VEERMATA JIAJABAI TECHNOLOGICAL INSTITUTE
MATUNGA, MUMBAI 19

Notice

Circular / Open Elective / Semester VI/ AY 2025-26 /01 Date 31st December 2025

Course Name, Detail Curriculum and Eligibility criteria of Open Elective Courses to be offered for VI semester of the Academic Year 2025-26 are given below. Students are requested to submit google form for open elective of semester VI (from 31 December 2025 to 4th January 2026).

Link of Google form: **https://forms.gle/u9qhUskrxgLWAMv17**

Rules:

1. Once selected, the course will not be changed under any circumstances. Therefore, students should be careful while selecting the course.
2. In case number of students opting for a particular course is less than 25, the course will not be offered.
3. **Students will not be allowed to learn same course contents twice. Students who have taken MDM of Entrepreneurship and Start-up can not opt for Business Development: from start to scale open elective. Also students of Computer Engineering and Information Technology can not opt for Financial Management open elective.**
4. **If students opt for online courses, they will have to enroll on NPTEL platform. Once enrolled, the videos and associated study material may also be downloaded for free. Learning from the course, submitting assignments, participating in the discussion forum is free. Mid Semester Test(MST) and End Semester Examination(ESE) will be conducted by the institute.**

Associate Dean Academics

Open Elective at Institute Level
(B. Tech VI Semester AY 2025-26)

Sr. No	Course Title	Department Offering Elective Course
1	Professional Communication Skills	Humanities and Management
2	Nonlinear Dynamics	Mathematics
3	Differential Geometry	Mathematics
4	Combinatorics and Graph Theory	Mathematics
5	Practices to Performance: Pathways to Enterprise Sustainability	Technical and Applied Chemistry
6	Nanoscience and Nanotechnology for Engineers	Physics
7	Financial Management	Humanities and Management
8	Leadership and Team Effectiveness (Online)	NPTEL
9	Principles of Management (Online)	NPTEL
10	Business Development: from start to scale (Online)	NPTEL

VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE
Matunga, Mumbai - 400 019
AY 2025-2026

Programme Name	**Third Year B.Tech. Institute Level Elective**	**Semester V**
Course Offered by	**Humanities and Management**	
Course Title	**Professional Communication Skills**	
Scheme	**3 Lec + 1 Tutorial**	
Credit	**4**	
Exam	**MST: 40; ESE: 60**	

Course Outcomes

Students will be able to:

1. Apply the principles and practices of business communication for communicating in a professional environment.
2. Design a technical document with correctness of language, appropriate vocabulary and style.
3. Deliver formal presentations employing an effective range of verbal and nonverbal skills.
4. Recognize the attributes of a suitable candidate for a job, through participation in group discussion, interview and resume writing.

Unit	Course Contents	Hours
1.	**Week 1: Foundations of Professional Communication** **Lecture:** Basics of Business Communication; Verbal & Non-verbal Communication in Professional Settings **Tutorial:** ATS-friendly Resume Writing, LinkedIn Branding	**08**
2.	**Week 2: Barriers & Channels of Communication** **Lecture:** Barriers to Communication; Role of Communication in the AI age **Tutorial:** Case Study Analysis	**04**

