NEW HORIZON
COLLEGE OF ENGINEERING

Department of Electrical and Electronics Engineering

Academic Year 2024-25

3rd and 4th Semester

Scheme & Syllabus

BATCH: 2023-27

CREDITS: 160

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NEW HORIZON COLLEGE OF ENGINEERING

VISION

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

MISSION

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

QUALITY POLICY

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

VALUES

- ➢ Academic freedom
- ➢ Integrity
- ➢ Inclusiveness
- ➢ Innovation
- ➢ Professionalism
- ➢ Social Responsibility

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To evolve into a centre of excellence in Electrical and Electronics Engineering for bringing out contemporary engineers, innovators, researchers and entrepreneurs for serving nation and society.

MISSION

- To provide suitable forums to enhance the teaching-learning, research and development activities.
- Framing and continuously updating the curriculum to bridge the gap between industry and academia in the contemporary world and serve society.
- To inculcate awareness and responsibility towards the environment and ethical values.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide good learning environment to develop entrepreneurship capabilities in various areas of Electrical and Electronics Engineering with enhanced efficiency, productivity, cost effectiveness and technological empowerment of human resource.

PEO2: To inculcate research capabilities in the areas of Electrical and Electronics Engineering to identify, comprehend and solve problems and adopt themselves to rapidly evolving technology.

PEO 3: To create high standards of moral and ethical values among the graduates to transform them as responsible citizens of the nation.

PEO TO MISSION STATEMENT MAPPING

PEOs	MISSION OF THE DEPARTMENT		
	M1	M2	M3
PEO1	3	3	2
PEO2	3	3	2
PEO3	2	2	3

PROGRAM OUTCOMES (POs)

S.No	Graduate Attributes	Program Outcomes (POs)
1	Engineering Knowledge	PO1: Able to understand the fundamentals of mathematics, science, Electrical and Electronics Engineering and apply them to the solution of complex engineering problems.
2	Problem Analysis	PO2: Ability to identify, formulate and analyse real time problems in Electrical and Electronics Engineering.
3	Design and Development of Solutions	PO3: Design solutions for complex engineering problems, that meet the specified needs and to interpret the data.
4	Investigation of Problem	PO4: Use research based knowledge and research methods to provide valid solutions for complex problems in Electrical and Electronics Engineering.
5	Modern Tool usage	PO5: Apply appropriate tools techniques for modeling, analyzing and solving Electrical and Electronics Engineering devices & systems.
6	Engineer and society	PO6: To give basic knowledge of social, economical, safety and cultural issues relevant to professional engineering.
7	Environment and sustainability	PO7: To impart knowledge related to the design and development of modern systems which are environmentally sensitive and to understand the importance of sustainable development.
8	Ethics	PO8: Apply ethical principles and professional responsibilities in engineering practice.
9	Individual & team work	PO9: Ability to visualize and function as an individual and as a member in a team of a multi-disciplinary environment.

10	Communication	PO10: Ability to communicate effectively complex engineering ideas to the engineering community & the society at large.
11	Lifelong learning	PO11: To impart education to learn and to engage in independent and life – long learning in the technological change.
12	Project management and finance	PO12: Ability to handle administrative responsibilities, manage projects & handle finance related issues in a multi-disciplinary environment.

<u>**PEOs to POs mapping**</u>

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Graduates will be able to solve real life problems of power system and power Electronics using MiPower, PSPICE and MATLAB software tools and hardware.

PSO 2: Graduates will be able to Develop & support systems based on Renewable and sustainable Energy sources.

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electrical and Electronics Engineering
Scheme of Teaching and Examinations for 2022- 2026 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
				III Semester									
1	BSC	22MAE31	Numerical Methods and Transforms	BS	2	1	0	0	3	4	50	50	100
2	PCC	22EEE32	DC Machines and Transformers	EE	3	0	0	0	3	3	50	50	100
3	PCCL	22EEL32	DC Machines and Transformers Laboratory	EE	0	0	1	0	1	2	50	50	100
4	PCC	22EEE33	Electric Circuit Theory	EE	3	0	0	0	3	3	50	50	100
5	PCCL	22EEL33	Electric Circuit Theory Laboratory	EE	0	0	1	0	1	2	50	50	100
6	ESC	22EEE34X	ESC/ PLC	EE	If the course is ESC						50	50	100
					3	0	0	0	3	3			
					If the course is PLC								
					2	0	1	0	3	4			
7	AEC	22EEE35X	Ability Enhancement Course–III	EE	0	0	1	0	1	2	50	50	100
8	BSC	22BIK36	Bio Inspired Design and Innovation	EE	3	0	0	0	3	3	50	50	100
9	UHV	22UHK37	Universal Human Values and Life Skills	Life skills	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 and Sports	Physical Education Director									
		22YOG30	Yoga	Yoga Teacher									
			Total						19	26/27	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.

Programming Language Course (PLC): Credit for PLC is 03 (L : T : P:S) can be considered as(2 : 1 : 0). The theory part of the PLC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of P L C shall be included in the SEE question paper.

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

Engineering Science Course / Programming Language Course (ESC/PLC)			
22EEE341	Object Oriented programming using JAVA (2:0:1:0)	22EEE344	Signals and Systems (3:0:0:0)
22EEE342	Sensors and Actuators (3:0:0:0)	22EEE345	Material Science (3:0:0:0)
22EEE343	Energy Storage Systems (3:0:0:0)		

Ability Enhancement Course–III (For EEE, all are Laboratory Courses 0-0-1-0)			
22EEE351	Microcontroller and Embedded Systems	22EEE354	555 IC Laboratory
22EEE352	Introduction to MATLAB	22EEE354	Electronics Applications Laboratory
22EEE353	SCI LAB for DC Machines and Transformers		

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, PEd, 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	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

2-hours Self Study for Skill Development (SDA) per week = 1 Credit	

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electrical and Electronics Engineering
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						Credit Distribution				Overall Credits	Contact Hours	Marks		
S. No.	**Course and Course Code**		**Course Title**	**BoS**		**L**	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	BSC	22MAE41	Numerical, Complex Analysis and Probability Theory	EE		2	1	0	0	3	4	50	50	100
2	PCC	22EEE42	Analog Electronics and Integrated Circuits	EE		3	0	0	0	3	3	50	50	100
3	PCCL	22EEL42	Analog Electronics and Integrated Circuits Laboratory	EE		0	0	1	0	1	2	50	50	100
4	PCC	22EEE43	Digital Logic Design	EE		3	0	0	0	3	3	50	50	100
5	PCCL	22EEL43	Digital Logic Design Laboratory	EE		0	0	1	0	1	2	50	50	100
6	PCC	22EEE44	Synchronous and Induction Machines	EE		3	0	0	0	3	3	50	50	100
7	PCCL	22EEL44	Synchronous and Induction Machines Laboratory	EE		0	0	1	0	1	2	50	50	100
8	ESC	22EEE45X	ESC/ PLC	EE		If the course is ESC						50	50	100
						3	0	0	0	3	3			
						If the course is PLC								
						2	0	1	0	3	4			
9	AEC	22EEE46X	Ability Enhancement Course–IV	EE		0	0	1	0	1	2	50	50	100
10	UHV	22SCK47	Social Connect and Responsibility	EE		0	0	1	0	1	2	50	--	50
11	PROJ	22EEE48	Mini Project-I	EE		0	0	1	0	1	2	50	50	100
12	NCMC	22NSS40	National Service Scheme	NSS		0	0	0	0	0	2	50	--	50
		22PED40	Physical Education	Physical Education										
		22YOG40	Yoga	Yoga Teacher										
Total										**21**	**30/31**	**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, IE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

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

Engineering Science Course / Programming Language Course (ESC/PLC)			
22EEE451	Internet of Things (2:0:1:0)	22EEE454	Electromagnetic Field Theory (3:0:0:0)
22EEE452	Advanced Data Structures (2:0:1:0)	22EEE455	Introduction to data Science (3:0:0:0)
22EEE453	Web design Technologies (2:0:1:0)		

Ability Enhancement Course–IV (For EEE, all are Laboratory Courses 0-0-1-0)			
22EEE461	AUTOCAD for Electrical Engineering	22EEE464	PCB Design Laboratory
22EEE462	Advanced Arduino Programming	22EEE465	Virtual Instrumentation Using Labview
22EEE463	SCI Lab for Electrical Engineering		

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 thedevelopmentofsmallsystems/applicationsetc.Basedontheability/abilitiesofthestudent/sandrecommendationsofthementor. 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.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hours 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

III 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	22MAE31.5	8 Hours

TRANSFORMS	22MAE31.6	

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

DC MACHINES AND TRANSFORMERS

Course Code	22EEE32	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:

22EEE32.1	Describe the construction, working principle and performance of DC Machines
22EEE32.2	Analyze different speed control techniques of DC machines
22EEE32.3	Evaluate the performance of Transformer by conducting various test
22EEE32.4	Understand the different types of transformers used in industrial applications
22EEE32.5	Analyze the different configurations, parallel operation and phase conversion of three-phase transformers.
22EEE32.6	Apply the knowledge of machines in various 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
22EEE32.1	3	2	2	2	-	-	-	-	-	-	-	-	-	1
22EEE32.2	3	2	2	2	-	-	-	-	-	-	-	-	-	1
22EEE33.3	3	2	2	2	-	-	-	-	-	-	-	-	-	1
22EEE34.4	3	2	2	2	-	-	-	-	-	-	-	-	-	1
22EEE35.5	3	2	2	2	-	-	-	-	-	-	-	-	-	1
22EEE35.6	3	2	2	2	-	-	-	-	-	-	-	-	-	1

MODULE-1	**DC GENERATOR**	**22EEE32.1, 22EEE32.6**	**8 Hours**

Construction, Principle of operation, EMF equation, Types of armature windings, Types of generator, Armature reaction, Commutation, Characteristics, Losses and efficiency, Applications.

Text Book	Text Book 1: 7.1, 7.2, 7.4, 7.5, 7.6,7.9,7.12 Text Book 2: 4.15,4.18		
MODULE-2	**DC MOTOR**	**22EEE32.1, 22EEE32.2, 22EEE32.6**	**8 Hours**

Principle of Operation, Significance of Back EMF, Types of Motor, Torque equation, Characteristics, Speed control, Starters and testing, Applications.

Applications	Investigate the different types of applications in industries with motors		
Text Book	Text Book 1: 7.15, 7.16, 7.17, 7.19, 7.20 Text Book 2: 4.18		
MODULE-3	**SINGLE PHASE TRANSFORMERS**	**22EEE32.3, 22EEE32.6**	**8 Hours**

Principle of operation, Types, EMF equation, Transformer on no-load and load - phasor diagram, Equivalent circuit, Efficiency, Regulation and testing

Text Book	Text Book 1: 3.2 ,3.3,3.4,3.5,3.6,3.9Text Book 2: 1.4, 1.7		
MODULE-4	**THREE PHASE TRANSFORMERS**	**22EEE32.5, 22EEE32.6**	**8 Hours**

Construction- Configurations- Scott Connection, Auto transformers and tap changers, Applications.

Self-Study	Applications using different connection in three phase transformer.		
Text Book	Text Book 1: 3.11,3.13,3.16 Text Book 2: 1.12, 1.14		
MODULE-5	**PARALLEL OPERATION**	**22EEE32.4, 22EEE32.5**	**8 Hours**

Need of parallel operation, Essential and desirable conditions for parallel operation, Parallel operation and load sharing of single-phase transformer, Grounding transformer, Audio-Frequency transformer, Welding transformer, Pulse transformer.

Self-study	Investigate the different types of transformer used in industry
Text Book	Text Book 1: 3.14, 3.19, 3.20, 3.21 Text Book 2: 1.18

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	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) Electric Machines, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill Education, 5th Edition, 2017. ISBN-10: 935260640X, ISBN-13: 978-9352606405
2) Electric Machinery, P. S. Bhimbra, Khanna publications, 7th Edition, 2015. ISBN: 978-81-7409-152-9

Reference Books:
1) Electrical Machines, S.K. Bhattacharya, McGraw Hill Education, 4th Edition, 2017. ISBN-10: 9332902852, ISBN-13: 978-9332902855
2) Electric machinery, Ashfaq Hussain, Dhanpat Rai& Co, 3rd Edition, 2016. ISBN-10: 8177001663, ISBN-13: 978-8177001662
3) Electrical Machines, R. K. Rajput, Laxmi Publication, 6th Edition, 2018. ISBN: 9788131804469
4) Electric Machinery, Fitzgerald & Kingsley's, Stephen Umans, McGraw Hill Education; 7th edition, 2014. ISBN10: 0073380466, ISBN13: 9780073380469
5) A Course in Electrical Technology-II, J.B. Gupta, S. K. Kataria and Sons, 14th Edition, 2017. ISBN-10 : 9350144158, ISBN-13: 978-9350144152

Web links and Video Lectures (e-Resources):
- https://onlinecourses.nptel.ac.in/noc21_ee13/preview
- https://electrical-engineering-portal.com/academy/courses/electrical-machines-dc-synchronous-induction-transformers
- https://www.beeindia.gov.in/sites/default/files/3Ch2.pdf
- https://www.electricaltechnology.org/2020/04/dc-machine-types-working-applications.html
- https://standards.ieee.org/ieee/1349/10559/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- Visit to any electrical machines manufacturing industry or any power plant
- Demonstration of DC Motor, Generator/ Transformer
- Demonstration of working of DC machines
- Video demonstration of latest trends in industry applications
- 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

DC MACHINES AND TRANSFORMERS   LABORATORY

Course Code	22EEL32	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:

22EEL32.1	Develop the winding diagram for DC machines using AutoCAD
22EEL32.2	Estimate the performance of a DC machines by conducting various tests
22EEL32.3	Examine the operation of Scott connection with two single-phase transformers
22EEL32.4	Evaluate the performance of Transformers by conducting various tests and load sharing

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
22EEL32.1	3	3	2	2	2	-	-	-	-	-	-	-	-	1
22EEL32.2	3	3	2	2	2	-	-	-	-	-	-	-	-	1
22EEL32.3	3	3	2	2	2	-	-	-	-	-	-	-	-	1
22EEL32.4	3	3	2	2	2	-	-	-	-	-	-	-	-	1

Exp. No.	List of Experiments	Hours	COs
	Prerequisite Experiments / Demo		
	Introduction to Basic electrical engineering	2	NA
	PART-A		
1	Develop a winding diagram for DC machines in AutoCAD	2	22EEL32.2
2	Speed control of DC shunt motor by armature voltage control and flux control methods	2	22EEL32.2
3	Brake test on a DC shunt motor –Determination of speed –torque and efficiency characteristic	2	22EEL32.2
4	Retardation Test on DC shunt machine	2	22EEL32.2
5	Field's test on series motor	2	22EEL32.1
6	Determination of magnetization,internal & load characteristics of DC shunt generator	2	22EEL32.4
	PART-B		
7	Swinburne's Test on DC shunt machine	2	22EEL32.2
8	Calculation of efficiency and regulation by open circuit and short circuit test on single phase transformer	2	22EEL32.2
9	Polarity Test and connection of three single phase transformer in star Delta	2	22EEL32.2
10	Sumpner's test on similar transformer and determination of combined and individual transformer	2	22EEL32.2
11	Scott connection with balanced and unbalanced resistive loads	2	22EEL32.3
12	Parallel operation of two dissimilar single-phase transformer	2	22EEL32.3
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)** 1. Familiarization of the electrical machine laboratory apparatus. https://ems-iitr.vlabs.ac.in/exp/lab-equipment-familiarization/ 2.To study the Load Characteristics of DC shunt generator https://ems-iitr.vlabs.ac.in/exp/load-characteristics-dc-shunt/ 3.Speed Control of DC motor by field resistance control		

https://ems-iitr.vlabs.ac.in/exp/dcmotor-field-resistance-control/
4.Speed Control of DC motor by Armature Resistance Control
https://ems-iitr.vlabs.ac.in/exp/dcshunt-motor-armature-control/
5.Determination of Transformer equivalent circuit from Open Circuit and Short Circuit Test.
https://ems-iitr.vlabs.ac.in/exp/circuit-parameters-oc-test/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) Electric Machines, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill Education, 5th Edition, 2017. ISBN-10: 935260640X, ISBN-13: 978-9352606405
2) Electric Machinery, P. S. Bhimbra, Khanna publications, 7th Edition, 2015. ISBN: 978-81-7409-152-9
3) Electrical Machines, S.K. Bhattacharya, McGraw Hill Education, 4th Edition, 2017. ISBN-10: 9332902852, ISBN-13: 978-9332902855
4) Electric machinery, Ashfaq Hussain, Dhanpat Rai& Co, 3rd Edition, 2016. ISBN-10: 8177001663, ISBN-13: 978-8177001662
5) Electrical Machines, R. K. Rajput, Laxmi Publication, 6th Edition, 2018. ISBN: 9788131804469
6) Electric Machinery, Fitzgerald & Kingsley's, Stephen Umans, McGraw Hill Education; 7th edition, 2014. ISBN10: 0073380466, ISBN13: 9780073380469
7) A Course in Electrical Technology-II, J.B. Gupta, S. K. Kataria and Sons, 14th Edition, 2017. ISBN-10 : 9350144158, ISBN-13: 978-9350144152
8) http://www.nptel.ac.in/

ELECTRIC CIRCUIT THEORY

Course Code	22EEE33	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:

22EEE33.1	Analyze the electrical networks using different network reduction
22EEE33.2	Examine the electrical circuits using network topology
22EEE33.3	Apply the concepts of frequency response on RLC circuits
22EEE33.4	Investigate the transient response of RLC circuits with DC and AC excitation
22EEE33.5	Evaluate the three phase circuits and two port networks with different connections
22EEE33.6	Design an electric system for a given application

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
22EEE33.1	3	3	3	-	-	-	-	-	-	-	-	-	2	2
22EEE33.2	3	3	3	-	-	-	-	-	-	-	-	-	2	2
22EEE33.3	3	3	3	-	-	-	-	-	-	-	-	-	2	2
22EEE33.4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
22EEE33.5	3	3	3	-	-	-	-	-	-	-	-	-	2	2
22EEE33.6	3	3	3	-	-	-	-	-	-	-	-	-	2	2

MODULE-1	**Basic concepts and Network Reduction**	**22EEE33.1, 22EEE33.6**	**8 Hours**

DC Circuits: Practical and ideal sources, Active and passive elements, Dependent and independent sources. Network reduction using star-delta transformation and Source transformation, Mesh Analysis and Nodal Analysis of DC and AC Circuits with dependent and independent sources. Concept of Super-Mesh and Super-Node.AC Fundamentals: Analysis of R-L,R-C,R-L-C Series circuit-Simple Numerical problems.

