

VEERMATA JIAJABAI TECHNOLOGICAL INSTITUTE, MUMBAI

Circular

Open Elective M. Tech (Semester I)

Open Elective / M. Tech_Semester I/ AY 2025-26

Date: 18th September, 2025

Students in First year of M. Tech (Semester I) are required to submit a Google form for an open elective during semester I (from 18th September, 2025 to 20th September, 2025.)

Google Link: - <https://forms.gle/Bk6942BAX7sjgiFv9>

Rules:

Once selected, the course will not be changed under any circumstances. Therefore, students should be careful while selecting the course

In case number of students opting for a particular course is less than 25, the course will be not being offered.

Opting open elective from another department is mandatory.

Students should not study same course as core/programme elective and open elective. e.g., Students of M. Tech (AIDS) having Machine Learning as elective course should not opt for Artificial Neural Networks and Machine Learning open elective.

Sd/-
Dr. Arvind Deshpande
Associate Dean Academics

Open Elective at Institute Level (M. Tech Semester I AY 2025 - 26)

Sr. No.	Course Title	Department Offering Elective Course
1	Sustainable Development	Civil
2	Database Management Systems	Computer
3	3D Printing	Mechanical
4	Artificial Neural Networks and Machine Learning	Electrical
5	Entrepreneurship & Development	Production
6	Continuum Solid Mechanics	Structural

Interdisciplinary Open Elective Course 01: Sustainable Development								
SN	Course Code	Course Title	L-T-P (Hours/Week)	Credit	TA	IST	ESE	ESE hours
2	CECM5061S-B	Sustainable Development	3-0-0=3	3	20	20	60	3

Course Outcomes:

After completion of course students will be able to

CO1: Describe sustainable development, development processes and relate impact of various levels of development

CO2: Formulate the methodology for assessment of sustainability of project using various indicators.

CO3: Apply environmental legislations to various development processes and projects

1 Development
Goals and means of development, MDG's and SDG's sustainable development, Comparing levels of development, GDP, GNP, global development level

2 Industrialization and Post-industrialization era
Major structural shifts, knowledge revolution, implications for development sustainability

3 Environmental episodes
Ozone depletion, global warming, greenhouse effect, Bhopal gas tragedy etc

4 Pollutions
Major sources, permissible standards and controls of urban air pollution, water pollution, Solid and hazardous waste disposals

5 Climate Change and the various industrial sectors
The Risk of Global Climate Change, impact of CC & CN due to various industrial sectors

6 Environmental legislations
Legislative provisions and measures towards sustainability

7 Indicators of Development Sustainability
Composition of National wealth, Accumulation of National Wealth as an Indicator of Sustainable Development, Development Goals and Strategies, Gross happiness index, Millennium Development Goals, Role of National Development Policies, Life cycle assessment, Carbon foot print

References Books:

1 Tatyana P. Soubbotina, Beyond Economic Growth: An Introduction to Sustainable Development, World Bank Institute Learning Resources Series, 2Nd edition, 2004. (ISBN: 08213-5933-99)

2 P. P. Roger, F. J. Jalal and J. A. Boyd, An Introduction to Sustainable Development, Earthscan Publications, 2nd edition, 2008. (ISBN: 9781844075201/1844075206)

Reference Books:

1 T. Strange and A. Bayley, Sustainable Development: Linking Economy, Society, Environment, 2008. (ISBN: 9789264047785)

2 H. G. Brauch, Sustainable Development and Sustainability Transition Studies, Series: Springer Briefs in Environment, Security, Development and Peace, Series Ed.

