ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(CSE,ECE,EEE, ME and CIV) & MBA
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS
(With effect from 2021-22)

Electronics and Communication Engineering

SECOND YEAR
(III and IV Semester)

2022 - 2023

III Semester (B.E. – Electronics and Communication Engineering)													
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	BSC	21MAE301	Complex Functions, Transforms and Numerical Methods	MAT	MAT	2	2		03	50	50	100	3
2	PCC	21ECE302	Network Theory (Integrated)	ECE	ECE	3		2	03	50	50	100	4
3	PCC	21ECE303	Digital System Design (Integrated)	ECE	ECE	3		2	03	50	50	100	4
4	PCC	21ECE304	Analog Circuits	ECE	ECE	2	2		03	50	50	100	3
5	PCC	21ECL305	Analog Circuits Laboratory	ECE	ECE	-	-	2	03	50	50	100	1
6	HSMC	21UHV306	Universal Human Values - II	COM		2	-	-	02	50	50	100	2
		21BFE306	Biology for Engineers	COM									
7	HSMC	21KBK307	Balake Kannada (Kannada for communication)/			--	2	--	02	50	50	100	1
		21KSK307	Saamskrutika Kannada (Kannada for Administration)										
		21CPC307	Constitution of India, Professional Ethics and Cyber Law			1	--	--					
8	SDC	21IEP308	IoT Enabled Prototyping	COM		-	-	2	03	50	50	100	1
9	SDC	21IOT309	Industry Oriented Training – Business Etiquettes	COM		-		2	02	50	-	50	-
					Total	12 **OR** **13**	6 **OR** **4**	10	24	**450**	**400**	**850**	**19**
10	HSMC	21ENG310	Business Communication	ENG			2		02	50	50	100	-
11	MNCC	21MAL301	Additional Mathematics- I	MAT	MAT	2	1		03	50	50	100	-

IV Semester (B.E. - Electronics and Communication Engineering)														
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical /Drawin**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	BSC	21MAE401	Linear Algebra & Statistical Methods	MAT	MAT	2	2	-	03	50	50	100	3
2	PCC	21ECE402	Signals and Systems (Integrated)	ECE	ECE	3	-	2	03	50	50	100	4
3	PCC	21ECE403	ARM Processor and Microcontroller (Integrated)	ECE	ECE	3	-	2	03	50	50	100	4
4	PCC	21ECE404	Analog Communication Engineering	ECE	ECE	2	2		03	50	50	100	3
5	PCC	21ECL405	Analog Communication Engineering Lab	ECE	ECE	-	-	2	03	50	50	100	1
6	UHV	21UHV406	Universal Human Values – II	COM		2	-	-	02	50	50	100	2
	HSMC	21BFE406	Biology for Engineers	COM									
7	HSMC	21KBK407	Balake Kannada (Kannada for communication)/			-	2	--	--	50	50	100	1
		21KSK407	Saamskrutika Kannada (Kannada for Administration)										
		21CPC407	Constitution of India, Professional Ethics and Cyber Law			1	--	--					
8	SDC	21CTE408	Computational Tools for Engineers	COM		-	-	2	03	50	50	100	1
9	SDC	21IOT409	Industry Oriented Training – Computing Skills	COM		-	-	2	02	50	-	50	-
10	INT	21INT410	Summer Internship - I						03	50	50	100	2
					Total	12 OR **13**	6 OR **4**	10	19	**500**	**450**	**950**	**21**
11	HSMC	21ENG410	Business Communication	ENG		-	2	-	02	50	50	100	-
12	MNCC	21MAL401	Additional Mathematics- II	MAT	MAT	2	1	-	03	50	50	100	-

Note: BSC: Basic Science Courses; ESC: Engineering Science Courses; HSMC: Humanity, Social Science and Management Courses; MNCC = Mandatory Non-Credit Course. INT: Internship, PCC: Professional Core Course; PEC = Professional Elective Course; OEC = Open Elective Course; UHV: Universal Human Values SDC: Ability Enhancement (Skill Development) Course. One-hour Lecture (L) per week per semester = 1 Credit Two-hour Tutorial (T) per week per semester = 1 Credit Two-hour Practical/Laboratory/Drawing (P) per week per semester = 1 Credit Four hours of Self-study = 1 Credit.
Summer Internship-II: All the students admitted shall have to undergo mandatory internship of minimum 04 weeks during the IV and V semester vacation. Summer Internship shall be Carried Out – based on industrial/ Govt./NGO /MSME/ Rural Internship /Innovation/Entrepreneurship, Credited in V Semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.
21KBK307/407 Balake Kannada (Kannada for communication) is prescribed for students who have not studied Kannada at any level of schooling (State/Central-CBSC/ICSE) and are not able to speak, write, read and understand Kannada. 21KSK307/407 Saamskrutika Kannada (Kannada for Administration) is prescribed for students who satisfy any one of the following. i. Studied 1 – 10th standard in Kannada medium ii. Studied Kannada as first or second language during high school and cleared SSLC examination iii. Studied Kannada at any level of schooling and are able to speak, write and read Kannada. iv. Passed diploma or certificate course in Kannada conducted by a university established by law in India v. Passed Kava, Jana and Rathna examinations conducted by Kannada Sahithya Parishat vi. Passed the SSLC examination or any other examination declared as equivalent thereto by the state government or any examinations higher than SSLC examination a) in which the question papers on different subjects are answered in Kannada language or b) in which Kannada was the main or second language or an optional subject but not one of the subjects in a composite paper.
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs: (a)The mandatory non – credit courses Additional Mathematics I and Business Communication prescribed for III semester and Additional Mathematics II prescribed for IV semester, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfil the requirements during subsequent semester/s to appear for SEE. (b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs: Lateral entrant students from B.Sc. Stream, shall clear the Mandatory non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
AICTE Activity Points to be earned by students admitted to BE/B.Tech Day College Programs: Over and above the academic grades, every student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth Semester Grade Card shall be issued only after earning the required Activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

SEMESTER –III

Complex Functions, Transforms and Numerical Methods

(Common to ECE & EEE)

Course Code	**21MAE301**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. To have an insight into Fourier series, Fourier transforms, Difference equations and Z-transforms.
2. To provide an insight into applications of complex variables, conformal mapping and special functions arising in potential theory, quantum mechanics, heat conduction and field theory.
3. To get proficiency in solving ODE's arising in engineering applications, using numerical methods.

Module-1

Calculus of complex functions: Review of function of a complex variable, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and properties of analytic functions (no proof). Construction of analytic functions: Milne-Thomson method-Problems. **8 Hours**

Module-2

Conformal transformations: Introduction. Discussion of transformations:
$\omega = z^2$, $\omega = e^z$, $\omega = z + \frac{1}{z}$ $(z \neq 0)$

Bilinear transformations- Problems.
Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems. **8 Hours**

Module-3

Fourier Series: Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2l. Half range Fourier series for arbitrary period. Practical harmonic analysis, examples from the engineering field. **8 Hours**

Module-4

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Simple problems.
Difference Equations and Z-Transforms: Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules (statement only). Inverse z-transform (by partial fraction method) and applications to solve difference equation. **8 Hours**

Module-5

Numerical solution of second order ordinary differential equations:
Runge Kutta Method of 4^{th} order and Milne's predictor & corrector formulae. (No derivations of formulae).
Numerical Integration: Trapezoidal rule, Simpson's (1/3)th and (3/8)th rules, Weddle's rule (without proof) –Application Problems. **8 Hours**

Course Outcomes: At the end of the course the student will be able to:	
21MAE301.1	Model the given problems related to the electromagnetic field and solve using the concept of complex analysis.
21MAE301.2	Utilize conformal transformation and complex integral in problems arising in aero foil theory, fluid flow visualization and image processing.
21MAE301.3	Demonstrate Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing and field theory.
21MAE301.4	Evaluate Fourier transform and Z-transform to illustrate discrete/continuous functions arising in wave and heat propagation, signals, and systems.
21MAE301.5	Solve second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods
21MAE301.6	Apply the knowledge of numerical methods in the modeling of various physical and engineering phenomena.

Question paper pattern:

Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition., 2017.
Reference Books				
1	Advanced Engineering Mathematics	C.Ray Wylie, Louis C.Barrett	McGraw- Hill Book Co., New York.	6th Edition, 2017
2	Introductory Methods of Numerical Analysis	S.S.Sastry	Tata McGraw-Hill, Publication	11th Edition,2017
3	Higher Engineering Mathematics	B.V.Ramana	Tata McGraw-Hill Publication	11th Edition,2016
4	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition. (Reprint), 2017.
5	Advanced Engineering Mathematics	H. C. Taneja	I.K. International Publishing House Pvt.	Ist Edition,2013

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12
21MAE301.1		3	1									
21MAE301.2	3	1										
21MAE301.3		1	3									
21MAE301.4	2	2										
21MAE301.5		3	1									
21MAE301.6		3	1									

1: Low 2: Medium 3: High

Network Theory (Integrated)			
Course Code	**21ECE302**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**3**:0:**2**	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. Describe basic network concepts emphasizing source transformation, source shifting, mesh and nodal techniques to solve for resistance/impedance, voltage, current and power.
2. Explain network Thevenin's, Millman's, Superposition, Maximum Power transfer and Norton's Theorems and apply them in solving the problems related to Electrical Circuits.
3. Explain the behavior of networks subjected to transient conditions.
4. Use applications of Laplace transforms to network problems.
5. Analyze two port network parameters like Z, Y, T and h and their inter-relationships and applications.
6. Analyze RLC Series and parallel tuned circuit.

Module-1 **8 Hours**

Basic Concepts:

Practical Sources, Source Transformations, Wye – Delta Transformation, Loop and Node Analysis with Linearly Dependent and Independent Sources for DC and AC Networks, Concepts of Super Node and Super Mesh.

(Text Book 1: Section 2.2, 3.3 and Text Book 3: Section 3.2, 3.3, 3.4, 3.5, 10.2, 10.3)

Module-2 **8 Hours**

Network Theorems:

Superposition, Reciprocity, Thevenin's Theorem, Norton's Theorem, Millman's Theorem, and Maximum Power Transfer Theorem.

(Text Book 2: Section 7.2, 7.3, 7.4, 7.5, 7.6, 7.7)

Module-3 **8 Hours**

RL RC RLC circuits:

Transient Behavior and Initial Conditions: Behavior of Circuit Elements under Switching Condition and their Representation, Solution of Differential Equations and Evaluation of Initial and Final Conditions in RL, RC and RLC Circuits.

(Text Book 1: Section 5.1, 5.2, 5.3, 5.4, 5.5)

Module-4 **8 Hours**

Laplace Transformation & Applications:

Step, Ramp and Impulse Responses, Initial and Final values, Waveform Synthesis.

(Text Book 2: Section 5.2, 5.3, 5.4, 5.5 5.6 and Text Book 3: Section 15.3)

Module-5 **8 Hours**

Two port network parameters:

Definition of Z, Y, h and Transmission Parameters, Modelling with these Parameters, Relationship Between Parameters Sets.

Resonance: Series Resonance and Parallel Resonance*:* Selectivity and Bandwidth, Quality factor, Half Power Frequencies.

