NEW HORIZON
COLLEGE OF ENGINEERING

Department of Electrical and Electronics Engineering

Academic Year 2024-25

7th and 8th Semester

Scheme & Syllabus

BATCH: 2021-25

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.

PEOs to POs mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
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 2021- 2025 BATCH (2021 Scheme)

VII Semester													
S. No.	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	IPCC	21EEE71	Electrical Drives and Vehicles	EE	2	0	1	0	3	4	50	50	**100**
2	PCC	21EEE72	Photo Voltaic Systems and Applications	EE	3	0	0	0	3	3	50	50	**100**
3	PROJ	21EEE73	Project Work	EE	0	0	12	0	12	0	100	100	**200**
4	AEC	21EEK74	Scientific Foundations of Health	EE	1	0	0	0	1	1	50	50	**100**
5	OEC	23NHOP7XX	Industrial Open Elective Course-II	Offering Dept.	3	0	0	0	3	3	50	50	**100**
				Total					**22**	**11**	**300**	**300**	**600**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

NCMC	**21NSS84**	National Service Scheme (NSS)	NSS coordinator	All students have to register for any one of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successful completion of the registered course is mandatory for the award of the degree. The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.
	21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	

Industrial Open Elective Course (OEC): Credit for OEC is 03 (L: T: P: S) can be considered as (3: 0: 0: 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. This Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

Project Work:

The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.

(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.

(iii) To impart flexibility and adaptability.

(iv) To inspire team working.

(v) To expand intellectual capacity, credibility, judgment and intuition.

(vi) To adhere to punctuality, setting and meeting deadlines.

(vii) To install responsibilities to oneself and others.

(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work 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.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work 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.

SEE procedure for Project Work: The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25.

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

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Electrical and Electronics Engineering

Scheme of Teaching and Examinations for 2021- 2025 BATCH (2021 Scheme)

VIII Semester

S. No.	Course and Course Code		Course Title	BoS	Credit Distribution				Overall Credits	Contact Hours	Marks		
					L	T	P	S			CIE	SEE	Total
1	PEC	21EEE81X	Professional Elective Course-III	EE	3	0	0	0	3	3	50	50	**100**
2	SEM	21EEE82	Technical Seminar	EE	0	0	1	0	1	0	50	-	**50**
3	INT	21EEE83	Research Internship/ Industry Internship/ Rural Internship	EE	0	0	12	0	12	0	100	100	**200**
4	NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	2	50	50	**100**
		21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		21YOG84	Yoga	Yoga Teacher									
Total									**16**	**5**	**250**	**200**	**450**

NCMC: Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **SEM**: Seminar, **INT**: Industry Internship / Research Internship / Rural Internship, **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, , **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course-III			
21EEE811	Bio Inspired Design and innovation	21EEE814	Power System Operation and Control
21EEE812	Neural Network and Fuzzy Logic in Electrical Engineering	21EEE815	Smart Grid Technologies
21EEE813	Machine learning for Electrical Engineering		

Elucidation:

Research/Industry Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for **24 weeks**. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent SEE examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.

Non – credit mandatory courses (NCMC):

National Service Scheme/ Physical Education (Sport and Athletics)/ Yoga:

(1)Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2)In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3)In case, any student fails to register for NSS, PE or Yoga / fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5)These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

TECHNICAL SEMINAR (21XXX82): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(vi) Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question-and-answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report: 25 marks
Presentation skill: 10 marks
Technical Paper Publication: 15 marks.

Syllabus of Seventh Semester BE

ELECTRICAL DRIVES AND VEHICLES			
Course Code	**21EEE71**	**CIE Marks**	**50**
L: T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hours / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21EEE71.1	Integrate the knowledge from power electronics, control, and electrical machines to meet the demand for automation in industry.
21EEE71.2	Understand the fundamentals of drive dynamics, Mult quadrant operation, motor rating selection and speed control methods.
21EEE71.3	Analyse the operation of the Controlled rectifier and Chopper fed dc drives.
21EEE71.4	Analyse various types of AC drives and its closed loop control to meet the requirement of electrical vehicles.
21EEE71.5	Discuss the basics of electric vehicles, their architecture, technologies and their performance.
21EEE71.6	Summarize the environmental impact and features of energy storage systems in EVs.

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
21EEE71.1	3	2	2	2	1	-	-	-	-	-	-	-	2	1
21EEE71.2	3	2	2	2	1	-	-	-	-	-	-	-	2	1
21EEE71.3	3	2	2	2	1	-	-	-	-	-	-	-	2	1
21EEE71.4	3	2	2	2	1	-	-	-	-	-	-	-	2	1
21EEE71.5	3	2	2	2	1	-	-	-	-	-	-	-	2	1
21EEE71.6	3	2	2	2	1	-	-	-	-	-	-	-	2	1

MODULE-1	**DYNAMICS OF ELECTRICAL DRIVES**	**21EEE71.1, 21EEE71.2**	**8 Hours**

Introduction to Electrical Drives, Fundamental torque equations, Speed torque conventions and multi-quadrant operation, Equivalent values of Drive parameters, Nature and classification of load torques, Calculation of time and energy-loss in transient operation, Steady state stability, Classes of Motor duty and Determination of Motor rating.

Laboratory Component:

1. Design and simulation of DC-DC converters
2. Design and simulation of inverters
3. Simulation of different PWM techniques for converter and inverter control

Text Book	Text Book 1: 2.1,2.2,2.3,2.5,2.6,2.7,4.2, 4.3

MODULE-2	**DC MOTOR DRIVES**	**21EEE71.3, 21EEE71.2, 21EEE71.1**	**8 Hours**

Starting, Braking and Speed control, Steady state analysis of the single and three phase controlled rectifier fed separately excited DC motor drive, Chopper Controlled DC drives, converter ratings and closed loop control.

Self-study	Multi quadrant operation of DC drive

Laboratory Component:

1. Design of PI controller for DC motor using MATLAB.
2. Simulation of PI controller for chopper controlled DC drives using MATLAB/SIMULINK.

Text Book	Text Book 1: 5.2,5.3,5.5,5.10,5.11,5.12,5.13,5.18,5.19,5.20,5.22

MODULE-3	**AC MOTOR DRIVES and SPECIAL MACHINES AC DRIVES**	**21EEE71.4, 21EEE71.2, 21EEE71.1**	**8 Hours**

Induction Motor Drives: Analysis and performance, Analysis of Induction Motor fed from non-sinusoidal voltage supply, Speed Control, variable frequency control of an induction motor, voltage source inverter control, current source inverter control, closed loop speed control.

Synchronous Motor variable speed drives, Brushless DC motor drives, Switched Reluctance Motor Drive Construction-Working Principle.

Applications	Industrial application – Steel mills, Textile mills and Paper mills

Laboratory Component:

1. Design of PI controller for Induction motor using MATLAB.
2. Design of PI controller for PMSM motor using MATLAB.
3. Design of bidirectional battery circuit using Boost /Buck converter using MATLAB/SIMULINK.

Text Book	Text Book 1: 6.1.1, 6.4,6.8 ,6.12.1,6.13,6.17,6.15,7.3,7.10,8.2		
MODULE-4	**ELECTRIC VEHICLES**	**21EEE71.5, 21EEE71.6, 21EEE71.4**	**8 Hours**
History of Electric vehicle, Environmental impact, Architecture of Electric Vehicle, General description of vehicle movement, vehicle resistance, Dynamic equation, Tire ground adhesion and maximum traction effort, Power train tractive effort and vehicle speed, Vehicle performance, Brake performance.			
Self-Study	Plug-In Hybrid electric vehicles		

Laboratory Component:

1. Modelling and simulation to calculate electric vehicle speed, torque and power.
2. Modelling and simulation of electric vehicle dynamics.
3. Simulation of bidirectional operation in Electric Vehicle.

