NEW HORIZON
COLLEGE OF ENGINEERING

Department of
Electronics and Communication Engineering

Academic Year 2024-25
7th & 8th Semester
Scheme and Syllabus

BATCH: 2021-25
CREDITS: 160

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NEW HORIZON COLLEGE OF ENGINEERING

INSTITUTION

Vision

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

Mission

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

Quality Policy

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

Values

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

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VISION

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

MISSION

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

Program Education objectives (PEOs)

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

PEO to Mission Statement Mapping

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

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

Program Outcomes (PO) with Graduate Attributes

	Graduate Attributes	Program Outcomes (POs)
1	**Engineering knowledge**	**PO1:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems in Electronics and Communication Engineering.
2	**Problem analysis**	**PO2:** Identify, formulate, review research literature, and analyze complex engineering problems in Electronics and Communication Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	**Design/development of solutions**	**PO3:** Design solutions for complex engineering problems and design system components or processes of Electronics and Communication Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	**Conduct investigations of complex problems**	**PO4:** Use research-based knowledge and research methods including design of experiments in Electronics and Communication Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	**Modern tool usage**	**PO5:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities in Electronics and Communication Engineering with an understanding of the limitations.
6	**The engineer and society**	**PO6:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice in Electronics and Communication Engineering.
7	**Environment and sustainability**	**PO7:** Understand the impact of the professional engineering solutions of Electronics and Communication Engineering in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8	**Ethics**	**PO8:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	**Individual and team work**	**PO9:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10	**Communication**	**PO10:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11	**Project management and finance**	**PO11:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12	**Life-long learning**	**PO12:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

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

Mapping of PEOs to POs & PSOs

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

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

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electronics and Communication Engineering
Scheme of Teaching and Examinations for 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	21ECE71	Wireless Communication	EC	2	0	1	0	3	4	50	50	**100**
2	PCC	21ECE72	Coding and Cryptography	EC	3	0	0	0	3	3	50	50	**100**
3	PROJ	21ECE73	Project Work	EC	0	0	12	0	12	0	100	100	**200**
4	AEC	21ECK74	Scientific Foundations of Health	EC	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, IPCC: Integrated 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:	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session
1-hour Lecture (L) per week=1Credit	
2-hoursTutorial(T) per week=1Credit	02- Credits courses are to be designed for 25 hours of Teaching-Learning Session
2-hours Practical / Drawing (P) per week=1Credit	
2-hous Self Study for Skill Development (SDA) per week = 1 Credit	01-Credit courses are to be designed for 15 hours of Teaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING
B. E. in Electronics and Communication Engineering
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VIII Semester													
S. No.	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**CIE**	**SEE**	**Total**
					L	**T**	**P**	**S**					
1	PEC	21ECE81X	Professional Elective Course-III	EC	3	0	0	0	3	3	50	50	**100**
2	SEM	21ECE82	Technical Seminar	EC	0	0	1	0	1	0	50	-	**50**
3	INT	21ECE83	Research Internship/ Industry Internship /Rural Internship	EC	0	0	12	0	12	0	100	100	**200**
4	NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	0	50	50	**100**
		21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		21YOG84	Yoga	Yoga Teacher									
Total									**16**	**3**	**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			
21ECE811	Cyber Security	21ECE814	Data Communication and Networking
21ECE812	Digital Image Processing	21ECE815	Machine Learning Algorithms

21ECE813	Analog and Mixed Mode VLSI Design		

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 (21ECE82): 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.

SEVENTH SEMESTER

(SYLLABUS)

WIRELESS COMMUNICATION			
Course Code	**21ECE71**	**CIE Marks**	**50**
L:T:P:S	**2:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2+2**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21ECE71.1	Understand the basics of wireless communication and evolution of wireless communication standards with time.
21ECE71.2	Choose appropriate radio signal propagation model for different communication systems
21ECE71.3	Identify the basic operations and call setup processes of GSM and CDMA
21ECE71.4	Evaluate the significance of multi-carrier modulation techniques in the current communication scenario
21ECE71.5	Apply the concept of smart multi antenna systems for advanced wireless communication
21ECE71.6	Analyze the concepts of wireless communication using Simulation tools

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
21ECE71.1	2	-	-	-	-	-	-	-	-	-	-	2	3	3
21ECE71.2	3	2	1	-	-	-	-	-	-	-	-	2	3	3
21ECE71.3	3	2	-	-	-	-	-	-	-	-	-	2	3	-
21ECE71.4	3	2	1	1	-	-	-	-	-	-	-	2	3	3
21ECE71.5	3	2	-	-	-	-	-	-	-	-	-	2	3	3
21ECE71.6	3	2	1	-	3	-	-	-	-	-	-	2	3	3

MODULE-1	**Introduction to wireless communication systems**	**21ECE71.1 21ECE71.6**	**5 Hours**

Evolution of wireless communication systems, Examples of wireless communication systems. Cellular concept - Frequency reuse - channel assignment strategies - hand off strategies - interference & system capacity – trunking & grade of service – Improving coverage and capacity in cellular system.

LIST OF EXPERIMENTS: 3 **Hours**

1.Study of basic operation of a spectrum analyzer.
2.Visualization of different waveforms in wireless communication.
3.Simulate Communication System using Matlab.

Self-study	Different Cellular systems.
Text Book	**Text Book 1: 1.1,1.4, 3.1,3.2,3.3,3.4, 3.5, 3.6, 3.7**

MODULE-2	**Free Space Propagation Model**	**21ECE71.2 21ECE71.6**	**5 Hours**

Three Basic Propagation mechanism – Reflection (Ground Reflection -Two Ray model), Diffraction(knife-edge diffraction model)and Scattering ,model - Link Budget design using Path

Loss model(log normal shadowing) Outdoor and Indoor Propagation models –Okumura model, Hata model, long-distance path loss model Small scale multipath propagation –Parameters of mobile multipath channels.

LIST OF EXPERIMENTS: 3 **Hours**

1.Simulation of Okumura model using MATLAB.
2.Simulation of Hata model using MATLAB.
3.Simulation of log normal shadowing model using MATLAB.

Self-study	Fading effects due to Multipath time delay spread and Fading effects due to Doppler spread - Rayleigh and Rician distribution.
Text Book	Text Book 1:4.1, 4.2, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9,4.10,4.11,5.4,5.5,5.5.1,5.5.2, 5.6

MODULE-3	**Wireless standards**	**21ECE71.3 21ECE71.6**	**5 Hours**

Introduction to wireless standards – 1G-AMPS, 2G. GSM services and features, System architecture, Radio subsystem, channel types, Frame structure for GSM CDMA (IS-95) – CDMA frequency bands, Forward and Reverse CDMA Channel.

