

Department of Electronics and Communication Engineering

Academic Year 2023-24



**3rd and 4th Semester
Scheme and Syllabus**

BATCH: 2022-26

CREDITS: 160

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NEW HORIZON COLLEGE OF ENGINEERING INSTITUTION

Vision

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

Mission

- To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.
- To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
- To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

Quality Policy

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level.

Values

- | | |
|--------------------|-------------------------|
| ❖ Academic Freedom | ❖ Professionalism |
| ❖ Innovation | ❖ Inclusiveness |
| ❖ Integrity | ❖ Social Responsibility |

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

To create high quality engineering professionals who can serve the society and earn global recognition.

MISSION

- To build strong foundation in Electronics and Communication Engineering aspects by exposing students to state of the art technology and research.
- To strengthen the curriculum through interaction with industry experts to equip the students with the required competency.
- To mould students to share technical knowledge and to practice professional and moral values.

Program Education objectives (PEOs)

PEO1	To produce graduates with understanding of fundamentals and applications of Electronics and Communication Engineering.
PEO2	To hone graduates with ability to apply, analyze, design and develop electronic systems.
PEO3	To enhance graduates with latest technologies to enable them to engineer products for real world problems in Electronics and Communication.
PEO4	To build leadership qualities, management skills, communication skills, moral values, team spirit and lifelong learning ability for the graduates.

PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3	PEO4
To build strong foundation in Electronics and Communication Engineering aspects by exposing students to state of the art technology and research.	3	3	3	2
To strengthen the curriculum through interaction with industry experts to equip the students with the required competency.	2	3	3	2
To mould students to share technical knowledge and to practice professional and moral values.	1	2	2	3

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

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1	Engineering knowledge	PO1: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems in Electronics and Communication Engineering.
2	Problem analysis	PO2: Identify, formulate, review research literature, and analyze complex engineering problems in Electronics and Communication Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions	PO3: Design solutions for complex engineering problems and design system components or processes of Electronics and Communication Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems	PO4: Use research-based knowledge and research methods including design of experiments in Electronics and Communication Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	Modern tool usage	PO5: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Electronics and Communication Engineering with an understanding of the limitations.
6	The engineer and society	PO6: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice in Electronics and Communication Engineering.
7	Environment and sustainability	PO7: Understand the impact of the professional engineering solutions of Electronics and Communication Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	Ethics	PO8: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and team work	PO9: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10	Communication	PO10: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11	Project management and finance	PO11: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	Life-long learning	PO12: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

PSO1	To demonstrate the ability to design and develop complex systems in the areas of next generation Communication Systems, IoT based Embedded Systems, Advanced Signal and Image Processing, latest Semiconductor technologies, RF and Power Systems.
PSO2	To demonstrate the ability to solve complex Electronics and Communication Engineering problems using latest hardware and software tools along with analytical skills to contribute to useful, frugal and eco-friendly solutions.

Mapping of PEOs to POs & PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	2	2	2	1	1	1	1	1	1	1	1	1
PEO2	3	3	3	3	3	2	2	2	2	2	2	2	3	2
PEO3	3	3	3	3	3	3	3	2	2	2	2	2	3	3
PEO4	1	1	1	1	1	2	2	3	3	3	3	3	1	1

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

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

III Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	BSC	22MAE31	Numerical Methods and Transforms	BS	3	0	0	0	3	3	50	50	100
2	PCC	22ECE32	Analog Electronic Circuits	EC	3	0	0	0	3	3	50	50	100
3	PCCL	22ECL32	Analog Electronic Circuits Lab	EC	0	0	1	0	1	2	50	50	100
4	PCC	22ECE33	Digital Electronic Circuits	EC	3	0	0	0	3	3	50	50	100
5	PCCL	22ECL33	Digital Electronic Circuits Lab	EC	0	0	1	0	1	2	50	50	100
6	ESC	22ECE34X	Engineering Science Course	EC	3	0	0	0	3	3	50	50	100
7	AEC	22ECE35X	Ability Enhancement Course - III	EC	0	0	1	0	1	2	50	50	100
8	BSC	22BIK36	Bio-inspired Design and Innovation	EC	3	0	0	0	3	3	50	50	100
9	UHV	22UHK37	Universal Human Values and Life Skills	LS	1	0	0	0	1	2	50	50	100
10	NCMC	22NSS30	National Service Scheme	NSS coordinator	0	0	0	0	0	2	50	--	50
		22PED30	Physical Education	Physical Education Director									
		22YOG30	Yoga	Yoga Teacher									
Total									19	25	500	450	950

11	NCMC	22DMAT31*	Basic Applied Mathematics-I	BS	0	0	0	0	0	2	50	--	50
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BSC: Basic Science Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC:** Ability Enhancement Course, **L:** Lecture, **T:** Tutorial, **P:** Practical **S:** SDA: Self Study for Skill Development, **K:** This letter in

the course code indicates common to all the stream of engineering. **ESC**: Engineering Science Course, **ETC**: Emerging Technology Course, **PLC**: Programming Language Course, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation.

22DMAT31*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Engineering Science Course (ESC)			
22ECE341	Circuit Design and Analysis	22ECE343	Linear Integrated Circuits
22ECE342	Signals and Systems	22ECE344	Control Systems

Ability Enhancement Course – III			
22ECE351	Electronics Design using Proteus	22ECE353	Embedded Design using MP Lab
22ECE352	PCB Design using OrCAD	22ECE354	System Design using Altium

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

<p>Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit</p>	<p>03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions</p>
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NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations for 2022- 2026 BATCH (2022 Scheme)

IV Semester													
S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	BSC	22MAE41	Numerical, Complex Analysis and Probability Theory	BS	3	0	0	0	3	3	50	50	100
2	PCC	22ECE42	System Design using HDL	EC	3	0	0	0	3	3	50	50	100
3	PCCL	22ECL42	Hardware Description Language Lab	EC	0	0	1	0	1	2	50	50	100
4	PCC	22ECE43	Digital Signal Processing	EC	3	0	0	0	3	3	50	50	100
5	PCCL	22ECL43	Digital Signal Processing Lab	EC	0	0	1	0	1	2	50	50	100
6	PCC	22ECE44	Microprocessors & Interfacing	EC	3	0	0	0	3	3	50	50	100
7	PCCL	22ECL44	Microprocessors Lab	EC	0	0	1	0	1	2	50	50	100
8	PLC	22ECE45X	Programing Language Course	EC	2	0	1	0	3	4	50	50	100
9	AEC	22ECE46X	Ability Enhancement Course – IV	EC	0	0	1	0	1	2	50	50	100
10	UHV	22SCK47	Social Connect and Responsibility	EC	0	0	1	0	1	2	50	--	50
11	PROJ	22ECE48	Mini Project	EC	0	0	1	0	1	2	50	50	100
12	NCMC	22NSS40	National Service Scheme	NSS Coordinator	0	0	0	0	0	2	50	--	50
		22PED40	Physical Education	Physical Education Director									
		22YOG40	Yoga	Yoga Teacher									
Total									21	30	600	500	1100
13	NCMC	22DMAT41*	Basic Applied Mathematics-II	BS	0	0	0	0	0	2	50	--	50

BSC: Basic Science Course, **PCC:** Professional Core Course, **PCCL:** Professional Core Course laboratory, **UHV:** Universal Human Value Course, **NCMC:** Non-Credit Mandatory Course, **AEC:** Ability Enhancement Course, **PROJ:** Mini Project work, **L:** Lecture, **T:** Tutorial, **P:** Practical **S:** SDA: Self Study for Skill Development, **K:** This letter in the course code indicates common to all the stream of engineering. **ESC:** Engineering Science Course, **ETC:** Emerging Technology Course, **PLC:** Programming Language Course, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Evaluation.

22DMAT41*: This non-credit mandatory course to be offered with only CIE and no SEE to Lateral entry students.

Programming Language Course (PLC)

22ECE451	Object Oriented Programming using Java	22ECE453	Embedded Linux Programming
22ECE452	IoT Programming	22ECE454	Programming using RoboDK

Ability Enhancement Course – IV

22ECE461	Electronics Applications using Scilab	22ECE463	Virtual Instrumentation using LabVIEW
22ECE462	Embedded Designs using Atmel Studio	22ECE464	App Development using Google Flutter

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

- (i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)
- (ii) A group of 2- 4 if mini project work is single discipline (applicable to all Core Branches)
- (iii) A group of 2 - 4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project. The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), and Yoga (YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

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THIRD SEMESTER
(SYLLABUS)

NUMERICAL METHODS AND TRANSFORMS (Common to ECE, EEE, MEE)												
Course Code	22MAE31						CIE Marks				50	
L:T:P:S	3:0:0:0						SEE Marks				50	
Hrs. / Week	4						Total Marks				100	
Credits	03						Exam Hours				03	
Course outcomes:												
At the end of the course, the student will be able to:												
22MAE31.1	Use appropriate numerical methods to solve algebraic equations and transcendental equations											
22MAE31.2	Differentiate the physical problems numerically, evaluate a definite integral numerically and use appropriate numerical methods to solve boundary value problems in partial differential equations											
22MAE31.3	Justify Z-transforms method to solve continuous/discrete model problems											
22MAE31.4	Express the periodic functions as Fourier series expansion analytically and numerically											
22MAE31.5	Solve the continuous model problems using Fourier transform											
22MAE31.6	Analyze the Fast Fourier transforms method to solve the discrete model problems											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22MAE31.1	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.2	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.3	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.4	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.5	3	3	-	-	-	-	-	-	-	-	-	-
22MAE31.6	3	3	-	-	-	-	-	-	-	-	-	-
MODULE-1	NUMERICAL METHODS-1						22MAE31.1				8 Hours	
Numerical solution of algebraic and transcendental equations: Newton-Raphson Method-Problems. Interpolation: Newton's forward and backward formulae for equal intervals, Newton divided difference, Lagrange's formula and Lagrange's inverse interpolation formula for unequal intervals (without proofs)-Problems.												
Case Study	Case studies on Numerical Analysis.											
Text Book	Text Book 1: 28.2, 28.3, 29.6, 29.10, 29.12, 29.13. Text Book 3: 19.2, 19.3.											
MODULE-2	NUMERICAL METHODS-2						22MAE31.2				8 Hours	
Numerical Differentiation: Derivatives of first order and second order using Newton's forward differences and Newton's backward differences.												
Numerical integration: Trapezoidal rule and Simpson's 1/3rd rule (without proofs)-Problems.												
Applications	Application of numerical integration to velocity of a particle and volume of solids. Numerical solution of one-dimensional wave equation, heat equation and two-dimensional Laplace's equation.											
Text Book	Text Book 1: 30.2, 30.6, 30.7, 29.6, 29.10, 29.12, 29.13, Text Book 3: 19.5.											
MODULE-3	Z-TRANSFORM						22MAE31.3				8 Hours	
Definition, Z-transforms of some standard functions, properties, damping rule, shifting rule (without proof), initial and final value theorems, inverse Z- transforms by partial fractions method.												
Applications	Applications: Solving difference equations using Z-transform.											
Text Book	Text Book 1: 23.3, 23.4, 23.5, 23.6, 23.9, 23.15, 23.16. Text Book 2: 6.14.11, 6.14.12											
MODULE-4	FOURIER SERIES						22MAE31.4				8 Hours	

Periodic function, Dirichlet's conditions, Fourier series of periodic functions of period 2π and arbitrary period $2l$, half range series-Problems.				
Applications	Applications: Practical harmonic analysis-Problems.			
Text Book	Text Book 1: 10.2, 10.4, 10.5, 10.6, 10.7, 10.11, Text Book 3: 11.1			
MODULE-5	FOURIER TRANSFORMS, DISCRETE AND FAST FOURIER TRANSFORMS	22MAE31.5 22MAE31.6	8 Hours	
Fourier Transforms: Infinite Fourier transforms, Fourier Sine and Cosine transforms, Inverse Fourier sine and cosine transforms. Discrete Fourier Transform and Fast Fourier Transform: Definition of N-Point DFT, problems for 4-points and inverse DFT for four points only. FFT algorithm to compute the Fourier transforms 4-point only.				
Text Book	Text Book 1: 22.4, 22.5, Text Book 2:8.3, 8.4, 9.2, 9.3, Text Book 3: 11.9			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	-
L3	Apply	10	5	10
L4	Analyze	2.5	-	-
L5	Evaluate	2.5	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	5		
L5	Evaluate	5		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.				
2) Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, Wiley-India Publishers, Second impression, 2015, ISBN: 9780198081937.				
3) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.				
Reference Books:				
1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.				
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.				
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.				
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.				
Web links and Video Lectures (e-Resources):				
1) https://youtu.be/IgoJV4g_0LM?si=JO1_bkIvMR8xlC0V				
2) https://youtu.be/mIFwzg11uO4?si=Xd13dh0eNlmswPS				
3) https://youtu.be/74g5_3TC-tQ?si=yB2PHVGr4hxllqPo				

- 4) <https://youtu.be/QQFIWwDA9NM?si=3wJrtlm1NdPSbXmB>
- 5) <https://youtu.be/5817fLmsTGE?si=Y7ORyV2ETSCxZRAZ>
- 6) https://youtu.be/XJRW6jamUHk?si=G_UTgCM622bz9yh4
- 7) https://youtu.be/QHH50jy8s_A?si=eNUoUXYLEvEZj3KM
- 8) <https://youtu.be/m3mMeXLt2OQ?si=r9QXzwCRo0PC0ewz>
- 9) <https://youtu.be/aSu5Yde9Sfk?si=6kZbU3QRXEFEn2ua>
- 10) <https://www.youtube.com/live/tjBxcBLBe6I?si=v4RH4oqyttKhfaPd>
- 11) https://youtu.be/-Y_0FY-IDrI?si=-ERIHGln3U2dr54J
- 12) <https://youtu.be/zWRVxWdwXaw?si=Y78g7TogvDZIKhvs>
- 13) <https://youtu.be/nl9TZanwbBk?si=LdywSeCJ0EIt5zCx>
- 14) <https://youtu.be/E8HeD-MUrjY?si=JWwQzkQWfaTIqVhG>

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
 - Organizing Group wise discussions on related topics
 - Seminars

ANALOG ELECTRONIC CIRCUITS														
Course Code	22ECE32					CIE Marks						50		
L:T:P:S	3:0:0:0					SEE Marks						50		
Hrs / Week	3					Total Marks						100		
Credits	03					Exam Hours						03		
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE32.1	Compare the BJT and JFET configurations and its respective biasing methods to perform the load line analysis													
22ECE32.2	Examine the AC model of BJT and JFET to perform the small signal analysis													
22ECE32.3	Analyze the frequency response of BJT and FET amplifier circuits													
22ECE32.4	Compare the effect of feedback topologies in amplifier circuits													
22ECE32.5	Apply the positive feedback topology to the BJT circuit to obtain the frequency of different oscillator circuits													
22ECE32.6	Analyze the working principles of power amplifiers for real world applications													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE32.1	3	-	-	-	-	-	-	-	-	-	-	-	3	1
22ECE32.2	3	3	-	-	-	-	-	-	-	-	-	-	3	1
22ECE32.3	3	3	2	1	-	-	-	-	-	-	-	2	3	1
22ECE32.4	3	3	2	1	-	-	-	-	-	-	-	2	3	1
22ECE32.5	3	-	-	-	-	-	-	-	-	-	-	2	3	1
22ECE32.6	3	3	2	1	1	-	-	-	-	-	-	2	3	1
MODULE-1 BJT BIASING AND AC ANALYSIS 22ECE32.1 8 Hours														
Transistor configurations (CE, CB, CC), Need for Biasing, Load Line (AC and DC) analysis for CE configuration and Q-point, Biasing Circuits- Fixed Bias, Emitter Bias, Voltage Divider bias with their stability factors. Analysis of various bias configurations using re transistor model. Numerical Examples.														
Case-study	Investigate the problems based on various bias configurations and solve using re transistor model.													
Text Book	Text Book 1 - 4.1 to 4.5, 4.7, 4.8, 4.18 (221-223: Derived equations are excluded), 5.4 to 5.6, 5.8, 5.9 Text Book 3 - 8.9, 8.11													
MODULE-2 JFET BIASING AND AMPLIFIERS 22ECE32.2 8 Hours														
Construction and characteristics of JFET, JFET configurations (CS, CG, CD), JFET Biasing (Fixed bias, Self-bias and Voltage divider bias), JFET small signal model for CS configuration. Numerical Examples.														
Case-study	Investigate and solve the problems for various JFET small signal model for CS configuration.													
Text Book	Text Book 1 - 6.1 to 6.3, 7.1 to 7.5, 8.1 to 8.5													
MODULE-3 BJT AND JFET FREQUENCY RESPONSE 22ECE32.3 8 Hours														
Introduction (Logarithms and Decibels), Low Frequency Analysis - Bode plot, Low Frequency Response of BJT and FET amplifiers, Impact of Rs on the BJT low frequency response, Miller Effect Capacitance, High frequency response of BJT and FET amplifiers.														
Self-study	Explore the Miller's Theorem and its various applications.													
Text Book	Text Book 1 - 9.1 to 9.3, 9.6 to 9.12, 5.19, 5.20 Text Book 2:16.6.16.8.16.9													
MODULE-4 FEEDBACK AND OSCILLATOR CIRCUITS 22ECE32.4, 22ECE32.5 8 Hours														
The feedback concept, Feedback connection types, Practical Feedback Circuits, Theory of Sinusoidal Oscillation, Phase Shift Oscillator, Wien Bridge Oscillator, Tuned Oscillator Circuits (Colpitts, Hartley), and Crystal Oscillator.														

Applications	Scrutinize the different types of oscillators and their applications.			
Text Book	Text Book 1 - 14.1 to 14.9			
MODULE-5	POWER AMPLIFIERS	22ECE32.6	8 Hours	
Introduction (Amplifier Types and Efficiency), Class A amplifier (Series fed, Transformer coupled), Class B amplifier (Transformer coupled, push-pull), Class AB Complementary Symmetry, Amplifier Distortion, Power Transistor Heat Sinking, Class C and Class D amplifiers.				
Case Study	Survey on amplifier types and efficiency, design, applications and case studies of the same.			
Text Book	Text Book 1 - 12.1 to 12.8			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	10	-	5
L3	Apply	05	10	-
L4	Analyze	05	5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	20		
L3	Apply	10		
L4	Analyze	10		
L5	Evaluate	--		
L6	Create	--		
Suggested Learning Resources:				
Text Books:				
1) Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, 11th edition, Pearson Education/PHI, 2008.				
2) Electronic Principles, Albert Malvino and David Bates, 7th edition, McGraw-Hill, 2015.				
3) Electronics Devices and Circuits, Millman J and Halkias C, 3rd edition, 2007, TMH.				
Reference Books:				
1) Electric Circuits, (Schaum's Outline Series) by M Nahvi, Joseph Edminister, K Rao, 5th edition, McGraw-Hill Education.				
Web links and Video Lectures (e-Resources):				
<ul style="list-style-type: none"> • https://archive.nptel.ac.in/courses/108/102/108102095/ • https://pages.uoregon.edu/rayfrey/AnalogNotes.pdf • https://youtu.be/pkIxCmaxWFg • https://www.youtube.com/watch?v=kWZVKszReLs • http://rfic.eecs.berkeley.edu/~niknejad/ee142_fa05lects/pdf/lect26.pdf 				
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning				
<ul style="list-style-type: none"> • Visit to any electronics/VLSI industry • Demonstration of bode plot for frequency response of BJT and FET • Video demonstration of latest trends in transistors • Contents related activities (Activity-based discussions) <ul style="list-style-type: none"> ➤ Organizing Group wise discussions on issues 				

ANALOG ELECTRONIC CIRCUITS LAB															
Course Code	22ECL32										CIE Marks	50			
L:T:P:S	0:0:1:0										SEE Marks	50			
Hrs / Week	2										Total Marks	100			
Credits	01										Exam Hours	03			
Course outcomes:															
At the end of the course, the student will be able to:															
22ECL32.1	Apply the knowledge of network theorems and device models to demonstrate the given analog electronic circuit														
22ECL32.2	Model the applications of diode, BJT and FET circuits using discrete components and simulation tools														
22ECL32.3	Construct analog circuits for the given design specification using suitable analog electronic components														
22ECL32.4	Evaluate the performance of advanced analog circuit configurations														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECL32.1	3	-	-	-	2	-	-	-	-	-	-	1	3	3	
22ECL32.2	3	2	2	1	2	-	-	-	-	-	-	1	3	3	
22ECL32.3	3	2	2	1	2	-	-	-	-	-	-	1	3	3	
22ECL32.4	3	2	2	1	2	-	-	-	-	-	-	1	3	3	
Exp. No. / Pgm. No.	List of Experiments											Hours	COs		
Prerequisite Experiments															
	<ul style="list-style-type: none"> • Knowledge of PN junction Diode • Basics of BJT and its applications 											2	NA		
PART-A															
1	To design and test single ended and double ended Clippers circuits, plot the input, output waveforms and Transfer characteristics											2	22ECL32.1 22ECL32.2		
2	To design and test Clamper circuits, plot the input and output waveforms.											2	22ECL32.1 22ECL32.2		
3	To design and test the Integrators and Differentiators circuit. Plot the input and output waveforms.											2	22ECL32.1 22ECL32.2		
4	To Construct & test the Audio Amplifier.											2	22ECL32.1 22ECL32.2		
5	To design and test the RC coupled BJT Amplifier.											2	22ECL32.2 22ECL32.3		
6	To design and test differential Amplifier using BJT.											2	22ECL32.2 22ECL32.3		
PART-B															
7	To design and set-up the following tuned oscillator circuits using BJT, and determine the frequency of oscillation. (a) Hartley Oscillator (b) Colpitts Oscillator											2	22ECL32.2 22ECL32.3		
8	Simulation of RC phase shift oscillator for the given frequency.											2	22ECL32.2 22ECL32.3		
9	Simulation of Common Source Amplifier using PSPICE.											2	22ECL32.2 22ECL32.3		

10	Simulation of current-series and voltage shunt feedback amplifier and to calculate the following parameters with and without feedback. 1. Mid band gain. 2. Bandwidth and cut-off frequencies. 3. Input and output impedance	2	22ECL32.2 22ECL32.4
11	Simulation of Darlington emitter follower circuit to calculate the Bandwidth.	2	22ECL32.2 22ECL32.4
12	Simulation of push pull amplifier & observe the crossover distortion.	2	22ECL32.2 22ECL32.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. Familiarisation with Oscilloscope and Function Generator
<http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp1/index.html>
2. Active Filter
<http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp2/index.html>
3. Monostable Multivibrator using IC 555
<http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp3/index.html>
4. Astable Multivibrator using IC 555
<http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp4/index.html>
5. Schmitt Trigger
<http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp5/index.html>
6. Frequency Response of CS Amplifier
<http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAE/exp6/index.html>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	5
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Electronic Devices and Circuit Theory - Robert L. Boylestad and Louis Nashelsky - 10th edition (Pearson Education), 2009.
2. Microelectronic Circuits - Theory and applications by Adel S. Sedra and Kenneth C. Smith 5th Edition (Oxford International Student Edition), 2012.