Text Book	Text Book 3:1.1,1.2,1.6,2.1,2.2,2.3,2.4,2.5,2.7,2.9		
MODULE-5	**ENERGY STORAGE IN ELECTRIC VEHICLES**	**21EEE71.6, 21EEE71.5**	**8 Hours**
Traction batteries, Battery Modeling, Battery Parameters: Open Circuit voltage, state of charge and discharge, Specific energy, specific power, energy efficiency, Fuel cells, compressed air storage, ultracapacitor, Flywheels.			
Self-study	Hybridization of energy storages		

Laboratory Component:

1. SoC control of Lithium-Ion battery in MATLAB/SIMULINK for EV.
2. Battery controller based on SoC for charging and discharging of battery in EV using MATLAB/SIMULINK.
3. Battery controller based on SoC for discharging of battery in EV using MATLAB/SIMULINK.

Text Book	Text Book 2: 4.6,4.5,4.3,5.1.5.2,5.3,5.4

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) Fundamental of Electrical Drives, G.K. Dubey, 2nd Edition, 2010, Narosa Publishing House, ISBN-13: 978-8173194283.
2) Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, 2nd edition, 2016, CRC Press, ISBN-13:978-1439811757.
3) Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, 2nd Edition, 2015, CRC Press, ISBN-13: 978-0849331541.

Reference Books:

1) Power Electronics: Devices, Circuits, and Applications, M.H.Rashid, , 3rd Edition, 2017, Pearson, ISBN-13: 978-8120345317
2) Power Electronics, Devices, Circuits and Industrial Applications, V.R. Moorthi, 1st Edition, 2005, Oxford University Press, ISBN-13: 978-0195670929
3) Modern Electric Vehicle Technology, C.C Chan, K.T Chau, 1st Edition, 2001, Oxford University Press, ISBN-13: 978-0198504160

Web links and Video Lectures (e-Resources):

- https://www.electrical4u.com/electrical-engineering-articles/electrical-drives/
- https://archive.nptel.ac.in/courses/108/104/108104140/
- https://archive.nptel.ac.in/courses/108/103/108103009/
- https://www.udemy.com/course/electric-vehicle-basics-u/

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

- Visit to any electrical Vehicle manufacturing industry
- Demonstration of DC Motor, AC motor speed control through electrical drive
- Video demonstration of latest trends in EV
- Organizing Group wise discussions on environmental impact of EV
- Seminars

PHOTOVOLTAIC SYSTEMS AND APPLICATIONS			
Course Code	**21EEE72**	**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:

21EEE72.1	Describe the basics of PV systems and its connections
21EEE72.2	Interpret the parameters of PV modules and their connections to form arrays
21EEE72.3	Analyze the design, integration and economics of PV systems
21EEE72.4	Demonstrate the importance of charge controllers and MPPT
21EEE72.5	Evaluate the BMS and their necessity for remote applications of solar PV systems
21EEE72.6	Design the PV system as per the real time applications and requirements

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
21EEE72.1	3	2	2	2	-	-	-	-	-	-	-	-	-	2
21EEE72.2	3	2	2	2	-	-	-	-	-	-	-	-	-	2
21EEE72.3	3	2	2	2	-	-	-	-	-	-	-	-	-	2
21EEE72.4	3	2	2	2	-	-	-	-	-	-	-	-	-	2
21EEE72.5	3	2	2	2	-	-	-	-	-	-	-	-	-	2
21EEE72.6	3	2	2	2	-	-	-	-	-	-	-	-	-	2

MODULE-1	**SOLAR CELLS, PV MODULES AND ARRAYS**	**21EEE72.1, 21EEE72.2, 21EEE72.6**	**8 Hours**
Parameters of Solar Cells, Factors affecting Electricity generated from a Solar Cell, Solar PV Modules–Ratings, and Module Parameters. Factors Affecting Electricity Generated by a Solar PV Module, Measuring Module Parameters, Solar PV Module Arrays - Connection of Modules in Series, in Parallel and in Combination			
Text Book	Text Book 1: Chapters 2, 3,4; Text Book 2: 1.1,5.1-5.4		
MODULE-2	**SOLAR PV SYSTEM DESIGN**	**21EEE72.3**	**8 Hours**
Types of Solar PV Systems – Standalone, Grid-connected and Hybrid, Design Methodology for SPV System, Grid-connected Solar PV Power Systems – Introduction, Components and Configurations, Grid-connected PV System Design for Small Power Applications and for Power Plants. Economics of PV Systems-sample payback period, lifecycle costing.			
Text Book	Text Book 1: Chapter 10, 11; Text Book 2: 8.7-8.12		
MODULE-3	**CHARGE CONTROLLER, MPPT AND INVERTERS**	**21EEE72.4, 21EEE72.6**	**8 Hours**
Need For Balance of System (BoS), Power Converters and their efficiency, DC to AC Converters (Inverters), DC to DC Converters, Charge Controllers, Maximum Power Point Tracking (MPPT), Types of Wires and Wire Sizing, Junction Box.			
Text Book	Text Book 1: Chapter 8,9		
MODULE-4	**BATTERIES AND THEIR APPLICATIONS TO SOLAR PV SYSTEMS**	**21EEE72.5, 21EEE72.6**	**8 Hours**
Types of batteries, Parameters of Batteries, Selection of a battery, Connecting Batteries together–Series, Parallel and mixed combination, Estimating Number of Batteries to be Connected in a battery Bank, Testing and Maintenance of Batteries, Fault Detection, Instruments used for Maintenance.			
Case Study	Case Study of a Solar PV System, Environmental considerations of PV Systems		
Text Book	Text Book 1: Chapter 6		
MODULE-5	**APPLICATIONS OF PV SYSTEMS**	**21EEE72.4, 21EEE72.5, 21EEE72.6**	**8 Hours**
Battery chargers, Domestic and Street lighting, Water pumping, Solar PV building heating and Solar furnaces, solar cooking, air conditioning and refrigeration applications, solar vehicles, solar PV systems in space and Solar green houses			

Applications	Design a solar PV system for a particular application
Text Book	Text Book 2: Chapter 22

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) Chetan Singh Solanki ,Solar Photovoltaic Technology and Systems: A Manual for Technicians, Trainers and Engineers, PHI Learning Publications, 3rd Edition, 2015, Print Book ISBN : 9788120347113, eBook ISBN : 9789390544912
2) Ajay Kumar Gupta, Solar PV Power and Solar Products hand book, NIIR Project Consultancy Services, 1st Edition,2022, ISBN: 9788195577590
3) Angèle Reinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Photovoltaic Solar Energy: From Fundamentals to Applications, Wiley Publishers, 2016, ISBN: 978-1-118-92746-5

Reference Books:

1) Chetan Singh Solanki, Solar Photovoltaics: Fundamentals, Technologies and Applications, PHI Learning Publications, 3rd Edition, 2015, Print Book ISBN: 9788120351110 eBook ISBN: 9789390544448
2) Roger A. Messenger and Amir Abtahi, 'Photovoltaic Systems Engineering', Taylor and Francis Group Publications, 3rd Edition, 2017(CRC Press Reprint – 2020), ISBN 9780367736330

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ee71/preview
- **https://www.youtube.com/watch?v=px239v5o6xU**
- **https://archive.nptel.ac.in/courses/115/107/115107116/**
- **https://archive.nptel.ac.in/courses/117/108/117108141/**

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

- Visit to any solar PV industry or power plant
- Demonstration of PV module, panel
- Video demonstration of latest trends in Solar PV
- Seminars

PROJECT WORK

Course Code	21EEE73	CIE Marks	100
L:T:P:S	0:0:12:0	SEE Marks	100
Hrs / Week	--	Total Marks	200
Credits	12	Exam Hours	03

Course outcomes:

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

21EEE73.1	Identify the specified societal needs and categorize them into multi-disciplinary areas in engineering.
21EEE73.2	Conduct detailed review of industrial and societal needs to reach sustainable conclusions.
21EEE73.3	Integrate significant techniques and modern tools to solve complex real-world problems.
21EEE73.4	Evaluate the identified methodologies and select based on specific criteria.
21EEE73.5	Interpret the progress and outputs of the project through professional engineering reports and present it to a community or industry.
21EEE73.6	Role effectively as an individual and as a team.

