Lokmanya Tilak Jankalyan Shikshan Santha's

Lokmanya Tilak College of Engineering

Sector 4, Vikas Nagar, Koparkhairane, Navi Mumbai 400709

An Autonomous Institute Affiliated to University of Mumbai

Minor /Honours Degree (18 Credits)

CURRICULUM STRUCTURE

For

SECOND YEAR ENGINEERING

(BASED ON NEP 2020)

w.e.f. A.Y. 2025-26

Approved by Academic Council on 15/04/2025

Preface

In alignment with the vision of the National Education Policy (NEP) 2020, engineering education in India is undergoing a transformative shift toward greater flexibility, interdisciplinarity, and learner-centric design. A key feature of this transformation is the integration of the Honours and Minor program into the undergraduate engineering curriculum. This document outlines the framework and rationale behind the Honours/Minor structure, which aims to empower students to pursue academic excellence in their core engineering discipline while exploring emerging and complementary fields. The Honours track offers depth through advanced courses and practical-based learning in the student's major area, whereas the Minor provides breadth by enabling structured learning in a secondary area of interest. By encouraging cross-disciplinary engagement, the program is designed to cultivate well-rounded engineers who are not only technically sound but also adaptable, innovative, and responsive to the needs of a rapidly changing world. This curriculum model seeks to bridge the gap between academia and industry, while also fostering critical thinking, creativity, and lifelong learning. This preface introduces the detailed structure, credit requirements, and intended outcomes of the Honours/Minor offerings in the engineering curriculum, and serves as a guide for students, faculty, and academic administrators involved in its implementation and continual development.

The Government of Maharashtra has instructed autonomous colleges to update their curriculum and begin implementing the National Education Policy (NEP) 2020. We are fully committed to ensuring the effective and meaningful adoption of NEP 2020 in its true essence. At "Lokmanya Tilak College of Engineering", the holistic development of learners has always been our top priority and central focus. LTCE embraced the NEP philosophy as early as 2022 wherein we have introduced the concept of Honours and Minors programs on emerging fields as per the guidelines of University of Mumbai and in 2024, we proudly graduated our first batch under this holistic curriculum. The autonomous curriculum for 2024-28 is structured in line with the recommendations of NEP 2020, AICTE, and UGC. The Honors and Minor Degree programs offer students the flexibility to explore emerging fields like Blockchain Technology, Cyber Security, Artificial Intelligence, Data Science, 3D printing, Electric Vehicles, etc. and build specialized skills beyond their core curriculum. By integrating these options, LTCE aims to prepare well-rounded graduates ready to meet the evolving demands of industry and research.

Sd/-

Dr. Sheeba P. S.
Dean, Academics & Research

Sd/-

Dr. Subhash K. Shinde
Principal

Minor/ Honours Degree Program Mapping with Engineering Programs

In alignment with AICTE and MH Govt. guidelines, the Honours and Minor degree programs have been introduced by the institute to enable students to pursue additional specialized courses in emerging areas of their interest, thereby enhancing their competence in those domains. Honours or Minor Degree will cumulatively require additional **18 credits** in the specified area in addition to the credits essential for obtaining the Under Graduate Degree in Major Discipline.

Minor/ Honours' degree program in emerging technology to be chosen by eligible students studying in second year of various engineering programs are elaborated in following table to bring clarity to all stakeholders including students and faculty members. Each eligible student can opt for maximum one minor/ honour's program at a time.

Sr. No.	Name of Minor/ Honours Degree Programs	Eligible Programs
1.	**Blockchain Technology**	Computer Engineering/ CSE (AI & ML)/ CSE (DS)/ Electronics & Telecommunication/ Electrical Engineering/ Mechanical Engineering
2.	**Artificial Intelligence & Data Science**	Computer Engineering/ CSE (IoT & CSBT) / Electronics & Telecommunication/ Electrical Engineering/ Mechanical Engineering
3.	**Cyber Security**	Computer Engineering/ CSE (AI & ML)/ CSE (DS)/ Electronics & Telecommunication/ Electrical Engineering/ Mechanical Engineering
4.	**3D Printing**	Computer Engineering/ CSE (AI & ML)/ CSE (DS)/ CSE (IoT & CSBT)/ Electronics & Telecommunication/ Electrical Engineering / Mechanical Engineering
5.	**Electric Vehicles**	Computer Engineering/ CSE (AI&ML)/ CSE (DS)/ CSE (IoT & CSBT)/ Electronics & Telecommunication/ Electrical Engineering / Mechanical Engineering

Eligibility Criteria for Students:

- Students with no backlog in Semester I, II, and III.
- The CGPI (based on semester I, II, and III) of the students must be 7.50 and above.
- For Direct Second Year (DSE) admitted students - No backlog in semester III and CGPI must be 6.75 and above.
- The Minor/Honours degree program can be opted only during regular engineering studies.
- The student shall complete the Minor/Honours degree program in stipulated four semesters only.

