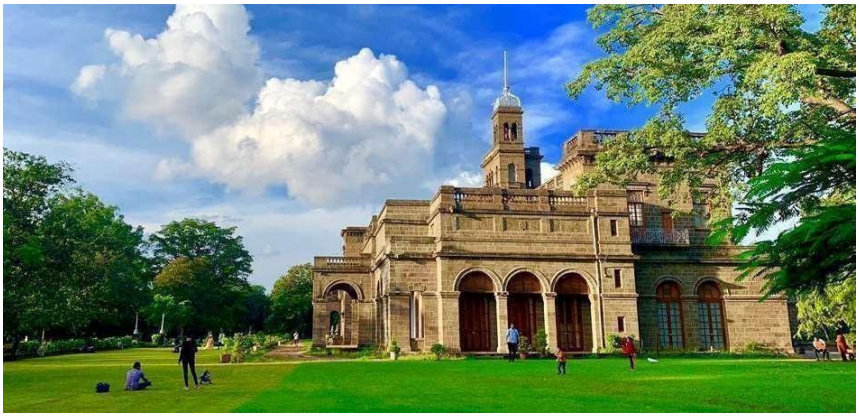
सावित्रीबाई फुले पुणे विद्यापीठ

Savitribai Phule Pune University, Pune, Maharashtra, India

Faculty of Science and Technology



National Education Policy (NEP)-2020 Compliant Curriculum

Second Year Engineering (2024Pattern)

Production Engineering (Sandwich)

(With effect from Academic Year 2025-26)

Contents

Abbreviations

AEC	Ability Enhancement Course
BSC	Basic Science Course
CCC	Co-Curricular Courses
CCE	Comprehensive Continuous Evaluation
CEP	Common Engineering Project
CO	Course Outcome
ELC	Experiential Learning Courses
ESC	Engineering Science Course
FP	Field Project
IKS	Indian Knowledge System
INT	Internship
MDM	Multidisciplinary Minor
NEP	National Education Policy
OEL	Open Elective
OJT	On Job Training
PCC	Program Core Course
PEC	Programme Elective Course
PO	Program Outcomes
PR	Practical
PRJ	Project
PSO	Program Specific Outcome
RM	Research Methodology
TH	Theory
TU	Tutorials
VEC	Value Education Course
VSE	Vocational and Skill Enhancement Course

Preface by Board of Studies

Dear Students and Faculty Members,

We, the members of the Board of Studies in Production and Industrial Engineering, are pleased to present the revised syllabus for Second Year Production Engineering and Production SW, effective from the Academic Year 2025–26. This curriculum will be progressively implemented for Third Year and Final Year in the academic years 2026–27 and 2027–28, respectively.

Production Engineering (Sandwich)is an interdisciplinary domain that brings together the principles of Manufacturing processes, mechanical engineering, Electrical and electronics and control systems. It serves as the backbone for the design, development, and implementation of intelligent manufacturing systems and automated solutions across industries. This curriculum aims to provide students with a strong foundation in core concepts, emerging technologies, and practical applications, while preparing them for the dynamic landscape of Industry 4.0 and beyond.

The syllabus has been carefully aligned with the vision of the National Education Policy (NEP) 2020, and adheres to the guidelines of Savitribai Phule Pune University, AICTE, UGC, and leading accreditation bodies. It emphasizes innovation, multidisciplinary learning, and industry relevance to ensure students are well-equipped for the future.

This outcome-based curriculum has been developed through collaborative input from academic experts, industry professionals, and alumni. It not only addresses current industry needs but also nurtures the skills required for higher studies, research, and entrepreneurial ventures in the field of Production Engineering.

We are confident that this revised curriculum will empower students to emerge as technically sound, ethically responsible, and future-ready professionals, contributing meaningfully to society and the technological ecosystem.

Dr. K N Nandurkar
Coordinator
Board of Studies (Production and Industrial Engineering)

Members of Board of Studies: Production and Industrial Engineering	
Dr S S Ohol	Dr N G Shekapure
Dr S H Wankhade	Dr S M Kherde
Dr K R Borole	Dr N K Kamble
Dr R S Katikar	Dr V M Deshpande
Dr S S Sarnabot	Mr Nilesh Bagul
Dr S S Patil	

Program Specific Outcomes (PSO)

PSO1: Interdisciplinary Engineering Skills: The ability to apply knowledge from mechanical systems, electronics, control systems, and computer programming to design, analyze, and implement intelligent manufacturing systems.

PSO2: Problem Solving and Innovation: The ability to model, simulate, and optimize manufacturing processes using modern engineering tools and methodologies to solve real - world industrial and societal challenges.

PSO3: Professional Growth and Entrepreneurship: The ability to pursue successful careers in manufacturing, industrial automation, and related fields, with an entrepreneurial mindset and a commitment to lifelong learning, innovation, and societal development.

Programme Educational Objectives (PEO)

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve.

PEO	PEO Focus	PEO Statements
PEO1	**Core Competence**	Attainment of fundamental principles of Manufacturing processes and enable graduates to design tools and dies and manage the manufacturing systems
PEO2	**Problem Solving and Ethics**	Ability to analyze engineering problems and provide sustainable solutions to manufacturing problems while adhering to ethical / sustainable practices and industry standards.
PEO3	**Professionalism and Lifelong Learning**	Cultivate professionalism, a spirit of innovation, and lifelong Learning to adapt to emerging technologies and make meaningful contributions to industry and society.

Knowledge and Attitude Profile (WK)

A Knowledge and Attitude Profile (KAP), often represents WK (Knowledge and Attitude Profile) in some contexts, is a framework or assessment tool used to evaluate an individual's knowledge and attitudes related to a specific area, topic, or domain.

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2	Conceptually based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice are as in the engineering discipline; much is at the forefront of the discipline.
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6	Knowledge of engineering practice (technology)in the practice is as in the engineering discipline.
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Reference: Self- Assessment Report t(SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version4.0 (GAPCV4.0)-(August 2024) Page55.

Programme Outcomes (PO)

Program Outcomes are statements that describe what students are expected to know and be able to do upon graduating from the program. These relate to the skills, knowledge, attitude and behavior that students acquire through the program. On successful completion of B.E. in Artificial Intelligence and Data Science, graduating students/graduates will be able to:

PO1	Engineering Knowledge	Applying knowledge of mathematics, natural science, engineering fundamentals, and the chosen engineering specialization to solve complex problems.
PO2	Problem Analysis	Identifying, formulating, reviewing research literature, and analyzing complex engineering problems to reach substantiated conclusions.
PO3	Design/Development of Solutions	Designing creative solutions for complex engineering problems, developing system components or processes to meet specified needs while considering public health and safety, and environmental concerns.
PO4	Conduct Investigations of Complex Problems	Conducting investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to reach valid conclusions.
PO5	Modern Tool Usage	Selecting and applying appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations.
PO6	The Engineer and Society	Applying reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO7	Environment and Sustainability	Understanding the impact of professional engineering solutions in societal and environmental contexts, and demonstrating knowledge of and need for sustainable development.
PO8	Ethics	Applying ethical principles and committing to professional ethics and responsibilities and norms of engineering practice
PO9	Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication	Communicating effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO11	Project Management and Finance	Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Reference: Self-Assessment Report (SAR) Format Undergraduate Engineering Programs Graduate Attributes and Professional Competencies Version 4.0 (GAPC V4.0)- (August 2024) Page 56.

General Rules and Guidelines

- **Course Outcomes (CO):** Course Outcomes are narrower statements that describe what students are expected to know and are able to do at the end of each course. These relate to the skills, knowledge and behaviour that students acquire in their progress through the course.
- **Assessment:** Assessment is one or more processes, carried out by the institution, that identify, collect, and prepare data to evaluate the achievement of Program Educational Objectives and Program Outcomes.
- **Evaluation:** Evaluation is one or more processes done by the Evaluation Team, for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which Program Educational Objectives or Program Outcomes are being achieved, and results in decisions and actions to improve the program

Guidelines for Examination Scheme

Theory Examination: The theory examination shall be conducted in two different parts Comprehensive Continuous Evaluation (CCE)and End-Semester Examination (ESE).

Comprehensive Continuous Evaluation (CCE):

1. CCE of 40 marks based on all the Units of course syllabus to be scheduled and conducted at institute level.
2. Case studies included under each unit are intended to support applied learning and are part of Comprehensive Continuous Evaluation
3. These case studies will be assessed through internal assessment components such as presentations, assignments, or group discussions. They shall not be included in the End-Semester Theory Examination.
4. To design a Comprehensive Continuous Evaluation scheme for a theory subject of 40 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr. No	Parameters	Marks	Coverage of Units
1	Unit Test	16	Units1 &Unit 2(6 Marks/Unit)
2	Assignments/ Case Study	16	Units 3 &Unit 4(6 Marks/Unit)
3	Seminar Presentation/ Open Book Test/ Quiz	8	Unit5

5. CCE of 15 marks based on all the Units of course syllabus to be scheduled and conducted at institute level. To design a Comprehensive Continuous Evaluation (CCE) scheme for a theory subject of 15 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr. No	Parameters	Marks	Coverage of Units
1	Unit Test	10	Units 1& Unit 2 (5 Marks/ Unit)
2	Seminar Presentation/ Open Book Test/ Quiz	5	Unit3andUnit4

Format and Implementation of Comprehensive Continuous Evaluation (CCE)