3.	**Week 3: Technical & Workplace Writing Style** **Lecture**: Style, Organisation, and Clarity in Technical Writing **Tutorial**: Editing exercises + Workplace Email Writing (professional email, follow-up, escalation)	**04**
4	**Week 4: Technical Proposal Writing** **Lecture**: Structure of Business & Technical Proposals **Tutorial**: Drafting Business Proposal Outline (unique product/service idea)	**02**
5	**Week 5: Public Speaking for Engineers** **Lecture:** Public Speaking Techniques; Handling Stage Anxiety, Decoding Powerful Speeches **Tutorial:** Evaluating a Professional Talk (Video-based), Speech Activity	**04**
6	**Week 6: Group Discussion Fundamentals** **Lecture**: GD Types, Roles, and Evaluation Criteria (Placement Focus) **Tutorial**: Practice GDs with structured feedback	**08**
7	**Week 7: Interview Skills – Foundations** **Lecture**: Interview Types; Common HR & Behavioral Questions **Tutorial**: Mock Interviews and written answers to common interview questions	**04**
8	**Week 8: Business & Corporate Ethics** **Lecture:** Ethics in Engineering, AI, Data Privacy **Tutorial:** Case-based ethical dilemma discussions	**02**
8	**Week 9: Business & Corporate Ethics** **Lecture:** Ethics in Engineering, AI, Data Privacy **Tutorial:** Case-based ethical dilemma discussions	**04**

Pedagogy:

1. Reading and studying the prescribed textbooks
2. Tutorials will comprise analysis of popular culture including books, documentaries and films.
3. Students will be required to make field visits as a part of environmental study
4. Interaction with the experts and guest speakers

Primary Study Material:

1. H. S. Mukherjee, Business Communication: Connecting at Work, Oxford University Press; Pap/Cdr edition (26 November 2012), (ISBN: 9780198073475)

2. A. Rizvi, Effective Technical Communication, McGraw Hill Education; 1 edition (27 June 2005), (ISBN: 0070599521)

3. M. Raman, P. Singh, Business Communication, Oxford; Second edition (6 August 2012), (ISBN: 9780198077053)

Secondary reading and reference books:

1. E. H. Mcgrath, Basic Managerial Skills for All, Prentice Hall India Learning Private Limited; 9 edition (2011), (ISBN: 9788120343146)

2. R. Subramanian, Professional Ethics, Oxford University Press; Second edition (17 April 2017), (ISBN: 0199475075)

Course Code		Semester	VI	Credits	3	Lectures/Week	3L/1T/0P
Course	Differential Geometry						

Course Outcomes:

After the completion of this course, the student should be able to

1. Utilize scalar and vector fields to solve problems on surfaces; Interpret physical significance of gradient, divergence and curl;
2. Develop an understanding of isometries and invariance in Euclidean spaces;
3. Parametrize a given curve in the plane and determine its signed curvature; Obtain a curve in space using given curvature and torsion functions;
4. Describe a surface by parametrization or through an implicit form, be familiar with standard surfaces;
5. Determine orientability of a surface through differentials of smooth functions; Describe the nature of a surface through the Gauss and Weingarten maps;
6. Use different types of curvatures of a surface in real-world applications.

Module	Content	Hours
1	**Vector Calculus** Scalar and Vector Fields; Gradient, Divergence and Curl; Line, Surface and Volume Integrals	4
2	**Isometries of Euclidean Spaces** Definition of Isometry, Orientation-preserving isometries, Orthogonal Transformations and Matrices, Isometries of the Plane: Translations, Rotations, Reflections and Glides.	5
3	**Planar and Spatial Curves** Regular Curves in the Plane and in Space, Arc-Length Parametrization, Signed Curvature for Planar Curves, Curvature and Torsion for Spatial Curves, Invariance with respect to Isometries, The Frenet-Serret Equations, Fundamental Theorem for Space Curves.	6
4	**Regular Surfaces** Surfaces in Space, Level Sets and Graphs, Quadrics, Ruled Surfaces, Tangent Space to a Surface at a Point, Smooth Functions on Surfaces, Differentials, Orientability.	6
5	**Curvature of a Surface** The First and the Second Fundamental Forms, Gauss Map, Weingarten Map, Curvatures of a Surface: Principal, Normal, Gaussian, Mean; Geodesics, Minimal Surfaces.	6
6	**Applications in Engineering** Structural Deformations; Robotics and Motion Planning; Optimal Control; Behaviour of Electromagnetic Fields; Shape Optimization and Recognition	5

Reference Books:

- A. Pressley, Elementary Differential Geometry, Springer Undergraduate Texts in Mathematics.
- C. Bar, Elementary Differential Geometry, Cambridge University Press.
- M. Do Carmo, Differential Geometry of Curves and Surfaces, Dover.
- G. B. Thomas and R. L. Finney, Calculus and Analytic Geometry, Pearson.
- G. Anastassiou and I. Iatan, Intelligent Routines II: Solving Linear Algebra and Differential Geometry with SAGE, Springer.

