VIVEKANAND EDUCATION SOCIETY'S
Institute of Technology
(An Autonomous Institute Affiliated to University of Mumbai, Approved by A.I.C.T.E & Recognized by Govt. of Maharashtra)
Department of Electronics and Computer Science

Department of Electronics and Computer Science

Syllabus (NEP Scheme)

Sem-VII and Sem-VIII

w.e.f. A.Y. 2026-27

VIVEKANAND EDUCATION SOCIETY'S

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Department of Electronics and Computer Science

Course Type	Semester VII Teaching Scheme (AY 2026-27)								
	Course Code	Course Name	Teaching Scheme (Contact hours)			Credits Assigned			
			TH	PR	TUT	TH	PR	TUT	Total
PCC	NECPC71	Power Electronics & Applications	3	2	---	3	1	---	4
PCC	NECPC72	Deep learning & GenAI	3	2	---	3	1	---	4
PEC	NECPE47X	Program Elective 1*	3	2	---	3	1	---	4
PEC	NECPE57X	Program Elective 1*	3	2	---	3	1	---	4
RM	NECMM 53	Research Methodology	---	---	4	---	---	---	4
PROJECT	NECCP72	Capstone Project-II	---	4	---	---	4	---	2
	Total Credits								22

Course Type	Semester VII Marks Scheme							
	Course Code	Course Name	TH	MT	CA	TW	PR/ OR	Total
PCC	NECPC71	Power Electronics & Applications	60	20	20	25	25	150
PCC	NECPC72	Deep learning & GenAI	60	20	20	25	25	150
PEC	NECPE47X	Program Elective 1*	60	20	20	25	25	150
PEC	NECPE57X	Program Elective 2**	60	20	20	25	25	150
RM	NECMM 53	Research Methodology	---	---	---	25	25	50
PROJECT	NECCP72	Capstone Project-II	---	---	---	50	100	150
	Total Marks							800

*Program Electives (PEC 1)	*Program Electives (PEC 2)
NECPE471: Robotics	**NECPE571:** Cloud Computing and GPU
NECPE472: Electrical Vehicle	**NECPE572:** Cyber Security
NECPE473: Wireless Technology	**NECPE573:** Blockchain Technology

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Department of Electronics and Computer Science

Semester VII
Syllabus

COURSE NAME: - POWER ELECTROCS AND APPLICATIONS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPC 71	Power Electronics & applications (Theory)	03	---	---	03	---	---	03
NECPCL 71	Power Electronics & applications (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPC 71	Power Electronics & applications (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPC 71	Power Electronics & applications (Theory)	20	20	60	---	---	100

Course Objectives:	
1	To develop the understanding of fundamental principles of power electronics and disseminate various power electronic semiconductor devices and their characteristics.
2	To develop the concept of AC-DC converters.
3	To develop the concept of DC-DC converters.
4	To develop the concept of DC-AC converters.
5	To develop the concept of AC-AC converters.
6	To develop the understanding of applications of power electronics.
Course Outcomes: After successful completion of the course students will be able to:	
1	Describe the features and characteristics of power semiconductor devices and Analyze and design triggering, commutation and protection circuits.
2	Illustrate, analyze and design AC-DC converters.
3	Illustrate, analyze and design DC-DC converters.
4	Illustrate, analyze and designDC-AC converters.
5	Illustrate, analyze and design AC-AC converters.
6	Illustrate and analyze applications of power electronics.

POWER ELECTROCS AND APPLICATIONS (THEORY)

Module	Contents	Hrs
1	**Power Semiconductor Devices, Triggering, Commutation and Protection**	**08**
1.1	Principle of operation and characteristics of: SCR, TRIAC, DIAC, GTO, MOSFET and IGBT.Comparison between components.	
1.2	Thyristor Turn-on Methods, Firing circuits for Thyristors.TRIAC firing circuits.	
1.3	Methods of commutation of SCR.	
1.4	Methods of protection of SCR.	
2	**AC-DC Converters**	**06**
2.1	Uncontrolled half and full wave rectifiers with R and RL load.	
2.2	SCR controlled half and full wave rectifier with R and RL load. Power factor of the controlled rectifier. Effect of source and load inductances (Single Phase)	
3	**DC-DC Converters**	**06**
3.1	Buck, Boost and Buck-Boost converters	
3.2	DC-DC converters with R and RL load.	
4	**DC-AC Converters**	**06**
4.1	Principle of operation and performance parameters.(Single Phase)	
4.2	Voltage control of single phase inverters	
5	**AC-AC Converters**	**06**
5.1	Principle of on-off and phase angle control; performance parameters.	
5.2	Single phase full-wave AC-AC converter with R and RL load.	
6	**Applications of Power Electronics**	**07**
6.1	Solar and Wind Inverters.	
6.2	Variable Frequency Drives (VFDs) .	
6.3	Grid Integration,SMPS, UPS.	
6.4	Power Quality Improvement .	
Total		**39**
Textbooks:		
1	P.S. Bhimbra, Power Electronics, Khanna Publishers, 2012.	
2	M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, Pearson Education India, 2009	
3	N. Mohan, T. M. Undeland, W. P. Robbins, Power Electronics: Converters Application and Design, John Wiley & Sons, USA, 2003.	
4	M.D. Singh and K.B. Khanchandani, Power Electronics, Tata McGraw Hill	

5	Power Electronics Systems: Theory and Design, J. P. Agrawal,Pearson Education
Reference books:	
1	P.C. Sen, Modern Power Electronics, Wheeler publications.
2	Ramamurthy, Thyristor & Their Applications
3	S. Shrivastava, Power Electronics, Nandu publications, Mumbai.

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

POWER ELECTROCS AND APPLICATIONS (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPCL 71	Power Electronics & applications (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPCL 71	Power Electronics & applications (Lab)	---	---	---	25	25	50

Lab Objectives:	
1	To develop the understanding of fundamental principles of power electronics and disseminate various power electronic semiconductor devices and their characteristics.
2	To develop the concept of AC-DC converters.
3	To develop the concept of DC-DC converters.
4	To develop the concept of DC-AC converters.
5	To develop the concept of AC-AC converters.
6	To develop the understanding of applications of power electronics.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Describe the features and characteristics of power semiconductor devices and Analyze and design triggering, commutation and protection circuits.
2	Illustrate, analyze and design AC-DC converters.
3	Illustrate, analyze and design DC-DC converters.
4	Illustrate, analyze and designDC-AC converters.
5	Illustrate, analyze and design AC-AC converters.
6	Illustrate and analyze applications of power electronics.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	To study V-I characteristics of SCR.
2	To study V-I characteristics of DIAC
3	To study V-I characteristics of TRIAC
4	To study triggering circuits for SCR : R Triggering circuit
5	To study triggering circuits for SCR : RC Triggering circuit
6	To study class B commutation circuit of SCR.
7	To study Half wave controlled rectifiers using SCR.
8	To study AC phase control circuits using DIAC and TRIAC.
9	To study uncontrolled rectifiers.
10	To study controlled rectifiers.
11	To Study a controlled rectifier with (i) Source Inductance (ii) Freewheeling diode.
12	To study buck and boost converters.
13	To study single phase DC to AC converters
14	To study AC to AC converters.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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Department of Electronics and Computer Science

COURSE NAME: - DEEP LEARNING &GenAI

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPC 72	Deep Learning &GenAI (Theory)	03	---	01	03	---	---	03
Total Credits								03