LIST OF EXPERIMENTS: 3 **Hours**

1. Study of DS-SS modulation/Demodulation Process (trainer kit based)
2. Study of CDMA(DS-SS) technique using analog signal as an input signal (trainer kit based)
3. Study and identify different blocks of mobile phone units.
4. Sketch the waveforms of different sections in Mobile Communication Trainer board.

Case Study	Write and simulate a MATLAB program to analyze the propagation models
Text Book	Text Book 1: 11.1, 11.3, 11.4

MODULE-4	**OFDM for Wireless Communication**	**21ECE71.4 21ECE71.6**	**5 Hours**

Basic principles of orthogonality, single Vs Multi-carrier systems, ODFM Block diagram, OFDM signal mathematical representation, pilot insertion and channel estimation.

LIST OF EXPERIMENTS: 3 Hours

1. To study and execute different types of AT commands using Mobile Communication Trainer board. 2.To realize Voice communication using AT commands(trainer kit based).
3. Simulation of OFDM transmitter and receiver using MATLAB.

Application	Derive cyclic prefix in OFDM for 64 sub-carriers.
Text Book	Text Book 2: 9.1, 9.2, 9.3, 9.4, 9.9

MODULE-5	**Multipath Mitigation Techniques**	**21ECE71.5 21ECE71.6**	**5 Hours**

Diversity – Types of Diversity – Diversity combining techniques: Selection, Feedback, Maximal Ratio Combining and Equal Gain Combining Introduction to MIMO, MIMO based system architecture, MIMO channel modeling, Advantages and applications of MIMO. Introduction to advancements in wireless communication-5G and 6G technologies.

LIST OF EXPERIMENTS: **3 Hours**

1. Simulation of MIMO system using MATLAB.
2. To write a MATLAB program to calculate the link budget for satellite communication.
3. To write a MATLAB program to calculate the Carrier to noise ratio for uplink and downlink and also the overall carrier to noise ratio

Self Study	Compare SISO and MIMO.
Text Book	Text Book 2: 15.1, 15.2, 15.3,15.8, 15.13

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Textbooks:

1. Rappaport T.S., "Wireless communications: Principles and Practices ", Pearson Education, 2014, ISBN-13: 978-9332535794.
2. Wireless Communication — Upen Dalal, Oxford Univ. Press,2009, ISBN-13. 978-019806066.

References:

1. Lee, W.C.Y., Mobile Communication Engineering, McGraw Hill, 2.017, ISBN: 978-0071810419
2. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005, ISBN: 978-0521845274
3. Andreas.F. Molisch, "Wireless Communications", John Wiley India, 2006, ISBN: 978-8126511301
4. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press, ISBN: 978-0521837163

Web links and Video Lectures (e-Resources):

- https://www.coursera.org/learn/wireless-communications
- https://www.youtube.com/watch?v=RrTmXIY3FbM

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

- Seminars
- Experiments for different Use cases.
- Contents related activities (Activity-based discussions)
- Group Discussion
- Case- Study

CODING AND CRYPTOGRAPHY			
Course Code	**21ECE72**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21ECE72.1	Understand the fundamental concepts and principles of information theory and its role in coding and Cryptography
21ECE72.2	Interpret the various types of source coding algorithms and their performance
21ECE72.3	Apply the source coding algorithms for error detection and correction
21ECE72.4	Analyze the performance of convolutional codes compared to block codes in different noise environments
21ECE72.5	Use symmetric cryptography algorithms to encrypt and decrypt the information
21ECE72.6	Analyze secure systems and protocols using public key cryptographic methods

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
21ECE72.1	2	-	-	-	-	-	-	-	-	-	-	2	3	1
21ECE72.2	3	2	-	-	-	-	-	-	-	-	-	2	3	1
21ECE72.3	3	-	-	-	-	-	-	-	-	-	-	2	3	1
21ECE72.4	3	2	-	-	-	-	-	-	-	-	-	2	3	1
21ECE72.5	3	-	1	-	-	-	-	-	-	-	-	2	3	1
21ECE72.6	3	2	1	-	-	-	-	-	-	-	-	2	3	1

MODULE-1	**Information Theory and Source Coding**	**21ECE72.1**	**8 Hours**

Introduction to Information Theory, Uncertainty and Information, Entropy, Mutual information, Relationship between entropy and mutual information, Shannon Fano coding.
Source Coding Techniques: Huffman Coding, Arithmetic coding, Lempel-Ziv Coding, Run length coding.

Self-study	Study the measure of uncertainty in a random variable and its properties.
Text Book	Text Book 1: Chapter 2.1, 2.2, 2.3, 2.11, 5.4, 5.5, 5.8, 5.9, 5.10, 12.10

MODULE-2	**Error-Correcting Codes**	**21ECE72.1 21ECE72.2, 21ECE72.3**	**8 Hours**

Channel models, channel capacity, channel coding, Types of Codes.
Linear Block Codes: matrix description of Linear Block Codes, Error detection & Correction, hamming codes, Low Density Parity Check (LDPC) Codes.
Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction.

Self-study	Study the principles behind lossy compression algorithms, including JPEG and MPEG for images and videos, and MP3 for audio

Text Book	Text Book 2: Chapter 2,3		
MODULE-3	**Codes on Graph**	**21ECE72.1 21ECE72.4**	**8 Hours**
Introduction to Convolutional Codes, Tree Codes and Trellis Codes, Description of Convolutional Codes (Analytical Representation), The Generating Function, Matrix Description of Convolutional Codes. Viterbi Decoding of Convolutional Codes, Turbo codes, Encoding and decoding of Turbo codes.			
Case Study	Error control coding, essential for designing reliable communication systems.		
Text Book	Text Book 2: Chapter 4,7.1-7.5.		
MODULE-4	**Symmetric (Secret Key) Cryptography**	**21ECE72.1 21ECE72.5**	**8 Hours**
Introduction to Cryptography, An Overview of Encryption Techniques, Operations Used By Encryption Algorithms. Symmetric (Secret Key) Cryptography: Data Encryption Standard (DES), AES ,Linear Feedback Shift Registers.			
Application	Design a file encryption system for a cloud storage service to ensure that only authorized users can access the files.		
Text Book	Text Book 2: Chapter 9.1 -9.6		
MODULE-5	**Public-Key Cryptography**	**21ECE72.1 21ECE72.6**	**8 Hours**
Principles Public key crypto Systems, Diffie Hellman Key Exchange, RSA algorithm. MESSAGE AUTHENTICATION AND HASH FUNCTIONS: Authentication Requirement, Authentication Function, Message Authentication Code, Hash Function, Security of Hash Function and MACs. Overview of Digital Signature.			
Application	1.Public key cryptography in securing communications for a messaging app. 2.Public key cryptography for secure online transactions in an e-commerce platform.		
Text Book	Text Book 2: Chapter 9.6 -9.15		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	7.5	-
L4	Analyze	5	7.5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Thomas M.Cover, Joy A Thomas, Elements of Information Theory, 2 nd Edition, Wiley, 2015, ISBN: 978-1118585771