(Text Book 2: Section 10.3, 10.4, 10.5, 10.7, 10.9 and Text Book 3: Section 14.5 and 14.6)
List of Laboratory Experiments related to above modules – 2 hours each
1. Measurement and Analysis of DC Circuits 2. Verification of Star to Delta Transformations 3. Simulation of Mesh Analysis and Node Analysis 4. Verification of Network Theorems- Superposition Theorem and Thevenin's Theorem. 5. Simulation to Obtain the Transient Response of Series RC and RL circuit. 6. Determination of the Impedance (Z) and Admittance (Y) Parameters of a Two-Port Network. 7. To find the Resonant Frequency, Quality Factor and Bandwidth of a given Series and Parallel Resonant Circuits. 8. **Open ended experiment covering the concept of the syllabus.** **(Note: Experiments using Discrete components and Multisim Simulation tool)**

Course Outcomes: At the end of the course the student will be able to:	
21ECE302.1	Inspect DC and AC Networks and Apply Node & Loop analysis concepts.
21ECE302.2	Examine and Make Use of various Circuit Analysis Theorems.
21ECE302.3	Develop and Solve Mathematical Representations for Simple RLC Circuits
21ECE302.4	Utilize Laplace Transform to Solve the given Networks
21ECE302.5	Analyze Two-Port Network Parameters
21ECE302.6	Illustrate the Concept of Series and Parallel Resonance.

Textbooks

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Network analysis	M.E. Van Valkenburg	Prentice Hall of India	3rd Edition, 2000
2	Networks and systems	D Roy Choudhury	New Age International Publications	2nd Edition, 2006
3	Fundamentals of Electric Circuits	Charles K Alexander and Mathew N O Sadiku	Tata McGraw-Hill	4th Edition, 2009

Reference Books				
Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Circuit Analysis	Hayt, Kemmerly and Durbin	Tata McGraw-Hill	7th Edition, 2010.
2	Basic Engineering Circuit Analysis	J. David Irwin /R. Mark Nelms	John Wiley	8th Edition, 2006.

Web links/Video Lectures/MOOCs

1. NPTEL: NOC Network Analysis - Prof T K Bhattacharya - IIT – Kharagpur
2. NPTEL: Networks and Systems - Prof V G K Murti - IIT – Madras
3. NPTEL: Networks and Systems - Prof V G K Murti - IIT – Madras
4. NPTEL: Circuit Theory - Prof S C Dutta Roy - IIT Delhi
5. NPTEL: Network, Signal, and Systems - Prof T K Basu - IIT – Kharagpur
6. NPTEL: Basic Electrical Circuits - Prof Nagendra K - IIT - Madras

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21ECE302.1	**3**			**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**		**-**
21ECE302.2					**2**	**-**	**-**		**1**		**-**		**3**	**-**
21ECE302.3	**1**			**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**
21ECE302.4	**1**	**3**		**2**		**-**	**-**	**1**			**-**			**-**
21ECE302.5			**2**		**-**	**2**	**-**	**-**	**-**	**-**	**-**		**3**	**-**
21ECE302.6	**3**			**2**	**-**	**-**	**-**	**-**			**-**	**-**	**1**	**-**

1: Low 2: Medium 3: High

Digital System Design (Integrated)			
Course Code	**21ECE303**	CIE Marks	**50**
Teaching Hours/Week (L:T:P)	**(3:0:2)**	SEE Marks	**50**
Credits	**04**	Exam Hours	**03**

Course Learning Objectives:

1. Describe the Basic concepts of Boolean Algebra, Verilog HDL and implement the Boolean expressions using Logic gates.
2. Design and implement Combinational Circuits such as Decoders, Encoders, Multiplexers, Adders, Subtractors, and Binary Comparators and demonstrate their HDL Models.
3. Implement various Synchronous sequential Logic Circuits and describe Synthesizable HDL models of Sequential Circuits.
4. Construct various types of Registers and Counters using Flip-flops.
5. Design circuits at the Register Transfer Level with different levels of description.
6. Using simulation softwares, test the function of various combinational and sequential circuits.

Module-1 **8 Hours**

Introduction to Digital Logic: Minterms & Maxterms (canonical) and standard forms of Boolean Expressions, 3 & 4 variable K-MAP, SOP & POS Simplifications, Don't Care Conditions, Exclusive OR function (Self Study), Parity Generation and Checking.

Hardware Description Language: Introduction, Verilog-Design Encapsulation, Structural Modeling, Gate Delays, Verilog-User Defined Primitives.

(Text 1 :2.6, 3.2, 3.3, 3.4, 3.5, 3.8, 3.9)

Module-2 **8 Hours**

Combinational logic: Introduction, Combinational Circuits, Analysis Procedure, Design Procedure, Binary Adder-Subtractor, Decimal Adder, Binary Multiplier**,** Magnitude Comparator, Decoders, Encoders, Multiplexers, HDL Models of Combinational Circuits, Behavioral Modeling, Writing a Simple Testbench (Only Verilog concepts to be discussed).

(Text 1 : Chapter 4 except 4.15)

Module-3 **8 Hours**

Synchronous Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Storage Elements: Flip-Flops, Analysis of Clocked Sequential Circuits, Synthesizable HDL models of Sequential Circuits (Only Verilog concepts to be discussed), State Reduction and Assignment, Design Procedure.

(Text 1 - Chapter 5)

Module-4 **8 Hours**

Registers and Counters: Registers, Shift Registers, Ripple Counters, Synchronous Counters, HDL Models of Registers and Counters (Only Verilog concepts to be discussed).

(Text 1 : 6.1, 6.2, 6.3, 6.4, 6.6)

Module-5 **8 Hours**

Design at the Register Transfer Level: Introduction, Register Transfer Level Notation, RTL Descriptions (Only Verilog concepts to be discussed), Algorithmic State Machines (ASM's) (**Text 1 :8.1, 8.2, 8.3, 8.4)**

Asynchronous Sequential Logic: Circuits with Latches, Design Procedure, Reduction of State and Flow tables, Hazards (**Text 1: 9.3, 9.4, 9.5, 9.7)**

List of Laboratory Experiments related to above modules – 2 hours each

PART A (Using discrete components & Trainer Kits)

1. The Simplification of SOP & POS expressions using K Map and Realization using Basic Gates & Universal Gates.
2. Design and Implementation of Full Adder and Full Subtractor using a) Half adder and Half Subtractor b) NAND gates.
3. Realization of Code Converters and Multiplexers.
4. Realize Ripple Carry Adder and Carry Look Ahead Adder.

PART B (Using Xilinx Vivado tool)

5. Write a Verilog code and implement Adders & Subtractors.
6. Design Comparators.
7. Realize SR, JK, T & D Flip-Flops.
8. Design Counters & Shift Registers.
9. Design Clock Pulse Generator.
10. Design and implement 4-bit ALU using Verilog program.
11. Design an Open Ended Experiment covering the concept of entire syllabus.

Course Outcomes:

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

21ECE303.1	Develop Simplified Switching Equations using Karnaugh Maps.
21ECE303.2	Design Digital Combinational Control Circuits and Implement those using HDL Models.
21ECE303.3	Implement Shift Registers & Counters using Latches and Flipflops.
21ECE303.4	Design the Sequential Circuits and Analyze the Problems using State Diagrams.
21ECE303.5	Illustrate the Digital System Design at the Register Transfer Level.
21ECE303.6	Test the Function of Various Combinational and Sequential Circuits using Simulation Softwares.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Digital Design with an Introduction to the Verilog HDL, VHDL, and System Verilog	Morris Mano, Michael D. Ciletti	Pearson	Sixth Edition, 2019
Reference Books				
1	Digital Logic Applications and Design	John M Yarbrough	Thomson Learning	2001
2	Digital System Design Using Verilog	Byeong Kil Lee,Charles H Roth,LizzyJohn	Cengage Learning	First Edition 2014

Web links/Video Lectures/MOOCs/papers

1. Virtual Lab :Digital Electronics IITR.
   https://de-iitr.vlabs.ac.in/
2. NPTEL Lecture by Prof Roy Choudary, Department of CSE, IIT Kharagpur.
   https://nptel.ac.in/courses/117/105/117105080/
3. NPTEL Lecture by Prof Neeraj Goel, IIT Rourkee (https://onlinecourses.nptel.ac.in/noc21_ee39/preview)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21ECE303.1	3	3	-	-	-	-	-	-	-	-	-	1	2	-
21ECE303.2	3	-	2	-	-	-	-	-	-	-	-	1	2	-
21ECE303.3	2	-	2	-	-	-	-	-	-	-	-	1	2	-
21ECE303.4	2	2	2	2	-	-	-	-	-	-	-	1	-	-
21ECE303.5	-	-	2	2	-	-	-	-	-	2	-	-	-	-
21ECE303.6	-	-	-	2	2	-	-	2	-	2	-	-	-	-

1: Low 2: Medium 3: High

Analog Circuits

Course Code	**21ECE304**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**3**	Exam Hours	03

Course Learning Objectives:

1. Describe MOS Transistor construction and working.
2. Acquire knowledge of FET characteristics.
3. Describe the MOS amplifier configurations.
4. Explain various types of FET biasing, and demonstrate the use of FET amplifiers.
5. Demonstrate the ability to design Amplifiers and Filters using Op-amp.
6. Demonstrate the ability design Op-amp based Oscillators, Multivibrators, and Precision rectifiers.

Module-1 **8 Hours**

MOS Field Effect Transistors (MOSFETs): Device structure and physical operation, Device structure, Operation with no gate voltage, Creating a channel for current flow, Applying a small V_{DS}, Operation as V_{DS} is increased, Operation for V_{DS} is greater than V_{OV}, Current-Voltage characteristics, i_D-v_{DS} characteristics, i_D-v_{GS} characteristics, The role of the substrate-The body effect, Temperature effect, Breakdown and input protection, MOSFET circuits at DC (Problems), The MOSFET as an amplifier and as a switch, Large signal operation-The transfer characteristics, Operation as a switch, Operation as a linear amplifier, Biasing in MOS amplifier circuits, Biasing by fixing V_{GS} , Biasing by fixing V_G and connecting a resistance in the source, Biasing using drain to gate feedback resistor.
[Text 1: Chapter 4: 4.1 (4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.1.5, 4.1.6), 4.2 (4.2.2, 4.2.3, 4.2.6, 4.2.7, 4.2.8), 4.3, 4.4 (4.4.1, 4.4.3, 4.4.4), 4.5 (4.5.1, 4.5.2, 4.5.3)]
Self-Study: The p-channel MOSFET and characteristics.

Module-2 **8 Hours**

Small Signal Operation and Models: The DC bias point, The signal current in the drain terminal, The voltage gain, Separating the DC analysis and the signal analysis, Small signal equivalent circuit models, Transconductance, T Equivalent circuit model, Basic MOSFET amplifier configuration, The three basic configuration, The Common Source amplifier, The Common Source amplifier with a source resistance, The Common Drain amplifier, The MOSFET internal capacitance and high frequency model, The gate capacitive effect, The junction capacitances, The high frequency MOSFET model, Frequency response of the Common Source amplifier, The three frequency bands, High frequency response, The low frequency response. [Text 1: Chapter 4: 4.6, 4.7 (4.7.1, 4.7.3, 4.7.4, 4.7.6), 4.8 (4.8.1, 4.8.2, 4.8.3), 4.9]
Self-Study: Common Gate amplifier.