Minor/ Honours Courses* (18 Credits)

Semester	Course Code	Course Name	Teaching Scheme		Credit Assigned		Total Credits	Examination Scheme					
								Internal Assessment		End Semester Exam		Oral / Practical	Total
			L	P	L	P		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)	Marks	Duration (Hrs)		
IV	XXMC401	Honor/ Minor Course 1	4		4		4	20	20	60	2	-	100
V	XXMC501	Honor/ Minor Course 2	4		4		4	20	20	60	2	-	100
VI	XXMC601	Honor/ Minor Course 3	3		3		3	20	20	60	2	-	100
VI	XXMCL601	Honor/ Minor Lab Course 3		2		1	1	-	25	-		25	50
VII	XXMC701	Honor/ Minor Course 4	4		4		4	20	20	60	2		100
VII	XXCP701	Capstone Project		4		2	2		50			50	100
	Total		**15**	**6**	**15**	**3**	**18**	**80**	**155**	**240**	**8**	**75**	**550**

* **Eligibility:** Students with no backlog in Semester I, II, and III and the CGPI must be 7.50 and above. For Direct Second Year (DSE) admitted students: No backlog in semester III and CGPI must be 6.75 and above.

Minor/ Honours Courses

Honors/Minors Degree		Blockchain Technology (BT)	Artificial Intelligence & Data Science (AD)	Cyber Security (CS)	3D Printing (DP)	Electric Vehicles (EV)
Semester	**Credits**	**Course Name**				
IV	**4**	**BTMC401:** Blockchain & Crypto Currencies	**ADMC401:** Mathematics for AI & Data Science	**CSMC401:** Network Security & Ethical Hacking	**DPMC401:** Introduction to CAD	**EVMC401:** Vehicular Systems and Dynamics
V	**4**	**BTMC501:** Smart Contracts & Use Cases	**ADMC501:** Machine Learning	**CSMC501:** Digital Forensic	**DPMC501:** 3D Printing: Introduction & Processes	**EVMC501:** EV Drive and Energy Sources
VI	**3**	**BTMC601:** Blockchain Applications	**ADMC601:** Data Science for Business Intelligence	**CSMC601:** Information Security Management Vulnerability	**DPMC601:** Applications of 3D Printing	**EVMC601:** Automotive Controller and Auxiliary Systems
	1	**BTMCL601:** Blockchain Programming Lab	**ADMCL601:** Data Science for Business Intelligence Lab	**CSMCL601:** Assessment & Penetration Testing Lab	**DPMCL601:** Digital Fabrication Lab	**EVMCL601:** Electric Vehicle Lab
VII	**4**	**BTMC701:** NFT and Decentralised Finance	**ADMC701:** Deep learning and Gen AI	**CSMC701:** Application Security & Laws	**DPMC701:** 3D Printing in Medical Technology	**EVMC701:** Electric Vehicle System Design
VII	**2**	**BTCP701:** Capstone Project	**ADCP701:** Capstone Project	**CSCP701:** Capstone Project	**DPCP701:** Capstone Project	**EVCP701:** Capstone Project

Second Year Engineering Curriculum: Semester IV

Minor/ Honours: Blockchain Technology

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	4 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					4
BTMC401	Blockchain & Cryptocurrency	20	20	60	1	2	100	

Prerequisite: Basic concepts of cryptography and security	
Course Objectives: The course aims	
1	To get acquainted with the concept of Block and Blockchain.
2	To learn the concepts of consensus and mining in Blockchain.
3	To get to know cryptographic concepts in cryptocurrency.
4	To get familiar with bitcoin and its history.
5	To understand the blockchain platform and its terminologies.
6	To understand the concept of Ethereum Ecosystem.
Course Outcomes: Learners will be able to	
1	Describe the basic concept of Block chain.
2	Associate knowledge of consensus and mining in Block chain.
3	Apply the concept of cryptography in cryptocurrency at an abstract level.
4	Enumerate the Bitcoin features and its alternative options.
5	Analyze different types of blockchain platforms.
6	Illustrate the use of the Ethereum ecosystem.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Introduction to Blockchain**	08	CO1
	What is a blockchain, Origin of blockchain (cryptographically secure hash functions), Foundation of blockchain: Merkle trees Components of blockchain, Block in blockchain, Types: Public, Private, and Consortium, Consensus Protocol, Limitations and Challenges of blockchain. Structure of a Block, Block Header, Block Identifiers: Block Header Hash and Block Height, The Genesis Block, Linking Blocks in the Block chain, Merkle Trees and Simplified Payment Verification (SPV).		
	Self-learning Topics: Block chain Demo.		
02	**Consensus and Mining**	08	CO2
	Decentralized Consensus, Byzantine Generals Problem, Independent Verification of Transactions, Mining Nodes, Aggregating Transactions into Blocks, Constructing the Block header, Mining the Block, Validating a New Block, Assembling and Selecting Chains of Blocks, Block chain Forks		
	Self-learning Topics: Study different consensus algorithms		
03	**Cryptocurrency**	08	CO3
	Cryptographic primitives, Asymmetric cryptography, Public and private keys. Cryptocurrency: History, Bitcoin, Altcoin, and Tokens (Utility and Security), Cryptocurrency wallets: Hot and cold wallets, Cryptocurrency usage, Transactions in Blockchain, UTXO and double spending problem Bitcoin blockchain: Consensus in Bitcoin, Proof-of-Work (PoW), Proof-of-Burn (PoB), Proof-of-Stake (PoS), and Proof-of-Elapsed Time (PoET), Life of a miner, Mining difficulty, Mining pool and its methods		
04	**Introduction to Bitcoin**	10	CO4
	What is Bitcoin and the history of Bitcoin, Getting the first bitcoin, finding the current price of bitcoin, sending and receiving bitcoin, Bitcoin Transactions. **Keys and addresses, Wallets and Transactions:** Public Key Cryptography and Crypto currency, Private and Public Keys, Bitcoin Addresses, Base58 and Base58Check Encoding, Nondeterministic (Random) Wallets, Deterministic (Seeded) Wallets, HD Wallets (BIP-32/BIP-44), Wallet Best Practices, Using a Bitcoin Wallet, Transaction Outputs and Inputs, Transaction Fees, Transaction Scripts and Script Language, Turing Incompleteness, Stateless Verification, Script Construction (Lock + Unlock), Pay-to-Public-Key-Hash (P2PKH), Bitcoin Addresses, Balances, and Other Abstractions		
	Self-learning Topics: Study the website coinmarketcap.com/ Visit and use https://bitcoin.org/en/		
05	**Introduction to Blockchain Platforms**	08	CO5