2. Bose, Ranjan. Information theory, coding and cryptography, 3rd Edition, Tata McGraw-Hill Education, 2015, ISBN: 978-9332901257

3. William Stallings , "Cryptography and Network Security Principles and Practice", Pearson Education Inc., 6th Edition, 2014, ISBN: 978-93- 325-1877-3

Reference Books:

1.K. Deergha Rao, Channel coding Techniques for wireless communications, 2 nd edition, Springer, 2019, ISBN: 978-9811337383

2.SimonHaykin, Communication Systems, 4th edition, Wiley Publications, 2001, ISBN: 978-0471178699.

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/108102117**
- **https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee39/**
- **https://www.youtube.com/watch?v=U4dzerJHIFw&t=3s**
- https://cse29-iiith.vlabs.ac.in/

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

- Implementing encryption algorithms and protocols in programming languages like Python.
- Hands-on in encode and decode messages using various coding techniques
- Contents related activities (Activity-based discussions)
  - Group Discussion
  - Case- Study

PROJECT WORK

Course Code	**21ECE73**	**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:

21ECE73.1	Identify the specified societal needs and categorize them into multi-disciplinary areas in engineering
21ECE73.2	Conduct detailed review of industrial and societal needs to reach sustainable conclusions
21ECE73.3	Integrate significant techniques and modern tools to solve complex real-world problems
21ECE73.4	Evaluate the identified methodologies and select based on specific criteria
21ECE73.5	Interpret the progress and outputs of the project through professional engineering reports and present it to a community or industry.
21ECE73.6	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
21ECE73.1	3	3	-	-	-	1	1	1	3	-	1	2	3	3
21ECE73.2	3	3	2	-	-	1	1	1	3	-	1	2	3	3
21ECE73.3	3	3	-	-	2	-	-	-	3	-	1	2	3	3
21ECE73.4	3	3	2	-	-	-	-	-	3	-	1	2	3	3
21ECE73.5	3	3	2	-	-	1	1	1	3	-	1	2	3	3
21ECE73.6	3	3	-	-	-	-	-	-	3	3	1	2	3	3

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).

Project Work: Roadmap, activities, and deliverables

Goal Selection and Project Planning:

- Identification of suitable topic based on Sustainable Development Goals.
- Forming project teams based on common interests and skill sets.
- Teams' involvement in developing project proposals outlining objectives, strategies, and expected outcomes.

Research and Needs Assessment: Survey conduction by thorough research on the chosen SDGs, including global and local context, challenges, and opportunities.

• Conduct needs assessments to identify specific issues or gaps that student projects can address

Interdisciplinary approaches :

• Applying interdisciplinary approaches and innovative solutions to tackle sustainability challenges.

Deployment:

• Deploy the project on appropriate hardware and software environments, considering scalability, security, and performance requirements.

• Configure servers, databases, and other infrastructure components to support the application's operation.

• Conduct deployment testing to ensure a smooth transition from development to production.

Knowledge Sharing and Communication:

• students to share their project experiences and insights through presentations, reports, and social media.

• Foster peer-to-peer learning and collaboration by creating platforms for knowledge.

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Review 1 (50 Marks)	Review 2 (50 Marks)
L1	Remember	-	-
L2	Understand	10	10
L3	Apply	10	10
L4	Analyze	10	10
L5	Evaluate	10	10
L6	Create	10	10

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (100)
L1	Remember	-
L2	Understand	20
L3	Apply	20
L4	Analyze	20
L5	Evaluate	20
L6	Create	20

SCIENTIFIC FOUNDATIONS OF HEALTH			
Course Code	**21ECK74**	**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:

21ECK74.1	Understand the concepts of Health and wellness and the importance of achieving balanced good health
21ECK74.2	Implement healthy lifestyle habits effectively to enhance overall well-being
21ECK74.3	Adopt the innovative & positive methods to avoid risks from harmful habits in their campus & outside the campus
21ECK74.4	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:

21ECK74.1	**PO1**	**PO2**	**PO 3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
21ECK74.2	-	-	-	-	-	1	-	-	-	-	-	-
21ECK74.3	-	-	-	-	-	2	-	-	-	-	-	-
21ECK74.4	-	-	-	-	-	3	-	-	-	-	-	-

MODULE-1	**GOOD HEALTH AND IT'S BALANCE FOR POSITIVE MINDSET**	**21ECK74.1**	**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**	**21ECK74.2**	**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**	**21ECK74.1, 21ECK74.2**	**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**	**21ECK74.3**	**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**	**21ECK74.4**	**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

EIGHTH SEMESTER

(SYLLABUS)

ESSENTIALS OF CYBER SECURITY			
Course Code	**21ECE811**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21ECE811.1	Understand the key concepts, terminology, and principles in cyber security, including threat landscapes, attack vectors, and defence strategies
21ECE811.2	Apply fundamental cyber security principles to analyze and mitigate risks in practical scenarios, such as securing networks, systems, and data
21ECE811.3	Evaluate different cyber security solutions and technologies and make informed decisions on their suitability based on organizational needs and threat environments
21ECE811.4	Acquire hands-on experience in implementing secure practices across various domains, including encryption techniques, access controls, and incident response protocols
21ECE811.5	Proficient in detecting, analysing, and responding to security incidents using appropriate tools and methodologies, ensuring minimal impact on organizational operations
21ECE811.6	Develop communication skills to effectively convey cyber security concepts, risks, and solutions to diverse stakeholders, fostering a culture of awareness and responsibility within organizations

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
21ECE811.1	3	-	-	-	-	-	-	-	-	-	-	2	3	2
21ECE811.2	3	-	-	-	-	-	-	-	-	-	-	2	3	2
21ECE811.3	3	2	-	-	-	2	-	-	-	-	-	2	3	2
21ECE811.4	3	2	-	-	-	-	2	-	-	-	-	2	3	2
21ECE811.5	3	2	-	-	2	-	-	2	-	-	-	2	3	2
21ECE811.6	3	2	-	-	-	-	-	-	-	-	-	2	3	2

MODULE-1	**Infrastructure Security in the Real World and Access-Control and Monitoring Systems**	**21ECE811.1**	**8 Hours**

Infrastructure Security in the Real World-Security Challenges, Understanding Access-Control and Monitoring Systems - Access Control-Security Policies-Physical Security Controls-Authentication Systems-Remote-Access Monitoring.