Course Code		Semester	VI	Credits	3	Lectures/Week	3L/1T/0P
Course	Nonlinear Dynamics						

Course Outcomes:

After the completion of this course, the student should be able to

1. Describe the behaviour of solutions of differential equations using phase portraits;
2. Develop an understanding of higher-dimensional linear systems using methods from linear algebra;
3. Describe the nature of equilibria of nonlinear systems;
4. Utilize various nonlinear techniques in understanding and solving systems;
5. Understand applications of nonlinear dynamics in various fields of engineering and technology.

Module	Content	Lectures
1	**Planar Systems** First-Order Equations; The Poincare Map, Linearity Principle; Second-Order Equations; Phase Portraits, Classification of Planar Systems	6
2	**Higher Dimensional Linear Systems** Preliminaries from Linear Algebra: Eigenvalues, Eigenvectors, Bases and Subspaces, Genericity; Harmonic Oscillators; Exponential of a Matrix; Nonautonomous Linear Systems	6
3	**Nonlinear Systems and Equilibria** Dynamical Systems, Continuous Dependence of Solutions, The Variational Equations; Nonlinear Sinks, Sources and Saddles; Stability and Bifurcations	6
4	**Nonlinear Techniques** Nullclines, Stability of Equilibria, Gradient Systems, Hamiltonian Systems, The Poincare-Bendixson Theorem and its Applications	5
5	**Applications of Nonlinear Dynamics** Biology: Infectious Disease Modeling, Predator-Prey Systems; Circuit Theory: Lienard Equation, van der Pol Equation, Hopf Bifurcation; Mechanics: Conservative Systems, Central Force Systems, Classical Limits of Quantum Mechanical Systems; Strange Attractors: Lorenz, Chaotic, Roessler; Discrete Dynamical Systems	9

Reference Books:

- M. Hirsch, S. Smale and R. Devaney, Differential Equations, Dynamical Systems, and an Introduction to Chaos, Elsevier Academic Press, 2004.
- L. Perko, Differential Equations and Dynamical Systems, Springer-Verlag, 2001
- C. Chicone, Ordinary Differential Equations with Applications, Springer-Verlag, 1999

Course Code		Semester	VI	Credits	3	Lectures/Week	3L/1T/0P
Course	Combinatorics and Graph Theory						

Course Outcomes:

After the completion of this course, the student should be able to

1. Solve counting problems involving the multiplication rule, permutations and combinations principle of inclusion- exclusion, and Pigeonhole principle.
2. Use Generating functions to solve counting problems, recurrence relations and establishing binomial identities.
3. Learn the fundamental concepts of Graph theory such as the properties of Eulerian and Hamiltonian graphs.
4. Model and solve real world problems using Graph theory concepts.

Module	Content	Hours
1	**Counting:** The basics of counting, the pigeonhole principle, permutations and combinations with repetition, Binomial coefficients and identities, Stirling numbers of second kind, partition of integers, recurrence relations, solving recurrence relations, generating functions, inclusion - exclusion principle, Derangements.	12
2	**Graphs:** Basic terminology, The Handshaking theorem, Complete graphs, Bipartite graphs, Representing graphs by adjacency matrices, graph isomorphism, Connectedness and paths, Euler's paths and circuits, Hamilton paths and circuits, Shortest routes, spanning Trees and cut sets, planar graphs, Euler's formula, Graph coloring, The four color theorem, chromatic number of a graph, applications to scheduling exams, index registers.	18

Reference Books:

- Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay, R. Manohar, Tata McGraw Hill, 2008
- Kenneth H. Rosen, Discrete Mathematics and its Applications, 7th Edition, Tata McGraw Hill, 2012
- Douglas B. West, Introduction to Graph Theory, Pearson, 2015
- Graph Theory with Applications to Engineering and Computer Science by Narsingh Deo, Prentice Hall of India, 2003.