	Why Blockchain Platform: Platform types, Public, Private, technology requirements for implementation. Introduction to Smart Contracts, Types of Smart Contracts, Structure of a Smart Contract, Smart Contract Approaches, Limitations of Smart Contracts, Hyperledger, Other Blockchain platforms.		
06	**Ethereum Ecosystem** Ethereum components: miner and mining node, Ethereum virtual machine, Ether, Gas, Transactions, accounts, swarm and whisper, Ethash, end to end transaction in Ethereum, architecture of Ethereum. Types of test-networks used in Ethereum, Transferring Ethers Using MetaMask, Mist Wallet, Ethereum Frameworks, Case study of Ganache for Ethereum blockchain (e.g. e-voting) applications on Ganache framework. **Self-learning Topics**: Emerging blockchain platforms	**10**	**CO6**
	Total Hours	**52**	

Text Books:	
1	Blockchain Technology, Chandramouli Subramanian, Asha A George, Abhilash K. A and Meena Karthikeyan, Universities press.
2	Imran Bashir, Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Packt Publishing
3	Mastering Bitcoin, Programming The Open Blockchain, 2nd Edition by Andreas M. Antonopoulos, June 2017, O'Reilly Media, Inc. ISBN: 9781491954386.
4	Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, July 19, 2016, by Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, Steven Goldfeder, Princeton University Press.
5	Mastering Ethereum, Building Smart Contract and Dapps, Andreas M. Antonopoulos Dr. Gavin Wood, O'reilly.
References:	
1	Blockchain for Beginners, Yathish R and Tejaswini N, SPD
2	Blockchain Basics, A non-Technical Introduction in 25 Steps, Daniel Drescher, Apress
3	Blockchain with Hyperledger Fabric, Luc Desrosiers, Nitin Gaur, Salman A. Baset, Venkatraman Ramakrishna, Packt Publishing
4	Mastering Ethereum: Building Smart Contracts and Dapps Paperback by Andreas Antonopoulos, Gavin Wood, Publisher(s): O'Reilly Media
5	Mastering Blockchain, by Imran Bashir, Third Edition, Packt Publishing
Useful Links:	
1	https://andersbrownworth.com/blockchain/
2	https://andersbrownworth.com/blockchain/public-private-keys/
3	https://www.coursera.org/learn/cryptocurrency
4	https://coinmarketcap.com/
5	NPTEL: https://onlinecourses.nptel.ac.in/noc19_cs63/preview

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

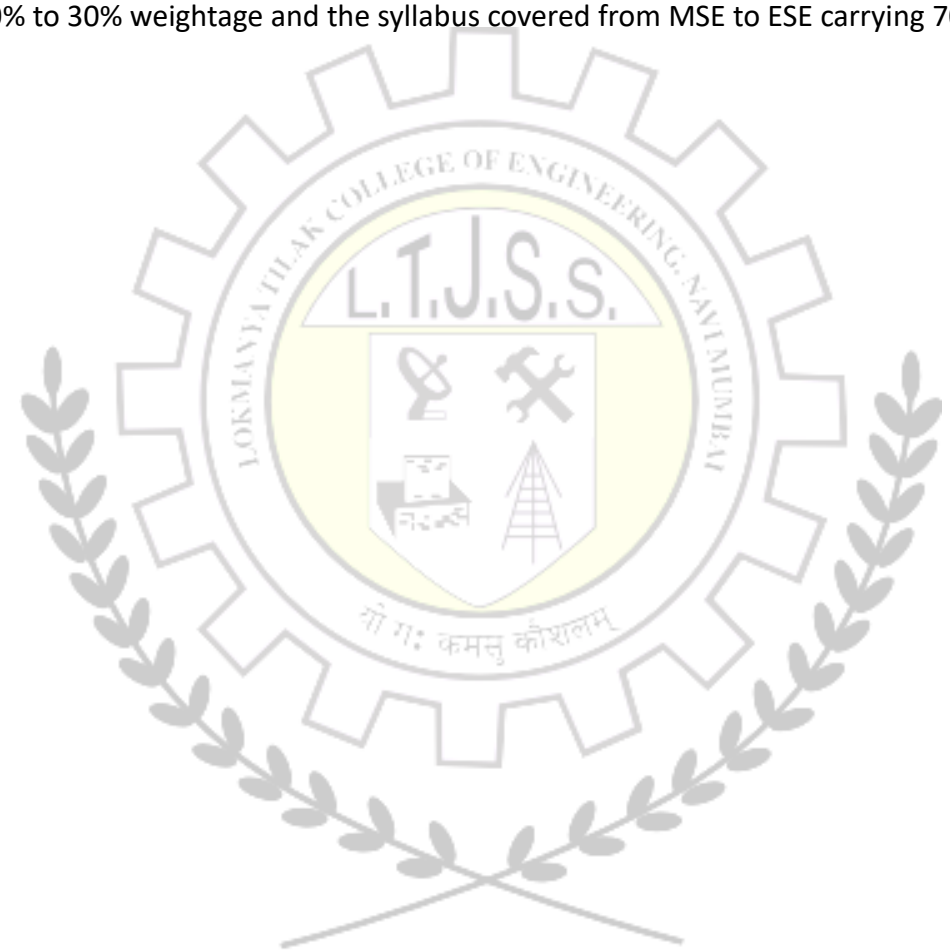
Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.



