सावित्रीबाई फुले पुणे विद्यापीठ

Savitribai Phule Pune University, Pune, Maharashtra, India

Faculty of Science and Technology

National Education Policy (NEP)-2020 Compliant Curriculum

First Year Engineering (2024 Pattern)

[Common to All UG Engineering Programs]

(With effect from Academic Year 2024-25)

NEP 2020 Compliant Curriculum Structure

First Year Engineering (2024 Pattern)

Level 4.5														
Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Term work	Practical	Oral	Theory	Tutorial	Practical	Total
Semester I														
BSC-101-BES	Basic Science Course	Engineering Mathematics- I	3	1	-	30	70	25	-	-	3	1	-	4
BSC-102-BES/ BSC-103-BES	Basic Science Course	Engineering Physics / Engineering Chemistry	3	-	2	30	70	25	-	-	3	-	1	4
ESC-101-ETC / ESC-102-ELE	Engineering Science Course	Basic Electronics Engineering / Basic Electrical Engineering	2	-	2	30	70	25	-	-	2	-	1	3
ESC-103-MEC/ ESC-104-CVL	Engineering Science Course	Engineering Graphics / Engineering Mechanics	2	-	2	30	70	25	-	-	2	-	1	3
ESC-105-COM	Engineering Science Course	Fundamentals of Programming Languages	2	-	2	30	70	25	-	-	2	-	1	3
VSE-101/ VSE-102	Vocational and Skill Enhancement Course	Manufacturing Practice Workshop/ Design Thinking and Idea Lab	-	-	2	-	-	25	-	-	-	-	1	1
AEC-101	Ability Enhancement Course	Professional Communication Skills	-	2	-	-	-	25	-	-	-	2	-	2
CCC-101	Co-Curricular Courses	Co-Curricular Course-I	-	-	4	-	-	25	-	-	-	-	2	2
Total			**12**	**03**	**14**	**150**	**350**	**200**	**-**	**-**	**12**	**03**	**07**	**22**

CCE*: Comprehensive Continuous Evaluation

NEP 2020 Compliant Curriculum Structure

First Year Engineering (2024 Pattern)

Level 4.5														
Course Code	Course Type	Course Name	Teaching Scheme (Hrs./week)			Examination Scheme and Marks					Credits			
			Theory	Tutorial	Practical	CCE*	End-Sem	Term work	Practical	Oral	Theory	Tutorial	Practical	Total
Semester II														
BSC-151-BES	Basic Science Course	Engineering Mathematics-II	3	1	-	30	70	25	-	-	3	1	-	4
BSC-103-BES/ BSC-102-BES	Basic Science Course	Engineering Chemistry/ Engineering Physics	3	-	2	30	70	25	-	-	3	-	1	4
ESC-102-ELE/ ESC-101-ETC	Engineering Science Course	Basic Electrical Engineering/ Basic Electronics Engineering	2	-	2	30	70	25	-	-	2	-	1	3
ESC-104-CVL/ ESC-103-MEC	Engineering Science Course	Engineering Mechanics/ Engineering Graphics	2	-	2	30	70	25	-	-	2	-	1	3
PCC-151-ITT	Program Core Course	Programming and Problem Solving	2	-	2	30	70	25	-	-	2	-	1	3
VSE-102/ VSE-101	Vocational and Skill Enhancement Course	Design Thinking and Idea Lab / Manufacturing Practice Workshop	-	-	2	-	-	25	-	-	-	-	1	1
IKS-151	Indian Knowledge System	Indian Knowledge System	-	2	-	-	-	25	-	-	-	2	-	2
CCC-151	Co-Curricular Courses	Co-Curricular Course-II	-	-	4	-	-	25	-	-	-	-	2	2
Total			**12**	**03**	**14**	**150**	**350**	**200**	**-**	**-**	**12**	**03**	**07**	**22**

CCE*: Comprehensive Continuous Evaluation

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Preface

The New Education Policy (NEP) 2020 has ushered a new era of change, in India's education system to better meet the needs of the 21st century. SPPU is committed to the effective and fruitful implementation of NEP 2020 in its true spirits emphasizing holistic and multidisciplinary education as per the directives of Maharashtra government. It emphasizes a multidisciplinary approach, aiming to develop critical thinking and creativity, thereby contributing to the holistic development of individuals.