Module-3 **8 Hours**

Op-Amp with Negative Feedback and General Applications: The general feedback structure, Properties of negative feedback, The four basic feedback topologies (Block diagram only), Voltage-Series feedback and Voltage-Shunt feedback Amplifiers – Closed Loop voltage gain, Input impedance, Output impedance, and Bandwidth with feedback. DC and AC Amplifiers, Summing, Scaling and Averaging amplifiers, Instrumentation amplifier. [Text 1: 7.1, 7.2, 7.3] [Text 2: 3.3 (3.3.1 to 3.3.6), 3.4 (3.4.1 to 3.4.5) 6.2, 6.5, 6.6 (6.6.1)]

Module-4	**8 Hours**
Op-Amp Filters and Oscillators: Active Filters, First order low-pass Butterworth filter, Second order low-pass Butterworth filter, First order high-pass Butterworth filter, Second order high-pass Butterworth filter, Band-pass filters, Band reject filters. Oscillator principles, Oscillator types, Frequency Stability, Phase shift oscillator and Wien Bridge oscillator. [Text 2: 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9, 7.11 (7.11.1, 7.11.2, 7.11.3), 7.12, 7.13]	
Module-5	**8 Hours**
Op-Amp Circuits: Comparators, Zero Crossing Detector, Schmitt trigger, DAC - Weighted resistor and R-2R ladder, ADC- Successive approximation type, Clippers and Clampers, Positive and Negative clippers, Small Signal half wave rectifier, Positive and Negative clampers, Sample and Hold circuit. 555 Timer, Monostable multivibrator, Monostable operation, Astable Multivibrator, Astable operation. [Text 2: 8.2, 8.3, 8.4, 8.11 (8.11.1a, 8.11.1b, 8.11.2a), 8.12, 8.15, 9.4 (9.4.1, 9.4.1(a), 9.4.3, 9.4.3(a))] **Self-Study:** Monostable and Astable Multivibrator application.	

Course Outcomes: At the end of the course the student will be able to:	
21ECE304.1	Illustrate the working principles, and characteristics of FET.
21ECE304.2	Compare the various FET biasing schemes.
21ECE304.3	Inspect the frequency response characteristics of CS amplifiers.
21ECE304.4	Design an op-amp based amplifier in inverting and non-inverting configuration.
21ECE304.5	Construct a filter and oscillator using op-amp.
21ECE304.6	Develop and explain the functioning of op-amp based linear and non-linear circuits.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Microelectronic Circuits Theory and Applications,	Adel S Sedra and Kenneth C. Smith	International Version, Oxford University Press	6th Edition, 2009.
2	Op-Amps and Linear Integrated Circuits,	Ramakant A Gayakwad	Prentice Hall India	4th Edition, 2000.
Reference Books				
1	Electronic Devices and Circuit Theory	Robert L Boylestad and Louis Nashelsky	Pearson	10th Edition, 2009.
2	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008.

3	Electronic Devices	Thomas L Floyd	Pearson	9th Edition, 2015.
4	Fundamentals of Microelectronics	Behzad Razavi	Wiley	3rd Edition, 2021.
5	Design with Operational Amplifiers and Analog Integrated Circuits	Franco Sergio	Tata-McGraw-Hill	3rd Edition, 2017.

Web links/Video Lectures/MOOCs/papers

1. NPTEL: Analog Circuits by Prof. A.N. Chandorkar, IIT Bombay, (https://nptel.ac.in/courses/117/101/117101106/)
2. NPTEL: Analog Circuits and Systems 1 by Prof. K. Radhakrishna Rao, IISc Bangalore, (https://nptel.ac.in/courses/117/108/117108107/)
3. NPTEL: Analog Circuits by Dr. Nagendra Krishnapura, IIT Madras, (https://nptel.ac.in/courses/108/106/108106084/)

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
21ECE304.1	1													
21ECE304.2	1		2											
21ECE304.3	1													
21ECE304.4	1	2	2		3									
21ECE304.5	1	2	3		3									
21ECE304.6	1	2	3		3	1								

1: Low 2: Medium 3: High

ANALOG CIRCUITS LABORATORY			
Course Code	21ECL305	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	01	Exam Hours	03

Course Learning Objectives:

1. Understand the Circuit Configurations and Connectivity of FET Amplifiers and Study of Frequency Response
2. Design and Test of Analog Circuits Using Op-Amps
3. Understand the Feedback Configurations of Transistor and Op-Amp Circuits
4. Design an Oscillator for a Given Frequency
5. Build a Filter for Given Cut-Off Frequency
6. Use of Circuit Simulation for the Analysis of Electronic Circuits.

PART A: Experiments using Discrete Components

1. Design and Setup the Common Source MOSFET Amplifier and Plot the Frequency Response and Determine the Gain.
2. Design Active Second Order Butterworth Low Pass and High Pass Filters for a Given Cut-Off Frequency.
3. Design Adder, Integrator and Differentiator Circuits Using Op-Amp for a Given Input Frequency.
4. Design a Schmitt Trigger for the Given UTP and LTP Values and Obtain the Hysteresis.
5. Design 4 Bit R – 2R Op-Amp Digital to Analog Converter (I) Using 4-Bit Binary Input From Toggle Switches and (Ii) Generating Digital Inputs Using Mod-16 Counter.
6. Design a Monostable and Astable Multivibrator Using 555 Timer.

Part B: Simulation using EDA Software

1. Design and Set-Up BJT/FET I) Colpitts Oscillator and Ii) Crystal Oscillator
2. Test a Comparator Circuit Using 741 Op-Amp
3. Test a Precision Half and Full Wave Rectifier
4. Design a Narrow Band-Pass Filter and Narrow Band-Reject Filter

Open Ended Experiments

1. Design an Inverting Amplifier with Gain = 2
2. Design an Non-Inverting Amplifier with Unity Gain
3. Design a Voltage Follower and Check the Output Voltage.
4. Design and Set Up an Instrumentation Amplifier
5. Design Log and Antilog Amplifier and Check the Output in Multisim
6. Set Up a Zero Crossing Detector Circuit
7. Set Up a Non-Zero Crossing Detector Circuit Taking any Reference Voltage.
8. Design a Differential Amplifier, Rig up the Circuit and Measure the Output Voltage.
9. Design and Set Up a RC Phase Shift Oscillator Using FET In Multisim
10. Design and Set Up a Hartleys Oscillator.

Course Outcomes: At the end of the course the student will be able to:	
21ECL305.1	Design and Analyze the MOS CS Amplifier Configurations
21ECL305.2	Design and Analyze the Butterworth Low-Pass and High-Pass Filter
21ECL305.3	Demonstrate and Analyze the Working of Oscillators and Multivibrators
21ECL305.4	Design and Analyse the Linear and Non-linear Circuits Using Op-Amps
21ECL305.5	Demonstrate the Ability to Identify Resistors, Capacitors, Transistors and Use Power Supply, Signal Generators and Oscilloscopes.
21ECL305.6	Make Use of EDA Tools to Perform the Analysis and Simulations of circuits.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Reference Books				
1	Microelectronic Circuits – Theory and Applications	Adel S Sedra, Kenneth C. Smith	Oxford University Press	5th Edition - International Version,2009.
2	Electronic Devices and Circuit Theory	Robert L Boylestad, Louis Nashelsky,	Pearson	10th Edition, 2009.
3	Electronic Devices and Circuits	David A Bell	Oxford University Press	5th Edition, 2008.
4	Op-Amps and Linear Integrated Circuits,	Ramakant A Gayakwad	PHI	4th Edition, 2000.
5	Design with Operational Amplifiers and Analog Integrated Circuits	Franco Sergio	Tata-McGraw-Hill	3rd Edition, 2017.

Web links/Video Lectures/MOOCs

1. https://nptel.ac.in/courses/108/106/108106084/
2. https://nptel.ac.in/courses/117/105/117105147/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21ECL305.1	-	-	2	2	-	-	-	1	1	1	-	-	-	-
21ECL305.2	-	-	2	2	-	-	-	1	1	1	-	-	1	-
21ECL305.3	-	-	2	2	-	-	-	1	1	1	-	-	1	-
21ECL305.4	-	-	2	2	-	-	-	1	1	1	-	-	1	-
21ECL305.5	-	-	-	-	-	1	-	-	-	-	-	2	-	-
21ECL305.6	-	-	-	-	2	-	-	-	-	-	-	1	-	-

1: Low 2: Medium 3: High

Universal Human Values- II			
Course Code	**21UHV306/406**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement toward value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Module-1

Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Activities: Sharing about Oneself, Exploring Human Consciousness and Exploring Natural Acceptance. **5 Hours**

Module-2

Harmony in the Human Being

Understanding Human beings as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Activities: Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body and Exploring the difference of Needs of Self and Body. **5 hours**

Module 3

Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Activities: Exploring the Feeling of Trust, Exploring the Feeling of Respect and Exploring the Feeling systems to fulfil Human Goal. **5 hours**

Module-4

Harmony in the Nature/Existence

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Activities: Exploring the Four Orders of Nature and Co-existence in Existence **3 hours**

Module-5
Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession Activities: Exploring Ethical Human Conduct**,** Humanistic Models in Education and steps of Transition towards Universal Human Order **5 hours**

Course Outcomes: At the end of the course the student will be able to:	
21UHV306.1	Practice the method of self-exploration to understand the basic human aspiration.
21UHV306.2	Distinguish between needs of self and body.
21UHV306.3	Evolve a program for self-regulation and health.
21UHV306.4	Differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them
21UHV306.5	Realize sustainable solutions to the problems in society and nature
21UHV306.6	Develop competence in professional ethics and strategies for the transition towards a value-based life/profession

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Text Books				
1	Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi	2, 2019
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi	2, 2019
Reference Books				
1	Jeevan Vidya: Ek Parichaya	A Nagaraj	Jeevan Vidya Prakashan, Amarkantak	1999
2	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	2004

Web links/Video Lectures/MOOCs/papers

1. The Story of Stuff (Book).
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
4. Economy of Permanence - J C Kumarappa
5. Bharat Mein Angreji Raj – Pandit Sunderlal
6. Rediscovering India - by Dharampal

7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)

11. UHV-I Teaching material (Presentations, Pre & Post Surveys etc.)
https://fdp-si.aicte-india.org/AicteSipUHV_download.php

12. Details of UHV-II: Universal Human Values – Understanding Harmony and Ethical Human Conduct
https://drive.google.com/file/d/1cznDaqDwKy__EKWmqJLWF94MeY4AXcsU/view?usp=sharing

13. Recorded FDP (Refresher 1 Part 1: Preparing to teach UHV-I in SIP)
https://www.youtube.com/watch?v=kejuD4faDDE&list=PLWDeKF97v9SOjS4RanhaYj4YLiImqm5pj&index=1

14. Resources, including the class notes and presentations
https://drive.google.com/drive/folders/1nh9m5ibEtvMyqekeiexAJtfbdNtmtt6-?usp=sharing

15. Hindi Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SMRfe5PK1HPYnEcrrJOL6K7

16. English Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21UHV306.1						2			3	2				
21UHV306.2						3	3							
21UHV306.3	2								3			2		
21UHV306.4						3	3	3						
21UHV306.5	2					2			3					
21UHV306.6						3	3			2				

1: Low 2: Medium 3: High

Biology for Engineers			
Course Code	**21BFE306/406**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

7. To bring awareness of biological concepts to engineering students
8. To introduce the building blocks of life and their complexity
9. To encourage interdisciplinary studies and projects
10. To appreciate the discoveries that mimic nature and its working
11. To inculcate nature-inspired design and operational principles

Module-1

Basic Cell Biology: Introduction to Biology, The cell: the basic unit of life, Expression of genetic information-protein structure and function, Cell metabolism; Cells respond to their external environments, Cells grow and reproduce, Cellular differentiation. **5 Hours**

Module-2

Biochemistry and Molecular Aspects of Life: Biodiversity-Chemical bonds in Biochemistry; Biochemistry and Human biology, Protein synthesis -DNA; RNA, Transcription and translation factors play key roles in protein synthesis, Differences between eukaryotic and prokaryotic protein synthesis, Stem cells and their applications. **5 Hours**

Module-3

Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network), Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).