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
21EEE73.1	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21EEE73.2	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21EEE73.3	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21EEE73.4	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21EEE73.5	3	3	3	2	3	2	1	1	2	1	2	2	2	2
21EEE73.6	3	3	3	2	3	2	1	1	2	1	2	2	2	2

Project is an experimental learning 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 of recognizing a problem with appropriate consideration about societal needs in multiple areas and solve it using latest tools and technologies. Based on the ability/abilities of the student(s) and recommendations of the guide, multidisciplinary project can be assigned to a group having not more than 4 students. The project work will be reviewed by a panel of experts throughout the semester. The CIE marks awarded for the 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 project the student will submit a project report, which will be evaluated by duly appointed examiner(s).

CONTENTS	COs
Perform a literature search to review current knowledge and developments in the chosen technical area. Review and finalization of the Approach to the Problem relating to the chosen topic/title. Preparation of work schedule with a team.	21EEE73.1, 21EEE73.2
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as required for the chosen field.	21EEE73.2, 21EEE73.3
Development of product/process, testing, results, conclusions and future directions.	21EEE73.4
Present the work in a forum involving poster presentations and demonstrations of operational hardware and software.	21EEE73.5
Preparation of a project report in the standard format for being evaluated by the guide and the department with plagiarism certificate and present it as a team to the evaluators.	21EEE73.5, 21EEE73.6

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Review 1 (25 Marks)	Review 2 (25 Marks)
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 (100)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	10

SCIENTIFIC FOUNDATIONS OF HEALTH			
Course Code	**21EEK74**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**1**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**2**

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

21EEK74.1	Understand the concepts of Health and wellness and the importance of achieving balanced good health
21EEK74.2	Implement healthy lifestyle habits effectively to enhance overall well-being
21EEK74.3	Adopt the innovative & positive methods to avoid risks from harmful habits in their campus & outside the campus
21EEK74.4	Create the formulate strategies to fight against harmful diseases for good health through positive mindset

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21EEK74.1	-	-	-	-	-	1	-	-	-	-	-	-
21EEK74.2	-	-	-	-	-	2	-	-	-	-	-	-
21EEK74.3	-	-	-	-	-	3	-	-	-	-	-	-
21EEK74.4												

MODULE-1	**GOOD HEALTH AND IT'S BALANCE FOR POSITIVE MINDSET**	**21EEK74.1**	**3 Hours**

Health -Importance of Health, influencing factors of Health, Health beliefs, Advantages of good health, Health & Behavior, Health & Society, Health & family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health.

Case Study	Factors Affecting Health and Mindset
Text Book	Text Book 1: Ch. 1

MODULE-2	**BUILDING OF HEALTHY LIFESTYLES FOR BETTER FUTURE**	**21EEK74.2**	**3 Hours**

Developing healthy diet for good health, Food & health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, eating disorders, Fitness components for health, Wellness and physical function, how to avoid exercise injuries.

Self-study	Benefits of mindfulness practices for stress reduction and mental clarity.
Text Book	Text Book 1: Ch. 2, Text Book 3: Ch. 7

MODULE-3	**CREATION OF HEALTHY AND CARING RELATIONSHIPS**	**21EEK74.1, 21EEK74.2**	**3 Hours**

Building communication skills (Listening and speaking), Friends and friendship - education, the value of relationships and communication, Relationships for Better or worsening of life, understanding of basic instincts of life (more than a biology), Changing health behaviours through social engineering.

Case Study	Guidance and support to colleagues facing challenges or seeking career advancement.
Text Book	Text Book 1: Ch. 3

MODULE-4	**AVOIDING RISKS AND HARMFUL HABITS**	**21EEK74.3**	**3 Hours**

Characteristics of health compromising behaviors, Recognizing and avoiding of addictions, how addiction develops and addictive behaviors, Types of addictions, influencing factors for addictions, Differences between addictive people and non-addictive people and their behavior with society, Effects and health hazards from addictions, how to recovery from addictions.

Self-study	Study the impact of excessive sugar, salt, and saturated fats on cardiovascular health, obesity, and chronic diseases.
Text Book	Text Book 1: Ch. 4, Text Book 3: Ch. 5,6

MODULE-5	**PREVENTING AND FIGHTING AGAINST DISEASES FOR GOOD HEALTH**	**21EEK74.4**	**3 Hours**

Process of infections and reasons for it, Management of chronic illness for Quality of life, Health and Wellness of youth , Measuring of health & wealth status.

Self-study	Explore diagnostic tests and their role in detecting health conditions before symptoms appear.
Text Book	Text Book 1: Ch. 5, Text Book 2: Ch. 5

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	30
L3	Apply	10
L4	Analyze	-
L5	Evaluate	-
L6	Create	-

Suggested Learning Resources:

Textbook:

1. "Scientific Foundations of Health" – Study Material Prepared by Dr. L Thimmesha, Published in VTU - University Website.
2. "Scientific Foundations of Health", (ISBN-978-81-955465-6-5) published by Infinite Learning Solutions, Bangalore – 2022.
3. Health Psychology - A Textbook, FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited - Open University Press.

Reference Books:

1. Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor – Published by Routledge 711 Third Avenue, New York, NY 10017.
2. HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR - University of California, Los Angeles, McGraw Hill Education (India) Private Limited - Open University Press.

Web links and Video Lectures (e-Resources):

- **https://archive.nptel.ac.in/courses/109/103/109103182/**
- **https://www.youtube.com/watch?v=BYmQbtyNfCo**
- **https://www.youtube.com/watch?v=u9TFeiBc_SE**
- **https://archive.nptel.ac.in/courses/109/101/109101007/**

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

- Activities to improve health, fitness, mindfulness etc.
- Case studies on healthy habits, impact of good lifestyle

Syllabus of Eight Semester BE

BIO INSPIRED DESIGN AND INNOVATION			
Course Code	**21EEE811**	**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:

21EEE811.1	Verify the biomimetic principles in relation to the needs at that moment.
21EEE811.2	Evaluate the Bio-material properties for health care applications
21EEE811.3	Investigate novel bioengineering initiatives by evaluating design and development principles
21EEE811.4	Investigate creative bio-based solutions for socially vital issues with critical thought
21EEE811.5	Understand the bio computing optimization through research and experiential learning.
21EEE811.6	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	PSO1	PSO2
21EEE811.1	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21EEE811.2	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21EEE811.3	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21EEE811.4	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21EEE811.5	3	3	3	3	2	-	-	-	1	1	-	2	3	3
21EEE811.6	3	3	3	3	2	-	-	-	1	1	-	2	3	3

MODULE-1	**BIO-INSPIRED DESIGN AND ENGINEERING**	**21EEE811.1**	**8 Hours**
Bio-Inspired Engineering and design, History, Evolution, Basics of Bio-mimetics and other Disciplines, Rawling's Classifications, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).			
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**	**21EEE811.2**	**8 Hours**
Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Design of materials- (Hierarchy, fracture tough materials, structural colours, Actuating Materials, Bio-Compatible Materials). Bio Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic Wasp-Inspired Needle, Octopus-Inspired Sucker for Tissue Grafting, Peacock-Inspired Biosensors, Gecko Inspired Surgical Glue) Robotics, Marine and Aeronautical			
Applications	Investigate the different types of applications in industries with motors		
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15		
MODULE-3	**BIO SUSTAINABLE DEVELOPMENT**	**21EEE811.3, 21EEE811.4**	**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 mega structures.			
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10		
MODULE-4	**BIO COMPUTING AND OPTIMISATION**	**21EEE811.5**	**8 Hours**
No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm- Crossover and Mutation Operations. Bio-Inspired Optimization, Ant Colony Optimization (ACO), Swarm Intelligence-Particle Swam Optimization (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**	**21EEE811.6**	**8 Hours**
Bio-inspired innovations in– Automotive, Automation, Materials and Manufacturing, Sensors, Controllers, Communications, Healthcare, Agriculture, food production, and Sports, Environment infrastructure. Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), eco-restorations (Eco-friendly pesticide).			
Self-study	Survey on Bio-inspired Innovations, design, applications and case studies of the same.		