3 G. Marletto, S. Franceschini, C. Ortolani and C. Sillig, Mapping Sustainability Transitions: Networks of Innovators, Techno-economic Competences and Political Discourses, Springer Briefs in Business, 2016. (ISBN: 9783319422725/9783319422749)

Programme Name	M. Tech. Computer Engineering		
Course Code	COCE5061S		
Course Title	Database Management Systems		
Course Type	Open Elective		
Prerequisites: Nil.			
Course Outcomes: At the end of the course student will be able to: CO1. Differentiate various database architectures. CO2. Design and implement relational databases. CO3. Execute MongoDB commands to manipulate data. CO4. Use advanced XML queries on database. CO5. Apply practices of implementing database security. CO6. Perform transaction processing and achieve concurrency control.			
	Course Contents	Hrs.	CO
1.	Introduction to Database Management Systems and Enhanced Data Models for Advanced Applications: Characteristics of database, Database users, Advantages of DBMS, Data Models, Schema and Instances, Three schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment, Centralized and Client / Server Architecture for DBMS. Introduction to Temporal Database and Multimedia Databases.	4	CO1
2	Relational-Database Design and SQL: Functional dependencies, Normalisation forms, Decomposition, Overall database design process. SQL: DDL: Create, Modify, Alter, Drop, View definition, etc.DML: SELECT, INSERT, DELETE, Update, Nested Query, SQL with SET operations: Union, Intersect, Except, etc, Aggregate Functions: Group By, Having, SUM, etc, SQL with Logical operations, Nested and Complex Queries, Join Queries. DCL : GRANT, REVOKE, etc DBA level query. Cursors and Triggers, Procedures and Functions, Partitions, SQL Backup and Recovery.	8	CO2
3.	Introduction to NoSQL Databases: Introduction, Design of parallel systems, Parallel query processing. Avenues for parallelism, Array and vector processors. Multiprocessor architecture: taxonomy of parallel architectures, Parallel Query Evaluation. Advanced Transaction Processing Non-relational DBMS: consistency and availability trade-offs, NoSQL DBMS (key-value, document, and graph), MongoDB: CRUD operations.	8	CO3

4.	XML Databases: Introduction to XML Documents and Databases, XML schemas, tree structure, and DOM, XML Query.	6	CO4
5.	Database Security: Introduction to major database attacks: SQL Injection, DoS/DDoS etc. Encryption and Public Key Infrastructures.	4	CO5
6.	Transaction Processing and Concurrency Control: Schedules and serializability, Lock management, Compensation and Databases, Deadlock Handling, Multiple granularity, validation protocols, multi-version protocols, snapshot isolation, predicate locking, Weak Levels of Consistency in Practice.	8	CO6

Text Books

1.	Elmasri, Navathe. Fundamentals of Database Management systems, Pearson Education, 2008.
2.	Avi Silberschatz, Henry F. Korth, S. Sudarshan. Database System Concepts, Seventh Edition, McGraw-Hill, 2010.
3.	P. Sadalage and M. Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison Wesley, 2012.

Reference Books

1.	Thomas Connolly and Carolyn Begg, "Database Systems" 3rd Edition, Addison-Wesley, 2005.
2.	V.S. Subrahmanian, "Multimedia database systems", Springer, 1996.

Program	M. Tech. (All Branches)	Semester - I
Course Code	PEPM5061S	
Course Title	Entrepreneurship Development	
	<p>Course outcomes: On the completion of this course, the learner will able to</p> <ol style="list-style-type: none"> 1. Demonstrates skills required by an entrepreneur 2. Analyze business opportunities and the basics to create, launch and manage new businesses 3. Develop a Business Model for their Idea/Problem 4. Create MVP (Minimum Viable Product). 	
	Syllabus	
1.	<p>Introduction Discover yourself – Find your Flow, Effectuation, and Identify your entrepreneurial style</p>	
2.	<p>Problem Identification and Idea generation Identify Problems worth Solving, Introduction to Design Thinking, generate ideas that are potential solutions to the problem identified, GOOTB: Run problem interviews with prospects, Class Presentation: Present the problem you "love", Team Formation.</p>	
3.	<p>Customer Study and Value Proposition Identify Your Customer Segments and Early Adopters - Market Types, Segmentation, and Targeting, Defining the personas; Understanding Early Adopters and Customer Adoption Patterns, Customer identification, Market, Creative solution;</p> <p>Craft Your Value Proposition - Come up with creative solutions for the identified problems, Deep dive into Gains, Pains, and “Jobs-To-Be-Done” (using Value Proposition Canvas, or VPC), and Identify the UVP of your solution using the Value Proposition section of the VPC, Outcome-Driven Innovation.</p>	
4.	<p>Business Model Canvas Get Started with Lean Canvas - Basics of Lean Approach and Canvas; Types of Business Models (B2B; B2C), Sketch the canvas- "Document your Plan A", Intro to Risks; Identify and document your assumptions (Hypotheses); identify the riskiest parts of your Business Plan, Risk identification, Class Presentation: Present your Lean Canvas.</p>	