5 Hours

Module-4

Relevance of Biology as an interdisciplinary approach: Biological observation that led to major discoveries, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro). **5 Hours**

Module-5

Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling, Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems, Dynamic Updating DNA Computing Algorithms, Bee-Hive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour. **5 Hours**

Course Outcomes:

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

21BFE306.1	Discuss how the cell forms the basic building block of life
21BFE306.2	Distinguish between transcription and translation
21BFE306.3	Describe the role played by proteins within the cell
21BFE306.4	Analyze the role of bioinspired design in novel applications
21BFE306.5	Apply bioinspired design principles to other domains
21BFE306.6	Implement a simple genetic algorithm

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Biology for Engineers	Thyagarajan.S., Selvamurugan. N., Rajesh.MP, Nazeer RA, Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K	Tata McGraw Hill	2012
2	Molecular Biology	Robert Weaver	McGraw-Hill	5, 2012
Reference books				
1	Lewin's Genes XII	Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick	Jones and Bartlett Learning	2017
2	Bioinspired Engineering	Jenkins, C.H.	Momentum Press	2012
3	Bio mimetics: Nature-Based Innovation	Yoseph Bar-Cohen	CRC Press	1, 2016
4	A Practical Guide to Bio-inspired Design	Hashemi Farzaneh, Helena, Lindemann, Udo,	Springer	2019

Web links/Video Lectures/MOOCs/papers

1. https://books.google.co.in/books?id=-2LNBQAAQBAJ&printsec=frontcover#v=onepage&q&f=false
2. https://www.aminotes.com/2017/02/biology-for-engineers-module-1-cocepts.html

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21BFE306.1	2					1								
21BFE306.2		1				1								
21BFE306.3	2					2								
21BFE306.4		2										2		
21BFE306.5	2											2		
21BFE306.6		2										2		

1: Low 2: Medium 3: High

Balake Kannada			
Course Code	**21KBK307/407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives:

1. To enable the students to understand, speak, read and write the Kannada language.
2. To communicate in the Kannada language in their daily life with Kannada speakers
3. To give the overall information about the Kannada language and Karnataka state

Module- 1	
Kannada Aksharamaale haagu Uchchaarane (Kannada Alphabets and Pronunciation)	**3 hours**
Module-2	
Sambhashanegaagi Kannada Padagalu (Usage of Kannada Words in General Communication and Vocabulary)	**3 hours**
Module-3	
Sambhashaneyalli Kannada (Usage of Kannada in the proper manner - in Kannada Conversation)	**3 hours**
Module-4	
Kannadadalli Chatuvatikegalu (Activities related to the Kannada Language - Development of Skill vocabulary)	**3 hours**
Module-5	
Karnataka raajya, Kannada Bhashe, Saahithyada bagege Maahithi (Information about the Karnataka State, Kannada Language and Literature)	**3 hours**

Course Outcomes:

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

21KBK307.1	Write and read the Kannada alphabet
21KBK307.2	Communicate Kannada fluently
21KBK307.3	Communicate in Kannada in his day-to-day life
21KBK307.4	Build confidence to address large gatherings
21KBK307.5	Develop skills, vocabulary and fluency
21KBK307.6	Make use of state language and literature

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Balake Kannada	Dr L Thimmesha	Prasaranga VTU Belagavi	1st Edition. 2020
2	Vyavaharika Kannada	Dr L Thimmesha, Prof V Keshavamoorthy	Prasaranga VTU Belagavi	1st Edition. 2020
Reference Books				
1	Kannada Kali	Lingadevaru Halemane	Kannada University Hampi	Fourth Edition 2016
2	Spoken Kannada	N. D Krishnamurthy, Dr S. M. Rameshchandra Swamy, Abdul Rehman Pasha	Kannada Sahithya Parishat	2018

Web links/Video Lectures/MOOCs/papers

1. https://youtu.be/daY6TRvHFB4
2. https://youtu.be/RuRmq7VyCaQ

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21KBK307.1	2									2				
21KBK307.2	2									2				
21KBK307.3	2									2				
21KBK307.4	2									2				
21KBK307.5	2									2				
21KBK307.6	2									2				

1: Low 2: Medium 3: High

Saamskruthika Kannada			
Course Code	**21KSK307/407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives:

1. ಕನ್ನಡ ಸಾಹಿತ್ಯ , ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನುಡಿಯ ಪರಿಚಯ
2. ಕನ್ನಡದಲ್ಲಿ ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನಗಳ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವಿಷಯಗಳ ಪರಿಚಯ
3. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ , ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತದ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ
4. ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು
5. ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳ ಪರಿಚಯ
6. ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು

Module-1

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ; ಹಂಪ ನಾಗರಾಜಯ್ಯ
2.ಕನ್ನಡ ನಾಡು ನುಡಿ
3.ಕನ್ನಡ ಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ **3 Hours**

Module-2

4.ಕಾವ್ಯ ಭಾಗ- ಆಧುನಿಕ ಪೂರ್ವ
(ವಚನಗಳು, ಕೀರ್ತನೆಗಳು, ತತ್ವಪದಗಳು,ಜನಪದ ಗೀತೆ)
5. ಕಾವ್ಯ ಭಾಗ – ಆಧುನಿಕ
(ಡಿ ವಿ ಜಿ, ದ.ರಾ.ಬೇಂದ್ರೆ, ಕುವೆಂಪು, ಕೆ.ಎಸ್. ಎನ್, ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ, ಚಂದ್ರಶೇಖರ ಕಂಬಾರ, ಸಿದ್ಧಲಿಂಗಯ್ಯ) **3 Hours**

Module-3

6.ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ
7. ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ
8. ಪತ್ರವ್ಯವಹಾರ - ಆಡಳಿತ ಪತ್ರಗಳು; ಸಾಮಾನ್ಯ, ಸಾರ್ಕಾರಿ ಪತ್ರಗಳು, ಅರೆಸರ್ಕಾರಿ ಪತ್ರಗಳು **3 Hours**

Module-4

9. ಡಾ.ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ –ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ ; ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
10. ಯುಗಾದಿ; - ವಸುಧೇಂದ್ರ **3 Hours**

Module-5

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ
11. “ಕ” ಮತ್ತು “ಬ” ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡ ಟೈಪಿಂಗ್
12. ಕನ್ನಡ – ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ
13. ತಾಂತ್ರಿಕ ಪದಕೋಶ –ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು **3 Hours**

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

21KSK307.1	**ಕನ್ನಡ ನಾಡು ನುಡಿಯ ಅರಿವು ಹಾಗೂ ಸಂಸ್ಕೃತಿಯ ಹರಿವು**
21KSK307.2	**ಕವಿ ಕಾವ್ಯಗಳ ಪರಿಚಯ- ಕವಿತೆಗಳ ಮೂಲಕ ಬದುಕಿನ ನೈಜತೆಯ ಚಿತ್ರಣ**
21KSK307.3	**ಶುದ್ಧ ಕನ್ನಡದ ಬಳಕೆ, ಪತ್ರಗಳತ್ತ ಒಲವು, ಸುಲಭ ವ್ಯಾಕರಣ**
21KSK307.4	**ಕನ್ನಡ ಸಾಹಿತ್ಯದ ವಿವಿಧ ಪ್ರಕಾರಗಳು- ವ್ಯಕ್ತಿ ಪರಿಚಯ ಹಾಗೂ ಕತೆಯ ತಂತ್ರಗಾರಿಕೆ**
21KSK307.5	**ತಂತ್ರಾಂಶಗಳ ಬಳಕೆ, ಪಾರಿಭಾಷಿಕ ಪದಗಳ ಪರಿಚಯ**
21KSK307.6	**ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನ, ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ**

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	ಆಡಳಿತ ಕನ್ನಡ	ಡಾ.ಎಲ್ .ತಿಮ್ಮೇಶ್ ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ	ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ	2019
2	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ	ಡಾ .ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ , ಡಾ.ಎಲ್ .ತಿಮ್ಮೇಶ್	ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ	2020
Reference Books				
1	ಕನ್ನಡ ಸಾಹಿತ್ಯಕೋಶ & ವ್ಯಾಕರಣ ಪುಸ್ತಕ	ರಾಜಪ್ಪ ದಳವಾಯಿ ———	ದಳವಾಯಿ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು.	2008
2	ಕನ್ನಡ ಕ್ಲಿಷ್ಟಪದ ಕೋಶ (ಶಬ್ದದ ವ್ಯುತ್ಪತ್ತಿ ಸಹಿತ)	ಪ್ರೊ. ಜಿ. ವೆಂಕಟ ಸುಬ್ಬಯ್ಯ ಹಾಗೂ ರಾಜ್ಯಶ್ರೀ ಸತೀಶ್	ಪ್ರಿಸಮ್ ಬುಕ್ಸ್ ಪ್ರೈ.ಲಿ.	2006

Web links/Video Lectures/MOOCs/papers

1. https://youtu.be/HS8InQR36E4
2. https://youtu.be/C_SF24_ygxQ
3. https://youtu.be/wuT7UED7yuQ
4. https://youtu.be/pxLwNWXhbnQ
5. https://youtu.be/H6FXRSBNO4c

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21KSK307.1		2										2		
21KSK307.2		2										2		
21KSK307.3		2								2				
21KSK307.4		2										2		
21KSK307.5		2				2								
21KSK307.6						2				2				

1: Low 2: Medium 3: High

Constitution of India, Professional Ethics and Cyber Law			
Course Code	**21CPC307/407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives: To

1. Know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and *the* duties of citizens
2. Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
3. Know about cybercrimes and cyber laws for cyber safety measures.

Module-1

Introduction to Indian Constitution:

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building. **3 Hours**

Module-2

Union Executive and State Executive:

Parliamentary System, Federal System, Centre-State Relations. Union Executive - President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives - Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,37JJ) for some States. **3 Hours**

Module-3

Elections, Amendments and Emergency Provisions:

Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments - 7,9, 10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and their consequences.

Constitutional special provisions:

Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

3 Hours

Module-4

Professional/ Engineering Ethics:

Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities **in** Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, TPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering. **3 Hours**

Module-5
Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies. **3 Hours**

Course Outcomes: At the end of the course the student will be able to:	
21CPC307.1	Discuss the constitutional knowledge and legal literacy
21CPC307.2	Review the Indian constitution
21CPC307.3	Analyze the role and functions of Union and state executives
21CPC307.4	Review the Electoral Process, the System of Election Commission and its functions
21CPC307.5	Discuss professional ethics and responsibilities of engineers
21CPC307.6	Analyze the cybercrimes and cyber laws for cyber safety measures

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
1	Introduction to the Constitution of India	Durga Das Basu	Prentice -Hall	2008
2	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice -Hall	2004

Web links/Video Lectures/MOOCs/papers

1.https://www.constitutionofindia.net/constitution_of_india

2. https://infosecawareness.in/cyber-laws-of-india

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CPC307.1						2		2						
21CPC307.2								2				2		
21CPC307.3						2		2				2		
21CPC307.4						2		2						
21CPC307.5						2		2						
21CPC307.6								2				2		

1: Low 2: Medium 3: High

IOT ENABLED PROTOTYPING			
Course Code:	**21IEP308**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	03

Course Learning Objectives:

1. Understand the IoT concepts such as sensing, actuation, and communication.
2. Development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication and Protocols
3. Understand the significance of Project Management and the different techniques of planning
4. To introduce fundamental aspects of intellectual property rights, Govt. policies on IPR, and patentability search techniques.