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-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	5	-
L2	Understand	5	-
L3	Apply	5	10
L4	Analyze	5	10
L5	Evaluate	5	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) Helena Hashemi Farzaneh, Udo Lindemann, "A Practical Guide to Bio-inspired Design", Springer Vieweg, 1st edition 2019, ISBN-10: 366257683X, ISBN-13: 978-3662576830.
2) Torben A. Lenau, Akhlesh Lakhtakia,"Biologically Inspired Design: A Primer (Synthesis Lectures on Engineering, Science, and Technology)", Publisher: Morgan & Claypool Publishers, 2021, ISBN-10: 1636390471, ISBN-13: 978-1636390475.

Reference Books:

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

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc22_ge24/preview
- https://biodesign.berkeley.edu/bioinspired-design-course/
- https://www.youtube.com/watch?v=cwxXY9Qe8ss
- https://www.youtube.com/watch?v=V2GvQXvjhLA
- https://nsf-gov-resources.nsf.gov/2023 03/Bioinspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf

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
- Seminars

NEURAL NETWORK AND FUZZY LOGIC IN ELECTRICAL ENGINEERING			
Course Code	**21EEE812**	**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:

21EEE812.1	Understand the concepts of Neuron model and its terminologies
21EEE812.2	Develop the neural network models for single layer and multi-layer network
21EEE812.3	Apply ANN techniques to electrical load forecasting problem and control system problem
21EEE812.4	Analyze the operation of fuzzy based systems
21EEE812.5	Design fuzzy logic algorithm for motor control and AVR operation and 18 bus bar system
21EEE812.6	Develop modern tools for understanding and implementation of neuro-fuzzy model

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21EEE812.1	3	3	3	2	1	-	-	-	-	-	-	-	1	1
21EEE812.2	3	3	3	2	2	-	-	-	-	-	-	-	1	1
21EEE812.3	3	3	3	3	2	-	-	-	-	-	-	-	1	1
21EEE812.4	3	3	3	3	2	-	-	-	-	-	-	-	1	1
21EEE812.5	3	3	3	3	2	-	-	-	-	-	-	-	1	1
21EEE812.6	3	3	3	3	2	-	-	-	-	-	-	-	1	1

MODULE-1	**ARTIFICIAL NEURAL NETWORKS**	**21EEE812.1**	**8 Hours**
Basics of ANN - Comparison between Artificial and Biological Neural Networks – Basic Building Blocks of ANN – Artificial Neural Network Terminologies – McCulloch Pitts Neuron Model			
Text Book	Text Book 1: 2.1 to 2.8		
MODULE-2	**SINGLE LAYER AND MULTI LAYER NETWORKS**	**21EEE812.2**	**8 Hours**
Learning Rules – ADALINE and MADALINE Models – Perception Networks – Back Propagation Neural Networks – Associative Memories.			
Applications	Investigate the different types of applications in industries with motors		
Text Book	Text Book 1: 2.10,3.1,3.2,4.5,4.6		
MODULE-3	**ANN APPLICATIONS TO ELECTRICAL ENGINEERING**	**21EEE812.3, 21EEE812.6**	**8 Hours**
ANN approach to: Electrical Load Forecasting Problem – System Identification –Control Systems – Pattern Recognition.			
Text Book	Text Book 1: 2.10, 3.4, 4.6; Reference Book: 14.1 -14.10		
MODULE-4	**FUZZY LOGIC**	**21EEE812.4**	**8 Hours**
Classical Sets – Fuzzy Sets – Fuzzy Properties and Operations – Fuzzy Logic System– Fuzzification – Defuzzification – Membership Functions – Fuzzy Rule base – Fuzzy Logic Controller Design.			
Text Book	Text Book 1: 6.1 to 6.5, Text Book 2: 2,3; Reference Book 4 : 6,7		
MODULE-5	**FUZZY LOGIC APPLICATIONS TO ELECTRICAL ENGINEERING**	**21EEE812.5 21EEE812.6**	**8 Hours**
Fuzzy Logic Implementation for Induction Motor Control – Switched Reluctance Motor Control –Fuzzy Excitation Control Systems in Automatic Voltage Regulator – Fuzzy Logic Controller in an 18 Bus Bar System			
Self-study	Fuzzy Logic Implementation for switched reluctance motor control used in EVs		
Text Book	Text Book 1: 7.6, Text Book 2: 6,7; Reference Book 4: 19		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	Remember	5	-
L2	Understand	5	-
L3	Apply	5	10
L4	Analyze	5	10
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) S. Rajasekaran and G.A. Vijayalakshmi Pai, "Neural Network, Fuzzy Logic, and Genetic Algorithms", PHI, New Delhi, 2016.
2) Timothy J. Ross, "Fuzzy Logic with Engineering Applications", Third Edition, WILEY India Edition, 2018, ISBN: 13. 978-0470743768.

Reference Books:

1) S. N. Sivanandam, S. Sumathi and S. N. Deepa, "Introduction to Fuzzy Logic using MATLAB", Springer International Edition, 2016, ISBN: 978-3-642-07144-7.
2) Yung C. Shin and Changing Xu, "Intelligent System – Modeling, Optimization & Control", CRC Press, 2017.
3) Jacek M. Zurada, "Introduction to Artificial Neural Network", Jaico Publishing House, New Delhi, Third Edition, 2019, ISBN: 9788172242664.
4) Vinoth Kumar K, "Fundamentals of Soft Computing", S.K.Kataria and Sons Publishers, New Delhi, Second Edition, 2020, ISBN: 978-9350141168.

Web links and Video Lectures (e-Resources):

- https://au.mathworks.com/academia/books/introduction-to-neural-networks-using-matlab-sivanandam.html
- https://www.coursera.org/learn/neural-networks-deep-learning
- https://nptel.ac.in/courses/117105084
- https://highered.mheducation.com/sites/0070591121/student_view0/
- https://neuroph.sourceforge.net/
- https://cofes.com/neural-network-software/

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

- Video demonstration of latest trends in industry applications
- Visit to any AI based industries of electrical 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/problem statements
- Seminars
- IBM academic initiatives

MACHINE LEARNING FOR ELECTRICAL ENGINEERING			
Course Code	**21EEE813**	**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:

21EEE813.1	Understand the basics of machine learning
21EEE813.2	Apply the different learning algorithms for prediction
21EEE813.3	Develop skills to analyze and evaluate the performance of machine learning models using appropriate metrics and techniques.
21EEE813.4	Design a model to solve classification /clustering problems using supervised or unsupervised machine learning algorithms.
21EEE813.5	Evaluate the performance of various machine learning algorithms using different real world data sets.
21EEE813.6	Apply ML algorithms for solving practical applications related to electrical and electronics engineering

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
21EEE813.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21EEE813.2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
21EEE813.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21EEE813.4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
21EEE813.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
21EEE813.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	**INTRODUCTION TO MACHINE LEARNING**	**21EEE813.1 21EEE813.2**	**8 Hours**

Introductions to Machine Learning: Terminologies in machine learning, Applications, Types of machine learning: supervised, unsupervised, semi-supervised learning, Reinforcement Learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Linear discriminate Analysis (LDA).

Text Book	Text Book 1: Ch 1

MODULE-2	**SUPERVISED LEARNING**	**21EEE813.1 21EEE813.2 21EEE813.3 21EEE813.4**	**8 Hours**

Binary Classification: Linear Classification model, Performance Evaluation-Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure. Support Vector Machines-Large margin classifiers, Nonlinear SVM, kernel Functions. Multi-class Classification: Model, Performance Evaluation Metrics – Multiclass Classification Techniques-One vs. One, One vs. Rest, Decision Trees: Concept sand Terminologies, Classification and Regression Tree (CART). Regression: Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Estimating the values of the regression coefficients. Multivariate Regression: Model Representation. Naïve Bayes Classifier. K-Nearest Neighbor for Classification. Over fitting and Under fitting, Bias and Variance.