Minor/ Honours: Artificial Intelligence & Data Science

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	4 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					4
ADMC401	Mathematics for AI & Data Science	20	20	60	1	2	100	

Prerequisite: Applied Mathematics, Discrete mathematics	
Course Objectives: The course aims to	
1	To build an intuitive understanding of Mathematics and relating it to Artificial Intelligence and Machine Learning.
2	To provide a strong foundation for probabilistic and statistical analysis mostly used in varied applications in Engineering.
3	To focus on exploring the data with the help of graphical representation and data visualisation.
4	To explore optimization and dimensionality reduction techniques.
Course Outcomes: Learners will be able to	
1	Illustrate linear algebra concepts to model, solve and analyze real-world problems.
2	Utilise probability distributions and sampling distributions in real world problems.
3	Articulate an appropriate graph representation for the given data.
4	Apply exploratory data analysis to some real data sets and provide interpretations via relevant visualization
5	Analyze various optimization techniques.
6	Understand Dimension Reduction Algorithms

Module		Topics	Hours.
1.0		**Linear Algebra**	**07**
	1.1	Vectors and Matrices, Solving Linear equations, The four Fundamental Subspaces, Eigenvalues and Eigen Vectors, The Singular Value Decomposition (SVD).	
2.0		**Probability and Statistics**	**09**
	2.1	Introduction, Random Variables and their probability Distribution, Random Sampling, Sample Characteristics and their Distributions, Chi-Square, t-, and F-Distributions: Exact Sampling Distributions, Sampling from a Bivariate Normal Distribution, The Central Limit Theorem.	
3.0		**Introduction to Graphs**	**10**
	3.1	Quantitative vs. Qualitative data, Types of Quantitative data: Continuous data, Discrete data, Types of Qualitative data: Categorical data, Binary data, Ordinary data, Plotting data using Bar graph, Pie chart, Histogram, Stem and Leaf plot, Dot plot, Scatter plot, Time-series graph, Exponential graph, Logarithmic graph, Trigonometric graph, Frequency distribution graph.	

4.0		**Exploratory Data Analysis**	**09**
	4.1	Need of exploratory data analysis, cleaning and preparing data, Feature engineering, Missing values, understand dataset through various plots and graphs, draw conclusions, deciding appropriate machine learning models.	
5.0		**Optimization Techniques**	**10**
	5.1	Types of optimization- Constrained and Unconstrained optimization, Methods of Optimization- Numerical Optimization, Bracketing Methods- Bisection Method, False Position Method, Newton's Method, Steepest Descent Method, Penalty Function Method.	
6.0		**Dimension Reduction Algorithms**	**07**
	6.1	Introduction to Dimension Reduction Algorithms, Linear Dimensionality Reduction: Principal component analysis, Factor Analysis, Linear discriminant analysis.	
	6.2	Non-Linear Dimensionality Reduction: Multidimensional Scaling, Isometric Feature Mapping. Minimal polynomial	
		Total	**52**

Text Books:

1 Linear Algebra for Everyone,
2 Gilbert Strang, Wellesley Cambridge Press.
3 An Introduction to Probability and Statistics, Vijay Rohatgi, Wiley Publication
4 An introduction to Optimization, Second Edition, Wiley-Edwin Chong, Stainslaw Zak.
5 Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press.
6 Exploratory Data Analysis, John Tukey, Princeton University and Bell Laboratories.