Self Study	Biometric Authentication Systems and its Challenges
Text Book	Text Book 1: 1.1,2.1,2.2,2.3,2.4,2.5,2.6

MODULE-2	**Video Surveillance Systems, Intrusion-Detection and ReportingSystems and Securing Devices**	**21ECE811.2, 21ECE811.3**	**8 Hours**

Understanding Video Surveillance Systems-Video Surveillance Systems.Understanding Intrusion-Detection and Reporting Systems-Intrusion-Detection and Reporting Systems, Securing Devices The Three Layers of Security.

Case Study	The Integration of Video Surveillance and Intrusion Detection Systems.
Text Book	Text Book 1: 3.1,4.1,6.1

MODULE-3	Protecting Remote Access, Network Transmission Media Security	21ECE811.4	8 Hours
Protecting Remote Access - Protecting Local Computing Devices-Implementing Local Protection Tools-Using Local Intrusion-Detection Tools-Configuring Browser Security Options-Defending Against Malicious Software-Hardening Operating Systems, Understanding Network Transmission Media Security-The Basics of Network Transmission MEDIA-Transmission Media Vulnerabilities.			
Case Study	Techniques for Hardening Operating Systems Against Remote Access Threats.		
Text Book	Text Book 1: 9.1,9.2,9.3,9.4,9.5,9.6,16.1,16.2		
MODULE-4	**Understanding the Environment and Protecting the Perimeter**	**21ECE811.5**	**8 Hours**
Understanding the Environment-The Basics of Internet Security-Understanding the Environment, Protecting the Perimeter-Understanding the Perimeter-Firewalls-Network Appliances-Proxy Servers-Honeypots-Extranets. Protecting Data Moving Through the Internet-Securing Data in Motion.			
Application	Implementing a Secure VPN (Virtual Private Network) for Remote Workforce Data Transmission		
Text Book	Text Book 1: 19.1,19.2,21.1,21.2,21.3,21.4,21.5,21.6		
MODULE-5	**Tools and Utilities, Identifying and Defending Against Vulnerabilities**	**21ECE811.6**	**8 Hours**
Tools and Utilities-Using Basic Tools-Monitoring Tools and Software-Identifying and Defending Against Vulnerabilities-Zero Day Vulnerabilities-Software Exploits-Network Threats and Attacks-Dictionary Attacks-Denial of Service (DoS) Attacks-Spam.			
Application	Effective Use of Monitoring Tools to Detect and Mitigate Zero Day Vulnerabilities and Network Threats		
Text Book	Text Book 1: 23.1,23.2,24.1,24.2,24.4,24.5,24.6		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	7.5	-
L4	Analyze	5	7.5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Cyber security Essentials, Charles J. Brooks, Christopher Grow, Philip Craig, Donald Short, Sybex, October 2018, ISBN: 978-1119362395.

Reference Books:

1.Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, B.B.Gupta, D.P.Agrawal, Haoxiang Wang, CRC Press, 2018, ISBN: 978-0815371335.

2.Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press 2018 ISBN: 978-1439851265.

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc23_cs127/preview**
- **https://onlinecourses.swayam2.ac.in/nou19_cs08/preview**
- **https://www.w3schools.com/cybersecurity/index.php**
- **https://www.javatpoint.com/cyber-security-tutorial**

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

- Industrial Visit to Cyber Security Based Companies.
- Demonstration of case studies related to cyber-attacks.
- Video demonstration of latest trends in Cyber threats and security measures.
- Contents related activities (Activity-based discussions)
    - For active participation of students, instruct the students to prepare Flowcharts and Handouts
    - Organizing Group wise discussions on processor developments
    - Seminars and Workshops

DIGITAL IMAGE PROCESSING

Course Code	**21ECE812**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21ECE812.1	Understand the fundamental concepts of a digital image acquisition and processing system
21ECE812.2	Analyze the various two-dimensional transformations used in processing digital images
21ECE812.3	Examine various filtering techniques used to enhance images in the spatial domain
21ECE812.4	Evaluate various filtering techniques used to enhance images in the frequency domain
21ECE812.5	Analyze the distinct characteristics of various color models, such as RGB, CMY, and HSI, including their constituent components and their roles in representing color within digital images.
21ECE812.6	Examine the mathematical modelling of Degradation/Restoration Process

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
21ECE812.1	2	-	-	-	-	-	-	-	-	-	-	-	3	2
21ECE812.2	3	2	-	-	1	-	-	-	-	-	-	-	3	2
21ECE812.3	3	2	-	-	1	-	-	-	-	-	-	-	3	2
21ECE812.4	3	2	-	-	1	-	-	-	-	-	-	-	3	2
21ECE812.5	3	2	1	-	1	-	-	-	-	-	-	-	3	3
21ECE812.6	3	2	-	-	-	-	-	-	-	-	-	-	3	3

MODULE-1	**Digital Image Fundamentals**	**21ECE812.1**	**8 Hours**

Introduction to Digital Image Processing, Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels.

Self-study / Case Study / Applications	Self-study topics: Arithmetic and Logical operations. Practical topics: Problems on Basic Relationships Between Pixels.
Text Book	Text 1: Chapter 1, Chapter 2: Sections 2.1 to 2.5.

MODULE-2	**Image Transforms**	**21ECE812.2**	**8 Hours**

Introduction, Two-Dimensional Orthogonal and Unitary Transforms, Properties of Unitary Transforms, Two-Dimensional DFT, cosine Transform, Haar Transform, Hadamard transforms

Self-study	Self-study topics: Sine transforms, Hadamard transforms, KL transform, Slant transform. Practical topics: Problems on Haar transforms, Hadamard transforms, DFT and DCT.
Text Book	Text 2: Chapter 5: Sections 5.1 to 5.3, 5.5, 5.6, 5.9.

MODULE-3	**Spatial Domain**	**21ECE812.3**	**8 Hours**

Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filter.

Self-study	Self-study topics: Point, line and edge detection. Practical topics: Problems on Intensity Transformation Functions, Histogram, Spatial domain filters

Text Book	Text1 : Chapter 3: Sections 3.2 to 3.6		
MODULE-4	**Frequency Domain and Color Image Processing**	**21ECE812.4, 21ECE812.5**	**8 Hours**

Frequency Domain: Basics of Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters.