Self -study	AC Circuit with dependent sources
Text Book	Text Book 2: 1.5, 1.7, 1.10, 1.11, 2.3, 2.4, 2.5, 2.6

MODULE-2	**Network Theorems**	**22EEE33.2, 22EEE33.6**	**8 Hours**

Superposition theorem- Thevenin's theorem, Norton's theorem -Maximum power transfer theorem-Reciprocity theorem (problems with independent ac and dc sources)

Text Book	Text Book 2: 3.2, 3.3, 3.4, 3.5,3.6, 6.4, 6.5, 6.6, 6.7

MODULE-3	**Resonance and Coupled circuits**	**22EEE33.3, 22EEE33.6**	**8 Hours**

Series resonance, parallel resonance - phasor diagram, effect of power factor, current, voltage, frequency, band width, selectivity and variation of quality factor (Q) on resonance. Problems on resonant frequency, band width, and quality factor at resonance - Self-Inductance, Mutual Inductance, Coefficient of Coupling (k), inductances in series and parallel- cumulative coupling, differential coupling, Analysis of coupled circuits.

Text Book	Text Book 2:5.1, 5.2, 5.3, 5.4, 7.2, 7.3, 7.4, 7.5, 7.6,7.7, 7.8

MODULE-4	**Transient Analysis**	**22EEE33.4, 22EEE33.6**	**8 Hours**

Behavior of R, L, C under different switching instances, Source Free RL, RC and RLC Circuits, Step Response of RL, RC and RLC Circuits.

Text Book	Text Book 1:7.2, 7.37.5, 7.6, 8.4, 8.5, 8.6		
MODULE-5	**Three Phase Circuits and Two Port Networks**	**22EEE33.5, 22EEE33.6**	**8 Hours**
Balance three phase voltages, Analysis of Balanced three phase systems – wye-wye, wye-delta, delta-wye, and delta-delta. Two port network concepts, open circuit impedance, short circuit admittance, and transmission parameters and their evaluation for simple circuits			
Self -study	Delta-delta connection		
Text Book	Text Book 1: 12.1, 12.2, 12.3, 12.4, 12.5, 12.6		

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
	RBT Levels	Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	-	-	-
L2	Understand	5	3	-
L3	Apply	10	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	2	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:
 Text Books:
 1) Fundamentals of Electric Circuits, Charles Alexander, McGraw Hill; Standard 7th Edition, 2022, ISBN10 : 9355320167;ISBN-13 : 978-9355320162
 2) Network Analysis and Synthesis, Ravish R Singh, McGraw Hill Education (India) Private Limited, ISBN (13): 978-1-25-906295-7, ISBN (10): 1-25-906295-3
Reference Books:
1) Circuit theory: Analysis and Synthesis, A Chakrabharti , Shree Hari Publications, 2021
2) Electric Circuits (Schaum's Outline Series),McGraw Hill Education; 5th edition ,2017, ISBN-10 : 0070151431 ;ISBN-13 : 978-0070151437
3) Engineering circuit analysis, Hayt and Kemmerly, McGraw Hill, 7th edition, 2022. ISBN-13 9781259098635;ISBN-10 1259098635

Web links and Video Lectures (e-Resources):
 - https://www.youtube.com/watch?v=uyE_UhLwIXc
 - https://www.youtube.com/watch?v=BNK4gxqWaV0
 - https://www.youtube.com/watch?v=aTuFqX-uN80&list=PLQS5IUr7LE3_oxuRxxEaG5-_atSuz1sSa

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

- Experiential learning approach through lab sessions (Hardware/Software)
- Learning to solve real life problems using PSPICE
- 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

<table>
<tr><td colspan="5" align="center">**ELECTRIC CIRCUIT THEORY LABORATORY**</td></tr>
<tr><td>**Course Code**</td><td>**22EEL33**</td><td></td><td>**CIE Marks**</td><td>**50**</td></tr>
<tr><td>**L:T:P:S**</td><td>**0:0:1:0**</td><td></td><td>**SEE Marks**</td><td>**50**</td></tr>
<tr><td>**Hrs / Week**</td><td>**2**</td><td></td><td>**Total Marks**</td><td>**100**</td></tr>
<tr><td>**Credits**</td><td>**01**</td><td></td><td>**Exam Hours**</td><td>**03**</td></tr>
</table>

Course outcomes:

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

22EEL33.1	Deduce the given network using different network reduction techniques
22EEL33.2	Analyze various network using mesh and nodal methods
22EEL33.3	Apply different network theorems for the given circuit
22EEL33.4	Design various transient circuits and evaluate the frequency response and steady state response of a mutually coupled circuit

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
22EEL33.1	3	3	3	3	3	-	-	-	1	-	-	-	1	-
22EEL33.2	3	3	3	3	3	-	-	-	1	-	-	-	1	-
22EEL33.3	3	3	3	3	3	-	-	-	1	-	-	-	1	-
22EEL33.4	3	3	3	3	3	-	-	-	1	-	-	-	1	-

Exp. No.	List of Experiments	Hours	COs
Prerequisite Experiments / Demo		
	• Resistance colour coding. • Familiarization of breadboards and PSPICE.	2	NA
PART-A		
1	Verification of KCL & KVL	2	22EEL33.1
2	Network Reduction using Series-Parallel Combination	2	22EEL33.1
3	Network Reduction using Star-Delta Transformation	2	22EEL33.1
4	Network Reduction and Analysis using Source Transformation	2	22EEL33.1
5	Network Analysis using Mesh-Current Method	2	22EEL33.2
6	Network Analysis using Node-Voltage Method	2	22EEL33.2
PART-B		
7	Verification of Superposition Theorem	2	22EEL33.3
8	Verification of Thevenin's Theorem & Norton's Theorem	2	22EEL33.3
9	Verification of Maximum Power Transfer Theorem	2	22EEL33.3
10	Determination of Resonant Frequency, Bandwidth and Quality Factor of a RLC Circuit	2	22EEL33.4
11	Transient and steady state analysis of RL, RC and RLC Circuits	2	22EEL33.4
12	Steady State Analysis of Mutually Coupled Circuits	2	22EEL33.4

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

1.Verification of Thevenin Theorem
https://asnm-iitkgp.vlabs.ac.in/exp/verification-thevenin-theorem/simulation.html
2.Verification of Maximum Power Transfer Theorem
https://asnm-iitkgp.vlabs.ac.in/exp/maximum-power-transfer-theorem/
3.R-L-C Circuit Analysis
https://asnm-iitkgp.vlabs.ac.in/exp/rlc-circuit-analysis/

4.Verification of Superposition Theorem https://asnm-iitkgp.vlabs.ac.in/exp/verification-superposition-theorem/		

CIE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Test (s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	-
L3	Apply	5	15
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	-
L3	Apply	20
L4	Analyze	15
L5	Evaluate	15
L6	Create	-

Suggested Learning Resources:
Reference Books:
1) Electric Circuits Laboratory Manual, Asadi, Farzin, Publisher: Springer Cham, 2023, ISBN-9783031245510

22EEE34X -Engineering Science Course / Programming Language Course (ESC/PLC)

OBJECT ORIENTED PROGRAMMING USING JAVA				
Course Code	**22EEE341**		**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:

22EEE341.1	Apply the concepts of OOP to write special functions and I/O programs
22EEE341.2	Apply governing principles of Java for writing advanced programs and troubleshooting mechanisms
22EEE341.3	Analyze the Java control structures, I/O operations and file operations
22EEE341.4	Analyze the Inheritance, Interface and Package to optimize Java program
22EEE341.5	Evaluate the exception handling mechanisms and its implementations
22EEE341.6	Develop Java frameworks using Java Swing

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
22EEE341.1	3	2	2	3	3	-	-	-	-	-	-	-	-	1
22EEE341.2	3	2	2	3	3	-	-	-	-	-	-	-	-	1
22EEE341.3	2	3	2	3	3	-	-	-	-	-	-	-	-	1
22EEE341.4	2	3	2	3	3	-	-	-	-	-	-	-	-	1
22EEE341.5	1	1	1	3	3	-	-	-	-	-	-	-	-	1
22EEE341.6	2	2	3	3	3	-	-	-	-	-	-	-	-	1

MODULE-1	**Introduction to Java**	**22EEE341.1, 22EEE341.3**	**6 Hours**

Introduction to Java:
Basics and Overview of Java programming, - "Hello, World" Program, Compiling and Running a Java Program, Data types, Variables, Operators, Control structures including selection, Looping, Math class, Arrays in Java

Laboratory Component:	**3 Hours**
1. Write a JAVA program to demonstrate selection statements. 2. Write a JAVA program to demonstrate looping statement. 3. Write a JAVA program to demonstrate math class.	

Text Book	Text Book 1: 3,4,5

MODULE-2	**Objects, Classes and Constructors**	**22EEE341.1**	**6 Hours**

Working with Objects, Implementing Classes, Object Construction, Static Variables and Methods, Overloading, Constructors: Visibility modifiers, Methods and Objects, Inbuilt classes like String, Character, String Buffer, 'this' reference, nested classes.

Laboratory Component:	**3 Hours**
1. Write a JAVA program to demonstrate method overloading. 2. Write a JAVA program to demonstrate Arrays. 3. Write a Java Program to define a class, describe its constructor & overload the Constructors.	

Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	Inheritance, Interface and Package	22EEE341.2, 22EEE341.4	6 Hours

Inheritance, Interface and Package:
  Inheritance and types, Base and Derived classes, Overriding, Polymorphism, Dynamic Binding, Casting objects, super(), final-keyword and method, finalize, Abstract class, Interface, Package.

Laboratory Component:			**3 Hours**
1. Write a JAVA program to implement single inheritance.			
2. Write a JAVA program to demonstrate use of method overriding.			
3. Write a JAVA program to demonstrate the use of implementing interfaces.			

Text Book	Text Book 2:2.5, 3.1, 3.3, 4.1		
MODULE-4	**Exception Handling and Files**	**22EEE341.3, 22EEE341.5**	**6 Hours**

Exception Handling:
Exception Types, Uncaught Exceptions, Using try and catch block, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's Built-in Exceptions and User defined Exceptions.
I/O Basics &Files:
Reading input, Writing output - Reading and Writing files.

Laboratory Component:			**3 Hours**
1. Write a JAVA program to implement the concept of Exception Handling using predefined exception.			
2. Write a JAVA program to implement the concept of Exception Handling by creating user defined exceptions			
3. Write a JAVA program to demonstrate File I/O Operations.			

Text Book	Text Book 2: 5.1, 5.2, 5.3		
MODULE-5	**Multithreading and Java Swing**	**22EEE341.2, 22EEE341.6**	**6 Hours**

Threads: Java Thread Model, Main Thread, Thread Life Cycle- Creating a Thread, Running, Suspending, Resuming and Stopping Threads, Creating Multiple Threads, Thread Priorities, Synchronization.

Java Swing : JFrame, JButton, JLabel, JTextField, JRadioButton, JTable, Jlist, JOptionPane, JScrollBar, JCheckBox, JMenu, JSlider

Laboratory Component:			**3 Hours**
1. Write a JAVA program to implement multithreading.			
2. Write a JAVA program to add a label and button in a frame.			
3. Write a JAVA program to create a table and show some data.			

Text Book	Text Book 3: 10,11		

CIE Assessment Pattern (50 Marks – Theory and Lab)

		Marks Distribution		
	RBT Levels	**Test (s)**	**Qualitative Assessment**	**Lab**
		25	**05**	**20**
L1	**Remember**	-	-	-
L2	**Understand**	5	-	-
L3	**Apply**	15	2.5	10
L4	**Analyze**	5	2.5	10
L5	**Evaluate**	-	-	-
L6	**Create**	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	25
L4	Analyze	15
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:
  Text 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)Debasis Samantha, Object oriented Programming with Java, cse.iitkgp.ac.in/~dsamanta/java/index.htm
Reference Books:
1) SAMS teach yourself Java–2: 3rd Edition by Rogers Cedenhead and Leura Lemay Pub. Pearson Education. ISBN: 978-0672324550
2) Ken Kousen, Modern Java Recipes, O'Reilly Media, Inc., 2017, ISBN: 9781491973172

Web links and Video Lectures (e-Resources):
- **https://onlinecourses.nptel.ac.in/noc19_cs84/preview**
- **https://youtube.com/playlist?list=PLD_UHTlXPZJOel4rygnbL1wke53kFZuJc**
- **https://www.youtube.com/watch?v=eIrMbAQSU34**
- **https://java-programming.mooc.fi/part-1**

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

- Experiential learning approach through lab sessions
- Video demonstration of coding using JAVA
- Problem solving approach
- Collaborative learning
- Contents related activities (Activity-based discussions)
- Seminars

SENSORS AND ACTUATORS				
Course Code	22EEE342	**CIE Marks**	50	
L:T:P:S	3:0:0:0	**SEE Marks**	50	
Hours / Week	3	**Total Marks**	100	
Credits	3	**Exam Hours**	03	

Course outcomes:

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

22EEE342.1	Understand the concepts, principles, and applications of sensors, transmitters, and transducers
22EEE342.2	Apply the principles, construction, characteristics, and applications of inductive and capacitive transducers to various real-world scenarios
22EEE342.3	Acquire thorough comprehension of diverse actuator types, their fundamental principles, and practical applications, and skillfully apply actuators across a wide array of engineering assignments and situations
22EEE342.4	Analyze real-world scenarios to determine the suitability of micro sensors and actuators for practical applications
22EEE342.5	Evaluate the advantages and limitations of different types of micro sensors and actuators in various contexts
22EEE342.6	Analyze real-world scenarios to determine the most suitable sensor materials and processing techniques for practical 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
22EEE342.1	3	2	2	1	-	-	-	-	-	-	-	-	-	1
22EEE342.2	3	2	2	1	-	-	-	-	-	-	-	-	-	1
22EEE342.3	3	2	2	1	-	-	-	-	-	-	-	-	-	1
22EEE342.4	3	2	2	1	-	-	-	-	-	-	-	-	-	1
22EEE342.5	3	2	2	1	-	-	-	-	-	-	-	-	-	1
22EEE342.6	3	2	2	1	-	-	-	-	-	-	-	-	-	1

MODULE-1	**SENSORS**	**22EEE342.1**	**8 Hours**

Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Strain Gauges, Resistance thermometer, Thermistor, Photo-resistive sensor.

Self -study	Different types of sensors used in real time applications
Text Book	Text book 1:1.1, 1.2, 1.3,1.4, 2.1, 2.2

MODULE-2	**INDUCTIVE & CAPACITIVE TRANSDUCER**	**22EEE342.2**	**8 Hours**

Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, synchros. Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor.

Text Book	Text book 2:2.6, 2.7, 2.5, 2.6

MODULE-3	**ACTUATORS**	**22EEE342.3**	**8 Hours**

Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C

motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.			
Case study	Different types of actuators used in real time applications		
Text Book	Text book 3:1.4, 1.5, 2.4, 3.2, 3.3, 3.4		
MODULE-4	**MICRO SENSORS AND MICRO ACTUATORS**	**22EEE342.4, 22EEE342.5**	**8 Hours**
Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.			
Text Book	Text book 2:6.1, 6.2, 6.3, 6.4, 6.5		
MODULE-5	**SENSOR MATERIALS AND PROCESSING TECHNIQUES:**	**22EEE342.6**	**8 Hours**
Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process.			
Text Book	Text book 3: 4.1, 4.2		

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
	RBT Levels	**Test (s)**	**Qualitative Assessment (s)**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	5	-	-
L2	**Understand**	5	-	-
L3	**Apply**	5	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) Sensors and Actuators: Engineering System Instrumentation, Clarence W. de Silva, Publisher: 2nd Edition, CRC Press Inc, 2015. ISBN-10: 1466506814, ISBN-13: 9781466506817
2) Hand Book of Modern Sensors: Physics, Designs and Applications, Jacob Fraden, Publisher : 5th Edition, Springer, 2016. ISBN-10: 3319307673, ISBN-13: 978-3319307671
3) Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, W. Bolton, 4th Edition, Publisher: Pearson Education, 2020, ISBN-10: 8131732533, ISBN-13: 978-8131732533
Reference Books:
1) Sensors, Actuators, and their Interfaces: A multidisciplinary introduction, Nathan IDA, Publisher: SciTech Publishing Inc, ISBN-10: 1613530064, ISBN-13: 978-1613530061.
2) Sensor and Actuators, Patranabis D, Publisher: 2nd Edition, Prentice Hall of India (Pvt) Ltd, 2019, ISBN-10: 9788120321984, ISBN-13: 978-8120321984.