References:

1 Introduction to Linear Algebra, Gilbert Strang.
2 Advanced Engineering Mathematics, Erwin Kreyszig
3 Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar. Foundations of Machine Learning. MIT Press, 2018.
4 Shai Shalev-Shwartz and Shai Ben-David. Understanding Machine Learning: From Theory to Algorithms. Cambridge University Press, 2014
5 Last updated on Sep 9, 2018.
6 Mathematics and Programming for Machine Learning with R, William B. Claster, CRC Press,2020

Useful Links:

1 https://math.mit.edu/~gs/linearalgebra/
2 https://www.coursera.org/learn/probability-theory-statistics
3 https://nptel.ac.in/courses/111/105/111105090/
4 https://onlinecourses.nptel.ac.in/noc21_ma01/preview
5 https://ocw.mit.edu/courses/mathematics/18-06-linear-algebra-spring-2010/video-lectures/

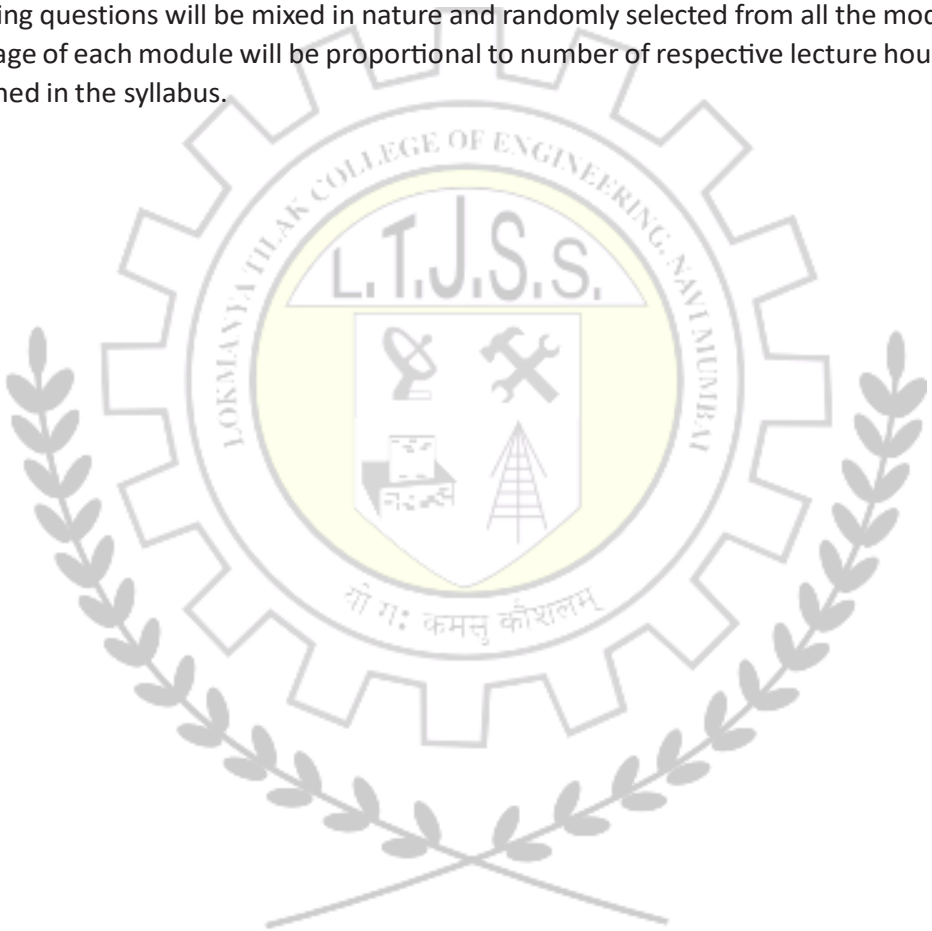
Assessment:

Internal Assessment: (20)

1. Assessment consists of two class tests of 20 marks each.
2. The first-class test is to be conducted when approx. 40% syllabus is completed and second-class test when additional 40% syllabus is completed.
3. Duration of each test shall be one hour.

End Semester Theory Examination: (80)

1. Question paper will comprise of **total 06** questions, each carrying **20 marks**.
2. **Question No: 01** will be **compulsory** and based on the entire syllabus wherein 4 to 5 sub-questions will be asked.
3. Remaining questions will be mixed in nature and randomly selected from all the modules.
4. Weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.



Minor/ Honours: Cyber Security

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	4 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					4
CSMC401	Network Security & Ethical Hacking	20	20	60	1	2	100	

Prerequisite: Computer Networks	
Course Objectives: The course aims to	
1	Understand Network and Web Security Principles
2	Develop Proficiency in Cryptography and Ethical Hacking
3	Analyze and Mitigate Web and Hardware Security Threats
4	Perform Hands-on Security Analysis and Attack Simulations
Course Outcomes: Learners will be able to	
1	Articulate the fundamentals of Computer Networks, IP Routing, and core concepts of ethical hacking
2	Demonstrate the principles of cryptographic techniques
3	Explain the principles, objectives, and phases of ethical hacking
4	Analyze web security threats, and apply security techniques to protect web applications from cyberattacks
5	Evaluate hardware security threats and its countermeasures
6	Analyze various cyber-attack scenarios, evaluate their impact, and its mitigation techniques

Module	Detailed Contents	Hrs.	CO Mapping
01	**Fundamentals of Network Security**	08	CO1
	Fundamentals of Computer Networks/IP protocol stack, IP addressing and routing, Routing protocol, Protocol vulnerabilities, Demonstration of Routing Protocols using Cisco Packet Tracer, Computer security and Network Security (Definition), CIA, Services, Mechanisms and attacks, OSI security architecture, Network security model		
	Self-Learning Topic: OSI, TCP-IP Interconnection		
02	**Introduction to Cryptography**	08	CO2
	Private-key encryption, public key-encryption, Classical Encryption Techniques, key Exchange Protocols, Cryptographic Hash Functions & applications, steganography, biometric authentication, lightweight cryptographic algorithms. Demonstration of various cryptographic tools and hashing algorithms, Message Authentication Code.		
	Self-Learning Topic: Study of elliptical curve digital signature and its benefits over RSA digital signature		