5.	Validation Develop the Solution Demo - Build solution (mock-ups) demo, How to run solution interviews, GOOTB: Run Solution interviews, Does your solution solve the problem for your customers: The problem-solution test. Sizing the Opportunity - Differences between a Start-up venture and a small business; Industry Analysis: Understanding what is Competition and its role, Analyse competition; Building an MVP - Identification of MVP, Solution development, building products/services, Build-measure-learn loop for development
6.	Money Revenue streams, Pricing, and cost, Financing Your New Venture - Venture financing, Investor expectations.
7.	Team building Shared leadership, the role of a good team, how to pitch to candidates to join your startup Collaboration tools and techniques - Brainstorming, Mind mapping, Kanban Board, #Slack
8.	Marketing and sales Positioning of Products/Services, Channels, and strategies, Building Digital Presence and leveraging Social media, Budgeting, and planning. Sales planning - Buying decisions, Sales planning, setting targets, Unique Sales Proposition (USP); Art of the sales pitch (focus on customers' needs, not on product features), Follow-up and closing a sale; Asking for the sale.
9.	Support Planning and tracking - Importance of project management to launch and track progress, Understanding time management, workflow, and delegation of tasks. Business Regulation - Basics of business regulations of starting and operating a business; Importance of being compliant and keeping proper documentation; How to find help to get started.
	Text Books
1.	Roy R.: Entrepreneurship, Oxford University Press.
2.	Maurya A.: Running Lean: Iterate from Plan A to a Plan That Works. O'Reilly Media
	References
1.	Jeffrey A: New venture creation, Tata McGraw Hill
2.	Osterwalder, A and Pigneur Yves: Business Model Generation: A Handbook for Visionaries, Game Changers and Challengers.
3.	Gupta T. S: Intellectual Property Law in India, Kluwer Law International.
4.	Saraswathi S.D: Effectuation: Elements of Entrepreneurial Expertise. Edward Elgar

	Publishing.
5.	Kim W. C. and Mauborgne R: Blue Ocean Strategy, Harvard Business School Press.
6.	Ries, E.: The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, The Crown Publishing Group

Programme Name	Masters of Technology in Mechanical Engineering with Specialization in CAD/CAM Robotics
Course Code	MECC5061S
Course Title	3D Printing

Course Outcomes

After completion of course, students would be able to

1. Understand and evaluate various existing Product Development processes
2. Develop new technologies in the field Rapid Prototyping Manufacturing
3. Generate innovative ideas to reduce time and cost by developing new methods and materials for the modern manufacturing industry.

Course Contents

Rapid Product Development

Product Developing Cycle, Definition of Rapid Product Development, Virtual prototypical and rapid manufacturing technologies, Physical Prototyping & rapid manufacturing technologies, Synergic integration technologies

Rapid Prototyping Processes

Principal of Rapid Prototyping, Various RP technologies, Selection of a suitable RP process for a given application, Status of outstanding issue in RP- accuracy, speed, materials (strength, homogeneity and isotropy), Emerging Trends

Rapid Tooling

Introduction to Rapid Tooling, Indirect Rapid Tooling Processes, Direct Rapid Tooling Processes, Emerging Trends in Rapid Tooling

Reverse Engineering

Data Extraction, Data Processing

Applications and Case Studies

Engineering Applications, Medical Applications

Processing of Polyhedral Data

Polyhedral BRep modeling, Introduction to STL format, Defects and repair of STL files, Overview of the algorithms required for RP&T and Reverse Engineering

Laboratory and Demonstration Sessions

Exercise using 3D CAD software, Preparation STL files processing, Making models on FDM RP machine, Demonstration of Silicon Rubber Molding and Application of post processing techniques on FDM parts.