Color Image Processing: Color Fundamentals, Color Models, Pseudo-color Image Processing

Self-study	Self-study topics: Basic concept of segmentation. Practical topics: Problems on Pseudo-color Image Processing
Text Book	Text 1: Chapter 4: Sections 4.7 to 4.9 and Chapter 6: Sections 6.1 to 6.3

MODULE-5	**Restoration**	**21ECE812.6**	**8 Hours**

A model of the Image Degradation/Restoration Process, Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering.

Self-study	Linear position invariant degradation, Estimation of degradation function
Text Book	Text 1: Chapter 5: Sections 5.1, to 5.4.3, 5.7, 5.8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	**Qualitative Assessment (s)**	**MCQ's**
		25	**15**	**10**
L1	**Remember**	5	**-**	**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	7.5	-
L4	**Analyze**	5	7.5	**-**
L5	**Evaluate**	-	-	**-**
L6	**Create**	**-**	**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1. Digital Image Processing- Rafael C Gonzalez and Richard E Woods, PHI, 3rd Edition 2010, ISBN: 978-0131687288
2. Fundamentals of Digital Image Processing- A K Jain, PHI Learning Private Limited 2014, ISBN: 978-8120309294

Reference Book:

1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill, 2014. ISBN: 978-0070144799.

2. B. Chanda and D.Majumdar, "Digital Image Processing and Analysis", 1st Edition, PHI Learning Private Limited, 2014, ISBN: 978-8120343250

Web links and Video Lectures (e-Resources):

- **Image databases, https://imageprocessingplace.com/root_files_V3/image_databases.htm**
- **Student support materials, https://imageprocessingplace.com/root_files_V3/students/students.htm**
- **NPTEL Course, Introduction to Digital Image Processing, https://nptel.ac.in/courses/117105079**
- **Computer Vision and Image Processing, https://nptel.ac.in/courses/108103174**
- **Image Processing and Computer Vision – Matlab and Simulink, https://in.mathworks.com/solutions/image-video-processing.html**

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

- Video demonstration of the concepts.
- Contents related activities (Activity-based discussions)
- Organizing Group wise discussions on issues
  - Seminars

ANALOG AND MIXED-MODE VLSI DESIGN			
Course Code	**21ECE813**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21ECE813.1	Use efficient analytical tools for quantifying the behavior of basic circuits by inspection
21ECE813.2	Design high-performance, stable operational amplifiers with the tradeoffs between speed, precision and power dissipation
21ECE813.3	Analyze the behavior of phase-locked-loops for specific applications
21ECE813.4	Identify the critical parameters that affect the analog and mixed-signal VLSI circuits design
21ECE813.5	Perform calculations in the digital or discrete time domain, more sophisticated data converters to translate the digital data to and from inherently analog world.
21ECE813.6	Explore real-world applications of SCCs and data converters in communication systems, sensor interfaces, audio processing, and other areas

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
21ECE813.1	3	-	-	-	-	-	-	-	-	-	-	1	2	2
21ECE813.2	3	2	-	-	-	-	-	-	-	-	-	1	2	2
21ECE813.3	3	2	-	-	-	-	-	-	-	-	-	1	2	2
21ECE813.4	3	-	-	-	-	-	-	-	-	-	-	1	2	2
21ECE813.5	3	-	-	-	-	-	-	-	-	-	-	1	2	2
21ECE813.6	3	2	-	-	1	1	-	-	-	-	-	1	2	2

MODULE-1	**Basic MOS Device Physics and TFET integration**	**21ECE813.1 21ECE813.2**	**8 Hours**

Basic MOS Device Physics: General considerations, MOS I/V Characteristics, second order effects, MOS device models. TFET operation, VI Characteristics, Comparison of conventional MOSFET with TFET.

Self-study	Understand the principles of Basic MOS Device Physics, including MOS I/V Characteristics and MOS device models.
Text Book	Text book 1: 2.1,2.2,2.3 2.4 Text Book 3: Chapter

MODULE-2	**Single Stage Amplifiers and Differential Amplifiers**	**21ECE813.3**	**8 Hours**

Single stage Amplifier: Source follower, common-gate stage, Cascode Stage, choice of device models. Differential Amplifiers: Single ended and differential operation, Basic differential pair, Common mode response

Case Study	Investigate real-world applications of single-stage amplifiers and differential amplifiers in electronic devices.
Text Book	Textbook1:3.1 to 3.7 and 4.1 to 4.3

MODULE-3	**Current Mirrors and Operational Amplifiers**	**21ECE813.4**	**8 Hours**

Passive and Active Current Mirrors: Basic current mirrors, Cascode Current mirrors, Active Current mirrors. Operational Amplifiers (part-1): General Considerations, One Stage OP-Amp, Two Stage OP-Amp, Gain boosting.

Self-study	Explore advanced topics related to current mirror design and operational amplifier configurations.
Text Book	Textbook1: 5.1 to 5.3 and 9.1 to 9.4

MODULE-4	**Feedback Amplifiers and Phase Locked Loops**	**21ECE813.4 21ECE813.5**	**8 Hours**

Operational Amplifiers (part-2): Common Mode Feedback, Slew rate, Power Supply Rejection. Phase Locked Loops: Simple PLL, Charge pump PLLs, Non-ideal effects in PLLs, Delay-Locked Loops, Applications			
Case Study	Investigate real-world applications of phase-locked loops in communication systems or signal processing.		
Text Book	Textbook1:9.7,9.9,9.11 and 16.1,16.216.3,16.4,16.5		
MODULE-5	**Switched-Capacitor Circuits and Data Converters**	**21ECE813.6**	**8 Hours**
Data Converter Architectures: DAC & ADC Specifications, Current Steering DAC, Charge Scaling DAC, Cyclic DAC, Pipeline DAC, Flash ADC, Pipeline ADC, Integrating ADC, Successive Approximation ADC			
Self-study	Explore practical design considerations, such as resolution versus speed trade-offs, noise considerations, and power consumption optimization techniques.		
Text Book	Textbook2:29.1, 29.1.4 , 29.1.5 29.1.6, 29.1.7 and 29.2, 29.2.1, 29.2.3, 29.2.4, 29.2.5,		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	7.5	-
L4	Analyze	5	7.5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) Razavi, Behzad. Design of Analog CMOS Integrated Circuits. McGraw-Hill Education, 2015, ISBN: 978-0072524933
2) Baker, R. Jacob, et al. CMOS Circuit Design, Layout, and Simulation. John Wiley & Sons, 2005, ISBN: 978-0471700554

Reference Books:

1) Gray, Paul R., et al. Analysis and Design of Analog Integrated Circuits. John Wiley & Sons, 2001, ISBN: 978-0471321681.
2) Allen, Phillip E., and Douglas R. Holberg. CMOS Analog Circuit Design. Oxford University Press, 2016, ISBN: 978-0199937424.
3) Review of Tunnel Field Effect Transistor (TFET) https://www.researchgate.net/publication/301548013_Review_of_Tunnel_Field_Effect_Transistor_TFET.