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPC 72	Deep Learning &GenAI (Theory)	02	---	---	02	---	---	02

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPC 72	Deep Learning &GenAI (Theory)	20	20	60	---	---	100

Course Prerequisite: Basic Mathematics, Linear Algebra, Machine Learning	
Course Objectives:	
1	To develop mathematical concepts required for Deep Learning algorithms
2	To gain an in-depth understanding of training Deep Neural Networks.
3	To acquire knowledge of advanced concepts of Convolution Neural Networks, Autoencoders and Recurrent Neural Networks
4	To get familiarised with the recent trends in Deep Learning.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand the basic knowledge of Neural Networks and Explain the process of training, optimization and Regularization of Deep Neural Networks
2	Design supervised models for CNN.
3	Design Recurrent Neural Networks (RNN)
4	Design unsupervised model for DNN.
5	Understand architecture and Mathematical Foundation of GEN AI and describe taxonomy of generative models.
6	Understand ethical concerns along with Transformer Foundations and describe the role of Generative AI ecosystem and various tools.

DEEP LEARNING & GenAI (THEORY)

Module	Contents	Hrs
1	**Introduction**	**06**
1.1	Biological neuron, Mc-Culloch Pitts Neuron, Perceptron, Perceptron Learning,	
1.2	**Training, Optimization and Regularization of Deep Neural Network**	
1.3	**Training Feedforward DNN** Multi Layered Feed Forward Neural Network, Learning Factors, Activation functions: Tanh, Logistic, Linear, Softmax, ReLU, Leaky ReLU, Loss functions: Squared Error loss, Cross Entropy, Choosing output function and loss function 6	
1.4	**Optimization** Learning with backpropagation, Learning Parameters: Gradient Descent (GD), Stochastic and Mini Batch GD, Momentum Based GD, Nesterov Accelerated GD, AdaGrad, Adam, RMSProp	
2	**Convolutional Neural Networks (CNN): Supervised Learning**	**08**
2.1	Convolution Operation, Motivation, Basic structure of a convolutional neural network: Padding, strides, pooling, fully connected layers, interleaving between layers .	
2.2	Training a convolutional network: Backpropagation through convolution, Backpropagation as convolution with inverted filter, Convolution/backpropagation as matrix multiplication	
2.3	Modern Deep Learning Architectures: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet	
3	**Recurrent Neural Networks (RNN)**	**07**
3.1	Sequence Learning Problem, Unfolding Computational graphs, Recurrent Neural Network, Bidirectional RNN, Back propagation Through Time (BTT), Vanishing and Exploding Gradients, Truncated BTT	
3.2	Long Short Term Memory: Selective Read, Selective write, Selective Forget, Gated Recurrent Unit	
4	**Autoencoders: Unsupervised Learning**	**07**
4.1	Introduction, Linear Autoencoder, Undercomplete Autoencoder, Overcomplete Autoencoders, Regularization in Autoencoder	
4.2	Denoising Autoencoders, Sparse Autoencoders, Contractive Autoencoders	
5	**Introduction to GEN AI**	**06**
5.1	Introduction to Generative AI: Definitions, Generative AI vs. Discriminative AI, motivation and need for generative models History and evolution of Generative AI: GANs → Transformers → ChatGPT	

5.2	Mathematical foundations: Probability concepts and latent space representation Taxonomy of generative models: Explicit vs. Implicit models, Deterministic vs. Probabilistic models	
5.3	Foundation technologies for Generative AI: Autoencoders (AE), Variational Autoencoders (VAE), Architecture of Generative Adversarial Network (GAN)s, Transformers, Diffusion Models NLP foundations: Tokenization (WordPiece, BPE), text representation (Bag-of-Words, TF-IDF), word embeddings (Word2Vec, GloVe, BERT)	
6	**Transformer Foundations**	**05**
6.1	Transformer architecture: Attention mechanism, Scaled Dot-Product Attention, Self-attention, Multi-head Attention, Positional Encoding, Layer Normalization, Encoder (BERT) vs. Decoder (GPT) architectures	
6.2	Vector embeddings and Vector Databases: FAISS, Pinecone, Weaviate, Approximate Nearest Neighbor (ANN) search Generative AI ecosystem and tools: Hugging Face, LangChain, Diffusers, OpenAI APIs, GPT-4, DALL·E, Claude, Gemini, MusicLM	
6.3	Challenges and ethical concerns: Hallucination, bias, deepfakes, misuse, alignment, evaluation, multimodality, scaling, current challenges and future trends in Generative AI	
Total		**39**

Textbooks:	
1	Ian Goodfellow and Yoshua Bengio and Aaron Courville. Deep Learning. An MIT Press book. 2016.
2	Li Deng and Dong Yu, "Deep Learning Methods and Applications", now publishers Inc (30 June 2014)
3	Satish Kumar "Neural Networks A Classroom Approach" Tata McGraw-Hill.
4	J M Zurada "Introduction to Artificial Neural Systems", Jaico Publishing House
5	M. J. Kochenderfer, Tim A. Wheeler. "Algorithms for Optimization", MIt Press.
6	Rehmani, Altaf. Generative AI for Everyone: Understanding the Essentials and Applications of This Breakthrough Technology. 2024.
7	Applied Generative AI for Beginners: Practical Knowledge on Diffusion Models,ChatGPT, and Other LLMs by Akshay Kulkarni, Adarsha Shivananda, Anoosh Kulkarni and Dilip Gudivada
Reference books:	
1	Jon Krohn, Grant Beyleveld, Aglae Bassens, "Deep Learning Illustrated: A Visual, Interactive Guide to Artificial Intelligence", Pearson Education.
2	Buduma, N. and Locascio, N., "Fundamentals of deep learning: Designing next-generation machine intelligence algorithms" 2017. O'Reilly Media, Inc."
3	François Chollet, "Deep Learning with Python", Manning Publications, 2018.
4	Douwe Osinga. "Deep Learning Cookbook", O'REILLY, SPD Publishers, Delhi.

5	Simon Haykin, Neural Network- A Comprehensive Foundation- Prentice Hall International, Inc.
6	Generative AI for Everyone: Deep learning, NLP, and LLMs for creative and practical applications - Karthikeyan Sabesan, Sivagamisundari, Nilip Dutta

Online References:	
Sr. No.	**Website Links**
1	https://nptel.ac.https://deeplearning.cs.cmu.edu/S21/index.html
2	http://www.cse.iitm.ac.in/~miteshk/CS6910.html
3	https://nptel.ac.in/courses/106/106/106106184/
4	https://www.deeplearningbook.org/
5	http://introtodeeplearning.com/
6	http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

DEEP LEARNING & GenAI (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPCL 72	Deep Learning &GenAI (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPCL 72	Deep Learning &GenAI (Lab)	---	---	---	25	25	50

Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Implement basic neural network models to learn logic functions.
2	Design and train feed-forward neural networks using various learning algorithms.
3	Build and train deep learning models such as Auto-encoders, CNNs, RNN, LSTM etc.
4	Demonstrate the ability to explore and compare foundational GenAI tools and frameworks such as OpenAI, Gemini, Hugging Face.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr. No.	**Name of the Experiment**
1	**Based on Module 1 (Any ONE) using Virtual Lab**
	Implement Mc-Culloch Pitts model for binary logic functions.
	Implement Perceptron algorithm to simulate any logic gate.
	Implement Multilayer Perceptron algorithm to simulate XOR gate.
	To explore python libraries for deep learning e.g. Theano, TensorFlow etc.
2	**Module 2 (Any ONE)**
	Apply any of the following learning algorithms to learn the parameters of the

	supervised single layer feed-forward neural network. a. Stochastic Gradient Descent b. Mini Batch Gradient Descent c. Momentum GD d. Nestorev GD e. Adagrad GD Adam Learning GD
3	**Module 3 (Any One)**
	Implement a back-propagation algorithm to train a DNN with at least 2 hidden layers.
	Design and implement a fully connected deep neural network with at least 2 hidden layers for a classification application. Use appropriate Learning Algorithm, output function and loss function
4	**Module 4 (Any One)**
	Design and implement a CNN model for digit recognition application.
	Design and implement a CNN model for image classification.
5	**Module 5 (Any One)**
	Design the architecture and implement the auto-encoder model for Image Compression.
	Design the architecture and implement the auto-encoder model for Image denoising.
6	**Module 6 (Any One)**
	Design and implement LSTM for Text / Image / Audio / Video / etc.
	Design and implement GRU for Text / Image / Audio / Video / etc.
	Design and implement RNN for Text / Image / Audio / Video / etc.
7	**Module 7 (Any Two)**
	Explore generative AI frameworks (OpenAI, Gemini, Copilot) – OpenAI ChatGPT, Google Gemini, GitHub Copilot
	Generate simple text using a pre-trained model – Hugging Face Transformers, Google Colab
	Real-world applications: Healthcare, media, art, code generation, synthetic data generation

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - ROBOTICS

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE 471	Robotics (Theory)	03	---	---	03	---	---	03
NECPE 4L71	Robotics (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE 471	Robotics (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE 471	Robotics (Theory)	20	20	60	---	---	100

Course Prerequisite:) Applied Mathematics I , Applied Mathematics II.	
Course Objectives:	
1	To get acquainted with the basics of robotics.
2	To familiarize students with kinematics & dynamics of robots
3	To familiarize students with Trajectory & task planning of robots.
4	To familiarize students with robot vision
Course Outcomes: After successful completion of the course students will be able to:	
1	Describe the basics of Robotics.
2	Describe and derive dynamics of stationary and mobile robots.
3	Describe and derive kinematics of stationary and mobile.
4	Apply trajectory planning algorithms.
5	Describe concepts of robot motion planning algorithms.
6	Apply image processing in robotic vision.

ROBOTICS (THEORY)

Module	Contents	Hrs
1	**Fundamentals of Robotics**	**04**
1.1	Robot Classification, Robot Components, Robot Specification, Joints, Coordinates, Coordinate frames, Workspace, Specification Notations, Applications.	
2	**Direct Kinematics**	**07**
2.1	Dot and Cross Products, Co-ordinate frames, Rotations, Homogeneous Co-ordinates, Link Co-ordinates, Arm Equation (3 axis and 4 axis Robots)	
3	**Inverse Kinematics and Work Space Analysis**	**08**
3.1	General properties of solutions, Tool Configuration, Inverse kinematics of 2 axis, 3 axis Robots, Work Space Analysis of 2 axis and 3 axis Robots, Work Envelope.	
4	**Trajectory planning**	**06**
4.1	Basics of Trajectory planning, Joint-space trajectory planning, Pick and place operations, Continuous path motion, Interpolated motion, Straight line motion	
5	**Task Planning**	**07**
5.1	Task level programming, Uncertainty, Configuration Space, Gross motion Planning; Grasp planning, Fine-motion Planning, Source and goal scenes, BUG 1, BUG 2 and Tangent Bug Algorithms	
6	**Robot Vision**	**07**
6.1	Image representation, Template matching, Polyhedral objects, Shape analysis, Segmentation, Iterative processing, Perspective transform.	
Total		**39**

Textbooks:	
1	Robert Shilling, "Fundamentals of Robotics - Analysis and control, Prentice Hall of India, 2009 .
2	Saeed Benjamin Niku, "Introduction to Robotics – Analysis, Control, Applications", Wiley India Pvt. Ltd., Second Edition, 2011
Reference books:	
1	John J. Craig, "Introduction to Robotics – Mechanics & Control", Third Edition, Pearson Education, India, 2009 .
2	Mark W. Spong , Seth Hutchinson, M. Vidyasagar, "Robot Modeling & Control ",Wiely Publication

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

ROBOTICS (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPE 4L71	Robotics (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE 4L71	Robotics (Lab)	---	---	---	25	25	50

Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Use the acquired knowledge in solving direct and inverse kinematics problems.
2	Select and implement suitable task and trajectory planning algorithms.
3	Develop suitable programming tools for Robotic applications.
4	Construct Robots/Robotic arms for automation applications.

Suggested Experiments: Students are required to complete at least 08 experiments.	
Sr.No.	**Name of the Experiments**
1	Study/Demo of 4 axis robotic arm
2	Workspace analysis
3	Forward kinematics
4	Inverse kinematic
5	Joint-space trajectory
6	Cartesian-space trajectory
7	Template matching
8	Iterative processing
9	Segmentation

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - ELECTRIC VEHICLES

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE472	Electric Vehicles (Theory)	03	---	---	03	---	---	03
NECPE4L72	Electric Vehicles (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE472	Electric Vehicles (Theory)	03	---	01	03	---	---	04

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE472	Electric Vehicles (Theory)	20	20	60	---	---	100

Course Objectives:	
1	Understand the basics, need, types, and challenges of electric vehicles.
2	Learn the components and operation of battery electric vehicle drive train systems.
3	Understand the architecture and working of hybrid and fuel cell electric vehicles
4	Study power electronic converters and EV charging systems used in electric vehicles.
5	Analyze batteries, battery management systems, and alternative energy storage technologies for EV applications
6	Understand EV safety requirements, testing procedures, standards, and certification processes.
Course Outcomes: After successful completion of the course students will be able to:	
1	Explain the need, types, and challenges of electric vehicles.
2	Describe the construction and operation of BEV drive train components and battery systems.
3	Analyze the working principles of HEV and FCEV systems.
4	Explain the operation of EV chargers and power electronic converters.
5	Evaluate battery performance, SOC/SOH estimation, and battery management techniques.
6	Apply EV safety standards, testing methods, and regulatory requirements in electric vehicle systems.