- **Unit Test**
  - **Format:** Questions designed as per Bloom's Taxonomy guidelines to assess various cognitive Levels (Remember, Understand, Apply, Analyze, Evaluate, Create).
  - **Implementation**: Schedule the test after completingUnits1and2.Ensure the question paper is balanced and covers key concepts and applications.
- **Sample Question Distribution**
  - **Remembering**(2Marks): Define key terms related to [Topic from Units1and2].
  - **Understanding**(2Marks): Explain the principle of [Concept]in[Context].
  - **Applying**(2Marks): Demonstrate how [Concept] can be used in[Scenario].
  - **Analyzing**(3Marks): Compare & contrast [Two related concepts] from Units1and 2.
  - **Evaluating**(3Marks): Evaluate the effectiveness of [Theory/Model in [Situation].
- Assignments/Case Study: Students should submit one assignment, or one Case Study Report based on Unit3 and one assignment or one Case Study Report based on Unit4.
  - **Format**: Problem-solving tasks, theoretical questions, practical exercises, or case studies that require in-depth analysis and application of concepts.
  - **Implementation:** Distribute the assignments or case study after covering Units3 and 4. Provide clear guidelines and a rubric for evaluation.
- **Seminar Presentation:**
  - **Format**: Oral presentation on a topic from Unit5, followed by a Q&A session.
  - **Deliverables:** Presentation slides, a summary report in 2 to 3 pages, and performance during the presentation.
  - **Implementation**: Schedule the seminar presentations towards the end of the course
    Provide students with ample time to prepare and offer guidance on presentation skills.
- **Open Book Test:**
  - **Format**: Analytical and application-based questions to assess depth of understanding.
  - **Implementation:** Schedule the open book test towards the end of the course,ensuring it covers critical aspects of Unit5.
- **Quiz:**
  - **Format:** Quizzes can help your students practice existing knowledge while stimulating interest in learning about new topic in that course. You can set your quizzes to be completed individually or in small groups.
  - **Implementation:** Online tools and software can be used create quiz. Each quiz is made up of a variety of question types including multiple choice, missing words, true or false etc

- **Example Timeline for conducting CCE:**
  - Weeks1-4: CoverUnits1and 2
  - Week5 : Conduct Unit Test (12marks)
  - Weeks6-8: Cover Units 3 and 4
  - Week 9: Distribute and collect Assignments/ Case Study(12marks)
  - Weeks10-12: CoverUnit5
  - Week13: Conduct Seminar Presentations or Open Book Test or Quiz(6marks)
- **Evaluation and Feedback:**
  - **Unit Test**: Evaluate promptly and provide constructive feedback on strengths and areas for improvement.
  - **Assignments/ Case Study**: Assess the quality of submissions based on the provided rubric. Offer feedback to help students understand their performance.
  - **Seminar Presentation**: Evaluate based on content, delivery, and engagement during the Q&A session. Provide feedback on presentation skills and comprehension of the topic.
  - **Open Book Test:** Evaluate based on the depth of analysis and application of concepts. Provide feedback on critical thinking and problem-solving skills.

End-Semester Examination (ESE)

End-Semester Examination (ESE) of 60 marks written theory examination based on all the unit of course syllabus scheduled by university. Question papers will be sent by the University through QPD (Question Paper Delivery). University will schedule and conduct ESE at the end of the semester.

- **Format and Implementation:**
  - Question Paper Design: Below structure is to be followed to design an End-Semester Examination (ESE)for a theory subject of 60marks on all 5units of the syllabus with questions set as per Bloom's Taxonomy guidelines and 14 marks allocated per unit.
  - Balanced Coverage: Ensure balanced coverage of all units with questions that assess different cognitive levels of Bloom's Taxonomy: Remember, Understand, Apply, Analye,Evaluate, and Create.
  - The questions should be structured to cover:
    - Remembering: Basic recall of facts and concepts.
    - Understanding: Explanation of ideas or concepts.
    - Applying: Use of information In new situations.
    - Analyzing: Drawing connections among ideas.
    - Evaluating: Justifying a decision or course of action.
    - Creating: Producing new or original work (if applicable).
  - Detailed Scheme: Unit-Wise Allocation (14Marks per Unit): Each unit will have a combination of questions designed to assess different cognitive levels. By following this scheme, you can ensure a comprehensive and fair assessment of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

NEP 2020 Compliant Curriculum Structure

Second Year Engineering (2024Pattern)

Production Engineering (Sandwich)

Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Termwork	Practical	Oral	Total	Theory	Tutorial	Practical	Total
	Semester III														
PCC-201-PES	PCC	Mathematics III	3	-	-	40	60	-	-	-	**100**	3	-	-	**3**
PCC-202-PES	PCC	Manufacturing processes	3	-	-	40	60	-	-	-	**100**	3	-	-	**3**
PCC-203-PES	PCC	Heat and Fluid Engineering	3	-	-	40	60	-	-	-	**100**	3	-	-	**3**
PCC-204-PES	PCC	Manufacturing processes Lab	-	-	4	-	-	25	50	-	**75**	-	-	2	**2**
PCC-205-PES	PCC	Heat and Fluid Engineering Lab	-	-	2	-	-	25	-	25	**50**	-	-	1	**1**
OE-221	OEL	*Open Elective–I	2	-	-	15	35	-	-	-	**50**	2	-	-	**2**
MDM-222-PES	MDM	Material Science	2	-	-	40	60	-	-	-	**100**	2	-	-	**2**
EEM-231-PES	EEM	Engineering Economics	-	1	2	-	-	25	-	-	**25**	1	-	1	**2**
VEC-232-PES	VEC	Universal Human Values	2	-	-	15	35	-	-	-	**50**	2	-	-	**2**
CEP-241-PES	CEP	Mini-project/ Case study/ Seminar	-	-	4	-	-	25	-	25	**50**	-	-	2	**2**
Total			**15**	**01**	**12**	**150**	**350**	**100**	**50**	**50**	**700**	**15**	**01**	**06**	**22**

*Note:

Students can opt for Open Electives offered by different faculty like Arts, Science, Commerce, Management, Humanities or Inter-Disciplinary studies.

• Example–Open Elective I-Financial Accounting, Digital Finance, Digital Marketing can be opted from Commerce and Management faculty.

• Elective II-Project Management, Business Analytical, Financial Management can be opted from Inter-Disciplinary studies, Commerce and Management faculty respectively.

NEP2020 Compliant Curriculum Structure

Second Year Engineering (2024Pattern)

Production Engineering (Sandwich)

Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks						Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Termwork	Practical	Oral	Total	Theory	Tutorial	Practical	Total
	Semester IV														
PCC-251-PES	PCC	Industrial Electronics and Electrical Machines	3	-	-	40	60	-	-	-	**100**	3	-	-	**3**
PCC-252-PES	PCC	Theory of Machines	3	-	-	40	60	-	-	-	**100**	3	-	-	**3**
PCC-253-PES	PCC	Design of Machine Elements	2	-	-	40	60	-	-	-	**100**	2	-	-	**2**
PCC-254-PES	PCC	Industrial Electronics and Electrical Machines Lab	-	-	2	-	-	25	25	-	**50**	-	-	1	**1**
PCC-255-PES	PCC	Design of Machine Elements Lab	-	-	2	-	-	-	-	25	**25**	-	-	1	**1**
OE-271	OEL	*Open Elective–II	2	-	-	15	35	-	-	-	**50**	2	-	-	**2**
MDM-272-PES	MDM	Smart Materials	2	-	-	40	60	-	-	-	**100**	2	-	-	**2**
VSEC- 281-PES	VSEC	Measurement Lab	-	-	2	-	-	-	25	-	**25**	-	-	1	**1**
VSEC-282-PES	VSEC	Creative Problem Solving and Critical Thinking	-	-	2	-	-	25	-	-	**25**	-	-	1	**1**
AEC-283-PES	AEC	Modern Indian Languages (Marathi/Hindi)	-	1	2	-	-	50	-	-	**50**	-	1	1	2
EEM-284-PES	EEM	Behavioural Science	-	1	2	-	-	25	-	-	**25**	-	1	1	**2**
VEC-285-PES	VEC	Environmental Studies	2	-	-	15	35	-	-	-	**50**	2	-	-	**2**
Total			**14**	**02**	**12**	**150**	**350**	**125**	**50**	**25**	**700**	**14**	**02**	**06**	**22**

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-201-PES Course Name:

Mathematics III

Teaching Scheme	Credit	Examination Scheme
Theory : 3Hours/Week	03	CCE : 40Marks End-Semester: 60Marks

Prerequisite Courses, if any:

- Differential and Integral calculus, Differential equations of first order and first degree, Fourier series, Collection, classification and representation of data, Permutations & combinations and Vector algebra

Course Objectives:

To make the students familiarize with concepts and techniques in Ordinary & Partial differential equations, Laplace transform & Fourier transform, Statistical methods, Probability theory and Vector calculus. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Solve higher order linear differential equations and its applications to model and analyze mass spring systems.
2. Apply Integral transform techniques such as Laplace transform and Fourier transform to solve differential equations involved in vibration theory, heat transfer and related mechanical engineering applications.
3. Apply Statistical methods like correlation, regression in analyzing and interpreting experimental data applicable to Reliability engineering and probability theory in testing and quality control.
4. Perform Vector differentiation and integration, analyze the vector fields and apply to fluid flow problems.
5. Solve Partial differential equations such as wave equation, one- and two-dimensional heat flow equations

Course Contents

Unit I	Linear Differential Equations (LDE) and Applications	(07Hours)

LDE of nth order with constant coefficients, Complementary Function, Particular Integral, General method, Short methods, Method of variation of parameters, Cauchy's and Legendre's DE, Simultaneous and Symmetric simultaneous DE. Modelling of mass-spring systems, free and forced damped and undamped systems.

Unit II	Transforms	(07Hours)

Laplace Transform **(LT):** LT of standard functions, properties and theorems, Inverse LT, Application of To solve LDE. Fourier Transform **(FT):** Fourier integral theorem, Fourier transform, Fourier Sine& Cosine transform, Inverse Fourier Transforms.