Web links and Video Lectures (e-Resources):
- https://onlinecourses.nptel.ac.in/noc21_ee32/preview
- https://youtu.be/nE1C4ghfvac
- https://youtu.be/n_lZCIA25aI

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- Video demonstration of latest trends in Sensors and Actuators
- Contents related activities (Activity-based discussions)
- Organizing Group wise discussions on issues
- Seminars

<div align="center">**ENERGY STORAGE SYSTEMS**</div>

Course Code	22EEE343	CIE Marks	50
L: T: P: S	3:0:0:0	SEE Marks	50
Hours / Week	03	Total Marks	100
Credits	03	Exam Hours	03

Course outcomes:

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

22EEE343.1	Understand the various types of energy storage technologies
22EEE343.2	Develop various thermal storage systems
22EEE343.3	Choose appropriate battery storage technologies
22EEE343.4	Design the thermodynamics of fuel cell
22EEE343.5	Analyze the appropriate storage technologies for different applications
22EEE343.6	Explore the alternate energy storage technologies

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
22EEE343.1	3	1	-	-	-	-	-	-	-	-	-	-	2	-
22EEE343.2	3	-	2	-	-	-	-	-	-	-	-	-	2	-
22EEE343.3	3	-	2	-	-	-	-	-	-	-	-	-	2	-
22EEE343.4	3	-	2	-	-	-	-	-	-	-	-	-	2	-
22EEE343.5	3	3	-	-	-	-	-	-	-	-	-	-	2	-
22EEE343.6	3	2	2	-	-	-	-	-	-	-	-	-	2	-

MODULE-1	INTRODUCTION	22EEE343.1, 22EEE343.2	3 Hours

Necessity of energy storage – types of energy storage – comparison of energy storage technologies- Applications.

Text Book	Text Book 1: Ch. 1, 2		
MODULE-2	**THERMAL STORAGE SYSTEM**	**22EEE343.2, 22EEE343.3**	**3 Hours**

Thermal storage – Types – Modeling of thermal storage units – Simple water and rock bed storage system – pressurized water storage system – Modelling of phase change storage system –Simple units, packed bed storage units - Modelling using porous medium approach, Use of TRNSYS.

Text Book	Text Book 1: Ch. 3		
MODULE-3	**ELECTRICAL ENERGY STORAGE**	**22EEE343.4**	**3 Hours**

Fundamental concept of batteries – measuring of battery performance, charging and discharging,power density, energy density, and safety issues. Types of batteries – Lead Acid, Nickel – Cadmium, Zinc Manganese dioxide, Li-ion batteries - Mathematical Modelling for Lead Acid Batteries – Flow Batteries.

Case Study	To analyze the data sheets of different types of battery and observe the parameters
Text Book	Text Book 2: Ch. 1,2,3 and 4

MODULE-4	FUEL CELL	22EEE343.5	3 Hours

Fuel Cell – History of Fuel cell, Principles of Electrochemical storage – Types – Hydrogen oxygencells, Hydrogen air cell, Hydrocarbon air cell, alkaline fuel cell, detailed analysis – advantages and disadvantages.

Text Book	Text Book 3: Ch. 1,2 and 3		
MODULE-5	**ALTERNATE ENERGY STORAGE TECHNOLOGIES**	**22EEE343.5, 22EEE343.6**	**3 Hours**

Flywheel, Super capacitors, Principles & Methods – Applications, Compressed air Energy storage, Concept of Hybrid Storage – Applications, Pumped Hydro Storage – Applications.

Case Study	Analyze different types of storage elements available in the market
Text Book	Text Book 2: Ch. 8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	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) Ibrahim Dincer and Mark A. Rosen, 'Thermal Energy Storage Systems and Applications',John Wiley & Sons, 3rd Edition, 2021, ISBN: 978-1-119-71315-9
2) Ru-shi Liu, Lei Zhang and Xueliang sun, 'Electrochemical technologies for energy storageand conversion', Wiley publications, 2nd Volume set, 2012, ISBN: 978-3-527-64007-2
3) James Larminie and Andrew Dicks, 'Fuel cell systems Explained', Wiley publications, 3rdEdition, 2018, ISBN:9781118613528.

Reference Books:
1) Francisco Díaz-González, Andreas Sumper, Oriol Gomis-Bellmunt," Energy Storage in Power Systems" Wiley Publication, ISBN: 978-1-118-97130-7, Mar 2016.
2) Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018, ISBN: 9783319699509

Web links and Video Lectures (e-Resources):
- Prof. Subhasish Basu Majumder, "Electrochemical Energy Storage", NPTEL Course,https://nptel.ac.in/courses/113105102.
- Prof. PK Das, "Energy conservation and waste heat recovery", NPTEL Course,https://nptel.ac.in/courses/112105221.

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

- Video Sessions
- Organizing Group Wise Discussions
- Seminars

<div align="center">

SIGNALS AND SYSTEMS

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Course Code	22EEE344	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:

22EEE344.1	Understand and represent the continuous and discrete time signals and systems
22EEE344.2	Examine the properties of LTI systems and evaluate the response
22EEE344.3	Represent any periodic signal using Fourier series
22EEE344.4	Estimate the frequency response of any time domain signal using Fourier Transform
22EEE344.5	Evaluate the time response using Z Transform
22EEE344.6	Realize Discrete Time system

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
22EEE344.1	3	3	2	3	-	-	-	-	-	-	-	-	-	-
22EEE344.2	3	3	2	3	-	-	-	-	-	-	-	-	-	-
22EEE344.3	3	3	2	3	-	-	-	-	-	-	-	-	-	-
22EEE344.4	3	3	2	3	-	-	-	-	-	-	-	-	-	-
22EEE344.5	3	3	2	3	-	-	-	-	-	-	-	-	-	-
22EEE344.6	3	3	2	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	**SIGNALS AND SYSTEMS**	**22EEE344.1**	**8 Hours**

Signals- Continuous -Discrete – Periodic and Aperiodic – Even and Odd - Energy and Power signals.
Systems- Continuous and Discrete – Linear and Non-Linear – Time Variant and Invariant, Causal and Non-Causal – Stable and Unstable - Static and Dynamic systems.
Types of test signals.

Text Book	Text book1: 1.1, 2.1		
MODULE-2	**TIME-DOMAIN REPRESENTATIONS FOR LTI SYSTEMS**	**22EEE344.1, 22EEE344.2**	**8 Hours**

Convolution – Properties – Convolution Sum and Convolution Integral for infinite duration sequences - Solutions of differential and difference equations – Block diagram representation – Direct form I and Direct form II.

Self -study	Numerical on block diagram representation of LTI systems		
Text Book	1.2, 1.3, 2.2		
MODULE-3	**FOURIER SERIES**	**22EEE344.3**	**8 Hours**

Representation - Properties - Dirichlet conditions – Trigonometric and Exponential Fourier series -Complex Fourier spectrum.

Text Book	1.3, 2.3		
MODULE-4	**FOURIER TRANSFORM**	**22EEE344.4**	**8 Hours**

Deduction from Fourier series - Fourier transform of arbitrary and standard signals - Properties -Fourier transforms involving impulse function and Signum function.

Self -study	Numerical on stability of system		
Text Book	1.3, 1.4, 2.3		
MODULE-5	**Z TRANSFORM AND REALISATION OF SYSTEMS**	**22EEE344.5, 22EEE344.6**	**8 Hours**

The Z Transform – Properties of Region of Convergence - Properties of Z Transform – Inverse Z transform. Stability – Causality.

Text Book	1.7, 2.5

CIE Assessment Pattern (50 Marks – Theory)

	RBT Levels	Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	**15**	**10**
L1	Remember	10	-	-
L2	Understand	10	-	-
L3	Apply	5	5	5
L4	Analyze	-	5	5
L5	Evaluate	-	5	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:
 Text Books:
1) Signals and Systems, Simon Haykin and Barry Van Veen, 2nd edition, 2007, John Wiley & sons.
2) Signals and Systems, Udaykumar S, 6th edition, 2012, Prism book House.

Reference Books:
1) Signals and Systems, Allen V Oppenheim, Allen S. Willsiky, S. Hamid Nawab, 2015, PHI.
2) Principles of Linear Systems and Signals, B.P.Lathi, 2nd edition, 2009, Oxford University Press.

Web links and Video Lectures (e-Resources):
- https://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011/lecture-notes/
- https://www.youtube.com/playlist?list=PLC6210462711083C4

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

- Video sessions
- Organizing Group wise discussions
- Seminars
- E – Resources for the virtual learning environment
- Practical sessions
- Occasional Flipped classroom exercise

MATERIAL SCIENCE				
Course Code	**22EEE345**		**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**		**SEE Marks**	**50**
Hours / Week	**3**		**Total Marks**	**100**
Credits	**3**		**Exam Hours**	**03**

Course outcomes:

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

22EEE345.1	Understand the conductors and semiconductor properties and materials.
22EEE345.2	Analyze special materials and modern techniques for material studies.
22EEE345.3	Differentiate dielectric materials and plastics properties and applications.
22EEE345.4	Select a proper insulating and magnetic material for manufacturing electrical equipment.
22EEE345.5	Understand piezo-electric materials and various types of ceramics used in electrical equipment.
22EEE345.6	Evaluate appropriate materials for electrical equipment according to desired specification.

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
22EEE345.1	2	2	2	1	1	-	2	1	1	1	1	1	-	1
22EEE345.2	2	2	2	1	1	-	2	1	1	1	1	1	-	1
22EEE345.3	2	2	2	1	1	-	2	1	1	1	1	1	-	1
22EEE345.4	2	2	2	1	1	-	2	1	1	1	1	1	-	1
22EEE345.5	2	2	2	1	1	-	2	1	1	1	1	1	-	1
22EEE345.6	2	2	2	1	1	-	2	1	1	1	1	1	-	1

MODULE-1	**CONDUCTIVITY OF METALS**	**22EEE345.1**	**8 Hours**

Review of metallic conduction on basis of free electron theory, Fermi-Dirac distribution, variation of conductivity with temperature and composition materials for electric resistors-general electric properties, material for brushes of electrical machines, lamp filaments, fuses and solder.
Semiconductors: Review of mechanism of conduction in semiconductors and types of semiconductors, density of carrier in intrinsic semiconductors, Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors.

Text Book	Text book 1:1.1, 1.2, 1.3,1.4, 2.1, 2.2		
MODULE-2	**MAGNETIC AND NON MAGNETIC MATERIALS**	**22EEE345.2**	**8 Hours**

Classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials used in electrical machines, Instruments and relays.
Insulating Materials: Inorganic materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and Bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators

Text Book	Text book 2:2.6, 2.7, 2.5, 2.6		
MODULE-3	**DIELECTRICS**	**22EEE345.3**	**8 Hours**

Review of dielectric materials(Polarisation,Types,Temperature dependence on Polarization) Complex dielectric constant , dipolar relaxation, dielectric loss, Factors influencing dielectric strength and capacitor materials
Plastics: Thermoplastics, rubber, Thermostats, properties and applications.

Text Book	Text book 3:1.4, 1.5, 2.4, 3.2, 3.3, 3.4		
MODULE-4	**MATERIALS FOR SPECIAL APPLICATIONS**	**22EEE345.4, 22EEE345.5**	**8 Hours**

Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, and sintered alloys for breaker and switch contacts.
Modern Techniques For Materials Studies: Principle and Experimental set up: optical microscopy, Electron microscopy, Photo electron spectroscopy, Atomic absorption spectroscopy, magnetic nuclear magnetic resonance, and ferromagnetic resonance.

Text Book	Text book 2:6.1, 6.2, 6.3, 6.4, 6.5		
MODULE-5	**PIEZO ELECTRIC MATERIALS**	**22EEE345.6**	**8 Hours**

Introduction Properties and Application of Piezoelectric materials, Eletrostrictive materials, Magnetostrictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydrogels.

Ceramics : Properties, Application to conductors ,insulators and capacitors

Text Book	Text book 3: 4.1, 4.2

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**	5	15	--
L4	**Analyze**	5	--	--
L5	**Evaluate**	5	--	--
L6	**Create**	--	--	--

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:
Text Books:
   1) An Introduction to Electrical Engineering Materials, C.SIndulkar&S.Thiruvengadam, S.Chand& company limited, 5th Edition,2013.
   2) Materials Science for Electrical and Electronic Engineers , Ian P. Jones, Oxford University Press, Indian Edition, 2010.
   3) Electrical and Electronics Engineering Materials, G.K Banerjee, PHI Learning Private Limited, First edition ,ISBN-978-81-203-5014-4
   4) Magnetism and Magnetic Materials, J. M. D. Coey, Cambridge University Press, ISBN-978-0-521-81614-4
   Reference Books:
   1) Electrical Properties of Materials, L.Solymar, D.Walsh, OUP oxford, 9th Indian Edition, 2014.
   2) Electrical Engineering materials,A.J.Dekkar, Prentice Hall of India private limited, 2013.

Web links and Video Lectures (e-Resources):
   - https://www.youtube.com/watch?v=KWmWFs8iIQ4
   - https://www.youtube.com/watch?v=KMcsjCXfLQw

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
   - Video demonstration of Various Conductors and Semiconductors Used
   - Contents related activities (Activity-based discussions)
   - Seminars

22EEE35X-Ability Enhancement Course–III
(For EEE, all are Laboratory Courses 0-0-1-0)

MICRCONTROLLER AND EMBEDDED SYSTEMS LABORATORY				
Course Code	22EEE351	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:

22EEE351.1	Apply 8051 microcontroller assembly language programs for basic operations on the memories
22EEE351.2	Use SFRs, delay subroutine to write 8051 microcontroller assembly language programs for data processing
22EEE351.3	Analyze embedded C program to the 8051 microcontroller to an external world
22EEE351.4	Interface the 8051 for DAC, Stepper motor control, DC motor control, LCD and Keyboard

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
22EEE351.1	3	3	3	3	2	-	-	-	-	-	-	-	2	-
22EEE351.2	3	3	3	3	2	-	-	-	-	-	-	-	2	-
22EEE351.3	3	3	3	3	2	-	-	-	-	-	-	-	2	-
22EEE351.4	3	3	3	3	2	-	-	-	-	-	-	-	2	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Introduction to 8051 Microcontroller architecture (Block diagram, pin diagram, memory organization, I/O Ports, Registers, instruction set etc.)	2	NA
	PART-A		
1	Study of data transfer and data manipulation instructions, loop operation (block data movement, sorting, exchanging, finding largest element in an array)	2	22EEE351.1
2	To write an ALP for Arithmetic instructions: Addition, subtraction, multiplication and division. Square and cubeoperationsfor16-bitnumbers.	2	22EEE351.1, 22EEE351.2
3	To write an ALP for Boolean and logical instructions(bit manipulation)	2	22EEE351.1, 22EEE351.2
4	To write an ALP for Conditional call and return instructions	2	22EEE351.1
5	To write an ALP for code conversion programs: ASCII to decimal, Decimal to ASCII, Hexa to decimal and Decimal to Hexa	2	22EEE351.1, 22EEE351.2
6	To write an ALP for delay operations	2	22EEE351.1, 22EEE351.2
	PART-B		
7	To write an ALP and C Program using serial port and on-chip timer	2	22EEE351.3, 22EEE351.4
8	To write an ALP and C Program: 8051Interfacing with DC motor	2	22EEE351.3, 22EEE351.4
9	To write an ALP and C Program: 8051Interfacing with stepper Motor	2	22EEE351.3, 22EEE351.4
10	To write an ALP and C Program: 8051 Interfacing: LCD	2	22EEE351.3, 22EEE351.4

11	To write an ALP and C Program: 8051 Interfacing: DAC (waveform generation)	2	22EEE351.3, 22EEE351.4
12	To write an ALP and C Program: 8051 Interfacing: Keyboard	2	22EEE351.3, 22EEE351.4

<div style="text-align:center; color:red;">

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

</div>

1.Flash LED in 8051 MicroController

http://ebootathon.com/labs/beta/ec/MicroprocessorAndMicrocontrollerLab/exp1/simulation.html

2.LCD Interfacing with 8051 Microcontroller

https://embetronicx.com/tutorials/microcontrollers/8051/lcd-interfacing-with-8051-microcontroller/

3.Real Time Embedded Systems

http://vlabs.iitkgp.ac.in/rtes/

CIE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) The 8051 Microcontroller and Embedded Systems – using assembly and C, Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rollin D.McKinlay, 2nd Edition, 2007, Pearson Education. ISBN: 9788131710265.

2) The 8051 Microcontroller & Embedded Systems Using Assembly and C with CD, Kenneth Ayala, 1st Edition, 2010, Cengage Learning, India. ISBN: 9788131511053.