Self-Study	Understand the Linear Algebra and Calculus: concepts like vectors, matrices, derivatives, and gradients.
Text Book	Text Book 1: Ch 2, Text Book 2: Ch 3.1,3.2,3.3,6.3,8.2

MODULE-3	**UNSUPERVISED LEARNING**	**21EEE813.1 21EEE813.2 21EEE813.3 21EEE813.4**	**8 Hours**

Distance Based Models: Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid algorithm with example. Principal Component analysis (PCA).

Text Book	Text Book 2: Ch 6.12		
MODULE-4	**TRENDS IN MACHINE LEARNING**	**21EEE813.5**	**8 Hours**
Ensemble Learning- Combining Multiple models, bagging, boosting, stacking-Algorithms-Random Forest, ada-boost. Introduction to Reinforcement Learning –Exploration, exploitation, rewards, penalties			
Text Book	Text Book 1: Ch 17, Text book 2: Ch 13		
MODULE-5	**APPLICATIONS OF ML TECHNIQUES**	**21EEE813.5 21EEE813.6**	**8 Hours**
Machine learning applications to electrical engineering: Electrical load forecasting, wind and solar energy forecasting, fault identification and classification, reinforcement learning for control, Image classification and segmentation.			
Applications	Discuss how machine learning can contribute to energy efficiency and conservation efforts.		
Text Book	Text book 3: Ch 15		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	**Remember**	5	-
L2	**Understand**	5	-
L3	**Apply**	5	10
L4	**Analyze**	5	10
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) Introduction to Machine, E. Alpaydin Learning, PHI, 2005. ISBN 978-0-262-02818-9.
2) Machine Learning, Tom Mitchell, New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
3) Machine Learning Algorithms and Applications in Engineering, P. Chaterjee, M.Yazdani, F F Navarro, JP Rodriguez, ISBN: 9780367569129.

Reference Books:

1) Machine Learning, T. Mitchell, McGraw Hill. ISBN: 0070428077.
2) Introduction to Machine Learning, Alex Smola, S.V.N. Vishwanathan, Cambridge University Press 2008. ISBN 0 521 82583 0.
3) Pattern Recognition and Machine Learning, Christopher Bishop, Springer. ISBN-13: 978-0387-31073-2.

Web links and Video Lectures (e-Resources):

- **https://www.youtube.com/watch?v=dGNJ-feQLC4**
- **https://onlinecourses.nptel.ac.in/noc21_cs24/preview**
- **https://www.youtube.com/watch?v=NVUpLo1AFs8**
- **https://www.youtube.com/watch?v=My1_-ttLsfg&list=PLNZMKGYv14qLjeZyyoFIjvTZtEYZU0BVq**

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 read research topics on Machine Learning
- Class Presentation.

POWER SYSTEM OPERATION AND CONTROL

Course Code	**21EEE814**	**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:

21EEE814.1	Understand real power control and operation.
21EEE814.2	Analyze the response of single area and two area systems.
21EEE814.3	Describe the concept of reactive power and voltage control in power system.
21EEE814.4	Optimize the scheduling of generation units.
21EEE814.5	Apply different methods to solve unit commitment problem.
21EEE814.6	Develop the models for computer control of power systems and data acquisition.

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
21EEE814.1	3	-	-	-	-	-	-	-	-	-	-	-	1	2
21EEE814.2	3	3	-	-	-	-	-	-	-	-	-	-	1	2
21EEE814.3	3	3	1	2	-	-	-	-	-	-	-	-	1	2
21EEE814.4	3	3	-	2	-	-	-	-	-	-	-	-	1	2
21EEE814.5	3	3	-	2	-	-	-	-	-	-	-	-	1	2
21EEE814.6	3	3	-	2	-	-	-	-	-	-	-	-	1	2

MODULE-1	**INTRODUCTION**	**21EEE814.1 21EEE814.2**	**8 Hours**

Structure of Electric Energy System, Operating States of Power System, Transmission Capacity. Load Characteristics: Voltage and Frequency Load Dependency. The Real Power Balance and its Effect on System Frequency. The Reactive Power Balance and its Effect on System Voltage. Control of Generation: Megawatt-frequency and Mega -voltage control, Generator Model, Load Model, Prime-Mover Model, Governor Model.

Text Book	Text Book 1: 3.1, 2.2, 3.3, 3.4, 3.5, 3.6, to 3.11

MODULE-2	**LOAD FREQUENCY CONTROL**	**21EEE814.2**	**8 Hours**

Speed-Load characteristics of Governor, Parallel operation of Generators, Concept of Control Area. Megawatt-Frequency Control of Single Area: the uncontrolled and controlled case. The two-area system: Block diagram of two area system. Static and Dynamic response of uncontrolled two-area system, Static and Dynamic response of controlled two-area system.

Text Book	Reference Book 1: 3.1 to 3.23

MODULE-3	**REACTIVE POWER AND VOLTAGE CONTROL**	**21EEE814.3**	**8 Hours**

Production and absorption of reactive power, Methods of Voltage Control, Shunt reactors Shunt Capacitors, Series Capacitors Synchronous condensers, Static VAR systems, Principles of Transmission system compensation, Modeling of reactive compensating devices, Application of tap changing transformers to transmission systems, Distribution system voltage regulation, Modeling of transformers ULTC control systems.

Text Book	Reference Book 1: 2.1 to 2.23

MODULE-4	**ECONOMIC DISPATCH OF THERMAL UNITS AND UNIT COMMITMENT**	**21EEE814.4**	**8 Hours**

Optimal operation of Generators in Thermal Power Stations, - heat rate Curve – Cost Curve – Incremental fuel and Production costs, input-output characteristics, Optimum generation allocation with line losses neglected using Lagrangian function. Optimum generation allocation including the effect of transmission line losses – Loss Coefficients, General transmission line loss formula. Unit Commitment: Constraints in Unit Commitment, Spinning Reserve, Thermal Unit Constraints, Hydro-Constraints, Must Run Constraint & Fuel Constraints. Unit Commitment Solution Methods: Priority List, Lagrange Relaxation Solution.

Case Study	Economic Dispatch of Thermal Power Plant
Text Book	Text Book 1: 4.1 to 4.29

MODULE-5	**POWER SYSTEM SECURITY& MODERN TRENDS IN POWER SYSTEM CONTROL**	**21EEE814.5**	**8 Hours**

Factors affecting Power System Security, Linear Sensitivity Factors (LSFs). Contingency Analysis using LSFs, Numerical Problems. Energy Management Systems, SCADA Control of the Indian Power Grid, Role of Load Dispatch Centers, Synchro-phasors, Phasor Measurement Unit (PMU), Wide Area Monitoring System (WAMS), Overview of WAMS in Indian Grid.	
Case Study	Relay Coordination and Contingency Analysis
Text Book	Text Book 1: 10.1 to 10.7

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) Power Generation Operation and Control, Allen J.Wood, Bruce.F.Wollenberg, Gerald B. ShebléWiley & Sons, 2013, ISBN: 0471586994.
2) Electric Energy Systems Theory, Elgerd.O.I McGraw Hill Education; Second Edition, 2017. ISBN: 007099286X.