Department of Technical and Applied Chemistry VJTI, Matunga Mumbai

Open Elective Course								
S. No.	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
		Practices to Performance: Pathways to Enterprise Sustainability	**3 — 1 — 0 = 4**	**4**	**20**	**30**	**50**	**3**

Course Outcomes:
After completion of course students will be able to;

CO1: Interpret the importance of Sustainability Principles, sustainable materials, product, and process.

CO2: Compare the performance of various materials and products against the conventional one.

CO3: Analyze the processes for attaining sustainability by calculating GHG emissions, energy reduction, waste reductions.

CO4: Apply the key concept of ESG and its importance in industry and reporting frameworks

Course Content

Modules	Description	CO	Contact Hours
Module 1	**Introduction to Industrial Processes:** Study of input-output models of various industrial process. Overview of Industrial Revolution and its importance towards sustainability. Overview of various industrial parameters such as material, energy, and its environmental implications etc.	CO1	4
Module 2	**Sustainability Principles:** Definition of sustainability. Concept of triple bottom line: Environmental, Social and Economic Dimensions and its significance in the industry. SDG, Concept of Corporate Sustainability.	CO2	4
Module 3	**Industrial Waste and Concept of Circularity:** Overview of different types of waste from various industries: Solid, liquid, hazardous, non-hazardous, biodegradable, non- biodegradable, and toxic wastes. Organic, biomedical, chemical and E waste, Concept of solid and liquid waste management with relevant examples. Recycling, upcycling, and zero waste models (ZLD): Case studies and demonstration. Basic overview of liner and circular economy, case studies.	CO3	8
Module 4	**Climate change & GHG Accounting: Classifications, Calculations:** Understanding GHG emissions and its importance. Overview of Scope 1, Scope 2, and Scope 3 emissions etc and estimating them with examples. Understanding climate change and risk assessment methods. Overview of best available techniques for industrial process with suitable examples. Basic concepts of GHG calculations and carbon footprint reduction.	CO3	8
Module 5	**ESG Reporting and Practices:** Introduction to key concept of Environmental, Social, and Governance (ESG). Brief introduction to ESG frameworks, sustainability reporting, Global and Indian ESG reporting requirements, Global frameworks like GRI, SASB, etc. UN SDG Principles and Impact reporting. Case studies of ESG Reporting, Concept of Corporate Carbon Neutrality and Offsetting Programs, and Reporting framework.	CO4	6
Module 6	**Regulatory and Compliance Systems on Sustainability:** Introduction to regulatory and compliance management. Sustainable Finance. Basics of Reporting techniques, BRSR, Concept of Green Washing, Product stewardship, Concept of Life Cycle Analysis, Understanding the impact of various industrial process on human and environment. Concept of Green supply	CO1	6

	chain and implementation. Basics of eco and environmental toxicity, and Reporting framework.		

Details of Tutorials:

1. Preparing business models based on comparative study of conventional and sustainable products from industry.
2. Case study: Sustainability and Climate reports from various industry.
3. Sustainable auditing and certification process with suitable example.
4. Visit to CETP plant, ZLD plant: Analysis and report preparation.
5. Carbon footprint calculations with suitable example
6. Case studies highlighting sustainability challenges and practices in Indian manufacturing sectors

Recommended Reading

1] Handbook for Chemical Process Industries, 562 Seiten 2025 CRC Press (Verlag) 978-1-032-53486-2

2] E. P. G. Gohl, L. D. Vilensky, Textile Science, an Explanation of Fibre Properties, Second Edition, 1987, CBS Publishers & Distributors Pvt. Ltd.