ELECTRIC VEHICLES (THEORY)

Module	Contents	Hrs
1	**Introduction to Electric vehicles**	**06**
1.1	Present scenario of electric vehicles, Need of Electric Vehicles, Economic and environmental impacts of using Electrical vehicles.	
1.2	Challenges faced by electric vehicles to replace ICE. Major requirements of electric vehicles.	
1.3	Types of electric vehicle and their challenges: Types of electric vehicle, Pure Electric Vehicle (PEV): Battery Electric vehicle, Fuel Cell electric vehicle (FCEV), Hybrid Electric vehicle (HEV).	
2	**Battery Electrical vehicle**	**07**
2.1	Components of BEV drive train, the electric propulsion subsystem - Power converter, Driving wheels, Suspension system, Driveshaft, Mechanical transmission, Electric Motor, power electronics converters (DC-AC/DC-DC), The electronic control unit (ECU).	
2.2	The energy source subsystem Battery pack with Battery Management System.	
2.3	On board charger, the auxiliary subsystem -Power steering unit, Common parts between ICE drive train and EV drive train, Differences (modifications/parts to be removed/added) between ICE and EV drive train.	
3	**Hybrid Electrical vehicle and Fuel cell electric vehicle**	**08**
3.1	Introduction to Hybrid Electric Vehicles ,Basic architecture of hybrid drive trains, Components of HEV drive train system Economic and environmental impacts of Electric hybrid vehicle Parameters affecting Environmental and economic analysis	
3.2	Classification of HEV: Conventional HEV (Micro, Mild and Full hybrid-series hybrid, parallel hybrid, series parallel hybrid, complex hybrid).	
3.3	Fuel cell electric vehicle (FCEV) -Basic architecture of FCEV.Components of FCEV drive train system.	
4	**On-board Chargers**	**06**
4.1	Review of semiconductor devices; turn-on and turn-off characteristics; loss computation in semiconductor devices;	
4.2	basics of non-isolated/isolated DC-DC and grid connected converters;	
4.3	classification of EV chargers; modelling and control of bi-directional DC-DC converters; discussions on V2X applications	
5	**Batteries**	06

5.1	Overview of batteries , Battery Parameters, types of batteries , Battery Charging	
5.2	Alternative novel energy sources-solar photovoltaic cells, fuel cells, super capacitors, flywheels	
5.3	Battery Modeling: Equivalent circuit models, State of Charge (SOC) and State of Health (SOH) estimation, Battery Management Systems (BMS): Cell balancing, thermal management	
6	**EV-Safety, Testing, Regulations, And Standards**	**06**
6.1	Standards Roadmap For Electric Vehicles, SAE Standards,Arai Standards	
6.2	Performance & Safety, Applicable Battery Standards,Battery Safety	
6.3	Battery Transportations, Charging Standards ,Governing Bodies For Regulation, Certification Requirement & Options,Battery Characterization & Cycle Testing.	
Total		**39**

Textbooks:	
1	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2 nd Edition, 2017. (Unit-I, II)
2	Ali Emadi, "Advanced Electric Drive Vehicles (Energy, Power Electronics, and Machines)", CRC Press, 2015. (Unit-III)
3	John G. Hayes and A. Goodarzi, "Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles", Wiley, 2018. (Unit-IV & V)
Reference books:	
1	James Larminie, John Lowry, "Electric Vehicle Technology Explained", Wiley, 2 nd Edition 2012.

Access to NPTEL / Swayam Course:	
1	https://nptel.ac.in/courses/108106170
2	https://onlinecourses.nptel.ac.in/noc22_ee53
3	https://onlinecourses.nptel.ac.in/noc21_ee112

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

VIVEKANAND EDUCATION SOCIETY'S

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Department of Electronics and Computer Science

ELECTRIC VEHICLES (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPE4L72	Electric Vehicles (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE4L72	Electric Vehicles (Lab)	---	---	---	25	25	50

Lab Objectives:	
1	To understand the basic concepts, types, and performance characteristics of electric vehicles through simulation studies.
2	To study the operation and performance of EV drive train components, motors, and battery systems using MATLAB/Simulink.
3	To analyze the working and performance of HEV and FCEV models using simulation tools.
4	To simulate and study the operation of power electronic converters and EV charging systems.
5	To analyze battery characteristics, SOC/SOH estimation, BMS operation, and renewable energy integration in EV systems.
6	To study EV safety parameters, battery testing methods, and performance evaluation techniques using simulation and analysis tools.

Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Explain the basic operation, types, and performance characteristics of electric vehicles.
2	Simulate and analyze EV drive train systems, motors, and battery operation.
3	Analyze the working principles and performance of HEV and FCEV systems.
4	Simulate EV charging systems and analyze the operation of power electronic converters.
5	Evaluate battery performance, SOC/SOH estimation methods, and battery management

	techniques.
6	Perform analysis related to EV safety, battery testing, and applicable standards for electric vehicle systems.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Modeling of Basic Electric Vehicle in MATLAB/Simulink
2	Modeling of DC-DC Buck Converter
3	Modeling of Bidirectional DC-DC Converter
4	Battery Charging and Discharging Characteristics
5	State of Charge (SOC) Estimation of Battery
6	Thermal Effect Analysis on EV Battery
7	Simulation of Regenerative Braking System
8	Comparative Study of ICE and EV Efficiency
9	Simulation of Hybrid Electric Vehicle (HEV) Architecture
10	Performance Analysis of Fuel Cell Electric Vehicle
11	Modeling of EV On-board Charger
12	Vehicle-to-Grid (V2G) Power Flow Simulation
13	Modeling of Solar PV Based EV Charging System
14	Simulation of Battery Management System (BMS)
15	Comparative Analysis of EV Motors
16	EV Safety Standards and Battery Testing
17	Battery Cycle Testing and Performance Evaluation

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - WIRELESS TECHNOLOGY

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE473	Wireless Technology (Theory)	03	---	---	03	---	---	03
NECPE4L73	Wireless Technology (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE473	Wireless Technology (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE 473	Wireless Technology (Theory)	20	20	60	---	---	100

Course Objectives:	
1	To understand the fundamentals of wireless communication systems and propagation.
2	To analyze various wireless technologies and standards used in modern networks.
3	To study cellular communication, multiple access techniques, and mobility management.
4	To explore wireless networking protocols and architectures.
5	To evaluate emerging wireless technologies like 5G/6G and IoT.
6	To develop practical skills in wireless system design and performance analysis.
Course Outcomes: After successful completion of the course students will be able to:	
1	Explain wireless communication principles, spectrum usage, and propagation models.
2	Analyze and compare multiple access techniques and modulation scheme.
3	Understand cellular system design, handoff, and mobility management
4	Evaluate wireless network architectures and protocols (Wi-Fi, Bluetooth, etc.).
5	Assess performance issues such as interference, fading, and capacity.
6	Explore and apply concepts of emerging technologies like 5G, IoT, and beyond.

WIRELESS TECHNOLOGY (THEORY)

Module	Contents	Hrs
1	**Introduction to Wireless Communication**	**06**
1.1	Evolution of wireless systems , Wireless spectrum and regulations ,Basic communication system model	
1.2	Types of wireless networks (PAN, LAN, MAN, WAN) ,Challenges in wireless communication	
2	**Radio Propagation & Channel Modeling**	**06**
2.1	Free space propagation model , Path loss models (Okumura, Hata),	
2.2	Shadowing and multipath fading ,Doppler effect ,Channel capacity and Shannon theorem	
3	**Modulation & Multiple Access Techniques**	**08**
3.1	Digital modulation techniques (ASK, FSK, PSK, QAM)	
3.2	Spread spectrum techniques (DSSS, FHSS)	
4	**Cellular Communication Systems**	**06**
4.1	Cellular concept and frequency reuse , Cell splitting, sectoring , Handoff techniques.	
4.2	GSM architecture and call processing & Introduction to LTE.	
5	**Wireless Networking & Protocols**	**07**
5.1	IEEE 802.11 (Wi-Fi) architecture , Bluetooth and ZigBee .	
5.2	Ad hoc and sensor networks , Routing in wireless networks.	
6	**Emerging Wireless Technologies**	**06**
6.1	5G architecture and features , Introduction to 6G concepts	
6.2	MIMO	
6.3	Software-defined radio (SDR) and cognitive radio	
Total		**39**