INTRODUCTION TO MATLAB

Course Code	22EEE352		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:

22EEE352.1	Perform basic mathematical operations using the software
22EEE352.2	Explore the utility of computational tools
22EEE352.3	Analyze an engineering system/Problem through graphical representation and numerical analysis
22EEE352.4	Develop the electrical and electronics circuits for the given applications

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO010	PO011	PO12	PSO1	PSO2
22EEE352.1	3	2	2	2	2	-	-	-	-	-	-	-	3	-
22EEE352.2	3	2	2	2	2	-	-	-	-	-	-	-	3	-
22EEE352.3	3	2	2	2	2	-	-	-	-	-	-	-	3	-
22EEE352.4	3	2	2	2	2	-	-	-	-	-	-	-	3	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic Computational knowledge • Basic knowledge on the application circuits	2	NA
	PART-A		
1	To write a program to perform some basic operation on matrices such as addition, subtraction, multiplication.	2	22EEE352.1
2	To write a program to generate various signals and sequences, such as unit impulse, unit step, unit ramp, sinusoidal, square, saw tooth, triangular, sine signals.	2	22EEE352.2
3	Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files.	2	22EEE352.2
4	To write program using Matrix Constructors and Operator, Matrix Bitwise operator, Relational Operators and Logical Operator	2	22EEE352.2
5	To write a program to create 2-D and 3-D plots in MATLAB using the plot function to visualize data	2	22EEE352.3
6	To write and execute programs using control loop statement.	2	22EEE352.2
	PART-B		
7	Analyze a given electrical network by applying Network Theorems using MATLAB.	2	22EEE352.4
8	Analyze the basic electronics circuits using MATLAB.	2	22EEE352.4
9	Design and analysis of measurement of Real Power, Reactive Power and Power Factor in Three Phase Circuits using MATLAB.	2	22EEE352.3
10	Determination of ABCD parameter of transmission network.	2	22EEE352.4
11	To write a MATLAB program to find the impulse response and step response of a system from its difference equation.	2	22EEE352.4
12	Speed control of DC motor using MATLAB.	2	22EEE352.4
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**		

1. MATLAB Fundamentals
https://in.mathworks.com/matlabcentral/
2. Signals and their properties

https://ssliitg.vlabs.ac.in/Signals%20and%20their%20properties(objectives).html

3.   2-D and 3-D Plots

https://in.mathworks.com/help/matlab/learn_matlab/plots.html

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) MATLAB: An Introduction with applications, Amos Gilat - Wiley India Pvt. Ltd, 4th Ed., 2012, ISBN-8126537205
2) Getting started with MATLAB, Rudra Pratap – Oxford University Press, 2010, ISBN- 0198069197
3) https://www.udemy.com/MATLAB/Online-Course
4) https://nptel.ac.in/courses/103/106/103106118
5) https://www.matlabtutorials.com/mathforum/

SCI LAB FOR DC MACHINES AND TRANSFORMERS

Course Code	22EEE353	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:

22EEE353.1	Examine the efficiencies and regulation of DC machines using different tests
22EEE353.2	Design various winding for DC Machines
22EEE353.3	Analyze the losses of a transformer and to test performance of the transformer
22EEE353.4	Simulate single phase transformer suing software

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
22EEE353.1	3	3	3	3	2	-	-	-	1	-	-	-	-	1
22EEE353.2	3	3	3	3	2	-	-	-	1	-	-	-	-	1
22EEE353.3	3	3	3	3	2	-	-	-	1	-	-	-	-	1
22EEE353.4	3	3	3	3	2	-	-	-	1	-	-	-	-	1

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
Prerequisite Experiments / Programs / Demo		
	• Introduction to Electrical Machines	2	NA
PART-A		
1	Open Circuit and Short circuit tests on single phase step up or step down transformer and predetermination of (i) Efficiency and regulation (ii) Calculation of parameters of equivalent circuit.	2	22EEE353.1
2	Sumpner's test on similar transformers and determination of combined and individual transformer efficiency.	2	22EEE353.1
3	Parallel operation of two dissimilar single-phase transformers of different kVA and determination of load sharing and analytical verification given the Short circuit test data.	2	22EEE353.1
4	Voltage regulation of an alternator by ZPF method.	2	22EEE353.2
5	Voltage regulation of an alternator by EMF and MMF methods	2	22EEE353.2
PART-B		
6	Air gap MMF calculation for magnetic circuits using SCILAB		
7	A SCILAB program for Design of Electromagnet	2	22EEE353.3
8	Design of an iron cored choke coil using SCILAB coding	2	22EEE353.3
9	Core Loss Calculations in magnetic materials using SCILAB Programming	2	22EEE353.3
10	Design of a small single-phase transformer using SCILAB coding	2	22EEE353.4

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

1. Electrical System modelling
https://www.scilab.org/software/xcos/electronics
2. DC Motor Simulation and Code Generation using ScicosLab and E4Code
https://youtu.be/AOV7YxOUNrI?si=ifHjS_4TejVqPzMy
3. Single Phase Transformer

CIE Assessment Pattern (50 Marks – Lab)

	RBT Levels	Test (s) 20	Weekly Assessment 30
L1	Remember	-	-
L2	Understand	-	-
L3	Apply	10	15
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	-
L3	Apply	20
L4	Analyze	15
L5	Evaluate	15
L6	Create	-

Suggested Learning Resources:
Reference Books:
1)Electrical Machines, S.K. Bhattacharya, McGraw Hill Education, 4th Edition, 2017. ISBN-10: 9332902852, ISBN-13: 978-9332902855
2) Electric machinery, AshfaqHussain, DhanpatRai& Co, 3rd Edition, 2016. ISBN-10: 8177001663, ISBN-13: 978-8177001662

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555 IC LABORATORY

</div>

Course Code	22EEE354	**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:

22EEE354.1	Understand the working and applications of 555 timers
22EEE354.2	Design the multivibrator circuits using IC555
22EEE354.3	Analyze multivibrator circuits using op-amp and 555Timer
22EEE354.4	Design and test LED circuits, Alarm Circuits and generate pulse, frequency shift keying using 555 timer

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
22EEE354.1	3	3	3	3	-	-	-	-	-	-	-	-	3	-
22EEE354.2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
22EEE354.3	3	3	3	3	-	-	-	-	-	-	-	-	3	-
22EEE354.4	3	3	3	3	-	-	-	-	-	-	-	-	3	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
Prerequisite Experiments / Programs / Demo		
	• **555 IC Architecture, pin diagram and timer applications.** • **Digital logic circuits basics**	2	NA
PART-A		
1	Construct Astable Multivibrator circuit using IC-555 Timer	2	22EEE354.1, 22EEE354.2
2	Construct Mono-stable Multivibrator circuit using IC-555 Timer	2	22EEE354.1, 22EEE354.2
3	Construct bistable multivibrator using 555 timer	2	22EEE354.1
4	Generate Pulse Width Modulator (PWM) signal using IC-555 Timer.	2	22EEE354.1, 22EEE354.2
5	Construct Burglar Alarm circuit using IC-555 Timer.	2	22EEE354.1, 22EEE354.2
PART-B		
6	Construct and generate Frequency Shift Keying (FSK) signal using IC-555 Timer.	2	22EEE354.3, 22EEE354.4
7	Construct and test Running LED circuit using IC-555 Timer.	2	22EEE354.3, 22EEE354.4
8	Construct water level indicator using IC-555 Timer	2	22EEE354.3, 22EEE354.4
9	Construct continuity tester using IC-555 Timer	2	22EEE354.3, 22EEE354.4
10	Construct and test Sequential timer using IC-555.	2	22EEE354.3, 22EEE354.4
11	Construct and test Advanced Red LED Flasher.	2	22EEE354.3, 22EEE354.4

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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.Astable and monostable multivibrator using IC 555
https://ae-iitr.vlabs.ac.in/exp/astable-monostable-multivibrator/theory.html

2.555 Timer circuit-https://www.multisim.com/content/JGVP34rADPxaJTV2epEsPk/555-timer-circuit/
3. DAC and ADC-https://he-coep.vlabs.ac.in/exp/digital-analog-converter/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1)Design of Function Circuits with 555 Timer Integrated Circuit, By K.C. Selvam, ISBN 9781032391700
2)Op-Amps and Linear Integrated Circuits | Fourth Edition | By Pearson Paperback ,by Ramakant A. Gayakwad, ISBN-9789332549913

ELECTRONICS APPLICATIONS LABORATORY

Course Code	22EEE355	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:

22EEE355.1	Apply powerful numerical computation capabilities, making it suitable for analyzing and designing electronic circuits
22EEE355.2	Simulate the various electronic circuits and study the circuit behavior, and optimize designs for various applications
22EEE355.3	Analyze the model of complex electronic circuits and assess their performance
22EEE355.4	Explore complex electronics signal scenarios 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
22EEE355.1	3	3	2	2	2	-	-	-	1	-	-	2	3	3
22EEE355.2	3	3	2	2	2	-	-	-	1	-	-	2	3	3
22EEE355.3	3	3	2	2	2	-	-	-	1	-	-	2	3	3
22EEE355.4	3	3	2	2	2	-	-	-	1	-	-	2	3	3

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	Cos
	Prerequisite Experiments / Programs / Demo		
	Basic Electronics Knowledge: Fundamental understanding of electronics principles, circuits, and components **Scilab Proficiency**: Familiarity with Scilab is essential. **Circuit Simulation Knowledge**: Create and analyze electronic circuit models using simulation tools can be highly advantageous. **Mathematical Concepts**: Electronics applications often involve mathematical operations, such as solving equations, differential equations, and signal processing.	2	NA
	PART-A		
1	Determine the base, emitter, collector current of Common Base configuration for the given alpha value.	2	22EEE355.1
2	Determine operating point of Fixed Bias circuit, given transistor gain and base to emitter voltage.	2	22EEE355.1
3	Determine output voltage of circuit given V_{be} for transistors Q1, Q2.	2	22EEE355.1
4	Determine value of drain current Id and gate source voltage V_{gs} for self-bias circuit.	2	22EEE355.1
5	Design Zener Shunt voltage regulator for the given specifications	2	22EEE355.2
6	Determine the value of R_s to achieve self-bias condition of N channel JFET	2	22EEE355.2
	PART-B		
7	Find the capacitance value in Wien-bridge oscillator given value of R and Frequency of oscillation.	2	22EEE355.2
8	Find Frequency of RC phase shift oscillator if the 3 resistances are equal and 3 capacitances are equal.	2	22EEE355.2

9	Determine input, output impedance voltage and current gain given h-parameters of transistor.	2	22EEE355.3
10	Design Schmitt Trigger circuit using 2 silicon NPN transistors with given configuration 243	2	22EEE355.3
11	Write a program to generate an exponential Sequence. $X(n) = (a)^n$ for $(i)\ 0 \leq a \leq 1$ $(ii)\ -1 \leq a \leq 0$ $(iii)\ a \leq -1$ $(iv)\ a > 1$	2	22EEE355.4
12	Write a program to generate the signal $S(n) = 2*n*(0.8^\wedge n)$ Corrupted by the noise d (n) resulting the signal X(n). $X(n) = s(n) + d(n)$.	2	22EEE355.4

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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 study I-V Characteristics of Diode.$\leq$
https://ee-iitb.vlabs.ac.in/exp1/index.html
2. To study the operation of rectifiers
https://ee-iitb.vlabs.ac.in/exp2/index.html
3. To study the output characteristics of BJT
https://ee-iitb.vlabs.ac.in/exp4/index.html
4. To study the voltage comparator
https://ae-iitr.vlabs.ac.in/exp/voltage-comparator/
5. To study log and antilog amplifier.
https://ae-iitr.vlabs.ac.in/exp/log-antilog-amplifier/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) Anil Kumar Verma, "Scilab A Beginner'S Approach by Anil Kumar Verma, Cengage India", Books from
2) same Publisher, ISBN:9789386858931. Cengage India.
3) Sandeep Nagar, "Introduction to Scilab: For Engineers and Scientists Paperback", Apress; ISBN: 1484231910

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) –

		Marks Distribution		
RBT Levels		**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 %20Workshop%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	Working on Task bar; team building activities; Interviewing Corporate experts to understand expectations

corporate people			
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

<table>
<tr><td colspan="5" align="center">**BASIC APPLIED MATHEMATICS-I**
(Common to all Branches)</td></tr>
<tr><td>**Course Code**</td><td>**22DMAT31**</td><td>**CIE Marks**</td><td>**50**</td></tr>
<tr><td>**L:T:P:S**</td><td>**0:0:0:0**</td><td>**SEE Marks**</td><td>**--**</td></tr>
<tr><td>**Hrs. / Week**</td><td>**2**</td><td>**Total Marks**</td><td>**50**</td></tr>
<tr><td>**Credits**</td><td>**00**</td><td>**Exam Hours**</td><td>**--**</td></tr>
</table>

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

<div align="center">

NUMERICAL, COMPLEX ANALYSIS AND PROBABILITY THEORY
(Common to ECE, EEE, MEE)

</div>

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:

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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

ANALOG ELECTRONICS AND INTEGRATED CIRCUITS

Course Code	22EEE42	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:

22EEE42.1	Understand the principle of basic semiconductor devices and its performance characteristics.
22EEE42.2	Apply mathematical knowledge to design and compare transistor amplifiers.
22EEE42.3	Analyze the power amplifier circuits and oscillators for different frequencies.
22EEE42.4	Choose proper operational amplifiers depending upon application and technological upgradation.
22EEE42.5	Design different electronics circuits to meet the specified needs
22EEE42.6	Apply the knowledge of Analog & Integrated Circuits to address the real life problems

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
22EEE42.1	3	3	-	3	-	-	-	-	-	-	-	-	1	1
22EEE42.2	2	3	2	3	-	-	-	-	-	-	-	-	1	1
22EEE42.3	2	3	3	3	-	-	-	-	-	-	-	-	1	1
22EEE42.4	3	3	3	3	-	-	-	-	-	-	-	-	1	1
22EEE42.5	3	3	3	3	3	-	-	-	-	-	-	-	1	1
22EEE42.6	3	2	2	2	3	-	-	-	-	-	-	-	1	1

MODULE-1	DIODE CIRCUITS AND TRANSISTOR DC BIASING	22EEE42.2, 22EEE42.5	8 Hours

PN Junction Diode - Diode equivalent circuits -Diode Clipping and Clamping circuits - BJT – Operating point - Analysis and design of Fixed bias circuit - Emitter stabilized bias circuit - Voltage divider bias circuit - Stability factor.

Self-study	V-I characteristics of CB,CC,CE configuration
Text Book	Text Book 1: 1.6, 1.9, 2.8, 2.9, 3.3, 4.3,4.4,4.5

MODULE-2	TRANSISTOR MODELING AND MULTI STAGE AMPLIFIER	22EEE42.1, 22EEE42.3 22EEE42.6	8 Hours

BJT transistor modeling-(hybrid equivalent model) - emitter follower, analysis using h – parameter model- CB configuration using approximate hybrid model- Frequency Response of CE single stage amplifier - Need for cascading - Cascade and Cascade connection - Darlington connection

Text Book	Text Book 1: 5.4, 5.5, 5.6,5.8,5.19

MODULE-3	POWER AMPLIFIERS, FEEDBACK AMPLIFIER AND OSCILLATOR	22EEE42.3, 22EEE42.6	8 Hours

Definitions and amplifier types - Transformer coupled Class A amplifiers - Class B amplifier circuits - Feedback concept - Effects of Negative Feedback - Feedback connection types- Barkhausen criterion - analysis and working of Phase shift Oscillator- Tuned Oscillator circuits - Crystal Oscillator.

Text Book	Text Book 2: 13.1, 3.3, 3.5, 3.7, 3.10

MODULE-4	OPERATIONAL AMPLIFIERS	22EEE42.4, 22EEE42.6	8 Hours

Introduction, Block diagram and characteristics of an Op-amp. Inverting & non –inverting amplifier
General Linear Applications: A.C. amplifier, summing, scaling & averaging amplifier, Instrumentation amplifier.

Self -study	Schmitt Trigger
Text Book	Text Book 3: 2.1, 2.7, 3.3-3.8

MODULE-5	COMPARATORS & ACTIVE FILTERS	22EEE42.5, 22EEE42.6	8 Hours

Basic comparator, zero crossing detector, inverting Schmitt trigger circuit. Triangular Wave Generator.

First & Second order high pass & low pass filter.
Timer: Internal architecture of 555 timers, Mono stable multivibrator, Astable Multivibrator.

Text Book	Text Book 3: 8.2-8.4

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:
 Text Books:
1) Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, PHI, 11th Edition, 2015. ISBN: 9332542600

2) Electronics Devices and Circuits, David A.Bell, PHI, 5th Edition, 2008. ISBN: 019569340X

3) Operational amplifiers and linear IC's, David A Bell, Oxford University Press, 2014, ISBN: 9780195696134

Reference Books:
1) Integrated Electronics, Jacob Millman & Christos, C. Halkias, Tata-McGraw Hill, 2nd Edition, 2010. ISBN:9780070151420

2) FundamentalsofAnalogCircuits,ThomasLFloyd,Pearson,2nd edition,2012,ISBN: 0130606197

3) ElectronicDevicesandCircuits,S.Salivahanan,N.Suresh,McGrawHill,3rd edition,2013 ISBN:
    978-0070660847

4) Op-Amps, Design, Applications and Trouble Shooting, Elsevier, 2ndEdition, 2015. ISBN: 9780750697026.

5) Linear Integrated Circuits, S.Salivahanan, V S Kanchana, Bhasskaran Mc Graw Hill, August 2018. ISBN: 9789351342885

6) Operational Amplifiers & Linear Integrated Circuits Theory and Application / 3E, James M. Fiore Version 3.2.6, 07 May 2021, ISBN: 0314908935

Web links and Video Lectures (e-Resources):
- https://www.youtube.com/watch?v=pkIxCmaxWFg
- https://www.youtube.com/watch?v=qRIhUkNeq04
- https://www.youtube.com/watch?v=oZj7iI9zVH4

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

- Video demonstration of latest trends in analog electronics

- For active participation of students, instruct the students to prepare Flowcharts, Handouts, Mind maps.