3] The Handbook of Manufacturing Engineering, CRC Press, Boca Raton 2006 0824723414.

4] Sustainable Development in Economics, Technology and Environmental Engineering, Proceedings of ISC SAI 2023.

5] Environment and Sustainable Development Perspectives and Issues, Manish Verma, ISBN 978-0-367-54182-8.

6] Environmental Social Governance: Managing Risk and Expectations Karlheinz Spitz, John Trudinger, Matthew Orr CRC Press, 27 Mar 2022 - Business & Economics.

7] Greenhouse Gas: Emission and Mitigation Hardcover – Import, 1 March 2022, Micah Taylo, ISBN-978-1641166195.

Department of PHYSICS

OPEN ELECTIVE for AY EVEN SEM 2025-26

Course Name:- Nanoscience and Nanotechnology for Engineers

Course Outcomes (COs)

CO1 To understand the importance of nanoscience and to differentiate between different Types of nanomaterials

CO2 To understand and analyse structure-property relationship at nanoscale.

CO3 To identify and compare nanomaterial synthesis techniques.

CO4 To be able to interpret data from nanomaterial characterization techniques

CO5 To understand Engineering Application of Nanomaterials and to learn how to work safely with Nanomaterials and its environmental impact

Course Contents

1.	**Introduction:** Introduction to Nanoscience & Nanotechnology (Evolution, Feynman's idea, interdisciplinary nature), Scale of Nanomaterials (Atomic/Molecular scale, surface-to-volume ratio), Nucleation theory, surface energy and stabilization, magic numbers, modeling of nanoparticles, Quantum Nature of Nanoworld: dots, wires, well. **Classification of Nanomaterials-** One, two and three-dimensional Nanomaterials (Quantum dots, nanowires, nanotubes, thin films), Carbon nanostructures: fullerenes, carbon nanotubes. Silicon nanostructures -nanoscale silicon forms nanoparticles, nanowires, quantum dots. Bulk nanostructured materials, solid disordered nanostructures, nanostructured multilayers, metal nanoclusters	**8**
2.	**Properties of Nanomaterials:** Structure property relationship at nanoscale, Mechanical properties at nanoscale, Electrical, Optical, Chemical, Thermal and Magnetic properties, Comparison of bulk and nanomaterials.	**8**

3.	**Fabrication and characterization:** **Synthesis and Fabrication of Nanostructures:** Top-Down Approaches Lithography-Patterning, Masks and Photolithography; High energy mechanical milling, melt mixing, Evaporation-condensation method Bottom-Up Approaches- Ionized cluster beam deposition, Sputter deposition, ALD, PVD, Chemical Vapor Deposition, pulse laser methods, Chemical Reduction Method, microemulsion, sol-gel method	**6**

	Green synthesis of nanomaterials	
4.	**Characterization of nanomaterials**: Particle size and surface analysis Structural: XRD (X-ray Diffraction), Electron Diffraction. Microscopy: SEM (Scanning Electron Microscopy), TEM (Transmission Electron Microscopy), STM (Scanning Tunneling Microscopy). Spectroscopy: UV-Vis, FTIR, Raman, XPS (X-ray Photoelectron Spectroscopy).	**8**
5.	**Application of Nanotechnology:** Existing and emerging applications in electronics and sensors, Energy, medicine and healthcare, automotives, textiles, construction. Nanodevices- Quantum dots and quantum well devices, plasmon waveguides (optical devices) space and defense, sports and cosmetics. **Safety:** Environmental impact and nanotoxicology of nanomaterials, Safety protocols. Role of nanotechnology in sustainable development	**10**