Unit III	Statistics	(07Hours)
Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves, Correlation and Regression, Reliability of Regression Estimates.		
Unit IV	**Probability and Probability Distributions**	**(06Hours)**
Probability, Theorems on Probability, Bayes, Theorem, Random variables, Mathematical Expectation, Probability distributions: Binomial, Poisson, Normal, Test of Hypothesis: Chi-Square test, t-distribution		
Unit V	**Vector Calculus**	**(06Hours)**
Vector differentiation, Gradient, Divergence and Curl, Directional derivative, Solenoidal and Irrotational fields, Vector identities. Line, Surface and Volume integrals, Green's Lemma, Gauss's Divergence theorem and Stoke's theorem.		

Learning Resources

Text Books:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraww-Hill).
2. Higher Engineering Mathematics by B.S. Grewal (Khanna Publication, Delhi)

Reference Books:

1. Advanced EngineeringMathematics,10 ed, by Erwin Kreyszig (Wiley India).
2. Advanced EngineeringMathematics,2 ed, by M.D. Greenberg (Pearson Education).
3. Advanced EngineeringMathematics,7ed.,by Peter V.O'Neil (Cengage Learning).
4. Differential Equations,3eby S.L. Ross (Wiley India).
5. Introduction to Probability and Statistics for Engineers and Scientists, 5e, by Sheldon M. Ross (Elsevier Academic Press)
6. Partial Differential Equations for Scientists and Engineers by S.J. Farlow (DoverPublications,1993)

Savitribai Phule Pune University
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Course Code: PCC-202-PES

Course Name: Manufacturing processes

Teaching Scheme	Credit	Examination Scheme
Theory : 3Hours/Week	**03**	**CCE : 40Marks** **End-Semester: 60Marks**

Prerequisite Courses,if any: Basic Mechanical Engineering ,Physics

Course Objectives:

To make students understand the concepts and basic mechanics of metal casting, metal cutting, working of standard machine tools such as lathe, milling, drilling and allied machines, grinding and allied machines and super-fininshing processes long with additive manufacturing.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Understand working principles and operations of sand-casting process
2. Understand working principles and operations of metal cutting processes
3. Demonstrateoperations/toolingandkinematicsofconventionalmachines.
4. Select appropriate joining process for a given application
5. Identify applications of additive manufacturing processes

Course Contents

Unit I	Casting processes	(07Hours)

Introduction, Solidification: progressive and directional solidification; rate of solidification; Chvorinov's Rule, Riser design, gating system: types, characteristics, and design, pattern design, moulding and core making processes, melting and fluidity, casting design consideration, Inspection and Quality Control

Unit II	Metal Joining	(07Hours)

Survey of welding and allied processes. Gas welding and cutting, process and equipment. Arc welding: Power sources and consumables. TIG and MIG processes and their parameters. Resistance welding-spot, seam projection etc. Other welding processes such as atomic hydrogen, submerged arc, electroslag, friction welding. Soldering & Brazing. Adhesive bonding. Weld decay in HAZ.

Unit III	Machine Tools-I: Lathe and Milling	(07Hours)

Lathe: Lathe, Specifications, Parts of lathe machine, accessories, Kinematics of lathe, Turret and Capstan lathe, various lathe operations
Milling: Classification of milling machines, Various Milling operations, Indexing,

Unit IV	Machine Tools-II: Drilling and Grinding	(06Hours)

Drilling: Types of drilling machines, specifications, parts of drilling machine, Difference between drilling, boring & reaming, Boring operations & boring machines.
Grinding: Types of grinding machines, specifications, cylindrical, surface, centerless grinding, Grinding operations, Grinding wheels and their selection.

Unit V	Superfinishing processes	(06Hours)

Honing, Lapping, Buffing, Polishing, Tumbling, Electroplating, Galvanizing, Metal spraying, Hot dipping and Burnishing. Study of input process parameters of above processes.

Learning Resources

Text Books:

1. S.K.Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy,"Elements of Workshop Technology "VolI,II, Media Promoters, ISBN-10:8185099154
2. S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy,"Elements of Workshop Technology" VolI, Media Promoters, ISBN-10:8185099154
3. Khanna O.P. ,"Welding Technology",Dhanpat Rai& sons,1996.
4. Khanna O.P.,"Foundry Technology",Dhanpat Rai& sons, 1999.Welding process and Technology",2ed. Khanna Publishers,1997.
5. RaoP.N.,"Manufacturing Technology & Foundry, Forming & Welding", VolI,II, Tata McGraw Hill Publishing Co.,2004, ISBN:0074518631.
6. Jain R.K.,"Production Technology", Khanna Publishers,2008 , ISBN81-7409-099-1.
7. Sharma P.C., "A Textbook of Production Technology- Manufacturing Processes", S. Chand & Co., 2008, ISBN: 81- 219- 111-4-1.
8. Raghuwanshi B.S.,"A course in Workshop Technology",Vol.I,II, Dhanpat Rai & Co. ISBN:81-7409-099-1

Reference Books:

1. ChapmanW.A.J.,"Workshop Technology" Vol.I,II & III, Edward Arnold Publishers,1998, ISBN:071313287
2. HMT,"Production Technology",Tata McGraw Hill Publishing Co.,ISBN:0-07-096443-2
3. Degarmo, Black and Kosherth,"Materials & Processes in manufacturing",8th Edition, Prentice Hal lof India, ltd, Delhi, 2002.ISBN:8126525223.
4. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-203-PES

Course Name: Heat and Fluid Engineering

Teaching Scheme	Credit	Examination Scheme
Theory : 3Hours/Week	**03**	**CCE : 40Marks** **End-Semester: 60Marks**

Prerequisite Courses, if any: Engineering Mathematics I, Engineering Mathematics II.

Course Objectives:

The main objective of this unit is to introduce students to the fundamental thermodynamic and fluid mechanics physical laws and develop in students the ability to apply these fundamental principles in thermal and fluid energy systems .It emphasizes understanding basic principles and applying them to practical situations using lab demonstrations. The aim is to give students the necessary skills to carryout basic design and performance analysis in the area of fluid statics, fluid motion ,heat, and power system in steam and similar power plants, engines, and refrigeration systems. The thermal part will cover three thermodynamic laws and the application of thermodynamics laws in thermal analysis of engines, refrigerators/heat pumps, and power cycles. The fluid part deals with hydrostatic pressure and forces, flow along streamlines with and without friction, flow momentum and forces, similarity and modeling.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Understand the basic principles and laws of fluid mechanics to recognize and analyze the type of fluid and fluid flow along with its application.
2. Develop the understanding of basic pressure measurement and its application throughout fluid mechanics.
3. Analyse boiler and energy balance concept. Also understand the properties and behavior of steam and different types of fuels.
4. Understand basic working principles and application of Vapor compression cycle, turbines and compressor and analyze its performance characteristics.
5. Perform individually or in a group to formulate and solve the engineering problem and to conclude the result of the outcome.

Course Contents

Unit I	Introduction & Fluid properties	(06Hours)

Definition of fluid, Newton's law of Viscosity, classification of fluid: Newtonian & Non-Newtonian fluids, Ideal & Real fluids, Fluid properties: viscosity compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure, cavitation. (Numerical) Static's of Fluid ,Pascal's law, Pressure on plane/curved surface ,pressure measurements, Manometers, centre of pressure, metacentric height.

Unit II	Fluid Flow	(06Hours)

Types of flow, examples, forces acting on fluid flow, Streamlines, Path lines, Streak lines. Velocity potential, Euler's equation of motion along a streamline, Bernoulli's equation, applications of Bernoulli's equation, orifice meter, venturi meter ,Pitot tube (Numerical)

Unit III	Losses through pipes	(06Hours)
Flow through pipes, Laminar and turbulent flow through circular pipes, major loss-Darcy-Weisbach equation, minor losses,, water hammer, Buckingham's pie theorem, dimensionless numbers Fluid Machinery, Construction, working and applications of hydraulic turbines, centrifugal pumps and reciprocating pumps.		
Unit IV	**Fuels and lubricants**	**(06Hours)**
Mass function, combustion equation, proximate and ultimate analysis of fuel, stoichiometric analysis of combustion products, volumetric and gravimetric analysis, types & properties of lubricants, flash point, fire point, viscosity, Vapour pressure Steam generators: Steam generation, steam properties, Babcock and Wilcox boiler, Cochran boilers (construction and working), boiler accessories, boiler performance, boiler efficiency, equivalent of evaporation and energy balance.(Numerical)		
Unit V	**Refrigeration**	**(06Hours)**
Air refrigeration, vapour compression refrigeration system, various refrigerants used in refrigeration systems, their effect on environment		

Learning Resources

Text and Reference Books:

1. Bansal R.K.,"Fluid Mechanics and Hydraulic Machines",9th Edition, Laxmi Publication,ISBN81-7008-311-7.
2. JainA.K.,"Fluid Mechanic including Hydraulic achines",Khanna Publishers,ISBN81-7409-194-7.
3. Munson,Young,Okiishi and Huebsch,"Fundamentals of Fluid Mechanics, Sixth Edition, Wiley–India Edition,2010.
4. Kumar A.,"Thermal Engineering", Narosa Publishing House,ISBN97-88-1731-95281
5. Kothandaraman C. P., Khajuria P. P., Arora S. and Domkundawar S, "A course in Thermodynamics and heat engines (Thermal engineering with solar energy)", 3 ed.,Dhanpat Rai & sons, 1989.
6. Modi P.N. and Seth S.M,"Hydraulics and Fluid Mechanics", Standard Book House, NewDelhi,1987.
7. Deshpande V.M.,"Hydraulics Machinery Textbook of Fluid Machinery", Everest Publication,1998.
8. Khurmi R.S. and GuptaJ.K.,"Textbook of Refrigeration and Air Conditioning", S .Chand Co.