Reference Books:

1) Reactive Power Control in Electric Systems, Timothy J. E. Miller, Wiley, First Edition, Reprint 2010, ISBN: 13: 978-8126525201.
2) EPRI Power System Dynamics Tutorial, Electric Power Research Institute, Jul 27, 2009.
3) Unified Real Time Dynamic State Measurement (URTSM), Power Grid Corporation of India, Feb 2012.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/104/108104052/
- https://onlinecourses.nptel.ac.in/noc23_ee128/preview

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

- Video demonstration of the concepts.
- Organizing group wise discussions.
- Seminars.
- Case study
- Industry visit

SMART GRID TECHNOLOGIES

Course Code	**21EEE815**	**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:

21EEE815.1	Understand smart grids and the smart grid policies and developments in smart grids.
21EEE815.2	Apply concepts of smart grid technologies in hybrid electrical vehicles.
21EEE815.3	Realize smart substations and feeder automation.
21EEE815.4	Analyze micro grids and distributed generation systems.
21EEE815.5	Evaluate the effect of power quality in smart grid.
21EEE815.6	Classify the stake holders and market drivers of smart grid.

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
21EEE815.1	3	2	1	1	-	-	-	-	-	-	-	-	1	2
21EEE815.2	3	2	2	1	-	-	-	-	-	-	-	-	1	2
21EEE815.3	2	2	1	2	-	-	-	-	-	-	-	-	1	2
21EEE815.4	2	3	2	2	-	-	-	-	-	-	-	-	1	2
21EEE815.5	3	3	3	3	1	-	-	-	-	-	-	-	1	2
21EEE815.6	3	3	2	1	1	-	-	-	-	-	-	-	1	2

MODULE-1	**SMART GRID EVOLUTION**	**21EEE815.1**	**8 Hours**

Evolution of Indian Power Grid, Smart Grid-Definitions, Functions of Smart Grid, Opportunities & Barriers of Smart Grid, Drivers for SG in India, Challenges for SG, Difference between conventional & smart grid, Smart Grid Vision & Roadmap for India, Concept of Resilient and Self-Healing Grid, Present development & International policies of Smart Grid.

Functionalities and key components of smart grid. Smart grid Components for Transmission system, Smart grid components at distribution level, Architecture of smart grid, Pilot projects of Smart Grid in India.

Text Book	Text Book 1: 1.1, 1.2, 1.3, 1.4, 1.5, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10,

MODULE-2	**SMART GRID TECHNOLOGIES**	**21EEE815.2, 21EEE815.3**	**8 Hours**

Introduction to Smart Meters, Advanced Metering Infrastructure, Distribution Automation, Automatic Meter Reading (AMR), Outage Management System (OMS), Plug in Hybrid Electric Vehicles (PHEV), Vehicle to Grid Technology (V2G), Smart Sensors, Smart Homes, Building Energy Management System

Substation Automation, Feeder Automation. Geographic Information System (GIS), Peak load Management, Energy Storage systems, Pumped hydro storage, CAES, FES, storage batteries, Thermal energy storage, Super capacitors.

Text Book	Reference Book 1: 2.1 to 3.1

MODULE-3	**MICROGRIDS**	**21EEE815.4**	**8 Hours**

Architecture and Layout of Microgrid, Types of Micro grid- DC Micro grid, AC Microgrid, Hybrid AC/DC Microgrid, Benefits of Distributed generation, Energy storage in Microgrids, Micro grid- Protection, Case studies of Micro grid in India.

Small scale distributed generation, Distributed Generation Resources-Fuel Cells, Solar Photovoltaic cells, Wind power, Fixed speed Wind Turbine generators, Variable speed wind turbine generators, Synchronous generator with In-line frequency control, Advantages of DG.

Case Study	DG integration into grid
Text Book	Text Book 4: 2.10 to 2.26, 2.48, 2.99

MODULE-4	**POWER QUALITY MANAGEMENT IN SMART GRID**	**21EEE815.4**	**8 Hours**

Power Quality-Basic definitions, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Power Quality Audit and its significance.

Advanced Metering Infrastructure (AMI), Home Area Network (HAN), Neighborhood Area Network (NAN), Wide Area Network (WAN). Bluetooth, Zig-Bee, GPS, Wi-Fi, Wi- Max based communication, Wireless Mesh Network, Broadband over Power line (BPL).

Case Study	Power Quality Audit
Text Book	Text Book 2: 2.9 to 3.9

MODULE-5	**SMART GRID MARKET DRIVERS**	**21EEE815.5**	**8 Hours**

		21EEE815.6	

Introduction – Comparison of Micro grid, power grid and Smart grid – Case study of STUXNET –Cyber security, Smart Grid Stake holders-Roles and Responsibilities, Technical challenges in SG Market operation.
Electric Vehicle Technology, EV charging Infrastructure, EVSE Power standards, EVSE communication standards, Vehicle grid Integration (VGI), Challenges associated with VGI.

Case Study	Electric Vehicle charging specifications with comparison
Text Book	Text Book 2: 1.2, 1.3, 1.6

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution-NPTEL	
		Test (s)	Qualitative Assessment (s)
		25	25
L1	**Remember**	5	-
L2	**Understand**	5	5
L3	**Apply**	5	10
L4	**Analyze**	5	10
L5	**Evaluate**	5	-
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) Smart grid Advance Technology and solution, Stuart Borlase, CRC Press, Second edition, Nov 2017, ISBN: 9781498799553.
2) Smart Grids: Clouds, Communications and Automation, Krzysztof Iniewski, David Bakken, Open Source, CRC Press, Taylor and Francis group, May 2014, ISBN: 9781315215525.
3) Smart Power: Climate Changes, the Smart Grid, and the Future of Electric Utilities, Peter S. Fox Penner, Island Press; 1 edition, Jun 2010, ISBN: 1597267066.
4) Microgrids and Active Distribution Networks, S. Chowdhury, S. P. Chowdhury, P. Crossley, Institution of Engineering and Technology, Jun 2009, ISBN: 1849190143.

Reference Books:

1) Control and Automation of Electric Power Distribution Systems (Power Engineering), James Northcote, Green, Robert G. Wilson CRC Press, 2017, ISBN: 978-0824726317.
2) Substation Automation systems Design and Implementation, Evelio Padilla Wiley Publishers, 2015, ISBN: 9781118987209.
3) Smart Grid: Fundamentals of design and analysis, James Momoh, John Wiley & sons Inc, IEEE press, 2015, ISBN: 978-1-118-15610-0.
4) Smart Grid: Technology and Applications, Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, John Wiley & sons Inc, 2012, ISBN: 978-0-470-97409-4.
5) Smartgrid Fundamentals of Design and Analysis, James Momoh, IEEE press, A John Wiley & Sons, Inc., Publication, 2012, ISBN: 978-1-118-15610-0.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_ee60/preview
- https://www.smartgrid.gov/the_smart_grid/smart_grid.html
- https://indiasmartgrid.org/

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

- Video demonstration of the concepts.
- Organizing group wise discussions.
- Seminars.
- Case study

TECHNICAL SEMINAR

Course Code	**21EEE82**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**--**
Hrs / Week	**--**	**Total Marks**	**50**
Credits	**01**	**Exam Hours**	**--**

Course outcomes:

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

21EEE82.1	Learn about the quickly evolving field in multidisciplinary areas through independent study.
21EEE82.2	Identify the advancements in the technology pertinent to the chosen area.
21EEE82.3	Demonstrate the identified technology and analyze its effects on the environment, society, and domain.
21EEE82.4	Compile the study report and provide it to the audience while abiding by ethical guidelines.
21EEE82.5	Develop interpersonal skills and presentation skills.
21EEE82.6	Use their developed skills in real life situations.

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
21EEE82.1	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21EEE82.2	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21EEE82.3	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21EEE82.4	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21EEE82.5	-	-	-	-	-	2		1	3	2	2	-	-	-
21EEE82.6	-	-	-	-	-	2	-	1	3	2	2	-	-	-

It is crucial to stay current with the practical and communicative aspects of recent technologies. Technical seminar course is designed in such a way the preparation for presentations and models would foster practical creativity as well as the general personality of students. Based on the ability of the students, each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of specialization. The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question-and-answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman. At the completion of the semester the student will submit a seminar report, which will be evaluated by internal panel of experts.