We are delighted to present the first-year engineering syllabus -2024 pattern, which has been meticulously designed in alignment with the NEP 2020 with effect from academic year 2024-25. This curriculum aim to provide students with a holistic approach to engineering education ensuring a strong foundation in Mathematics and Science courses. This curriculum also includes components of vocational and skill enhancement courses, Indian Knowledge System and Co-curricular courses to shape well-rounded engineers who can adapt to global demands. Also, this document provides information on the credit system, course contents, examination and evaluation scheme along with guidelines to make best use of the curriculum designed.

The syllabus encourages experiential learning, where theoretical concepts are supported by practical laboratory sessions. Also promotes research and innovation, encouraging students to engage in projects from the early stages of their academic journey. I wish to thank all the Board of Studies chairpersons and members who contributed in designing this curriculum.

We believe that this syllabus, crafted with the essence of the NEP 2020, will equip our students with the necessary skills and knowledge to excel in their future endeavors. We look forward to embarking on this exciting academic journey with our students.

Dr. Pramod D. Patil
Dean – Science and Technology
Savitribai Phule Pune University, Pune

Program Outcomes (POs)

PO1	**Engineering knowledge**	Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems.
PO2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.
PO3	**Design / Development of Solutions**	Design solutions for complex Engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.
PO4	**Conduct Investigations of Complex Problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	**Modern Tool Usage**	Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modelling to complex Engineering activities with an understanding of the limitations.
PO6	**The Engineer and Society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practices.
PO7	**Environment and Sustainability**	Understand the impact of the professional Engineering solutions in societal and Environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	**Ethics**	Apply ethical principles and commit 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 Skills**	Communicate 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.
PO12	**Life-long Learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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
OE	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

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)

Comprehensive Continuous Evaluation (CCE) of 30 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 30 marks with the specified parameters, the allocation of marks and the structure can be detailed as follows:

Sr.	Parameters	Marks	Coverage of Units
1.	Unit Test	12 Marks	Units 1 & Unit 2 (6 Marks/Unit)
2.	Assignments / Case Study	12 Marks	Units 3 & Unit 4 (6 Marks/Unit)
3.	Seminar Presentation / Open Book Test/ Quiz	06 Marks	Unit 5

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 completing Units 1 and 2. Ensure the question paper is balanced and covers key concepts and applications.
Sample Question Distribution:

- Remembering (2 Marks): Define key terms related to [Topic from Units 1 and 2].
- Understanding (2 Marks): Explain the principle of [Concept] in [Context].
- Applying (2 Marks): Demonstrate how [Concept] can be used in [Scenario].
- Analyzing (3 Marks): Compare & contrast [Two related concepts] from Units 1 and 2.
- Evaluating (3 Marks): Evaluate the effectiveness of [Theory/Model] in [Situation].

Assignments / Case Study:

Students should submit one assignment or one Case Study Report based on Unit 3 and one assignment or one Case Study Report based on Unit 4.
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 Units 3 and 4. Provide clear guidelines and a rubric for evaluation.

Seminar Presentation:

Seminar Presentation Format:

- Oral presentation on a topic from Unit 5, 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 Unit 5.

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:

Weeks 1-4	: Cover Units 1 and 2
Week 5	: Conduct Unit Test (12 marks)
Weeks 6-8	: Cover Units 3 and 4
Week 9	: Distribute and collect Assignments / Case Study (12 marks)
Weeks 10-12	: Cover Unit 5
Week 13	: Conduct Seminar Presentations or Open Book Test or Quiz (6 marks)

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.
By following this scheme, you can ensure a structured and comprehensive evaluation of students' understanding and application of the course material, adhering to Bloom's Taxonomy guidelines for cognitive skills evaluation.

End-Semester Examination (ESE)

End-Semester Examination (ESE) of 70 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 of End-Semester Examination (ESE)

Question Paper Design

Below structure is to be followed to design an End-Semester Examination (ESE) for a theory subject of 70 marks on all 5 units 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, Analyze, 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 (12 Marks 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.