Textbooks:	
1	Wireless Communication - Vijay Garg
2	Introduction to Wireless Communications and Networks – Krishnamurthy Raghunandan
3	Wireless Communications: Theory and Techniques – Asrar U. H. Sheikh
4	Wireless Communication Electronics – Robert Sobot
Reference books:	
1	Wireless Communication Electronics by example – Robert Sobot
2	Advanced Wireless Communications and Mobile Networks
3	Wireless Sensor Networks – Jaydip Sen
4	5G and 6G Enhanced Broadband Communications – Isiaka Ajewale Alimi

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:

Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

WIRELESS TECHNOLOGY (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPE4L73	Wireless Technology (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE4L73	Wireless Technology (Lab)	---	---	---	25	25	50

Lab Objectives:	
1	To understand practical aspects of wireless communication systems and devices.
2	To implement and analyze digital modulation techniques.
3	To study wireless channel behavior such as path loss and fading.
4	To configure and evaluate wireless networks (Wi-Fi, Bluetooth, etc.).
5	To gain hands-on experience with simulation tools (MATLAB/Python/NS-3).
6	To explore IoT-based wireless communication systems.
Lab Outcomes: After successful completion of the lab course students will be able to:	
1	Implement and analyze basic wireless communication models using simulation tools.
2	Evaluate performance of modulation and multiple access techniques.
3	Analyze wireless channel characteristics like path loss and fading.
4	Configure and test wireless network protocols and devices.
5	Design and demonstrate simple IoT-based wireless systems.
6	Interpret experimental results and prepare technical reports.

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Simulation of Basic Wireless Communication System • Block-level simulation using MATLAB/Python • Signal generation, transmission, and reception
2	Study of Path Loss Models • Free space vs log-distance model • Plot received power vs distance
3	Digital Modulation Techniques • Implementation of ASK, FSK, PSK, QAM • BER vs SNR analysis
4	Multiple Access Techniques • FDMA, TDMA, CDMA simulation • Performance comparison
5	Wi-Fi Network Setup & Analysis • Configure wireless LAN • Measure signal strength, throughput, latency
6	Bluetooth / ZigBee Communication • Device pairing and data transfer • Range and power consumption study
7	Wireless Network Simulation using NS-3 / OMNeT++ • Ad hoc network setup • Routing protocol performance analysis
8	IoT-based Wireless System Mini Project • Example: Smart home / sensor monitoring system • Use Wi-Fi / Bluetooth / LoRa modules

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

COURSE NAME: - CLOUD COMPUTING AND GPU

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE571	Cloud Computing and GPU (Theory)	03	---	---	03	---	---	03
NECPE5L71	Cloud Computing and GPU (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE571	Cloud Computing and GPU (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE571	Cloud Computing and GPU (Theory)	20	20	60	---	---	100

Course Prerequisite:

1. Computer Communication Networks
2. IoT and Embedded Systems
3. Operating Systems fundamentals
4. Python/C/C++ Programming
5. Basics of Computer Architecture and Linux environment

Course Objectives:	
1	To understand cloud computing architectures and virtualization technologies.
2	To study distributed cloud systems, storage, and cloud security mechanisms.
3	To explore containerization and orchestration techniques for scalable applications.
4	To understand GPU architecture and parallel computing concepts.
5	To develop CUDA/OpenCL based GPU programming skills.
6	To design cloud-GPU integrated solutions for AI, IoT, and edge computing applications
Course Outcomes: After successful completion of the course students will be able to:	
1	Explain cloud computing models, architectures, and virtualization concepts.
2	Analyze distributed cloud systems, storage frameworks, and security mechanisms.

3	Deploy containerized applications using Docker and orchestration platforms.
4	Understand GPU architecture and parallel computing performance metrics.
5	Develop and optimize CUDA/OpenCL programs for engineering applications.
6	Design heterogeneous cloud-GPU solutions for AI, IoT, and embedded systems.

CLOUD COMPUTING AND GPU (THEORY)

Module	Contents	Hrs
1	**Introduction to Cloud Computing**	**06**
1.1	**Fundamentals of Cloud Computing** • Evolution of distributed and cloud computing • Characteristics and advantages of cloud computing	
1.2	**Cloud Service and Deployment Models** • IaaS, PaaS, SaaS • Public, Private, Hybrid, and Community clouds	
1.3	**Cloud Architecture and Data centers** • NIST cloud reference architecture • Data center overview and resource provisioning	
1.4	**Cloud Applications** • Applications in IoT and embedded systems • Load balancing and SLA concepts	
2	**Virtualization and Containerization**	**06**
2.1	**Virtualization Fundamentals** • Concepts and advantages of virtualization • Type I and Type II hypervisors	
2.2	**Resource Virtualization** • Virtualization of CPU, memory, storage, and I/O devices • Virtual machines and resource allocation	
2.3	**Containerization Concepts** • Introduction to containers • Docker architecture and container lifecycle	
2.4	**Cloud Deployment Tools** • Docker images and containers • Overview of container-based deployment	
3	**Distributed Cloud Systems and Security**	**07**
3.1	**Distributed Cloud Computing** • Distributed computing fundamentals	

	• CAP theorem and distributed systems	
3.2	**Cloud Storage Systems** • Distributed storage systems • NoSQL databases, BigTable, and DynamoDB	
3.3	**Cloud Security and Privacy** • Identity and Access Management (IAM) • Cloud security threats, encryption, and privacy	
3.4	**Reliability and Infrastructure Management** • Backup and disaster recovery Introduction to Infrastructure as Code (IaC)	
4	**Cloud Orchestration and Edge Integration**	**05**
4.1	**Container Orchestration** • Kubernetes fundamentals • Container orchestration concepts	
4.2	**Cloud Resource Management** • Auto scaling and monitoring • Cloud resource management techniques	
4.3	**Server less and Edge Computing** • Server less computing overview • Edge computing concepts	
4.4	**IoT-Cloud Integration** • Edge-cloud communication architecture • Industrial IoT cloud platform case studies	
5	**GPU Architecture and Parallel Computing**	**07**
5.1	**5.1 Parallel Computing Fundamentals** • Introduction to parallel computing • Latency vs throughput computing	
5.2	**5.2 GPU Architecture** • CPU vs GPU architecture • Multi-core and many-core processors SIMT architecture, GPC, and Streaming Multiprocessors	

5.3	**5.3 GPU Memory and Scheduling**
	• Warp scheduling concepts
	• GPU memory hierarchy:
	  • Global memory
	  • Shared memory
	  • Constant memory
	  • Texture memory	

5.4	**5.4 GPU Performance Metrics** • Speedup, efficiency, and scalability • Brief introduction to Amdahl's Law • Overview of OpenCL framework	

6	**CUDA Programming and Heterogeneous AI Systems**	**07**
6.1	**CUDA Programming Fundamentals** • CUDA programming environment setup • CUDA kernels and thread organization • Grid, block, and thread hierarchy	
6.2	**GPU Programming Optimization** • Synchronization mechanisms • Memory transfer between CPU and GPU • Shared memory optimization and memory coalescing	
6.3	**CUDA-Based Parallel Applications** • Vector and matrix operations using CUDA • Reduction operations • GPU acceleration for image and signal processing	
6.4	**GPU for AI and Edge Systems** • Tensor Cores and hardware accelerators • Jetson Nano and embedded GPU platforms • GPU integration with TensorFlow/PyTorch • Applications in AI, IoT, and smart embedded systems	
Total		**39**