- Organizing Group wise discussions on real world project

- Seminars
- Experiential learning through lab experiments

ANALOG ELECTRONICS AND INTEGRATED CIRCUITS LABORATORY

Course Code	22EEL42	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:

22EEL42.1	Explore the knowledge of different analog electronic components
22EEL42.2	Analyze the characteristics of semiconductor diodes and implement various analog circuits.
22EEL42.3	Choose various analog and integrated circuits according to the applications
22EEL42.4	Compare different filter circuits and its characteristics

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
22EEL42.1	3	3	2	2	-	-	-	-	-	-	-	-	2	-
22EEL42.2	3	3	2	2	-	-	-	-	-	-	-	-	2	-
22EEL42.3	3	3	3	3	-	-	-	-	-	-	-	-	2	-
22EEL42.4	3	3	3	3	-	-	-	-	-	-	-	-	2	-

Exp. No.	List of Experiments	Hours	COs
	Prerequisite Experiments		
	• Demonstration for measuring instruments-Multimeter, CRO • Basic idea about electronic circuits and its operation • Familiarization of the components and equipment used in the lab, Ex: Resistors, Capacitors	2	NA
	PART-A		
1	Design and implementation of Half-wave rectifiers with and without capacitor filter	2	22EEL42.1, 22EEL42.2,
2	Design and implementation of Full-wave rectifiers with and without Capacitor filter	2	22EEL42.1, 22EEL42.2
3	Design and implementation of Clipper and clamper circuits	2	22EEL42.1, 22EEL42.2
4	Design and implementation of Zener voltage regulator	2	22EEL42.1, 22EEL42.2
5	Design and Implementation of Series Voltage Regulator	2	22EEL42.2
6	Design and Implementation of RC coupled amplifier	2	22EEL42.2
	PART-B		
7	Design and Implementation of Class B Push-Pull amplifier	2	22EEL42.2
8	Design and Implementation of RC Phase Shift Oscillator	2	22EEL42.2
9	Design and verify the operation of op – amp as an (a) adder (b) subtractor (c) integrator and (d) differentiator	2	22EEL42.3
10	Design and realize to analyze the frequency response of an op – amp amplifier under inverting and non -inverting configuration for a given gain	2	22EEL42.3
11	Design and realize Schmitt trigger circuit using an op – amp for desired upper trip point (UTP) and lower trip point (LTP)	2	22EEL42.3
12	Design and realize an op – amp based first order Butterworth (a) low pass (b) high pass and (c) band pass filters for a given cut off frequency/frequencies to verify the frequency response characteristic	2	22EEL42.4
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**		

1. Half wave rectifier-https://be-iitkgp.vlabs.ac.in/exp/half-wave-rectification/
2. Zener diode voltage regulator- https://be-iitkgp.vlabs.ac.in/exp/voltage-regulator/
3. RC frequency response- https://be-iitkgp.vlabs.ac.in/exp/frequency-response/
4. Inverting and non-inverting op-amp- https://be-iitkgp.vlabs.ac.in/exp/non-inverting-amplifiers/
5. Differentiator and integrator using op-amp- https://be-iitkgp.vlabs.ac.in/exp/operational-amplifier/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) Integrated Electronics, JacobMillman &Christos, C.Halkias,Tata-McGrawHill,2ndEdition,2010. ISBN:9780070151420
2)FundamentalsofAnalogCircuits,ThomasLFloyd,Pearson,2ndedition,2012,ISBN: 0130606197
3)ElectronicDevicesandCircuits,S.Salivahanan,N.Suresh,McGrawHill,3rdedition,2013 ISBN: 978-0070660847
4) Op-Amps, Design, Applications and Trouble Shooting, Elsevier, 2ndEdition, 2015. ISBN:9780750697026.

DIGITAL LOGIC DESIGN

Course Code	22EEE43	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:

22EEE43.1	Choose appropriate Boolean reduction technique for digital logic circuit design
22EEE43.2	Design the combinational logic circuits
22EEE43.3	Analyze various synchronous and asynchronous digital logic circuits
22EEE43.4	Design sequential logic circuits for various applications
22EEE43.5	Construct optimized digital circuits for the desired specification
22EEE43.6	Develop Verilog code for 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
22EEE43.1	3	3	2	1	-	-	-	-	-	-	-	-	1	1
22EEE43.2	3	3	3	2	-	-	-	-	-	-	-	-	1	1
22EEE43.3	3	3	3	3	-	-	-	-	-	-	-	-	1	1
22EEE43.4	3	3	3	2	-	-	-	-	-	-	-	-	1	1
22EEE43.5	3	3	3	2	-	-	-	-	-	-	-	-	1	1
22EEE43.6	3	3	3	-	3	-	-	-	-	-	-	-	1	1

MODULE-1	COMBINATIONAL LOGIC CIRCUITS		22EEE43.1	8 Hours

Definition of digital system, combinational logic circuits, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3, 4 and 5 variables, Incompletely specified functions (Don't Care terms), Simplifying Max term equations. Design of combination circuits using NAND and NOR gates.
Quine-McCluskey minimization technique, Quine-McCluskey using Don't care terms, Map entered variable.

Self-study	Recall the concepts of Boolean algebra and logic gates
Text Book	Text Book 1: 2.1 to 2.5 Text book 2: 5.1 to 5.7

MODULE-2	ANALYSIS AND DESIGN OF COMBINATIONAL LOGIC CIRCUITS		22EEE43.2	8 Hours

Adders and subtractors, cascading full adders, Look ahead carry, Binary comparators, Decoders-Encoders, Priority encoders. Digital multiplexers, Using multiplexers as Boolean function generators, Demultiplexers.

Applications	Investigate combinational logic circuit applications.
Text Book	Text Book 1: 4.3 to 4.6 Ref.Book 3: 4.1,4.2 to 4.8

MODULE-3	SEQUENTIAL LOGIC CIRCUITS		22EEE43.3, 22EEE43.4	8 Hours

Basic Bistable Element, Latches, SR Latch, gated SR Latch, gated D Latch, Characteristics equations of latches. Flip-flops-SR, JK,D,T, Master-Slave SR Flip-Flops, Master-Slave JK Flip-Flops, Registers, Types of shift – registers

Text Book	Text Book 1: 6.1 to 6.6

MODULE-4	DESIGN OF SEQUENTIAL LOGIC CIRCUITS		22EEE43.5	8 Hours

Design of asynchronous & synchronous counters, binary counters, Counters based on Shift Registers, Design of a Synchronous Modulo Counter using clocked Flip-Flops. Concept of states, state diagram, state table & state assignment. Mealy & Moore state models.

Self study	Investigate sequential logic circuit applications.
Text Book	Text Book 1: 7.1 to 7.6 Text Book 2: 11.1 to 11.8 Ref.Book 3: 5.1 to 5.9

MODULE-5	VERILOG HDL		22EEE43.6	8 Hours

Introduction, A brief history of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, Simulation and synthesis. Design of combinational, sequential logic circuits and state machines using Verilog

Text Book	Text Book 2: 10.1 to 10.6

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	2	2
L3	Apply	10	5	3
L4	Analyze	5	5	3
L5	Evaluate	5	3	2
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:
  Text Books:
1) Digital Design and computer design, M. Morris Mano, Pearson Education, 6th Edition, 2018.
2) Fundamentals of logic design, Charles H Roth, larry L henny, Raghunandan G. H. Cengage India Private Limited, 1st Edition, 2019.

Reference Books:
1) Digital electronics, B.R.Gupta, V.Singhal, S.K Kataria& sons, 7thEdition, 2014.
2) Logic and computer design Fundamentals, Mono and Kim, Prentice Hall, 5th Edition, 2015.
3) Fundamentals of digital logic with Verilog design, S. Brown and Z. Vranesic, McGraw-Hill, Third Edition, 2014.
4) Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 8th Edition, reprint 2017.
5) Verilog HDL: A Guide to Digital Design and Synthesis, S. Palnitkar, Pearson Education, Second Edition, 2015

Web links and Video Lectures (e-Resources):
- https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
- https://www.youtube.com/watch?v=7B7ieen98bY
- https://www.tutorialspoint.com/digital_electronics/index.asp
- https://www.youtube.com/watch?v=vsoYlH1_hbc&list=PLWPirh4EWFpHk70zwYoHu87uVsCC8E2S-
- https://onlinecourses.nptel.ac.in/noc20_ee32/preview

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

- Demonstration of logic gates using hardware

- Video demonstration of digital logic circuits

- Industry expert lecture

DIGITAL LOGIC DESIGN LABORATORY

Course Code	22EEL43	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:

22EEL43.1	Apply Boolean Algebra and Simplification tools for solving problems
22EEL43.2	Analyze the operation of combinational and sequential logic circuits
22EEL43.3	Use EDA tool to develop digital logic circuits
22EEL43.4	Evaluate the logic circuits to draw conclusions based on RTL synthesis

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
22EEL43.1	3	2	2	1	-	-	-	-	-	-	-	1	-	1
22EEL43.2	2	3	2	1	-	-	-	-	-	-	-	1	-	1
22EEL43.3	2	2	2	1	3	-	-	-	-	-	-	1	-	1
22EEL43.4	2	2	2	3	3	-	-	-	-	-	-	1	-	1

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	1. Boolean Laws and Simplification procedures 2. Understanding the operation of combinational and logic circuits	2	NA
	PART-A		
1	Simplification, realization of Boolean expressions using logic gates/Universal gates.	2	22EEL43.1 22EEL43.2
2	Realization of Half/Full adder and Half/Full Subtractors using logic gates.	2	22EEL43.1 22EEL43.2
3	MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter.	2	22EEL43.1 22EEL43.2
4	Realization of One/Two bit comparator and study of 7485 magnitude comparator.	2	22EEL43.1 22EEL43.2
5	Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type.	2	22EEL43.1 22EEL43.2
6	Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).	2	22EEL43.1 22EEL43.2
	PART-B		
7	Develop a Verilog module for full adder and parallel adder. Test the modules using test bench	2	22EEL43.3 22EEL43.4
8	Develop a Verilog module for 8 to 1 Mux. Test the modules using test bench	2	22EEL43.3 22EEL43.4
9	Develop a Verilog module for 8 to 3 Priority Encoder. . Test the modules using test bench	2	22EEL43.3 22EEL43.4
10	Develop a Verilog module for D, SR, JK and T Flip Flops. Test the modules using test bench	2	22EEL43.3 22EEL43.4
11	Develop a Verilog module for counters. Test the modules using test bench	2	22EEL43.3 22EEL43.4
12	Develop a Verilog module for Shift Register. Test the modules	2	22EEL43.3 22EEL43.4
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**		

1.Analysis of Boolean equations- https://dec-iitkgp.vlabs.ac.in/exp/basic-logic-gates/

2. Analysis of logic circuits using decoders-https://dec-iitkgp.vlabs.ac.in/exp/functions-using-decoders/

3. Analysis of logic circuits using comparator-https://dec-iitkgp.vlabs.ac.in/exp/digital-comparators/

4. Analysis of sequential circuits using flip flops-https://dec-iitkgp.vlabs.ac.in/exp/sequential-circuits/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) Joseph Cavanagh, "Verilog HDL Design Examples", Publisher: CRC Press, Taylor & Francis group, 2018, ISBN- 9781138099951
2) Dr. Cherry Bhargava and Dr. RajkumarSarma, "Hardware Description Language Demystified: Explore Digital System Design using Verilog HDL and VLSI Design Tools", Publisher: BPB Publications, 2020, ISBN-9789389898040

SYNCHRONOUS AND INDUCTION MACHINES

Course Code	22EEE44	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:

22EEE44.1	Understand the operation and performance of three phase induction motor.
22EEE44.2	Select suitable starting and speed control technique(s) for three phase induction motors.
22EEE44.3	Implement the starting of single-phase induction motors.
22EEE44.4	Develop winding design and predetermine the regulation of synchronous generators
22EEE44.5	Analyze hunting phenomenon, implement methods of staring and correction of power factor with synchronous motor.
22EEE44.6	Identify appropriate AC machines 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
22EEE44.1	3	3	1	1	-	-	-	-	-	-	-	-	-	1
22EEE44.2	3	3	1	1	-	-	-	-	-	-	-	-	-	1
22EEE44.3	3	3	1	1	-	-	-	-	-	-	-	-	-	1
22EEE44.4	3	3	1	1	-	-	-	-	-	-	-	-	-	1
22EEE44.5	3	3	1	1	-	-	-	-	-	-	-	-	-	1
22EEE44.6	3	3	1	1	-	-	-	-	-	-	-	-	-	1

MODULE-1	**THREE PHASE INDUCTION MACHINES**	**22EEE44.1, 22EEE44.6**	**8 Hours**

Concept of rotating magnetic field – Principle of operation – Construction – Types of rotor – Torque-Slip characteristics – Losses – Efficiency.

Text Book	Text Book 1: 9.1, 9.2, 9.3, 9.4, 9.5 Text Book 2: 6.1, 6.2, 6.3

MODULE-2	**STARTING AND TESTING OF THREE-PHASE INDUCTION MOTOR**	**22EEE44.2, 22EEE44.6**	**8 Hours**

Necessity of starter - Types of starters- Speed control methods- No load and blocked rotor tests - brake test- Circle diagram - Cogging and Crawling.

Self- Study	Speed control methods
Text Book	Text Book 1: 9.6, 9.7, 9.8, 9.9, 9.10 Text Book 2: 6.4, 6.5, 6.6

MODULE-3	**SINGLE-PHASE INDUCTION MOTOR**	**22EEE44.3, 22EEE44.6**	**8 Hours**

Double revolving field theory - Principle of operation – Types - Split phase induction motors- Capacitor start motor - Capacitor start and run motor - Shaded pole motor - AC series motor - Applications.

Text Book	Text Book 1: 10.2 Text Book 2: 6.7, 6.8, 6.9

MODULE-4	**SYNCHRONOUS GENERATOR**	**22EEE44.4, 22EEE44.6**	**8 Hours**

Principle of operation- Construction - EMF equation - Armature reaction - Phasor diagram - Voltage regulation - EMF, MMF and ZPF methods - Parallel operation.

Text Book	Text Book 1: 8.13, 8.14, 8.15, 8.16, 8.17 Text Book 2: 5.11, 5.12, 5.13

MODULE-5	**SYNCHRONOUS MOTOR**	**22EEE44.4, 22EEE44.6**	**8 Hours**

Principle of operation - Phasor diagram - V and inverted V curves - Starting Methods – Applications.

Self -Study	Applications of synchronous motor
Text Book	Text Book 1: 8.1, 8.2, 8.3, 8.4, 8.5 Text Book 2: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6

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	5
L3	Apply	5	5	-
L4	Analyze	5	3	-
L5	Evaluate	5	2	-
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) Electric Machines, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill Education, 5th Edition, 2017. ISBN-10: 935260640X, ISBN-13: 978-9352606405
 2) Electric Machinery, P. S. Bhimbra, Khanna publications, 7th Edition, 2015. ISBN: 978-81-7409-152-9

Reference Books:
 1) Electrical Machines, S.K. Bhattacharya, McGraw Hill Education, 4th Edition, 2017. ISBN-10: 9332902852, ISBN-13: 978-9332902855
 2) Electric machinery, Ashfaq Hussain, Dhanpat Rai& Co, 3rd Edition, 2016. ISBN-10: 8177001663, ISBN-13: 978-8177001662
 3) Electrical Machines, R. K. Rajput, Laxmi Publication, 6th Edition, 2018. ISBN: 9788131804469
 4) Electric Machinery, Fitzgerald & Kingsley's, Stephen Umans, McGraw Hill Education; 7th edition, 2014. ISBN10: 0073380466, ISBN13: 9780073380469
 5) A Course in Electrical Technology-II, J.B. Gupta, S. K. Kataria and Sons, 14th Edition, 2017. ISBN-10 : 9350144158, ISBN-13: 978-9350144152

Web links and Video Lectures (e-Resources):
 - https://onlinecourses.nptel.ac.in/noc21_ee13/preview
 - https://electrical-engineering-portal.com/academy/courses/electrical-machines-dc-synchronous-induction-transformers
 - https://www.beeindia.gov.in/sites/default/files/3Ch2.pdf
 - https://electrical-engineering-portal.com/resources/knowledge/induction-machines
 - https://standards.ieee.org/ieee/1349/10559/

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

- Visit to any electrical machines manufacturing industry or any power plant
- Demonstration of induction motor/ synchronous motor
- Demonstration of working of induction machines
- Video demonstration of latest trends in industry
- 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

SYNCHRONOUS AND INDUCTION MACHINES LABORATORY

Course Code	22EEL44	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:

22EEL44.1	Investigate various speed control techniques of induction motors
22EEL44.2	Evaluate the performance of induction and synchronous machines
22EEL44.3	Analyze load sharing among different alternators
22EEL44.4	Choose a suitable starter 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
22EEL44.1	3	3	2	2	-	-	-	-	1	-	-	-	-	1
22EEL44.2	3	3	2	2	-	-	-	-	1	-	-	-	-	1
22EEL44.3	3	3	2	2	-	-	-	-	1	-	-	-	-	1
22EEL44.4	3	3	2	2	-	-	-	-	1	-	-	-	-	1

Exp. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Introduction to Synchronous and Induction Machines	2	NA
	PART-A		
1	Load test on single phase induction motor	2	22EEL44.2
2	No load and Blocked rotor tests on single phase Induction motor	2	22EEL44.2
3	Load test on three phase induction motor	2	22EEL44.2
4	No load and Blocked rotor tests on three phase squirrel cage Induction motor	2	22EEL44.2
5	Speed control of three phase slip-ring induction motor	2	22EEL44.1
6	Study of starters: DOL and Star-Delta starters	2	22EEL44.4
	PART-B		
7	Regulation of three phase alternator by EMF Method	2	22EEL44.2
8	Regulation of three phase alternator by MMF Method	2	22EEL44.2
9	Regulation of three phase alternator by ZPF Method	2	22EEL44.2
10	Slip test and determination of regulation on Salient pole synchronous machine	2	22EEL44.2
11	Parallel operation of alternators	2	22EEL44.3
12	V and Inverted V curves of a synchronous motor	2	22EEL44.3

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

1. https://ems-iitr.vlabs.ac.in/exp/speed-control-slip-ring/
2. https://ems-iitr.vlabs.ac.in/exp/lab-equipment-familiarization/
3. https://em-coep.vlabs.ac.in/exp/synchronous-motor/
4. https://em-coep.vlabs.ac.in/exp/blocked-rotor-test-induction-motor/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:

Reference Books:
1) Electric Machines, D. P. Kothari and I. J. Nagrath, Tata McGraw Hill Education, 5th Edition, 2017. ISBN-10: 935260640X, ISBN-13: 978-9352606405
2) Electric Machinery, P. S. Bhimbra, Khanna publications, 7th Edition, 2015. ISBN: 978-81-7409-152-9
3) Electrical Machines, S.K. Bhattacharya, McGraw Hill Education, 4th Edition, 2017. ISBN-10: 9332902852, ISBN-13: 978-9332902855
4) Electric machinery, Ashfaq Hussain, Dhanpat Rai& Co, 3rd Edition, 2016. ISBN-10: 8177001663, ISBN-13: 978-8177001662
5) Electrical Machines, R. K. Rajput, Laxmi Publication, 6th Edition, 2018. ISBN: 9788131804469
6) Electric Machinery, Fitzgerald & Kingsley's, Stephen Umans, McGraw Hill Education; 7th edition, 2014. ISBN10: 0073380466, ISBN13: 9780073380469
7) A Course in Electrical Technology-II, J.B. Gupta, S. K. Kataria and Sons, 14th Edition, 2017. ISBN-10 : 9350144158, ISBN-13: 978-9350144152
8) http://www.nptel.ac.in/

22EEE45X-ESC/PLC COURSES

INTERNET OF THINGS

Course Code	22EEE451		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:

22EEE451.1	Understand the fundamentals of IOT technology
22EEE451.2	Illustrate the programming of Arduino by simulation
22EEE451.3	Demonstrate the usage of sensors and actuators with Arduino
22EEE451.4	Develop the applications using interfacing using Arduino Uno
22EEE451.5	Analyze the networking and Wi-Fi systems in different environment
22EEE451.6	Explore various cloud platforms for IOT.