Web links and Video Lectures (e-Resources):

- **https://nptel.ac.in/courses/117101105**
- **https://ocw.mit.edu/courses/6-777j-design-and-fabrication-of-integrated-circuits-spring-2005/**

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

- Hands-on Design and Simulation using CAD Tools
- Group Discussions on Recent Advancements and Case Studies in Analog and Mixed-Mode VLSI Design
- Video demonstration of the concepts.

DATA COMMUNICATION AND NETWORKING			
Course Code	**21ECE814**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

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

21ECE814.1	Understand the various components of data communication
21ECE814.2	Apply the principles of protocol layering and compare the TCP/IP protocol suite with the OSI model
21ECE814.3	Differentiate between various transmission modes, such as baseband and broadband transmission, and their respective applications in data communication network
21ECE814.4	Analyze the fundamental principle of digital communication and switching
21ECE814.5	Compare data link layer protocols in computer networks
21ECE814.6	Summarize IEEE 802.xx standards

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
21ECE814.1	2	-	-	-	-	-	-	-	-	-	-	2	3	2
21ECE814.2	3	-	-	-	-	-	-	-	-	-	-	2	3	2
21ECE814.3	3	3	-	-	-	-	-	-	-	-	-	2	3	2
21ECE814.4	3	3	-	-	-	-	-	-	-	-	-	2	3	2
21ECE814.5	3	3	-	-	-	-	-	-	-	-	-	2	3	2
21ECE814.6	3	3	-	-	-	-	-	-	-	-	-	2	3	2

MODULE-1	**Introduction**	**21ECE814.1 21ECE814.2**	**8 Hours**

Data Communications, Networks, Network Types, Internet History, Standards and Administration, Networks Models: Network topologies, Protocol Layering, TCP/IP Protocol suite, The OSI model. Introduction to Physical Layer-1: Data and Signals, Digital Signals, Transmission Impairment, Data Rate limits, Performance.

Text Book	Text Book 1: Ch 1.1 to 1.5, 2.1 to 2.3, 3.1, 3.3 to 3.6

MODULE-2	**Digital Transmission**	**21ECE814.3**	**8 Hours**

Digital to digital conversion (Only Line coding: Polar, Bipolar and Manchester coding).
Physical Layer-2: Analog to digital conversion (only PCM), Transmission Modes
Analog Transmission: Digital to analog conversion.

Text Book	Text Book 1: Ch 4.1 to 4.3, 5.1

MODULE-3	**Network bandwidth utilization**	**21ECE814.4**	**8 Hours**

Bandwidth Utilization: Multiplexing and Spread Spectrum, switching: Introduction, Circuit Switched Networks and Packet switching. Error Detection and Correction: Introduction, Block coding, Cyclic codes, Checksum

Text Book	Textbook1: Ch 6.1, 6.2, 8.1 to 8.3, 10.1 to 10.4

MODULE-4	**Data link control**	**21ECE814.4 21ECE814.5**	**8 Hours**

Data link control: DLC services, Data link layer protocols, Point to Point protocol (Framing, Transition phases only). Media Access control: Random Access, Controlled Access and Channelization, Introduction to Data-Link Layer: Introduction, Link-Layer Addressing, ARP. IPv4 Addressing and subnetting: Classful and CIDR addressing, DHCP, NAT

Text Book	Textbook1: Ch 9.1, 9.2, 11.1, 11.2 11.4, 12.1 to 12.3, 18.4 RBT: L1, L2		
MODULE-5	**Wired LANs Ethernet**	**21ECE814.6**	**8 Hours**
Wired LANs Ethernet: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, Wireless LANs: Introduction, IEEE 802.11 Project and Bluetooth. Other wireless Networks: Cellular Telephony.			
Text Book	Textbook1: Ch 13.1 to 13.5, 15.1 to 15.3, 16.2		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution		
		Test (s)	Qualitative Assessment (s)	MCQ's
		25	15	10
L1	Remember	5	-	5
L2	Understand	5	-	5
L3	Apply	10	7.5	-
L4	Analyze	5	7.5	-
L5	Evaluate	-	-	-
L6	Create	-	-	-

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) Behrouz A. Forouzan, Data Communications and Networking 5E, 5th Edition, Tata McGraw-Hill, 2013, ISBN-13: 978-0073376226

Reference Books:

1) Alberto Leon-Garcia and Indra Widjaja: Communication Networks - Fundamental Concepts and Key architectures, 2nd Edition Tata McGraw-Hill, 2004, ISBN-13: 978-0072463521.

2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007, ISBN-13: 978-0132433105.

3. Larry L. Peterson and Bruce S. Davie: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007, ISBN-13: 978-0123705488.

Web links and Video Lectures (e-Resources):

- https://ocw.mit.edu/courses/6-263j-data-communication-networks-fall-2002/
- https://archive.nptel.ac.in/courses/106/105/106105082/

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

- Demonstration of NS2 software's
  - ➢ Organizing Group wise discussions on new trends in Networking

MACHINE LEARNING ALGORITHMS			
Course Code	**21ECE815**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

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

21ECE815.1	Understand the Core concepts of Machine learning
21ECE815.2	Analyze the Mathematical relationships within and across Machine learning algorithms
21ECE815.3	Categorize the paradigms of supervised and un-supervised learning
21ECE815.4	Apply the Machine learning techniques to solve the real-world problem
21ECE815.5	Understand analytical learning and reinforced learning
21ECE815.6	Construct a simulation environment of Reinforced Learning problem

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
21ECE815.1	3	-	-	-	-	-	-	-	-	-	-	2	3	-
21ECE815.2	3	3	-	-	2	-	-	-	-	-	-	2	3	3
21ECE815.3	3	3	2	-	2	-	-	-	-	-	-	2	3	3
21ECE815.4	3	3	2	-	2	-	-	-	-	-	-	2	3	3
21ECE815.5	3	-	-	-	-	-	-	-	-	-	-	2	3	3
21ECE815.6	3	3	2	-	2	-	-	-	-	-	-	2	3	3

MODULE-1	**LEARNING**	**21ECE815.1**	**8 Hours**

Designing Learning systems, Perspectives and Issues, Concept Learning, Version Spaces and Candidate Elimination Algorithm, Inductive bias.