Guidelines for Term Work Evaluation

Term Work assessment shall be conducted for the theory courses, lab practical, VSE, IKS, AEC and CCC assignments submitted in journal form. Term work is continuous assessment based on work done, submission of work in the form of report/journal, timely completion, attendance, and understanding.

It should be assessed by subject teacher of the institute and the final grade for a Term Work shall be assigned based on the performance of the student and is to be submitted to the Savitribai Phule Pune University (SPPU) at the end of the semester.

Overview:

Students will submit a journal documenting their practical assignments, providing a comprehensive record of their practical work and learning experiences throughout the course. The journal will include detailed descriptions of the practical assignments, observations, results, reflections, and any additional relevant materials.

Journal Components:

Practical Assignments: Each practical assignment should be clearly labelled and dated. Include the assignment prompt, objectives, materials used, procedures, observations, and results. Ensure assignments cover a variety of practical skills and techniques as outlined in the syllabus.

Reflections: Reflective entries should accompany each practical assignment. Discuss the learning process, challenges faced, and how they were overcome. Highlight key takeaways and how the practical assignment contributed to overall understanding.

Supplementary Materials: Include any additional materials relevant to the practical assignments (e.g., raw data, sketches, photographs, feedback received). Supplementary materials should be organized and clearly linked to the corresponding assignments.

Evaluation Criteria:

- **Completeness (20%):** All practical assignments are included, completed, and properly labeled. Reflective entries are present for each practical assignment.
- **Quality of Work (40%):** Practical assignments are completed with a high level of accuracy and thoroughness. Demonstrates a strong understanding of practical techniques and principles. Reflective entries provide meaningful insights into the learning process.
- **Organization (20%):** The journal is well-organized and easy to navigate. Practical assignments and reflections are clearly labeled and ordered chronologically. Supplementary materials are appropriately linked and referenced.
- **Presentation (10%):** The journal is neatly presented and free of spelling and grammatical errors. Includes a cover page with the student's name, course title, and submission date. Utilizes a consistent format and style throughout.
- **Creativity and Engagement (10%):** Demonstrates creativity in approach and presentation. Engages deeply with the practical work, going beyond surface-level understanding. Shows evidence of critical thinking and personal engagement with the assignments.

Submission Guidelines:

Journals should be submitted in a bound or digital format as specified by the instructor. Ensure that all components are included and properly organized before submission. Late submissions may be subject to penalties as per the course policy.

Example Timeline:

- **Weeks 1-3 :** Complete and document Practical Assignments 1 and 2, including reflections.
- **Weeks 4-6 :** Complete and document Practical Assignments 3 and 4, including reflections.
- **Weeks 7-9** : Complete and document Practical Assignments 5 and 6, including reflections.
- **Week 10 :** Finalize and organize the journal.
- **Week 11 :** Submit the completed journal for evaluation.

Benefits:

- Encourages regular and consistent engagement with practical work.
- Provides a comprehensive record of student progress and learning.
- Develops skills in reflection, organization, and presentation.
- Allows for personalized feedback and growth opportunities.
- By structuring term work evaluation through journal submissions, students can benefit from a holistic and continuous assessment process that supports their practical skills development and academic growth.

Guidelines for conducting 1 Hour Tutorial Session

Conducting a two-hour tutorial session allows for more in-depth exploration and interaction compared to shorter sessions. Here are comprehensive guidelines to effectively conduct a two-hour tutorial session for a theory subject:

1. Preparation:

Review Content: Ensure a thorough understanding of the theory subject and select key topics or concepts to cover during the session.

Set Objectives: Define clear learning objectives that align with the course syllabus and students' learning needs.

Prepare Materials: Gather necessary materials such as lecture notes, slides, handouts, and any supplementary resources or examples.

2. Structure of the Tutorial:

Introduction and Agenda Setting (05 minutes): Welcome students and outline the agenda for the tutorial session. Clarify the learning objectives and expectations for the session.

Recap or Review (07 minutes): Recap briefly the key points from previous sessions or relevant topics. Address any lingering questions or uncertainties from the previous material.