03	**Introduction to Ethical Hacking** Principles, objectives, and significance of ethical hacking, Hacker Classes. Phases of Ethical Hacking: Footprinting, Scanning, Enumeration, Vulnerability Analysis - Open VAS, Nessus, System hacking: Password cracking, penetration testing methodologies, Social engineering attacks, Malware threats and attack vectors, hacking wireless networks (WEP, WPA, WPA2), Proxy network Study of Network Security tools: Wireshark, John the Ripper, Metasploit **Self-Learning Topic:** Ransomware (Wannacry), Botnets, Rootkits	12	**CO3**
04	**Introduction to web Security and Attacks** Fundamentals of Web Security: OWASP Top 10 vulnerabilities, Web security considerations and best practices. Web Security Threats and Attacks: Bugs and security misconfigurations, Sniffing and ARP poisoning, Denial of Service (DoS) attacks, Clickjacking, Cross-Site Scripting (XSS), Cross-Site Request Forgery (CSRF), Session Hijacking and Management, Phishing and Pharming techniques. Web Security Techniques: Single Sign-On (SSO), OAuth 2.0 and API security, SQL Injection.	10	**CO4**
05	**Hardware Security Threats and Countermeasures** Introduction to Hardware Security, Importance of securing hardware components, Threats and risks in embedded systems and IoT devices Side-Channel Attacks), Demonstration of Side-Channel Attacks on RSA, Physical Unclonable Functions, Hardware Security Mechanisms: Firewalls – Protecting network and system hardware, Intrusion Detection Systems (IDS) & Honeypots – Detecting and analyzing cyber threats. **Self-Learning Topic:** IoT Security Life cycle	10	**CO5**
06	**Case Studies and Attack Demonstrations** Various attacks scenarios and their remedies. Demonstration of attacks using Damn Vulnerable Web App (DVWA).	04	**CO6**

Text Books:

1. Network Security and Cryptography -- Bernard Menezes, Cengage Learning
2. Computer Security Principles and Practice --William Stallings, Seventh Edition, Pearson Education
3. Security in Computing -- Charles P. Pfleeger, Fifth Edition, Pearson Education
4. EC-Council “Ethical Hacking and Countermeasures Attack Phases”, Cengage Learning
5. Network Security Bible -- Eric Cole, Second Edition, Wiley

References:

1. Cryptography and Network Security -- Atul Kahate, 3rd edition, Tata Mc Graw Hill, 2013
2. TCP/IP Protocol Suite -- B. A. Forouzan, 4th Edition, Tata Mc Graw Hill, 2017
3. Kevin Smith, “Hacking How to Hack - The ultimate Hacking Guide”, Hacking Intelligence
4. Kevin Beaver, “Hacking for dummies” Wiley publication
5. Mark Stamp’s Information Security Principles and Practice, Wiley
6. https://freevideolectures.com/course/4070/nptel-ethical-hacking
7. https://owasp.org/www-project-top-ten/
8. https://www.computersecuritystudent.com/

9. https://www.opentechinfo.com/learn-use-kali-linux/
10. https://pentesterlab.com

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.

Minor/ Honours: 3D Printing

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	4 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					4
DPMC401	Introduction to CAD	20	20	60	1	2	100	

Prerequisite: Basic knowledge of Engineering Graphics	
Course Objectives:	
1	To impart the 3D modelling skills for development of 3D models of basic engineering components.
2	To familiarize with basic concepts of computer graphics.
3	To familiarize with basic concepts of additive and subtractive manufacturing process
Course Outcomes: Learners will be able to	
1	Illustrate basic understanding of design.
2	Create the CAM Toolpath for specific given operations.
3	Illustrate basic understanding of types of CAD model creation.
4	Generate assembly models of given objects using assembly tools of a modelling software.
5	Identify suitable computer graphics techniques for 3D modelling.
6	Transform, manipulate objects & store and manage data.

Module	Detailed Contents	Hrs.	CO Mapping
01	**Design thinking** Identification of need, Embodiment of design, Generation of ideas and research topics	06	CO1
02	**Manufacturing** **Subtractive Manufacturing:** Introduction to NC/CNC/DNC machines **Additive Manufacturing:** Introduction to 3D Printing, Limitations of Subtractive manufacturing, Digital fabrication	07	CO2
03	**CAD Introduction** History & Scope of CAD, CAD hardware and software, Advantages, Disadvantages and Applications of CAD	08	CO3
04	**Introduction to 2D modelling** CAD models Creation, Types and uses of models from different perspectives **Introduction to assembly drawing:**	08	CO4

	Types of assembly drawings, part drawings, drawings for catalogues and instruction manuals, patent drawings, drawing standards		
05	**Computer Graphics** Overview of 2D and 3D Computer Graphics, Parametric representation of curves: Synthetic Curves - Bezier curves, Hermite Curves, B-spline curves **Geometric Modelling:** Wire Frame Modelling, Solid Modelling, Surface Modelling, Parametric Modelling, Feature based Modelling, Constraint Based Modelling.	**07**	**CO5**
06	**Geometric Transformation** 2D & 3D Transformations (Translation, Rotation, & Scaling & Reflection), Concatenations	**07**	**CO6**