Self Study	Exploring the Role of Inductive Bias in the Performance of Concept Learning Algorithms
Text book	Text book 1: Chapter 1,2

MODULE-2	**DECISION TREE AND ANN**	**21ECE815.1 21ECE815.2**	**8 Hours**

Decision Tree Representation, Hypothesis Space Search, Inductive bias in decision tree, issues in Decision tree. Neural Network Representation, Perceptrons, Multilayer Networks and Back Propagation Algorithms.

Self Study	Comparing Inductive Bias and Hypothesis Space Search in Decision Trees and Neural Networks
Text book	Text book 1: Chapter 3,4

MODULE-3	**BAYESIAN AND COMPUTATIONAL LEARNING**	**21ECE815.2, 21ECE815.3, 21ECE815.4**	**8 Hours**

Bayes Theorem, Bayes Theorem Concept Learning, Maximum Likelihood, Minimum Description Length Principle, Bayes Optimal Classifier, Gibbs Algorithm, Naïve Bayes Classifier.

Case Study	Applying Naïve Bayes Classifier for Email Spam Detection.
Text book	Text book 1: Chapter 6

MODULE-4	INSTANT BASED LEARNING AND LEARNING SET OF RULES	21ECE815.3, 21ECE815.4	8 Hours
K- Nearest Neighbour Learning, Locally Weighted Regression, Radial Basis Functions, Case-Based Reasoning. Sequential Covering Algorithms, Learning Rule Sets, Learning First Order Rules, Learning Sets of First Order Rules.			
Text book	Text book 1: Chapter 8,10		
MODULE-5	**ANALYTICAL LEARNING AND REINFORCED LEARNING**	**21ECE815.5 21ECE815.6**	**8 Hours**
Perfect Domain Theories, Explanation Based Learning, Inductive-Analytical Approaches, FOCL Algorithm, Reinforcement Learning.			
Application	Developing an Intelligent Tutoring System Using Explanation-Based Learning and Reinforcement Learning.		
Text book	Text book 1: Chapter 11,13, Text book 2 : chapter 7		

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

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

Suggested Learning Resources:

Text Books:

1) Tom Mitchell, —Machine Learning, McGraw Hill, 1997, ISBN-13: 978-0070428072.

2) E. Alpaydin, —Introduction to Machine Learning, PHI, 2005, ISBN-13: 978-8120331946.

Reference Books:

1)Aurolien Geron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow, Shroff/O'Reilly",2017, ISBN-13: 978-1491962299.

2) Andreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly, 2016, ISBN-13: 978-1449369415.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc23_cs18/preview
- https://www.youtube.com/watch?v=JxgmHe2NyeY
- https://www.youtube.com/watch?v=ZftI2fEz0Fw&list=PLKnIA16_Rmvbr7zKYQuBfsVkjoLcJgxHH

- https://developers.google.com/machine-learning/crash-course/ml-intro

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

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

TECHNICAL SEMINAR

Course Code	**21ECE82**	**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:

21ECE82.1	Learn about the quickly evolving field in multidisciplinary areas through independent study.
21ECE82.2	Identify the advancements in the technology pertinent to the chosen area.
21ECE82.3	Demonstrate the identified technology and analyze its effects on the environment, society, and domain.
21ECE82.4	Compile the study report and provide it to the audience while abiding by ethical guidelines.
21ECE82.5	Develop interpersonal skills and presentation skills.
21ECE82.6	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
21ECE82.1	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21ECE82.2	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21ECE82.3	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21ECE82.4	3	3	3	2	3	2	-	1	3	2	2	-	2	2
21ECE82.5	-	-	-	-	-	2		1	3	2	2	-	-	-
21ECE82.6	-	-	-	-	-	2	-	1	3	2	2	-	-	-

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.

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the Course of Specialization.

- Carryout literature survey, organize the seminar content in a systematic manner.
- Prepare the report with own sentences, avoiding cut and paste act.
- Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
- Present the seminar topic orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit typed report with a list of references.

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

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	**21ECE83**	**CIE Marks**	**100**
L:T:P:S	**0:0:12:0**	**SEE Marks**	**100**
Hrs / Week	**2**	**Total Marks**	**200**
Credits	**12**	**Exam Hours**	**03**

Course outcomes:

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

21ECE83.1	Identify the Research/industry and their products/expertise/domain, and interact with the authorities there
21ECE83.2	Understand their operations, applications, and maintenance; the research/ industry's business model; and industry innovations/achievements
21ECE83.3	Interact with industrial personnel and follow engineering practices and discipline prescribed in industry
21ECE83.4	Communicate effectively through technical presentations, reports, and interactions, and identify career goals and paths based on individual attributes such as affinity, aptitude, strengths and challenges, and inputs from the in-plant training
21ECE83.5	Develop awareness about general workplace behavior and build interpersonal and team skills
21ECE83.6	Demonstrate excellent control of personal behaviour, ethics, and attitudes, and adhere to ethical norms relevant to the Research/Industrial internship location

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
21ECE83.1	3	3	-	-	-	-	-	-	-	-	3	-	2	2
21ECE83.2	3	-	-	-	-	-	-	-	3	-	3	-	2	2
21ECE83.3	3	3	2	-	-	-	-	-	-	3	-	-	2	2
21ECE83.4	3	3	2	-	-	-	-	-	3	3	3	-	2	2
21ECE83.5	3	3	2	-	2	-	-	-	3	-	3	3	2	2
21ECE83.6	3	3	2	-	2	3	3	3	3	-	3	-	2	2

Research internship Outcomes

- Generating technical paper/s and publishing in refereed journal/s.
- Possibility of acquiring intellectual ownership and patent.
- Build a prototype for an idea on which the research was carried out.
- File patent/s.
- Add academic knowledge to the field.
- Enhanced ability in arranging meetings, presentations, seminars, trainings, etc.
- Improved conscientiousness and ethics

Industrial Internships Outcomes

- To bridge a gap between the theoretical knowledge obtained in the classrooms and the practical skills required in the actual workplace.
- Understanding of the analytical concepts and tools, hone their skills in the real-life situations and build confidence in applying the skills learned.
- Have ample opportunities to attend seminars, symposiums, workshops, etc. This in turn provides an opportunity to establish rapports with professionals and pioneers in their respective fields for further growth.
- Have wide scope to publish paper/s in journals and also helps to acquire team spirit, motivated acts, techniques to resolve conflicts, develop a lot of leadership skills etc.
- Increases the prospect of placement in the same concern, provided the intern has exhibited a clear understanding of basics and successfully completed the internship.
- Fosters to substantiate the issues with facts and figures.