DIGITAL ELECTRONIC CIRCUITS															
Course Code	22ECE33										CIE Marks	50			
L:T:P:S	3:0:0:0										SEE Marks	50			
Hrs / Week	3										Total Marks	100			
Credits	03										Exam Hours	03			
Course outcomes:															
At the end of the course, the student will be able to:															
22ECE33.1	Apply the fundamental concepts of Digital logic to implement the functions using logic gates														
22ECE33.2	Make use of standard methods to simplify the Boolean expressions														
22ECE33.3	Employ the simplification methods for designing combinational logic circuits														
22ECE33.4	Demonstrate the design of general sequential logic circuits														
22ECE33.5	Design the circuits of standard Registers and Counters using flip flops														
22ECE33.6	Examine the significance of state machines in Digital system design														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECE33.1	3	-	-	-	-	-	-	-	-	-	-	3	3	1	
22ECE33.2	3	3	-	-	-	-	-	-	-	-	-	3	3	1	
22ECE33.3	3	3	3	-	-	-	-	-	-	-	-	3	3	1	
22ECE33.4	3	3	3	3	-	-	-	-	-	-	-	3	3	1	
22ECE33.5	3	3	3	3	-	-	-	-	-	-	-	3	3	1	
22ECE33.6	3	3	3	3	-	-	-	-	-	-	-	3	3	1	
MODULE-1 PRINCIPLES OF COMBINATIONAL LOGIC															
										22ECE33.1		22ECE33.2		8 Hours	
Binary Logic functions, pass gates & Logic Gates using n-MOS, p-MOS and CMOS, Definition of combinational logic, Canonical forms, Generation of switching equations from truth table, Karnaugh maps (3, 4 and 5 variables), Incompletely specified functions (Don't care terms), QM method, Map entered Variables (3 and 4 variables), Realizing functions using MOS Logic.															
Text Book	Text Book 1 Chapter-3														
Self-study	Discuss how digital electronics play a pivotal role in the operation of modern computers and processors, and list some key applications in this domain.														
MODULE-2 ANALYSIS AND DESIGN OF COMBINATIONAL LOGIC															
										22ECE33.3		8 Hours			
Analysis and design of combinational logic: General Approach to combinational logic, Decoders, Encoders, Priority Encoders, Digital Multiplexers, Adders and Subtractor, Cascading full adders, Look Ahead carry adder, Binary Comparators, Code Conversion, Array multiplier, MUX using Pass Gates and Inverters, realization of different logics using 2X1 Multiplexer.															
Text Book	Text Book 1, Chapter- 4														
Applications	Combinational circuits in designing digital displays, like LED matrices or LCD screens.														
MODULE-3 SEQUENTIAL CIRCUITS															
										22ECE33.4		8 Hours			
Sequential circuit models, Basic Bistable Element, Latches-SR Latch, Application of SR Latch-A Switch Debouncer, S'R' Latch, The gated SR Latch, The gated D Latch, Timing Considerations, Flip-Flops – JK Clocked Flip Flops, Clocked T Flip-flop, Clocked D Flip-flop, The Master Slave Flip-Flops, Edge Triggered Flip-Flop, Characteristic equations, D Flip Flop using CMOS Pass gates and inverters, Conversion of Flip-Flops.															
Text Book	Text Book 2 ,Chapter -6														
Self-Study	Study the concept of sequential circuit optimization. What strategies can be used to reduce the complexity and improve the efficiency of a sequential circuit?														

MODULE-4	SIMPLE FLIP-FLOP APPLICATIONS	22ECE33.5	8 Hours	
Shift Registers: PIPO, SIPO, PISO, SISO, Universal Shift register. Counter: Ripple Counters, synchronous binary counter, Counters based on Shift Registers, Design of synchronous counters- using clocked JK Flip-Flops, clocked D, T, or SR Flip-Flops, Ring counter, Johnson counter, Design of asynchronous counters – 3bit asynchronous up/down counter, decade counter, frequency divider.				
Text Book	Text Book 2, Chapter -6			
MODULE-5	SEQUENTIAL CIRCUIT DESIGN	22ECE33.6	8 Hours	
Moore and Mealy State models, state machine notations, Synchronous Sequential Circuit Analysis, Construction of state diagrams, Sequence detector Serial Ex-3 to BCD code converter, counter design, Design of ALU, Applications of Mealy and Moore machines – Design of ALU, Full adder.				
Text Book	Text Book 1, Chapter-6			
CIE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	10	-
L4	Analyze	5	5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	--		
Suggested Learning Resources:				
Text Books:				
1. Digital Logic: Applications and Design, John M. Yarbrough, Cengage Learning,2015 reprint. Digital Principles and Design, Donald D. Givone, 2003, Tata McGraw Hill Edition2002.				
Reference Books:				
1. Digital Fundamentals, Thomas Floyd, 11thedition,2014, Pearson Education. 2. Digital Logic and Computer Design: M. Morris Mano, Pearson Education. 3. An Illustrative Approach to Logic Design, R.D. Sudhakar Samuel, 2010, Pearson Education.				
Web links and Video Lectures (e-Resources):				
<ul style="list-style-type: none"> • https://www.electronicsforu.com/technology-trends/learn-electronics/digital-electronics-basics • https://onlinecourses.nptel.ac.in/noc20_ee32/preview 				
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning				
<ul style="list-style-type: none"> • Contents related activities (Activity-based discussions) <ul style="list-style-type: none"> ➤ For active participation of students, instruct the students to prepare Flowcharts and Handouts ➤ Organizing Group wise discussions on issues ➤ Seminars 				

DIGITAL ELECTRONIC CIRCUITS LAB														
Course Code	22ECL33				CIE Marks				50					
L:T:P:S	0:0:1:0				SEE Marks				50					
Hrs / Week	2				Total Marks				100					
Credits	01				Exam Hours				03					
Course outcomes:														
At the end of the course, the student will be able to:														
22ECL33.1	Perform the truth table of various expressions and combinational circuits using logic gates													
22ECL33.2	Analyze digital combinational circuits and sequential logic circuit													
22ECL33.3	Design digital combinational circuits and sequential logic circuit													
22ECL33.4	Demonstrate various types of Shift registers, up/down counters, Mealy and Moore model													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECL33.1	3	-	-	-	2	-	-	-	-	-	-	2	3	2
22ECL33.2	3	2	2	-	2	-	-	-	-	-	-	2	3	2
22ECL33.3	3	2	2	-	2	-	-	-	-	-	-	2	3	2
22ECL33.4	3	2	2	-	2	-	-	-	-	-	-	2	3	2
Exp. No.														
List of Experiments														
Hours														
Cos														
Prerequisite Experiments														
	<ul style="list-style-type: none"> Digital logic gates Boolean algebra - basic theoretical background is required. 											2	NA	
PART-A														
1	Simplification of Boolean expressions using K-map and realization of simplified expressions using basic and universal gates.											2	22ECL33.1	
2	Realization of Half/Full adder and Half/Full Subtractor using Logic gates.											2	22ECL33.1 22ECL33.2	
3	a) Realization of parallel adder/ Subtractors using 7483 chip b) BCD to Excess-3 code conversion and vice versa.											2	22ECL33.1 22ECL33.2	
4	Realization of Binary to Gray code conversion and vice versa.											2	22ECL33.1 22ECL33.2	
5	MUX/DEMUX—use of 74153, 74139 for arithmetic circuits and code Converter.											2	22ECL33.1 22ECL33.2	
6	Realization of One/Two bit comparator and study of 7485 Magnitude comparator.											2	22ECL33.1 22ECL33.2	
PART-B														
7	a) Use of Decoder chip to drive LED display b) Verifying the functionality of Priority encoder											2	22ECL33.1 22ECL33.2	
8	Truth table verification of Flip-Flops: a) JK Master slave b) T type c) D type											2	22ECL33.2 22ECL33.3	
9	Shift left; Shift right, SIPO, SISO, PISO, PIPO operations using 74S95.											2	22ECL33.2 22ECL33.3 22ECL33.4	
10	Realization of Johnson and Ring counter.											2	22ECL33.2	

			22ECL33.3 22ECL33.4
11	Realization of synchronous and asynchronous counters.	2	22ECL33.2 22ECL33.3 22ECL33.4
12	Design and implementation of synchronous or clocked sequential circuits using Mealy and Moore model.	2	22ECL33.3 22ECL33.4

PART-C
Beyond Syllabus Virtual Lab Content

1. Interpretation of truth table for AND,OR,NOT,NAND,NOR,Ex-OR,Ex-NOR gates
<https://de-iitr.vlabs.ac.in/exp/truth-table-gates/>
2. Seat belt warning system using basic AND and NOT gates
<https://da-iitb.vlabs.ac.in/exp/seat-belt-warning-system/>
3. Universal NOR gate and its application in automobile alarm system
<https://da-iitb.vlabs.ac.in/exp/automobile-alarm-system/>
4. Half and Full subtractor
<https://de-iitr.vlabs.ac.in/exp/half-full-subtractor/>
5. DIY Build your own combinational logic circuit using generalized simulator
<https://da-iitb.vlabs.ac.in/exp/generalized-simulator/>
6. Shift Register
<https://he-coep.vlabs.ac.in/exp/shift-registers/simulation.html>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Digital Fundamentals, Thomas Floyd, 11th edition, 2014, Pearson Education.
2. An Illustrative Approach to Logic Design, R. D. Sudhakar Samuel, 2010, Pearson Education.

CIRCUIT DESIGN AND ANALYSIS															
Course Code	22ECE341								CIE Marks	50					
L:T:P:S	3:0:0:0								SEE Marks	50					
Hrs / Week	3								Total Marks	100					
Credits	03								Exam Hours	03					
Course outcomes:															
At the end of the course, the student will be able to:															
22ECE341.1	Apply the concepts of basic laws and network theorems to solve the given electrical Circuits														
22ECE341.2	Examine current and voltages for the given circuit under transient conditions														
22ECE341.3	Evaluate two-port parameters for the given electrical network and waveform synthesis														
22ECE341.4	Analyze the operational amplifier and its characteristics														
22ECE341.5	Design the solution for linear and non-linear analog circuits using operational amplifiers														
22ECE341.6	Examine the operation of Filters using operational amplifiers														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECE341.1	3	-	-	-	-	-	-	-	-	-	-	1	2	1	
22ECE341.2	3	3	2	-	-	-	-	-	-	-	-	1	2	1	
22ECE341.3	3	3	-	-	-	-	-	-	-	-	-	1	2	1	
22ECE341.4	3	3	-	-	-	-	-	-	-	-	-	1	2	1	
21ECE541.5	3	3	2	-	-	-	-	-	-	-	-	1	2	1	
22ECE341.6	3	3	2	-	-	-	-	-	-	-	-	1	2	1	
MODULE-1 FUNDAMENTALS OF CIRCUIT ANALYSIS 22ECE341.1 8 Hours															
Basic Circuit Analysis: Introduction to Basic laws, Wye-Delta Transformation, Nodal Analysis and Mesh Analysis Using Independent sources, Nodal and Mesh Analysis by inspection, Super Mesh and Super Node Concepts.															
Self- Study	Circuit Analysis using Super mesh and Super Node concept														
Text Book	Text book 1 : Chapter 2, 3														
MODULE-2 CIRCUIT THEOREMS AND TRANSIENT RESPONSE 22ECE341.1, 22ECE341.2 8 Hours															
Circuit Theorem- Superposition theorem, Thevenin's theorem, Norton's Theorem, Maximum Power transfer Theorem.															
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for DC excitations.															
Application	Reciprocity Theorem and its Applications														
Text Book	Text book 1 : Chapter 4, 16.1, 16.2, 16.3														
MODULE-3 TWO-PORT NETWORKS AND TRANSFORM FUNCTIONS 22ECE341.3 8 Hours															
Two-port networks: Characterization of two port networks, Z, Y, ABCD and h parameters, Reciprocity and symmetry. Inter-relationships between the parameters.															
Laplace Transformation & Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis.															
Self-Study	Initial and Final Value Theorem														
Text Book	Text Book 1: 19.1,19.2,19.3,19.4,19.5, 19.6, Text Book 2: 8.1, 8.2, 8.3														
MODULE-4 INTRODUCTION TO OPERATIONAL AMPLIFIER 22ECE341.4 8 Hours															
Op-Amp Fundamentals: Basic Op-Amp characteristics and parameters.															
Op-Amps as DC Amplifiers: Direct coupled (DC) Voltage Followers, DC-Non-inverting Amplifiers, DC-Inverting amplifiers, Summing amplifiers, Difference amplifier, Instrumentation amplifier.															
Self-Study	Op-Amps as Precision Rectifier														

Text Book	Text Book 3: 2, 3.2,3.3,3.4,3.6,3.7,3.8			
MODULE-5	OP-AMP APPLICATIONS AND FILTERS	22ECE341.5 22ECE341.6	8 Hours	
OP-Amp Applications: Voltage sources, current sources, Log and antilog amplifiers, Integrator and differentiator Filters: Filter Types and characteristics, First Order Active Filters.				
Self- Study	Timers and its applications using op-amp			
Text Book	Text Book 3: 7.1, 7.2, 7.6, 8.6, 8.7, 12.1, 12.2			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	10	-
L4	Analyze	5	5	
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1. Fundamentals of Electric Circuits, Charles K. Alexander and Matthew N. O. Sadiku, 6th Edition, McGraw Hill Education, 2019.				
2. M.E. Van Valkenberg (2000), –Network analysis, Prentice Hall of India, 3rd edition, 2000, ISBN: 9780136110958.				
3. Operational Amplifiers and Linear IC's, David A. Bell, 3rd edition, 2011, Oxford University Press.				
Reference Books:				
1. Network Theory, K Channa Venkatesh, D Ganesh Rao, Pearson Education Limited, 2010.				
2. Linear Integrated Circuits, D. Roy Choudhary and Shail B. Jain, 4th edition, 2015, New Age International.				
3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th edition, 2015, Pearson.				
Web links and Video Lectures (e-Resources):				
<ul style="list-style-type: none"> • https://onlinecourses.nptel.ac.in/noc23_ee81/preview • https://onlinecourses.nptel.ac.in/noc23_ee65/preview 				
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning				
<ul style="list-style-type: none"> • Problem solving in Network Analysis using PSPICE. • Video demonstration of solving Network Theorem. • Assign pre-recorded video lectures or readings for students to review before class, freeing up class time for interactive discussions, problem-solving, and hands-on activities. 				
Contents related activities (Activity-based discussions)				
➤ Seminars demonstrating theorems and Op-Amps based Circuit Design and applications using Breadboard.				

SIGNALS & SYSTEMS														
Course Code	22ECE342								CIE Marks			50		
L:T:P:S	3:0:0:0								SEE Marks			50		
Hrs / Week	3								Total Marks			100		
Credits	03								Exam Hours			03		
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE342.1	Classify the continuous time and discrete time signals and systems													
22ECE342.2	Apply the basic operations on signals to perform dependent and independent variable transformation													
22ECE342.3	Compute the response of an LTI system using Convolution operator													
22ECE342.4	Solve the system response from differential and difference equations													
22ECE342.5	Analyze the discrete time system in Z-domain													
22ECE342.6	Make use of Fourier Transform tool to represent a signal in frequency domain													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE342.1	3	3	-	-	-	-	-	-	-	-	-	2	3	2
22ECE342.2	3	-	-	-	-	-	-	-	-	-	-	2	3	2
22ECE342.3	3	3	2	-	-	-	-	-	-	-	-	2	3	2
22ECE342.4	3	3	2	-	-	-	-	-	-	-	-	2	3	2
22ECE342.5	3	3	-	-	-	-	-	-	-	-	-	2	3	2
22ECE342.6	3	-	-	-	-	-	-	-	-	-	-	2	3	2
MODULE-1	CLASSIFICATION OF SIGNALS								22ECE342.1, 22ECE342.2			8 Hours		
Continuous time and Discrete time signals, Periodic and Aperiodic signals, Even and odd signals, Energy and power signals, Deterministic and random signals. ELEMENTARY SIGNALS / FUNCTIONS: Unit step, Unit ramp, Unit impulse, Complex exponential, and Sinusoidal signals. BASIC OPERATION ON SIGNALS: Amplitude scaling, addition, multiplication, time scaling, time shift and time reversal.														
Applications		Signal Processing: Bio-Signal Representation												
Text Book		Text Book 1: 1.1, 1.2, 1.3, 1.4												
MODULE-2	CLASSIFICATION OF SYSTEMS AND LTI SYSTEM								22ECE342.1, 22ECE342.3			8 Hours		
Continuous and discrete time systems, Linear and non-linear systems, Time variant and invariant systems, causal and non-causal systems, Static system, BIBO system, LTI systems. TIME DOMAIN REPRESENTATION OF LTI SYSTEM: Convolution, Properties of convolution, Convolution Sum and Convolution Integral for infinite duration sequences.														
Applications		Signal Processing in a Digital Camera												
Text Book		Text Book 1: 1.5, 1.6, 2.1, 2.2												
MODULE-3	SYSTEM RESPONSES OF LTI SYSTEM								22ECE342.4			8 Hours		
Properties of impulse response representation, Impulse response and step response of a continuous time and discrete time LTI system. DIFFERENTIAL AND DIFFERENCE EQUATION REPRESENTATION OF LTI SYSTEM: Solution for Differential & Difference equations- Natural Response, Forced Response and Complete response.														
Applications		Analysis of discrete and continuous time LTI system												
Text Book		Text Book 1: 2.3, 2.4 Text Book 2: Chapter 2												

MODULE-4	Z-TRANSFORM AND INVERSE Z TRANSFORM	22ECE342.5	8 Hours	
Z-transforms, properties of the region of convergence, Pole Zero Plot, System Function. INVERSE Z TRANSFORM: Partial Fraction Expansion, Causality, and stability.				
Self-Study	Realization of Digital Filters			
Text Book	Text Book 1: 10.1, 10.2, 10.3, 10.5, 10.7			
MODULE-5	FOURIER TRANSFORM REPRESENTATION OF A SIGNAL	22ECE342.6	8 Hours	
Discrete and continuous Fourier transform & its properties (with Proof), Basic exercises, Fourier transform of periodic signals, Magnitude and Phase Spectrum. INTRODUCTION TO WAVELET: Definition, comparison between wavelet transform and Fourier transform.				
Applications	Image Processing, Noise Removal from ECG Signals			
Text Book	Text Book 1: 4.1, 4.2, 4.3, 4.4, 4.5, 5.1, 5.2, 5.3, 5.4, 5.5			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	10	-
L4	Analyze	5	5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1) Signals and Systems, Allen V. Oppenheim, Allen S. Willsiky, S. Hamid Nawab, PHI, 2015.				
2) Signals and Systems, Simon Haykin and Barry Van Veen, 2nd edition, John Wiley & sons, 2007.				
Reference Books:				
1) Principles of Linear Systems and Signals, B. P. Lathi, 2nd edition, Oxford University Press, 2009.				
2) Signals and Systems, Uday kumar S, 6th edition, Prism book House, 2012.				
3) Insight into Wavelets: From Theory to practice, Soman K P & Rama chandran K I, Prentice Hall, 2004.				
Web links and Video Lectures (e-Resources):				
<ul style="list-style-type: none"> • https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/ • https://archive.nptel.ac.in/courses/108/106/108106163/ • https://www.youtube.com/watch?v=2znm6o8HUsA 				
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning				
<ul style="list-style-type: none"> • Demonstration of signal processing program using python • Video demonstration of Signal Processing application 				

- Contents related activities (Activity-based discussions)
- For active participation of students, debate the advantage and limitation of different Analog signal Processing and digital Signal Processing
- Assign pre-recorded video lectures or readings for students to review before class, freeing up class time for interactive discussions, problem-solving, and hands-on activities.
- Contents related activities (Activity-based discussions)
 - Seminars

LINEAR INTEGRATED CIRCUITS														
Course Code	22ECE343					CIE Marks					50			
L:T:P:S	3:0:0:0					SEE Marks					50			
Hrs / Week	3					Total Marks					100			
Credits	03					Exam Hours					03			
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE343.1	Apply the basic concepts of the circuit configuration for the design of linear integrated circuits for solving engineering problems													
22ECE343.2	Analyse the operational amplifiers DC and AC characteristics and its effect on output													
22ECE343.3	Build various linear and non-linear analog circuits using operational amplifiers													
22ECE343.4	Analyze Switching circuits, signal processing and signal converting circuits using operational amplifiers													
22ECE343.5	Model the filter circuits using operational amplifiers													
22ECE343.6	Analyze the behaviour of timer IC and other linear IC's													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE343.1	3	-	-	-	2	-	-	-	-	-	-	-	2	1
22ECE343.2	3	-	-	-	-	-	-	-	-	-	-	-	2	1
22ECE343.3	3	3	2	1	2	-	-	-	-	-	-	1	2	1
22ECE343.4	3	3	-	-	2	-	-	-	-	-	-	-	2	1
22ECE343.5	3	3	2	1	-	-	-	-	-	-	-	1	2	1
22ECE343.6	3	3	2	1	2	-	-	-	-	-	-	1	2	1
MODULE-1	OPERATIONAL AMPLIFIER FUNDAMENTALS					22ECE343.1 22ECE343.2					8 Hours			
Basic OpAmp circuit, Op-Amp parameters – Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate, Frequency limitations. Op-Amps as DC Amplifiers-Direct coupled – Voltage Followers, Non-inverting Amplifiers, Inverting amplifiers, Summing amplifiers, Difference amplifier.														
Self-study / Case Study / Applications			Explore how to Create a function generator using Op-Amps to generate different waveforms, such as sine, square, triangle, and sawtooth waves.											
Text Book			Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16											
MODULE-2	OP-AMP AS AC AMPLIFIERS					22ECE343.2 22ECE343.3 22ECE343.4					8 Hours			
Capacitor coupled Voltage Follower, Capacitor coupled Non-inverting Amplifiers, and Capacitor coupled Inverting amplifiers. High input impedance - Capacitor coupled Voltage Follower, setting the upper cut-off frequency, Use of a single polarity power supply, frequency response of op-amp.														
Self-study / Case Study / Applications			Investigate how to calculate voltage gain and analyze frequency response in AC amplifier circuits.											
Text Book			Text Book 1: 2.2, 2.3, 2.4 to 2.15											
MODULE-3	OP-AMP APPLICATION					22ECE343.3 22ECE343.4					8 Hours			
Limiting circuits, Rectifiers, Peak detectors, Sample and hold circuits, V to I and I to V converters, Differentiating Circuit, Integrator Circuit, Phase shift oscillator, Instrumentation amplifier, Crossing detectors, inverting Schmitt trigger. (Text 1) Log and antilog amplifiers, Multiplier and divider.														

Self-study / Case Study / Applications	Develop a bio-signal amplifier circuit using an instrumentation amplifier for biomedical applications.			
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10			
MODULE-4	FILTER AND IC REGULATORS	22ECE343.4 22ECE343.5	8 Hours	
Active Filters: First order and second order active Low-pass and high pass filters, Bandpass Filter, Band stop Filter. Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators. 723 general purpose regulators.				
Self-study / Case Study / Applications	Explore real-world applications of filters, including audio processing, communications, and signal conditioning.			
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7			
MODULE-5	OPERATION & APPLICATIONS OF DIFFERENT IC'S	22ECE343.6	8 Hours	
Phase locked loop: Basic Principles, Phase detector/comparator, VCO. DAC and ADC convertor: DAC using R-2R, ADC using Successive approximation. Other IC Application: 555 timer, Basic timer circuit, 555 timer used as Astable and Monostable multivibrator.				
Self-study / Case Study / Applications	Use PLL ICs to build a frequency synthesizer for generating stable and precise frequencies in RF applications.			
Text Book	Text Book 2: 12.1 to 12.10			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	10	-
L4	Analyze	5	5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1. Operational Amplifiers and Linear IC's , David A. Bell, 2nd edition, PHI/Pearson, 2004. ISBN 978-81-203-2359-9.				
2. Linear Integrated Circuits , D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2006, New Age International ISBN 978-81-224-3098-1.				
Reference Books:				

1. Ramakant A Gayakwad, Op-Amps and Linear Integrated Circuits||, Pearson, 4th Ed, 2015. ISBN 81-7808-501-1.
2. B Somanathan Nair, Linear Integrated Circuits: Analysis, Design & Applications,|| Wiley India, 1st Edition, 2015.
3. James Cox,Linear Electronics Circuits and Devices||, Cengage Learning, Indian Edition, 2008, ISBN-13: 978-07-668-3018-7.

Web links and Video Lectures (e-Resources):

- <https://www.youtube.com/watch?v=7iOPteIA2m0>
- <https://www.youtube.com/watch?v=WYKsYvLj7HE>
- <https://www.youtube.com/watch?v=pEWUL6WhnEc>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Flowcharts and Handouts
 - Organizing Group wise discussions on issues
 - Seminars

CONTROL SYSTEMS

Course Code	22ECE344		CIE Marks	50										
L:T:P:S	3:0:0:0		SEE Marks	50										
Hrs / Week	3		Total Marks	100										
Credits	03		Exam Hours	03										
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE344.1	Illustrate the basic concepts of control systems with various examples													
22ECE344.2	Apply the transfer function concepts to develop the Mathematical Models for electrical and mechanical systems													
22ECE344.3	Analyse transient and steady state response of first order and second order systems for standard test input signals													
22ECE344.4	Examine the absolute and relative system stability in S-Domain using Hurwitz criterion, Routh's criterion and root locus technique in control system													
22ECE344.5	Analyse the stability of the system using frequency response specifications using polar, and bode plots													
22ECE344.6	Solve state equations based on the concepts of state model													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE344.1	3	-	-	-	-	-	-	-	-	-	-	2	3	2
22ECE344.2	3	-	-	-	-	-	-	-	-	-	-	2	3	2
22ECE344.3	3	2	1	-	-	-	-	-	-	-	-	2	3	2
22ECE344.4	3	2	1	-	-	-	-	-	-	-	-	2	3	2
22ECE344.5	3	2	1	-	-	-	-	-	-	-	-	2	3	2
22ECE344.6	3	2	1	-	-	-	-	-	-	-	-	2	3	2
MODULE-1	BASIC CONTROL SYSTEM						22ECE344.1, 22ECE344.2		8 Hours					
Introduction: The control system, Concept of Open loop and Closed loop systems, Feed-Back Characteristics, Effects of feedback. Mathematical modeling of Physical systems: Transfer function, Representation of physical systems by differential equations, Modeling of Electric systems, Translational mechanical systems, Analogous systems, Determination of transfer function by block diagram reduction techniques and signal flow method using Mason's gain formula.														
Self-study / Case Study / Applications			Describe how temperature sensors can be integrated into a smart home setup.											
Text Book			Text book 1 : Chapter -1,2											
MODULE-2	TIME RESPONSE ANALYSIS						22ECE344.3		8 Hours					
Time Response Analysis: Standard test signals, Time response of first order and second order systems, Steady state analysis: steady state error and error constants, transient response of second order systems. Proportional derivative (PD), proportional integral (PI) and proportional derivative and integral systems (PID). (excluding design)														
Self-study / Case Study / Applications			If a disturbance causes a sudden temperature drop, explain how the PID controller reacts to bring the temperature back to the setpoint.											
Text Book			Text book 1 : Chapter 3											
MODULE-3	STABILITY ANALYSIS IN S-DOMAIN						22ECE344.4		8 Hours					
Stability Analysis in S-Domain: The concept of stability, Necessary conditions for stability, Hurwitz stability criterion, Routh stability criterion and its applications, Relative stability analysis The Root Locus Technique: The root locus concepts - construction of root loci.														

Self-study / Case Study / Applications	Robotic systems are used in various industries, including manufacturing and healthcare. Explain how s-domain stability analysis is relevant to the control of robotic arms or autonomous vehicles.			
Text Book	Text book 1 : Chapter- 4,5,6			
MODULE-4	FREQUENCY RESPONSE ANALYSIS	22ECE344.5	8 Hours	
Frequency Response Analysis: Introduction, Correlation between time and frequency domain, Frequency domain specifications, Bode diagrams, Determination of Frequency domain specifications, Phase margin and Gain margin, Stability analysis from Bode Plots, Determination of transfer function from Bode plots, Polar plots, Stability analysis using Nyquist plots.				
Self-study / Case Study / Applications	Consider an audio amplifier used in sound systems. Explain how frequency-domain stability analysis is relevant in ensuring the stability of the amplifier's feedback loop.			
Text Book	Text book 1 : Chapter-6,7			
MODULE-5	STATE SPACE ANALYSIS OF CONTINUOUS SYSTEMS	22ECE344.1, 22ECE344.6	8 Hours	
State Space Analysis of Continuous Systems: Concept of state, state variables and state model, State models for Linear continuous time systems (SISO) Control system design, Unmanned Aerial Vehicle Control system, Under watered Robotics vehicle control system.				
Self-study / Case Study / Applications	Consider a commercial aircraft's flight control system. Explain how state-space analysis is applied to model the aircraft's dynamics and control its motion.			
Text Book	Text book 1: Chapter-8			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	10	-
L4	Analyze	5	5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1) J. Nagarath and M.Gopal, " Control System s Engineering", New Age International(P) Limited, Publishers, Fifth edition- 2005,ISBN: 81 - 224 - 2008-7.				
2) Control System Engineering, Norman S. Nise, 5 th Edition, 2009, Wiley.				
Reference Books:				
1) Modern Control Engineering, Ogata Katsuhiko, 5th Edition, 2010,PHI,				
2. B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003				

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=RcuGxWc0HyQ&ab_channel=NPTEL-NOCIITM
- https://www.youtube.com/watch?v=39Ggoj2fQ2c&ab_channel=Controlengineering
- https://www.youtube.com/watch?v=5NltqMpJG2k&ab_channel=Controlengineering

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any manufacturing/aero/auto industry or any power plant
- Simulation Software: Utilize simulation software like MATLAB and Simulink to create virtual experiments that mimic real-world control system scenarios.
- Contents related activities (Activity-based discussions)- Students can model and simulate various control systems, analyze their behavior, and experiment with different controller designs.
- Feedback from Industry Professionals: Invite guest speakers or industry experts to share their experiences with implementing control systems in real-world applications. This gives students insights into practical challenges and solutions.
- Robotics and Automation Projects: Introduce robotics or automation projects that require students to design and implement control systems for robotic arms, drones, or other automated systems. This hands-on experience enhances their understanding of control principles.
- Workshops and Demonstrations: Conduct workshops or demonstrations on control system components, such as sensors, actuators, and controllers. Students can learn about interfacing with hardware and integrating components into control loops.

ELECTRONICS DESIGN USING PROTEUS														
Course Code	22ECE351										CIE Marks		50	
L:T:P:S	0:0:1:0										SEE Marks		50	
Hrs / Week	2										Total Marks		100	
Credits	01										Exam Hours		03	
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE351.1	Apply the fundamental concepts of electronics for creating schematics and layout of electronics design problems													
22ECE351.2	Simulate electronic circuits to study the behavior of components and circuits before building physically													
22ECE351.3	Make use of software interface for placing components on the board and routing traces to establish connections, mimicking the real-world PCB fabrication process													
22ECE351.4	Analyze the functionality of the code and its interaction with the hardware components without needing physical hardware													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE351.1	3	-	-	-	2	-	-	-	-	-	-	2	3	3
22ECE351.2	3	3	1	1	2	-	-	-	-	-	-	2	3	3
22ECE351.3	3	3	1	1	2	-	-	-	-	-	-	2	3	3
22ECE351.4	3	3	1	1	2	-	-	-	-	-	-	2	3	3
Exp. No. / Pgm. No.	List of Experiments											Hours	COs	
Prerequisite Experiments														
	<ul style="list-style-type: none"> • Basic Electronics Knowledge • Proteus Software Installation • Components and Libraries • Circuit Design Basics. • Circuit Simulation 											2	NA	
PART-A														
1	To understand the principles of LED operation and current limiting											2	22ECE351.1	
2	To investigate the charging behavior of capacitors.											2	22ECE351.1	
3	To design transistor as a Switch											2	22ECE351.1	
4	To design and analyze an inverting amplifier											2	22ECE351.1	
5	To create a square wave generator using 555 Timer in A stable Mode											2	22ECE351.2	
6	To convert an AC signal to DC Using a Rectifier (Half wave)											2	22ECE351.2	
PART-B														
7	To obtain a stable 5V DC output using LM7805 Voltage Regulator											2	22ECE351.2	
8	To investigate the basic logic gates											2	22ECE351.2	
9	To Investigate serial to parallel conversion using Shift register											2	22ECE351.3	
10	To design and analyze a crystal oscillator											2	22ECE351.3	
11	To display frequency of an input signal using 7-segment Display											2	22ECE351.4	
12	To convert an AC signal to DC Using a Rectifier (Full wave)											2	22ECE351.4	
PART-C														
Beyond Syllabus Virtual Lab Content														
(To be done during Lab but not to be included for CIE or SEE)														
1.Draw the layout for 5V DC Power Supply circuit on Proteus.														

<https://www.studocu.com/row/document/air-university/electrical-circuit-analysis/1634537390389-lab5-pcb-designing-in-proteus/25746984>

2.Design and Simulation of Hartley Oscillator.

<https://www.youtube.com/watch?v=akqoYmkaiSc>

3.Flashing Led's Using 555 Ic Circuit, Simulation, And PCB Layout Design.

<https://www.youtube.com/watch?v=j2A35oHB3tM>

4.Half Adder using Proteus.

<https://www.youtube.com/watch?v=CAMURFssBaQ>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. George Shopov, "PROTEUS PCB DESIGN EXAMPLES" - ARES Kindle: ASIN : B07XFG3R1Y, 2020
2. Farzin Asadi, "Essential Circuit Analysis Using Proteus", eBook ISBN 978-981-19-4353-9, 2023.
3. <https://www.labcenter.com/>

PCB DESIGN USING ORCAD															
Course Code	22ECE352										CIE Marks	50			
L:T:P:S	0:0:1:0										SEE Marks	50			
Hrs / Week	2										Total Marks	100			
Credits	01										Exam Hours	03			
Course outcomes:															
At the end of the course, the student will be able to:															
22ECE352.1	Apply the knowledge of circuit analysis to select the appropriate electronic components for a given application														
22ECE352.2	Simulate various Digital and Analog circuits using modern software tools														
22ECE352.3	Design complex and functional PCB layouts for various electronic devices, from simple circuits to advanced systems														
22ECE352.4	Create high-quality PCB designs that meet industry standards and best practices														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECE352.1	3	-	-	-	3	-	-	-	-	-	-	2	3	2	
22ECE352.2	3	3	2	1	3	-	-	-	-	-	-	2	3	2	
22ECE352.3	3	3	2	1	3	-	-	-	-	-	-	2	3	2	
22ECE352.4	3	3	2	1	3	-	-	-	-	-	-	2	3	2	
Exp. No. / Pgm. No.	List of Experiments											Hours	COs		
Prerequisite Experiments															
	<ul style="list-style-type: none"> Knowledge of Basic Electronics Components Familiar with Basic electronic circuit connections Basic knowledge to use computer 											2	NA		
PART-A															
1	Introduction to circuit creation and simulation OrCAD software: Half Wave Rectifier.											2	22ECE352.1 22ECE352.2		
2	Design and simulate a Full Wave Centre-Tapped Rectifier.											2	22ECE352.1 22ECE352.2		
3	Analyze positive and negative clipper circuits.											2	22ECE352.1 22ECE352.2		
4	Analyze positive and negative clamper circuits.											2	22ECE352.1 22ECE352.2		
5	Verify the diode characteristics using OrCAD.											2	22ECE352.1		
6	To verify the BJT Amplifier characteristics using OrCAD.											2	22ECE352.1		
PART-B															
7	Simulate all gates in OrCAD.											2	22ECE352.2		
8	Implement the half adder using OrCAD.											2	22ECE352.2		
9	Implement NAND as universal gate (NOT, AND, OR using NAND).											2	22ECE352.2		
10	Introduction to PCB layout design.											2	22ECE352.3		
11	PCB design of Half Wave Rectifier.											2	22ECE352.4		
12	PCB design of Full Wave Centre Tapped Rectifier.											2	22ECE352.4		
PART-C															
Beyond Syllabus Virtual Lab Content															
(To be done during Lab but not to be included for CIE or SEE)															

1. Create A simple schematic circuits using OrCAD
<https://resources.pcb.cadence.com/orcad-tutorials/2021-capture-walk-through-1-starting-a-schematic>
2. Complete Design flow of two stage RC circuit on OrCAD Tool
<https://www.youtube.com/watch?v=IgxPh7m-qgo>
3. OrCAD simple flow from schematic to PCB
<https://www.youtube.com/watch?v=4882amwAHfA> from schematic to PCB
4. LM317 Adjustable Voltage Regulator
<https://www.youtube.com/watch?v=enhQhQmW-a0>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

- 1) ORCAD software User manual.
- 2) R S Khandpur, Printed Circuit Boards- Design Fabrication, Assembly and Testing, Tata Mc Graw Hill Publishing Company Limited, 1st edition 2008

EMBEDDED DESIGN USING MPLAB															
Course Code	22ECE353										CIE Marks	50			
L:T:P:S	0:0:1:0										SEE Marks	50			
Hrs / Week	2										Total Marks	100			
Credits	01										Exam Hours	03			
Course outcomes:															
At the end of the course, the student will be able to:															
22ECE353.1	Demonstrate the fundamental core concepts of programming with MPLAB XC8														
22ECE353.2	Apply the basic knowledge of programming and system control to perform a specific task														
22ECE353.3	Conduct experiments to interface different peripherals														
22ECE353.4	Develop programming skills in embedded systems for various applications														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECE353.1	3	-	-	-	3	-	-	-	-	-	-	2	3	3	
22ECE353.2	3	2	2		3	-	-	-	-	-	-	2	3	3	
22ECE353.3	3	2	1		3	-	-	-	-	-	-	2	3	3	
22ECE353.4	3	3	2		3	-	-	-	-	-	-	2	3	3	
Exp. No. / Pgm. No.	List of Programs											Hours	COs		
Prerequisite Programs															
	Revisit to C basics											2	NA		
PART-A															
1	Getting Started with MPLAB XC8											2	22ECE353.1		
2	Flashing an LED											2	22ECE353.1 22ECE353.2		
3	Button Press Detection											2	22ECE353.2		
4	Reading a Switch											2	22ECE353.2		
5	Interfacing a Seven Segment Display											2	22ECE353.3		
6	Interfacing an LCD Display											2	22ECE353.3		
PART-B															
7	Interrupt Handling											2	22ECE353.3		
8	Programming Digital Thermometer											2	22ECE353.3		
9	Analog-to-Digital Conversion (ADC)											2	22ECE353.4		
10	Temperature and Humidity Sensing											2	22ECE353.4		
11	Interfacing Matrix Keypad											2	22ECE353.4		
12	RS232 Serial Communication											2	22ECE353.4		
PART-C															
1. Programming a Development Board (microchip.com)															
2. Interfacing of ADC and data transfer by software polling, study of aliasing http://vlabs.iitkgp.ernet.in/rtes/exp4/index.html															
3. MCU-DAC interfacing and generation of ramp wave http://vlabs.iitkgp.ernet.in/rtes/exp3/index.html															
4. Interfacing 4x4 switch matrix with the microcontroller http://vlabs.iitkgp.ernet.in/rtes/exp12/index.html															

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:**Reference Books (MPLAB starting documents)**

- 1) <https://www.microchip.com/en-us/tools-resources/develop/mplab-x-ide>
- 2) <https://skills.microchip.com/page/mplab-x-ide>

SYSTEM DESIGN USING ALTIUM														
Course Code	22ECE354				CIE Marks				50					
L:T:P:S	0:0:1:0				SEE Marks				50					
Hrs / Week	2				Total Marks				100					
Credits	01				Exam Hours				03					
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE354.1	Make use of Altium designer tools to construct, edit, and manage electronic circuit designs													
22ECE354.2	Create complex schematic diagrams using Altium Designer, incorporating various electronic components, connections, and hierarchical design techniques													
22ECE354.3	Translate schematic designs into multi-layer printed circuit board (PCB) layouts using Altium Designer													
22ECE354.4	Analyse Altium Designer tools for testing, simulation and design verification													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE354.1	3	3	2	1	3	-	-	-	-	-	-	2	3	3
22ECE354.2	3	3	2	1	3	-	-	-	-	-	-	2	3	3
22ECE354.3	3	2	1	-	3	-	-	-	-	-	-	2	3	3
22ECE354.4	3	3	2	1	3	-	-	-	-	-	-	2	3	3
Exp. No. / Pgm. No.	List of Experiments											Hours	COs	
Prerequisite Experiments														
	<ol style="list-style-type: none"> Basic Electronics, Circuit Theory, Digital Logic, and Programming Basics Knowledge. Familiarity with various electronic components like resistors, capacitors, inductors, diodes, transistors, and integrated circuits. Basic computer skills including file management, working with windows and menus, and understanding software installation processes. 											2	NA	
PART-A														
1	Introduction to Altium Interface <ul style="list-style-type: none"> Learn to navigate the Altium Designer interface. Create a new project and schematic sheet. Place basic components like resistors and capacitors onto the schematic. 											2	22ECE354.1	
2	Schematic Entry <ul style="list-style-type: none"> Explore component libraries and choose components for your design. Connect components using wires. Label nets and components for clear identification. 											2	22ECE354.1	
3	Design Annotation and Netlist Generation <ul style="list-style-type: none"> Understand the importance of designators and footprints. Annotate your schematic components. Generate a netlist for further steps in the design process. 											2	22ECE354.1	
4	PCB Footprint Association											2	22ECE354.1	

	<ul style="list-style-type: none"> Learn how to associate schematic symbols with PCB footprints. Ensure that the chosen footprints match the intended components. 		
5	PCB Layout Basics <ul style="list-style-type: none"> Transfer your schematic to the PCB layout environment. Place components onto the PCB layout canvas. Arrange components for optimal spacing and organization. 	2	22ECE354.2
6	Tracing and Routing <ul style="list-style-type: none"> Learn to route traces between components on the PCB. Follow best practices for trace length matching and signal integrity. 	2	22ECE354.2
PART-B			
7	Power and Ground Planes <ul style="list-style-type: none"> Understand the importance of power and ground planes. Create power and ground planes to ensure good power distribution and noise reduction. 	2	22ECE354.2
8	Design Rule Checking (DRC) <ul style="list-style-type: none"> Perform a basic design rule check to identify potential errors. Address any DRC violations to ensure manufacturability. 	2	22ECE354.2
9	3D Visualization <ul style="list-style-type: none"> Explore the 3D visualization capabilities in Altium Designer. Verify component placement and visualize the physical design. 	2	22ECE354.3
10	Creating Gerber Files <ul style="list-style-type: none"> Learn to generate Gerber files for fabrication. Understand the importance of proper layer selection and file formats. 	2	22ECE354.3
11	Schematic-to-PCB Integration <ul style="list-style-type: none"> Understand the link between schematic and PCB design. Learn how changes in one affect the other and vice versa. 	2	22ECE354.4
12	Project Documentation and Reporting <ul style="list-style-type: none"> Generate project documentation, including bill of materials (BOM). Create design reports and necessary files for sharing the design with others. 	2	22ECE354.4
PART-C Beyond Syllabus Lab Content (To be done during Lab but not to be included for CIE or SEE)			
<ol style="list-style-type: none"> Design a simple LED blinking circuit using Altium Designer. https://www.youtube.com/watch?v=H1lNbB7ICTs Design a digital stopwatch circuit using Altium Designer. https://www.youtube.com/watch?v=HD8wDa8CR5s Switch mode Power Supply https://www.youtube.com/watch?v=s-bL8LK6Gm8 Buck Converter Circuit Simulation https://www.youtube.com/watch?v=VTgiHjXXGL8 			

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:**Reference Books:**

1. Majid Pakdel, “Fast PCB Design with Altium Designer”, Publisher: Central West Publishing, 2021, ISBN-13: 9781922617095
2. Simon Monk, “Altium Designer - Getting Started with PCB Design”.
3. John Watson, “Advanced PCB Design with Altium Designer”.
4. <https://resources.altium.com/guide-books>
5. https://resources.altium.com/sites/default/files/uberflip_docs/file_1167.pdf

BIO INSPIRED DESIGN AND INNOVATION												
Course Code	22BIK36							CIE Marks	50			
L:T:P:S	3:0:0:0							SEE Marks	50			
Hrs / Week	3							Total Marks	100			
Credits	03							Exam Hours	03			
Course outcomes:												
At the end of the course, the student will be able to:												
22BIK36.1	Verify the biomimetics principles in relation to the needs at that moment.											
22BIK36.2	Evaluate the Bio-material properties for health care applications.											
22BIK36.3	Investigate novel bioengineering initiatives by evaluating design and development principles.											
22BIK36.4	Investigate creative biobased solutions for socially vital issues with critical thought.											
22BIK36.5	Understand the bio computing optimization through research and experiential learning.											
22BIK36.6	Explain the fundamental biological ideas through pertinent industrial applications and case studies.											
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22BIK36.1	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.2	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.3	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.4	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.5	3	3	3	3	2	-	2	-	1	-	-	2
22BIK36.6	3	3	3	3	2	-	2	-	1	-	-	2
MODULE-1 BIO-INSPIRED DESIGN AND ENGINEERING 22BIK36.1 8 Hours												
Bio-Inspired Engineering and design, History, Evolution, Basics of Biomimetics and other Disciplines, Rawling's Classifications, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).												
Self-study / Case Study / Applications			Investigate the Challenges of Bio inspired design, Compare with traditional areas of science and engineering.									
Text Book			Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16									
MODULE-2 BIO MATERIALS AND BIO HEALTHCARE DESIGN 22BIK36.2 8 Hours												
Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Design of materials- (Hierarchy, fracture tough materials, structural colours, Actuating Materials, Bio-Compatible Materials). Bio-Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic Wasp-Inspired Needle, Octopus-Inspired Sucker for Tissue Grafting, Peacock-Inspired Biosensors, Gecko-Inspired Surgical Glue) Robotics, Marine and Aeronautical.												
Self-study / Case Study / Applications			Investigate Bio-Compatible alloys and polymers for human implants and health care applications.									
Text Book			Text Book 1: 2.2, 2.3, 2.4 to 2.15									
MODULE-3 BIO SUSTAINABLE DEVELOPMENT 22BIK36.3, 22BIK36.4 8 Hours												
Innovations in Energy (Termite mound inspired shopping malls), Innovations in Resource-Air (purification, filtration), Dew water collection systems, water purification, desalination, Management of spaces, designs for megastructures.												

Self-study / Case Study / Applications	Explore the Bio inspired environmental constructions and development.			
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10			
MODULE-4	BIO COMPUTING AND OPTIMISATION	22BIK36.5	8 Hours	
No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm- Crossover and Mutation Operations. Bio-Inspired Optimisation, Ant Colony Optimisation (ACO), Swam Intelligence-Particle Swam Optimisation (PSO).				
Self-study / Case Study / Applications	Scrutinize the Different types of Optimization techniques, genetic research.			
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7			
MODULE-5	APPLICATIONS OF BIO-INSPIRED INNOVATIONS	22BIK36.6	8 Hours	
Bioinspired innovations in– Automotive, Automation, Materials and Manufacturing, Sensors, Controllers, Communications, Healthcare, Agriculture, food production, and Sports, Environment infrastructure. Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), eco-restorations (Eco-friendly pesticide).				
Self-study / Case Study / Applications	Survey on Bio inspired Innovations, design, applications and case studies of the same.			
Text Book	Text Book 2: 12.1 to 12.10			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	-	-
L3	Apply	10	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	10		
L4	Analyze	10		
L5	Evaluate	10		
L6	Create	--		
Suggested Learning Resources:				
Text Books:				
1) Helena Hashemi Farzaneh, Udo Lindemann, A Practical Guide to Bio-inspired Design, Springer Vieweg, 1st edition 2019, ISBN-10 : 366257683X, ISBN-13 : 978-3662576830				
2) Torben A. Lenau, Akhlesh Lakhtakia, Biologically Inspired Design: A Primer (Synthesis Lectures on Engineering, Science, and Technology, Publisher: Morgan & Claypool Publishers, 2021, ISBN-10: 1636390471, ISBN-13: 978-1636390475				
Reference Books:				

- 1) French M, Invention and evolution: Design in Nature and Engineering, Publisher: Cambridge University Press, 2020
- 2) Pan L., Pang S., Song T. and Gong F. eds, Bio-Inspired Computing: Theories and Applications, 15th International Conference, BIC-TA 2020, Qingdao, China, October 23-25, 2020, Revised Selected Papers (Vol. 1363). Springer Nature, 2021
- 3) Wann D, Bio Logic: Designing with nature to Protect the Environment, Wiley Publisher, 1994

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- <https://biodesign.berkeley.edu/bioinspired-design-course/>
- <https://www.youtube.com/watch?v=cwxXY9Qe8ss>
- <https://www.youtube.com/watch?v=V2GvOXvjhLA>
- <https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report%202232327%20October%202022%20Final.508.pdf>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Presenting students with bio-inspired design challenges and asking them to come up with solutions.
- Create physical models or prototypes that mimic biological structures or functions.
- Organizing Group wise discussions on issues
- Seminars

UNIVERSAL HUMAN VALUES AND LIFE SKILLS													
Course Code	22UHK37						CIE Marks			50			
L:T:P:S	1:0:0:0						SEE Marks			50			
Hrs / Week	2						Total Marks			100			
Credits	01						Exam Hours			02			
Course outcomes:													
At the end of the course, the student will be able to:													
22UHK37.1	Understand the concept and significance of life skills and universal human values.												
22UHK37.2	Develop Self-awareness and Self-management skills to promote personal growth.												
22UHK37.3	Apply Critical and Creative thinking and ethical decision-making skills in various contexts.												
22UHK37.4	Promote teamwork and collaboration while respecting diversity and inclusivity.												
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	
22UHK37.1	-	-	-	-	-	3	1	3	-	2	-	2	
22UHK37.2	-	-	-	-	-	1	2	1	-	2	-	2	
22UHK37.3	-	-	-	-	-	3	1	3	1	2	-	2	
22UHK37.4	-	-	-	-	-	2	2	1	3	3	-	3	
MODULE-1													
Self-Awareness and Self-Management						22UHK37.1			22UHK37.2			3 Hours	
Emotional Intelligence, Techniques of self-awareness: SWOT and JOHARI WINDOWS, Stress management and coming out of comfort zone, managing failure, Time Management to recalibrate priorities. Self-Exploration as a process of Value Education, the basic human Aspirations: Prosperity and Happiness, understanding infatuation.													
Self-study / Role play			Understand qualities of Role Models, explore self and do SWOT analysis for growth; participate in role play and presentations to come out of comfort zone.										
MODULE-2													
Towards Yourself						22UHK37.1			22UHK37.3			3 Hours	
Exploring opportunities, understanding expectations and self for right fitment in profession, Goal Setting - Personal and Professional, aligning Personal and Professional goals for greater achievement, Mind-Maps as a tool for Goal Setting													
Self-study / Mind Maps		Understand industry expectations to set professional goals; realizing connection between personal and professional goals for peaceful living.											
MODULE-3													
Leading self to lead others						22UHK37.3			22UHK37.4			3 Hours	
Quality analysis of leader and self-evaluation, Critical thinking, Creative thinking and Ethical decision making, Critical thinking and Creative thinking for contribution to technical world, Six thinking hats, Exploring ethical decision-making frameworks and principles.													
Activities / Case study/Applications		Case studies for Critical thinking and activities for Creative thinking.											
MODULE-4													
Ownership towards Family and Society						22UHK37.2			22UHK37.3			22UHK37.4	3 Hours
Responsibility, Diversity and Inclusivity: Understanding personal and social responsibility; Appreciating diversity and managing inclusivity, promoting teamwork and collaboration while respecting differences.													

Self-study / Interview with corporate people	Working on Task bar; team building activities; Interviewing Corporate experts to understand expectations.		
MODULE-5	Towards Nature and Industry	22UHK37.3 22UHK37.4	3 Hours
Personal code of conduct for harmony between self and nature, resisting external pressures, negotiation and conflict resolution, assertiveness and empathy, change management			
Role play	Role plays to understand contributions to nature and industry.		
CIE Assessment Pattern (50 Marks – Theory) –			
RBT Levels		Marks Distribution	
		Test (s)	Alternative Assessment (s)
		25	25
L1	Remember	-	-
L2	Understand	7	6
L3	Apply	8	7
L4	Analyze	10	7
L5	Evaluate	-	5
L6	Create	-	-
SEE Assessment Pattern (50 Marks – Group Discussion)			
RBT Levels		Exam Marks Distribution (50)	
L1	Remember	10	
L2	Understand	10	
L3	Apply	20	
L4	Analyze	10	
L5	Evaluate	--	
L6	Create	--	
Suggested Learning Resources:			
REFERENCE BOOKS:			
1. The 7 Habits of Highly Effective People, Stephen R Covey, Neha publishers.			
2. Seven Habits of Highly Effective Teens, Convey Sean, New York, Fireside Publishers, 1998.			
3. Emotional Intelligence, Daniel Coleman, Bantam Book, 2006.			
4. How to win friends and influence people, Dale Carnegie.			
5. BHAGAVADGITA for college students, Sandeepa Guntreddy.			
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning			
<ul style="list-style-type: none"> • Conduct interviews with HR personnel of corporates to understand expectations in terms of Soft Skills and Values • Participate in role plays and presentations to come out of comfort zone • Talk to industry people to understand opportunities available • Make a short movie to display creativity • Use Mind maps to plan successful completion of semester • Actively participate in Group Discussions and JAM sessions 			

NATIONAL SERVICE SCHEME												
Course Code	22NSS30						CIE Marks (each Semester)			50		
L:T:P:S	0:0:0:0						SEE Marks			--		
Hrs / Week	2						Total Marks			50 x 4 = 200		
Credits	00						Exam Hours			02		
Course outcomes: At the end of the course, the student will be able to:												
22NSS30.1	Understand the importance of his / her responsibilities towards society.											
22NSS30.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.											
22NSS30.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.											
22NSS30.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22NSS30.1	-	-	-	-	-	3	-	-	2	-	-	1
22NSS30.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30.4	-	-	-	-	-	3	3	-	2	-	-	1
Semester/ Course Code												
CONTENT												
COs												
HOURS												
3RD 22NSS30	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govt organization, 5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.						22NSS30.1, 22NSS30.2, 22NSS30.3, 22NSS30.4			30 HRS		
4TH 22NSS40	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.						22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4			30 HRS		
5TH 22NSS50	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs. (minimum 5 programs).						22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4			30 HRS		
6TH 22NSS60	10. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.						22NSS60.1, 22NSS60.2, 22NSS60.3, 22NSS60.4			30 HRS		
CIE Assessment Pattern (50 Marks – Activity based) –												

CIE component for every semester	Marks
Presentation - 1 Selection of topic, PHASE - 1	10
Commencement of activity and its progress - PHASE - 2	10
Case study-based Assessment Individual performance	10
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	50

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Suggested Learning Resources:

Reference Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
 - Lecture session by NSS Officer
 - Students Presentation on Topics
 - Presentation - 1, Selection of topic, PHASE – 1

- Commencement of activity and its progress - PHASE – 2
- Execution of Activity
- Case study-based Assessment, Individual performance
- Sector/ Team wise study and its consolidation
- Video based seminar for 10 minutes by each student at the end of semester with Report.

SI No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/ Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs. (minimum 5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION												
Course Code	22PED30						CIE Marks (each semester)	50				
L:T:P:S	0:0:0:0						SEE Marks	--				
Hrs / Week	2						Total Marks	50 x 2= 100				
Credits	00						Exam Hours	02				
Course outcomes:												
At the end of the course, the student will be able to:												
22PED30.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness											
22PED30.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle											
22PED30.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.											
22PED30.4	Understand the roles and responsibilities of organization and administration of sports and games											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22PED30.1	-	-	-	-	-	2	-	3	3	-	-	2
22PED30.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED30.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED30.4	-	-	-	-	-	2	-	3	3	-	-	2
Semester	CONTENT								COs	HOURS		
3RD 22PED30	Module 1: Orientation A. Lifestyle, B. Fitness C. Food & Nutrition D. Health & Wellness E. Pre-Fitness test.								22PED30.1, 22PED30.2	5 HRS		
	Module 2: General Fitness & Components of Fitness A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash D. Agility – Shuttle Run E. Flexibility – Sit and Reach F. Cardiovascular Endurance – Harvard step Test								22PED30.2, 22PED30.3	15 HRS		
	Module 3: Recreational Activities A. Postural deformities. B. Stress management. C. Aerobics. D. Traditional Games.								22PED30.3, 22PED30.4	10 HRS		
4TH 22PED40	Module 1: Ethics and Moral Values A. Ethics in Sports B. Moral Values in Sports and Games								22PED40.1, 22PED40.2	5 HRS		
	Module 2: Specific Games (Anyone to be selected by the student) A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. C. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and								22PED40.3	20 HRS		

	Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. F. Athletics (Track / Field Events) – Any event as per availability of Ground.		
	Module 3: Role of Organization and administration	22PED40.4	5 HRS

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
Participation of student in all the modules	10
Quizzes – 2, each of 7.5 marks	15
Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25
Total	50

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA												
Course Code	22YOG30						CIE Marks (each Semester)	50				
L:T:P:S	0:0:0:0						SEE Marks	--				
Hrs / Week	2						Total Marks	50 x 4 = 200				
Credits	00						Exam Hours	02				
Course outcomes:												
At the end of the course, the student will be able to:												
22YOG30.1	Use Yogasana practices in an effective manner											
22YOG30.2	Become familiar with an authentic foundation of Yogic practices											
22YOG30.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas											
22YOG30.4	Use the teachings of Patanjali in daily life.											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22YOG30.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30.4	-	-	-	-	-	3	-	-	-	-	-	1
Semester / Course Code												
CONTENT												
COs												
HOURS												
3rd 22YOG30	Introduction of Yoga: Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer Brief introduction of yogic practices for common man: Yogic practices for common man to promote positive health Rules and regulations: Rules to be followed during yogic practices by practitioner Misconceptions of yoga: Yoga its misconceptions, Difference between yogic and non-yogic practices. Suryanamaskara: 1. Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar. 2. Suryanamaskar 12 count, 2 rounds Different types of Asanas: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supine line: Utthitadvipadasana, Ardhalasana, Halasana						22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4			Total 32 Hrs/ Semester 2 Hrs/week		

<p style="text-align: center;">4TH 22YOG40</p>	<p>Suryanamaskara: Suryanamaskar 12 count,4rounds</p> <p>Brief introduction and importance of: Kapalabhati: Revision of Kapalabhati -40strokes/min3rounds Different types of Asanas:</p> <ol style="list-style-type: none"> 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana <p>Patanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya Bhedana</p>	<p>22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4</p>	<p>Total 32 Hrs/ Semester 2 Hrs/week</p>
<p style="text-align: center;">5TH 22YOG50</p>	<p>Kapalabhati: Revision of Kapalabhati - 60strokes/min3rounds Brief introduction and importance of: Different types of Asanas:</p> <ol style="list-style-type: none"> 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarva <p>Patanjali's Ashtanga Yoga: Pratyahara, Dharana Pranayama: Ujjayi, Sheetali, Sheektari</p>	<p>22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4</p>	<p>Total 32 Hrs/ Semester 2 Hrs/week</p>
<p style="text-align: center;">6TH 22YOG60</p>	<p>Kapalabhati: Revision of Kapalabhati – 80 strokes/min3rounds Brief introduction and importance of: Different types of Asanas:</p> <ol style="list-style-type: none"> 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 4. Balancing: Sheershasana <p>Patanjali's AshtangaYoga: Dhyana (Meditation), Samadhi Pranayama: Bhastrika, Bhramari, Ujjai Shat Kriyas: Jalaneti and sutraneti, Sheetkarma Kapalabhati</p>	<p>22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4</p>	<p>Total 32 Hrs/ Semester 2 Hrs/week</p>

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)

CIE	Marks
Avg of Test 1 and Test 2	25
Demonstration of Yogasana	25
Total	50

Suggested Learning Resources:

Reference Books:

1. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)

2. Tiwari, O P: Asana Why and How
3. Ajitkumar: Yoga Pravesha (Kannada)
4. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
5. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
6. Nagendra H R: The art and science of Pranayama
7. Tiruka: Shatkriyegalu (Kannada)
8. Iyengar B K S: Yoga Pradipika (Kannada)
9. Iyengar B K S: Light on Yoga (English)

Web links and Video Lectures (e-Resources):

- <https://youtu.be/KB-TYlgd1wE>
- <https://youtu.be/aa-TG0Wg1Ls>

BASIC APPLIED MATHEMATICS-I (Common to all Branches)												
Course Code	22DMAT31						CIE Marks				50	
L:T:P:S	0:0:0:0						SEE Marks				--	
Hrs. / Week	2						Total Marks				50	
Credits	00						Exam Hours				--	
Course outcomes:												
At the end of the course, the student will be able to:												
22DMAT31.1	Know the principles of engineering mathematics through calculus											
22DMAT31.2	Determine the power series expansion of a function											
22DMAT31.3	Find the definite integrals with standard limits and also develop the ability to solve different types of differential equations											
22DMAT31.4	Apply ideas from linear algebra in solving systems of linear equations and determine the Eigen values and Eigen vectors of a matrix											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22DMAT31.1	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.2	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.3	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT31.4	3	3	-	-	-	-	-	-	-	-	-	-
MODULE-1	DIFFERENTIAL CALCULUS										22DMAT31.1	8 Hours
											22DMAT31.2	
Polar Curves-Problems on angle between the radius vector and tangent, Angle between two curves-Problems, Pedal equation for polar curves-Problems. Maclaurin's theorem for function of one variable (statement only)-Problems.												
Text Book	Text Book 1: 4.4, 4.7, 4.8, Text Book 2: 15.4											
MODULE-2	PARTIAL DIFFERENTIATION										22DMAT31.1	8 Hours
Definition and Simple problems, Euler's theorem for Homogeneous function (NO Derivation and NO extended theorem) Problems, Jacobians of order two - definition and problems.												
Text Book	Text Book 1: 5.4, 5.7,											
MODULE-3	INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS										22DMAT31.3	8 Hours
Problems on evaluation of $\sin n x$ and $\cos n x$ integrals with standard limits (0 to $\pi/2$). Solution of first order and first-degree differential equations-Variable separable, Linear and Exact differential equations.												
Text Book	Text Book 1: 6.2, 11.6, 11.9, 11.11, Text Book 2: 1.3, 1.4, 1.5											
MODULE-4	LINEAR ALGEBRA-1										22DMAT31.4	8 Hours
Problems on rank of a matrix by elementary transformations, Solution of system of linear equations by Gauss elimination method-Problems.												
Text Book	Text Book 1: 2.7, 28.6, Text Book 2: 7.3, 7.4											
MODULE-5	LINEAR ALGEBRA-2										22DMAT31.4	8 Hours
Linear transformation, Eigen values and Eigen Vectors of square matrix-Problems.												
Text Book	Text Book 1: 2.11, 2.13, Text Book 2: 7.9, 8.1.											
CIE Assessment Pattern (50 X 2=100 Marks - Theory)												
RBT Levels		Marks Distribution										
		Test (s)	Qualitative Assessment (s)	MCQ's								
		25	15	10								
L1	Remember	5	5	-								
L2	Understand	5	5	-								
L3	Apply	10	5	10								
L4	Analyze	2.5	-	-								
L5	Evaluate	2.5	-	-								

L6	Create	-	-	-	
<p>Suggested Learning Resources:</p> <p>Text Books:</p> <ol style="list-style-type: none"> 1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491. 2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232. <p>Reference Books:</p> <ol style="list-style-type: none"> 1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236. 2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190. 3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831. 4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320. 					
<p>Web links and Video Lectures (e-Resources):</p> <ol style="list-style-type: none"> 1) https://youtu.be/IUV0_Nj4d1s?si=eO3s7keCbCO1_jcz 2) https://youtu.be/VzUcs7aiqgg?si=YLtTUGr4Xp88KGY3 3) https://youtu.be/LDBnS4c7YbA?si=udUOdJ-u0ZxFmBAW 4) https://youtu.be/palSdK9P-ns?si=7A8_VSxEI4lGvksB 5) https://youtu.be/Bw5yEqwMjQU?si=jzbnklZmVev1w8K2S 6) https://youtu.be/LBqdGn1r_fQ?si=DWcAliFnosT7zikY 7) https://youtu.be/N5YCG0yTSuU?si=Wsf75V5fkUpfVVxr 8) https://youtu.be/gd1FYn86P0c?si=7drzBEqVFSv6sQeZ 9) https://youtu.be/cSj82GG6MX4?si=4QN1DFXEqaJoUBn7 10) https://youtu.be/0c3yq9btr3A?si=jIoz8eu5TgV7mh8G 11) https://youtu.be/PhfbEr2btGQ?si=HVK1uk65oHph0t8G 					
<p>Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:</p> <ul style="list-style-type: none"> • Contents related activities (Activity-based discussions) <ul style="list-style-type: none"> ➤ For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes ➤ Organizing Group wise discussions on related topics ➤ Seminars 					

FOURTH SEMESTER
(SYLLABUS)

NUMERICAL, COMPLEX ANALYSIS AND PROBABILITY THEORY (Common to ECE, EEE, MEE)												
Course Code	22MAE41						CIE Marks				50	
L:T:P:S	3:0:0:0						SEE Marks				50	
Hrs. / Week	4						Total Marks				100	
Credits	03						Exam Hours				03	
Course outcomes:												
At the end of the course, the student will be able to:												
22MAE41.1	Solve initial value problems using appropriate numerical methods											
22MAE41.2	Apply the concepts of Complex variables to solve Engineering Problems											
22MAE41.3	Apply the concepts of Transformations, Complex integration, Poles and Residuals in the stability analysis of engineering problems											
22MAE41.4	Gain ability to use probability distributions to analyze and solve real time problems											
22MAE41.5	Apply the concept of sampling distribution to solve engineering problems											
22MAE41.6	Use the concepts to analyze the data to make decision about the hypothesis											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22MAE41.1	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.2	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.3	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.4	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.5	3	3	-	-	-	-	-	-	-	-	-	-
22MAE41.6	3	3	-	-	-	-	-	-	-	-	-	-
MODULE-1 NUMERICAL METHODS 22MAE41.1 8 Hours												
Numerical solution of ordinary differential equations of first order and of first degree: Taylor's series method, Modified Euler's method and Runge-Kutta method of fourth-order-Problems. Milne's predictor and corrector methods-Problems. Numerical Solution of second order ordinary differential equations by Runge-Kutta method of fourth-order-Problems.												
Case Study	Case studies on Numerical Analysis.											
Text Book	Text Book 1: 32.3, 32.5, 32.7, 32.9, 32.12, Text Book 2: 21.1.											
MODULE-2 COMPLEX VARIABLES 22MAE41.2 8 Hours												
Functions of complex variables, Analytical functions, Cauchy-Riemann Equations in Cartesian and Polar forms, Harmonic functions and Construction of analytic functions-Problems using Milne-Thompson's method.												
Application	Applications of Flow Problems-Velocity potential, Stream functions and complex potential functions.											
Text Book	Text Book 1: 20.2, 20.4, 20.5, 20.6, Text Book 2: 13.1, 13.2, 13.3, 13.4.											
MODULE-3 CONFORMAL TRANSFORMATIONS AND COMPLEX INTEGRATIONS 22MAE41.3 8 Hours												
$W = z^2$ and $W = e^z$. Cauchy's Theorem (with proof), Generalized Cauchy's integral formula, Singularities, Poles and Residues, Residue theorem (without proof)-Problems.												
Text Book	Text Book 1: 20.10, 20.13, 20.14, 20.18. Text Book 2: 14.1, 14.2, 14.3, 14.4, 16.1, 16.2, 16.3, 16.4, 17.1.											
MODULE-4 PROBABILITY DISTRIBUTIONS 22MAE41.4 8 Hours												
Random variables (discrete and continuous), probability density functions, Discrete Probability distributions: Binomial and Poisson Distributions-Problems. Continuous Probability distributions: Exponential and Normal Distributions-Problems. Joint Probability Distribution-Problems.												
Case Study	Case studies of Probability Theory in signal & image processing and in Optical communication system.											
Text Book	Text Book 1: 26.8, 26.9, 26.12, 26.14, 26.15, 26.16.											

MODULE-5	SAMPLING THEORY	22MAE41.5 22MAE41.6	8 Hours	
Sampling, Sampling distributions, test of hypothesis of large samples for means and proportions, Inferences for variance and proportion. Central limit theorem (without proof), Confidence limits for means, Student's t-distribution, Chi-Square test of goodness of fit and F-distribution for test of goodness of fit for small samples.				
Case Study	Case Studies of Sampling Theory in multi band signal Analysis and Extension of Sampling Theorem in speech Compression.			
Text Book	Text Book 1: 27.2, 27.3, 27.4, 27.5, 27.6, 27.7, 27.8, 27.9, 27.10, 27.11, 27.12, 27.14, 27.15, 27.16, 27.17, 27.19.			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	5	-
L2	Understand	5	5	-
L3	Apply	10	5	10
L4	Analyze	2.5	-	-
L5	Evaluate	2.5	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	5		
L5	Evaluate	5		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.				
2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.				
Reference Books:				
1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.				
2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.				
3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.				
4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.				
Web links and Video Lectures (e-Resources):				
1) https://youtu.be/4lCiEnuhbA4?si=My95pvqwAMRDfjid				
2) https://youtu.be/QQFIWwDA9NM?si=3wJrtlm1NdPSbXmB				
3) https://youtu.be/bI46OqXUtd8?si=_Po-jfq_94X4p_O				
4) https://youtu.be/NqZUHJgitHk?si=Y6viSg1DFA4hgM9u				
5) https://youtu.be/oPPJNoKYCro?si=A5zWC_vQQaHY7HIQ				
6) https://youtu.be/hll0DAilhoA?si=2dN3KfjMBy9ZGxjD				
7) https://youtu.be/x6X1P8rGXXs?si=YcmH8nxx1iQwq8mA				
8) https://youtu.be/dOr0NKyD31Q?si=dMBU-BXGdGL6jIZy				

- 9) <https://youtu.be/BR1nN8DW2Vg?si=melzz97SqhK3wr-->
10) https://youtu.be/ugd4k3dC_8Y?si=xF5U2gjIgp0woDQt
11) https://youtu.be/z0Ry_3_qhDw?si=6IG2a65BZgdbaKsn
12) https://youtu.be/36cAE1Ovpq4?si=jfR8gkFmMOckWNZ_
13) <https://youtu.be/vFz2FG65Hbc?si=SCHi3Y1XuHWg-pPT>
14) <https://youtu.be/2Dsz1lZBJ3Y?si=8ATLUE-mkISMewO3>

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
 - Organizing Group wise discussions on related topics
 - Seminars

SYSTEM DESIGN USING HDL														
Course Code	22ECE42					CIE Marks			50					
L:T:P:S	3:0:0:0					SEE Marks			50					
Hrs / Week	3					Total Marks			100					
Credits	03					Exam Hours			03					
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE42.1	Illustrate the importance of HDL for the automation of VLSI design													
22ECE42.2	Employ VHDL and / or Verilog data types and operators for describing the electronic hardware													
22ECE42.3	Examine the usage of various types of assignments in Verilog													
22ECE42.4	Identify the need of synthesis in the implementation of HDL													
22ECE42.5	Apply design rules to write Verilog code for the design of specific applications													
22ECE42.6	Distinguish between the commonly used programmable devices													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE42.1	3	3	-	-	-	-	-	-	-	-	-	2	3	2
22ECE42.2	3	3	2	-	-	-	-	-	-	-	-	2	3	2
22ECE42.3	3	3	2	-	-	-	-	-	-	-	-	2	3	2
22ECE42.4	3	3	2	1	-	-	-	-	-	-	-	2	3	2
22ECE42.5	3	3	2	1	-	-	-	-	-	-	-	2	3	2
22ECE42.6	3	3	2	1	-	-	-	-	-	-	-	2	3	2
MODULE-1	INTRODUCTION TO VHDL										22ECE42.1, 22ECE42.2, 22ECE42.3		8 Hours	
A brief history of HDL, Structure of HDL module, Translation of VHDL Code into a Circuit, Operators, Data types, Types of Descriptions (Behavioral, structural, Data-flow), Procedures and functions, Brief comparison of VHDL and Verilog.														
Self-study / Case Study / Applications	Case study on designing combinational and sequential circuits using VHDL .													
Text Book	Text Book 1: chapter 1,6; Text 3: 1.5													
MODULE-2	INTRODUCTION TO VERILOG										22ECE42.1, 22ECE42.2, 22ECE42.3		8 Hours	
Computer-Aided Design, Hardware Description Languages, Verilog Data Types and Operators, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments.														
Self-study / Case Study / Applications	Design of combinational circuits using Verilog .													
Text Book	Text Book 2: 2.1,2.2,2.3,2.11, 2.4,2.5													
MODULE-3	PROCEDURAL ASSIGNMENTS										22ECE42.1, 22ECE42.2, 22ECE42.3		8 Hours	
Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, SRAM model.														

Self-study / Case Study / Applications	Design of sequential circuits using Verilog.			
Text Book	Text Book 2: 2.6,2.7,2.8, 2.13, 2.14,2.15,8.6			
MODULE-4	SIMULATION AND SYNTHESIS	22ECE42.3, 22ECE42.5	8 Hours	
Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Simple Synthesis Examples. Constants, Arrays, Loops in Verilog, Testing Verilog Model, Verilog functions, Verilog Tasks, System functions. DESIGN EXAMPLES: A BCD Adder, 32-Bit Adders, Array Multiplier.				
Self-study / Case Study / Applications	Perform Simulation and synthesis of digital circuits.			
Text Book	Text Book2: 2.9,2.10,2.12,2.16,2.17,2.18,2.19, 8.1,8.2,8.11,4.2,4.3,4.9			
MODULE-5	INTRODUCTION TO PROGRAMMABLE LOGIC DEVICES AND DESIGNING WITH FPGA	22ECE42.4, 22ECE42.6	8 Hours	
Brief Overview of Programmable Logic Devices. Simple Programmable Logic Devices (SPLDs)- Read Only Memories, Programmable Logic Arrays, Programmable array Logic. Complex Programmable Logic Devices (CPLDs). Field Programmable Gate Arrays (FPGAs) - Organization of FPGAs, FPGA Programming techniques, Programmable Logic block Architecture, Design flow of FPGAs, Implementing Functions in FPGAs				
Self-study / Case Study / Applications	Interfacing with FPGA.			
Text Book	Text Book2: 3.1,3.2,3.3,3.4,6.1			
CIE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	5	-
L4	Analyze	5	5	-
L5	Evaluate	-	5	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	--		
Suggested Learning Resources:				
Text Books:				
1) HDL Programming (VHDL and Verilog), Nazeih M. Botros, 2015, John-Weily India Pvt.Ltd				
2) Digital System design Using Verilog, Charles H. Roth Jr., Lizy Kurian John, Byeong Kil Lee, 1st Edition, 2015, CL Engineering.				

3) Volnei A. Pedroni, "Circuit Design with VHDL", The MIT Press, 2004.

Reference Books:

1) Digital Systems Design using VHDL, Charles H Roth, Jr., 2007, Thomson

2) Digital Design: An Embedded Systems approach Using VERILOG, Peter J. Ashenden, 2014, Elsevier

3) J Bhaskar, "A Verilog HDL Primer (3/e)", Kluwer, 2005

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_cs63/preview
- https://onlinecourses.nptel.ac.in/noc21_ee97/preview
- <https://www.youtube.com/watch?v=PIGvZSlSLK>
- https://www.youtube.com/watch?v=bwoyQ_RnaiA

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration on different FPGAs
- Class Presentation
- Contents related activities (Activity-based discussions)
- For active participation of students, conduct program solving sessions
- Design thinking activity
- Seminars

HARDWARE DESCRIPTION LANGUAGE LAB															
Course Code	22ECL42										CIE Marks	50			
L:T:P:S	0:0:1:0										SEE Marks	50			
Hrs / Week	2										Total Marks	100			
Credits	01										Exam Hours	03			
Course outcomes:															
At the end of the course, the student will be able to:															
22ECL42.1	Build the Verilog / VHDL programs to simulate Combinational circuits in Dataflow, Behavioral and Gate level Abstractions														
22ECL42.2	Simulate sequential circuits like flip flops and counters in Behavioral description and obtain simulation waveforms														
22ECL42.3	Design the functionality of digital circuit/system by writing test benches														
22ECL42.4	Synthesize the digital circuits on programmable ICs and test the hardware														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECL42.1	3	3	2	-	3	-	-	-	1	-	-	2	3	2	
22ECL42.2	3	3	2	-	3	-	-	-	1	-	-	2	3	2	
22ECL42.3	3	3	2	1	3	-	-	-	1	-	-	2	3	2	
22ECL42.4	3	3	2	1	3	-	-	-	1	-	-	2	3	2	
Exp. No. / Pgm. No.	List of Experiments / Programs											Hours	COs		
Prerequisite Experiments / Programs / Demo															
	Digital electronics circuits, combinational and sequential circuits, state diagrams.											2	NA		
PART-A															
1	Quartus Prime Design Software tool flow (www.intel.com)											2	22ECL42.1 22ECL42.2 22ECL42.3 22ECL42.4		
2	Write an HDL code to describe the functions of a Full Adder using three modeling styles											2	22ECL42.1 22ECL42.3		
3	Write a model for 16bit ALU using the 4bit opcodes; the requisite functions can be defined for the chosen opcodes											2	22ECL42.1 22ECL42.3		
4	Write an HDL program for the following designs: a. 4 bit Binary to Gray converter b. 4-bit Binary Comparator											2	22ECL42.1 22ECL42.3		
5	Write an HDL program for the following designs: a) Decoder & Encoder b) Develop the HDL code for the following flipflops: T, D, SR, JK.											2	22ECL42.1 22ECL42.3 22ECL42.2 22ECL42.3		
6	Design 4-bit Binary and BCD counters (Synchronous reset and Asynchronous reset and "any sequence" counters).											2	22ECL42.2 22ECL42.3		
PART-B															
7	Synthesize the code of above experiments and generate gate level netlist.											2	22ECL42.4		

8	Study the use of clocks in timed circuits: Timers and Real-Time Clocks	2	22ECL42.3 22ECL42.4
9	Implement a finite state machine (FSM) that recognizes two specific sequences of applied input symbols, namely four consecutive 1s or four consecutive 0s.	2	22ECL42.2 22ECL42.3
10	Write an HDL code to display messages on the given seven segment display	2	22ECL42.3 22ECL42.4
11	Write the HDL code to control speed, direction of dc and stepper motor	2	22ECL42.3 22ECL42.4
12	Write the HDL code to generate different waveforms (sawtooth, sine wave, square, triangle, ramp etc) using DAC and FPGA kit	2	22ECL42.4

PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

1. Synthesis of Boolean relations using Digital Comparator of two binary numbers
<https://dec-iitkgp.vlabs.ac.in/exp/digital-comparators/>
2. To design multiplexers etc. using vhdl coding
<https://vlab.amrita.edu/?sub=3&brch=66&sim=531&cnt=862>
3. To build an FSM that would detect the pattern 101
https://mddl-iitb.vlabs.ac.in/sequence_detector/index.html
4. Simple Processor
<https://www.intel.com/content/www/us/en/developer/topic-technology/fpga-academic/materials-digital-logic.html>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. HDL Programming (VHDL and Verilog), Nazeih M. Botros, 2015, John-Wiley India Pvt. Ltd
2. Digital System design Using Verilog, Charles H. Roth Jr., Lizy Kurian John, Byeong Kil Lee, 1 st Edition, 2015, CL Engineering.
3. Volnei A. Pedroni, "Circuit Design with VHDL", The MIT Press, 2004
4. Digital Systems Design using VHDL, Charles H Roth, Jr., 2007, Thomson
5. Digital Design: An Embedded Systems approach Using VERILOG, Peter J. Ashenden, 2014, Elsevier.
6. Verilog HDL: A Guide to Digital Design and Synthesis, 2 nd Ed, Samir Palnitkar, PHI, 2003

DIGITAL SIGNAL PROCESSING															
Course Code	22ECE43								CIE Marks	50					
L:T:P:S	3:0:0:0								SEE Marks	50					
Hours / Week	3								Total Marks	100					
Credits	03								Exam Hours	03					
Course outcomes:															
At the end of the course, the student will be able to:															
22ECE43.1	Apply the knowledge of Fourier analysis to compute Discrete Fourier Transforms of signals														
22ECE43.2	Use the concept of convolutional operators for linear filtering techniques														
22ECE43.3	Determine the DFT and inverse DFT using Fast Fourier Transform algorithms														
22ECE43.4	Design the digital filters to obtain the desired response														
22ECE43.5	Illustrate the basic features of programmable Digital Signal Processor														
22ECE43.6	Develop different digital signal processing applications using DSP processor														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECE43.1	3	-	-	-	-	-	-	-	-	-	-	2	3	2	
22ECE43.2	3	3	-	-	3	-	-	-	-	-	-	2	3	2	
22ECE43.3	3	3	2	-	-	-	-	-	-	-	-	2	3	2	
22ECE43.4	3	3	2	-	3	-	-	-	-	-	-	2	3	2	
22ECE43.5	3	-	-	-	-	-	-	-	-	-	-	2	3	2	
22ECE43.6	3	-	-	1	3	-	-	-	-	-	-	2	3	2	
MODULE-1 INTRODUCTION TO SIGNAL PROCESSING AND DISCRETE FOURIER TRANSFORMS															
22ECE43.1															
8 Hours															
Classification of signals and systems, Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms, Computation of N - point DFT and IDFT, Properties of DFT.															
Self Study Investigate the various characteristics of LTI System.															
Text Book Text Book1: 7.1, 7.2															
MODULE-2 DSP ALGORITHMS															
22ECE43.2,22ECE43.3															
8 Hours															
Convolution: Linear Convolution, Circular convolution, Stockham Method.															
Fast Convolution overlap-save and overlap-add method.															
FFT algorithm: Need for efficient computation of the DFT, Radix-2 FFT algorithm for the computation of DFT and IDFT, decimation-in time and decimation-in-frequency algorithms.															
Case Study Case study on Designing wind speeds using fast Fourier transform.															
Text Book Text Book 1: 8.1,8.1.3															
MODULE-3 FIR AND IIR FILTERS															
22ECE43.4															
8 Hours															
Design of FIR filter: Need, types and characteristics of window, design of FIR filters using Rectangular and Hamming window.															
Design of IIR Filter: Analog to analog frequency transformations, Impulse Invariance method, Bilinear Transformation, Digital Butterworth filter design.															
Self-study Realization of FIR and IIR filters -Direct Form 1 and 2, Cascade and Parallel.															

Text Book	TextBook1:9.2.1, 10.2.1, 10.2.2 Text Book1: 9.3.1, 9.3.3, 9.3.4, 10.3.2, 10.3.3, 10.3.4, 10.4.1			
MODULE-4	PROGRAMMABLE DIGITAL SIGNAL PROCESSOR	22ECE43.5, 22ECE43.6	8 Hours	
An Introduction to Programmable Digital Signal Processor: DSP system, Features of Digital Signal Processors, shifter, Barrel Shifter, MAC unit, Pipelining in DSP Processor Number formats: Fixed point and Floating-Point formats, Q notation.				
Applications	Interfacing FIR LPF of order 5 and cut off frequency of 1000 HZ. Audio application using C/C++.			
Text Book	Text Book2: -1.1,1.2,1.3, 3.1,3.2 ,4.1,4.2,4.3 ,7.2			
MODULE-5	MULTI-RATE DIGITAL SIGNAL PROCESSING AND ITS APPLICATIONS	22ECE43.5, 22ECE43.6	8 Hours	
Introduction, decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by the factor of I/D, Digital Filter Banks. Application: Radar signal Processing, DSP based measurement system.				
Applications	Noise cancelation using adaptive filters.			
Text Book	Text Book2: 1.1,1.2,1.3, 3.1,3.2 ,4.1,4.2,4.3 ,7.2			
CIE Assessment Pattern (50 Marks - Theory) -				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	5	-
L4	Analyze	5	5	-
L5	Evaluate	-	5	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels / Marks Distribution	Exam			
	50			
Remember: L1	10			
Understand: L2	10			
Apply: L3	20			
Analyze: L4	10			
Evaluate: L5	-			
Create: L6	-			

Suggested Learning Resources:

Text Books:

1. Digital signal processing: Principles, Algorithms & Applications, Proakis & Monalakis, 4thEdition, 2014, Pearson education.
2. Digital Signal Processing, Avtar Singh & S. Srinivasan, Thomson Brooks /Cole, 2004
3. Digital Signal Processing, P. Ramesh Babu, 6th Edition, 2014, Scitech Publications

Reference Books:

- 1) Discrete Time Signal Processing, Oppenheim & Schaffer, 7th Edition, 2010, TMH.
2. Digital Signal Processing, S. K. Mitra, 4thEdition, 2014, Tata Mc-GrawHill.

Web links and Video Lectures (e-Resources):

- <https://youtu.be/QcuIYZ4RRE>
- <https://www.youtube.com/watch?v=rwENxNH0zdA>
- <https://www.youtube.com/watch?v=ADnSkJnprBY>
- <https://www.youtube.com/watch?v=Bdw3XcXgHa8>
- https://www.youtube.com/watch?v=HVGW85eGPQQ&list=PLyqSpQzTE6M_h5UgZWpybzBVD_GmHGhQQb
- https://www.youtube.com/watch?v=MOzY8cIBiFs&list=PLgMDNELGI1CYvviJ_ZHrHy5TKLb-Vn7-r
- <https://www.youtube.com/watch?v=Iw77CYUT74c&t=17s>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in Digital Signal Processing
- Contents related activities (Activity-based discussions)
- For active participation of students, conduct problem solving sessions
- Organizing Group wise discussions on issues
- Seminars

DIGITAL SIGNAL PROCESSING LAB														
Course Code	22ECL43										CIE Marks		50	
L:T:P:S	0:0:1:0										SEE Marks		50	
Hrs / Week	2										Total Marks		100	
Credits	01										Exam Hours		03	
Course outcomes:														
At the end of the course, the student will be able to:														
22ECL43.1	Analyze the signals in Time domain and Frequency domain for different DSP Algorithms													
22ECL43.2	Design FIR and IIR filters for the desired frequency response													
22ECL43.3	Implement discrete computations using DSP processor													
22ECL43.4	Analyze the response of digital filters using a simulation tool													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012	PS01	PS02
22ECL43.1	3	2	1	-	3	-	-	-	-	-	-	2	3	2
22ECL43.2	3	2	2	-	3	-	-	-	-	-	-	2	3	2
22ECL43.3	3	2	1	-	3	-	-	-	-	-	-	2	3	2
22ECL43.4	3	2	1	-	3	-	-	-	-	-	-	2	3	2
Exp. No. / Pgm. No.	List of Programs											Hours	COs	
Prerequisite Programs														
	<ul style="list-style-type: none"> LTI System and its properties. Types of signals, autocorrelation and cross correlation basics. 											2	NA	
PART-A														
1	Computation of N-point DFT of a given sequence and plotting of Magnitude and phase spectrum.											2	22ECL43.1	
2	Linear convolution & Circular convolution of two sequences using DFT/IDFT.											2	22ECL43.1	
3	Auto correlation and cross correlation of given signals in time domain and frequency domain.											2	22ECL43.1	
4	Computation of FFT and IFFT using User defined function.											2	22ECL43.1	
5	Design and implementation of IIR filters of different types (Butter worth: low pass, high pass, band pass and band reject) to meet given specifications.											2	22ECL43.2	
6	Design and implementation of FIR filters of different types using windowing techniques to meet given specifications.											2	22ECL43.2	
PART-B														
7	Computation of N-Point DFT of a given sequence using DSP Processor.											2	22ECL43.3	
8	Impulse response of first order and second order system using DSP Processor.											2	22ECL43.3	
9	Linear convolution and circular convolution of two given sequences using DSP Processor.											2	22ECL43.3	
10	Sampling of a signal using MATLAB Simulink.											2	22ECL43.4	
11	Design of IIR filter of different types (Butter worth): low pass, high pass, band pass and band reject) to meet given specifications using MATLAB Simulink.											2	22ECL43.4	

12	Design of FIR filter to meet given specifications using MATLAB Simulink.	2	22ECL43.4
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PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)

1. Study of sampling theorem, effect of undersampling.
<http://vlabs.iitkgp.ernet.in/dsp/exp1/index.html>
2. Study of properties of Linear time-invariant system.
<http://vlabs.iitkgp.ernet.in/dsp/exp4/index.html>
3. Study of convolution: series and parallel system.
<http://vlabs.iitkgp.ernet.in/dsp/exp5/index.html>
4. Study of Transform domain properties and its use.
<http://vlabs.iitkgp.ernet.in/dsp/exp7/index.html>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. Digital signal processing: Principles, Algorithms & Applications, Proakis & Monalakis, 4th Edition, 2014, Pearson education.
2. Digital Signal Processing. Ramesh Babu, 6thEdition, 2014, Scitech Publications.
3. Discrete Time Signal Processing, Oppenheim & Schaffer, 7thEdition, 2010, TMH.
4. Digital Signal Processing, S. K. Mitra, 4thEdition, 2014, Tata Mc-Graw Hill.

MICROPROCESSORS AND INTERFACING															
Course Code	22ECE44										CIE Marks	50			
L:T:P:S	3:0:0:0										SEE Marks	50			
Hrs / Week	3										Total Marks	100			
Credits	03										Exam Hours	03			
Course outcomes:															
At the end of the course, the student will be able to:															
22ECE44.1	Understand the functional features of 8086 Microprocessor														
22ECE44.2	Apply the knowledge of addressing modes to write assembly language program in 8086														
22ECE44.3	Analyze different assembler directives and interrupt methods in 8086 programming														
22ECE44.4	Examine the timing diagrams using minimum and maximum mode configuration of 8086.														
22ECE44.5	Model the peripheral Interfacing concepts in 8086														
22ECE44.6	Build the system using microprocessor and peripherals for real time applications														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECE44.1	2	-	-	-	-	-	-	-	-	-	-	-	3	-	
22ECE44.2	3	-	-	-	2	-	-	-	-	-	-	3	3	2	
22ECE44.3	3	3	-	-	2	-	-	-	-	-	-	3	3	2	
22ECE44.4	3	3	-	-	2	-	-	-	-	-	-	3	3	-	
22ECE44.5	3	3	2	-	2	-	-	-	-	-	-	3	3	2	
22ECE44.6	3	3	2	2	2	-	-	-	-	-	-	3	3	2	
MODULE-1 ARCHITECTURE OF 8086															
22ECE44.1	8 Hours														
Overview of 8086 Microprocessor Family, Architecture of 8086, Signal Descriptions of 8086, Addressing Modes, Machine language, Instruction formats, Instruction set.															
Text Book			Text Book 1: 2.11, 2.12,2.13,2.14,2.15, 2.16 Text Book-2: 1.3, 2.1, 2.2, 2.3												
MODULE-2 ASSEMBLY LANGUAGE PROGRAMMING															
22ECE44.2,	8 Hours														
22ECE44.3															
Introduction to Programming of 8086, Simple Assembly Language Programming, Assembler Directives, Interrupts, Interrupt cycle of 8086 and Interrupt Service Routines.															
Text Book			Text Book 1: 6.30-6.36 Text Book-2: 2.4, 3.4, 4.3, 4.4, 4.5, 4.6, 4.7												
MODULE-3 8086 BUS CONFIGURATION AND TIMINGS															
22ECE44.4	8 Hours														
Memory Organization, Bus operation, Minimum Mode and Timing diagrams, Maximum Mode and Timing diagrams. Procedures and Macros.															
Text Book			Text Book 2: 1.4 1.5,1.6, 1.8 ,1.9, 4.8, 4.10												
MODULE-4 PERIPHERAL INTERFACING															
22ECE44.5	8 Hours														
Interfacing I/O Ports, Programmable Peripheral Interface (8255), Keyboard Display controller (8279), Programmable interrupt controller (8259), Programmable DMA Controller (8257).															
Text Book			Text Book 2: 5.3,5.4,5.5,6.2,6.3,7.1.7.2												
MODULE-5 APPLICATIONS OF 8086															
22ECE44.6	8 Hours														
Interfacing simple switches and LEDs using 8255, Stepper Motor Interfacing. ADC-0808/0809, DAC-0800, Timer Operating Modes of 8254, Interfacing programs.															
Text Book			Text Book 2: 5.5,5.6, 5.7.2, 5.8												

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	20	05
L1	Remember	5	-	-
L2	Understand	5	5	-
L3	Apply	10	5	5
L4	Analyze	5	5	-
L5	Evaluate	-	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:**Text Books:**

- 1) Microprocessor and Interfacing- Douglas V Hall, SSSP Rao, 3rd edition, TMH, 2012.
- 2) Advanced Microprocessors and Peripherals- A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2015.

Reference Books:

- 1) Microcomputer systems-The 8086 / 8088 Family – Y.C. Liu and A.Gibson, 2nd edition, PHI -2003.
- 2) The 8086 Microprocessor: Programming & Interfacing the PC – Kenneth J Ayala, ENGAGE Learning, 2011.
- 3) The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ee09/preview
- https://www.tutorialspoint.com/microprocessor/microprocessor_io_interfacing_overview.htm
- https://www.youtube.com/results?search_query=microprocessor+architecture+8086

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Industrial Visit to Electronics Based Companies
- Demonstration of Manufacturing/Fabrication of ICs
- Video demonstration of latest trends in Processors
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Flowcharts and Handouts
 - Organizing Group wise discussions on processor developments
 - Seminars and Workshops

MICROPROCESSORS LAB														
Course Code	22ECL44				CIE Marks				50					
L:T:P:S	0:0:1:0				SEE Marks				50					
Hrs / Week	2				Total Marks				100					
Credits	01				Exam Hours				03					
Course outcomes:														
At the end of the course, the student will be able to:														
22ECL44.1	Develop assembly level programs using 8086 to perform arithmetic and logical operations													
22ECL44.2	Build assembly code for string operations, sorting of numbers and branch instructions of 8086													
22ECL44.3	Design 8086 assembly level programs to perform Seven Segment Display and Keyboard interfacing													
22ECL44.4	Demonstrate the interfacing of 8086 with stepper motor and LCD modules, and other relevant peripherals													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
22ECL44.1	3	-	-	-	2	-	-	-	1	-	-	2	3	2
22ECL44.2	3	3	-	-	2	-	-	-	1	-	-	2	3	2
22ECL44.3	3	-	1	-	2	-	-	-	1	-	-	2	3	2
22ECL44.4	3	3	1	1	2	-	-	-	1	-	-	2	3	2
Exp. No. / Pgm. No.														
List of Programs														
Prerequisite Programs														
PART-A														
1	Write an assembly level programs for basic arithmetic operations using 8086 (i) Unsigned and signed Addition (32 bit and 16 bit) (ii) Unsigned and signed Subtraction (32 and 16 bit)											2	22ECL44.1	
2	Write an assembly level programs for basic arithmetic operations using 8086 (i) Signed and Unsigned Multiplication (8 bit and 16 bit) (ii) Signed and Unsigned division (8 bit and 16 bit)											2	22ECL44.1	
3	Write an assembly level programs assembly level programs for basic logical operation using 8086 (i) To check number is positive or negative (ii) To count number of one's and zero's											2	22ECL44.1	
4	Write an assembly level program to separate even and odd number using 8086											2	22ECL44.2	
5	Write an assembly Level programs for code conversion of 8086 (i) ASCII to binary (ii) Decimal to Hex (iii) ASCII to Decimal (iv) Binary to BCD and vice versa											2	22ECL44.2	

6	Write an assembly level programs for String operations using 8086 (i) Reverse the string (ii) To check whether the string is palindrome or not	2	22ECL44.2
PART-B			
7	Write an assembly level program using 8086 for sorting operations like ascending, descending, largest and smallest in microprocessor	2	22ECL44.2
8	Interfacing of Seven segment using 8086 microprocessors	2	22ECL44.3
9	Interfacing of Keyboard Display using 8086 microprocessors	2	22ECL44.3
10	Interfacing of 8086 with (Assembly Level Programming) LED modules, switches.	2	22ECL44.4
11	Interfacing of 8086 with (Assembly Level Programming) Logic controller (BCD up counter and down counter)	2	22ECL44.4
12	Assembly Level Programming to illustrate the interfacing of stepper motor with 8086	2	22ECL44.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. Design of Ripple Carry Adders
https://cse.iitkgp.ac.in/~chitta/coldvl/rca_design.html
2. Design of Arithmetic Logic Unit
<http://vlabs.iitkgp.ac.in/coa/exp8/index.html>
3. CPU Design
<http://vlabs.iitkgp.ac.in/coa/exp12/index.html#>
4. Booth Multiplier
<http://vlabs.iitkgp.ernet.in/coa/exp7/index.html>
5. Traffic light Controller using 8086
<https://www.youtube.com/watch?v=t3thKRqMK2M>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:**Reference Books:**

- 1) Microprocessor and Interfacing- Douglas V Hall, SSSP Rao, 3rd edition, TMH, 2012.
- 2) Advanced Microprocessors and Peripherals- A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition, 2015
- 3) The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003.

OBJECT ORIENTED PROGRAMMING USING JAVA														
Course Code	22ECE451				CIE Marks	50								
L:T:P:S	2:0:1:0				SEE Marks	50								
Hrs / Week	2+2				Total Marks	100								
Credits	03				Exam Hours	03								
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE451.1	Use the syntax and semantics of java programming language and basic concepts of OOP													
22ECE451.2	Analyse the working of operators in JAVA for the development of simple programs													
22ECE451.3	Apply I/O and file handling concepts to develop Java programs													
22ECE451.4	Compare the implementation of different Inheritance in Java													
22ECE451.5	Develop reusable programs using the concepts of interfaces, packages and exception handling in Java													
22ECE451.6	Create, debug and execute the Java programs using Java JDK environment													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE451.1	2	-	-	-	-	-	-	-	-	-	-	-	2	2
22ECE451.2	3	2	-	-	3	-	-	-	-	-	-	3	2	2
22ECE451.3	3	-	-	-	3	-	-	-	-	-	-	3	2	2
22ECE451.4	3	2	-	-	-	-	-	-	-	-	-	-	2	2
22ECE451.5	3	2	-	-	-	-	-	-	-	-	-	-	2	2
22ECE451.6	3	2	-	-	3	-	-	-	-	-	-	3	2	2
MODULE-1 INTRODUCTION TO JAVA 22ECE451.1 5 Hours														
An Overview of Java: Object-Oriented Programming, A First Simple Program, A Second Short Program, Two Control Statements, Lexical Issues, Data Types, Variables, and Arrays: The Primitive Types, Integers, Floating-Point Types, Characters, Booleans, A Closer Look at Literals, Variables, Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays.														
Laboratory Component: 3 Hours														
1. Software Installing / IDE for Java 2. Java Program to Implement Type Casting of the Datatype 3. Java Program to illustrate Type Conversion.														
Case study The Java Class Libraries.														
Text Book Text Book 1: Ch 2, Ch 3														
MODULE-2 OPERATORS 22ECE451.2 5 Hours														
Arithmetic Operators, The Bitwise Operators, Relational Operators, Boolean Logical Operators, The Assignment Operator, The ? Operator, Operator Precedence, Using Parentheses Control Statements: Java's Selection Statements, Iteration Statements, Jump Statements.														
Laboratory Component: 3 Hours														
1. Java program to illustrate working of various operators. 2. Java program to illustrate working of control statements. 3. Java program to illustrate working of looping and iteration.														
Text Book Text Book 1: Ch 4, Ch 5														
MODULE-3 CLASSES, I/O AND FILE HANDLING 22ECE451.3 5 Hours														
Class fundamentals, Declaring Objects, Assigning Object Reference variables, Introducing Methods, Constructors, The This Keyword, Garbage collection, The Finalize method () I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing files														
Laboratory Component: 3 Hours														
1. Write a program to define a class, describe its constructor with overloading, instantiate its object and use static members. 2. Write a program to demonstrate File I/O operations.														

3. Write a program to demonstrate nested classes and array of objects.				
Self-study	Exercise on File operations			
Text Book	Text Book 1: Ch 6 and Ch 13			
MODULE-4	INHERITANCE	22ECE451.4 22ECE451.6	5 Hours	
Inheritance, Using super, creating a Multilevel Hierarchy, When Constructors Are Called, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, The Object Class.				
Laboratory Component:			3 Hours	
1. Write a program to implement inheritance in Java . 2. Write a java program to demonstrate dynamic binding using method overriding. 3. Write a program to implement multilevel inheritance.				
Text Book	Text Book 1: Ch 8			
MODULE-5	PACKAGES, INTERFACES AND EXCEPTION HANDLING	22ECE451.5 22ECE451.6	5 Hours	
Packages, Access Protection, Importing Packages, Interfaces Exception Handling: Exception Types, Uncaught Exceptions, Using try and catch block, Multiple catch clauses, Nested try statements, throw, throws, finally block.				
Laboratory Component:			3 Hours	
1. Write a program to demonstrate the use of extending interfaces 2. Write a program to implement the concept of importing classes from user defined packages 3. Write a program to implement the concept of Exception Handling				
Self study	Know Java's Built-in Exceptions.			
Text Book	Text Book 1: Ch 9 and Ch 10			
CIE Assessment Pattern (50 Marks - Theory and Lab)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	10	5	10
L4	Analyze	5	-	5
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks - Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		

Suggested Learning Resources:

Text Books:

1. Herbert Schildt, Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.

Reference Books:

- 1) Herbert Schildt, Java™: The Complete Reference, McGraw-Hill, 12th edition, November 2021, ISBN: 978-1-260-46341-5
- 2) Cay S. Horstmann, Core Java® SE 9 for the Impatient, Addison Wesley, Second Edition, 2018, ISBN: 978-013-4694726
- 3) Think Java How to Think Like a Computer Scientist Allen B. Downey and Chris Mayfield 6.1.3 Green Tea Press Needham, Massachusetts 2016
<https://www.pdfdrive.com/think-java-how-tothink-like-acomputer-scientiste17327018.html>

Web links and Video Lectures (e-Resources):

1. https://www.onlinegdb.com/online_java_compiler
2. <https://www.geeksforgeeks.org/java/>

IoT PROGRAMMING														
Course Code	22ECE452					CIE Marks	50							
L:T:P:S	2:0:1:0					SEE Marks	50							
Hours / Week	2+2					Total Marks	100							
Credits	03					Exam Hours	03							
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE452.1	Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT													
22ECE452.2	Compare different sensing devices and actuator types													
22ECE452.3	Demonstrate the processing in IoT which can interact with Sensors and Actuators													
22ECE452.4	Design an IoT device to work with a Cloud Computing infrastructure													
22ECE452.5	Make Use of IoT protocols for communication													
22ECE452.6	Investigate the IoT applications for resolving real-world problems and life-long learning													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE452.1	2	-	-	-	-	-	-	-	-	-	-	-	3	3
22ECE452.2	3	2	-	-	-	-	-	-	-	-	-	-	3	3
22ECE452.3	3	3	2	-	2	-	-	-	-	-	-	2	3	3
22ECE452.4	3	3	2	1	2	-	-	-	-	-	-	2	3	3
22ECE452.5	3	3	2	1	2	-	-	-	-	-	-	2	3	3
22ECE452.6	-	-	2	1	2	-	-	-	2	-	-	2	3	3
MODULE-1 Introduction 22ECE452.1 5 Hours														
Basics of Networking: Introduction, Network Types, Layered network models.														
Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components.														
Laboratory Component:													3 Hours	
1. Led Control Using Arduino Board.														
2. Potentiometer And Ir Sensor Interfacing with Arduino.														
3. Controlling Two Actuators Using Arduino.														
Case Study		Aurdino Installation and Various libraries												
Text Book		Textbook 1: Chapter 1- 1.1 to 1.3 Chapter 4 – 4.1 to 4.4												
MODULE-2 IoT Sensing and Actuation 22ECE452.2 5 Hours														
Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.														
Laboratory Component:													3 Hours	
1. Creation of Things Speak Account.														
2. Actuator Controlling Through Cloud.														
3. Dht11sensor Data to Cloud.														
Case Study		Different sensors and Actuators.												
Text Book		Textbook 1: Chapter 5 – 5.1 to 5.9												
MODULE-3 IoT Processing Topologies and Types 22ECE452.3 5 Hours														

Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.				
Laboratory Component:			3 Hours	
<ol style="list-style-type: none"> IoT based Air Pollution Control System. Tds Sensor Interfacing with Arduino. Actuator Controlling by Mobile Using Arduino. 				
Case Study		IoT Applications in Environment		
Text Book		Textbook 1: Chapter 6 – 6.1 to 6.5		
MODULE-4	ASSOCIATED IoT TECHNOLOGIES	22ECE452.4	5 Hours	
ASSOCIATED IoT TECHNOLOGIES Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. IoT CASE STUDIES Agricultural IoT – Introduction and Case Studies.				
Laboratory Component:			3 Hours	
<ol style="list-style-type: none"> Soil moisture detection using IoT. Detection of light using Photo resistor. Interfacing of temperature Sensor LM35 with Arduino. 				
Case Study		IoT Applications in Agriculture.		
Text Book		Textbook 1: Chapter 10– 10.1 to 10.6; Chapter 12- 12.1-12.2		
MODULE-5	IOT CASE STUDIES AND FUTURE TRENDS	22ECE452.5 22ECE452.6	5 Hours	
Vehicular IoT – Introduction Healthcare IoT – Introduction, Case Studies IoT Analytics – Introduction				
Laboratory Component:			3 Hours	
<ol style="list-style-type: none"> Interfacing Servo motor with Arduino. Intrusion detection system with Arduino. Direction control Using Arduino. 				
Case Study		IoT Applications in Vehicles, Healthcare.		
Text Book		Textbook 1: Chapter 13– 13.1; Chapter 14- 14.1-14.2; Chapter 17- 17.1		
CIE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	10	5	10
L4	Analyze	5	-	5
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks – Theory)				
RBT Levels / Marks Distribution		Exam		
		50		

Remember: L1	10	
Understand: L2	10	
Apply: L3	20	
Analyze: L4	10	
Evaluate: L5	-	
Create: L6	-	
Suggested Learning Resources:		
Books		
1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021. Reference:		
2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.		
3. Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.		
4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.		
Web links and Video Lectures (e-Resources):		
1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/		
Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning		
<ul style="list-style-type: none"> • Video demonstration of IoT Programming <p>Contents related activities (Activity-based discussions)</p> <ul style="list-style-type: none"> • For active participation of students, conduct problem solving sessions • Organizing Group wise discussions on issues • Seminars 		

Course Code	22ECE453		CIE Marks	50										
L:T:P:S	2:0:1:0		SEE Marks	50										
Hours / Week	2+2		Total Marks	100										
Credits	03		Exam Hours	03										
Course outcomes:														
At the end of the course, the student will be able to:														
22ECE453.1	Understand the embedded Linux development environment													
22ECE453.2	Apply Linux BSP for a hardware platform													
22ECE453.3	Analyze the Linux model for embedded storage													
22ECE453.4	Use the drivers for embedded storage applications													
22ECE453.5	Compare different embedded Linux drivers such as serial, I2C, and so on													
22ECE453.6	Create Port applications to embedded Linux from a traditional RTOS													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE453.1	2	-	-	-	-	-	-	-	-	-	-	2	3	3
22ECE453.2	3	3	2	1	2	-	-	-	-	-	-	2	3	3
22ECE453.3	3	3	2	1	2	-	-	-	-	-	-	2	3	3
22ECE453.4	3	3	2	1	2	-	-	-	-	-	-	2	3	3
22ECE453.5	3	3	2	1	2	-	-	-	-	-	-	2	3	3
22ECE453.6	3	3	2	1	2	-	-	-	-	-	-	2	3	3
MODULE-1 Introduction					22ECE453.1		8 Hours							
History of Embedded Linux, Embedded Linux versus Desktop Linux, Embedded Linux Distributions, Architecture of Embedded Linux, Linux Kernel Architecture, Linux StartUp Sequence, GNU Cross Platform Tool chain.														
Laboratory Component:														
Building a cross-compiling toolchain.														
1. Configure the cross tool-ng tool.														
2. Execute cross tool-ng.														
3. Build up your own cross-compiling toolchain.														
Text Book		Text Book 1: 1.1, 1.2,1.3,1.5,2.1,2.2,2.3.,2.4,2.5												
		Text Book 2 : Lab Manual												
MODULE-2 Board Support Package					22ECE453.2		8 Hours							
Inserting BSP in Kernel Build Procedure, Memory Map, Interrupt Management, The PCI Subsystem, Timers, UART, Power Management.														
Laboratory Component														
Access hardware devices and declare new ones														
1. USB														
2. I2C														
3. PCI														
Text Book		Text Book 1: 3.1 to 3.8												
		Text Book 2 : Lab Manual												
MODULE-3 Embedded Storage					22ECE453.3,		22ECE453.4			8 Hours				
Flash Map, MTD—Memory Technology Device, MTD Architecture, Flash Mapping Drivers, MTD Block and Character devices, Embedded File systems, Optimizing Storage Space.														

Laboratory Component:				
<ol style="list-style-type: none"> 1. Bootloader - TF-A and U-Boot. 2. Fetching Linux kernel sources. 3. configure and boot an embedded Linux system relying on block storage. 				
Text Book	Text Book 1: 4.1 to 4.10 Text Book 2 : Lab Manual			
MODULE-4	Embedded Drivers	22ECE453.5	8 Hours	
Linux Serial Driver, Ethernet Driver , I2C Subsystem on Linux, USB Gadgets, Watchdog Timer, Kernel Modules.				
Laboratory Component:				
<ol style="list-style-type: none"> 1. Application Developments using Input Devices. 2. Application Developments using Output Devices. 				
Text Book	Text Book 1: 5.1 to 5.6 Text Book 2 : Lab Manual			
MODULE-5	Porting Applications	22ECE453.6	8 Hours	
Architectural Comparison, Application Porting Roadmap, Programming with threads, Operating System Porting Layer (OSPL), Kernel API Driver				
Case Study / Applications	Real-Time Linux: Linux and Real-Time, Real-Time Programming in Linux, Hard Real-Time Linux			
Text Book	Text Book 1: 6.1 to 6.5			
CIE Assessment Pattern (50 Marks – Theory and Lab)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	10	5	10
L4	Analyze	5	-	5
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		
Suggested Learning Resources:				
Text Books:				
1) Embedded Linux System Design and Development, P. Raghavan, Amol Lad, Sriram Neelakandan, 2006, Auerbach Publications.				
Reference Books:				
1) Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, “Building embedded Linux systems”, O'Reilly, 2008.				

2) <https://bootlin.com/doc/training/embedded-linux/embedded-linux-labs.pdf>

Web links and Video Lectures (e-Resources):

- <https://www.arm.com/resources/education/online-courses/embedded-linux>
- https://regn.nielitvte.edu.in/online_courses.php
- <https://bootlin.com/doc/training/embedded-linux/embedded-linux-labs.pdf>
- [https://extendedstudies.ucsd.edu > courses-and-programs](https://extendedstudies.ucsd.edu/courses-and-programs)

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any ARM Industry.
- Video demonstration of latest trends in mobility/robotics
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Flowcharts and Handouts
 - Organizing Group wise discussions on issues
 - Seminars

PROGRAMMING USING ROBODK																
Course Code	22ECE454					CIE Marks						50				
L:T:P:S	2:0:1:0					SEE Marks						50				
Hrs / Week	2+2					Total Marks						100				
Credits	03					Exam Hours						03				
Course outcomes:																
At the end of the course, the student will be able to:																
22ECE454.1	Understand the different coordinate systems and degrees of freedom for a robot															
22ECE454.2	Illustrate the robotic coordinate systems by teaching the robot															
22ECE454.3	Examine the functionalities of robotic end effectors															
22ECE454.4	Develop various industrial applications using RoboDK															
22ECE454.5	Differentiate tools for Industrial applications using RoboDK simulation tool															
22ECE454.6	Build RoboDK program for basic industrial applications															
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:																
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2		
22ECE454.1	2	-	-	-	2	-	-	-	-	-	-	-	2	2		
22ECE454.2	3	3	-	-	2	-	-	-	-	-	-	-	2	2		
22ECE454.3	3	3	2	-	2	-	-	-	-	-	-	-	2	2		
22ECE454.4	3	3	2	-	2	-	-	-	-	-	-	-	2	2		
22ECE454.5	3	3	2	-	2	-	-	-	-	-	-	-	2	2		
22ECE454.6	3	3	2	-	2	-	-	-	-	-	-	-	2	2		
MODULE-1 INTRODUCTION TO ROBODK 22ECE454.1 8 Hours																
Overview of RoboDK capabilities – Installation and setup - User interface and navigation – Toolbar Menu – Shortcuts – Project creation – Reference Frame – Import 3D Objects – Tool creation – Target setting																
Laboratory Component:																
1. Installation and setup of RoboDK																
2. Project creation																
3. Tools and Target selection																
Case Study	Robot Jogging using RoboDK Virtual Teach Pendant															
Text Book	Text Book 1: RoboDK User Manual – Chapter 1 & 2 Text Book 2: Chapter 1															
MODULE-2 ROBOT INTERFACING 22ECE454.2 22ECE454.6 8 Hours																
Robot Panel – Robot Tool (TCP) – Reference Configuration – Object setting – Main Menu – Option menu – CAD tab – CAM tab – Program tab – Python tab – Accuracy tab.																
Laboratory Component:																
1. Program testing, editing & Touch up																
2. Using and setting up of User frame																
3. Using and setting up of Tool Frame																
Case Study	Robot Reference Frames - RoboDK															
Text Book	Text Book 1: RoboDK User Manual – Chapter 3 & 4															
MODULE-3 ROBOT PROGRAMMING 22ECE454.3, 22ECE454.6 8 Hours																
Offline Programming – Program instructions – Set/wait IO – Program call - Simulate robot program – Generate program – Transfer Program – Post Processor – Convert circular to linear movement – Inline subprogram .																

Laboratory Component:				
1. Practice on various I/O instructions				
2. Practice on Set/Wait and Branching Instructions				
3. Practice on movement conversion				
Case Study	Split large robot Programs			
Text Book	Text Book 1: RoboDK User Manual – Chapter 5			
MODULE-4	ROBODK – MACHINING	22ECE454.4 22ECE454.6	8 Hours	
Robot Manufacturing – Robot machining 3X – Robot machining 5X – Robot machining with external axes – Laser Cutting – Setup for Machining – Approach / Retract – Optimization Parameters – Configurations – Collision detection.				
Laboratory Component:				
1. Practice on Pick and Place application				
2. Practice on Palletization				
3. Practice on Collision Detection				
Case Study	Multi Axis Robot Machining			
Text Book	Text Book 1: RoboDK User Manual – Chapter 6 & 7			
MODULE-5	INDUSTRIAL APPLICATIONS OF ROBOTS	22ECE454.5 22ECE454.6	8 Hours	
Spot welding – Polishing – Deburring – Dispensing – Mold Machining – Robot Cutting – Robot Welding – Laser Cutting.				
Laboratory Component:				
Practice on				
1. Spot welding & welding				
2. Deburring				
3. Cutting				
Case Study	ROBOT Operations and Programming.			
Text Book	Text Book 1 : RoboDK User Manual – Chapter 8.			
CIE Assessment Pattern (50 Marks – Theory and Lab)				
RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment	Lab
		25	05	20
L1	Remember	5	-	-
L2	Understand	5	-	5
L3	Apply	10	5	10
L4	Analyze	5	-	5
L5	Evaluate	-	-	-
L6	Create	-	-	-
SEE Assessment Pattern (50 Marks – Theory)				
RBT Levels		Exam Marks Distribution (50)		
L1	Remember	10		
L2	Understand	10		
L3	Apply	20		
L4	Analyze	10		
L5	Evaluate	-		
L6	Create	-		

Suggested Learning Resources:**Text Books: add latest version of textbook**

1. RoboDK User Manual
2. Deb S.R, "Robotics Technology and flexible automation", Tata McGraw-Hill Education, 2nd Edition 2017.

Reference Books:

1. Mikell P Groover& Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, "Technology Programming and Applications", McGraw Hill, 2012.
2. Introduction to Robotics: mechanics and control, Craig J J, 3/E, Pearson Education India, 2008.

Web links and Video Lectures (e-Resources):

- <https://www.coursera.org/learn/modernrobotics-course1>
- <https://robodk.com/doc/en/Basic-Guide.html#Guide>
- <https://www.youtube.com/@AdamWillea/videos>
- <https://www.youtube.com/@danstaifer2028/videos>

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to deFacto India/Fanuc India Pvt Limited
- Demonstration of using RoboDX Installation & working
- Demonstration of Robo build up
- Video demonstration of latest trends robotics
- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare prototype
 - Organizing Robo Race for the group of students
 - Seminars

ELECTRONICS APPLICATION USING SCILAB														
Course Code	22ECL461				CIE Marks				50					
L:T:P:S	0:0:1:0				SEE Marks				50					
Hrs / Week	2				Total Marks				100					
Credits	01				Exam Hours				03					
Course outcomes:														
At the end of the course, the student will be able to:														
22ECL461.1	Apply the fundamental concepts of analog electronics to simulate the analog circuits using SCILAB													
22ECL461.2	Analyze electronic circuits and systems using SCILAB													
22ECL461.3	Simulate the analog circuits by applying SCILAB to real-world electronic applications													
22ECL461.4	Debug and troubleshoot electronic systems using SCILAB													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECL461.1	3	-	-	-	2	-	-	-	-	-	-	2	3	3
22ECL461.2	3	3	2	2	2	-	-	-	-	-	-	2	3	3
22ECL461.3	3	3	2	2	2	-	-	-	-	-	-	2	3	3
22ECL461.4	3	3	2	2	2	-	-	-	-	-	-	2	3	3
Exp. No. / Pgm. No.														
List of Experiments														
Hours														
COs														
Prerequisite Experiments														
	<ul style="list-style-type: none"> Analog Electronics Basics Mathematical modelling and analysis. 											2	NA	
PART-A														
1	Determine the rms value of 50mA peak to peak.											2	22ECL461.1 22ECL461.2	
2	Determine the resistance of diode when forward current is given.											2	22ECL461.1 22ECL461.2	
3	Determine the I_e emitter current and h_{fe}											2	22ECL461.1 22ECL461.2	
4	Determine the I base current and change in collector											2	22ECL461.1 22ECL461.2	
5	Determine the zener current and voltage across the load											2	22ECL461.1 22ECL461.2	
6	Determine voltage gain and current gain and power gain of Amplifier											2	22ECL461.1 22ECL461.2	
PART-B														
7	Determine amount of feedback required											2	22ECL461.2 22ECL461.3 22ECL461.4	
8	Determine amplifier output voltage produced by input signal of 10 mV											2	22ECL461.2 22ECL461.3 22ECL461.4	
9	Determine static value of current gain and voltage gain											2	22ECL461.2 22ECL461.3 22ECL461.4	
10	Determine the value of open loop voltage gain in OP-AMP											2	22ECL461.2 22ECL461.3	

			22ECL461.4
11	Determine the parameters of timer circuit that produce 5V	2	22ECL461.2 22ECL461.3 22ECL461.4
12	Determine the circuit parameters using opamps	2	22ECL461.2 22ECL461.3 22ECL461.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. **Study of basic properties of operational amplifier: inverting and non-inverting amplifiers**
<https://be-iitkgp.vlabs.ac.in/exp/non-inverting-amplifiers/>
2. **Study of Differentiator and Integrator using Operational Amplifier**
<https://be-iitkgp.vlabs.ac.in/exp/operational-amplifier/>
3. **RC Differentiator and Integrator**
<https://be-iitkgp.vlabs.ac.in/exp/differentiator-integrator/>
4. **To develop an APP with SCILAB**
<https://www.youtube.com/watch?v=pPbVYJvct6U>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

- 1) Electronic Devices And Circuits, 5E : David A. Bell
- 2) linear-Integrated-Circuit-2nd-Edition-D-Roy-Choudhary

EMBEDDED DESIGNS USING ATMEL STUDIO														
Course Code	22ECL462					CIE Marks			50					
L:T:P:S	0:0:1:0					SEE Marks			50					
Hrs / Week	2					Total Marks			100					
Credits	01					Exam Hours			03					
Course outcomes:														
At the end of the course, the student will be able to:														
22ECL462.1	Analyze the architecture of microcontroller and its peripherals using embedded C													
22ECL462.2	Make use of peripherals in a microcontroller using embedded C													
22ECL462.3	Develop the Interfacing hardware (LED, LCD,7 segment etc) using embedded C													
22ECL462.4	Demonstrate different motors and controlling operations using embedded C													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECL462.1	3	-	-	-	2	-	-	-	1	-	-	2	3	3
22ECL462.2	3	-	-	-	2	-	-	-	1	-	-	2	3	3
22ECL462.3	3	3	2	-	2	-	-	-	1	-	-	2	3	3
22ECL462.4	3	3	2	-	2	-	-	-	1	-	-	2	3	3
Exp. No. / Pgm. No.	List of Programs											Hours	Cos	
Prerequisite Programs														
	<ul style="list-style-type: none"> • Basics on Architecture of AVR microcontroller. • Proficiency in C Programming. • Basic Understanding in Proteus tool. 											2	NA	
PART-A														
1	Write an Embedded C Program to display Hello World message using Internal UART.											2	22ECL462.1	
2	Write an Embedded C Program to read input from switch and Automatic control/flash LED (software delay).											2	22ECL462.1	
3	Write an Embedded C Program to interface a simple Switch and display its status through Relay, Buzzer and LED.											2	22ECL462.1	
4	Write an Embedded C Program for Master slave communication using SPI.											2	22ECL462.2	
5	Write an Embedded C Program to configure watchdog timer in watchdog & interval mode.											2	22ECL462.2	
6	Write an Embedded C Program by using the Internal PWM module generate PWM and vary its duty cycle.											2	22ECL462.2	
PART-B														
7	Write an Embedded C Program to interface a 4×4 keyboard and display the key code on an LCD.											2	22ECL462.3	
8	Write an Embedded C Program to measure Ambient temperature using a sensor and SPI ADC IC.											2	22ECL462.3	
9	Write an Embedded C Program to display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay											2	22ECL462.4	
10	Write an Embedded C Program to interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.											2	22ECL462.4	

11	Write an Embedded C Program to Control speed of a DC Motor	2	22ECL462.4
12	Write an embedded C Program to interface a sensor.	2	22ECL462.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. Square wave generation using 8051 microcontroller.
<https://www.youtube.com/watch?v=8ne8LAuEh9w>
2. Write an embedded C Program to interface Ultrasonic sensor and measure the distance of an object.
<https://www.electronicshub.org/ultrasonic-rangefinder-using-8051/>
3. Write an embedded C program to interface RFID card.
https://www.youtube.com/watch?v=p1C_Sb0vp8
4. Write an embedded C to demonstrate Traffic Light Controller.
<https://www.youtube.com/watch?v=Y6M2b-mFh-s>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

- 1) The AVR microcontroller and embedded system, Muhammad Ali Mazidi, Sarmad Naimi, Sepeher Naimi, PEARSON.
- 2) <https://www.microchip.com/content/dam/mchp/documents/MCU08/ProductDocuments/UserGuides/Getting-Started-with-Microchip-Studio-DS50002712B.pdf>

VIRTUAL INSTRUMENTATION USING LABVIEW															
Course Code	22ECL463											CIE Marks	50		
L:T:P:S	0:0:1:0											SEE Marks	50		
Hrs / Week	2											Total Marks	100		
Credits	01											Exam Hours	03		
Course outcomes:															
At the end of the course, the student will be able to:															
22ECL463.1	Select different functions available in Lab VIEW for engineering applications														
22ECL463.2	Apply concepts of virtual instrumentation and develop basic programs using loops														
22ECL463.3	Demonstrate user interfaces with charts, graph, and buttons														
22ECL463.4	Use the Lab VIEW platform to create and analyze data acquisition systems														
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
22ECL463.1	3	-	-	-	2	-	-	-	-	-	-	3	3	3	
22ECL463.2	3	-	-	-	2	-	-	-	-	-	-	3	3	3	
22ECL463.3	3	3	2	-	2	-	-	-	-	-	-	3	3	3	
22ECL463.4	3	3	2	1	2	-	-	-	-	-	-	3	3	3	
Exp. No. / Pgm. No.	List of Programs											Hours	COs		
Prerequisite Programs															
	<ul style="list-style-type: none"> Knowledge of Microsoft Windows Knowledge of writing algorithms in the form of flowcharts or block diagrams http://www.ni.com/getting-started/labview-basics/environment 											2	NA		
PART-A															
1	To perform basic arithmetic operations: addition, subtraction, multiplication, and division using LabVIEW.											2	22ECL463.1		
2	To perform Boolean operations: AND, OR, XOR, NOT and NAND using LabVIEW.											2	22ECL463.1		
3	To find the Sum of 'n' numbers using 'for' loop and 'while' loop.											2	22ECL463.3		
4	To perform the Factorial of a given number using 'for' loop and 'while' loop.											2	22ECL463.3		
5	To sort even numbers using 'while' loop in an array.											2	22ECL463.3		
6	To find the maximum and minimum variable from an array.											2	22ECL463.2		
PART-B															
7	To create a sine wave using formula node.											2	22ECL463.2		
8	Build a Virtual Instrument which adds two sine waves of different frequencies and displays the result in a graph.											2	22ECL463.1		
9	To apply filtering technique (median filter) for a given input signal.											2	22ECL463.1		
10	To build a Virtual Instrument that converts Celsius to Fahrenheit.											2	22ECL463.4		
11	To build a Virtual Instrument for acquiring and continuously displaying a thermocouple signal.											2	22ECL463.4		
12	To acquire and analyze an ECG signal using NI ELVIS LabVIEW.											2	22ECL463.4		
PART-C															
Beyond Syllabus Virtual Lab Content															

(To be done during Lab but not to be included for CIE or SEE)

1. Simulations in LabVIEW
<https://www.youtube.com/watch?v=X6oRczEDOao>
2. LabVIEW Formula Node
https://www.youtube.com/watch?v=m5z_5j6iu2M
3. LabVIEW Mathscript
<https://www.youtube.com/watch?v=dQjmzEM8YKc>
4. Reading data from Spreadsheet
<https://www.just.edu.jo/FacultiesandDepartments/FacultyofEngineering/Departments/BiomedicalEngineering/Documents/labview%20experiments.pdf>

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

- 1) Virtual Instrumentation using LABVIEW, Jovitha Jerome, PHI, 2011
- 2) Virtual Instrumentation using LABVIEW, Sanjay Gupta, Joseph John, TMH, McGraw Hill, Second Edition, 2011.
- 3) Barry Paton, –Sensor, transducers and Lab view, Prentice Hall of India 2000.
- 4) LabVIEW Graphical Programming, Richard Jennings, Fabiola De la Cueva, 5th edition, McGraw-Hill Publishing 2020.

APP DEVELOPMENT USING GOOGLE FLUTTER														
Course Code	22ECL464										CIE Marks		50	
L:T:P:S	0:0:1:0										SEE Marks		50	
Hrs / Week	2										Total Marks		100	
Credits	01										Exam Hours		03	
Course outcomes:														
At the end of the course, the student will be able to:														
22ECL464.1	Demonstrate the features of flutter and flutter installation													
22ECL464.2	Use the appropriate flutter widgets to develop and verify the layouts													
22ECL464.3	Apply the dart language to build apps													
22ECL464.4	Create apps by learning the fundamentals of flutter													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECL464.1	3	3	2	-	3	-	-	-	2	-	-	3	3	1
22ECL464.2	3	3	2	-	3	-	-	-	2	-	-	3	3	1
22ECL464.3	3	3	2	-	3	-	-	-	2	-	-	3	3	1
22ECL464.4	3	3	2	2	3	-	-	-	2	-	-	3	3	1
Exp. No. / Pgm. No.														
List of Experiments / Programs														
Hours														
COs														
Prerequisite Programs														
	Introduction to Programming languages and their principles											2	NA	
PART-A														
1	Introduction of Flutter, how to install Flutter on Computer, Flutter Widgets.											2	22ECL464.1 22ECL464.2	
2	Basic Programming principles, Dart Primer, Creating Flutter App in Android studio.											2	22ECL464.1 22ECL464.2	
3	To add Scaffold AppBar and Text Widget, Center Widget, Colour library in flutter and adding Fonts in app development projects.											2	22ECL464.1 22ECL464.2	
4	To add Stateless Widgets, Hot Reload, image Widgets: Network image Widgets, Asset image Widgets. Icon and Button Widgets (flat and raised).											2	22ECL464.1 22ECL464.2	
5	To layout widgets in rows and in columns (Container and Padding Widgets, Flutter outline and shortcuts).											2	22ECL464.1 22ECL464.2	
6	To Expand widgets and Extract widget using Custom Classes and Cards in Flutter.											2	22ECL464.1 22ECL464.2	
PART-B														
7	To list the data and output that data in our widget tree using the map method(Stateful widgets).											2	22ECL464.2 22ECL464.3	
8	Verify how to update parent widget by passing a function into nested child widget.											2	22ECL464.2 22ECL464.3	
9	Verify how to use Maps in Dart and routing for apps.											2	22ECL464.3 22ECL464.4	

10	Verify how to create a spinner and how to use ternary operators in dart.	2	22ECL464.2 22ECL464.3
11	Flutter packages and Error Handling, List view builder to create a list-style layout in an app.	2	22ECL464.1 22ECL464.2 22ECL464.3 22ECL464.4
12	Create a mini app project with the knowledge of using Flutter.	2	22ECL464.1 22ECL464.2 22ECL464.3 22ECL464.4

PART-C

Beyond Syllabus Virtual Lab Content

(To be done during Lab but not to be included for CIE or SEE)

1. To create Android and iOS apps from scratch
<https://www.youtube.com/playlist?list=PL4cUxeGkcC9jLYyp2Aoh6hcWuxFDX6PBJ>
2. Create World Time App using flutter
3. Study how to build games with flutter
4. Build a Flutter App with Google's Flutter
[https://www.youtube.com/watch?v=x0uin\[vhNxI](https://www.youtube.com/watch?v=x0uin[vhNxI)

CIE Assessment Pattern (50 Marks - Lab)

RBT Levels		Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	-	5
L3	Apply	10	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks - Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	05
L3	Apply	20
L4	Analyze	15
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

- 1) Flutter for Beginners: An introductory guide to building cross-platform mobile applications with Flutter 2.5 and Dart, 2nd Edition, Thomas Bailey, Alessandro Biessek, Oct 2021, published by Packt Publishing Ltd.
- 2) Flutter Cookbook: Over 100 proven techniques and solutions for app development with Flutter 2.2 and Dart, 1st Edition, Simone Alessandria, Brian Kayfitz, June 2021, published by Packt Publishing Ltd.
- 3) Learn Google Flutter Fast: 65 Example Apps, Mark Clow, Apr 2019.
- 4) Flutter Complete Reference 2.0: The ultimate reference for Dart and Flutter, ebook, Alberto Miola, May 2023.

SOCIAL CONNECT AND RESPONSIBILITY												
Course Code	22SCK47						CIE Marks	50				
L:T:P:S	0:0:1:0						SEE Marks	--				
Hrs / Week	02						Total Marks	50				
Credits	01						Exam Hours	02				
Course outcomes:												
At the end of the course, the student will be able to:												
22SCK47.1	Communicate and connect to the surrounding											
22SCK47.2	Understand the needs and problems of the community and involve them in problem –solving											
22SCK47.3	Develop among themselves a sense of social & civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems											
22SCK47.4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes											
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22SCK47.1	-	-	-	-	-	3	2	-	2	3	-	1
22SCK47.2	-	-	-	-	-	3	2	-	2	3	-	1
22SCK47.3	-	-	-	-	-	3	2	-	2	3	-	1
22SCK47.4	-	-	-	-	-	3	2	-	2	3	-	1
MODULE-1	PLANTATION AND ADOPTION OF A TREE						22SCK47.1, 22SCK47.2		3 Hours			
Plantation of a tree that will be adopted for three years by a group of B. Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature -- Objectives, Visit, case study, report, outcomes.												
MODULE-2	HERITAGE WALK AND CRAFTS CORNER						22SCK47.2, 22SCK47.3		3 Hours			
Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms- Objectives, Visit, case study, report, outcomes.												
MODULE-3	ORGANIC FARMING AND WASTE MANAGEMENT						22SCK47.3, 22SCK47.4		3 Hours			
Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives, Visit, case study, report, outcomes.												
MODULE-4	WATER CONSERVATION						22SCK47.3, 22SCK47.4		3 Hours			
Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.												
MODULE-5	FOOD WALK						22SCK47.1 22SCK47.4		3 Hours			
City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.												
CIE Assessment Pattern (50 Marks – Activity based) –												
<ul style="list-style-type: none"> Each module is evaluated as given below and 100 marks in scaled down to 50 as final marks. 												

CIE component for each module	Marks
Field Visit, Plan, Discussion	10
Commencement of activities and its progress	20
Case study-based Assessment Individual performance with report	20
Module wise study & its consolidation 5*5 = 25	25
Video based seminar for 10 minutes by each student at the end of semester with Report. Activities 1 to 5, 5*5 = 25	25
Total	100

- Implementation strategies of the project (NSS work).
- Individual student has to submit a final report which should be signed by NSS Officer, the HOD and Principal.
- Finally, the consolidated marks sheet and the reports should be available in the department. .

Activity-Based Learning / Practical Based learning

- Platform to connect to others and share the stories with others:
 - Jamming session
 - Open mic
 - Poetry
- Share the experience of Social Connect.
- Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

Pedagogy:

- The students will be divided into groups. Each group will be handled by faculty mentor.
- A total of 40 - 50 hrs engagement in the semester
- Faculty mentor will design the activities (particularly Jamming sessions, open mic and poetry)
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.
- Students should present the progress of the activities as per the schedule in the prescribed practical session in the field.
- There should be positive progress in the vertical order for the benefit of society in general through activities.

Plan of Action:

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty mentor for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.
- Practice Session Description:
 - Lecture session in field to start activities
 - Students Presentation on Ideas
 - Commencement of activity and its progress
 - Execution of Activity
 - Case study-based Assessment, Individual performance
 - Sector/ Team wise study and its consolidation
 - Video based seminar for 10 minutes by each student at the end of semester with Report.

Sl No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Plantation and adoption of a tree	May be individual or team (3-5)	Farmers land/ parks / Villages / roadside/ community area / College campus	Site selection / Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
2.	Heritage walk and crafts corner	May be individual or team (3-5)	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations /Government Schemes officers/ campus	Site selection /Proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
3.	Organic farming and waste management	May be individual or team (3-5)	Farmers land / parks /Villages visits / roadside/ community area / College campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
4.	Water conservation: Conservation techniques	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers / campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
5.	Food walk: Practices in society	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus

MINI PROJECT

Course Code	22ECE48	CIE Marks	50
L:T:P:S	0:0:1:0	SEE Marks	50
Hrs / Week	2	Total Marks	100
Credits	01	Exam Hours	03

Course outcomes:

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

22ECE48.1	Identify technical aspects of the chosen project with a comprehensive and systematic approach
22ECE48.2	Review the literature and develop solutions for problem statement
22ECE48.3	Work as an individual or in a team in development of technical projects
22ECE48.4	Test the different phases of planned project
22ECE48.5	Articulate the project related activities and findings
22ECE48.6	Extend or use the mini project ideas for major project

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22ECE48.1	3	3	-	-	-	-	-	-	3	-	-	-	3	3
22ECE48.2	3	3	3	3	3	-	-	-	3	3	3	3	3	3
22ECE48.3	3	3	3	-	-	-	-	-	-	3	3	3	3	3
22ECE48.4	3	3	3	-	-	-	-	2	3	3	3	3	3	3
22ECE48.5	3	3	3	-	-	-	-	2	3	3	3	3	-	-
22ECE48.6	3	3	3	3	-	3	1	2	3	3	3	3	3	3

CIE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SEE Assessment Pattern (50 Marks)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

NATIONAL SERVICE SCHEME												
Course Code	22NSS40						CIE Marks (each Semester)			50		
L:T:P:S	0:0:0:0						SEE Marks			--		
Hrs / Week	2						Total Marks			50 x 4 = 200		
Credits	00						Exam Hours			02		
Course outcomes:												
At the end of the course, the student will be able to:												
22NSS40.1	Understand the importance of his / her responsibilities towards society.											
22NSS40.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.											
22NSS40.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development. Implement government or self-driven projects effectively in the field.											
22NSS40.4	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22NSS40.1	-	-	-	-	-	3	-	-	2	-	-	1
22NSS40.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS40.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS40.4	-	-	-	-	-	3	3	-	2	-	-	1
Semester/ Course Code												
CONTENT												
COs												
HOURS												
4TH 22NSS40	12. Water conservation techniques – Role of different stakeholders– Implementation. 13. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 14. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.									22NSS40.1, 22NSS40.2, 22NSS40.3, 22NSS40.4		30 HRS
5TH 22NSS50	15. Developing Sustainable Water management system for rural areas and implementation approaches. 16. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 17. Spreading public awareness under rural outreach programs. (minimum 5 programs).									22NSS50.1, 22NSS50.2, 22NSS50.3, 22NSS50.4		30 HRS
6TH 22NSS60	18. Organize National integration and social harmony events / workshops / seminars. (Minimum TWO programs). 19. Govt. school Rejuvenation and helping them to achieve good infrastructure.									22NSS60.1, 22NSS60.2, 22NSS60.3, 22NSS60.4		30 HRS
CIE Assessment Pattern (50 Marks – Activity based) –												
CIE component for every semester											Marks	
Presentation - 1 Selection of topic, PHASE - 1											10	
Commencement of activity and its progress - PHASE - 2											10	
Case study-based Assessment Individual											10	

performance	
Sector wise study and its consolidation	10
Video based seminar for 10 minutes by each student at the end of semester with Report.	10
Total marks for the course in each semester	50

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, The HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally, the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

Suggested Learning Resources:

Reference Books:

4. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
5. Government of Karnataka, NSS cell, activities reports and its manual.
6. Government of India, NSS cell, Activities reports and its manual.

Pre-requisites to take this Course:

4. Students should have a service-oriented mindset and social concern.
5. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
6. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

Pedagogy:

- In every semester from 3rd semester to 6th semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last, in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.
- State the need for NSS activities and its present relevance in the society and provide real-life examples.
- Support and guide the students for self-planned activities.
- NSS coordinator will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
- Encourage the students for group work to improve their creative and analytical skills.

Plan of Action:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
 - Lecture session by NSS Officer
 - Students Presentation on Topics
 - Presentation - 1, Selection of topic, PHASE – 1
 - Commencement of activity and its progress - PHASE – 2
 - Execution of Activity
 - Case study-based Assessment, Individual performance
 - Sector/ Team wise study and its consolidation
 - Video based seminar for 10 minutes by each student at the end of semester with Report.

SI No	Topic	Groupsize	Location	Activity execution	Reporting	Evaluation of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / Community area / College campus	Site selection /proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/ Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	site selection/proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs. (minimum 5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
11.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION												
Course Code	22PED40						CIE Marks (each semester)			50		
L:T:P:S	0:0:0:0						SEE Marks			--		
Hrs / Week	2						Total Marks			50 x 2= 100		
Credits	00						Exam Hours			02		
Course outcomes: At the end of the course, the student will be able to:												
22PED40.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness											
22PED40.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle											
22PED40.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.											
22PED40.4	Understand the roles and responsibilities of organization and administration of sports and games											
Mapping of Course Outcomes to Program Outcomes:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22PED40.1	-	-	-	-	-	2	-	3	3	-	-	2
22PED40.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED40.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED40.4	-	-	-	-	-	2	-	3	3	-	-	2
Semester												
CONTENT												
COs												
HOURS												
4 TH 22PED40	Module 1: Ethics and Moral Values C. Ethics in Sports D. Moral Values in Sports and Games						22PED40.1, 22PED40.2			5 HRS		
	Module 2: Specific Games (Anyone to be selected by the student) G. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. H. Throwball – Service, Receive, Spin attack, Net Drop & Jump throw. I. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus. J. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. K. Table Tennis – Service (Fore Hand & Back Hand), Receive (Fore Hand & Back Hand), Smash. L. Athletics (Track / Field Events) – Any event as per availability of Ground.						22PED40.3			20 HRS		
	Module 3: Role of Organization and administration						22PED40.4			5 HRS		
CIE Assessment Pattern (50 Marks – Practical) – CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.												
CIE						Marks						

	Participation of student in all the modules	10	
	Quizzes – 2, each of 7.5 marks	15	
	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	25	
	Total	50	

Suggested Learning Resources:

Reference Books:

12. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
13. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
14. Petipus, et.al., Athlete's Guide to Career Planning, Human Kinetics.
15. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
16. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
17. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
18. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
19. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
20. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
21. Dubey H.C., Basketball, Discovery Publishing House, New Delhi.
22. Rachana Jain, Teach Yourself Basketball, Sports Publication.
15. Jack Nagle, Power Pattern Offences for Winning basketball, Parker Publishing Co., New York.
16. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
17. SallyKus, Coaching Volleyball Successfully, Human Kinetics.

YOGA												
Course Code	22YOG40						CIE Marks (each Semester)	50				
L:T:P:S	0:0:0:0						SEE Marks	--				
Hrs / Week	2						Total Marks	50 x 4 = 200				
Credits	00						Exam Hours	02				
Course outcomes: At the end of the course, the student will be able to:												
22YOG40.1	Use Yogasana practices in an effective manner											
22YOG40.2	Become familiar with an authentic foundation of Yogic practices											
22YOG40.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas											
22YOG40.4	Use the teachings of Patanjali in daily life											
Mapping of Course Outcomes to Program Outcomes:												
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22YOG40.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG40.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG40.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG40.4	-	-	-	-	-	3	-	-	-	-	-	1
Semester / Course Code												
CONTENT												
COs												
HOURS												
4TH 22YOG40	Suryanamaskara: Suryanamaskar 12 count,4rounds						22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4			Total 32 Hrs/ Semester 2 Hrs/week		
	Brief introduction and importance of: Kapalabhati: Revision of Kapalabhati -40strokes/min3rounds Different types of Asanas: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana Patanjali's Ashtanga Yoga: Asana, Pranayama Pranayama: Chandra Bhedana, Nadishodhana, Surya Bhedana											
5TH 22YOG50	Kapalabhati: Revision of Kapalabhati - 60strokes/min3rounds Brief introduction and importance of: Different types of Asanas: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvar Patanjali's Ashtanga Yoga: Pratyahara, Dharana Pranayama: Ujjayi, Sheetali, Shektari						22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4			Total 32 Hrs/ Semester 2 Hrs/week		

6TH 22YOG60	<p>Kapalabhati: Revision of Kapalabhati – 80 strokes/min3rounds Brief introduction and importance of: Different types of Asanas:</p> <ol style="list-style-type: none"> 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasana (Relaxation posture) 4. Balancing: Sheershasana <p>Patanjali's AshtangaYoga: Dhyana (Meditation), Samadhi Pranayama: Bhastrika, Bhramari, Ujjai Shat Kriyas: Jalaneti and sutraneti, Sheetkarma Kapalabhati</p>	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week								
<p>CIE Assessment Pattern (50 Marks – Practical) – CIE to be evaluated every semester based on practical demonstration of Yogasana learnt in the semester and internal tests (objective type)</p> <table border="1" data-bbox="500 758 1157 890" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th style="text-align: center;">CIE</th> <th style="text-align: center;">Marks</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">Avg of Test 1 and Test 2</td> <td style="text-align: center;">25</td> </tr> <tr> <td style="text-align: center;">Demonstration of Yogasana</td> <td style="text-align: center;">25</td> </tr> <tr> <td style="text-align: center;">Total</td> <td style="text-align: center;">50</td> </tr> </tbody> </table>				CIE	Marks	Avg of Test 1 and Test 2	25	Demonstration of Yogasana	25	Total	50
CIE	Marks										
Avg of Test 1 and Test 2	25										
Demonstration of Yogasana	25										
Total	50										
<p>Suggested Learning Resources: Reference Books:</p> <ol style="list-style-type: none"> 10. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala) 11. Tiwari, O P: Asana Why and How 12. Ajitkumar: Yoga Pravesha (Kannada) 13. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger) 14. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger) 15. Nagendra H R: The art and science of Pranayama 16. Tiruka: Shatkriyegalu (Kannada) 17. Iyengar B K S: Yoga Pradipika (Kannada) 18. Iyengar B K S: Light on Yoga (English) 											
<p>Web links and Video Lectures (e-Resources):</p> <ul style="list-style-type: none"> • https://youtu.be/KB-TYlgd1wE • https://youtu.be/aa-TG0Wg1Ls 											

BASIC APPLIED MATHEMATICS-II (Common to all Branches)												
Course Code	22DMAT41										CIE Marks	50
L:T:P:S	0:0:0:0										SEE Marks	--
Hrs. / Week	2										Total Marks	50
Credits	00										Exam Hours	--
Course outcomes:												
At the end of the course, the student will be able to:												
22DMAT41.1	Gain knowledge of basic operations of vectors											
22DMAT41.2	Use curl and divergence of a vector function in three dimensions											
22DMAT41.3	Develop the ability to solve higher order Linear differential equations											
22DMAT41.4	Know the basic concepts of Laplace transform to solve the Periodic functions and also solve initial and boundary value problems using Laplace transform method.											
Mapping of Course Outcomes to Program Outcomes:												
	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	P011	P012
22DMAT41.1	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.2	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.3	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.4	3	3	-	-	-	-	-	-	-	-	-	-
MODULE-1 VECTORS											22DMAT41.1	8 Hours
Definition of scalar and vector, Vector addition, Subtraction and Multiplication-Dot product, Cross product, Scalar triple product. Orthogonal, Co-planar and Angle between vectors-Problems.												
Text Book	Text Book 1: 3.1, 3.5, 3.6, 3.9, Text Book 2: 7.1, 9.2, 9.3, 9.4.											
MODULE-2 VECTOR DIFFERENTIATION											22DMAT41.2	8 Hours
Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of a vector function-Problems. Solenoidal and irrotational vector fields-Problems.												
Text Book	Text Book 1: 8.5, 8.6, 8.7, Text Book 2: 9.7, 9.8, 9.9.											
MODULE-3 LINEAR DIFFERENTIAL EQUATIONS WITH CONSTANT COEFFICIENTS											22DMAT41.3	8 Hours
Solution of initial and boundary value problems, Inverse differential operator techniques for the functions- e^{ax} , $\sin(ax + b)$ and $\cos(ax + b)$.												
Text Book	Text Book 1: 13.3, 13.4, 13.5, 13.6,											
MODULE-4 LAPLACE TRANSFORM											22DMAT41.4	8 Hours
Definition and Laplace transforms of elementary functions-Problems. Properties of Laplace transforms (Shifting property-without proof), Periodic functions (without proof)-problems.												
Text Book	Text Book 1: 21.3, 21.4, 21.5, Text Book 2: 6.1.											
MODULE-5 INVERSE LAPLACE TRANSFORM											22DMAT41.4	8 Hours
Inverse Laplace Transform by partial fractions-Problems. Solution of linear differential equations using Laplace Transforms-Problems.												
Text Book	Text Book 1: 21.12, 21.15, Text Book 2: 6.4.											
CIE Assessment Pattern (50 X 2=100 Marks - Theory)												
RBT Levels		Marks Distribution										
		Test (s)	Qualitative Assessment (s)	MCQ's								
		25	15	10								
L1	Remember	5	5	-								
L2	Understand	5	5	-								

L3	Apply	10	5	10
L4	Analyze	2.5	-	-
L5	Evaluate	2.5	-	-
L6	Create	-	-	-

Suggested Learning Resources:

Text Books:

- 1) B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, Forty fourth Edition, 2022, ISBN: 9788193328491.
- 2) Erwin Kreyszig, Advanced Engineering Mathematics, Wiley-India Publishers, Tenth Edition, Reprint 2016, ISBN: 9788126554232.

Reference Books:

- 1) Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, Fourth Edition, 2015, ISBN: 9780273719236.
- 2) B. V. Ramana, Higher Engineering Mathematics, McGraw Hill Education (India) Private Limited, Fourth Edition, 2017, ISBN: 9780070634190.
- 3) H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., Twenty Second Edition, 2018, ISBN: 9789352533831.
- 4) N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications (P) Ltd., Ninth Edition, 2014, ISBN: 9788131808320.

Web links and Video Lectures (e-Resources):

- 1) <https://youtu.be/SaNDPSk1UVM?si=FRxMnRi1btCUiscK>
- 2) <https://youtu.be/HxrLu-qRJKc?si=pKc9XOClIBx-H4Wp>
- 3) https://youtu.be/ma1QmE1SH3I?si=Hoo3_cjiIds203os
- 4) <https://youtu.be/TKBXey91Gc4?si=JjZfQvJxdxN8I6YQ>
- 5) https://youtu.be/1THkFmulPXM?si=pc9VvmZ-9cQe_Wr_
- 6) <https://youtu.be/m7jH0jfRf2I?si=OOEWttfQhieJ9wih>
- 7) <https://youtu.be/qFnoRfZknBY?si=BeMrhMF3LML4hBGa>
- 8) <https://youtu.be/n9XP6pljtw8?si=3gU-XKgt5JIZe9LE>

Activity-Based Learning (Suggested Activities in Class)/Practical Based Learning:

- Contents related activities (Activity-based discussions)
 - For active participation of students, instruct the students to prepare Algorithms/Flowcharts/Programming Codes
 - Organizing Group wise discussions on related topics
 - Seminars

APPENDIX A

List of Assessment Patterns

1	Assignments
2	Group Discussions
3	Case Studies/ Caselets
4	Practical Orientation on Design thinking
5	Participatory & Industry-integrated Learning
6	Practical activities / Problem solving exercises
7	Class Presentations
8	Analysis of Industry / Technical / Business Reports
9	Reports on Industrial Visit
10	Industrial / Social / Rural Projects
11	Participation in external seminars / workshops
12	Any other academic activity
13	Online / Offline Quizzes

APPENDIX B

Outcome Based Education

Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead classes, opportunities, and assessments should all help students achieve the specified outcomes.

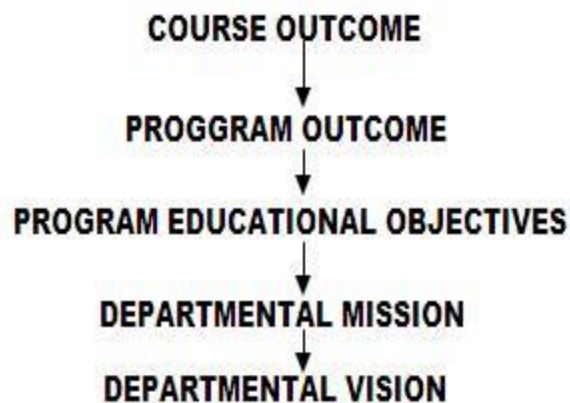
There are three educational Outcomes as defined by the National Board of Accreditation:

Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduate attributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the program curriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcomes



APPENDIX C

The Graduate Attributes of NBA

Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

Conduct investigations of complex problems: The problems that cannot be solved by straightforward application of knowledge, theories and techniques applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement (like: cost, power requirement, durability, product life, etc.) which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

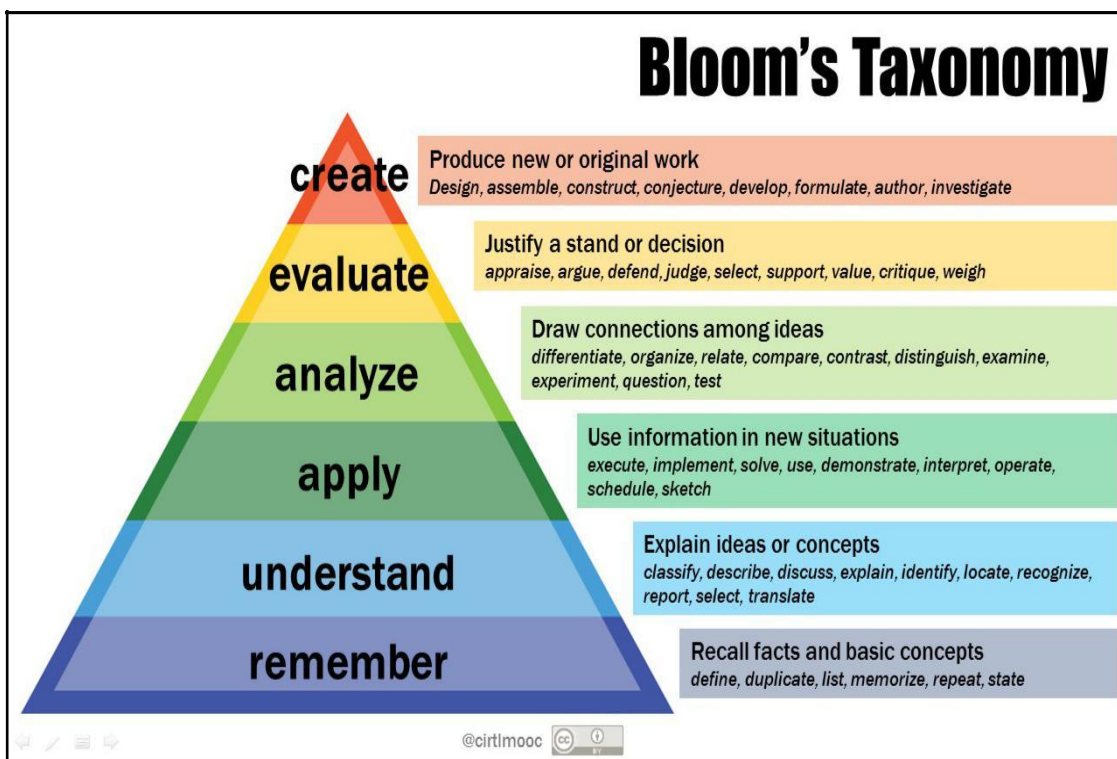
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

APPENDIX D

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels of human cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and other evaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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