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern) Course

Code:PCC-204-PES

Course Name: Manufacturing processes Lab

Teaching Scheme	Credit	Examination Scheme
Practical : 4Hours/Week	**02**	**Practical : 50 Marks** **TW: 25Marks**

Students have to perform mini- projects in workshop related to following topics

1. Job1. Making simple solid patterns involving wood turning operation and preparing mould.(one job)
2. Job 2. Demonstration on MMA, TIG, MIG, Resistance welding (spot welding) and fabricating a job involve various welding processes like manual metal arc welding (MMA), TIG, MIG.(one job)
3. Job 3. Job involving various operations on lathe (step, taper turning, drilling, chamfering knurling etc.) and at list one operation on drilling machine, milling machine and cylindrical grinding. (one job)
4. Job 4: Prepare prototype using 3DPrinting/ additive manufacturing

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-205-PES

Course Name: Heat and Fluid Engineering Lab

Teaching Scheme	Credit	Examination Scheme
Practical : 4 Hours/Week	**02**	**Oral : 25 Marks** **TW: 25 Marks**

List of Practical

1. Verification of Bernoulli's equation
2. Determination of friction factor for laminar and turbulent flow through pipes
3. Determination of losses in various pipe fitting /Assignment on major and minor losses.
4. Calibration of venture meter/orifice meter
5. Trial/Assignment on boilers.
6. Trial on vapour compression refrigeration system
7. Trial/Assignment on petrol engine

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: MDM-222-PES

Course Name: Materials Science

Teaching Scheme	Credit	Examination Scheme
Theory : 2Hours/Week	**02**	**CCE : 40Marks** **End-Semester: 60Marks**

Prerequisite Courses, if any: Engineering Chemistry

Course Objectives:

This course aims to explore the knowledge in fundamentals of materials science. Studying with good knowledge about semiconductors, solid solutions, Phase diagrams, mechanical properties, optical and magnetic properties of materials are very essential for materials scientists and engineers.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Draw and explain equilibrium diagrams for various alloy systems
2. Define the mechanical properties of materials and conduct destructive and nondestructive tests to evaluate the properties of materials
3. Explain various aspects of applications of powder metallurgy
4. Impart knowledge of various heat treatment processes of metals.
5. Acquaint about types, characteristics and applications of different ferrous, non-ferrous metals and their alloys.

Course Contents

Unit I	Fundamentals of materials science	(06Hours)

Mechanism of plastic deformation, Hume Rothery's rules of solid solubility, Gibb's phase rule, Solidification, Dendritic growth, Cooling curves, Leverrule,Iron-Iron carbide equilibrium diagram, Critical temperatures, Allotropy, volume changes of pure iron, Non-equilibrium cooling of steel, Widmanstatten structures

Unit II	Material Testing	(06Hours)

Destructive Tests: Evaluation of properties. Numerical based on Tension Test. Engineering stress - Strain curves of different materials. Compression Test, Cupping Test on Sheet metal, Hardness Tests: Brinell, Poldi, Vickers, Rockwell, Shores cleroscope, Durometer, Moh's test, Micro hardness test, and Impact tests.
Non-destructive tests: Visual Inspection, Magna flux test Dye penetrant test, Sonic and Ultrasonic test, Radiography, Eddy current test

Unit III	Ferrous metals and alloys	(06Hours)
Classification and applications of steels, specifications of some commonly used steels, Heat treatment processes, Surface Hardening processes, Alloy Steels and Cast Irons		
Unit IV	**Non-Ferrous Alloys**	**(06Hours)**
Copper alloys: Brasses, Bronzes, Tinalloys, Aluminium alloys Beryllium, Silicon Copper nickel alloys, Nickel - Silver, Solders, Bearing materials and their applications, Precipitation hardening alloys		

Learning Resources

Text and Reference Books:

1. Kodgire V.D.,"Material Science and Metallurgy for Engineers", Everest Publishing House, Pune, 2008,ISBN81-86314-00-8.
2. Smith W.F., "Principles of Material Science and Engineering", McGraw HillBookCo.,2002.ISBN: 0070591695
3. Davis H.E.,Troxell G.E. and Wiskocil C.T.,"Testing of Engineering Materials",Mc Graw Hill Book Co .ISBN :0070662479
4. Van VlackL.H.,"Elements of Material Science", Addison-Wesley PublishingCo.,1998. ISBN: 8131706001
5. Murthy, "Structure and properties engineering materials", Tata McGrawHill2003.ISBN: 007048287X
6. Donald R. Askl and ,Phule P.P.,"Science and engineering of materials", Thomson Learning, 2003.ISBN:0534553966

Savitribai Phule Pune University
Second Year of Engineering (2024Pattern)

Course Code: EEM-231-PES

Course Name: Engineering Economics

Teaching Scheme	Credit	Examination Scheme
Tutorial : 1 Hour/ Week **Practical : 2 Hour/ Week**	**02**	**Term work : 25 Marks**

Prerequisite Courses, if any: Basic Mathematics (no specialized prerequisites).

Course Objectives:

The course aims to

1. Introducing fundamental economic concepts relevant to engineering.
2. Equip students with methods to economically evaluate engineering projects.
3. Provide fundamental knowledge on cost estimation and break-even analysis.
4. Explain various depreciation methods and their importance in economics.
5. Introduce basics of replacement analysis and risk considerations.
6. Provide insights into contemporary economic issues affecting engineering decisions.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Apply fundamental economic concepts to engineering scenarios.
2. Perform economic valuation of projects using cash-flow techniques.
3. Conduct basic cost estimations and break-even analyses for decision-making.
4. Calculate depreciation and understand its impact on project economics.
5. Analyze basic replacement decisions and understand associated risks.
6. Discuss contemporary economic issues and their implications in engineering.

Course Contents

Unit I	**Fundamental Economic Principles**	**(02Hours)**

Importance of Engineering Economics, Basic economic concepts: Demand, Supply, Market Equilibrium, Time value of money: Interest types (Simple and Compound).

Unit II	**Economic Evaluation of Engineering Projects**	**(03Hours)**

Cash Flow diagrams, Economic evaluation methods: Present Worth(PW),Future Worth(FW), Annual Worth(AW),Internal Rate of Return (IRR)
Payback Period (basic numerical examples).

Unit III	**Cost Estimation and Break-evenx Analysis**	**(02Hours)**

Types of costs: Fixed, Variable, Marginal, Average Basic cost
estimation methods (overview)
Break-even analysis and practical applications (numerical examples).

Unit IV	Depreciation Methods	(02Hours)
Depreciation: Purpose and significance Depreciation calculation: Straight Line method, Declining Balance method (simple numerical problems)		
Unit V	**Replacement Analysis and Risk Considerations**	**(02Hours)**
Basics of replacement analysis (concept and criteria) Risk and uncertainty in economic analysis (conceptual overview and basic examples)		

Learning Resources

Text and Reference Books:

1. Leland Blank & Anthony Tarquin, “Engineering Economy,"McGraw-Hill Education.
2. Donald G. Newnan & Jerome P. Lavelle,"Engineering Economic Analysis, “Oxford University Press.
3. Chan S. Park ,"Fundamentals of Engineering Economics, "Pearson Education.

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)
Course Code: VEC-232-PES

Course Name: Universal Human Values

Teaching Scheme	Credit	Examination Scheme
Theory : 2 Hours/Week	**02**	**CCE : 15 Marks** **End-Semester : 35 Marks**

Prerequisite Courses, if any: No Prerequisite required.

1. **Course Objectives:** The course aims to
   1. Introduce value education as a process of self-exploration to understand one's purpose and aspirations.
   2. Facilitate the understanding of harmony in human beings, family, society, and nature.
   3. Enable students to identify the relationship between right understanding and ethical human conduct.
   4. Inspire a holistic vision for life and profession based on universal human values and coexistence.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Describe the process of self-exploration and explain its importance in achieving happiness and prosperity.
2. Analyze the coexistence of self and body and assess their distinct needs for leading a balanced life.
3. Demonstrate an understanding of harmonious relationships within the family and society.
4. Evaluate harmony in nature and existence, and integrate universal values into professional and personal life..

Course Contents

Unit I	Introduction to Value Education	(06 Hours)

Meaning and need for value education
Self-exploration as the basis for right understanding Human aspiration s: happiness and prosperity
Right understanding, relationship, and physical facility, Current scenario: confusion and contradictions in life Method to fulfill basic human aspirations

Unit II	Harmony in the Human Being	(06 Hours)

Human being as coexistence of self and body Distinction between needs of the self and body Role of the body as an instrument of the self
Harmony in the self and harmony of self with the body, Self-regulation and health: a value-based approach

Unit III	Harmony in the Family and Society	(06 Hours)

Family as the basic unit of human interaction
Values in relationships: trust, respect, affection, care Right evaluation and mutual fulfillment
Harmony in society: justice, fearlessness, and coexistence
Vision for a universal human order

Unit IV	Harmony in Nature and Existence	(06 Hours)

Interconnectedness and mutual fulfillment in nature Four orders in nature and their harmony
Existence as coexistence of units in space Holistic perception of harmony in existence
Professional ethics and transition to a value-based lifestyle