Presentation and Explanation (15 minutes): Present new material or delve deeper into selected topics. Provide clear explanations using examples, diagrams, or visual aids to aid understanding. Break down complex ideas into manageable parts and ensure clarity in explanations.

Interactive Discussion and Q&A (12 minutes): Engage students in discussions related to the presented material. Encourage active participation and critical thinking through open-ended questions. Address student queries and encourage them to ask questions for clarification.

Application and Practice (15 minutes): Assign activities or problem-solving exercises that apply the newly learned concepts. Monitor students' progress and provide guidance as they work through the tasks. Facilitate peer-to-peer learning by encouraging students to discuss their approaches with peers.

Summary and Conclusion (05 minutes): Summarize the main points covered during the tutorial session. Reinforce key concepts and their relevance to the broader course objectives. Prepare students for the next steps in their learning journey related to the topic.

Feedback and Next Steps (05 minutes): Gather feedback from students on the tutorial session, including what they found most helpful and any areas needing improvement. Provide recommendations for further study, additional resources, or upcoming assignments related to the topic.

3. Engagement Strategies:

Active Participation: Encourage all students to actively engage in discussions and activities throughout the session.

Use of Technology: Utilize multimedia presentations or online tools to enhance learning experiences and engagement.

Group Activities: Incorporate group discussions or collaborative activities to promote peer learning and interaction.

4. Assessment and Evaluation:

Formative Assessment: Assess student understanding through informal assessments, discussions, and problem-solving activities.

Feedback Mechanism: Provide timely feedback on students' participation and comprehension to support their learning progress.

5. Logistics and Environment:

Classroom Setup: Ensure a comfortable and conducive learning environment with adequate seating, lighting, and equipment for presentations.

Time Management: Manage time effectively to cover all planned activities within the two-hour duration.

6. Post-Tutorial Follow-Up:

Reflection: Reflect on the tutorial session to evaluate its effectiveness and identify areas for improvement in future sessions.

Student Support: Offer additional office hours or online support for students who may need further assistance with tutorial material or assignments.

By following these guidelines, you can conduct a structured and engaging two-hour tutorial session that enhances students' understanding and retention of theory subjects while fostering active learning and participation.

Guidelines for The Students Induction Programme (SIP) for First Year Engineering

When First Year Engineering students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Induction programme for First Year Engineering students is introduced to familiarize them to the new environment and encourage them to learn beyond classrooms.

Objective is to help new students adjust and feel comfortable in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self-exploration. Induction Program should be preferably of 3 weeks (2 weeks at beginning first semester and 1 week at the beginning of second semester).

In order to implement the (SIP) the following activities can be taken at college.

a) **Physical Activity**: - This would involve a daily routine of physical activity with games and sports.
b) **Creative Arts:** - Every student would choose one skill related to arts whether visual arts or performing arts.

c) **Mentoring and Universal Human values**: -Mentoring and connecting the students with faculty members and other students is the most important part of student induction. This can be effectively done by forming a group of 22-24 students with a faculty mentor each. This can be implemented through group discussion and real-life activities rather than only lecturing.

d) **Familiarization with College, Department and Branch:**- The incoming student should be told about the credit, grading system and scheme of the examination. They should be explained how the study in College differs from the study in school. They should be taken on College tour and shown important facilities such as library, canteen, gymkhana etc. They should be shown their own department.

e) **Literary Activity**:- Literary Activity would compass reading book, writing a summary, debating, enacting a play etc.

f) **Proficiency modules:** - The modules can be designed to overcome some critical lacunas that students might have like English Speaking, Computer familiarity etc.

g) **Lectures by Eminent People:** - The lectures of Eminent people be organized to expose the students to social activity and public life.

h) **Visit to local Area:-** A couple of visits to the landmarks of the city or a hospital are orphanage could be organized.

i) **Extracurricular activities in College**:- The new students should be introduced to the extracurricular activities at the College.

j) **Feedback and Report on the program**:-Students should be asked to give their mid program Feedback wherein each group of 22-24 students should be asked to prepare a single report on their experience of the program.