Module 1

Internet of Things – Hardware / System Design

Introduction to IoT fundamentals, Introduction to sensors, Difference between analog and Digital sensors, Interfacing Temperature, Light and Humidity sensor with Arduino, Interfacing Motors with Arduino, A simple program to control actuator based on the analog sensor. **6 Hours**

Module 2

Internet of Things

Networking in IoT:

Introduction to wireless communication, Wifi Module ESP8266 interface with Arduino, Machine to Machine (M2M) communication using WiFi module. A simple demonstration of sensing temperature from one device and control actuator on a second device (M2M)

IoT in Web/ Cloud Platform:

Introduction to a web server - XAMPP(windows), A simple interactive web page using HTML5, Bootstrap (or CSS), and Javascript. Interfacing ESP8266 with webserver, ThingSpeak API, and MQTT protocol, A simple project to demonstrate the status of two IoT devices communicating with a Web Server. **6 Hours**

Module 3

Project Planning and Management

Project initiation, Project charter, Project planning, and implementation, Scheduling and costing, Project monitoring and control, Project closure and reports.

6 Hours

Module 4

Intellectual Property Rights

Introduction and the need for intellectual property right (IPR) – Kinds of Intellectual Property Rights, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non - Patentable Subject Matter, Registration Procedure, Patentability search methods, Patent landscape, Freedom-to-market, National IPR Policy, Govt. initiatives and scheme in promoting IPR. **6 Hours**

Course Project

Develop IoT-based prototypes (solutions) to solve any industrial or societal problems. The prototype building is teamwork of 3-5 students. The goals should be clearly defined and should use robust technologies and rigorous testing.

6 Hours

Course Outcomes:

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

21IEP308.1	Analyze the basics of IoT and protocols
21IEP308.2	Develop IoT-based prototypes to solve industrial and societal problems

21IEP308.3	Apply appropriate approaches to plan a new project and develop a project schedule.
21IEP308.4	Discuss the ethical aspects in IPR, Govt. policies on IPR, and conducting patentability searches
21IEP308.5	Inculcate the teamwork and communication skills

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Reference Books				
1	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	Orient Blackswan Private Limited	1st Edition, 2015
2	Fundamentals of Intellectual Property	Dr. Kalyan C. Kankanala	Asia Law House	1st Edition, 2012
3	Project Management Absolute Beginner's Guide	Greg Horine	Pearson Education (US)	4th Edition, 2017

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
21IEP308.1			**2**		**2**				**2**	**2**				
21IEP308.2			**2**								**3**			
21IEP308.3					**2**						**2**			
21IEP308.4								**1**		**2**				
21IEP308.5								**1**	**2**	**2**				

1: Low 2: Medium 3: High

Industry Oriented Training - Business Etiquettes			
Course Code	**21IOT309**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	2

Course Learning Objectives:

12. Know the components of self-introduction
13. Develop a resume with the inclusion of core competencies
14. Involve and contribute to group discussions
15. Develop effective communication to succeed in the professional career
16. Know the etiquettes of digital communication

Module-1

Self Introduction &Essentials of grooming

Self Introduction: Learn the secret to introducing Yourself, Things to avoid when introducing yourself. Activity: Video record the self-introduction. **Essentials of grooming:** Creating the first impression, what does the well-dressed man wear? What does the well-dressed woman wear? Personal hygiene and habits **4 Hours**

Module-2

Resume Writing

Purpose, Identifying Relevant Competencies, Understanding Applicant Tracking Systems, Lists of Competencies, Writing Accomplishment/ Objective Statements, Finding the Right Words- Action verbs, The Most Popular Resume Format, Other Popular Resume Formats, Do's and Don'ts. Activity: Students have to submit a copy of their resume **4 Hours**

Module-3

Group Discussion

Types, process, Evaluation criteria, Do's and Don'ts Activity: Group discussions have to be held during the training sessions **4 Hours**

Module-4

Communicate effectively

Build a Story, Just a Minute, Group Activities, Team building activities, Role Play, Presentation Skills

4 Hours

Module-5

Digital right and wrong

Virtual Communication: Agenda, being prepared, Dressing appropriately, background, Use Microphone and camera the right way, restraining from off tasks during virtual meetings, protecting confidential data during online presentations, time management **4 Hours**

Course Outcomes: At the end of the course the student will be able to:	
21IOT309.1	Articulate the essential components required for self-introduction in any business or a networking event and also recognize the need to dress appropriately for a successful career in the corporate
21IOT309.2	Develop a resume inclusive of core competencies, and action verbs which are compatible with Applicant Tracking Systems
21IOT309.3	Demonstrate the types, process and evaluation process of Group Discussion and carry out effective group discussions
21IOT309.4	Develop skills required for effective communication
21IOT309.5	Associate and be accustomed to the etiquette to be followed during online meetings

Sources

1. English for Common Interactions in the Workplace: Basic Level: Coursera: https://www.coursera.org/learn/english-common-interactions-workplace-basic-level
2. Personal Communication-Introduce Yourself With Confidence: https://www.udemy.com/course/how-to-introduce-yourself/
3. Professionalism, Grooming and Etiquette: https://www.edx.org/course/professionalism-grooming-and-etiquette
4. How to Write a Resume: https://www.coursera.org/learn/how-to-write-a-resume#syllabus
5. Group Discussion Strategies: https://www.udemy.com/course/group-discussion-strategies/
6. Communication Strategies for a Virtual Age: https://www.coursera.org/learn/communication-strategies-virtual-age#syllabus

References

1. https://simplifytraining.com/course/personal-hygiene-and-good-grooming/
2. https://www.udemy.com/course/group-discussion-strategies/
3. https://www.educba.com/course/group-discussion/
4. https://getrafiki.ai/meetings/rules-of-virtual-meeting-etiquette-every-sales-professional-should-follow/
5. https://thedigitalworkplace.com/articles/online-meeting-etiquette-for-attendees/
6. https://rigorousthemes.com/blog/virtual-meeting-etiquette-guidelines-ground-rules/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21IOT309.1									2	3		1		
21IOT309.2										3		1		
21IOT309.3									2	3	1	1		
21IOT309.4									2	3	1	1		
21IOT309.5									2	3	1	1		

1: Low 2: Medium 3: High

Additional Mathematics - I

(A Bridge Course for Lateral Entry Students of BE Programmes)

(Common to all Programmes)

Course Code	**21MAL301**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	50
Credits	-	Exam Hours	03

Course Learning Objectives:

1. To familiarize concepts of Mathematics required for engineering study
2. To equip the students with standard concepts and tools to solve problems in their discipline of engineering.

Module-1

Complex Trigonometry: Complex Numbers, Definitions and properties. Modulus and amplitude of a complex number, De Moivre's Theorem, Argand diagram,
Vector Algebra: Scalars and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

8 Hours

Module-2

Trigonometry: Trigonometric ratios, quadrant rule, trigonometric ratios of standard angles, compound angles, Sum and product formula and Hyperbolic functions
Partial fraction: Type 1- Denominator is a product of non repeated linear factors, Type 2 -repeated linear factors and Type 3: Quadratic factors. **8 Hours**

Module-3

Differentiation: Derivative of a function, Derivative of a composite function, Differentiation of Implicit function, Differentiation of inverse trigonometric function, product formula, Quotient formula, Chain rule, nth derivative, Leibnizs Rule, angle between radius vector and tangent (only formula), angle between polar curves. **8 Hours**

Module-4

Integration: Definition, standard formulae, Integration by substitution, , Integration by partial fraction method, Integration by parts, Bernoulli's rule ,$\int e^{ax}\ sin\ bx\ dx$ and $\int e^{ax} \cos bx\ dx$
Definite Integrals and properties of definite integrals. Application- Definite integral as an area. **8 Hours**

Module-5

Linear Algebra: Rank of matrices - Rank of a matrix by Echelon form, consistency of system of linear equations - homogeneous and non-homogeneous equations, Gauss – Elimination and Gauss - Seidel methods. Eigen values and Eigenvectors-properties, largest Eigenvalue by Rayleigh's power method. Diagonalization of a square matrix of order two. **8 Hours**

Course Outcomes:

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

21MAL301.1	Apply complex numbers and vectors in Engineering Applications
21MAL301.2	Apply trigonometry in real life applications
21MAL301.3	Resolve the Rational fraction into partial fractions.
21MAL301.4	Compute derivative of different functions

21MAL301.5	Compare and different methods integration and select appropriate method to solve given problem
21MAL301.6	Analyze given problem and use appropriate method of solving given set of equations

Question paper pattern:
Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	**Higher Engineering Mathematics**	B.S. Grewal	Khanna Publishers	44th Edition, 2017
2	NCERT Text Book for Mathematics I PUC and II PUC	NCERT	NCERT	Reprint 2007
3	Higher Engineering Mathematics	H.K Dass and R Verma	C. Chand and Company	First Edition, 2011
Reference Books				
1	Advanced Engineering Mathematics – Volume I	E. Kreyszig John Wiley & Sons	Wiley Precise Textbook Series	10th Edition 2010
2	"Higher Engineering Mathematics"	B.V.Ramana	Tata McGraw-Hill Publications	11th Edition,2010

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
21MAL301.1	**3**	**1**										
21MAL301.2	**3**	**1**										
21MAL301.3	**3**		**1**									
21MAL301.4	**3**		**1**									
21MAL301.5	**3**		**1**									
21MAL301.6	**3**		**1**									

1: Low 2: Medium 3: High

Business Communication (A Bridge Course for Lateral Entry Students BE programmes)			
Course Code	**21ENG310/410**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	50
Credits	**00**	Exam Hours	02

Course Learning Objectives:

1. To enable the learner to communicate effectively in real-life situations.
2. To review English grammar effectively for study purposes across the curriculum.
3. To enhance English vocabulary and language proficiency.
4. To achieve better writing and presentation skills.

Module-1	**2 Hours**
Subject Verb Agreement, Sequences of tenses, Active and Passive, Reported speech, Articles, Preposition.	
Module-2	**2 Hours**
Vocabulary, One word substitutes, Confused words, Phrasal Verbs, Idioms and Phrases, Analogies.	
Module-3	**2 Hours**
Technical vocabulary, Homophones, Homographs, Homonyms, Synonyms and Antonyms, Common errors in the English language, and Phrasal verbs.	
Module-4	**2 Hours**
Formal letter writing, Covering letter with Resume, Email Etiquette Cloze passage.	
Module-5	**2 Hours**
Communication skills: Group discussion, Etiquette of the job interview, Dialogues in various situations, Telephonic conversation.	