Assignments/ Portfolio Tasks
Practical 1: Sharing about Oneself Introduction of students with following points yourself, family, friends, achievements and failures, your aspirations from life. How do you expect to fulfil these aspirations and live a life of fulfillment? Expected Outcome: The students start exploring themselves; get comfortable with each other and with the teacher and start appreciating the need and relevance of the course.
Practical 2: Exploring Human Consciousness Watch and discuss the documentary video "Story of Stuff". It is a about the materials economy – its motivation, process and outcome. (Source: http://storyofstuff.org/movies/story-of-stuff) Expected Outcome: The students start finding that right understanding is the basic need of human being; followed by relationship and physical facility. They also start feeling that lack of understanding of human values is the root cause
Practical 3: Exploring right understanding Make a list of your desires. Now for each item on the list, find out what would be necessary to fulfil it, i.e. will it require: (a) Right understanding? (b) Relationship (right feeling)? (c) Physical facility? Expected Outcome: Students start feeling that lack of understanding of human values is the root cause of all problems and the sustained solution could emerge only through understanding of human values and value based living.
Practical 4: Exploring Natural Acceptance Observation within the faculty of 'Natural Acceptance', based on which you can verify what is right or what is not right for you. Make a list of the problems in your family. For each problem, find out the most significant reason: is it related to lack of right understanding, lack of feelings in relationship or lack of physical facility? Also, find out how much time and effort you have devoted for each in the last one week. Expected Outcome: The students are able to see that self-verification must be based on their natural acceptance. In many cases, their actual living is not in accordance with their natural acceptance. In addition, lack of feeling in relationship is the major cause of problems in their family and with friends.
Practical 5: Exploring the difference of Needs of Self and Body Take the list of desires you made in Practical 2. Update it if required. Now classify the desires as being related to the need of the Self or need of the Body. Expected Outcome: The students are able to relate their desires to need of the Self and the Body distinctly. They are able to see that the Self and the Body are two distinct realities, and large parts of their desires are related to the need of the Self (and not the Body).
Practical 6: Exploring Sources of Imagination in the Self Recall the times that your body has been ill (in disharmony) in the last 3 years. What steps were taken to restore the harmony of the Body? If you were to take full responsibility for your body, (i.e. you had the feeling of self-regulation), what kind of daily schedule would you have? Approximately how much time would you allocate for keeping your body in good health? Expected Outcome: The students are able to list down activities related to proper upkeep of the Body and practice them in their daily routine. They are also able to appreciate the plants growing in and around the campus, which can be beneficial in maintaining their health and even curing common ailments.

Practical 7: Exploring the Feeling of Trust Show & discuss the video “Right Here Right Now”. It is a short film directed by Anand Gandhi about human behavior and its propagation. Part 1: https://www.youtube.com/watch?v=OVAokeqQuFM Part 2: https://www.youtube.com/watch?v=gIYJePEnvUY). Expected Outcome: The students are able to see that the natural acceptance (intention) of everyone is to be happy and make others happy! It is the competence that is lacking in themselves and in others. They are able to distinguish between reaction and response, appreciate the need for 100% response in human interaction and make effort towards it.
Practical 8: Exploring Systems to fulfil Human Goal Assuming that you would like to see your hostel/ educational institution/ workplace/ neighborhood as a model of human society, write down its goal(s) and the system to achieve these goals. Expected Outcome: The students are able to see that as a family, a society, the comprehensive human goal is naturally acceptable to all. They are able to see that the systems required for their fulfilment include; Education- Sanskar, Health Self-regulation, Production-Work, Justice-Preservation and Exchange-Storage. Meaningful participation by every individual, every family, every family cluster… every village, town, city… country and the whole world is required in these systems for the human goals to be fulfilled.

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: CEP-241-PES

Course Name: Mini-project/ Case study/Seminar

Teaching Scheme	Credit	Examination Scheme
Practical : 4 Hours/Week	02	Term work : 25 Marks Oral : 25 Marks

Course Objectives: The course aims to

1. Develop students' understanding of societal challenges through direct community engagement.
2. Foster application of engineering knowledge to solve practical community problems.
3. Enhance individual and team work capabilities, communication skills, and research orientation.
4. Encourage critical analysis and documentation skills for comprehensive learning.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Identify and understand societal issues within a community context clearly.
2. Apply appropriate robotics and automation technologies to real-life community needs.
3. Effectively document and communicate research findings or project outcomes through structured reporting and presentations.
4. Demonstrate professional ethics, social responsibility, and teamwork /individual skills during community interactions.
5. Critically analyze existing systems/technologies and propose informed improvements.
6. Reflect effectively on personal and professional learning outcomes from community engagement.

Detailed Guidelines forTasks:

Mini-project(Group-based: maximum 4 students):

Guidelines:

1. **Group Formation and Mentor Allocation**
   - Form groups of **maximum4 students**.
   - Assign one faculty mentor per group for regular guidance.
2. **Community Problem Identification**
   - Conduct initial visits/interviews/surveys to identify real community issues that can be addressed using basic robotics or automation (e.g., agriculture, waste management, energy conservation, water quality).
3. **Problem Definition and Project Proposal**
   - Clearly define the problem, objectives, scope, and feasibility of your project.
   - Prepare a one-page project proposal tobe reviewed and approved by your mentor.
4. **Project Planning and Implementation**
   - Perform literature review and select relevant technology.
   - Design, develop, and test a simple working prototype or solution.
   - Regular mentor-guided reviews to ensure practical viability.

5. Documentation and Reporting

- Compile a comprehensive final report(~20pages):
  - ✓ Introduction, Problem Statement
  - ✓ Objectives and Methodology
  - ✓ Technology and Tools used
  - ✓ Prototype development and Testing results
  - ✓ Community Impact and Outcomes
  - ✓ Conclusions, Challenges faced, Future scope
- Prepare a group presentation clearly demonstrating outcomes.

Case Study (Individual-based)

Guidelines:

Assign one faculty mentor per Student for regular guidance

1. Topic Identification

- Choose a relevant case study from your community involving robotics or automation systems (e.g.,smart farming, automated waste management, automated irrigation).

2. Case Analysis

- Collect detailed data via field visits, interviews, and observations.
- Analyze the system's implementation, benefits, challenges, and effectiveness.

3. Documentation and Critical Review

- Document findings with relevant data, photographs, and references.
- Critically review and propose informed recommendations or improvements.

4. Final Report and Presentation

- Structured report (~15pages):
  - ✓ Introduction, Objectives, and Scope
  - ✓ Detailed analysis of the current system
  - ✓ Benefits, Challenges, Observations
  - ✓ Recommendations for improvement
  - ✓ Conclusion and Reflection
- Individual oral presentation summarizing key insights and recommendations.

Seminar (Individual- based)

Assign one faculty mentor per Student for regular guidance Guidelines:

1. Seminar Topic Selection
   - Select a community-relevant topic linked with automation or robotics (e.g., role of robotics in health care, robotics in disaster management, automation for rural development).
2. Research and Preparation
   - Conduct comprehensive literature research and field interaction.
   - Gather detailed information, statistics, case examples relevant to your topic.
3. Seminar Content Development
   - Develop structured seminar content with clear introduction, main body, examples, practical implications, and conclusions.
4. Delivery and Report Submission
   - Present seminar individually (10–15minutes) clearly communicating your findings.
   - Submit a concise structured report (~15–20 pages) summarizing seminar content and community insights.

Savitribai Phule Pune University
Second Year of Engineering (2024 Pattern)

Course Code: PCC-251-PES

Course Name: Industrial Electronics and Electrical Machines

Teaching Scheme	Credit	Examination Scheme
Theory : 3Hours/Week	03	CCE : 40Marks End-Semester: 60Marks

Course Objectives:

The course aims to

1. Introduce fundamental concepts of Industrial Electronics for automation.
2. Familiarize students with embedded systems using Arduino for automation tasks.
3. Provide knowledge of DC motors, their characteristics.
4. Provide fundamental understanding of AC motors, starters and sPESd control methods.
5. Expose students to special purpose motors and actuators essential in robotics.
6. Integrate electronics, controllers, sensors and actuators into real-world automation systems.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Explain the working of basic semiconductor devices and apply them in simple industrial automation circuits.
2. Develop embedded solutions using Arduino for sensor interfacing and automation applications.
3. Evaluate and select suitable DC motors for automation applications.
4. Analyze AC motor characteristics and apply appropriate control strategies.
5. Select and integrate suitable special purpose motors into robotic applications.
6. Design and demonstrate simple automated systems using integrated control systems.

Course Contents

Unit I	Fundamentals of Industrial Electronics	(07Hours)

Introduction, scope and applications of Industrial Electronics. Semiconductor Devices: Diodes, BJTs, SCR, MOSFET, IGBT (Characteristics & applications). Rectifiers (half-wave & full-wave; Numerical on efficiency & ripple factor),Relay logic and simple relay-based circuits.

Unit II	Embedded Systems for Automation	(07Hours)

Introduction to functions of several variables, Limit, Continuity and Partial Derivatives. Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative and Change of Independent variables.

Unit III	DC Machines	(07Hours)
Construction, working principle of D.C. generator, DC motor: Construction, torque & speed relations (Numericals on torque-speed & back EMF). Types of DC Motors: Shunt, series, compound (characteristics & applications).Starters:3-point,4-point (working and diagrams). Speed control methods: PWM, voltage control (Numerical on PWM frequency & duty-cycle).		
Unit IV	**AC Machines**	**(06Hours)**
Three-phase induction motor: construction, slip & torque-slip characteristics (Numerical on slip & torque calculations).Motorstarters:DOL,Star-Delta,Auto-transformer(operation & circuits). Speed control: VFD & V/f method (conceptual). Single-phase induction motor types and applications.		
Unit V	**Special Purpose Motors**	**(06Hours)**
Stepper Motors: Types, step angle calculation (Numerical on step-angle & RPM), driver circuits. Servo Motors: Principle, feedback & closed-loop control. BLDC Motors: Working principle, role of Electronic Speed Controller (ESC), and typical industrial and consumer applications. Universal Motors: Basic construction, working principle, and common applications.		

Learning Resources

Text Books:

1. Muhammad Rashid, "Power Electronics,"Pearson.
2. Ashfaq Husain,"Electrical Machines,"Dhanpat Rai & Sons.
3. Ajay Deshmukh, "Microcontrollers:Theory & Applications," Tata McGrawHill.
4. Electronics Devices by Thomas.` L.Floyd,9th Edition, Pearson.

Reference Books:

1. Sensors and Transducers by D.Patrnabis,2ndEdition,PHI
2. Smarajit Ghosh,“Electrical Machines”, Pearson Education,New Delhi.
3. Kenneth J.Ayala,‘The 8051 Microcontroller’, Cengage Learning
4. Started with Arduino by Massimo Banzi and Michael Shiloh Published by Maker Media,Inc
5. A. E.Fitzgerald, Charles Kingsley, Stephen D. Umans, “Electrical Machines”, Tata McGraw Hill Publication Ltd.