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
22EEE451.1	3	3	3	3	3	-	-	-	1	-	-	-	-	3
22EEE451.2	3	3	3	3	3	-	-	-	1	-	-	-	-	3
22EEE451.3	3	3	3	3	3	-	-	-	1	-	-	-	-	3
22EEE451.4	3	3	3	3	3	-	-	-	1	-	-	-	-	3
22EEE451.5	3	3	3	3	3	-	-	-	1	-	-	-	-	3
22EEE451.6	3	3	3	3	3	-	-	-	1	-	-	-	-	3

MODULE-1	INTRODUCTION TO IOT:	22EEE451.1	6 Hours

Understanding IoT fundamentals-IOT Architecture and protocols-Various Platforms for IoT-Real time Examples of IoT- Overview of IoT components and IoT Communication Technologies- Challenges in IOT

Laboratory Component: 1. Study the fundamental of IOT softwares and components. 2.Familiarization with Arduino and performance of necessary software 3.To interface a push button with Arduino and write a program the LED turns .when its pushed to ON.	**3 Hours**

Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	ARDUINO SIMULATION ENVIRONMENT:	22EEE451.2, 22EEE451.4	6 Hours

Arduino Uno Architecture -Setup the IDE, Writing Arduino Software- Arduino Libraries-Basics of Embedded C programming for Arduino-Interfacing LED, push button and buzzer with Arduino- Interfacing Arduino with LCD

Laboratory Component: 1. Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino 2.Temperature Notification Using Arduino 3. Detect the Vibration of an Object Using Arduino.	**3 Hours**

Case Study	Brainstorm on various tools and libraries available in Arduino and develop some basic applications.
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	SENSOR & ACTUATORS WITH ARDUINO:	22EEE451.3, 22EEE451.4	6 Hours

Overview of Sensors working Analog and Digital Sensors-Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with- Arduino Interfacing of Actuators with Arduino.- Interfacing of Relay Switch and Servo Motor with Arduino

Laboratory Component:
    1. LDR to Vary the Light Intensity of LED Using Arduino.
    2. Detect the movement of objects inArduino.
    3. Relay switch interfacing Arduino.
		3 Hours

Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**NETWORKING WITH ESP8266 WIFI MODULE:**	**22EEE451.5**	**6 Hours**

Basics of Wireless Networking Introduction to ESP8266 Wi-Fi Module- Various Wi-Fi library-Web server-introduction, installation, configuration-Posting sensor(s) data to web serve-M2M vs. IOT Communication Protocols.

Laboratory Component:
    1.Installation of Wifi module with arudino
    2.Connect with the Available Wi-Fi Using Arduino
    3.Smart home automation using Arduino
	3 Hours

Self -study	Various Wi-Fi Module		
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	**CLOUD PLATFORMS FOR IOT:**	**22EEE451.6**	**6 Hours**

Virtualization concepts and Cloud Architecture - Cloud computing, benefits- Cloud services -- SaaS, PaaS, IaaS- Cloud providers& offerings - Study of IOT Cloud platforms- ThingSpeak API and MQTT- Interfacing ESP8266 with Web services

Laboratory Component:
    1. Managing sensors using Things Board cloud-based IoT platform
    2. Oracle intelligent IOT applications.
    3. Switching application using Think speak.
	3 Hours

Text Book	Text Book 2: 12.1 to 12.10

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	-	-
L3	**Apply**	5	1	10
L4	**Analyze**	5	2	10
L5	**Evaluate**	5	2	-
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**	--

Text Books:
1) Introduction to IOT, Sudip Misra, Anandarup Mukherjee, Arijit Roy, Publisher: Cambridge University Press; 2021 edition.
2) Internet of Things (IoT) Principles, Paradigms and Applications of IoT, Dr Kamlesh Lakhwani, Dr Hemant Kumar Gianey, Joseph Kofi Wireko, Kamal Kant Hiran,2020 Edition,BPB Publications,ISBN: 9389423368, 9789389423365
Reference Books:
1)Arduino project handbook,mark geddes, No Starch Press, San Francisco,2016, ISBN-10: 1-59327-690-7, ISBN-13: 978-1-59327-690-4.
2)Introduction   to   Sensors   in   IoT   and   Cloud   Computing   Applications,   Ambika

Nagaraj,DOI: 10.2174/9789811479359121010, ISBN: 978-981-14-7933-5
3)Sensors Handbook, SabrieSoloman, McGraw-Hill Companies,Second Edition 2010, ISBN: 978-0-07-160571-7

Web links and Video Lectures (e-Resources):
- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- https://onlinecourses.nptel.ac.in/noc22_cs53/preview
- https://www.youtube.com/watch?v=hdZzNOQV5vU
- https://www.youtube.com/watch?v=h0gWfVCSGQQ
- https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf
- http://www.diva-portal.org/smash/get/diva2:1481204/FULLTEXT01.pdf
- https://www.edx.org/learn/iot-internet-of-things

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

- Hands on sessions
- Seminars and Debates
- Development of small real time projects
- Demonstration of IOT applications using hardware tools
- Video demonstration of latest trends in IOT,IIOT,Indusrty4.0
- Organizing Group wise discussions on recent innovations and challenges of IOT

<div align="center">

ADVANCED DATA STRUCTURES

</div>

Course Code	22EEE452		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:

22EEE452.1	Describe the fundamentals of data structure
22EEE452.2	Apply the concept of Dynamic Memory allocation
22EEE452.3	Analyze the concepts of searching, sorting and hashing for problem solving
22EEE452.4	Analyze various techniques in linear data structure
22EEE452.5	Apply the concept of non-linear data structures using trees and graphs
22EEE452.6	Develop algorithms to solve problems using fundamental data structures

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
22EEE452.1	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22EEE452.2	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22EEE452.3	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22EEE452.4	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22EEE452.5	3	3	3	3	-	-	-	-	-	-	-	2	3	3
22EEE452.6	3	3	3	3	-	-	-	-	-	-	-	2	3	3

MODULE-1	INTRODUCTION TO DATA STRUCTURE	22EEE452.1 22EEE452.2	6 Hours

Introduction to Data Structures, Classification of Data Structures Tower of Hanoi problem, Conversion of expressions, Evaluation of postfix expression, Iteration v/s recursion. Application of Queue. Sparse matrix, transpose of a sparse matrix, dynamic memory management, Abstract Data Types.

Laboratory Component:	
1) Write a program to check whether the given matrix is sparse or not 2) Write a program to represent the matrix in sparse representation. 3) Write a program to determine the transpose of sparse representation.	**3 Hours**

Text Book	Text Book 1- chapter 1

MODULE-2	SEARCHING, SORTING AND HASHING TECHNIQUES	22EEE452.3	6 Hours

Sorting – Bubble sort, Selection sort, Quick Sort, Insertion sort, Shell sort –. Merge Sort – Hashing – Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Laboratory Component:	
1) Write a program to sort the numbers using quick sort with recursion. 2) Write a C program to sort the numbers using Bubble sort technique. 3) Write a C program to sort the numbers using Selection sort technique.	**3 Hours**

Case Study	Case study of hashing techniques
Text Book	Text Book 1- - chapter 2,3,4

MODULE-3	LINKED LISTS	22EEE452.4	6 Hours

Dynamic memory allocation revisited– malloc, calloc, realloc, free, Introduction to linked list, Representation of linked list in memory, primitive operations on linked list, searching a linked list, circular linked list, doubly linked list, header linked list. Applications of linked list: Josephus problem, addition of two long integers, addition of two polynomials, Linked representation of stack, Linked representation of queue.

Laboratory Component:	
1) Write a menu driven program to perform the following primitive operations on single linked list 2) Create a list with one node 3) Insertion at front, rear, after any given node 4) Deletion at front, rear, after any given node	**3 Hours**

5) Display Reverse			

Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**TREES-I: INTRODUCTION:**	**22EEE452.5**	**6 Hours**

Binary tree – strictly binary tree, complete binary tree, representing binary tree in memory, traversing a binary tree, binary Search tree, insertion and deletion in binary search tree, threaded binary tree. Expression trees, construction of an expression tree from prefix and postfix, Heap tree, creation of heap tree, insertion in heap, Deletion from heap.

Laboratory Component:	
1) Write a C program to search an element using Binary search technique. 2) Write a C program to insert an element in Binary tree. 3) Write a C program to delete an element in Binary tree.	**3 Hours**

Text Book	Text Book 1: Chapter 6,7		
MODULE-5	**TREES II & GRAPHS:**	**22EEE452.522EEE 452.6**	**6 Hours**

AVL Trees, Rotations in AVL tree, Insertion and deletion in an AVL tree, Huffman's algorithm. Introduction to Graph, Graph theory terminologies, sequential representation of a graph, adjacency matrix and path matrix, Warshall's algorithm, linked representation of a graph, Operations on a graph, Traversing a graph, Topological sorting

Laboratory Component:	
1) Write a C program to insert an element inAVL tree. *2)* Write a C program to delete an element inAVL tree. *3)* Develop a C program for solving Huffman's problem	**3 Hours**

Case Study	Case study compression – Huffman's encoding, Case study of Warshall's algorithm https://arxiv.org/pdf/1905.00276.pdf
Text Book	Text Book 1: Chapter 7,8

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	-	-
L3	Apply	5	2	10
L4	Analyze	5	2	10
L5	Evaluate	5	1	-
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) SEYMOUR LIPSCHUTZ, Data Structures with C, McGraw Hill, 13th Edition, Special Indian Edition, 2017, ISBN: 978-0070701984
2) Wisnu Anggoro, C++ DATA STRUCTURES ND ALGORITHMS, PacktPublishing ,ISBN: 9781788831970
Reference Books:
1)Richard F Gilberg and Behrouz A Forouzan, Data Structures – A Pseudo code Approach with C, Cengage Learning, Second edition, Fifth Indian Reprint, 2015, ISBN: 9788131503140

Web links and Video Lectures (e-Resources):
- https://onlinecourses.swayam2.ac.in/cec19_cs04/preview
- https://www.iitgoa.ac.in/~sreejithav/20Aug/cs220.html
- https://www.youtube.com/watch?v=WprjBK0p6rw

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 applications of data structures and algorithms
  - Seminars

WEB DESIGN TECHNOLOGIES				
Course Code	**22EEE453**	**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:

22EEE453.1	Design simple web pages using markup languages like HTML and XHTML.
22EEE453.2	Create dynamic web pages using DHTML and java script that is easy to navigate and use.
22EEE453.3	Analyze server-side web pages that have to process request from client-side web pages.
22EEE453.4	Investigate and apply web data using XML and develop web pages using JSP.
22EEE453.5	Solve various web services using PHP.
22EEE453.6	Develop real time application using server side programming and Web Services.

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
22EEE453.1	3	2	3	2	3	-	-	-	-	3	3	2	3	3
22EEE453.2	3	3	3	3	3	-	-	-	2	3	3	2	3	3
22EEE453.3	3	3	3	3	3	-	-	-	-	3	3	2	3	2
22EEE453.4	3	3	3	3	3	-	-	-	-	3	3	2	3	3
22EEE453.5	3	2	3	3	3	-	-	-	-	2	3	2	3	3
22EEE453.6	3	2	3	2	3	-	-	-	-	3	3	2	3	3

MODULE-1	**INTRODUCTION TO HTML**	**22EEE453.1**	**6 Hours**

what is HTML. HTML Syntax, Semantic Markup, Structure of HTML Documents, Introduction to CSS, what is CSS, CSS Syntax, Location of Styles.

Laboratory Component:	**3 Hours**
1. Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient 2. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values without table. 3. Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.	

Text Book	Textbook 1: Ch. 2, 3

MODULE-2	**HTMLTABLESANDFORMS**	**22EEE453.2**	**6 Hours**

Introducing Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility

Laboratory Component:	**3 Hours**
1. Write a JavaScript code that displays text "TEXT- GROWING" with increasing font size in the interval of 100ms in RED COLOR or other, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color or other color. Then the font size decreases to 5pt. 2. Develop and demonstrate a HTML5 file that includes JavaScript script that uses functions for the following problems: a. Parameter: A string b. Output: The position in the string of the left-most vowel c. Parameter: A number d. Output: The number with its digits in the reverse order. 3. Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.	

Text Book	Textbook 1: Ch. 4,5

MODULE-3	CLIENT-SIDESCRIPTING	22EEE453.3	6 Hours

What is JavaScript and What can it do? JavaScript Design Principles, Syntax, JavaScript Objects, The Document Object Model (DOM), Advantages and Disadvantages with its applications

Laboratory Component:
1. A program of JavaScript client side script that will run in the browser to display the name of cities.
2. A program to add two numbers by JavaScript client side script by CSS.
3. A program to display even and odd numbers using JavaScript.

3 Hours

Text Book	Textbook 1: Ch. 6, 8		
MODULE-4	PHPARRAYS	22EEE453.4, 22EEE453.5	6 Hours

PHP Classes and Objects, Object- Oriented Overview, Classes and Objects in PHP, Object Oriented Design, Error Handling and Validation, what are Errors and Exceptions.

Laboratory Component:
1. Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.
2. Write a PHP program to display a digital clock which displays the current time of the server.
3. Write a PHP programs for sum of two digits.

3 Hours

Text Book	Textbook 1: Ch. 9, 10		
MODULE-5	MANAGING STATE	22EEE453.6	6 Hours

Cookies, Serialization, Session State, HTML5 Web Storage, Caching, Introduction to JavaScript and jQuery, Backbone MVC Frameworks, XML Processing and Web Services, XML Processing, JSON, Overview of Web Services.

Laboratory Component:
1. Write a Scripting code for reading a Cookie.
2. Write a Scripting code for deleting a Cookie.
3. Write a Scripting Code to Parsing a Text String.

3 Hours

Text Book	Textbook 1: Ch. 13, 15,17

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	-	-
L3	Apply	10	5	10
L4	Analyze	5	-	10
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. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)

Reference Books:

1. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4th Edition, O'Reilly Publications, 2015. (ISBN:978-9352130153)

2. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2016. (ISBN:978-9332582736)

3. Nicholas C Zakas, "Professional JavaScript for Web Developers", 3rd Edition, Wrox/Wiley India, 2012. (ISBN:978-8126535088)

4. David Sawyer Mcfarland, "JavaScript &jQuery: The Missing Manual", 1st Edition, O'Reilly/Shroff Publishers & Distributors Pvt Ltd, 2014 (ISBN:978- 9351108078)

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/106106156
- https://sites.google.com/a/venusict.org/web-application-development/nptel-video-lectures

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

- Video demonstration of latest trends in web design

- For active participation of students, instruct the students to prepare Flowcharts and Handouts

- Organizing Group wise discussions on issues

- Seminars

ELECTROMAGNETIC FIELD THEORY

Course Code	22EEE454	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:

22EEE454.1	Understand the basic concepts of electrostatics and magneto statics
22EEE454.2	Interpret the potential field of a point charge, Potential gradient, Energy density in the electrostatic field and conductor's properties and boundary conditions.
22EEE454.3	Describe the Poisson's and Laplace Equations, Biot - Savart's law, Ampere's circuital law and Stokes theorem.
22EEE454.4	Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density
22EEE454.5	Illustrate the Faraday's law, Displacement current, Maxwell's equations
22EEE454.6	Understand the basic concepts of electromagnetic waves and characterizing parameters

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
22EEE454.1	3	3	3	3	-	-	-	-	-	-	-	-	-	-
22EEE454.2	3	3	3	3	-	-	-	-	-	-	-	-	-	-
22EEE454.3	3	3	3	3	-	-	-	-	-	-	-	-	-	-
22EEE454.4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
22EEE454.5	3	3	3	3	-	-	-	-	-	-	-	-	-	-
22EEE454.6	3	3	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	VECTOR ANALYSIS AND ELECTROSTATICS	22EEE454.1	8 Hours

Scalars and Vectors, Vector algebra, Cartesian co-ordinate system, Vector Components and unit vectors. Scalar field and Vector field. Dot product and Cross product, Gradient of a scalar field. Divergence and Curl of a vector field. Co – ordinate systems: cylindrical and spherical, relation between different coordinate systems. Expression for gradient, divergence and curl in rectangular, cylindrical and spherical co-ordinate systems. Numerical.
Coulomb's law, Electric field intensity and its evaluation for (i) point charge (ii) line charge (iii) surface charge (iv) volume charge distributions. Electric flux density, Gauss law and its applications. Maxwell's first equation (Electrostatics). Divergence theorem. Numerical.