Rural Internships Outcomes

• Enhanced Understanding: Deeper understanding of rural issues and Insight into socio-economic dynamics of rural communities. Skill Enhancement: Improved communication, leadership, and project management skills and Practical knowledge in agriculture, education, and healthcare.
• Community Impact: Positive contributions to community development projects and increased awareness and participation in community initiatives among rural populations.
• Personal Growth: Greater empathy and cultural sensitivity and enhanced problem-solving abilities and resilience.

Evaluation Procedure:

Assessment of CIE marks

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

(ii)Interdisciplinary: The CIE marks awarded for the internship, shall be group- wise size at the institution level with the participation of all guides of the internship. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the internship, shall be based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

Assessment of SEE marks

(i)Single discipline: Contribution to the internship and the performance of each group member shall be assessed individually in semester-end examination (SEE) conducted at the department. Marks shall be awarded based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

Interdisciplinary: Contribution to the internship and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to. Marks shall be awarded based on the evaluation of the diary, report, presentation skill and question and answer session in the ratio 50:25:25.

CIE Assessment Pattern (100 Marks)

RBT Levels		Internship
		100
L1	Remember	20
L2	Understand	20
L3	Apply	20
L4	Analyze	20
L5	Evaluate	20
L6	Create	-

SEE Assessment Pattern (100 Marks)

RBT Levels		Exam Marks Distribution (100)
L1	Remember	20
L2	Understand	20
L3	Apply	20
L4	Analyze	20
L5	Evaluate	20
L6	Create	-

NATIONAL SERVICE SCHEME (NSS)			
Course Code	**21NSS84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**0**	**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	Total 32 Hrs/ Semester 2 Hrs/week

	events/workshops / Seminars. (Minimum02programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	

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	**0**	**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	Total 32 Hrs/ Semester 2 Hrs/week

	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. 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. B.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 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash. 4. 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	**0**	**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 benefit 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	Assignments
2	Group Discussions
3	Case Studies/ Caselets
4	Practical Orientation on Design thinking
5	Participatory & Industry-integrated Learning
6	Practical activities / Problem solving exercises
7	Class Presentations
8	Analysis of Industry / Technical / Business Reports
9	Reports on Industrial Visit
10	Industrial / Social / Rural Projects
11	Participation in external seminars / workshops
12	Any other academic activity
13	Online / Offline Quizzes

APPENDIX B

Outcome Based Education

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

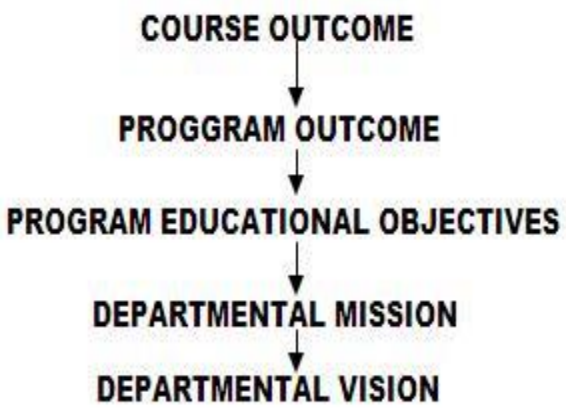
There are three educational Outcomes as defined by the National Board of Accreditation:

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

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

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

Mapping of Outcomes



APPENDIX C

The Graduate Attributes of NBA

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

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

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

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

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

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

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

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

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

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

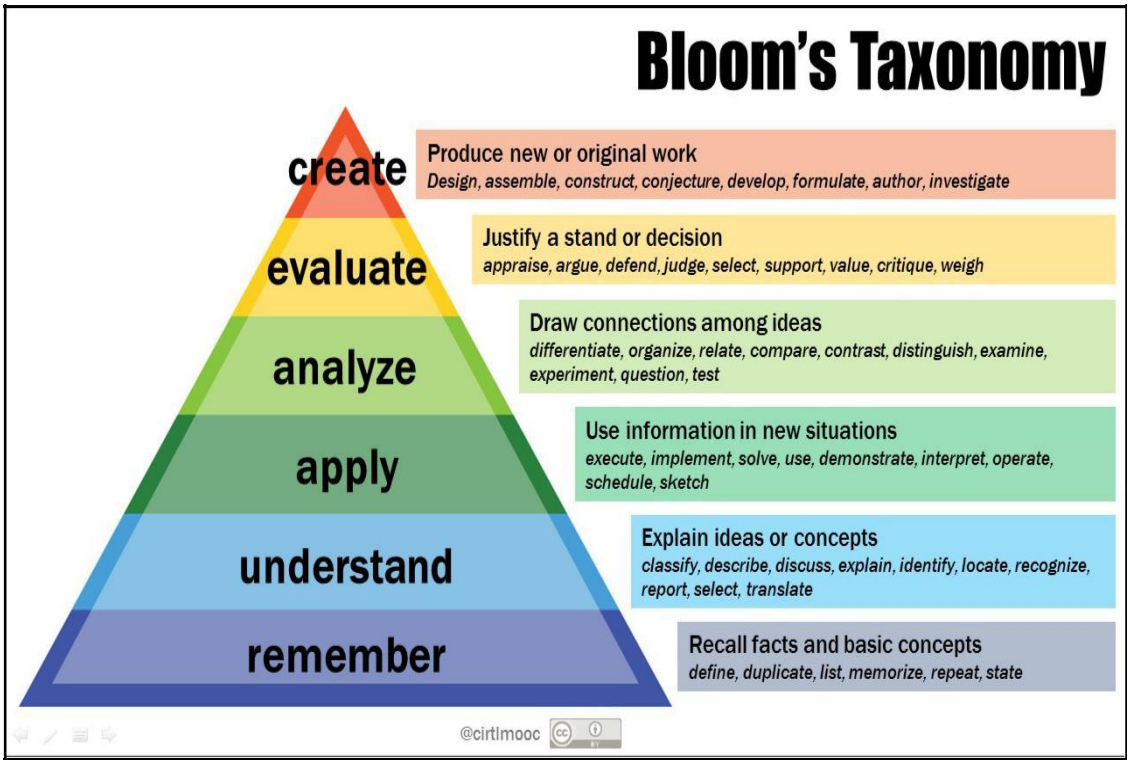
Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

APPENDIX D

BLOOM'S TAXONOMY

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



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