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-252-PES

Course Name: Theory of Machines

Teaching Scheme	Credit	Examination Scheme
Theory : 3Hours/Week	03	CCE : 40Marks End-Semester: 60Marks

Prerequisite Courses,if any: Basic mechanical Engineering, Engineering Mechanics.

Course Objectives:

The course aims to

1. To make the student conversant with commonly used mechanism for industrial application.
2. To acquaint students with basic concepts of belt drives and its applications.
3. To learn the students about types and applications of brakes and dynamometers
4. To develop competency in velocity analysis of mechanism by relative velocity and ICR methods.
5. To develop competency in acceleration analysis of mechanism by relative acceleration and Klein's construction.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Understand the basic knowledge of mechanism, their inversions and applications.
2. Select best suitable belt drive system for mechanical systems.
3. Understand the application of brakes, dynamometer in mechanical systems.
4. Analyze velocity in mechanisms by graphical method
5. Analyze acceleration in mechanisms by analytical and graphical method

Course Contents

Unit I	Fundamentals of Mechanism	(07Hours)

Basics: Kinematic Link, Types of links, Difference between machines, mechanism and structure, Kinematics pair, Types of Constrained Motion, Classification of Kinematics Pairs, Inversions of kinematic chain, Degrees of freedom of mechanisms, Kutzbach and Grubler Criterion, Grasoff's law, Equivalent linkage concept,.
Mechanisms: Straight line mechanisms- Exact straight line and approximate straight line type, Intermittent Motion Mechanism, Steering gear mechanisms- Davis and Ackerman type.

Unit II	Belt Drives	(07Hours)

Types of belt drives, Materials for Belt. Velocity Ratio, Slip, Creep of belt. Length of open and cross belt drive. Tension ratio, maximum tension in a belt, Centrifugal tension, Initial tension in belt, Maximum power transmitted, Power transmission and Ratio of driving tension for V- Belt drive (Numerical treatment expected)

Unit III	Brakes and Dynamometers	(07Hours)
Brakes: Types of brakes, Force analysis of brakes, block brakes, self-energize and self-locking brakes, band brakes, band and block brakes, Internal expanding shoe brakes, braking torque. (Numerical treatment expected) Dynamometer: Different types of absorption and transmission dynamometers.		
Unit IV	**Kinematic Analysis of mechanisms (Velocity Analysis)**	**(07Hours)**
Concept of position, displacement and velocity of a point and link of a given mechanism, Kinematic analysis of mechanism by- Relative velocity method, Instantaneous center of rotation method, Klein's construction (Numerical treatment expected)		
Unit V	**Kinematic Analysis of Mechanisms: (Acceleration Analysis)**	**(07Hours)**
Concept of acceleration of a point and link of a given mechanism, Kinematic analysis of mechanisms by – Relative acceleration method, Graphical method, Analytical method, Coriolis component of acceleration, Klein's construction (Numerical treatment expected)		

Learning Resources

Text and Reference Books:

1. S.S.Rattan, "Theory of Machines", Third Edition, McGrawHill Education(India)Pvt.Ltd., New Delhi.
2. Bevan T,"Theory of Machines", Third Edition, Longman Publication
3. G.Ambekar, "Mechanism and Machine Theory", PHI
4. Sadhu Singh,"Theory of Machines", Pearson
5. Ghosh Malik,"Theory of Mechanism and Machines",East-West Pvt. Ltd.
6. Hannah and Stephans,"Mechanics of Machines",Edward Arnolde Publication
7. R.L.Norton,"Kinematics and Dynamics of Machinery",First Edition, McGrawHill Education (India) PLtd.New Delhi
8. Dr.V.P.Singh,"Theory of Machine", Dhanpatrai and Sons
9. C.S. Sharma, Kamlesh Purohit, "Theory of Machine and Mechanism", PHI
10. J.J.Uicker,G.R.Pennock,J.E.Shigley,"Theory of Machines and Mechanisms", Fifth Edition, International Student Edition, Oxford
11. R S Khurmi & JK Gupta "Theory of Machines" S.Chand Publication, NewDelhi. Links to online

SWAYAM/NPTEL Courses–

1) https://nptel.ac.in/courses/112105268
2) https://nptel.ac.in/courses/112104121

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-253-PES

Course Name: Design of Machine Elements

Teaching Scheme	Credit	Examination Scheme
Theory : 2 Hours/Week	03	CCE : 40Marks End-Semester: 60Marks

Prerequisite Courses,if any:: Basic mechanical Engineering, Engineering Mechanics,

Course Objectives:

The course aims to

1. To understand various design considerations, design procedure and select materials for a specific application
2. To learn the design of various machine components such as shafts, couplings, keys.
3. To calculate the stresses in power screw due to various types of loads and study its failure.
4. To analyze the welded and threaded joints in mechanical systems subjected axial and eccentric loading.
5. To learn the design of various types of springs used in mechanical system.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Design and analyze the cotter and knuckle Joints, levers and components.
2. Design shafts, keys and couplings under static loading conditions.
3. Analyze different stresses in power screws and APPLY those in the procedure to design screw jack.
4. Evaluate & Amp; Interpret the stress developed on the different type of welded and threaded joints.
5. Apply the design and development procedure for different types of springs.

Course Contents

Unit I	Design process and design of Simple Machine elements	(07Hours)

Design Process: Machine Design, Design Process, Design considerations, Standards and codes, Use of preferred series, Factor of safety, Service factor.
Design of Simple Machine Parts: Design of Cotter joint, Knuckle joint, Levers-hand/
foot lever, lever for safety valve, bell crank lever, curved beams of circular cross section and components subjected to eccentric loading.

Unit II	Design of Shafts and Gears	(07Hours)

Shafts : Design considerations in Transmission shafts with spur gear and pulley , splined shafts, Shaft design on strength basis, Shaft design on torsional rigidity basis, A.S.M.E. code for shaft design,
Keys: Classification of keys, Design considerations in parallel and tapered sunk keys,

Design of square, flat and Kennedy keys, Splines.
Couplings: Design considerations, Classification, Design of Rigid, Muffcoupling, Flange coupling and Flexible bushed pin coupling.
Gear design: Classification of gears, Selection of type of gears,Types of Gears

Unit III	Design of Power Screws	(07Hours)

Power Screws: Types of screw threads,multiple threaded screws, Torque analysis with square and trapezoidal threads, Self-locking screw, Collar friction torque, Stresses in power screws, design of screw and nut, design of Screw jack.

Unit IV	Design of Springs	(06Hours)

Mechanical Springs: Types, Applications and materials of springs,Stress and deflection equations for helical springs, Types of ends, Design of helical compression and tension springs,Springs in series and parallel, Helical torsion spring, surge in spring.

Unit V	Threaded and welded joints	(06Hours)

Threaded Joints: Basic types of screw fasteners,Bolts of uniform strength,I.S.O.Metric screw threads, Bolts under tension, Eccentrically loaded bolted joint in shear, Eccentric load perpendicular and parallel to axis of bolt, Eccentric load on circular base. Design of Turn Buckle.
Welded Joints:Welding symbols,Stresses in butt and fillet welds,Strength of butt,parallel and transverse fillet welds, Axially loaded unsymmetrical welded joints, Eccentric load in plane of welds, Welded joints subjected to bending and torsional moments.

Learning Resources

Text Books:

1. ShigleyJ.E.and MischkeC.R., “Mechanical Engineering Design”,McGraw-Hill publication Co. Ltd., 1989, ISBN 0-07-049462-2.
2. SpottsM.F.and ShoupT.E.,“Design of Machine Elements”,8ed.,Pearson Education Pvt Ltd., 2008, ISBN 81 - 7758- 4219.
3. Bhandari V.B.,“Design of Machine Elements”,Tata Mcgraw-hillpublishing,2007,ISBN 978-00-60-681798.
4. Rattan S.S.,“Theory of Machines”,3rd edition,Tata McGraw-hillpublishing,2005,ISBN 007-059120-2.
5. S.K.Saha, Introduction to Robotics,3rd Edition, Tata McGraw Hill; Standard Edition,ISBN-13:978-9355326461.

Reference Books:

1. Orthewein and William C.Orthewein,“Machine Component Design”.
2. PSG Design data”,M/SDPVprinters,Coimbatore,2000.
3. Shigley Joseph Edward and VickerJohnJoseph.“Theory of Machines and Mechanisms”,3rd edition,1995, Oxford University Press.ISBN0-19-515598-x.
4. S.R. Deb, Robotics Technology and Flexible Automation,2ndEdition, Mc Graw Hill Education (India)Private Limited, ISBN:9780070077911

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-254-PES

Course Name: Industrial Electronics and Electrical Machines Lab

Teaching Scheme	Credit	Examination Scheme
Practical : 2Hours/Week	**01**	**Term Work : 25Marks** **Practical : 25Marks**

List of Practical:

1. Interfacing of LED to blink after every1sec.
2. Sensor interfacing with Arduino (LM35, Ultrasonic).
3. DC motor speed control using PWM.
4. AC motor starters practical demonstration.
5. Stepper motor positioning control.
6. Servomotor positional accuracy experiments.
7. BLDC motor speed control demonstration.
8. Mini-project: Arduino-based automation system integrating sensors, actuators (Mandatory).