Recommended Reading

1. Chua Chee Kai and Leong Kah Fai, Rapid Prototyping Principles and Applications in Manufacturing, John Wiley & Sons, 1997.
2. K.P.Karunakaran, Rapid Product Development & Manufacturing, IIT, Bombay, 1st edition, 2013.
3. Peter D. Hilton and Paul F. Jacobs (Editors.), Rapid Tooling Technologies and Industrial Applications, Marcel Dekker. 4th edition, 2000.
4. Todd Grimm, User's Guide to Rapid Prototyping, Society of Manufacturing Engineers, 1st edition, 2004.
5. Paul F. Jacobs, Stereo-lithography and Other RP&M Technologies from Rapid Prototyping to Rapid Tooling, SME/ASME, 1996.
6. N. Hopkinson, R. J. M. Hague, and P.M. Dickens, Rapid Manufacturing , An Industrial Revolution for the digital age, John Wiley & Sons, Ltd, 2nd edition, 2006.
7. Ken Pimentel, Kevin Teixeira, Virtual Reality, Windcrest/McGraw-Hill, 1st edition, 2003.
8. Andreas Gebhardt, Rapid Prototyping, Hanser Publishers, 2nd edition – 2003.
9. Rafiq Noorani, Rapid Prototyping Principles and Applications, John Wiley & Sons -1st edition, 2006.
10. Wasim Ahmed Khan, Abdul Raouf, Kai Cheng, Virtual Manufacturing, Springer, 2011

Programme Name	M. Tech. (IoT), SEMESTER-I (Open Elective)
Course Code	EEIT5061S
Course Title	ARTIFICIAL NEURAL NETWORKS AND MACHINE LEARNING

COURSE OBJECTIVE

The course is designed to introduce the field of neural network systems and Artificial Neural Networks. The basic concepts of machine learning are also the main goal of this subject.

COURSE OUTCOME

Students will be able to understand the fundamental concepts of the neural network systems. This area new field of research thus students will get to know about the recent trends in research fields.

Module 1: Introduction: Biological neurons and memory
Structure and function of a single neuron; Artificial Neural Networks (ANN); Typical applications of ANNs : Classification, Clustering, Vector Quantization, Pattern Recognition, Function Approximation, Forecasting, Control, Optimization.
Module 2: Supervised Learning
Single-layer networks; Perceptron-Linear separability, Training algorithm, Limitations; multi-layer networks-Architecture, Back Propagation Algorithm (BTA) Adaptive Multi-layer networks-Architecture, training algorithms; Recurrent Networks; Feed-forward networks; Radial-Basis-Function (RBF) networks;
Module 3: Unsupervised Learning
Winner-takes-all networks; Hamming networks; Maxnet; Simple competitive learning; Vector-Quantization; Counter propagation networks; Adaptive Resonance Theory; Kohonen's Self-organizing Maps; Principal Component Analysis.
Module 4: Associated Models and Optimization Methods
Hopfield Networks, Brain-in-a-Box network; Boltzmann machine; Hopfield Networks for- TSP, Solution of simultaneous linear equations; Iterated Gradient Descent; Simulated Annealing; Genetic Algorithm.
Module 5: Introductory Material to Machine Learning and AI
Motivations for Studying ML, Supervised and Unsupervised learning, Machine Learning in the Large
Module 6: Classical and Theoretical ML Topics

Concept Learning (also called Learning from Examples), Learning from Analogy, Explanation Based Learning, Structure Learning, Reinforcement Learning, Decision Tree Learning, Decision List Learning , Oracle Based Learning, Probably Approximately Correct (PAC) Model, Boosting, Bayesian Learning: Maximum Likelihood Estimates, Parameter Estimation, Bayesian Belief Networks
Expectation Maximization as a fundamental technique, Hidden Markov Models (HMM): Motivation for Generative Models, Forward-backward Algorithm, BaumWelch Iteration, Feature Enhanced HMM.
Module 8: Maximum Entropy Markov Models (MEMM)
Motivation for Discriminative Models, Training of MEMMs (v) Introductory Optimization Based Methods: Neural Nets, Support Vector Machines, Genetic Algorithms (v) Applications: Text Learning, Speech Processing, Data Mining, Bioinformatics