Text/Reference Books: -

1. Machine Drawing by N.D. Bhatt.
2. A textbook of Machine Drawing by Laxminarayan and M.L.Mathur, Jain brothers Delhi
3. CAD/ CAM, Theory & Practice, Ibrahim Zeid, R. Sivasubramanian, Tata McGraw Hill Publications
4. CAD/CAM Principles and Applications, P. N. Rao, Tata McGraw Hill Publications
5. CAD/CAM Computer Aided and Manufacturing, Mikell P. Groover and Emory W. Zimmers, Jr., Eastern Economy Edition
6. CNC Technology and Programming, Krar, S., and Gill, A., McGraw Hill Publishers.
7. Medical Modelling The Application of Advanced Design and Rapid Prototyping Techniques in Medicine, Richard Bibb, Dominic Eggbeer and Abby Paterson, Woodhead Publishing Series in Biomaterials: Number 91, Elsevier Ltd.
8. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, I. Gibson l D. W. Rosen l B. Stucker, Springer Publication.

Website Reference / Video Courses:

1. https://nptel.ac.in/courses/112/102/112102101/
2. https://nptel.ac.in/courses/106/102/106102065/
3. https://nptel.ac.in/courses/106/102/106102065/
4. https://nptel.ac.in/courses/112/102/112102103/
5. https://nptel.ac.in/courses/112/105/112105211/
6. https://nptel.ac.in/courses/112/104/112104265/
7. https://www.youtube.com/watch?v=2cCMty9v3Tg
8. https://www.youtube.com/watch?v=2zPh26Q1BT8

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

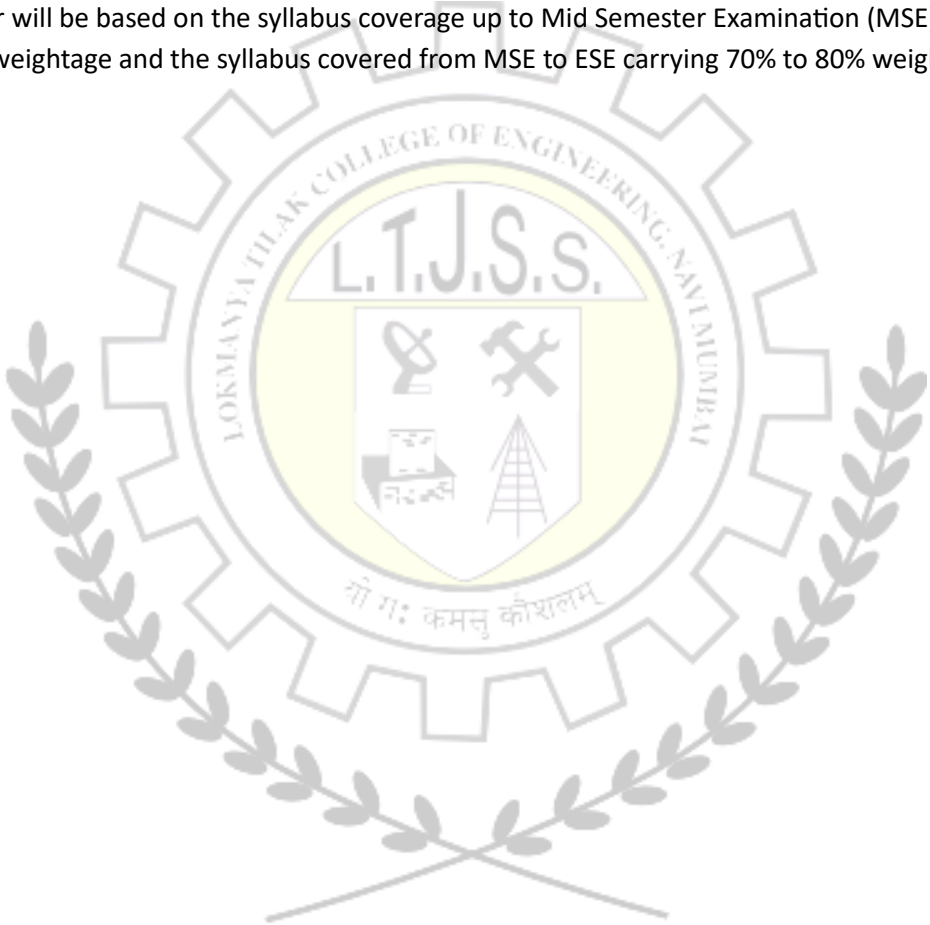
Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.