Text / Reference Books

1. Cao G., Nanostructures & nanomaterials: synthesis, properties & applications, Imperial college press, 2004
2. Handbook of Nano structured Materials and Nano Technology, Vols 1-5, Academic Press 2000
3. Poole Jr C .P. and Owens F. J., Introduction to nanotechnology, John Wiley & Sons, 2003
4. Pradeep T., Nano: the essentials: understanding nanoscience and nanotechnology, McGraw-Hill Education, 2007
5. Ashby M. F., Ferreira P. J. and Scholdek D. L., Nanomaterials, Nanotechnologies and Design, Butterworth-Heinemann, 2009
6. Murty B. S., Shankar P., Raj B., Rath B.B. and Murday J. Textbook of Nanoscience and Nanotechnology, Springer Science & Business Media, 2013
7. Nanotechnology: Principles and Practices – S. K. Kulkarni, Springer, 2015

Course Title: Financial Management

Prerequisites:

Course outcomes:

On completion of this course, the learner will be able to:

1. Understand the fundamental principles of financial management.
2. Analyze financial statements and interpret key financial ratios.
3. Develop budgeting and forecasting models.
4. Evaluate investment opportunities and understand risk management.

Syllabus:

1. Introduction to Financial Management

Objectives and Functions of Financial Management, Role of Financial Manager, Financial Management Environment.

2. *Financial Statements and Analysis*

Understanding Financial Statements: Balance Sheet, Income Statement, Cash Flow Statement; Financial Ratio Analysis: Liquidity Ratios, Profitability Ratios, Solvency Ratios, Efficiency Ratios; Trend Analysis and Comparative Analysis.

3. *Time Value of Money*

Concepts of Present Value and Future Value; Calculation of Present and Future Values of Single Sums and Annuities; Applications of Time Value of Money in Financial Decisions.

4. *Budgeting and Forecasting*

Introduction to Budgeting; Types of Budgets: Operational, Financial, Capital Budgets; Forecasting Techniques: Quantitative and Qualitative Methods; Budgetary Control and Variance Analysis.

5. *Investment Decisions*

Capital Budgeting: Importance and Process; Techniques of Capital Budgeting: Payback Period, Net Present Value (NPV), Internal Rate of Return (IRR), Profitability Index; Risk Analysis in Capital Budgeting.

6. *Financing Decisions*

Sources of Finance: Equity, Debt, Hybrid Instruments; Cost of Capital: Components and Calculation; Capital Structure: Factors Affecting Capital Structure, Theories of Capital Structure; Leverage: Operating and Financial Leverage.

7. *Working Capital Management*

Components of Working Capital; Operating Cycle and Cash Cycle; Management of Cash, Receivables, and Inventory; Working Capital Financing.

8. *Dividend Decisions*

Types of Dividends; Dividend Policy: Factors Influencing Dividend Policy, Theories of Dividend Policy; Stock Dividends and Stock Splits.

Text Books:

1. Brigham, E. F., & Ehrhardt, M. C. (2016). "Financial Management: Theory & Practice". Cengage Learning.
2. Van Horne, J. C., & Wachowicz, J. M. (2008). "Fundamentals of Financial Management". Pearson Education.

References:

1. Ross, S. A., Westerfield, R. W., & Jaffe, J. (2013). "Corporate Finance". McGraw-Hill Education. 2. Pandey, I. M. (2010). "Financial Management". Vikas Publishing House.
3. Damodaran, A. (2012). "Investment Valuation: Tools and Techniques for Determining the Value of Any Asset". John Wiley & Sons.
4. Brealey, R. A., Myers, S. C., & Allen, F. (2019). "Principles of Corporate Finance". McGraw-Hill Education.

NPTEL Program Details:

Sr. No.	Course Title	Link
1	Leadership and Team Effectiveness	https://onlinecourses.nptel.ac.in/noc26_mg61/preview
2	Principles of Management	https://onlinecourses.nptel.ac.in/noc26_mg72/preview
3	Business Development	https://onlinecourses.nptel.ac.in/noc26_mg50/preview