Reference Books:

1. Simon Haykin, “Neural Networks - A Comprehensive Foundation”, Macmillan Publishing Co., New York, 1994.
2. A Cichocki and R. Unbehauen, “Neural Networks for Optimization and Signal Processing”, John Wiley and Sons, 1993
3. J. M. Zurada, “Introduction to Artificial Neural Networks”, (Indian edition) Jaico Publisher, Mumbai, 1997.
4. Hui Jiang, “Machine Learning Fundamentals: A Concise Introduction” Cambridge University Press, 2022
5. Alexander Jung, “Machine Learning: The Basics (Machine Learning: Foundations, Methodologies, and Applications)” Springer, 2022

Programme Name	M. Tech. (Civil Engineering with Specialization in Structural Engineering)
Course Code	CESE5061S
Course Title	Continuum Solid Mechanics

COURSE OUTCOME:

After completion of this course students shall be able to

CO1: define basic definitions of modern continuum mechanics, such as deformations, strains, stress, constitutive equations of linear and non-linear materials.

CO2: apply basic elasticity formulation in 2-D and 3-D domains for rectangular and polar coordinate systems.

CO3: apply energy theorems for the elasticity solutions.

Introduction

Stress transformation and strain transformation at a point in an elastic body, 3D problems, rigid body translation and rotation of an element in space, formulation of generalized Hooke's law, derivation of displacement for a general displacement field u, v, w , evaluation of principal stresses and strains at a point. Tensor notations for stresses and strains at a point.

2-D Problems in Continuum Mechanics

Study of plane stress and plain strain idealizations of problems. Application of equilibrium and compatibility conditions to solve a problem of continuum mechanics. Application of boundary conditions and stress functions approach for solution of problems. 2-D problem formulation in rectangular coordinates, polynomial solutions and cantilever loaded at the end, simply supported beam under uniformly distributed load and linear loading. 2-D problem in polar coordinates, stress distribution about an axis, pure bending of curved bars, displacement for symmetrically loaded cases, bending of a curved bar by forces at end. Stress analysis of plates with circular hole due to in plane loading. Stress analysis in structures due to a concentrated load at a point of a straight boundary. Stress analysis of circular disks and wedges. 2-D formulation for stress analysis of prismatic bars of elliptical, rectangular, triangular and other sections subjected to torsion by Membrane Analogy.


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3-D Problems in Continuum Mechanics

Application of equilibrium and compatibility conditions to 3-D problems in continuum mechanics. Problems of rods under axial stress, bar under its own weight and pure bending of prismatic rods. Bending of prismatic bars as a problem of continuum mechanics in 3-D. Bending of a cantilever, stress function for circular and rectangular sections of bars.

Energy Theorems

Applications of complementary energy theorems to the problems of continuum mechanics
Case studies: Related to structural engineering problems.

Recommended Reading

1. Wang C. T., Applied Elasticity, McGraw Hill Book Co., 1953.
2. Timoshenko S. P. and Krieger S. W., Theory of Plates and Shells, McGraw Hill International Ed., 1959.
3. Timoshenko S. P. and Goodier J. N., Theory of Elasticity, McGraw Hill Book Company, International Ed., 1970.
4. Shames H. and Cozzarellie F. A., Elastic and Inelastic Stress Analysis, Prentice Hall New Jersey, 1992.
5. Chandrasekharaiah D. S. and Debnath L., Continuum Mechanics, Prism Books Pvt. Ltd., Bangalore, 1994.
6. Srinath L. S., Advanced Mechanics of Solids, Tata McGraw-Hill Education, 2009.
7. Boresi Arthur P., Chong K., Lee J. D., Elasticity in Engineering Mechanics, Wiley and Sons, 2011.
8. Budynas R. G., Advanced Strength and Applied Stress Analysis, WCB/McGraw-Hill, 1999.


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