CIE Assessment Pattern (50 Marks)

RBT Levels		Marks Distribution		
		Review 1 (15 Marks)	Review 2 (15 Marks)	Seminar Report (20 Marks)
		15	15	20
L1	**Remember**	-	-	-
L2	**Understand**	5	5	5
L3	**Apply**	-	-	-
L4	**Analyze**	5	5	5
L5	**Evaluate**	5	5	10
L6	**Create**	-	-	-

RESEARCH INTERNSHIP/ INDUSTRY INTERNSHIP /RURAL INTERNSHIP

Course Code	**21EEE83**	**CIE Marks**	**100**
L:T:P:S	**0:0:12:0**	**SEE Marks**	**100**
Hrs / Week	**0**	**Total Marks**	**200**
Credits	**12**	**Exam Hours**	**03**

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

21EEE83.1	Apply and test the basic theoretical knowledge learnt during the study on to projects in industry/Startup/CoE/Study Centre etc.
21EEE83.2	Cater to the recent industrial demands by analyzing and designing complex engineering solutions.
21EEE83.3	Work in real-life scenarios.
21EEE83.4	Perform either as an individual or as a team to communicate the complex engineering activities with the community and with the society and comprehend the work through articles/reports.

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
21EEE83.1	3	3	3	3	3	3	2	1	3	3	3	3	2	3
21EEE83.2	3	3	3	3	3	3	2	1	3	3	3	3	2	3
21EEE83.3	3	3	3	3	3	3	2	1	3	3	3	3	2	3
21EEE83.4	3	3	3	3	3	3	2	1	3	3	3	3	2	3

At the beginning of IV years of the program i.e., after VI semester, VII semester class work and VIII semester Research Internship /Industrial Internship / Rural Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for an internship.

In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship or Rural Internship.

Research/Industrial /Rural Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 14 to 20 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree.

Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

Rural Internship: Rural development internship is an initiative of Unnat Bharat Abhiyan Cell, RGIT in association with AICTE to involve students of all departments studying in different academic years for exploring various opportunities in techno-social fields, to connect and work with Rural India for their upliftment.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.

University shall not bear any cost involved in carrying out the internship by students. However, students can receive any financial assistance extended by the organization.

CONTENTS	COS	Weeks (Min)
Perform a literature search to review current knowledge and developments in the chosen technical area in Industry. Review and finalization of the Approach to the Problem relating to the chosen topic/title. Preparation of work schedule	21EEE83.1	**4**
Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as required for the chosen field of Internship study	21EEE83.2	**4**
Development of product/process, testing, results, conclusions and future directions as per industry needs/problems	21EEE83.3	**4**
Preparation of a Internship report/Presentations in the standard format for being evaluated by the guide and the department with certificate.	21EEE83.4	**2**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		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

Syllabus of NSS/PED/YOGA

NATIONAL SERVICE SCHEME (NSS)			
Course Code	**21NSS84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**2**

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

21NSS84.1	Understand the importance of his / her responsibilities towards society
21NSS84.2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
21NSS84.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
21NSS84.4	Implement government or self-driven projects effectively in the field.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21NSS84.1	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.2	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.3	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.4	-	-	-	-	-	3	1	1	3	2	**2**	1

Semester	CONTENT	HOURS
5th to 8th	**PART A** ONENSS–CAMP @College/University/State or Central Govt Level/ NGO's/General Social Camps **PART B** 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govtorganization,5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques–Role of different stakeholders–Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches. 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. 9. Spreading public awareness under rural outreach programs. (minimum5programs). 10. Organize National integration and social harmony events/workshops / Seminars. (Minimum02programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	Total 32 Hrs/ Semester 2 Hrs/week

CIE Assessment Pattern (50 Marks – Practical) –

1. **PART A:** Compulsorily students have to attend one camp.

2. **PART B:** Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.

3. CIE will be evaluated based on their presentation, approach and implementation strategies.

CIE Components	Marks
Presentation1-Selection of topic-(phase1)	10
Experiential Learning Presentation 2 (phase2)	10
Case Study-based Teaching-Learning	10
Sector-wise study & consolidation	10
Video based seminar (4-5 minutes per student)	10
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

- Implementation strategies of the project with report duly signed by the Dept's Coordinator, HoD and Principal.
- At last it should be evaluated by the NSS Coordinator.
- Finally consolidated report should be sent to the University.

Suggested Learning Resources:

Reference Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

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.

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)

Course Code	**21PES84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**02**

Course outcomes:

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

21PES84.1	Demonstrate the starting and finishing positions of different track and jump events.
21PES84.2	Demonstrate the holding and releasing stances in various throwing events, and takeoff and landing position in various jumping events of Athletics.
21PES84.3	Demonstrate the specific skills and techniques of the selected game/event.
21PES84.4	Demonstrate and describe the rules and regulations of specific games.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21PES84.1	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.2	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.3	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.4	-	-	-	-	-	-	-	1	2	-	-	1

Semester	CONTENT	HOURS
5th	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start(its variations)use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Kabaddi OR Kho-Kho** **Kabaddi:** A. Fundamental skills 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials. **Kho-Kho:** A Fundamental skills 1. Skills in Chasing: Sit on the box (Parallel &Bullet toe method),Getup from the box(Proximal & Distal foot method),Give Kho(Simple,Early, Late& Judgment),Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul.	Total 32 Hrs/ Semester 2 Hrs/week

	2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play. 3. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.	
6th	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations)use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Volleyball OR Throw Ball** **Volleyball:** A. Fundamental skills 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over-head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations B. Rules and their interpretation and duties of officials. **Throw Ball:** A. Fundamental skills: Over hand service, Side arm service, two hand catching, one hand over head return, side arm return. B. Rules and their interpretations and duties of officials **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations. C. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice.	

	5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	
7th	**Athletics**: 1. Track -Relay Race: • Starting, Baton Holding/Carrying, Baton Exchange in between zone, and Finishing • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- Triple Jump: Approach Run, Take-off, Flight in the Hop, Step, Jump and Landing 3. Throws- Javelin Throw: Grip, Carry, and Recovery (3/5 Impulse stride). Release **Cricket OR Baseball** **Cricket:** A. Fundamental skills 1. Batting- Forward Defense Stroke, Backward Defense Stroke, OffDrive, On Drive, Straight Drive, Cover Drive, Square Cut. 2. Bowling-Out-swing, In-swing Off Break, Leg Break and Googly. 3. Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw, Throwing on the Turn. 4. Wicket Keeping B. Rules and their interpretation and duties of officials. **Baseball:** A. Fundamental skills: 1. Player Stances – walking, extending walking, L stance, cat stance Grip – standard grip, choke grip 2. Batting – swing and bunt. 3. Pitching 4. Baseball: slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball B. Rules and their interpretations and duties of officials **Basketball OR Net Ball** **Basketball:** A. Fundamental Skills 1. Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass. 2. Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running. 3. Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. 4. Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw. 5. Rebounding: Defensive rebound and Offensive rebound. 6. Individual Defence: Guarding the player with the ball and without the ball, Pivoting. 7. Game practice with application of Rules and Regulations. **Netball:** A. Fundamental Skills 1. Catching: one handed, two handed, with feet grounded and in flight. 2. Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce).	