Textbooks:	
1	Cloud Computing, "Cloud Computing", 2nd edition, Wiley India Publications.
2	Mastering Cloud Computing, "Mastering Cloud Computing", McGraw Hill Education Publications.
3	Programming Massively Parallel Processors, "Programming Massively Parallel Processors: A Hands-on Approach", 4th edition, Morgan Kaufmann Publications.
4	CUDA by Example, "CUDA by Example: An Introduction to General-Purpose GPU Programming", Addison-Wesley Publications.
5	Distributed and Cloud Computing, "Distributed and Cloud Computing", Morgan Kaufmann Publications
Reference books:	
1	Cloud Computing, "Cloud Computing: A Hands-On Approach", Universities Press Publications.
2	Introduction to Parallel Computing, "Introduction to Parallel Computing", 2nd edition, Pearson Education Publications.
3	GPU Computing Gems, "GPU Computing Gems Emerald Edition", Morgan Kaufmann Publications.
4	Cloud Security and Privacy, "Cloud Security and Privacy", O'Reilly Media Publications.
5	CUDA Programming, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", Morgan Kaufmann Publications.

	Docker Deep Dive, "Docker Deep Dive", Leanpub Publications.
6	Kubernetes Up and Running, "Kubernetes: Up and Running", O'Reilly Media Publications.
7	Hands-On GPU Programming with Python and CUDA, "Hands-On GPU Programming with Python and CUDA", Packt Publishing Publications.
8	Cloud Computing, "Cloud Computing: A Hands-On Approach", Universities Press Publications.

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

CLOUD COMPUTING AND GPU (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPE5L71	Cloud Computing and GPU (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE5L71	Cloud Computing and GPU (Lab)	---	---	---	25	25	50

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
	Part A – Cloud Computing
1	Study of cloud computing platforms and cloud service models.
2	Installation and configuration of Virtual Box/VMware and creation of virtual machines.
3	Deployment and management of Linux virtual machines on cloud platforms.
4	Creating and configuring AWS EC2 or Google Cloud virtual machine instances.
5	Deployment of a web server application on a cloud platform.
6	Installation and configuration of Docker environment.
7	Creation and execution of Docker containers and Docker images.
8	Deployment of multi-container applications using Docker Compose.
9	Kubernetes cluster setup and basic container orchestration.
10	IoT sensor simulation using Python and uploading telemetry data to cloud storage/database.
11	IoT sensor simulation using Python and uploading telemetry data to cloud storage/database.
	Part B – GPU
12	Installation and configuration of CUDA Toolkit and GPU programming environment.
13	CUDA device query program to analyze GPU properties and specifications.
14	Implementation of vector addition using CUDA threads and blocks.
15	Implementation of matrix multiplication using CUDA kernels.
16	Comparative analysis of CPU and GPU performance for parallel applications.
17	Optimization of matrix operations using GPU shared memory.
18	Parallel image processing using CUDA programming.
19	Implementation of CUDA accelerated neural network inference using TensorFlow/PyTorch.
20	Edge AI implementation using Jetson Nano or equivalent embedded GPU platform.
21	Mini Project: Design and implementation of a Cloud-GPU integrated application for AI/IoT systems.
22	Installation and configuration of CUDA Toolkit and GPU programming environment.
23	CUDA device query program to analyze GPU properties and specifications.
24	Implementation of vector addition using CUDA threads and blocks.
Suggested Software and Tools	
1	Docker
2	Kubernetes
3	VirtualBox / VMware
4	NVIDIA CUDA Toolkit
5	Python
6	TensorFlow / PyTorch
7	OpenCL SDK
8	Google Colab

9	AWS Educate / Google Cloud Platform / Microsoft Azure
10	Jetson Nano Development Kit

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

VIVEKANAND EDUCATION SOCIETY'S

Institute of Technology

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Department of Electronics and Computer Science

COURSE NAME: - CYBER SECURITY

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE572	Cyber Security (Theory)	03	---	---	03	---	---	03
NECPE5L72	Cyber Security (Lab)	---	02	---	---	01	---	01
Total Credits								04

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Department of Electronics and Computer Science

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE572	Cyber Security (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE572	Cyber Security (Theory)	20	20	60	---	---	100

Course Prerequisite: Computer Networks	
Course Objectives:	
1	To understand the need for Cyber Security Awareness.
2	To understand the flow and methodology of an attack
3	To learn and explore various static and web vulnerability analysis tools.
4	To understand the various IPR, privacy and security compliances.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand the need of Cyber Security and its aspects.
2	Illustrate the various tools and techniques used by attackers to launch their attacks.
3	Identify cyber-attacks and its countermeasures.
4	Identify various web application and Network vulnerability scanning techniques and defence methodologies.
5	Describe the various Privacy and standard compliances with the help of real world application.

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Department of Electronics and Computer Science

CYBER SECURITY (THEORY)

Module	Contents	Hrs
1	**Introduction to Cyberspace**	**10**
1.1	**Prerequisite:** Computer Networks **Cyber Crime:** Cybercrime definition, Types of Cybercrime. Classifications of cybercrime, Cyber Hygiene, Types of Hackers - Hackers and Crackers - Cyber-Attacks and Vulnerabilities - Malware threats - Sniffing - Gaining Access - Escalating Privileges - Executing Applications - Hiding Files - Covering Tracks - Worms - Trojans - Viruses - Backdoors	
1.2	**Cyber Attacks:** Cyber-attack Lifecycle, social engineering, Cyber stalking, Cybercafé and Cybercrimes, Botnets, Attack vector, Attacks on Wireless and mobile Networks.	
2	**Cyber-crime Attacks and Techniques**	**08**
2.1	**Attacks Techniques:** Password Cracking, Keyloggers and Spywares Steganography, Identity Theft (ID Theft), Banner Grabbing Techniques, ransom wares, Crypto wares	
2.2	Network information gathering, vulnerability scanning, Virtual Private Networks (VPN), Open Port Identification, Social engineering, Types of social engineering, How cyber-criminal works? Prevention from being victim of social engineering.	
3	**Cyber Attacks and Preventions**	**06**
3.1	Attacks on WIFI and prevention, traditional techniques, theft of internet hours, Wi-Fi measures	
3.2	Attacks on Mobile phone and prevention, mobile phone theft, mobile virus, Mishing, vishing, smishing, hacking Bluetooth	
4	**Web and Network Security**	**08**
4.1	Web Security: WASP, Web Security Considerations, Management, Cookies, Privacy on Web, Web Browser Attacks, Web Bugs, Clickjacking, Session Hijacking and Management, Phishing and Pharming Techniques, Web Service Security	
4.2	Network security: DOS, DDOS, defences against Denial-of-Service Attacks. Virtual Private Networks (VPN)	
5	**Cyber Laws**	**04**
5.1	**Information Security Privacy and Standard Compliances (WR)** HIPPA, FISMA, PCI DSS, GDPR, Intellectual Property Aspect of Cyber Law, Creative Commons Library, Data Protection Laws in India.	
6	**Cyber Security Initiatives- (case studies)**	**03**