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: PCC-255-PES

Course Name: Design of Machine Elements Lab

Teaching Scheme	Credit	Examination Scheme
Practical : 2Hours/Week	**01**	**Oral : 25Marks**

List of Practical

1. Term work shall consist of ONE design project. Design project shall consist of two imperial size sheets –one involving assembly drawing with a part list and overall dimensions and other sheet involving drawings of individual components. Manufacturing tolerances, surface finish symbols and geometric tolerances should be specified so as to make it working drawing. A design report giving all necessary calculations of the design of components and assembly should be submitted in a separate file. Design projects should be in the form of „Design of Mechanical System‟ comprising of machine elements studied and topics covered in the syllabus. Design data book shall be used wherever necessary to achieve selection of standardized components.
2. Problem based assignment on Design process and design of Simple Machine elements
3. Problem based assignment on Design of Shafts, Keys and Couplings
4. Problem based assignment on Design of Power Screws
5. Problem based assignment on Mechanical Springs
6. Problem based assignment on Design Threaded and Welded joints

Savitribai Phule Pune University Second Year of Engineering(2024Pattern)

Course Code: MDM-272-PES Course Name:

SMART MATERIALS

Teaching Scheme	Credit	Examination Scheme
Theory : 2Hours/Week	02	CCE : 40Marks End-Semester: 60Marks

Prerequisite Courses ,if any:

- Material Science, Engineering Metallurgy

Course Objectives:

The course aims to

1. To develop futuristic insight into materials
2. To acquire the skills and techniques necessary for modern materials engineering practice
3. To acquaint students with basic concepts, properties and applications of Nanomaterials
4. To acquaint students with the requirements and behaviour of FGMs and Composites

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Explain the basic principles of smart materials
2. Describe the utilization of smart and modern materials in engineering applications
3. Gain the knowledge of properties and applications of Nanomaterials
4. Understand FGM and Composite materials, their behaviour and performance

Course Contents

Unit I	Fundamentals of Smart Materials	(06Hours)

Introduction to Smart Materials, Principles of Piezo electricty, Single Crystals and Polycrystalline, Piezoelectric Polymers, Magnetostrictive materials, Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC), Shape Memory Effect, Shape Memory Alloys

Unit II	Smart and Modern Materials	(06Hours)

Self-Sensing Piezoelectric Transducers, Shape Memory Actuators, Energy Harvesting Materials, Autophagous Materials, Self- Healing Polymers, Dielectrics, semiconductors, conductors & super conducting materials. Magnetic and photoelectric materials, optical materials, Bio materials.

Unit III	Nanomaterials	(06Hours)

Introduction, Unique properties of nanomaterials, Applications of nanomaterials- Nano electronics, Micro-and-Nano-electromechanical systems (MEMS/NEMS), Nanosensors, Nanocatalysts, Structure and Engineering, Automotive Industry, Nano-medical applications, Tools to characterize Nanomaterials- XRD, SEM, TEM, AFM, STM, FIM, 3DAP, Nano indentation

Unit IV	FGM & Composites	(06Hours)

Functionally Graded materials: Introduction, Classification, Characteristics, behavior and Applications, Fabrication of FGM. Types of composites, Types of fibers & matrix, Calculation of load sustained by fibres & matrix each under iso stress condition & iso strain conditions, Numerical based on this calculation. Applications of MMCs.

Learning Resources

Text and Reference Books:

1. O.P.Khanna, ―A Textbook of Material Science and Metallurgy, Dhan Pat Rai Publications(P) Ltd., 2013, ISBN- 978-81-89928-31-5
2. V.D.Kodgire, S.V. Kodgire,―Material Science and Metallurgy for Engineers", Everest Publishing House, 24th Edition, 2008, ISBN 81 86314 00 8.
3. R.K.Rajput, ―A Textbook of Material Science and Engineering, S.K.Kataria and Sons, 3rd Edition, 2011, ISBN 81-85749-92-2
4. Daniel Gay- Composite Materials- Design and Applications, CRC Press, 2014
5. Charles J A, Crane F.A.A. & Furness J A G ,"Selection and use of Engineering Materials", 3rd edition, Butterworth – Heiremann – 1977
6. C. Brian, Smart Structures and Materials, Artech House, 2000
7. W. G. Cady, Piezoelectricity, Dover Publication, New York, 2014.
8. Clyne T.W. and Withers P.J-Introduction to Metal Matrix Composites, Cambridge University Press,
9. Murray Schwartz, Mel M. Schwartz- Composite Materials Handbook, McGraw-Hill, 1992

Savitribai Phule Pune University
Second Year of Engineering (2024 Pattern)
Course Code: VSEC-281-PES

Course Name: Measurement Lab

Teaching Scheme	Credit	Examination Scheme
Practical : 2Hours/Week	**01**	**Practical : 25Marks**

Prerequisite Courses, if any:

- Basics of Linear measurements and working principles of Electrical and Electronics devices.

Course Objectives:

The course aims to

1. To develop necessary skills for calibration and testing of instruments
2. To apply fundamentals of measuring methods by collecting data ,analysis and interpretation
3. To apply knowledge of Designing limiting gauges
4. To apply knowledge of Electronic/Electrical measuring instruments
5. To apply knowledge of Temperature /Flow measurement instruments

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Evaluate causes of errors in Vernier calipers, micrometers by performing experiments in standard metrological conditions, noting deviations at actual and by plotting cause and effect diagram, to reduce uncertainty in measurement.
2. Analyze strain measurement parameters by taking modulus of elasticity in consideration to acknowledge its usage in failure detection and force variations.
3. Examine surface Textures, surface finish using equipment's like Talysurf and analyze surface finish requirements of metrological equipment's like gauges, jaws of vernier calipers, micrometers, magnifying glasses of height gauge and more, to optimize surface finish accuracy requirements and cost of measurement.
4. Measure the dimensional accuracy using micrometer, Comparator and limit gauges and appraise their usage in actual measurement or comparison with standards set to reduce measurement lead time.
5. Preform Testing of Flow rate, speed and temperature measurements and their effect on performance in machines and mechanisms like hydraulic or pneumatic trainers, lathe machine etc. to increase repeatability and reproducibility.
6. Complie the information of opportunities of entrepreneurships/business in various sectors of metrology like calibrations, testing, coordinate etc in preparing the report.

Lab Assignments/Activities:(Any6)

1. Linear and angular Measurement: Demonstration and calculations using Vernier Caliper, Screw gauge, Dial gauge, height gauge, Bevel protector etc.
2. Limit Gauges: Concepts, uses and applications of Go –No Go Gauges, Taylor's principle and Design of gauges
3. Surface roughness measurement of a given sample using surface tester
4. Screw Thread geometry measurement by floating carriage micrometer.
5. Gear Tooth geometry measurement by Gear tooth venire caliper.
6. Determination of geometry and dimensions of given composite object / single point tool, by using Optical Projector / Tool makers' Microscope and differentiate between its use fullness in real life
7. Calibration of Thermocouple for temperature measurement
8. Machine Tool Measurement-runout, offset etc on machine like lathe ,drilling, milling etc 9.Fundamentals of measurements and Calibration process by using Dead weight Tester/Strain Gauges/Pressure Gauge.
10. Verification of dimensions and geometry of given components using Electric/Mechanical/Optical/Pneumatic comparator in context of manufacturing.

Savitribai Phule Pune University
Second Year of Engineering (2024Pattern)
Course Code: VSEC-282-PES

Course Name: Creative Problem Solving and Critical Thinking

Teaching Scheme	Credit	Examination Scheme
Practical : 2Hours/Week	01	Term Work : 25Marks

Prerequisite Courses, if any: Design Thinking and Idea.

Course Objectives:

The course aims to

1. To develop creative and analytical problem-solving abilities in students.
2. To introduce structured methods of critical thinking and reasoning.
3. To enhance lateral thinking, brain storming, and decision-making skills.
4. To apply creative framework to real-world engineering and social problems.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Apply creative thinking techniques to generate innovative ideas.
2. Analyze problems critically using structured thinking models.
3. Evaluate alternative solutions using decision-making frameworks.
4. Collaborate in teams to solve real-world challenges.
5. Communicate ideas effectively using visual thinking and presentation skills.

Assignments/Activities

Foundations of Creative Thinking

Tutorial: Introduction to creativity,fixed vs growth mind set,convergent vs divergent thinking

Practical: "30CirclesActivity","SCAMPER Tool",Mind Mapping for idea generation

Critical Thinking Basics

Tutorial: Logic vs emotion, assumptions and biases, types of reasoning (inductive /deductive)

Practical: Case study analysis, identifying fallacies,"Fact vs Opinion"exercise

Problem-Solving Frameworks

Tutorial: Define the problem, Root Cause Analysis (5 Whys,Fishbone Diagram)

Practical: Apply tools to local problems (college/event-based),team discussions

Decision-Making and Evaluation

Tutorial: Decision trees,cost-benefit analysis, Pugh matrix

Practical: Scenario-based decision-making games, mock committee decisions

Innovation and Lateral Thinking

Tutorial: Edward de Bono's Six Thinking Hats, TRIZ basics

Practical: Role-play thinking hats ,reverse thinking challenge

Communicating Ideas

Tutorial: Visual thinking, storyt elling for innovation

Practical: Elevator pitch for a new solution, poster design for a creative idea

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)
Course Code:AEC-283-PES
Course Name: Modern Indian Languages (Marathi/Hindi)

Course Code: AEC-283-PES

Course: Modern Indian Language (Marathi)

Teaching Scheme	Credit	Examination Scheme	
Tutorial : 1 hours / week Practical :2 hours / week	1 1	TW	50 marks

Course Objectives:

अभ्यासक्रमाची उद्दिष्टे :

१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे.
२. प्रसारमाध्यमांतील संज्ञापनातील स्वरूप आणि स्थान स्पष्ट करणे.
३. व्यक्तिमत्त्व विकास आणि भाषा यांच्यातील सहसंबंध स्पष्ट करणे.
४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांचे परस्पर संबंध स्पष्ट करणे.
५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.