These are summarized guidelines to be given to the student inducing induction programme (SIP). Please refer SIP Manual published by AICTE for detail guidelines at https://www.aicte-india.org/content/student-induction-program-detailed-guide.

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Savitribai Phule Pune University
Faculty of Science and Technology

National Education Policy (NEP) Compliant Curriculum

Semester - I

First Year Engineering (2024 Pattern)

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Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: BSC-101-BES Course Name: Engineering Mathematics-I

Teaching Scheme			Credit	Examination Scheme		
Theory	**:**	**3 Hours/Week**	**03**	**CCE**	**:**	**30 Marks**
Tutorial	**:**	**1 Hour/Week**	**01**	**End-Semester**	**:**	**70 Marks**
				Term Work	**:**	**25 Marks**

Prerequisite Courses, if any:

- Differentiation, Integration, Maxima and Minima, Matrices and Determinants.

Course Objectives:

To familiarize the students with concepts and techniques in Calculus, Fourier series and Linear Algebra. 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:

CO1: Apply mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems. **Determine** the Fourier series representation and harmonic analysis of periodic functions in engineering applications.

CO2: Evaluate derivative functions of several variables that are essential in various engineering problems.

CO3: Apply the concept of Jacobian to find partial derivatives of implicit function and functional dependence. Use of partial derivatives in estimating errors & approximations and finding extreme values of the function.

CO4: Apply the essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, Linear dependence & Independence, finding linear and orthogonal transformations.

CO5: Determine Eigen values & Eigen vectors. Use it to diagonalize matrix and to reduce quadratic form to canonical form, applicable to engineering problems.

Course Contents

Unit I	Single Variable Calculus	(08 Hours)

Rolle's Theorem, Mean Value Theorems, Taylor's and Maclaurin's Series, Indeterminate Forms and L' Hospital's Rule.

Fourier series: Full range and Half rage Fourier series, Harmonic analysis, Applications to problems in Engineering

Unit II	Multivariable Calculus – Partial Differentiation	(08 Hours)

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	Applications of Partial Differentiation	(08 Hours)

Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers and Applications to problems in Engineering

Unit IV	Linear Algebra – Matrices and System of Linear Equations	(08 Hours)

Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in Engineering.

Unit V	Linear Algebra - Eigen Values, Eigen Vectors and Diagonalization	(08 Hours)

Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonalization of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations. Application to problems in Engineering.

Learning Resources

Text Books:

1.Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)

2.Higher Engineering Mathematics by B. S. Grewal (Khanna Publication)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I & Vol. II) by P.N.Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Elementary Linear Algebra. by Ron Larson and David C. Falvo (Houghton Mifflin Harcourt Publishing Company)

MOOC / NPTEL/YouTube Links: -
https://youtube.com/playlist?list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&si=3xAONJdT2ph_jcvG

Tutorial and Term Work:

1. Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division.
2. Term work shall consist of six assignments each on unit-I to unit-VI and is based on performance and continuous internal assessment.

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: BSC-102-BES Course Name: Engineering Physics

Teaching Scheme	Credit	Examination Scheme
Theory : 03 Hours/Week **Practical : 02 Hours/Week**	**03** **01**	**CCE : 30 Marks** **End-Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any:

Bohr's atomic theory, properties of mechanical and electromagnetic waves, Huygens' principle and wavefront, interference and polarization of light, wave particle duality, intrinsic and extrinsic semiconductors, basics of magnetism, trigonometry and calculus.

Course Objectives:

The objective of the course is to impart the knowledge of fundamentals of physics through hands-on experiments and extend it to relevant engineering applications.

Course Outcomes:

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

CO1: Develop the understanding of working principle of lasers, optical fibers and extend it to holography and fiber optic communication.

CO2: Deduce Schrödinger's wave equations and apply it to problems on the bound states by summarizing fundamentals of quantum physics.

CO3: Explain phenomena of interference in thin films, polarization, double refraction and connect to the Anti-Reflection Coating, LCD.

CO4: Develop understanding of Fermi level and Fermi energy in semiconductors on the basis of results of Fermi Dirac statistics and relate them with the working of semiconducting devices. Extend the **understanding** of Ultrasonic to thickness measurement, flaw detection.