Course Outcomes:

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

21ENG310.1	Analyze the concepts of grammar and its usage
21ENG310.2	Identify the nuances of phonetics, intonation and flawless pronunciation
21ENG310.3	Implement English vocabulary and language proficiency.
21ENG310.4	Apply the forms of writing skills at the professional level.
21ENG310.5	Demonstrate speaking ability in terms of fluency and comprehensibility.
21ENG310.6	Demonstrate competence in the four modes of literacy: Writing, Reading, Speaking and listening.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication skills	Sanjay Kumar and Pushp Lata	Oxford University Press	Second Edition, 2015
2	High School English Grammar and Composition	Wren and Martin	S Chand and Company Ltd	2015
Reference Books				
1	Practical English Usage	Michael Swan	Oxford University Press	2016
2	English Grammar in Use	Raymond Murphy	Cambridge University Press	Second Edition, 1994

Web links/Video Lectures/MOOCs

1.https://englishforeveryone.org
2.https://owl.purdue.edu
3.http://guidetogrammar.org

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21ENG310.1	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.2	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.3	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.4	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.5	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.6	2	-	-	-	-	-	-	-	-	3	-	-	-	-

1: Low 2: Medium 3: High

SEMESTER –IV

Linear Algebra and Statistical Methods

(Common to ECE & EEE)

Course Code	**21MAE401**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. To learn principles of advanced engineering mathematics through linear algebra.
2. To understand probability theory and random process that serve as an essential tool for applications of electronics and communication engineering sciences.

Module-1

Linear Algebra- I

Vector spaces & subspaces, null spaces, Column spaces & linear transformations, Linearly independent sets; basis, Coordinate systems, The dimension of a vector space, Rank:Rank and nullity theorem (without proof). **8 Hours**

Module-2

Linear Algebra- II

Inner product, length & orthogonality, orthogonal set, orthogonal projection Gram-Schmidt process, QR factorization of matrices, Eigenvalues and Eigenvectors (Recapitulation).Diagonalization of symmetric matrices. The singular value decomposition. **8 Hours**

Module-3

Statistical Methods and Curve Fitting:

Correlation and regression-Karl Pearson's coefficient of correlation-problems. Regression analysis- lines of regression -problems. Curve Fitting: Curve fitting by the method of least squares-fitting the curves of the form y = ax + b, y = ax^2+ bx + c and y = ax^b

8 Hours

Module-4

Probability Distributions:

Random variables (discrete and continuous), probability mass/density functions, cumulative density function. Binomial, Poisson, exponential and normal distributions-problems (No derivation for mean and standard deviation) **8 Hours**

Module-5

Sampling theory:

Introduction, sampling distributions, Testing of hypothesis for means, level of significance, confidence limits, Sampling of variables, central limit theorem, confidence limits for unknown mean, student's **t**-distribution, Chi-square distribution as a test of goodness of fit. **8 Hours**

Course Outcomes:

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

21MAE401.1	Make use of vector spaces in the process of obtaining a matrix of linear transformations.
21MAE401.2	Apply the technique of singular value decomposition for data compression and least-square approximation in solving inconsistent linear systems.
21MAE401.3	Examine the given data for the probability distribution.
21MAE401.4	Make use of the correlation and regression analysis to fit a suitable mathematical model for the statistical data.

21MAE401.5	Discover the relation between dependent & independent variables using the least square curve fitting method.
21MAE401.6	Demonstrate the validity of testing the hypothesis to arrive at a decision regarding the population through a sample

Question paper pattern:
Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition., 2017.
2	Linear Algebra & its applications	David C. Lay	Pearson Publication	3rd Edition, 2014
3	Introductory Probability and Statistical Applications	B L Mayer	Wiley Eastern Limited	2nd Edition,2014
Reference Books				
1	Advanced Engineering Mathematics	C.Ray Wylie, Louis C.Barrett	McGraw- Hill Book Co., New York	6th Edition,2017
2	Linear Algebra & its applications	Gilbert Strang	Cengage Learning India Edition	4th Edition 2006
3	Schaum's Outline of Linear Algebra	Seymour Lipschutz and Marc Lipson	McGraw Hill Education	5 th Edition, 2012
4	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill, Publication	11th Edition,2006

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	**PO2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
21MAE401.1		**3**	**1**									
21MAE401.2	**3**	**1**										
21MAE401.3		**1**		**3**								
21MAE401.4	**3**	**1**										
21MAE401.5		**3**	**1**									
21MAE401.6		**1**	**3**									

1: Low 2: Medium 3: High

Signals and Systems (Integrated)			
Course Code	**21ECE402**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. Understand the mathematical description of continuous time signals and systems.
2. Understand the mathematical description of discrete time signals and systems.
3. Analyze the signals in time domain using convolution sum and Integral.
4. Classify signals into different categories based on their properties.
5. Analyze Linear Time Invariant (LTI) systems in time and transform domains.
6. Analyze discrete time signal in Z domain.

Module-1 **8 Hours**

Introduction and Classification of signals: Definition of signal and systems, communication and control system as examples, Classification of signals.
Basic Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration, time scaling, time shift and time reversal.
Elementary signals: Exponential, Sinusoidal, Step, Impulse and Ramp Functions.
Textbook 1: 1.1-1.6

Module-2 **8 Hours**

Properties of systems: Linear-nonlinear, Time variant-invariant, causal-non-causal, static-dynamic, stable-unstable, invertible.
Time domain representation of LTI System: Impulse response, convolution sum, convolution integral.
Interconnections of LTI systems, Relationship between LTI system Properties and the Impulse Response, Step response.
Textbook 1: 1.8, 2.1- 2.8

Module-3 **8 Hours**

Fourier Representation of aperiodic Signals: Continuous Time Non Periodic Signals: The Fourier Transform-Definition and Basic Problems.
Textbook 1: 3.7

Module-4 **8 Hours**

Discrete Time Non Periodic Signals: The Discrete Time Fourier Transform-Definition, Properties and Problems.
Textbook 1: 3.6, 3.8
Discrete Fourier Transform: Introduction to DFT, The DFT
Textbook 2: 10.1,10.2

Module-5 **8 Hours**

The Z-Transforms: Two sided Z Transforms, Properties of Two sided Z transform, Poles, Zeros, and the z-Plane, The Transfer Function, The Inverse Z transform.
Textbook 2: 4.1-4.4, 4.8

List of Laboratory Experiments related to above modules – 2 hours each

Software Tool: MATLAB

1. Generate and analyse the standard signals
2. Perform various operations on signals such as addition, multiplication, time scaling, time shifting, time folding etc.
3. Compute energy and average power of a given signal.
4. Compute the output of a Linear Time Invariant System using Linear convolution. Also verify the properties of Linear Convolution.
5. Compute the Fourier Transform of a given signal and plot its' magnitude and phase

spectrum.

6. Verify the properties of DTFT of a given discrete-time signal.
7. Compute DFT of a given discrete time signal.
8. Locate the zeros and poles in the Z plane for the given transfer function.

Open ended experiment covering the concept of entire syllabus

Analyze various Bio Medical Signals in Time and Frequency Domain.

Course Outcomes:

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

21ECE402.1	Describe the Continuous Time (CT) and Discrete Time (DT) Signals and Systems.
21ECE402.2	Analyze the response of CT and DT Linear Time Invariant (LTI) Systems in Time Domain using Convolution operation.
21ECE402.3	Represent and Analyze CT and DT Non-Periodic Signals in Frequency Domain using Fourier Analysis.
21ECE402.4	Describe the concept of Frequency Domain Sampling.
21ECE402.5	Apply Z-transform techniques for the analysis of DT LTI Systems.
21ECE402.6	Analyze various signals and signal processing techniques using simulation tools.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Signals and Systems	Simon Haykins and Barry Van Veen	Wiley India	2nd Edition, 2008
2	Digital Signal Processing-A Modern Introduction	Ashok Ambardar	Nelson Engineering	1st Edition, 2007
Reference Books				
1	"Signals and Systems"	Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab	Pearson Education Asia / PHI,	2nd edition, 1997, Indian Reprint 2002.
2	"Linear Systems and Signals"	B. P. Lathi	Oxford University Press	2005

Web links/Video Lectures/MOOCs

MIT OPEN COURSEWARE:

https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/

Author: Prof. Alan V. Oppenheim

NPTEL:

Signals & Systems by PROF. KUSHAL K. SHAH, Department of Electrical and Electronics Engineering IISER Bhopal

https://nptel.ac.in/courses/108/106/108106163/#

Course Articulation Matrix

Course Outcomes (CO)	Program Outcomes (POs)													
	PO1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
21ECE402.1	2	2	-	-	-	-	-	-	-	-	-	-	2	-
21ECE402.2	2	-	2	-	-	-	-	-	-	-	-	-	2	-
21ECE402.3	2	-	2	-	-	-	-	-	-	-	-	-	2	-
21ECE402.4	2	-	1	-	-	-	-	-	-	-	-	-	2	-
21ECE402.5	2	-	2	-	-	-	-	-	-	-	-	-	2	-
21ECE402.6	-	-	-	2	3	-	-	-	3	2	-	-	-	-

1: Low 2: Medium 3: High

ARM Processor and Microcontroller (Integrated)			
Course Code	**21ECE403**	CIE Marks	50
Teaching Hours/Week (L: T: P)	(3:0:2)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. Introduce the outline architecture organization of the ARM Processor and Microcontroller.
2. Give an overview of system peripherals which cover bus structure, memory map, register programming etc.
3. To set up and customize a microcontroller development environment.
4. To know the ARM instruction set covering branching, data processing instructions, swap instruction, THUMB instruction set and others.
5. Know the internal architecture and interfacing details of the peripheral's devices to interact with other devices.
6. Learn to write and debug programs for hardware and software interaction and integration.

Module-1 **8 Hours**

INTRODUCTION

The Microprocessor: Microprocessor Architecture Classification: Instruction Set Architecture, Memory Interface-Based Architecture Classification, Performance Comparison of Different Architectures.

Cortex-M Architecture: Introduction to Cortex-M Microcontroller, Microprocessor Architecture, Nested Interrupt Vector Controller, Bus System and Bus Matrix, Memory and Peripherals. ***Exceptions and Interrupts Architecture:*** The Cortex-M Exceptions and Interrupts, Exception and Interrupt Priority, Handling of Exceptions or Interrupts.

Textbook-1:
CH-1(1.5,1.6)
CH-2 (2.1, 2.2, 2.3, 2.4, 2.5)
CH-3 (3.1, 3.2, 3.4)

Self-Study Topics:
Embedded Systems, Memory Information Storage Device (CH-1:1.2, 1.4)
Interrupt Configuration (CH-3:3.3)

Module-2 **8 Hours**

PROGRAMMING

Basics of Assembly Programming: Introduction to ARM Instruction Sets, Cortex-M Assembly Programming Basics, Instruction Set,

Data Processing Instructions: Shift, Rotate, and Logical Instructions, Basic Arithmetic Instructions, Data Movement Instructions, Bitfield Instructions, Test and Compare Instructions, Saturating Instructions.

Memory Access Instructions: Load and Store Instructions, LDR with PC-Relative Addressing Mode, The ADR Instruction, Stack Memory Access with PUSH and POP.

Branch and Control Instructions: Introduction to Conditional Execution, Branch Instructions, Conditional Branch Execution.