COURSE CONTENTS

Unit I&II (07 hours & 8 hours)

घटक	तपशील
१	१. भाषा आणि व्यक्तिमत्त्व विकास : सहसंबंध २. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे
२	प्रसारमाध्यमांसाठी लेखन १ वृत्तपत्रासाठी बातमीलेखन आणि मुद्रितशोधन २ नभोवाणीसाठी भाषणाची संहितालेखन ३ दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन

Unit III & IV (07 hours & 8 hours)

१	१. भाषा, जीवन व्यवहार आणि नवमाध्यमे, समाजमाध्यमे २. नवमाध्यमे आणि समाजमाध्यमांचे प्रकार : ब्लॉग, फेसबुक, ट्विटर. ३. नवमाध्यमे आणि समाजमाध्यमांविषयक साक्षरता, दक्षता, वापर आणि परिणाम
२	१. वेबसाईट आणि ब्लॉग, ट्विटरसाठी लेखन २. व्यावसायिक पत्रव्यवहार

LEARNING RESOURCES

संदर्भ ग्रंथ :

१ सायबर संस्कृती, डॉ. रमेश वरखेडे
२ उपयोजित मराठी, संपादक डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई
३ ओळख माहिती तंत्रज्ञानाची, टिमोथी जे. ओ लिअरी
४ संगणक, अच्युत गोडबोले, मौज प्रकाशन, मुंबई.
५ इंटरनेट, डॉ. प्रबोध चोबे, मनोरमा प्रकाशन, मुंबई.
६ व्यावहारिक मराठी, डॉ. ल. रा. नसिराबादकर, फडके प्रकाशन, कोल्हापूर.
७ आधुनिक माहिती तंत्रज्ञानाच्या विश्वात, शिक्रापूरकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाशन, पुणे.

Guidelines Term Work conduction and Evaluation

Implementation Guidelines

1. Subject teacher should frame minimum 08 assignments-based covering on all four units.

2. Scaffolding: Start with simpler tasks and gradually increase complexity. Provide necessary vocabulary and grammatical structures beforehand.

3. Differentiation: Offer varied levels of support for students with different proficiency.

4. Pair Work & Group Work: Encourage collaborative learning and peer correction.

5. Feedback: Provide constructive feedback on all assignments, focusing on both accuracy and fluency.

6. Authentic Materials: Use real-world Marathi materials (simple songs, short videos, advertisements) as much as possible.

7. Cultural Context: Integrate cultural aspects into the assignments (e.g., describing a Marathi festival, a famous personality).

8. Fun & Engaging: Make the activities enjoyable to keep students motivated. Use games and competitive elements where appropriate.

9. Technology Integration: Use online dictionaries, translation tools (with caution), and Marathi typing tools.

10. These assignments can be adapted based on the students' proficiency level and the specific learning objectives of the Marathi course.

Suggested List of Assignments

1. "Samvad Sadara Kara" (Present a Dialogue): Role-Playing Everyday Scenarios: Objective is to practice conversational Marathi, understanding social cues. In pairs or small groups, students create and perform a short dialogue based on a given scenario.

2. Vartamanpatra Vachan" (Newspaper Reading): (Columns like Sports, political, finance, edito-rial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal.

3. Creative writing: Write blogs and posts on social media up to 200 words on recent development in their field of study
4. “Mala He Sangayche Aahe" (I Want to Say This): Students are expected to show the objects and describe it to the class in Marathi. They should mention its color, size, use, why it’s important to them, etc.
5. Professional letter / report writing
(a) Write a letter to the principal/director for organizing NSS camp in nearby village. Preparation of the budget, permission letters and report submission in the University
(b) Write a letter for internship sponsorship to any organization.
6. Book Review – Students are expected to read any novel, fiction or literature book of their choice and write a review on post it on social media of their choice.
7. Participation in Competitions (in college/out side the college) debate, declamation, elocution –A Report should be submitted
8. Group Activity: Road show, skit play, one-act play
9. Participation in One-Act-Play - Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak and Shreetej Karandak.
10. Marathi Film Review – Watch the Marathi movie widely available on an OTT (Over-The-Top) platform, broadcaster in Television or availle on YouTube and write a review.

Savitribai Phule Pune University
Second Year of Engineering (2024Pattern)
Course Code: EEM-284-PES

Course Name: Behavioural Science

Teaching Scheme	Credit	Examination Scheme
Tutorial : 1Hour/Week Practical : 2Hours/Week	01	Term Work : 25Marks

Prerequisite Courses, if any: No Prerequisite required.

Course Objectives:

The course aims to

1. To introduce students to the psychological foundations of human behavior.
2. To develop emotional intelligence, interpersonal skills, and self-awareness.
3. To enhance group behavior, collaboration, and leadership in teams.
4. To nurture critical thinking, ethical reasoning, and lifelong behavioral competencies.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Understand and reflect on their personality, perception, and behavioral style.
2. Apply emotional intelligence and stress management in personal and academic life.
3. Demonstrate effective communication, teamwork, and leadership behaviors.
4. Use behavioral models for ethical reasoning and critical thinking.
5. Practice life skills like adaptability, grit, and motivation for personal growth.

Assignments/Activities

Foundations of Human Behavior Tutorial

Topics:

- Definition and importance of behavioral science
- Personality types, attitudes, and perception
- Johari Window for self-awareness

Practical Activities:

- Personality assessment quiz
- "Know Yourself"–Johari Window Reflection
- Group discussion: Role of behavior in tech teams

Emotional Intelligence & Self-Awareness Tutorial

Topics:

- Goleman's model of Emotional Intelligence
- Self-esteem, self-efficacy, motivation
- Stress causes and management

Practical Activities:

- Self-assessment
- Stress management techniques: Mindfulness, Time Logs
- Visualization and journaling for self-reflection

Interpersonal & Group Dynamics Tutorial

Topics:

- Verbal and non-verbal communication
- Team roles (Belbin),group behavior, conflict handling

Practical Activities:

- Listening circles and empathy exercises
- Team role-play: Handling difficult situations
- "Build a Bridge" collaborative game

Decision-Making Tutorial

Topics:

- Rational vs emotional decisions
- Common biases and heuristics
- Root Cause Analysis,5 Whys, Mind Mapping

Practical Activities:

- Case study analysis (behavioral errors in decision-making)
- Team brainstorming and decision simulation

Ethics, Integrity & Professional Behavior Tutorial

Topics:

- Meaning of ethics and professional conduct
- Whistle blowing, accountability, and dilemmas in engineering

Practical Activities:

- Case study discussions on engineering ethics
- Role-play on ethical dilemmas
- Reflective writing on integrity and values

Life Skills & Self-Development Tutorial

Topics:

- Growth mindset (CarolDweck),resilience, grit
- Self-leadership and behavioral adaptability

Practical Activities:

- Grit scale test
- Peer coaching and feedback session
- Vision board for personal growth

Savitribai Phule Pune University
Second Year of Engineering(2024Pattern)

Course Code: VEC-285-PES

Course Name: Environmental Studies

Teaching Scheme	Credit	Examination Scheme
Theory : 2Hours/Week	02	CCE : 15Marks End-Semester: 35Marks

Prerequisite Courses, if any: No specialized prerequisites

Course Objectives:

The course aims t o

1. To introduce the multidisciplinary nature and scope of environmental studies.
2. To understand eco system structures, biodiversity, and ecological balance through hands- on observation and documentation.
3. To examine the use and impact of natural resources on environmental sustainability.
4. To explore biodiversity conservation practices and develop eco-sensitive thinking through field based inquiry.

Course Outcomes:

After successful completion of the course, learner will be able to:

1. Illustrate the inter dependence of ecosystems through activity-based exploration
2. Analyze the role of natural resources in sustainable development using real-world data.
3. Investigate biodiversity threats and conservation strategies through surveys and projects
4. Create awareness tools or reports promoting sustainability based on their findings.

Course Contents

Unit I	Introduction to Environment and Ecosystem	(06Hours)

Meaning and Scope of Environment: Definition of environment, T ypes of environment(natural, built),Components of environment(biotic and abiotic),Man–environment relationship, Importance of environment and sustainability, Need for public environmental awareness.
Ecosystem Basics: Definition and major components of ecosystems, Structure and function of ecosystem
Case studies: forest ecosystem, Grass land ecosystem, Desert ecosystem, Aquatic ecosystem
Stability of ecosystems and their role in environmental sustainability

Unit II	Environmental Pollution and Control Measures	(06Hours)

Definition and Types of Pollution
Air Pollution: sources, effects, and Air Pollution Control Act Water
Pollution: sources, effects, and Water Pollution Control Act Noise
Pollution: sources and effects
Solid Waste Pollution: sources and impacts
Concept of integrated pollution control

Unit III	E-Waste Management	(06Hours)

Introduction to E-Waste: Definition, composition, and sources of e-waste, Global context of e- waste generation, Major pollutants and their hazardous properties, Effects of e -waste on human health and the environment E-Waste Management Principles: Basic principles and hierarchy of e-waste management, Technologies for resource recovery from e-waste, Mechanical processing and material recovery techniques, Occupational and environmental health perspectives,E-waste recycling scenario in India		
Unitl V	E-Waste Control, Laws, and Regulatory Framework	(06Hours)
Regulatory and Legal Measures: Need for health and environmental protection laws in India, E- Waste Management Rules,2016 and amendments, Extended Producer Responsibility (EPR), Import/export permissions and compliance, Administrative and engineering controls Sustainable E-Waste Management: Role of government, industry, and citizens, Monitoring and enforcement mechanisms, Strategies for reduction of waste at source, Strengthening of regulatory mechanisms through technical expertise		
Learning Resources		
Text Books: 1. Odum, Eugene P. "Fundamentals of Ecology" 2. R. Rajagopalan, "Environmental Studies– From Crisis to Cure", Oxford 3. Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi		
Reference Books: 1. Erach Bharucha, "Textbook of Environmental Studies", UGC 2. Anubha Kaushik and C.P. Kaushik, "Environmental Studies", New Age International		

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