CO5: Explain properties of nanoparticles and estimate engineering applications; Explain phenomenon of Superconductivity and estimate engineering applications.

Course Contents

Unit I	Fundamentals of Photonics	(08 Hours)

Laser: Spontaneous and stimulated emission, population inversion, pumping, active medium & active center, resonant cavity; Characteristics of lasers, CO2 laser: construction and working, Engineering applications of laser (IT, medical, industry), Holography (recording, reconstruction, applications); Optical

Optical fibers: Critical angle, acceptance angle, acceptance cone, numerical aperture, total internal reflection and propagation of laser; Classification of optical fibers: Single mode & multimode, step index & graded index, Attenuation: attenuation coefficient, causes of attenuation; Advantages of optical fiber communication, numerical problems on parameters of optical fiber.

Unit II	Quantum Physics	(08 Hours)

de Broglie hypothesis of matter waves, de Broglie wavelength for a particle accelerated by KE "E" and a charged particle accelerated by PD "V", properties of matter waves; Wave function and probability density, mathematical conditions for wave function, problems on de Broglie wavelength; Need and significance of Schrödinger's equations, Schrödinger's time independent and time dependent equations; Energy of a particle enclosed in a rigid box and related numerical problems; Quantum mechanical tunneling, alpha particle decay, principle and applications of STM; Principles of quantum computing: concept of qbit, superposition and entanglement, comparison of classical & quantum computing, potential applications of quantum computing.

Unit III	Wave optics	(08 Hours)

Interference in thin film of uniform thickness, conditions of maxima and minima for reflected system; Conditions for maxima and minima for wedge shaped film (qualitative), engineering applications – ARC, determination of optical flatness; Numerical problems on thin film and wedge shaped film; Types of polarization: Unpolarized, Polarized, PPL, CPL and EPL, Malu's law and related numerical problems; Double refraction: geometry of calcite crystal, Huygens' theory; Engineering applications of polarization: LCD, communication & radar, 3D movies (recording, projection).

Unit IV	Semiconductor Physics and Ultrasonics	(08 Hours)

Semiconductor Physics: Valence band, conduction band, band gap energy, classification of solids on the basis of band theory; Fermi level and Fermi energy for metal, FD distribution function and its temperature dependence, position of Fermi level in intrinsic semiconductors (derivation); Fermi level for extrinsic semiconductors, working of PN junction diode on the basis of Fermi energy; Solar cell: principle, working, IV-characteristics, efficiency and fill factor, measures to improve efficiency of solar cell, advantages and applications in environmental sustainability; Hall effect: derivation for Hall voltage and Hall coefficient and related numerical problems.

Ultrasonics: Characteristics and properties of ultrasonic waves, Generation of ultrasonic waves by inverse piezoelectric effect (using transistor); Engineering applications - thickness measurement, flaw detection and related numerical problems.

Unit V	Physics of Nanoparticles and Superconductivity	(08 Hours)

Nanoparticles: Quantum confinement and its effect on properties of nanoparticles, synthesis methods - ball milling and Physical Vapor Deposition; Properties of nanoparticles (optical, electrical, mechanical, magnetic); Applications of nanotechnology: Electronics (GMR effect and its application in read-write head of HDD), automobiles, environmental & energy, medical field (targeted drug delivery).

Superconductivity: Temperature dependence of resistivity, critical magnetic field, critical current, Meissner effect and perfect diamagnetism; Type I and Type II Superconductors, Numerical problems on critical magnetic field; Formation of Cooper pairs, DC and AC Josephson effect, SQUID: working principle and applications; Engineering applications: electronics, principle of Maglev train.