Self -study	Numerical on vector analysis
Text Book	Text Book 1: Chapter 1, 2, 3 Text book 2: Chapter 4,5,6(part –2)

MODULE-2	ENERGY AND POTENTIAL, CONDUCTOR AND DIELECTRICS	22EEE454.2	8 Hours

Energy expended in moving a point charge in an electric field. The line integral. Definition of potential difference and potential. The potential field of a point charge and of a system of charges. Potential gradient. The dipole. Energy density in the electrostatic field. Numerical.
Current and current density. Continuity of current. Metallic conductors, conductor's properties and boundary conditions. Perfect dielectric materials, capacitance calculations. Parallel plate capacitor with two dielectrics with dielectric interface parallel to the conducting plates. Numerical.

Text Book	Text Book 1: Chapter 4, 5

MODULE-3	POISSON'S AND LAPLACE EQUATIONS AND STEADY MAGNETIC FIELDS	22EEE454.3	8 Hours

Derivations and problems, Uniqueness theorem.
Biot - Savart's law, Ampere's circuital law. The Curl. Stokes theorem. Magnetic flux and flux density. Scalar and vector magnetic potentials. Numerical.

Text Book	Text Book 1: Chapter 7, 8		
MODULE-4	**MAGNETIC FORCES AND MAGNETIC MATERIALS AND MAGNETISM**	**22EEE454.4**	**8 Hours**

Force on a moving charge and differential current element. Force between differential current elements. Force and torque on a closed circuit. Numerical.
Nature of magnetic materials, magnetisation and permeability. Magnetic boundary conditions. Magnetic circuit, inductance and mutual inductance. Numerical.

Text Book	Text Book 1: Chapter 9		
MODULE-5	**TIME VARYING FIELDS AND MAXWELL'S EQUATIONS AND UNIFORM PLANE WAVE**	**22EEE454.5, 22EEE454.6**	**8 Hours**

Faraday's law, Displacement current. Maxwell's equations in point form and integral form. Numerical.
Electromagnetic radiation: near field—non-radiative and radiative, far field. Wave propagation in free space and in dielectrics. Pointing vector and power considerations. Propagation in good conductors, skin effect. Numerical.

Text Book	Text Book 1: Chapter 10, 11 Text book 2: Chapter 9,10(part –4)		

CIE Assessment Pattern (50 Marks – Theory)

		Marks Distribution		
RBT Levels		**Test (s)**	**Qualitative Assessment (s)**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	5	-	-
L2	**Understand**	5	-	5
L3	**Apply**	5	5	5
L4	**Analyze**	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:
Books
1. Engineering Electromagnetics William H Hayt et al McGraw Hill 8th Edition, 2017
2. Principles of Electromagnetics Matthew N. O. Sadiku Oxford 6th Edition, 2015

Reference books:
1. Fundamentals of Engineering Electromagnetics David K. Cheng Pearson 2014
2. Electromagnetism -Theory (Volume -1) -Applications (Volume-2) AshutoshPramanik PHI Learning 2014
3. Electromagnetic Field Theory Fundamentals, Bhag Guru et al, Cambridge, 2009
4. Electromagnetic Field Theory Rohit Khurana Vikas Publishing 1st Edition,2014

Web links and Video Lectures (e-Resources):
- https://archive.nptel.ac.in/courses/108/104/108104087/
- https://archive.nptel.ac.in/courses/108/106/108106073/
- https://nptel.ac.in/courses/115101005
- https://www.youtube.com/watch?v=Elv3WpL32UE

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- Video demonstration
- 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 /Critical Thinking
- Seminars

INTRODUCTION TO DATA SCIENCE

Course Code	22EEE455	CIE Marks	50
L:T:P:S	3:0:0:0	SEEMarks	50
Hrs/Week	3	TotalMarks	100
Credits	03	ExamHours	03

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

22EEE455.1	Explore predictive modeling techniques with necessary python packages
22EEE455.2	Apply descriptive statistics concepts for data preparation
22EEE455.3	Develop and examine appropriate methods for data wrangling
22EEE455.4	Analyze efficient solution for the given data sources.
22EEE455.5	Examine the data transformation and dimension reduction techniques on the data source.
22EEE455.6	Design different types of conversion techniques for the Machine Learning model

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

	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
22EEE455.1	3	-	-	-		-	-	-	-	-	-	3	3	3
22EEE455.2	3	-	-	-		-	-	-	-	-	-	3	3	3
22EEE455.3	3	3	3	3	3	-	-	-	-	-	-	3	3	3
22EEE455.4	3	3	-			-	-	-			-	3	3	3
22EEE455.5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
22EEE455.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	BASIC CONCEPTS AND PYTHON PACKAGES	22EEE455.1	8Hours

Basic Concepts: Predictive Modelling, Data preparation, Importance of Data preparation, Data Cleaning, Feature selection, Data Transform, Dimensionality reduction, K-fold cross validation, Data Leakage and avoidance measure. **Python Packages**: Numpy, Matplotlib, pandas, scipy, scikit, Data frame, Loading Machine Learning data.

Textbook	Textbook1: Chapter:1,2,3, 4

MODULE-2	DESCRIPTIVE STATISTICS AND DATA PREPARATION	22EEE455.1, 22EEE455.2, 22EEE455.4	8 Hours

Descriptive Statistics: Reasons to study Statistics, Sampling, Data Analysis Process, Mean, Median, Standard Deviation, Skewness, Kurtosis, Graphical Representation-Box Plots, Pivot Table, Heat Map Correlation, Statistics– ANOVA. **Data Preparation:** Need for Data Pre-processing, Data Transforms, and Rescale Data Standardize Data, Normalize Data, Binarize Data, Univariate and Bivariate Data, Recursive Feature Elimination, Principal Component Analysis.

Textbook	Textbook 2: Chapter:1, 2,4, 5, 8, 10,11, 12,13,14,15

MODULE-3	DATA CLEANING AND FEATURE SELECTION	22EEE455.3, 22EEE455.4	8 Hours

Data Cleaning: Basic data cleaning, Outlier Identification and Removal, how to Mark and Remove Missing Data, Statistical Imputation, KNN Imputation, Iterative Imputation. **Feature Selection:** Statistics for feature selection, Methods for categorical input, Methods for Numerical input, Select Features for Numerical Output, RFE for Feature Selection, Significance of feature selection.

Textbook	Text Book1: Chapter:5, 6,7, 8,9, 10,11, 12,13, 14,15, 16.

MODULE-4	DATA TRANSFORM AND DIMENSIONALITY REDUCTION	22EEE455.4, 22EEE455.5	8 Hours

Data Transforms: Scaling data source, min-max scalar and standard scaler, Scale data with outliers, encode categorical data, Make Distributions More Gaussian, Approach for Numerical Data Distributions, Deriving new input variables. **Dimensionality reduction:** Techniques for Dimensionality Reduction, Linear Discriminant Analysis, PCA Dimensionality Reduction, SVD Dimensionality Reduction

Textbook	Text Book1: Chapter:17, 18, 19,20,21,23,27, 28,29, 30.

MODULE-5	OTHER TRANSFORMS	22EEE455.5, 22EEE455.6	8 Hours

Transform numerical to categorical, Transform Numerical and Categorical Data, Transform the Target in Regression, Save and load the transformation, case studies for Binary classification, Multi classification and Regression

Case Study	Big Mart Sales Prediction ML Project –Learn about Unsupervised Machine Learning Algorithms, Health care (Pfizer), Boston House Pricing Prediction Project
Textbook	Textbook 1: Chapter:22,24,25, 26,

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	5	
L4	Analyze	5	10	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50Marks –Theory)

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

Text Books:
1) Jason Brownlee, "Data Preparation for Machine Learning" 2020
2) RoxyPeck, Chris Olsen and Jay Devore, "Introduction to Statistics & Data Analysis "3rd Edition Thomson Higher Education

Reference Books:
1) Andrew Park ,"Data Science For Beginners"
2) Nitish Vig, "Statistics101"
3) Norman Matloff, "Probability and Statistics for Data Science",CRC Press

Weblinks and Video Lectures(e-Resources):
- Data Science for Engineers :https://digimat.in/nptel/courses/video/106106179/L01.html
- Statistics for Data Science: https://www.youtube.com/watch?v=V5fqShLVpoI

22EEE46X -Ability Enhancement Course–IV

AUTOCAD FOR ELECTRICAL ENGINEERING

Course Code	22EEE461		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:

22EEE461.1	Use various symbols and notations in electrical and electronics engineering drawings.
22EEE461.2	Simulate/test simple electrical circuits using Simulation software
22EEE461.3	Simulate/test simple electronics circuits using Simulation software
22EEE461.4	Design a PCB layout for different electronic circuits

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
22EEE461.1	3	3	3	3	2	-	-	-	1	-	-	-	3	1
22EEE461.2	3	3	3	3	2	-	-	-	1	-	-	-	3	1
22EEE461.3	3	3	3	3	2	-	-	-	1	-	-	-	3	1
22EEE461.4	3	3	3	3	2	-	-	-	1	-	-	-	3	1

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Starting AUTOCAD for windows • Exploring workspace	2	NA
	PART-A		
1	Basic procedure to be adopted for computer aided drawings of electrical circuits: R-L series, parallel circuit, R-C series, parallel circuit, R-L-C series, parallel circuit	2	22EEE461.1
2	Basic procedure to be adopted for computer aided drawings of electrical machines: Electrical machines – AC and DC, motor	2	22EEE461.1
3	Basic procedure to be adopted for computer aided drawings of windings: A.C. and D.C. winding diagrams	2	22EEE461.1
4	Basic procedure to be adopted for computer aided drawings of electronic components I: Resistor, Inductor, transformer and Capacitor	2	22EEE461.1
5	Basic procedure to be adopted for computer aided drawings of electronic components II: Semiconductor device Diodes, Zener diode, Transistors PNP/ NPN, MOSFET, IGBT, UJT.	2	22EEE461.1
6	edure to be adopted for computer aided drawings of electronic circuits: , full-wave and bridge rectifier, Power amplifier and voltage amplifier	2	22EEE461.1
	PART-B		
7	Simulation of electrical circuits - Series and parallel R-L circuit, Series and parallel R-C circuit, Series and parallel R-L-C circuit, Resonance in AC Circuit	2	22EEE461.2
8	Simulation of electrical machines - Electrical machines circuits: Graphics, Plot, sub plot, label, legend	2	22EEE461.2
9	Simulation of electronic circuit - Half wave, full wave and bridge rectifier, Power amplifier and voltage amplifier	2	22EEE461.3
10	Simulation of electronic circuits - Different types of oscillators circuits	2	22EEE461.3
11	Overview of software for PCB design, PCB layout of rectifier circuit	2	22EEE461.4
12	PCB layout of amplifier circuit		22EEE461.4
	PART-C **Beyond Syllabus Virtual Lab Content**		

1. Electronics system Packing
   https://nptel.ac.in/courses/108108031
2. Sensor and sensor Design
   https://www.classcentral.com/course/sensors-circuit-interface-12049

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) AutoCAD Electrical 2023 for Engineers and Designers by Sham Tickoo, Dream tech press, New Delhi, Latest edition.
2) Mastering AutoCAD 2013 and AutoCAD LT 2013 by George Omura, Sybex, New Delhi, Latest edition

ADVANCED ARDUINO PROGRAMMING

Course Code	21EEE462	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:

22EEE462.1	Understand the basic concept of Arduino development board to perform different tasks
22EEE462.2	Understand the importance of Microcontroller in the functioning of embedded systems
22EEE462.3	Interface Arduino to the cloud, interact with online services, and control devices remotely
22EEE462.4	Analyze different types of actuators, such as servo motors, DC motors, and stepper motors

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
22EEE462.1	3	3	3	3	2	-	-	-	1	-	-	-	-	-
22EEE462.2	3	3	3	3	2	-	-	-	1	-	-	-	-	-
22EEE462.3	3	3	3	3	2	-	-	-	1	-	-	-	-	-
22EEE462.4	3	3	3	3	2	-	-	-	1	-	-	-	-	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Knowing basic programming concepts such as variables, data types, loops, and conditionals helps with learning Arduino programming.** • **Basic math skills, including arithmetic and algebra, aid in tasks like calculating resistor values and working with sensor data.** • **Developing logical thinking and problem-solving skills will aid in troubleshooting and writing efficient code.**	2	NA
	PART-A		
1	Digital input and digital output on Arduino Mega board and using LED and Buzzer.	2	22EEE462.1
2	Analog input and analog output on Arduino Mega board using PWM. Different outputs on LED.	2	22EEE462.1
3	Serial Communication between Arduino board and PC:- character send and received, Read and display voltage.	2	22EEE462.2
4	DC Motor to control motor speed and direction of rotation.	2	22EEE462.2
5	Rotate the servo motor to a specific angle using PWM signals.	2	22EEE462.2
6	Rotate a stepper motor in precise steps and directions.	2	22EEE462.3
	PART-B		
7	Using Arduino board, build a circuit to blink LED.	2	22EEE462.3
8	Temperature and Humidity Sensor: Interface with a DHT11 or DHT22 sensor to display real-time temperature and humidity readings.	2	22EEE462.3
9	Ultrasonic Distance Sensor: Measure distance and display the results.	2	22EEE462.4
10	Internet of Things (IoT): Send sensor data to cloud platforms like ThingSpeak or Blynk for remote monitoring.	2	22EEE462.4
11	LCD Display: Connect and control a character LCD to display text or sensor readings.	2	22EEE462.4
12	Potentiometer: Read values from a potentiometer and use them to control LED brightness or servo motor position.	2	22EEE462.4
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**		

1. Ambient Light Sensor- https://docs.simuli.co/components/bh1721

2. Barometric Pressure and temperature sensor-https://docs.simuli.co/components/bmp180
3. Stepper motor driver-https://docs.simuli.co/components/drv8834
4. Real time weather and data collection-https://docs.simuli.co/arduino-projects/weather-data-thingspeak

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Reference Books:
1) Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education, Second Edition, 2016, ISBN-10: 1259641635; ISBN-13: 978-1259641633.

2) John Nussey, Arduino For Dummies, 1st Edition, Publisher: John Wiley & Sons; ISBN-10: 1118446372; ISBN-13: 978-1118446379.

SCI LAB FOR ELECTRICAL ENGINEERING

Course Code	22EEE463		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:

22EEE463.1	Apply the basic laws to a given network and compute its electrical parameters.
22EEE463.2	Assess the transient response of RL,RC and RLC circuits and resonance circuits
22EEE463.3	Analyze the performance characteristics of transistors
22EEE463.4	Investigate the electrical parameters in transformer and motor

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
22EEE463.1	3	3	2	2	2	-	-	-	1	-	-	-	2	-
22EEE463.2	3	3	2	2	2	-	-	-	1	-	-	-	2	-
22EEE463.3	3	3	2	2	2	-	-	-	1	-	-	-	2	-
22EEE463.4	3	3	2	2	2	-	-	-	1	-	-	-	2	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• **Electric circuit theory** • **Analog and Digital Electronics** • **Electrical Machines and Transformers**	2	NA
	PART-A		
1	Verify Ohm's Law by a Scilab program.	2	22EEE463.1
2	Verify Kirchhoff's Voltage Law by a Scilab program.	2	22EEE463.1
3	Verify Kirchhoff's Current Law by a Scilab program.	2	22EEE463.1
4	Determine the mesh currents of the circuit using Scilab	2	22EEE463.1
5	Determine the nodal voltages of the circuit using Scilab	2	22EEE463.2
6	Simulation of R-C, R-L and RLC electric circuit transients	2	22EEE463.2
	PART-B		
7	Design and implementation of series and parallel resonance circuit.	2	22EEE463.2
8	Execute Code Conversions using Scilab programming	2	22EEE463.2
9	Simulate the characteristics of Field Effect Transistor	2	22EEE463.3
10	Simulate the characteristics of Bipolar Junction Transistor	2	22EEE463.3
11	Simulation of Hysteresis loss in a transformer using Scilab programming	2	22EEE463.4
12	Simulate and analyze the parameters of induction motor using Scilab	2	22EEE463.4
	PART-C **Beyond Syllabus Virtual Lab Content** **(To be done during Lab but not to be included for CIE or SEE)**		

1. Verification of Norton's theorem-https://asnm-iitkgp.vlabs.ac.in/exp/verification-norton-theorem/
2. RLC series network- https://asnm-iitkgp.vlabs.ac.in/exp/rlc-series-circuit/
3. Load test on Induction motor- https://asnm-iitkgp.vlabs.ac.in/exp/rlc-series-circuit/
4. Three phase power measurement-https://asnm-iitkgp.vlabs.ac.in/exp/three-phase-power-measurement/

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
https://www.scilab.org/tutorials
Reference Books:
1) A. R. Hambley, "Scilab Textbook Companion for Electrical Engineering - Principles and Applications", Publisher:Pearson Education, New Jersey, 2019, ISBN- 0-13-213006-8
2) Michael Baudin, "Introduction to Scilab", Publisher:TheScilabConsortium,January 2010.