Textbook-1:
CH-4 (4.1, 4.2, 4.5)
CH-5 (5.1, 5.2, 5.3, 5.4, 5.5, 5.6)
CH-6 (6.1, 6.2, 6.3, 6.4, 6.6)
CH-7 (7.1, 7.2, 7.3, 7.7, 7.12)

Self-Study Topics:
Our First Assembly Program, (CH-4: 4.3)
Implementing Loops and Switch-Case, Recursive Functions, Passing Parameters to Functions,

If-Then Conditional Instruction Block, Table Branch Instructions (CH-7: 7.5, 7.6, 7.8, 7.9, 7.10, 7.11)

Module- 3 **8 Hours**

INTERFACING

Fundamentals of Input-Output Interfacing: Basic Microcontroller GPIO Interfacing, Cortex-M-Based TM4C123 Microcontroller, TM4C123 Microcontroller Peripherals, Configuring Microcontroller Pins as GPIOs, Input-Output Interfacing for LED and Switch, Keypad Interfacing, Interfacing an LCD Module. **Textbook-1:**
CH-8 (8.1, 8.2, 8.3, 8.4, 8.4, 8.5, 8.7, 8.8)
Self-Study Topics: Seven-Segment LED Interfacing (CH-8:8.6)

Module-4 **8 Hours**

TIMING INTERFACES

Basics of Timing Interfaces, Clocking a Microcontroller, Timer Basics, TM4C123 Timing Interfaces and Systick Timer, Timer as Input Device, Frequency Measurement Using Timers, Timer as Output Device, General Purpose Timer Modules in TM4C123.
Textbook-1:
CH-10 (10.1, 10.2, 10.4, 10.5, 10.6, 10.7, 10.8, 10.9)
Self-Study Topics:
TM4C123 Clock Source and Frequency Configuration, TM4C123 Timer as Input/ Output Device **(**CH-10:10.3,10.10)
8 Hours

Module-5 **8 Hours**

SERIAL COMMUNICATION INTERFACES

Fundamentals of Serial Communication: UART Interface, UART details on TM4C123 Microcontroller, I2C Details on TM4C123 Microcontroller.
Analog Interfacing: Digital Representation of Analog Signals, ADC Types, ADC Details on TM4C123 Microcontroller
Textbook-1:
CH-11(11.1, 11.2, 11.3)
CH-12 (12.1, 12.2, 12.3 12.4)
Self-Study Topics:
I2C Interface, Serial Peripheral Interface (SPI) (CH-11: 11.4, 11.6)
Need for Analog Interfacing (CH-12: 12.1)

List of Laboratory Experiments related to above modules – 2 hours each

Experiments with ARM using Keil software
1. Data Transfer Programs: Block Moves & Exchange, Sorting, Finding largest element in an array.
2. Arithmetic Operations: Addition, Multiplication & Division, square, Cube.
3. Programs to generate delay
4. Programs on Counters.
Interfacing experiments with ARM- Keil software using C programming
5. Illustrate the interfacing of LED with ARM Microcontroller.
6. Interface a Stepper motor and DC Motor to ARM Microcontroller.
7. Interface DAC to generate various waveforms with ARM Microcontroller
8. Interface a simple Switch and display its status through Relay, and Buzzer
9. Open Ended Experiment on the hardware implementation using ARM microcontroller

Course Outcomes: At the end of the course the student will be able to:	
21ECE403.1	**Interpret** the basic concept of Microprocessor and Microcontrollers based digital system.
21ECE403.2	**Illustrate** the detailed software and hardware structure of the Microprocessor and Microcontroller.
21ECE403.3	***Analyze*** pin functions / ports for implementing peripheral interfaces with Microprocessor and Microcontrollers.
21ECE403.4	***Develop*** Assembly language programming skill using the instruction set of Cortex-M
21ECE403.5	***Describe*** the architectural features and instructions of ARM Cortex-M microcontroller.
21ECE403.6	***Apply*** the knowledge gained on programming the ARM microcontroller for different real time applications.

Sl. No.	**Title of the Book**	**Author/s**	**Publisher**	**Edition and Year**
Textbooks				
1	ARM Microprocessor Systems Cortex®-M Architecture, Programming, and Interfacing	Muhammad Tahir and Kashif Javed	CRC Press Taylor & Francis Group Boca Raton London New York	2017
Reference Books				
1	ARM assembly language: an Introduction	J. R. Gibson, ARM (Firm)	Cengage Learning	Second Edition 2011
2	The Definitive Guide to the ARM Cortex-M3 and Cortex-M4 Processors	Joseph Yiu	Newnes, (Elsevier)	Third Edition 2014
3	ARM System Developer's Guide Designing and Optimizing System Software	Andrew N. Sloss Dominic Symes Chris Wright	Morgan Kaufmann (Elsevier)	First Edition 2004
4	ARM Assembly Language	William Hohl, Christopher Hinds	CRC Press	2nd Edition 2015

Web links/Video Lectures/MOOCs

1. Embedded System Design With ARM: https://nptel.ac.in/courses/106105193
2. Embedded Software and Hardware Architecture.: https://www.coursera.org/lecture/embedded-
3. Arm Cortex-M Architecture and Software Development: https://www.coursera.org/learn/arm-cortex-m-processors-overview-course1/home/week/1

Course Articulation Matrix

Keywords (PO/PSO)	POS													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21ECE403.1	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
21ECE403.2	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
21ECE403.3	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
21ECE403.4	**2**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
21ECE403.5	**2**	**-**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**
21ECE403.6	**-**	**-**	**3**	**-**	**3**	**-**	**-**	**3**	**3**	**-**	**3**	**3**	**-**	**-**

1: Low 2: Medium 3: High

Analog Communication Engineering			
Course Code	**21ECE404**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**3**	Exam Hours	03

Course Learning Objectives:

1. Understand the Fundamentals of the Communication System and Significance of Modulation Techniques.
2. Classify the Various Amplitude Modulation Techniques and Learn the Generation and Detection of the same.
3. Explain the Need for Single Sideband and Vestigial Sideband Techniques in AM Modulation Scheme.
4. Analyze the Scope of Frequency Modulation and also its Generation and Detection Schemes
5. Understand the Effect of Noise in the AM and FM Receiver.
6. Explain the Need and Steps Involved for Digitization of the Analog Signals.

Module-1: 8 Hours

FUNDAMENTALS OF COMMUNICATION SYSTEM Introduction to Communications, Elements of a Communication System, Transmission of Message Signals, Limitations and Resources of Communication Systems, Ideal Low Pass Filters and Band Pass Transmission **(1.4,1.5,1.6, 3.4 and 3.5 in Text 1**)

Communication Networks, Communication Channels, Modulation Process **(4, 5 and 6 in Text 2)**

Amplitude Modulation**:** Introduction, Amplitude Modulation: Time & Frequency Domain Description, Generation of AM Waves - Square Law Modulator, Switching Modulator, Detection of AM Waves - Square Law Detector and Envelope Detector. **(7.1 in Text 1)**

Module-2 8 Hours

DSBSC AND SSBSC Double Sideband-Suppressed Carrier Modulation**:** Time and Frequency Domain Description, Generation of DSBSC-Waves, Balanced and Ring Modulator, Coherent Detection, Costas Receiver, Quadrature Carrier Multiplexing. **(7.2 - 7.3 in Text 1)**

Introduction to Hilbert Transform, Properties of Hilbert Transform

SSB Modulation: Time Domain Description, Frequency Domain Description, Generation of SSB Modulated Wave - Frequency Discrimination Method, Phase Discrimination Method, Demodulation of SSB Waves.

Vestigial Sideband Modulation: Generation of VSB Modulated Wave, Frequency Domain Description, Time Domain Description **(7.4,7.5 and 7.6 in Text 1)**

Self-learning Topics: Radio Broadcasting, Television, and HDTV

Module-3 8 Hours

ANGLE MODULATION Angle Modulation: Basic Concepts, Frequency Modulation, Single Tone Frequency Modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow Band FM, Wide Band FM, Transmission Bandwidth of FM Waves, Generation of FM Waves, Demodulation of FM Waves, FM Stereo Multiplexing, Phase – Locked Loop: Nonlinear Model of PLL, Linear Model of PLL. **(7.10,7.11, 7.12 and 7.14 in Text 1)**

Self-learning Topics: FM Stereo Multiplexing and FM Radio.

Module-4	**8 Hours**
RANDOM PROCESS & NOISE IN ANALOG MODULATION Mathematical Definition of Random Process, Mean, Correlation and Covariance Functions, Power Spectral Density. Noise: Shot, Noise, Thermal Noise, White Noise, Narrowband Noise, Representation of Narrowband Noise in terms of In-Phase and Quadrature Components. Sine Wave Plus Narrowband Noise (Signal to Noise Ratios: Basic Definitions, Noise in AM Receivers using Envelope Detection and Noise in FM Receivers **(1.2, 1.4 and 1.7, 1.9, 1.10, 1.11, 1.13, 2.10, 2.12 and 2.13 in Text 2)** **Self-learning Topics:** Noise in FM Reception, Maximization of Output Signal to Noise Ratio.	
Module-5	**8 Hours**
DIGITAL CODING OF ANALOG WAVEFORMS Introduction, Why Digitize Analog Sources, Digital Pulse Modulation, Pulse Code Modulation, Sampling, Sample and Hold Circuit, Pulse Amplitude Modulation, Quantization, Quantizing Noise, Coding, Digital Formats, Decoding and Regeneration Differential Pulse Code Modulation and Delta Modulation (**5.1 – 5.8 in Text 1)** **Self-learning Topics:** Time Division and Frequency Division Multiplexing.	

Course Outcomes: At the end of the course the student will be able to:	
21ECE404.1	Explain the Fundamentals of Communication System and Scope of Modulation Techniques.
21ECE404.2	Classify the Various Amplitude Modulated Schemes and Understand the Generation and Detection of the Modulated Signal.
21ECE404.3	Analyze the Need for Single Sideband and Vestigial Sideband Modulation Schemes.
21ECE404.4	Apply the Concepts of Angle Modulation for the Design of Communication Systems.
21ECE404.5	Explain the Statistical Characteristics of Noise and Evaluate the Performance of Communication System in the Presence of Noise.
21ECE404.6	Explain the Need for Digitization of Analog Signals and Analyze the Concepts of Digitization of Signals, Sampling, Quantizing and Encoding.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	An Introduction to Analog and Digital Communications	Simon Haykins	John Willey & Sons	2008
2	Communication Systems	Simon Haykins	John Willey	4th Edition 2010
Reference Books				
1	Modern Digital and Analog Communication Systems	B. P. Lathi	Oxford University Press	4th edition.
2	Principles of Communication Systems	H.Taub & D.L.Schilling	Tata McGraw Hill	2011

3	Analog and Digital Communications	T L Singal	McGraw Hill Education	2017

Web links/Video Lectures/MOOCs/papers

1. https://nptel.ac.in/courses/117105143
2. https://www.youtube.com/watch?v=-iqg05qUl0k
3. https://www.tutorialspoint.com/analog_communication/index.htm

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21ECE404.1	2	2	-	2	-	-	-	-	-	-	-	2	-	-
21ECE404.2	-	-	3	3	3	-	-	-	-	-	-	-	-	-
21ECE404.3	-	2	-	3	3	-	-	-	-	-	-	-	-	-
21ECE404.4	-	-	3	-	3	-	-	-	-	-	-	2	-	-
21ECE404.5	1	2	-	-	-	-	-	-	-	-	-	-	-	-
21ECE404.6	2	1	-	-	-	-	-	-	-	-	-	2	-	-

1: Low 2: Medium 3: High

ANALOG COMMUNICATION ENGINEERING LAB			
Course Code	**21ECL405**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	03

Course Learning Objectives:

The students will be able to

1. Design the Various Forms of Amplitude Modulation and Demodulation Circuits and Analyze the Output Waveforms.
2. Design the Frequency Modulation and Demodulation Circuits and Analyze the Output Waveforms.
3. Design the PAM, PWM and PPM Modulation and Demodulation Circuits and Analyze the Waveforms.
4. Explain the Basics of Sampling and Quantization of a Signal.
5. Design and Analyze a Frequency Mixer Circuit
6. Use the Simulation Tools for Analyzing the Various Modulation and Demodulation Schemes.