	3. Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. 4. Shooting: One hand, forward step shot, and backward step shot. 5. Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. 6. Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. 7. Intercepting: Pass and shot. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	
8th	**Athletics**: A. Track -Combined Events: a. Heptathlon all the 7 events b. Decathlon: All 10 Events B. Jumps- Pole Vault: Approach Run, Planting the Pole, Take-off, Bar Clearance and Landing. C. Throws- Hammer Throw: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Shuttle Badminton OR Table Tennis** **Shuttle Badminton:** A. Fundamental skills D. Basic Knowledge: Various parts of the Racket and Grip. E. Service: Short service, Long service, Long-high service. F. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash. G. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. **Table Tennis:** A. Fundamental skills: 1. Basic Knowledge: Various parts of the Racket and Grip(Shake Hand & PenHold Grip). 2. Stance: Alternate & Parallel. 3. Push and Service: Backhand &Forehand. 4. Chop: Backhand & Forehand. 5. Receive: Push and Chop with both Backhand & Forehand. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	

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
5th Semester	10
6th Semester	10
7th Semester	15
8th Semester	15
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

SEE	Marks
Athletics	20
Kabaddi OR Kho-Kho	05
Volleyball / Throw ball	05
Football/Hockey	05
Netball/Basketball	05
Shuttle Badminton / Table Tennis	05
Handball/ Badminton	05
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, etal. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma,P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, NewDelhi.
5. Jain,R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket ,Khel Sahitya Kendra, NewDelhi.
7. Saha,A.K.Sarir SiksherRitiniti,RanaPublishingHouse,Kalyani.
8. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, NewDelhi.
10. Dubey,H.C. Basketball, Discovery Publishing House, NewDelhi.
11. RachanaJain, Teach Yourself Basketball, Sports Publication.
12. JackNagle,Power Pattern Offences for Winning basketball,ParkerPublishingCo.,NewYork.
13. RenuJain, Play and Learn Basketball, Khel Sahitya Kendra,NewDelhi.
14. SallyKus, Coaching Volleyball Successfully, HumanKinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
16. Bandopadhyay, K.Sarir Siksha Parichay, Classic Publishers, Kolkata

YOGA			
Course Code	**21YOG84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**02**

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

21YOG84.1	Use Yogasana practices in an effective manner
21YOG84.2	Become familiar with an authentic foundation of Yogic practices
21YOG84.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
21YOG84.4	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
21YOG84.1	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.2	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.3	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.4	-	-	-	-	-	3	-	-	2	-	-	1

Semester	CONTENT	HOURS
5th	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga,its origin ,history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Kapalabhati:** Meaning, importance and benefits of Kapalabhati - 40strokes/min3rounds **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 **Patanjali's Ashtanga Yoga**: Yama, Niyama **Pranayama:** Suryanuloma –Viloma, Chandranuloma-Viloma	Total 32 Hrs/ Semester 2 Hrs/week
6th	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Kapalabhati:** Revision of Kapalabhati -60strokes/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	
7th	**Suryanamaskara:** Suryanamaskar 12 count,8rounds **Kapalabhati:** Revision of Kapalabhati - 80strokes/min3rounds **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana	

	3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	
8th	**Suryanamaskara:** Suryanamaskar 12 count,12rounds **Kapalabhati:** Revision of Kapalabhati - 100strokes/min3rounds **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Mayurasana 4. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 5. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Yogasana learnt in the semester.

CIE	Marks
5th Semester	10
6th Semester	10
7th Semester	15
8th Semester	15
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

SEE	Marks
Suryanamaskara	10
Kapalabhati	10
Asanas	10
Patanjali's Ashtanga Yoga	10
Pranayama / Shat Kriyas	10
Total	**50**

Suggested Learning Resources:

Reference Books:

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

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

APPENDIX B

Outcome Based Education

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

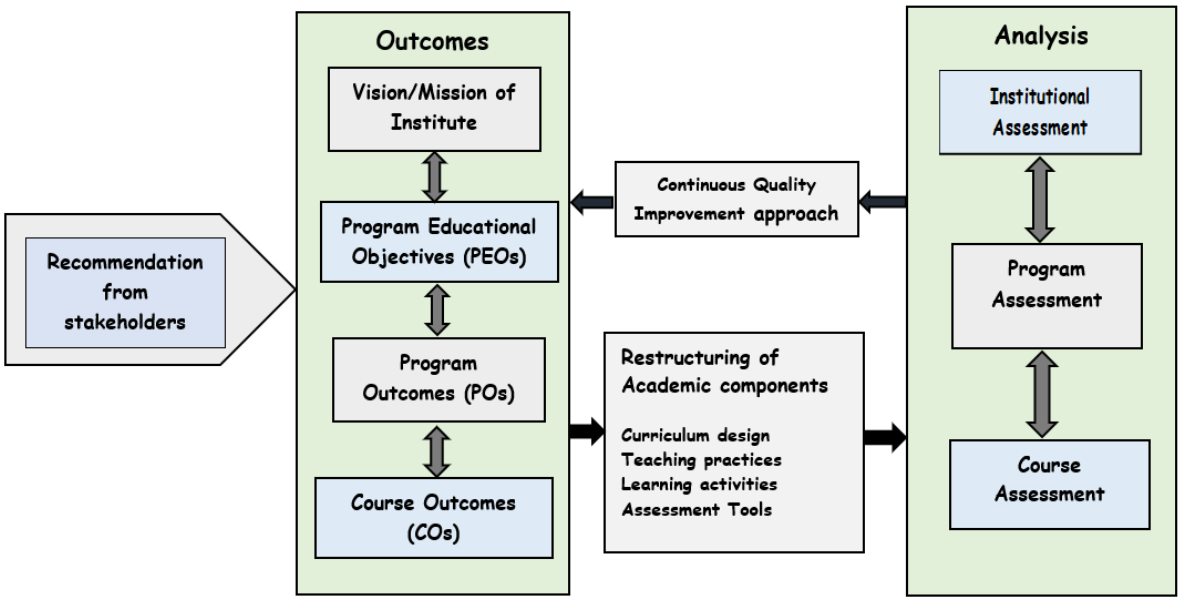
There are three educational Outcomes as defined by the National Board of Accreditation:

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

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 that require consideration of appropriate constraints/requirements not explicitly given in the problem statement. (like: cost, power requirement, durability, product life, etc.).,which need to be defined (modeled) within appropriate mathematical framework that often require use of modern computational concepts and tools.

Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and 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.

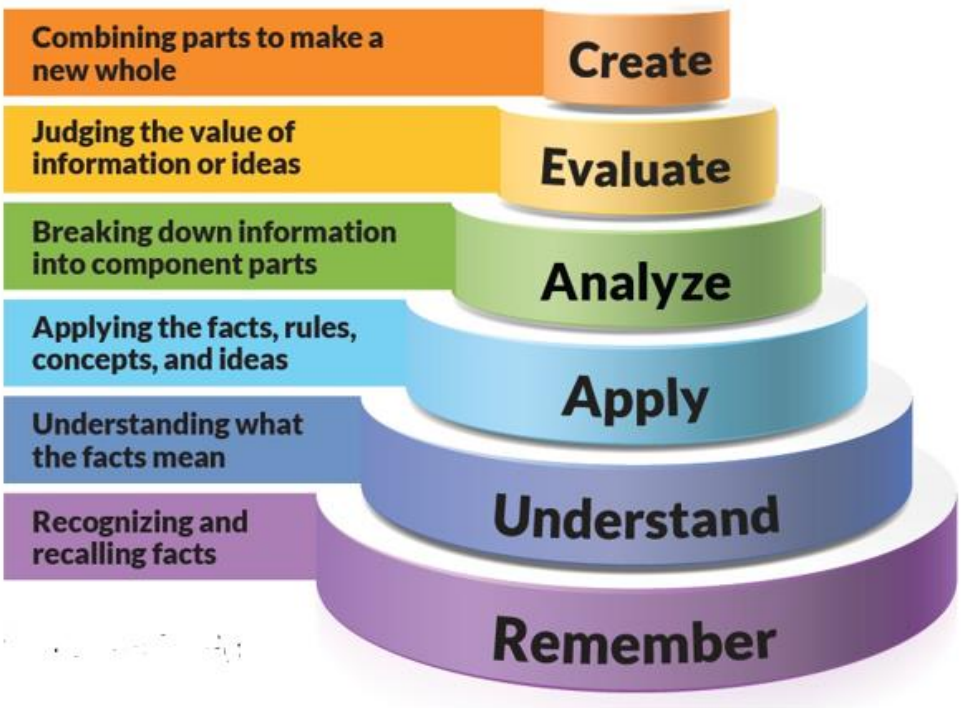
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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.

APPENDIX D

BLOOM'S TAXONOMY

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



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