6.1	Online Banking, Mobile Banking Security, Security of Debit and Credit Card, UPI Security	
6.2	Role of AI/ML in Cyber Security	
Total		**39**

Textbooks:	
1	Nina Godbole,Sunit Belapure, "Cyber Security-Understanding Cyber Crimes,Computer Forensics and Legal Perspective",Wiley-India,2011.
2	The Complete Cyber Security Course -Volume 1- Nathan House
3	Network Security Bible, Eric Cole, Second Edition, Wiley
Reference books:	
1	The Information technology Act, 2000; Bare Act- Professional Book Publishers, New Delhi.
2	James Graham,Richard Howard ,Ryan Olson. " Cyber Security Essentials,CRC Press,2018 print.
3	Build your own Security Lab, Michael Gregg, Wiley India
4	Computer Security, Dieter Gollman, Third Edition, Wiley

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Assessment tools	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks

8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

CYBER SECURITY (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPE5L72	Cyber Security (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE5L72	Cyber Security (Lab)	---	---	---	25	25	50

Lab Objectives:	
1	To provide practical exposure to cybersecurity concepts, tools, and technologies.
2	To develop skills in identifying, analyzing, and mitigating cyber threats.
3	To perform security assessments of systems, networks, and applications.
4	To understand cyber attack methodologies and defensive strategies.
5	To promote cyber hygiene and secure computing practices.
6	To enable students to apply cybersecurity principles in real-world scenarios.
Lab Outcomes: After successful completion of the lab course students will have:	
1	Demonstrate understanding of cybersecurity fundamentals and cyber threats.
2	Perform basic security assessments and vulnerability analysis.
3	Apply cybersecurity tools and techniques in controlled environments.
4	Evaluate the security posture of networks, wireless systems, and web applications.
5	Detects and responds to common cyber attacks and social engineering threats.
6	Design and implement basic cybersecurity solutions and security awareness

Suggested Experiments: Students are required to complete at least 10 experiments.	
Sr.No.	**Name of the Experiments**
1	Perform reconnaissance to find all the relevant information on selected websites using 5 network information gathering tools.
2	Identifying the target website and perform vulnerability assessment using Google dorking, netcraft, shodan and social media
3	Implementation of active reconnaissance using different tools – nmap, telnet, nikto
4	Install Wire shark and apply filters to gather different information related to protocols
5	Perform Session hijacking/ find credentials of unsecure real time website using Wireshark
6	Implementation of active reconnaissance using Angry IP scan
7	Generate Word list using wordlist generator Crunch
8	Perform windows login bypass using net user and using John the Ripper
9	Simulation for offensive attack using tryhackme safe and virtual environment
10	Create Trojan and Exploit victim's machine by taking its complete access
11	Scan systems to identify open ports and understand associated risks.
12	Study Wi-Fi security standards (WEP, WPA, WPA2, WPA3) and implement secure wireless configurations.
13	Demonstrate common wireless vulnerabilities and understand mitigation techniques in a controlled setup.
14	Examine mobile security settings, permissions, encryption, and application security.
15	Create simulated phishing, vishing, and smishing scenarios and identify prevention techniques.
16	Examine browser cookies, session identifiers, and session management mechanisms.
17	Identify common web vulnerabilities based on OWASP principles using a deliberately vulnerable web application.
18	Analyze suspicious emails and websites to identify indicators of phishing and pharming attacks.
19	Understand DoS/DDoS attack mechanisms and evaluate defensive strategies through simulations and case studies.
20	Configure a VPN connection and analyze secure communication and encryption mechanisms.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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Department of Electronics and Computer Science

COURSE NAME: - BLOCKCHAIN TECHNOLOGY

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE573	Blockchain Technology (Theory)	03	---	---	03	---	---	03
NECPE5L73	Blockchain Technology (Lab)	---	02	---	---	01	---	01
Total Credits								04

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	TW/PR	Tut	Total
NECPE573	Blockchain Technology (Theory)	03	---	---	03	---	---	03

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE573	Blockchain Technology (Theory)	20	20	60	---	---	100

Course Prerequisite: Computer Networks; Operating Systems; Cryptography and Network Security	
Course Objectives:	
1	Build the conceptual base required for understanding decentralized systems.
2	Understand cryptographic tools used in blockchain systems.
3	Understand how blockchain systems are built and maintained.
4	Deep dive into real-world blockchain platforms.
5	Build and integrate decentralized applications.
6	Explore modern applications and future directions.
Course Outcomes: After successful completion of the course students will be able to:	
1	Understand Distributed Systems and Blockchain Fundamentals
2	Apply Cryptographic Techniques in Blockchain Systems
3	Analyze Blockchain Architecture and Consensus Mechanisms
4	Develop and Evaluate Blockchain Platforms (Bitcoin & Ethereum)
5	Design and Build Decentralized Applications (dApps)
6	Evaluate Advanced Blockchain Applications and Emerging Trends

BLOCKCHAIN TECHNOLOGY (THEORY)

Module	Contents	Hrs
1	**Foundations of Distributed Systems**	**04**
1.1	Introduction to Blockchain and Web3 evolution, Centralized vs decentralized architectures, Basics of distributed systems, CAP theorem and system trade-offs, Byzantine fault tolerance problem, Consensus problem and FLP impossibility.	
2	**Cryptographic Foundations**	**05**
2.1	Hash functions (SHA-256) and properties, Public key cryptography, Digital signatures, Merkle trees and data integrity, Introduction to Zero-Knowledge Proofs, Commitment schemes and advanced primitives	
3	**Blockchain Architecture & Consensus**	**06**
3.1	Structure of a blockchain (blocks, chain, hashes), Transaction lifecycle, Consensus mechanisms: PoW, PoS, PBFT, Mining and incentives, Game theory in blockchain systems, Types of blockchains (public, private, consortium)	
4	**Bitcoin & Ethereum Systems**	**08**
4.1	Bitcoin architecture and UTXO model, Mining process and difficulty adjustment, Bitcoin limitations, Ethereum architecture and EVM, Smart contracts introduction, Solidity programming basics and advanced concepts, Gas mechanism and optimization, Smart contract design patterns, Security vulnerabilities (reentrancy, overflow, etc.)	
5	**dApps & Enterprise Blockchain**	**08**
5.1	dApp architecture, Web3.js / Ethers.js libraries, Wallet integration (MetaMask), Frontend + blockchain integration (React + Web3), Hyperledger Fabric architecture, Channels and chaincode, Enterprise blockchain use cases (supply chain, banking)	
6	**Advanced Blockchain Systems**	**08**
6.1	Decentralized Finance (DeFi), NFTs and token standards (ERC-721, ERC-20), Layer 2 scaling solutions (rollups, sidechains), Cross-chain interoperability and bridges, Blockchain security auditing techniques, Privacy technologies (ZKPs, mixers), Regulation and legal frameworks (India focus), Future of Web3 and blockchain.	
Total		**39**