Part A: HARDWARE EXPERIMENTS

1. Design an AM Modulation and Demodulation Circuit, Plot the Waveforms and also Calculate the Percentage Modulation Index for Different Input Levels.
2. Demonstrate the DSBSC Waveforms Using the Balanced Modulator and Plot the Waveforms.
3. Design a Circuit to Generate and Detect the FM and Plot the Waveforms. Calculate its Free Running Frequency.
4. Study the Behavior of a Class C Tuned Amplifier. Plot the Response and Calculate its Resonant Frequency, Bandwidth and Quality Factor.
5. Design Pulse Amplitude Modulation and Demodulation Circuits. Plot the waveforms.
6. Design a Pulse Width Modulation and Demodulation Circuit. Measure the Maximum and Minimum Pulse Width. Plot the Waveforms.
7. Design a Pulse Position Modulation Circuit and Plot the Waveforms.
8. Design a Frequency Mixer Circuit and Observe its Characteristics.

Part B: SIMULATION EXPERIMENTS

1. Write a MATLAB Code to Generate DSBSC Wave and Analyze the Same for Various Amplitude Levels of the Information Signal.
2. Write a MATLAB Code to Generate VSB-SC Wave and Analyze the Waveforms.
3. Simulate the Frequency Modulated and Demodulated Waves Using Simulink.
4. Design a Circuit to Simulate Phase Modulated and Demodulated Waves Using Simulink.

Course Outcomes: At the end of the course the student will be able to:	
21ECL405.1	Design and Analyze Various Modulation and Demodulation Schemes.
21ECL405.2	Design a Class C Tuned Amplifier and Estimate the Bandwidth and Quality Factor.
21ECL405.3	Demonstrate the Concept of Digitization of Analog Signals.
21ECL405.4	Analyze the Design of PPM and PAM Modulation and Demodulation Schemes.
21ECL405.5	Simulate the Various Forms of Modulation and Demodulation Schemes Using MATLAB.
21ECL405.6	Design a Circuit for Mixing of Two Signals Using BJT/FET.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Communication Systems	Simon Haykins & Moher	John Willey, India Pvt. Ltd	5th Edition,2010
Reference Books				
1	Principles of Communications	Herbert Taub & D.L.Schilling	TMH	3rd Edition, 2008

Web links/Video Lectures/MOOCs

1. https://nptel.ac.in/courses/117105143
2. https://www.youtube.com/watch?v=-iqg05qUl0k

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO 2
21ECL405.1	2	-	-	3	-	-	-	-	-	-	-	2	-	3
21ECL405.2	2	2	-	3	-	-	-	-	-	-	-	-	-	-
21ECL405.3	2	-	-	3	-	-	-	-	-	-	-	-	-	-
21ECL405.4	2	-	-	3	-	-	-	-	-	-	-	-	-	-
21ECL405.5	2	-	-	3	3	-	-	-	-	-	-	-	-	-
21ECL405.6	2	-	-	3	-	-	-	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

COMPUTATIONAL TOOLS FOR ENGINEERS			
Course Code:	**21CTE408**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	01	Exam Hours	03

Course Learning Objectives:

1. Apply modeling and simulation tools for a wide range of engineering problems.
2. Understand the analysis of data in Excel with statistics.
3. Use MATLAB and Simulink to perform engineering system analysis.

The engineering design process heavily relies on modeling and simulation. Modern simulation techniques enable the development of multi-physical, holistic system models that account for all system interactions. These digital models speed up the design and testing processes, saving time and money.

Module 1 **6** Hours

Engineering Design Analysis

Need for engineering design analysis. Product and system design. Introduction to analysis parameters – stress, deformation, acceleration, internal force and stability. Static structural analysis of engineering design using finite element method (case studies). Heat transfer and fluid dynamics modeling and simulation using CFD software (case studies).

Module 2 **4** Hours

Data Analysis with EXCEL

Calculate Mean, Median, Mode, Minimum, Maximum, Quartiles, Variance and Standard Deviation from some numbers. Analyze a population using data samples. Group data, build XY charts, apply Logarithmic Scale and Trend Line on a chart, forecast from some data, and calculate running averages. Normal Distribution, Exponential Distribution, Uniform Probabilities, Binomial Distribution, and Poisson Distribution.

Module 3 **6** Hours

MATLAB and Simulink for Engineers

Applications of MATLAB and Simulink in electrical engineering, electrical machines and power system projects, simulation of rectifiers, inverters, choppers, and cycloconverters

Course Project

Solve complex engineering problems via modeling and simulation. The project work is teamwork of 3-5 students. The goals should be clearly defined, use any software tool, and rigorous validation of the mathematical model should be done (experimental or theoretical).

Course Outcomes: At the end of the course, the student will be able to:	
21CTE408.1	Apply the Finite Element Method to solve engineering problems
21CTE408.2	Solve statistical problems using Excel
21CTE408.3	Perform system-level analysis using MATLAB and Simulink
21CTE408.4	Build mathematical models for any given engineering problem.
21CTE408.5	Demonstrate teamwork and communication skills

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Reference Books				
1	MATLAB and Simulink for Engineers	Agam Kumar Tyagi	Oxford University Press,	2012
2	Practical Finite Element Analysis	Nitin S.Gokhale	Finite To Infinite	2020
3	Excel Crash Course for Engineers	Eklas Hossain	Springer	2021

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
21CTE408.1	1				1	1								
21CTE408.2		1			2				2					
21CTE408.3		1			2									
21CTE408.4					2	2								
21CTE408.5	1								2					
21CTE408.6														

1: Low 2: Medium 3: High

Industry Oriented Training - Computing Skills			
Course Code	**21IOT409**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	02

Course Learning Objectives:

1. Use logical conditions for problem-solving and also introduce the concepts of arrays
2. Know functions, function calls, and parameter passing
3. Introduce algorithms and appreciate their importance in problem-solving
4. Introduce the core concepts of OOPs
5. Differentiate between front-end & back-end development and recognize the use of database management.

Module-1 Introduction to computing constructs

Logical conditions: For Loops, Nested For Loops, While Loops, Do-While Loops, Nesting and Boxes, and combine/negate several logical conditions using logic operations AND, OR, and NOT.

Arrays & strings: Create arrays of characters (strings), use the null terminator, and manipulate strings

4 Hours

Module-2 Functions & Pointers

Introduction to Functions, Returning Data From a Function, Passing Data Into a Function, Getting Valid User Input, Changing Parameter Values, Pointer Basics, Changing the Pointed to Value, Walking an Array with Pointers, Dynamic Memory Allocation, Getting More Memory, Pointers to Structure

4 Hours

Module-3 Algorithm analysis

Introduction to Algorithm Analysis, Big-O, Big-O Examples, Dynamic Array Operations, Bubble Sort, Selection Sort, Insertion Sort, Recursion, Recursive Binary Search, Merge Sort

4 Hours

Module-4 Object-oriented programming

Designing for Object-Oriented Programming, Core Concepts of OO Programming: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm.

4 Hours

Module-5 Frontend and backend development

UI, Database management: DBMS overview, Relational Data Model and the CREATE TABLE Statement, Basic Query Formulation with SQL

4 Hours

Course Outcomes:

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

21IOT409.1	Illustrate the use of logical conditions, declare and manipulate data into arrays
21IOT409.2	Implement functions, function calls, and parameter passing
21IOT409.3	Design, implement, and evaluate an algorithm to meet desired needs
21IOT409.4	Describe the core concepts of OOP's
21IOT409.5	Recognize the concepts of front-end development

21IOT409.6	Use the concepts of database management

Sources

1. Computational Thinking with Beginning C Programming Specialization: https://www.coursera.org/learn/simulation-algorithm-analysis-pointers?specialization=computational-thinking-c-programming#syllabus
2. Simulation, Algorithm Analysis, and Pointers: https://www.coursera.org/lecture/simulation-algorithm-analysis-pointers/big-o-examples-pdCan
3. Programming Fundamentals: https://www.coursera.org/learn/programming-fundamentals?specialization=c-programming#syllabus
4. Object-Oriented Programming Concepts: https://www.coursera.org/learn/concepts-of-object-oriented-programming#syllabus
5. Introduction to Back-End Development: https://www.coursera.org/learn/introduction-to-back-end-development

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
21IOT409.1	2	1	1											
21IOT409.2	2	1	1											
21IOT409.3	1	1	2											
21IOT409.4	2		1											
21IOT409.5	2	1	1											
21IOT409.6	2	1	1											

1: Low 2: Medium 3: High

ADDITIONAL MATHEMATICS - II

(A Bridge course for Lateral Entry students BE programmes)

(Common to all Programmes)

Course Code	**21MAL401**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	50
Credits	**00**	Exam Hours	03

Course Learning Objectives:

1. To familiarize the techniques of differential equations, vector analysis and linear algebra to engineering students.
2. To equip the students with standard concepts and tools that will help them in solving problems in their discipline of engineering.

Module-1 **8 Hours**

Partial Differentiation: Partial derivatives, Problems on Euler's theorem. Total derivative
Partial differential equations: Introduction, Formation of PDE, Solution of PDE by direct integration method.

Module-2 **8 Hours**

First order ordinary differential equations: Introduction**,** Variable Separable, Homogeneous, Linear Exact and reducible to exact, Bernoulli's equations, Orthogonal Trajectories in polar form.

Module-3 **8 Hours**

Linear Ordinary Differential Equations of Higher Order: Standard form of higher order linear differential equation with constant coefficients, Concept of different types of solutions. Solution of homogeneous equations. Non homogeneous equations- Concept of Inverse differential operator
(P.I restricted to R(x) = $e^{ax}, sinax\ or\ cosax\ for\ f(D)y = R(x)$.)

Module-4 **8 Hours**

Vector differentiation: Vector functions of a single variable, derivative of a vector function, velocity and acceleration, unit tangent. Scalar and vector functions, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector

Module-5 **8 Hours**

Numerical Methods: Finite differences. Interpolation using Newton‟s forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae, Numerical integration: Simpson‟s one third rule and three eighth rule (without proof) Problems.

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

21MAL401.1	Apply Euler's theorem for partial differentiation
21MAL401.2	Compare different methods of forming partial differential equations
21MAL401.3	Classify the given first order differential equations
21MAL401.4	Solve higher order differential equations
21MAL401.5	Differentiate between solenoidal and irrotational vectors.

21MAL401.6	Find root of a transcendental equation

Question paper pattern:
Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	Dr B.S. Grewal	Khanna Publishers	44th Edition, 2017
3	Higher Engineering Mathematics	H.K Dass and R Verma	C. Chand and Company	First Edition 2011
Reference Books				
1	Advanced Engineering Mathematics – Volume I	E. Kreyszig John Wiley & Sons	Wiley Precise Textbook Series	10th Edition 2015
2	Advanced Engineering Mathematics – Volume II	E. Kreyszig John Wiley & Sons	Wiley Precise Textbook Series	First Edition, 2014
3	"Higher Engineering Mathematics"	B.V.Ramana	Tata McGraw-Hill,	First Edition 2017

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAL401.1		3	1									
21MAL401.2		3	1									
21MAL401.3	3	1										
21MAL401.4	3		1									
21MAL401.5		3	1									
21MAL401.6		3	1									

1: Low 2: Medium 3: High

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