Minor/ Honours: Electric Vehicles

Course Code	Course Name	Examination Scheme						Lecture
		Marks Distribution			Exam Duration (Hrs)		Total Marks	4 Hrs
		Internal Assessment		End Semester Exam (ESE)	MSE	ESE		Total Credits
		Mid Sem Exam (MSE)	Continuous Internal Evaluation (CIE)					4
EVMC401	Vehicular Systems and Dynamics	20	20	60	1	2	100	

Prerequisite: Basic knowledge of Electrical systems	
Course Objectives: The course aims	
1	To study different automotive components and subsystems
2	To explore and compare the transition of automotive domain from ICE to electric vehicles
3	To study the architecture used in EV/ HEV
Course Outcomes: Learners will be able to	
1	Explain the general configuration and identify various components of automobile.
2	Demonstrate the functionality and principles of different types of Automotive Powertrains working
3	Explain illustrate the working of various automotive transmission systems
4	Identify and illustrate the various hybrid electric powertrains and their different modes of operations
5	Explain the basic and state of the art of Electric vehicles and its major parts.
6	Compare and contrast the performance of ICE vehicles, HEVs and EVs

Module	Detailed Contents	Hrs.	CO Mapping
01	**Vehicle Mechanics** History of Vehicle Development, General Configuration of Automobile, Body and Chassis Fundamentals: General Packaging, Types of Structural System, Backbone Construction; Body and Chassis Materials. Automotive Powertrain Mechanical, Suspensions system, Steering System, NVH, Control System Integration and Implementation. Front-Wheel Drive (FWD) Powertrains, Rear-Wheel Drive Powertrains (RWD), Multi-Wheel Drive Powertrains (AWD and 4WD)	10	**CO1**
02	**Transmission Systems** Transmission gears, Manual Transmission (MT), Automatic Transmission (AT), Automated Manual Transmissions (AMT) and Continuously Variable Transmissions (CVT); Manual Transmissions Powertrain Layout and Manual Transmission Structure, Power Flows and Gear Ratios, Manual Transmission Clutch and its structure. Drivetrain and Differential **Self-Learning Topic**: Power train assembly, idea of gears	10	**CO2**
03	**Automotive Subsystems**	06	**CO3**

	Automotive Aero-dynamics, Vehicle Power Demand Analysis; Types of suspension and drive, Braking systems, Tyre Mechanics: Tyres and wheels, Tyre characteristics; Vehicle handling & stability; Automotive instrumentation		
	Self-Learning Topic: Forces acting on vehicle movement		
04	**ICE Performance Characteristics:**	06	**CO4**
	Power and torque generation, specific fuel consumption, specific emissions, Efficiencies- fuel conversion efficiency, mechanical efficiency, volumetric efficiency		
	Self-learning Topic: Ideal characteristics of ICE,		
05	**Hybrid Powertrain**	10	**CO5**
	Series HEVs, Parallel HEVs, Series–Parallel HEVs, Complex HEVs, Operating Modes, Degree of Hybridization, Comparison of HEVs, Plug-in Hybrid Electric Vehicles (PHEVs), Real Life examples of HEVs		
06	**Electric Vehicles**	10	**CO6**
	Basics of Electric Vehicles, Current Status and Trends for EVs, Battery Electric Vehicles (BEVs), Fuel-Cell Electric Vehicles (FCEVs), Electric Machines for EV applications, EV Transmission: Single-Speed EV Transmission, Multiple Ratio EV Transmissions. Comparison of ICE vehicle with HEVs and EVs. National Policy for adoption of EVs		
	Self-Learning Topic: Specifications of AC/DC motors used in EV and HEV		

Text Books:

1. Vehicle Powertrain Systems by Behrooz Mashadi and David Crolla, Wiley, 2012
2. Automotive Aerodynamics by Joseph Katz, Wiley, 2016
3. Automotive Chassis Engineering, by David C. Barton and John D. Fieldhouse, Springer, 2018
4. Automotive Engineering Powertrain, Chassis System and Vehicle Body Edited by David A. Crolla, Elsevier, 2009
5. Automotive Power Transmission Systems by Yi Zhang and Chris Mi, Wiley, 2018
6. Linear Electric Machines, Drives, and MAGLEVs Handbook, by Ion Boldea, CRC Press. 2013
7. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles by Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, and Ali Emadi, CRC Press 2005
8. Electric Vehicle Technology Explained by James Larminie and John Lowry, John Wiley, 2003
9. Electric And Hybrid Vehicles- Design Fundamentals by Iqbal Husain, CRC Press, 2005 Edition.

Reference Books:-

1. Encyclopaedia of Automotive Engineering edited by David Crolla et al, Wiley, 2014
2. Design and Control of Automotive Propulsion Systems by Zongxuan Sun and Guoming Zhu, CRC Press, 2015
3. The Automotive Transmission Book by Robert Fischer, Ferit Küçükay, Gunter Jürgens, Rolf Najork, and Burkhard Pollak, Springer, 2015
4.Noise and Vibration Control in Automotive Bodies by Jian Pang, Wiley, 2019

Website Reference / Video Courses:

1. NPTEL Web course: Fundamentals of Automotive Systems, by Prof. C.S. Shankar Ram, IIT Madras, https://nptel.ac.in/courses/107/106/107106088/

Internal Assessment (40 Marks)

A. Mid Semester Exam (20 Marks)

Mid semester examination will be based on 40 % to 50% of the syllabus.

B. Continuous Internal Evaluation (20 Marks)

1. Assignment: 5 Marks
2. Quiz/Open book test/Presentation: 10 Marks
3. Regularity and attendance: 5 Marks

End Semester Examination (60 Marks)

End semester will be based on the syllabus coverage up to Mid Semester Examination (MSE) carrying 20% to 30% weightage and the syllabus covered from MSE to ESE carrying 70% to 80% weightage.