Textbooks:	
1	Imran Bashir, Mastering Blockchain (4th Edition), Packt Publishing *(Comprehensive coverage of blockchain architecture, cryptography, Bitcoin, Ethereum, smart contracts, and decentralized applications.)*
2	Daniel Drescher, Blockchain Basics: A Non-Technical Introduction in 25 Steps, Apress, *(Provides a clear conceptual introduction to blockchain, decentralization, consensus mechanisms, and smart contracts.)*
3	Andreas M. Antonopoulos, Mastering Bitcoin O'Reilly Media, *(Detailed technical explanation of Bitcoin protocol, UTXO model, mining, and transaction structures.)*
4	Andreas M. Antonopoulos & Gavin Wood, Mastering Ethereum, O'Reilly Media *(Covers Ethereum architecture, EVM, Solidity programming, and decentralized application development.)*
Reference books:	
1	Ferguson, Schneier, Kohno, Cryptography Engineering, Wiley *(Practical cryptographic design principles used in secure systems.)*
2	Jean-Philippe Aumasson, Serious Cryptography, No Starch Press *(Modern cryptographic techniques including hashing, encryption, and protocol design.)*
3	Don Tapscott & Alex Tapscott, Blockchain Revolution, Portfolio / Penguin *(Discusses the impact of blockchain on business, finance, and governance.)*
4	Antony Lewis, The Basics of Bitcoins and Blockchains, Mango Publishing *(Beginner-friendly explanation of Bitcoin, blockchain systems, and digital currencies.)*
5	Imran Bashir (Editor), Distributed Computing to Blockchain: Architecture, Technology, and Applications, Elsevier. *(Covers evolution from distributed systems to blockchain technology.)*
6	Academic Paper (Survey), SoK: Cryptography in Blockchain Systems *(Comprehensive research survey on cryptographic techniques in blockchain systems.)*

Internal Assessment:	
1	Assessment consists of one Mid Term Test of 20 marks and Continuous Assessment of 20 marks.
2	Mid Term test is to be conducted when approx. 50% syllabus is completed.
3	Duration of the midterm test shall be one hour.

Continuous Assessment:
Continuous Assessment is of **20 marks**. The rubrics for assessment will be considered on approval by the subject teachers. The rubrics can be any 2 or max 4 of the following:

Sr. No	Rubrics	Marks
1	Certificate course for 4 weeks or more: NPTEL/ Coursera/ Udemy/any MOOC	10 marks
2	Wins in the event/competition/hackathon pertaining to the course.	10 marks
3	Content beyond syllabus presentation	10 marks
4	Creating Proof of concept	10 marks
5	Mini Project / Extra Experiments/ Virtual Lab	10 marks
6	GATE Based Assignment test/Tutorials etc	10 marks
7	Participation in event/workshop/talk/competition followed by a small report and certificate of participation relevant to the subject	05 marks
8	Multiple Choice Questions (Quiz)	05 marks
9	Literature review of papers/journals.	05 marks

End Semester Theory Examination:	
1	Question paper will be of 60 marks.
2	Question paper will have a total of five questions.
3	All questions have equal weightage and carry 20 marks each.
4	Any three questions out of five needs to be solved.

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Department of Electronics and Computer Science

BLOCKCHAIN TECHNOLOGY (LAB)

Course Code	Course Name	Teaching Scheme (Teaching Hours)			Credits Assigned			
		Theory	Practical	Tutorial	Theory	Practical	Tut	Total
NECPE5L73	Blockchain Technology (Lab)	---	02	---	---	01	---	01

Course Code	Course Name	Examination Scheme					
		Theory			Term Work	Practical & Oral	Total
		Internal Assessment		End Sem Exam			
		Mid-Term Test	Continuous Assessment				
NECPE5L72	Blockchain Technology (Lab)	---	---	---	25	25	50

Lab Prerequisite: JavaScript or Python programming, concepts of Data Structures and algorithms, Knowledge of basic Cryptography concepts, Computer Networks,	
Lab Objectives:	
1	To set up and configure a blockchain development environment using tools such as Ganache, Truffle, and Hardhat for efficient development and testing.
2	To implement fundamental cryptographic primitives, including hashing algorithms like SHA-256 and digital signatures, for securing blockchain systems.
3	To design and simulate basic blockchain architectures by modeling blocks, transactions, and consensus mechanisms in a distributed ledger system.
4	To develop, test, and deploy smart contracts using Solidity on platforms such as Ethereum.
5	To build decentralized applications (dApps) that interact with blockchain networks using libraries such as Web3.js and Ethers.js.

6	To analyze the security and performance of blockchain systems by identifying vulnerabilities and evaluating metrics such as throughput, latency, and gas consumption.
Lab Outcomes:	
1	Setup and Configure Blockchain Development Environment
2	Implement Cryptographic Primitives for Blockchain
3	Design and Simulate Basic Blockchain Systems
4	Develop and Deploy Smart Contracts
5	Build Decentralized Applications (dApps)
6	Analyze Security and Performance of Blockchain Systems

Suggested Experiments: Students are required to complete at least 08 experiments.	
Sr.No.	**Name of the Experiments**
1	Blockchain Environment Setup - Install and configure blockchain development environment. Tools: Node.js, Ganache / Hardhat, MetaMask Outcome: Students can set up a local blockchain development environment.
2	Hash Function Implementation - Implement SHA-256 hashing and analyze properties. Tools:Python / JavaScript, Outcome: Understand collision resistance, avalanche effect, and determinism.
3	Basic Blockchain Creation - Build a simple blockchain with blocks and hash linking. Tools:Python / JavaScript Outcome: Understand how blocks are chained using cryptographic hashes.
4	Proof of Work Simulation - Simulate mining using Proof of Work algorithm. Tools: Python / Node.js Outcome: Understand mining difficulty and computational effort.
5	Digital Signature Implementation - Generate and verify digital signatures for transactions. Tools: Python (cryptography library) Outcome: Understand authentication and non-repudiation in blockchain.
6	Merkle Tree Construction - Construct a Merkle tree and verify transactions. Tools: Python Outcome: Understand efficient data verification in blockchain systems.
7	Smart Contract Development (Basic) - Write a simple smart contract in Solidity. Tools: Remix IDE, Solidity Outcome: Understand structure and deployment of smart contracts.
8	Smart Contract Deployment on Testnet - Deploy contract on Ethereum test network. Tools: MetaMask,Remix / Hardhat Outcome: Learn real-world deployment workflow.
9	dApp Development - Build a simple decentralized application (frontend + blockchain). Tools: React.js, Ethers.js / Web3.js, MetaMask Outcome: Understand full-stack blockchain application development.
10	Security Analysis of Smart Contracts - Identify vulnerabilities in smart contracts. Tools: Remix IDE, Static analysis tools

	Outcome: Understand attacks like reentrancy, overflow, and unsafe access control.

Note: Suggested List of Experiments is indicative. However, flexibilities lie with individual course instructor to design and introduce new, innovative and challenging experiments, (limited to maximum 30% variation to the suggested list) from within the curriculum, so that, the fundamentals and applications can be explored to give greater clarity to the students and they can be motivated to think differently.

Term-Work:	
1	Term work should consist of 10 experiments.
2	The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work.
3	Total 25 Marks (Experiments: 15-marks, Term work Assessment: 10-marks)

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Department of Electronics and Computer Science

Semester VIII
Scheme

Semester VIII Teaching Scheme								
Course Type	**Course Name**	**Teaching Scheme (Contact hours)**			**Credits Assigned**			
		TH	**PR**	**TUT**	**TH**	**PR**	**TUT**	**TOTAL**
PCC	MOOC Course 1	3	-	-	3	-	-	3
PCC	MOOC Course 2	3	-	-	3	-	-	3
Internship/ OJT	Internship	-	12	-	-	12	-	12
Total Credits								**18**