in standalone applications													
	CO3	Understand the data acquisition methods													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		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
	CO1						3								3
	CO2					2	3							2	3
	CO3					3	3							2	3

Course Content

UNIT- I

Graphical Programming: Introduction to Lab VIEW, Lab VIEW Programming Environment, Creating and saving VI, Controls and indicators, Data types, Strings

Conditional Statements: Case Structure, For loops, While loops, Shift Registers, Feed Back Nodes ,Local variables and global variables

UNIT – II

Modular Programming: Introduction, Creating Sub VI's, Timers, Creating a standalone application.

Arrays and Clusters: Creating one dimensional array, creating two dimensional array, Array functions, Auto indexing, Matrix operations with arrays, Creating clusters, Cluster operations, Conversion between arrays and clusters, Error handling.

UNIT – III

Plotting Data and Structures: Introduction, Types of wave forms, Wave form

	graphs, Wave form charts, Wave form data type, XY graphs,Case structures, Sequence structures, Formula nodes, Math script node. **File I/O**: Basics of file input/ output, Choosing a file format, File I/O VI's. **UNIT – IV** **Data Acquisition Basics**: Introduction to data acquisition, Sampling fundamentals, Signal conditioning, DAQ hardware configuration, DAQ hardware, DAQ assistant, Channels and task configuration.
Text books and Reference books	**Text Book:** 1. Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 1st Ed., PHI, 2013 **Reference Books:** 1. Sanjay Gupta, Joseph John, "Virtual Instrumentation using LabVIEW", 1st Ed., Tata McGraw-Hill, 2005. 2. Gary Johnson, Richard Jennings, "LabVIEW Graphical Programming", Tata McGraw-Hill, 2006
E-resources and other digital material	1. http://www.ni.com

20MC5108A BIOLOGY FOR ENGINEERS

Course Category:	Mandatory	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial -Practice:**	2-0-0
Prerequisites:	-	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	- 100

Course Outcomes	Upon successful completion of the course, the student will be able to:	
	CO1	Understand the biological concepts from an engineering perspective and classification of living organisms
	CO2	Demonstrate the fundamentals of biomolecules like structure, function and regulation of biological processes
	CO3	Understand the basic principles of Mendelian genetics, gene interactions and transfer/inheritance of genetic factors/genes
	CO4	Explain the process of cellular respiration and photosynthesis, and illustrate important diversified microorganisms and their classification

Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2-Medium, 3 – High)

	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
CO1							2							
CO2							2							
CO3							2							
CO4							2							

Course Content

Unit-I

Introduction and Classification of Living organisms

Introduction: (4 hrs)

Fundamental differences between science and engineering draw a comparison between eye and camera, Bird flight and aircraft. Biological observations of 18th Century that lead to major discoveries-examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.

Classification: (4 hrs)

Classification of living organisms based on (a) Cellularity- Unicellular or multicellular (b) Ultrastructure- prokaryotes or eukaryotes. (c) Energy and Carbon utilization -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – ammonotelic, uricotelic, ureotelic (e)Habitat-aquatic, terrestrial (e) Molecular taxonomy- three major kingdoms of life.

	Unit-II **Biomolecules and Enzymes** **Biomolecules**: (4 hrs) Biomolecules: Structures of sugars(Glucose and Fructose), starch and cellulose. Nucleotides and DNA/RNA. Amino acids and lipids. Proteins- structure and functions- as enzymes, transporters, receptors and structural elements. **Enzymes:** (3hrs) Enzyme classification. Mechanism of enzyme action. Enzyme kinetics and kinetic parameters. **Unit-III** **Genetics and Gene information Transfer** **Genetics :** (4 hrs) Mendel's laws of inheritance, Concept of segregation and independent assortment. Concept of allele, recessiveness and dominance. Gene interaction-Epistasis. Cell cycle and cell division-Meiosis and Mitosis. Transfer of genetic material from parent to offspring during cell division. **Information Transfer:** (4 hrs) DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination. **Unit-IV** **Metabolism and Microbiology** **Metabolism:** (4 hrs) Exothermic and endothermic reactions versus endergonic and exergonic reactions. Respiration-Breakdown of glucose to$CO_2 + H_2O$ (Glycolysis and Krebs cycle) Photosynthesis- synthesis of glucose from CO_2 and H_2O. Energy yielding and energy consuming reactions. **Microbiology:** (3 hrs) Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Growth kinetics. Ecological aspects of single celled organisms. Microscopy.
Text books and Reference books	1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd 2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wileyand Sons 3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company 4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher 5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers