NEW HORIZON
COLLEGE OF ENGINEERING

**Department of
Electronics and Communication Engineering**

**Academic Year 2024-25
3rd & 4th Semester
Scheme and Syllabus**

**BATCH: 2023-27
CREDITS: 160**

Department of Electronics and Communication Engineering

Academic Year 2024-25

3rd and 4th Semester Scheme & Syllabus

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

3rd and 4th Semester Scheme & Syllabus

Academic Year 2024-25

BATCH:2023-27 (CREDITS:160)

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

1. 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.
2. To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.
3. To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.
4. To develop value based socially responsible professionals for the betterment of the society.

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
- ❖ Innovation
- ❖ Integrity

- ❖ Professionalism
- ❖ Inclusiveness
- ❖ 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.
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 2023- 2027 BATCH (2022 Scheme)

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	2	1	0	0	3	4	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	26	500	450	950

| 11 | NCMC | 22DMAT31* | Basic Applied Mathematics-I | 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, **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.

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	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

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations for 2023- 2027 BATCH (2022 Scheme)

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	2	1	0	0	3	4	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	Programming 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-I	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	31	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.

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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	2:1:0:0	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=Xd13dh0eNlmIswPS

3)https://youtu.be/74g5_3TC-tQ?si=yB2PHVGr4hxIlqPo
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	1	-	-	-	-	-	-	-	-	2	3	1
22ECE32.4	3	3	1	-	-	-	-	-	-	-	-	2	3	1
22ECE32.5	3	-	-	-	-	-	-	-	-	-	-	2	3	1
22ECE32.6	3	3	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

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, 11thedition, Pearson Education/PHI, 2008, ISBN-13: 978-0135026496.
2) Electronic Principles, Albert Malvino and David Bates, 7th edition, McGraw-Hill, 2015, ISBN-13: 978-0073373881.
Reference Books:
1) Electric Circuits, (Schaum's Outline Series) by M Nahvi, Joseph Edminister, K Rao, 5th edition, McGraw-Hill Education, ISBN-13: 978-0071633727.
2) Electronics Devices and Circuits, Millman J and Halkias C, 3rd edition, 2007, TMH, ISBN-13: 978-0070634558.

Web links and Video Lectures (e-Resources):
- 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

- 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)
    - ➢ 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		
	• **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 & observer the crossover distortion.	2	22ECL32.2 22ECL32.4

<div align="center">

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

</div>

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) 20	Weekly Assessment 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, ISBN-13: 978-0135026496.
2. Microelectronic Circuits - Theory and applications by Adel S. Sedra and Kenneth C.Smith 5th Edition (Oxford International Student Edition),2012, ISBN-13: 978-0195338836.

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, ISBN-13: 978-8131505748.
2. Digital Principles and Design, Donald D. Givone, 2003, Tata McGraw Hill Edition2002, ISBN-13: 978-0072525038.

Reference Books:
1. Digital Fundamentals, Thomas Floyd, 11thedition,2014, Pearson Education, ISBN-13: 978-0132737968.
2. Digital Logic and Computer Design: M. Morris Mano, Pearson Education, ISBN-13: 978-0130898968.
3. An Illustrative Approach to Logic Design, R.D. Sudhakar Samuel, 2010, Pearson Education, ISBN-13: 978-8131732526.

Web links and Video Lectures (e-Resources):
- **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
- 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

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		
	• 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 using7483chip b) BCD to Excess-3code 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 using74S95.	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, 11thedition, 2014, Pearson Education, ISBN-13: 978-0132737968.
2. An Illustrative Approach to Logic Design, R. D. Sudhakar Samuel, 2010, Pearson Education, ISBN-13: 978-0132737968.

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
22ECE3416	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	1	-	-	-	-	-	-	-	-	1	2	1
22ECE341.3	3	3	-	-	-	-	-	-	-	-	-	1	2	1
22ECE341.4	3	3	-	-	-	-	-	-	-	-	-	1	2	1
21ECE541.5	3	3	1	-	-	-	-	-	-	-	-	1	2	1
22ECE341.6	3	3	1	-	-	-	-	-	-	-	-	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, ISBN-13: 978-1259251327.
2. M.E. Van Valkenberg (2000), —Network analysis, Prentice Hall of India, 3rdedition, 2000, ISBN: 9780136110958.
3. Operational Amplifiers and Linear IC's, David A. Bell, 3rd edition, 2011, Oxford University Press, ISBN-13: 978-0195696134.

Reference Books:
1. Network Theory, K Channa Venkatesh, D Ganesh Rao, Pearson Education Limited, 2010, ISBN-13: 978-8131734070.
2. Linear Integrated Circuits, D. Roy Choudhary and Shail B. Jain, 4th edition, 2015, New Age International, ISBN-13: 978-8122430677.
3. Ramakant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th edition, 2015, Pearson, ISBN-13: 978-0132808682.

Web links and Video Lectures (e-Resources):
- **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
- 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	1	-	-	-	-	-	-	-	-	2	3	2
22ECE342.4	3	3	1	-	-	-	-	-	-	-	-	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.

	Analysis of discrete and continuous time LTI system

Applications	
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, ISBN-13: 978-0138147570.
2) Signals and Systems, Simon Haykin and Barry Van Veen, 2nd edition, John Wiley & sons, 2007, ISBN-13: 978-0471164746.
Reference Books:
1) Principles of Linear Systems and Signals, B. P. Lathi, 2nd edition, Oxford University Press, 2009, ISBN-13: 978-0195158335.
2) Signals and Systems, Uday kumar S, 6th edition, Prism book House, 2012, ISBN-13: 978-9350133263
3) Insight into Wavelets: From Theory to practice, Soman K P & Rama chandran K I, Prentice Hall, 2004, ISBN-13: 978-8120324411.

Web links and Video Lectures (e-Resources):
- **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

- 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	1
22ECE343.2	3	-	-	-	-	-	-	-	-	-	-	-	2	1
22ECE343.3	3	3	-	-	-	-	-	-	-	-	-	1	2	1
22ECE343.4	3	3	-	-	-	-	-	-	-	-	-	-	2	1
22ECE343.5	3	3	-	-	-	-	-	-	-	-	-	1	2	1
22ECE343.6	3	3	-	-	-	-	-	-	-	-	-	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.

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	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.

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.

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.

Case Study	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)

		Marks Distribution		
RBT Levels		**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)

		Exam Marks Distribution (50)
	RBT Levels	
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, 4thedition, 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	Understand 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	2	-	-	-	-	-	-	-	-	-	-	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	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)

Case Study	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 Text Book1- Chapter 6 **The Root Locus Technique**: The root locus concepts - construction of root loci.	

Case Study	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

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	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 OSSF 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	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)

		Marks Distribution		
RBT Levels		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)

		Exam Marks Distribution (50)
RBT Levels		
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, 5th Edition, 2009, Wiley, ISBN-13: 978-0471794752.
1) **Reference Books:**

1) Modern Control Engineering, Ogata Katsuhiko, 5th Edition, 2010,PHI, ISBN-13: 978-0136156734.
2. B. C. Kuo", "Automatic Control Systems", John wiley and sons, 8th edition, 2003, ISBN-13: 978-0471124672.

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		
	• **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	1	-	3	-	-	-	-	-	-	2	3	2
22ECE352.3	3	3	1	-	3	-	-	-	-	-	-	2	3	2
22ECE352.4	3	3	1	-	3	-	-	-	-	-	-	2	3	2

Exp. No. / Pgm. No.	List of Experiments	Hours	COs
	Prerequisite Experiments		
	• 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=JgxPh7m-qqo
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, Ist 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	Understand 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	2	-	-	-	3	-	-	-	-	-	-	2	3	3
22ECE353.2	3	-	-		3	-	-	-	-	-	-	2	3	3
22ECE353.3	3	2	1		3	-	-	-	-	-	-	2	3	3
22ECE353.4	3	3	1		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	2	-	-	3	-	-	-	-	-	-	2	3	3
22ECE354.2	3	2	1	-	3	-	-	-	-	-	-	2	3	3
22ECE354.3	3	2	1	-	3	-	-	-	-	-	-	2	3	3
22ECE354.4	3	2	1	-	3	-	-	-	-	-	-	2	3	3

Exp. No. / Pgm. No.	List of Experiments	Hours	COs
	Prerequisite Experiments		
	1. Basic Electronics, Circuit Theory, Digital Logic, and Programming Basics Knowledge. 2. Familiarity with various electronic components like resistors, capacitors, inductors, diodes, transistors, and integrated circuits. 3. 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** • 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** • 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** • 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** • Learn how to associate schematic symbols with PCB footprints.	2	22ECE354.1

	• Ensure that the chosen footprints match the intended components.		
5	**PCB Layout Basics** • 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** • 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** • 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)** • Perform a basic design rule check to identify potential errors. • Address any DRC violations to ensure manufacturability.	2	22ECE354.2
9	**3D Visualization** • Explore the 3D visualization capabilities in Altium Designer. • Verify component placement and visualize the physical design.	2	22ECE354.3
10	**Creating Gerber Files** • 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** • 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** • 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)

1. Design a simple LED blinking circuit using Altium Designer.
   https://www.youtube.com/watch?v=H1lNbB7ICTs
2. Design a digital stopwatch circuit using Altium Designer.
   https://www.youtube.com/watch?v=HD8wDa8CR5s
3. Switch mode Power Supply
   https://www.youtube.com/watch?v=s-bL8LK6Gm8
4. 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	03	Total Marks	100
Credits	03	Exam Hours	03

Course outcomes:

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

22BIK36.1	Understand 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	Analyze 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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
22BIK36.1	3	3	3	3	2	-	-	-	1	1	-	2
22BIK36.2	3	3	3	3	2	-	-	-	1	1	-	2
22BIK36.3	3	3	3	3	2	-	-	-	1	1	-	2
22BIK36.4	3	3	3	3	2	-	-	-	1	1	-	2
22BIK36.5	3	3	3	3	2	-	-	-	1	1	-	2
22BIK36.6	3	3	3	3	2	-	-	-	1	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	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, 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.

Self-study	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.

Case Study	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 | 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).

| 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://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Work-shop%20Report_2232327_October%202022_Final.508.pdf

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

- ➢ Bio Materials printing using 3D Printing
- ➢ Flipped class room
- ➢ Organizing Group wise discussions on sub topics
- ➢ Student presentations

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.

Case study	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 play to understand contributions to nature and industry.		

CIE Assessment Pattern (50 Marks – Theory) –

		Marks Distribution	
RBT Levels		**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

- 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 forimplementation. 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 implementationapproaches. 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 developmentprograms 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 NSSofficer 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

- o Execution of Activity
- o Case study-based Assessment, Individual performance
- o Sector/ Team wise study and its consolidation
- o 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.	Organic farming, IndianAgriculture (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 Govtorganization, 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 contributionin social and economic issues.	May be individual or team	Women empowermentgroups/ 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 actionablebusiness 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 toachieve 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 SustainableWater 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 ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/	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

				campus		
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 a benefits of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana	22YOG30.1, 22YOG30.2, 22YOG30.3, 22YOG30.4	Total 32 Hrs/ Semester 2 Hrs/week

4TH **22YOG40**	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **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	22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4	Total 32 Hrs/ Semester 2 Hrs/week
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, Sarva **Patanjali's Ashtanga Yoga:** Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week
6TH **22YOG60**	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas:** 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation postu 4. Balancing: Sheershasana **Patanjali's AshtangaYoga:** Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week

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 22DMAT31.2	8 Hours
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)

		Marks Distribution		
RBT Levels		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/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=jzbklZmVev1w8K2S
6)https://youtu.be/LBqdGn1r_fQ?si=DWcAIiFnosT7zikY
7)https://youtu.be/N5YCGOyTSuU?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

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

FOURTH SEMESTER

(SYLLABUS)

<table>
<tr><td colspan="5" align="center">NUMERICAL, COMPLEX ANALYSIS AND PROBABILITY THEORY
(Common to ECE, EEE, MEE)</td></tr>
</table>

Course Code	**22MAE41**	**CIE Marks**		**50**
L:T:P:S	**2:1:0:0**	**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)

		Marks Distribution		
RBT Levels		**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-jfjq_94X4p_O
4)https://youtu.be/NqZUHJgitHk?si=Y6viSg1DFA4hgM9u
5)https://youtu.be/oPPJNoKYCro?si=A5zWC_vQQaHY7HlQ
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-mkJSMewO3

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,

Case Study	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

Case Study	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	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,	8 Hours

		22ECE42.5	

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.

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	Interfacing with FPGA.
Text Book	Text Book2: 3.1,3.2,3.3,3.4,6.1

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
RBT Levels		**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) HDL Programming (VHDL and Verilog), Nazeih M. Botros, 2015, John-Weily India Pvt.Ltd, ISBN-13: 978-8126554782
 2) Digital System design Using Verilog, Charles H. Roth Jr., Lizy Kurian John, Byeong Kil Lee, 1st Edition, 2015, CL Engineering, ISBN-13: 978-1305635157
 3) Volnei A. Pedroni, "Circuit Design with VHDL", The MIT Press, 2004, ISBN-13: 978-0262162241
Reference Books:
1) Digital Systems Design using VHDL, Charles H Roth, Jr., 2007, Thomson, ISBN-13: 978-0495244700.
2) Digital Design: An Embedded Systems approach Using VERILOG, Peter J. Ashenden, 2014, Elesvier, ISBN-13: 978-0123852221
3) J Bhaskar, "A Verilog HDL Primer (3/e)", Kluwer, 2005, ISBN-13: 978-0790613271.

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=PJGvZSlsLK
- 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

<p style="text-align:center;color:red;font-weight:bold;">PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)</p>

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	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:
Text Books:
1. Digital signal processing: Principles, Algorithms & Applications, Proakis & Monalakis, 4thEdition, 2014, Pearson education, ISBN-13: 978-0131873742.
2. Digital Signal Processing, Avtar Singh & S. Srinivasan, Thomson Brooks /Cole, 2004, ISBN-13: 978-0534401042.

Reference Books:
1.Discrete Time Signal Processing, Oppenheim & Schaffer, 7th Edition, 2010, TMH, ISBN-13: 978-0131988422
2. Digital Signal Processing, S. K. Mitra, 4thEdition, 2014, Tata Mc-GrawHill, ISBN-13: 978-0073380490.
3. Digital Signal Processing, P. Ramesh Babu, 6th Edition, 2014, Scitech Publications, ISBN-13: 978-8183714630

Web links and Video Lectures (e-Resources):
- **https://youtu.be/QcuIYJZ4RRE**
- **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=MQzY8cIBiFs&list=PLgMDNELGJ1CYvviJ_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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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		
	• **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	2	22ECL43.4

	Simulink.		

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, ISBN-13: 978-0131873742.
2. Digital Signal Processing. Ramesh Babu, 6thEdition, 2014, Scitech Publications, ISBN-13: 978-8183713425.
3. Discrete Time Signal Processing, Oppenheim & Schaffer, 7thEdition, 2010, TMH, ISBN-13: 978-0131988422.
4. Digital Signal Processing, S. K. Mitra, 4thEdition, 2014, Tata Mc-Graw Hill, ISBN-13: 978-0077366766.

MICROPROCESSORS & 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.

Self-Study	Investigate the pipeline architecture of the 8086 microprocessor, focusing on how instructions are fetched, decoded, and executed in assembly language
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, 22ECE44.3	8 Hours

Introduction to Programming of 8086, Simple Assembly Language Programming, Assembler Directives, Interrupts, Interrupt cycle of 8086 and Interrupt Service Routines.

Case Study	Explore the use of 8086 assembly language instructions for string manipulation, including operations like string copying, reversing, and comparing, leveraging the processor's instruction set and data registers.
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).

Case Study	Analyze the role of DMA in real-time data acquisition systems built around the 8086 microprocessor

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.			
Applications	Implementation of a Digital Clock Using the 8086 Microprocessor		
Text Book	Text Book 2: 5.5,5.6, 5.7.2, 5.8		

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
RBT Levels		**Test (s)**	**Qualitative Assessment (s)**	**MCQ's**
		25	**15**	**10**
L1	Remember	5	-	5
L2	Understand	5	5	5
L3	Apply	10	5	-
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) Microprocessor and Interfacing- Douglas V Hall, SSSP Rao, 3rd edition, TMH, 2012, ISBN-13: 978-1259006150.
2) Advanced Microprocessors and Peripherals- A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition,2015, ISBN-13: 978-1259006136.
Reference Books:
1) Microcomputer systems-The 8086 / 8088 Family – Y.C. Liu and A.Gibson, 2nd edition, PHI -2003, ISBN-13: 978-0130930811.
2) The 8086 Microprocessor: Programming & Interfacing the PC – Kenneth J Ayala,   ENGAGE Learning, 2011, ISBN-13: 978-1401861582.
3) The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey,
   6e, Pearson Education / PHI, 2003, ISBN-13: 978-0130607140.

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**

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	PSO1	PSO2
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	Hours	Cos
	Prerequisite Programs		
	Basic knowledge of Digital System Design Basic structure of a processor- instructions, registers and memory	2	NA
	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, ISBN-13: 978-1259006150.

2) Advanced Microprocessors and Peripherals- A.K. Ray and K.M. Bhurchandi, TMH, 3rd Edition,2015, ISBN-13: 978-1259006136.

3) The Intel Microprocessor, Architecture, Programming and Interfacing - Barry B. Brey, 6e, Pearson Education / PHI, 2003, ISBN-13: 978-0130607140.

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	6 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	6 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	6 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**	**6 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**	**6 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)

		Marks Distribution		
RBT Levels		**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, Massa chusetts 2016 https://www.pdfdrive.com/think-java-how-tothink-like-acomputer-scientiste17327018.html

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=V2GvQXvjhLA**
- **https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- Conduct on spot problem solving based on Data Structures and C.
- Develop simple algorithms and programs to build projects and applications

<div align="center">**IoT PROGRAMMING**</div>

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:

	PO1	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	2	1	-	2	-	-	-	-	-	-	2	3	3
22ECE452.4	3	2	1	-	2	-	-	-	-	-	-	2	3	3
22ECE452.5	3	-	1	-	2	-	-	-	-	-	-	2	3	3
22ECE452.6	3	2	1	-	2	-	-	-	1	-	-	2	3	3

MODULE-1		Introduction		22ECE452.1	6 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	6 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	6 Hours

Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.

Laboratory Component:				3 Hours
1. IoT based Air Pollution Control System				
2. Tds Sensor Interfacing with Arduino				
3. 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	6 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
1. Soil moisture detection using IoT	
2. Detection of light using Photo resistor	
3. 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	6 Hours

Vehicular IoT – Introduction
Healthcare IoT – Introduction, Case Studies
IoT Analytics – Introduction

Laboratory Component:	3 Hours
1. Interfacing Servo motor with Arduino	
2. Intrusion detection system with Arduino	
3. 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 Madisetti 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

- Video demonstration of IoT Programming

Contents related activities (Activity-based discussions)

- For active participation of students, conduct problem solving sessions
- Organizing Group wise discussions on issues
- Seminars

EMBEDDED LINUX PROGRAMMING

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	6 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:				3 Hours

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	6 Hours

Inserting BSP in Kernel Build Procedure, Memory Map, Interrupt Management, The PCI Subsystem, Timers, UART, Power Management.

Laboratory Component				3 Hours

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	6 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:			**3 Hours**
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**	**6 Hours**

Linux Serial Driver, Ethernet Driver , I2C Subsystem on Linux, USB Gadgets, Watchdog Timer, Kernel Modules.

Laboratory Component:			**3 Hours**
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**	**6 Hours**

Architectural Comparison, Application Porting Roadmap, Programming with threads,
Operating System Porting Layer (OSPL), Kernel API Driver

Laboratory Component:			**3 Hours**
1. Application porting roadmap. 2. Programming with threads			

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)

		Marks Distribution		
RBT Levels		**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, ISBN-13: 978-0849330791.

Reference Books:
1) Karim Yaghmour, Jon Masters, Gillad Ben Yossef, Philippe Gerum, "Building embedded Linux systems", O'Reilly, 2008, ISBN-13: 978-0596008655.
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

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	6 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:		3 Hours

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	6 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:	3 Hours

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	6 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:			3 Hours
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**	**6 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:			3 Hours
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**	**6 Hours**

Spot welding – Polishing – Deburring – Dispensing – Mold Machining – Robot Cutting – Robot Welding – Laser Cutting.

Laboratory Component:			3 Hours
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, ISBN-13: 978-1259004732.

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, ISBN-13: 978-0071282118.
   2. Introduction to Robotics: mechanics and control, Craig J J, 3/E,Pearson Education India,2008, ISBN-13: 978-0132060356.

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	22ECE461	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:

22ECE461.1	Apply the fundamental concepts of analog electronics to simulate the analog circuits using SCILAB
22ECE461.2	Analyze electronic circuits and systems using SCILAB
22ECE461.3	Simulate the analog circuits by applying SCILAB to real-world electronic applications
22ECE461.4	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
22ECE461.1	3	-	-	-	2	-	-	-	-	-	-	2	3	3
22ECE461.2	3	3	2	2	2	-	-	-	-	-	-	2	3	3
22ECE461.3	3	3	2	2	2	-	-	-	-	-	-	2	3	3
22ECE461.4	3	3	2	2	2	-	-	-	-	-	-	2	3	3

Exp. No. / Pgm. No.	List of Experiments	Hours	COs
	Prerequisite Experiments		
	• **Analog Electronics Basics** • Mathematical modelling and analysis.	2	NA
	PART-A		
1	Determine the rms value of 50mA peak to peak.	2	22ECE461.1 22ECE461.2
2	Determine the resistance of diode when forward current is given.	2	22ECE461.1 22ECE461.2
3	Determine the I_e emitter current and h_{fe}	2	22ECE461.1 22ECE461.2
4	Determine the I base current and change in collector	2	22ECE461.1 22ECE461.2
5	Determine the zener current and voltage across the load	2	22ECE461.1 22ECE461.2
6	Determine voltage gain and current gain and power gain of Amplifier	2	22ECE461.1 22ECE461.2
	PART-B		
7	Determine amount of feedback required	2	22ECE461.2 22ECE461.3 22ECE461.4
8	Determine amplifier output voltage produced by input signal of 10 mV	2	22ECE461.2 22ECE461.3 22ECE461.4
9	Determine static value of current gain and voltage gain	2	22ECE461.2 22ECE461.3 22ECE461.4
10	Determine the value of open loop voltage gain in OP-AMP	2	22ECE461.2

			22ECE461.3
			22ECE461.4
11	Determine the parameters of timer circuit that produce 5V	2	22ECE461.2
			22ECE461.3
			22ECE461.4
12	Determine the circuit parameters using opamps	2	22ECE461.2
			22ECE461.3
			22ECE461.4

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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)
</div>

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

<table>
<tr><td colspan="5" align="center">**EMBEDDED DESIGNS USING ATMEL STUDIO**</td></tr>
<tr><td>**Course Code**</td><td>**22ECE462**</td><td>**CIE Marks**</td><td>**50**</td></tr>
<tr><td>**L:T:P:S**</td><td>0:0:1:0</td><td>**SEE Marks**</td><td>**50**</td></tr>
<tr><td>**Hrs / Week**</td><td>2</td><td>**Total Marks**</td><td>**100**</td></tr>
<tr><td>**Credits**</td><td>01</td><td>**Exam Hours**</td><td>**03**</td></tr>
</table>

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

22ECE462.1	Analyze the architecture of microcontroller and its peripherals using embedded C
22ECE462.2	Make use of peripherals in a microcontroller using embedded C
22ECE462.3	Develop the Interfacing hardware (LED, LCD,7 segment etc) using embedded C
22ECE462.4	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
22ECE462.1	3	-	-	-	2	-	-	-	1	-	-	2	3	3
22ECE462.2	3	-	-	-	2	-	-	-	1	-	-	2	3	3
22ECE462.3	3	3	2	-	2	-	-	-	1	-	-	2	3	3
22ECE462.4	3	3	2	-	2	-	-	-	1	-	-	2	3	3

Exp. No. / Pgm. No.	List of Programs	Hours	Cos
	Prerequisite Programs		
	• **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	22ECE462.1
2	Write an Embedded C Program to read input from switch and Automatic control/flash LED (software delay).	2	22ECE462.1
3	Write an Embedded C Program to interface a simple Switch and display its status through Relay, Buzzer and LED.	2	22ECE462.1
4	Write an Embedded C Program for Master slave communication using SPI.	2	22ECE462.2
5	Write an Embedded C Program to configure watchdog timer in watchdog & interval mode.	2	22ECE462.2
6	Write an Embedded C Program by using the Internal PWM module generate PWM and vary its duty cycle.	2	22ECE462.2
	PART-B		
7	Write an Embedded C Program to interface a 4×4 keyboard and display the key code on an LCD.	2	22ECE462.3
8	Write an Embedded C Program to measure Ambient temperature using a sensor and SPI ADC IC.	2	22ECE462.3
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	22ECE462.4
10	Write an Embedded C Program to interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.	2	22ECE462.4
11	Write an Embedded C Program to Control speed of a DC Motor	2	22ECE462.4

12	Write an embedded C Program to interface a sensor.	2	22ECE462.4

<div style="text-align: center; color: red; font-weight: bold;">
PART-C
Beyond Syllabus Virtual Lab Content
(To be done during Lab but not to be included for CIE or SEE)
</div>

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/User Guides/Getting-Started-with-Microchip-Studio-DS50002712B.pdf

VIRTUAL INSTRUMENTATION USING LABVIEW

Course Code	22ECE463	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:

22ECE463.1	Select different functions available in Lab VIEW for engineering applications
22ECE463.2	Apply concepts of virtual instrumentation and develop basic programs using loops
22ECE463.3	Demonstrate user interfaces with charts, graph, and buttons
22ECE463.4	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
22ECE463.1	3	-	-	-	2	-	-	-	-	-	-	3	3	3
22ECE463.2	3	-	-	-	2	-	-	-	-	-	-	3	3	3
22ECE463.3	3	3	2	-	2	-	-	-	-	-	-	3	3	3
22ECE463.4	3	3	2	1	2	-	-	-	-	-	-	3	3	3

Exp. No. / Pgm. No.	List of Programs	Hours	COs
	Prerequisite Programs		
	• 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	22ECE463.1
2	To perform Boolean operations: AND, OR, XOR, NOT and NAND using LabVIEW.	2	22ECE463.1
3	To find the Sum of 'n' numbers using 'for' loop and 'while' loop.	2	22ECE463.3
4	To perform the Factorial of a given number using 'for' loop and 'while' loop.	2	22ECE463.3
5	To sort even numbers using 'while' loop in an array.	2	22ECE463.3
6	To find the maximum and minimum variable from an array.	2	22ECE463.2
	PART-B		
7	To create a sine wave using formula node.	2	22ECE463.2
8	Build a Virtual Instrument which adds two sine waves of different frequencies and displays the result in a graph.	2	22ECE463.1
9	To apply filtering technique (median filter) for a given input signal.	2	22ECE463.1
10	To build a Virtual Instrument that converts Celsius to Fahrenheit.	2	22ECE463.4
11	To build a Virtual Instrument for acquiring and continuously displaying a thermocouple signal.	2	22ECE463.4
12	To acquire and analyze an ECG signal using NI ELVIS LabVIEW.	2	22ECE463.4
	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	22ECE464		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:

22ECE464.1	Demonstrate the features of flutter and flutter installation
22ECE464.2	Use the appropriate flutter widgets to develop and verify the layouts
22ECE464.3	Apply the dart language to build apps
22ECE464.4	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
22ECE464.1	3	3	2	-	3	-	-	-	2	-	-	3	3	1
22ECE464.2	3	3	2	-	3	-	-	-	2	-	-	3	3	1
22ECE464.3	3	3	2	-	3	-	-	-	2	-	-	3	3	1
22ECE464.4	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	22ECE464.1 22ECE464.2
2	Basic Programming principles, Dart Primer, Creating Flutter App in Android studio	2	22ECE464.1 22ECE464.2
3	To add Scaffold AppBar and Text Widget, Center Widget, Colour library in flutter and adding Fonts in app development projects.	2	22ECE464.1 22ECE464.2
4	To add Stateless Widgets, Hot Reload, image Widgets: Network image Widgets, Asset image Widgets. Icon and Button Widgets (flat and raised)	2	22ECE464.1 22ECE464.2
5	To layout widgets in rows and in columns (Container and Padding Widgets, Flutter outline and shortcuts)	2	22ECE464.1 22ECE464.2
6	To Expand widgets and Extract widget using Custom Classes and Cards in Flutter	2	22ECE464.1 22ECE464.2
	PART-B		
7	To list the data and output that data in our widget tree using the map method(Stateful widgets)	2	22ECE464.2 22ECE464.3
8	Verify how to update parent widget by passing a function into nested child widget.	2	22ECE464.2 22ECE464.3
9	Verify how to use Maps in Dart and routing for apps	2	22ECE464.3 22ECE464.4
10	Verify how to create a spinner and how to use ternary operators in dart	2	22ECE464.2 22ECE464.3

11	Flutter packages and Error Handling, List view builder to create a list-style layout in an app	2	22ECE464.1 22ECE464.2 22ECE464.3 22ECE464.4
12	Create a mini app project with the knowledge of using Flutter	2	22ECE464.1 22ECE464.2 22ECE464.3 22ECE464.4

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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)

</div>

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=x0uinJvhNxI

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
22SCK472	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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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) –
 - **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-longactivities 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 byindividual 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 byindividual 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/ communityarea / College campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted byindividual 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 byindividual 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 byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus

MINI PROJECT-I				
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 forimplementation. 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 implementationapproaches. 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 developmentprograms 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 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 NSSofficer 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:
    o Lecture session by NSS Officer
    o Students Presentation on Topics
    o Presentation - 1, Selection of topic, PHASE – 1
    o Commencement of activity and its progress - PHASE – 2
    o Execution of Activity
    o Case study-based Assessment, Individual performance
    o Sector/ Team wise study and its consolidation
    o 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.	Organic farming, IndianAgriculture (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 Govtorganization, 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 contributionin social and economic issues.	May be individual or team	Women empowermentgroups/ 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 actionablebusiness 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 toachieve 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 SustainableWater 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 ruraloutreach programs. (minimum5 programs)	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/	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

						campus		
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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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
4TH **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 **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	22YOG40.1, 22YOG40.2, 22YOG40.3, 22YOG40.4	Total 32 Hrs/ Semester 2 Hrs/week
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, Sarvan **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	22YOG50.1, 22YOG50.2, 22YOG50.3, 22YOG50.4	Total 32 Hrs/ Semester 2 Hrs/week

6TH **22YOG60**	**Kapalabhati:** Revision of Kapalabhati – 80 strokes/min3rounds **Brief introduction and importance of:** **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Supine line: Setubandhasana, Shavasanaa (Relaxation posture 4. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	22YOG60.1, 22YOG60.2, 22YOG60.3, 22YOG60.4	Total 32 Hrs/ Semester 2 Hrs/week

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**

<div align="center">

BASIC APPLIED MATHEMATICS-II
(Common to all Branches)

</div>

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:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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)

		Marks Distribution		
RBT Levels		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=pKc9XOCllBx-H4Wp
 3)https://youtu.be/ma1QmE1SH3I?si=Hoo3_cjiIds203os
 4)https://youtu.be/TKBXey91Gc4?si=JjZfQvJxdxN8I6YQ
 5)https://youtu.be/1THkFmuIPXM?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

COURSE OUTCOME
↓
PROGGRAM OUTCOME
↓
PROGRAM EDUCATIONAL OBJECTIVES
↓
DEPARTMENTAL MISSION
↓
DEPARTMENTAL VISION
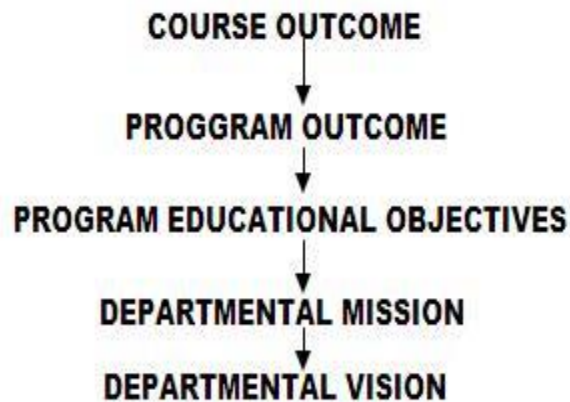
APPENDIX C

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.
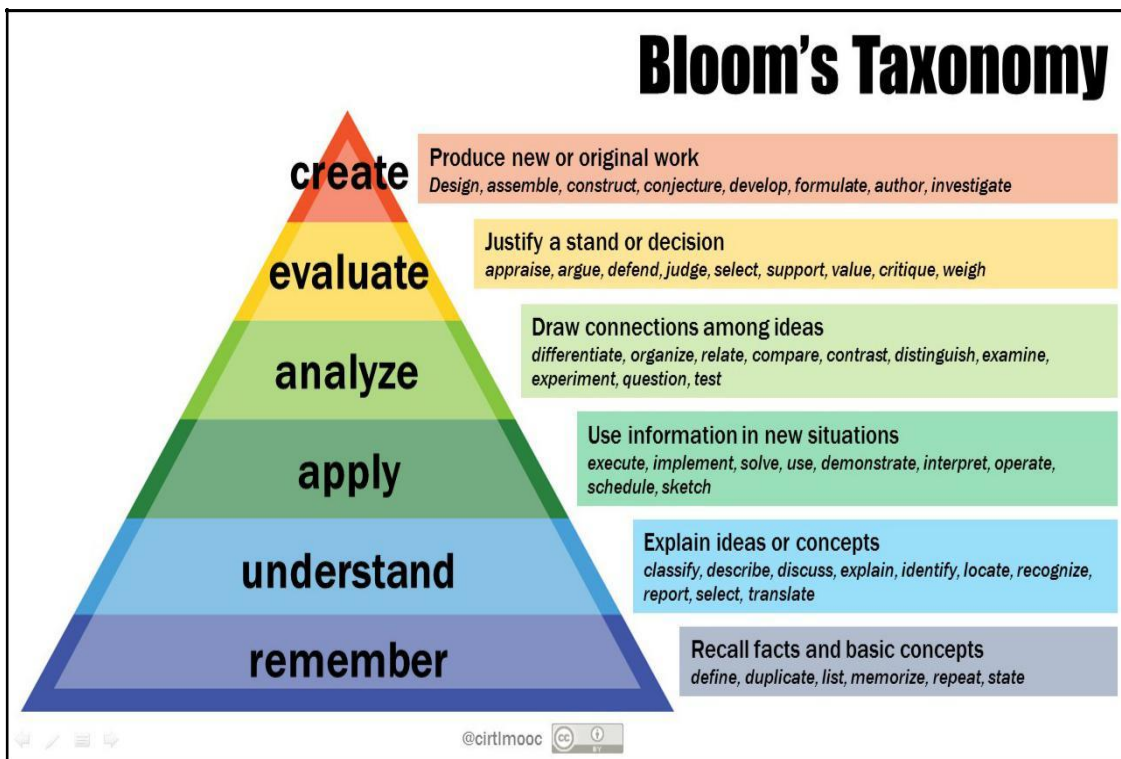
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