PCB DESIGN LABORATORY

Course Code	22EEE464		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:

22EEE464.1	Understand the characteristics of electronic components and basic electronic instruments.
22EEE464.2	Analyze the circuits with PCB design and identify the various processes involved
22EEE464.3	Gain in-depth core knowledge in the and fabrication of Printed Circuit Boards
22EEE464.4	Learn assembling and testing of the PCB based electronic circuits

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
22EEE464.1	3	3	2	2	2	-	-	-	-	-	-	-	2	-
22EEE464.2	3	3	2	2	2	-	-	-	-	-	-	-	2	-
22EEE464.3	3	3	2	2	2	-	-	-	-	-	-	-	2	-
22EEE464.4	3	3	2	2	2	-	-	-	-	-	-	-	2	-

Exp. No. / Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic concepts of Electronics	2	NA
	PART-A		
1	Study of Electronic Components	2	22EEE464.1
2	Study of Instruments and Equipment (DMM, Power supply, CRO, FG)	2	22EEE464.1
3	Introduction to Orcad Schematic entry / drawing, net listing, layering, component foot print library selection & designing, design rules,	2	22EEE464.2
4	Component placing: Manual & automatic, track routing: automatic & manual, rules: track length, angle, joint & size, Auto router setup. Design Rules.	2	22EEE464.2
5	Single side PCB Fabrication	2	22EEE464.2
	PART-B		
6	Design PCB Layout using ORCAD,PCB Design - Full wave Rectifier	2	22EEE464.3
7	Assembly and Testing - Full wave Rectifier	2	22EEE464.3
8	PCB Designing Practice: PCB Designing of Basic and Analog Electronic Circuits, PCB Designing of Power Supplies.	2	22EEE464.4
9	Post Designing & PCB Fabrication Process: Printing the Design, Etching, Drilling,	2	22EEE464.4
10	Interconnecting and Packaging electronic Circuits, Gerber Generation, Soldering and Desoldering, Component Mounting, PCB and Hardware Testing.	2	22EEE464.4

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

1. PCB design laboratory- https://fab-coep.vlabs.ac.in/exp/pcb-design-fabrication/
2. PCB design-https://www.rs-online.com/designspark/virtual-lab-project-pcb-design
3. Remote flying fish - https://www.rs-online.com/designspark/ch-7-diy-series-of-remote-flying-fish-pcb-design-schematic

CIE Assessment Pattern (50 Marks – Lab)

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

SEE Assessment Pattern (50 Marks – Lab)

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

Suggested Learning Resources:
Text Books:
1) Printed circuit board design ,fabrication assembly and testing By R. S. Khandpur, Tata McGraw Hill 2006
Reference Books:
1) Printed circuit Board Design and technology, Walter C. Bosshart
2) Printed Circuits Handbook, Sixth Edition,by Clyde F. Coombs, Jr, Happy T. Holden,Publisher: McGraw-Hill Education Year: 2016
3) Complete PCB Design Using OrCAD Capture and PCB Editor,Kraig Mitzner Bob Doe Alexander Akulin Anton Suponin Dirk Müller, 2nd Edition 2009.

VIRTUAL INSTRUMENTATION USING LABVIEW

Course Code	22EEE465	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:

22EEE465.1	Select different functions available in Lab VIEW for engineering applications
22EEE465.2	Apply concepts of virtual instrumentation and develop basic programs using loops
22EEE465.3	Demonstrate user interfaces with charts, graph, and buttons
22EEE465.4	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
22EEE465.1	3	-	-	-	2	-	-	-	-	-	-	3	3	3
22EEE465.2	3	-	-	-	2	-	-	-	-	-	-	3	3	3
22EEE465.3	3	3	2	-	2	-	-	-	-	-	-	3	3	3
22EEE465.4	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	22EEE465.1
2	To perform Boolean operations: AND, OR, XOR, NOT and NAND using LabVIEW.	2	22EEE465.1
3	To find the Sum of 'n' numbers using 'for' loop and 'while' loop.	2	22EEE465.3
4	To perform the Factorial of a given number using 'for' loop and 'while' loop.	2	22EEE465.3
5	To sort even numbers using 'while' loop in an array.	2	22EEE465.3
6	To find the maximum and minimum variable from an array.	2	22EEE465.2
	PART-B		
7	To create a sine wave using formula node.	2	22EEE465.2
8	Build a Virtual Instrument which adds two sine waves of different frequencies and displays the result in a graph.	2	22EEE465.1
9	To apply filtering technique (median filter) for a given input signal.	2	22EEE465.1
10	To build a Virtual Instrument that converts Celsius to Fahrenheit.	2	22EEE465.4
11	To build a Virtual Instrument for acquiring and continuously displaying a thermocouple signal.	2	22EEE465.4
12	To acquire and analyze an ECG signal using NI ELVIS LabVIEW.	2	22EEE465.4
	PART-C **Beyond Syllabus Virtual Lab Content**		

<p style="text-align: center; color: red;">**(To be done during Lab but not to be included for CIE or SEE)**</p>

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

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	-
L3	Apply	20
L4	Analyze	20
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.

SOCIAL CONNECT AND RESPONSIBILITY

Course Code	22SCK47		CIE Marks	50
L:T:P:S	0:0:1:0		SEE Marks	--
Hrs / Week	02		Total Marks	50
Credits	01		Exam Hours	02

Course outcomes:

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

22SCK47.1	Communicate and connect to the surrounding
22SCK47.2	Understand the needs and problems of the community and involve them in problem –solving
22SCK47.3	Develop among themselves a sense of social & civic responsibility and utilize their knowledge in finding practical solutions to individual and community problems
22SCK47.4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes

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

	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 by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
2.	**Heritage walk and crafts corner**	May be individual or team (3-5)	Temples / monumental places / Villages/ City Areas /	Site selection /Proper consultation/ Continuous	Report should be submitted by	Evaluation as per the rubrics of scheme and

			Grama panchayat/ public associations /Government Schemes officers/ campus	monitoring/ Information board	individual to the concerned evaluation authority	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 by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
4.	**Water conservation:** Conservation techniques	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers / campus	site selection / proper consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus
5.	**Food walk:** Practices in society	May be individual or team (3-5)	Villages/ City Areas /Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus

<table>
<tr><td colspan="5" align="center">**MINIPROJECT-I**</td></tr>
<tr><td>**Course Code**</td><td>**22EEE48**</td><td></td><td>**CIE Marks**</td><td>**50**</td></tr>
<tr><td>**L:T:P:S**</td><td>0:0:1:0</td><td></td><td>**SEE Marks**</td><td>**50**</td></tr>
<tr><td>**Hrs / Week**</td><td>02</td><td></td><td>**Total Marks**</td><td>**100**</td></tr>
<tr><td>**Credits**</td><td>01</td><td></td><td>**Exam Hours**</td><td>**03**</td></tr>
</table>

Course outcomes:

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

22EEE48.1	Apply the knowledge learned via several courses to practical issues.
22EEE48.2	Evaluate small hardware systems by using modern tools and technologies.
22EEE48.3	Able to work in teams and manage the conduct of the research study.
22EEE48.4	Communicate and comprehend the work through articles.
22EEE48.5	Articulate the project related activities and findings
22EEE48.6	Extend or use the idea in mini project 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
22EEE48.1	3	3	3	2	3	2	2	2	3	3	3	2	2	2
22EEE48.2	3	3	3	2	3	2	2	2	3	3	3	2	2	2
22EEE48.3	3	3	3	2	3	2	2	2	3	3	3	2	2	2
22EEE48.4	3	3	3	2	3	2	2	2	3	3	3	2	2	2
22EEE48.5	3	3	3	2	3	2	2	2	3	3	3	2	2	2
22EEE48.6	3	3	3	2	3	2	2	2	3	3	3	2	2	2

Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. The student shall be capable to recognise a problem in the area of Electrical and Electronics Engineering and solve it using latest technologies in a mini-project. Based on the ability/abilities of the student/s and recommendations of the guide, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. The mini-project work will be reviewed by a panel of experts throughout the semester. The CIE marks awarded for the Mini-project work shall be based on the work accomplishment, project presentation skill, and question and answer session. The Plagiarized projects will automatically result an F grade and the student will be liable for further disciplinary action. At the completion of a mini project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE Assessment Pattern (50 Marks – Theory) –

		Marks Distribution	
RBT Levels		**Review 1 (25 Marks)**	**Review 2 (25 Marks)**
		25	25
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	5	5

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	Remember	-

L2	Understand	10	
L3	Apply	10	
L4	Analyze	10	
L5	Evaluate	10	
L6	Create	10	

BASIC APPLIED MATHEMATICS-II

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	PO011	PO12
22DMAT41.1	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.2	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.3	3	3	-	-	-	-	-	-	-	-	-	-
22DMAT41.4	3	3	-	-	-	-	-	-	-	-	-	-

MODULE-1	VECTORS	22DMAT 41.1	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	22DMAT 41.2	8 Hours

Vector differential operator-Gradient of a scalar function, Divergence of a vector function, Curl of vector functio
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	22DMAT 41.3	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	22DMAT 41.4	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	22DMAT 41.4	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 (50 Marks)				
RBT Levels		Test (s)	Assignment-1	Assignment-2	Quiz-1	Quiz-2
		25	7.5	7.5	5	5
L1	Remember	5	2.5	2.5	-	-
L2	Understand	5	2.5	2.5	-	-
L3	Apply	10	2.5	2.5	5	5
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

NATIONAL SERVICE SCHEME (NSS)				
Course Code	**22NSS30, 22NSS40**	**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:

22NSS30/40.1	Understand the importance of his / her responsibilities towards society.
22NSS30/40.2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
22NSS30/40.3	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.
22NSS30/40.4	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
22NSS30/40.1	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30/40.2	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30/40.3	-	-	-	-	-	3	3	-	2	-	-	1
22NSS30/40.4	-	-	-	-	-	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

CIE Assessment Pattern (50 Marks – Activity based) –

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

Total marks for the course in each semester	50

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

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

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

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

Plan of Action:
- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.
- Practice Session Description:
  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 byindividual 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 byindividual 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 empowerment groups/ Consulting NGOs & Govt Teams / College campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual 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 byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Group selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual 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/Govern ment Schemes officers	School selection/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual 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/pro per consultation/ Continuous monitoring/ Information board	Report should be submitted byindividual 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 byindividual 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/ 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 by NSS officer
10.	Organize National integration and socialharmony events / workshops / seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers/ campus	Place selection/proper consultation/ Continuous monitoring / Information board	Report should be submitted byindividual 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 byindividual to the concerned evaluation authority	Evaluation as per the rubrics of scheme and syllabus by NSS officer

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)

Course Code	22PED30, 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:

22PED30/40.1	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
22PED30/40.2	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle
22PED30/40.3	Perform in the selected sports or athletics of student's choice and participate in the competition at regional/state / national / international levels.
22PED30/40.4	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
22PED30/40.1	-	-	-	-	-	2	-	3	3	-	-	2
22PED30/40.2	-	-	-	-	-	2	-	3	3	-	-	2
22PED30/40.3	-	-	-	-	-	2	-	3	3	-	-	2
22PED30/40.4	-	-	-	-	-	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 Bonus. D. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up. E. Table Tennis – Service (Fore Hand & Back Hand), Receive	22PED40.3	20 HRS

	(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, 22YOG40**	**CIE Marks**	**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:

22YOG30/40.1	Understanding the origin, history, aim and objectives of Yoga
22YOG30/40.2	Become familiar with an authentic foundation of Yogic practices
22YOG30/40.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat
22YOG30/40.4	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
22YOG30/40.1	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30/40.2	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30/40.3	-	-	-	-	-	3	-	-	-	-	-	1
22YOG30/40.4	-	-	-	-	-	3	-	-	-	-	-	1

Semester / Course Code	CONTENT	COs	HOURS
3rd **22YOG30**	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and b 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

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:

4. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
5. Tiwari, O P: Asana Why and How
6. Ajitkumar: Yoga Pravesha (Kannada)
7. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
8. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
9. Nagendra H R: The art and science of Pranayama
10. Tiruka: Shatkriyegalu (Kannada)
11. Iyengar B K S: Yoga Pradipika (Kannada)
12. 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**

APPENDIX A

List of Assessment Patterns

1. Assignment
2. Group Discussions
3. Case studies
4. Practical Orientation on design thinking, Creative & Innovation
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 Visits
10. Industrial/Social/Rural Projects
11. Participation in External Seminars/Workshops
12. Online/Offline Quizzes

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 engineering degree programarethe statements that describe the expected achievements of graduate in their career and also in particular what the graduates are expected to perform and achieve during the first few years after graduation. [nbaindia.org]

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

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

Mapping of Outcomes
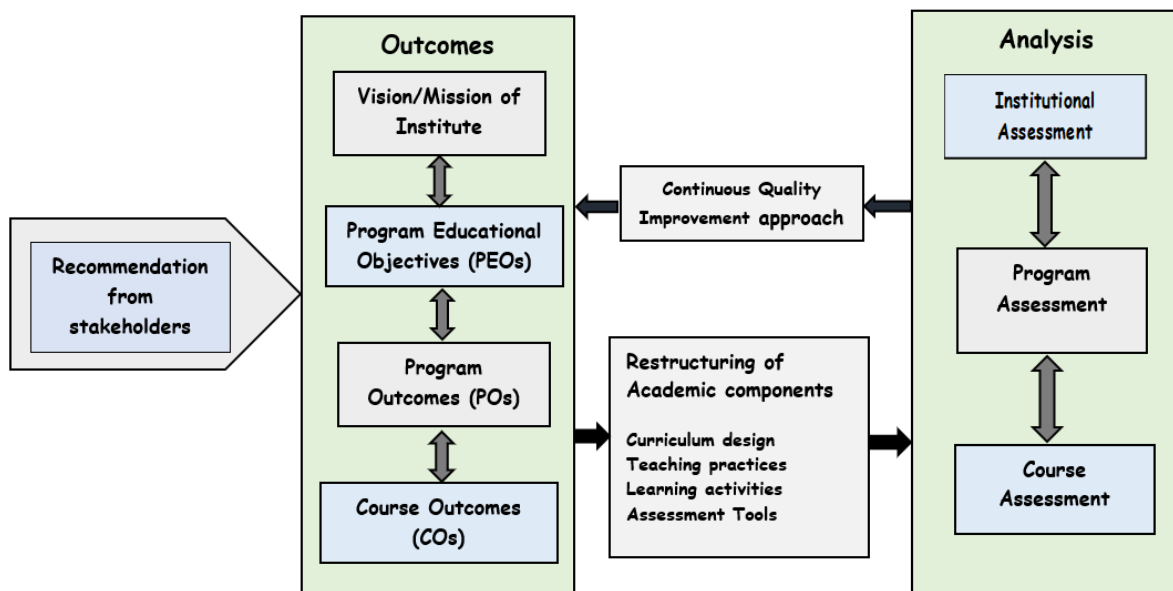
APPENDIX C

The Graduate Attributes of NBA

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

Problem analysis: Identify, formulate, research literature, and analyze 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 straight forward 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. Hat 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 modeling 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.

<center>**APPENDIX D**</center>

<center>**BLOOM'S TAXONOMY**</center>

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 <u>assessments</u> (tests and other evaluations of student learning), <u>curriculum</u> (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies. [eduglosarry.org]
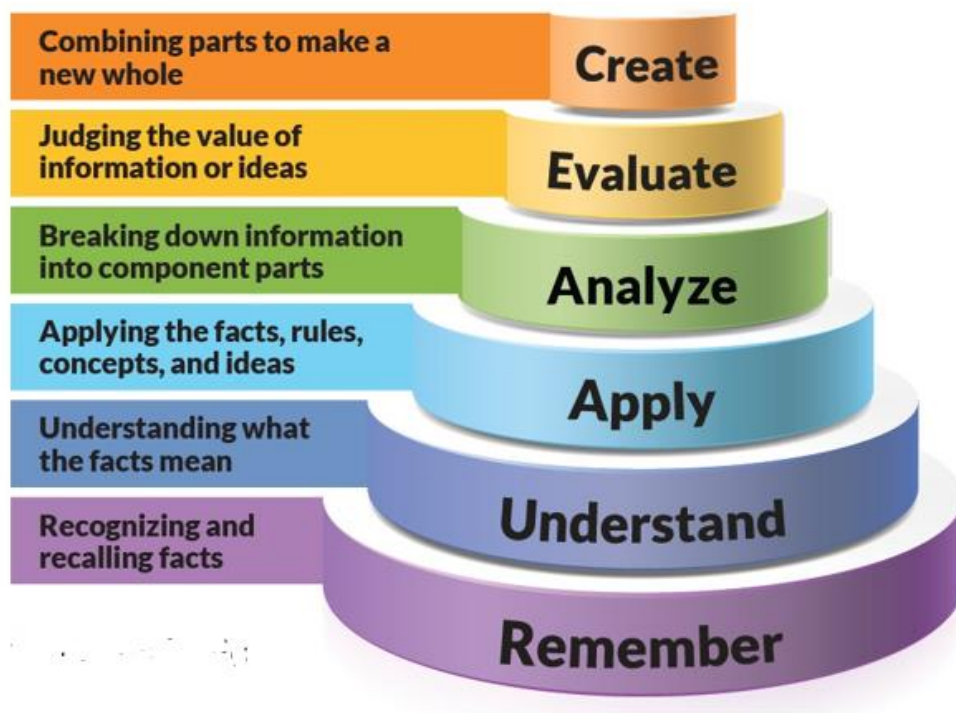
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