List of Laboratory Experiments/Assignments (Any 8 from the given list)

1. An experiment based on Laser: To determine the divergence of a laser beam or to determine diameter of a thin wire or to perform beam profile analysis of a laser beam.
2. An experiment based on optical fiber: To determine the numerical aperture or attenuation coefficient or critical angle of incidence for given a glass slab or any experiment to calculate parameters of optical fiber.
3. Determination of Planck's constant using available experimental setup.
4. Newton's rings - to understand the interference and determine radius of curvature of a given plano-convex lens or determine wavelength of given monochromatic light.
5. An experiment based on diffraction: determination of number of lines per centimeter on grating surface using normal incidence method or determination of wavelength of laser using transmission grating or to determine wavelength of light using diffraction grating & spectrometer.
6. An experiment based on polarization: To verify cosine square law of Malus Law for plane polarized light or to determine the specific rotation of the given sample with the help of a polarimeter or to determine refractive indices of extraordinary and ordinary rays using double refractive prism.
7. To determine the band gap energy of a semiconductor sample using a PN junction diode.
8. To plot I-V characteristics and determine fill factor and efficiency of a given solar cell.
9. To determine Hall coefficient and charge carrier density of a given semiconductor sample.
10. Determination of velocity of ultrasonic waves and compressibility of given liquid by using Ultrasonic Interferometer
11. An experiment based on physical measurements developed using Arduino interface for Hall effect sensor or Ultrasonic sensor.
12. Study tour / visit to a research laboratory / facility and submit a report.

Note: Apart from the above list, any one experiment related to the curriculum available in the institute / developed in-house / performing experiment on Virtual Lab platform may also be considered to be performed out of eight experiments.

Learning Resources

Text Books:

- A Textbook of Engineering Physics, M. N. Avadhanulu, P. G. Kshirsagar & TVS Arun Murthy, S. Chand Publications.
- Engineering Physics, R. K. Gaur and S. L. Gupta, Dhanpat Rai Publications.

Reference Books:

- Optics, Ajoy Ghatak, Tata Mc Graw Hill
- Introduction to Solid State Physics, C. Kittel, Wiley and Sons.
- Quantum Mechanics, A. K. Ghatak, S. Lokanathan, Laxmi Publications.
- Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing.
- Physics for Scientists and Engineers with Modern Physics, Serway and Jewett, Cengage Publications.

e-Books:

1. Feynman Lecture series: https://www.feynmanlectures.caltech.edu/
2. Concepts of Modern Physics, Arthur Beiser: https://nitsri.ac.in/Department/PHYSICS/Beiser_Modern_Physics.pdf

MOOC / NPTEL/YouTube Links:

1. Lectures by Walter Lewin: https://www.youtube.com/channel/UCiEHVhv0SBMpP75JbzJShqw
2. Quantum Mechanics Lecture Series by Prof. H. C. Verma: https://www.youtube.com/playlist?list=PLWweJWdB_GuISnGkAafMpzzDBvTHg02At

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: BSC-103-BES Course Name: Engineering Chemistry

Teaching Scheme	Credit	Examination Scheme
Theory : 03 Hours/Week **Practical : 02 Hours/Week**	**03** **01**	**CCE : 30 Marks** **End-Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any: Types of titrations, structure property relationship, classification and properties of polymers, electromagnetic radiation, electrochemical series.

Course Objectives:

To acquire knowledge of water quality analysis technology and electro-analytical techniques for chemical analysis. Learn about specialty polymers and nanomaterials. Study conventional and alternative fuels, and understand corrosion mechanisms and prevention methods.

Course Outcomes:

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

CO1: Understand the practical approaches and techniques required to effectively monitor water quality.

CO2: Select appropriate electro analytical techniques for understanding the materials.

CO3: Demonstrate the structure and properties of advanced engineering materials for various technological applications.

CO4: Analyze different types of conventional and alternative fuels.

CO5: Explain causes of corrosion and methods for minimizing corrosion.

Course Contents

Unit I	Water Technology	(08 Hours)

Impurities in water, hardness of water: Types, Units and Numerical. Determination of hardness (by EDTA method using molarity concept) and alkalinity, numerical. Ill effects of hard water in boilers - priming and foaming, scale and sludge. Water treatment: i) Zeolite method and numerical ii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis. Modern technique for /of atmospheric water generation.

Unit II	Instrumental Methods of Analysis	(08 Hours)

Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), ion selective electrode (solid membrane electrode)

[A] Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve. (Strong acid- Strong base). Applications of conductometry**.**

[B] pHmetry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve and its applications.

[C] UV-Visible Spectroscopy: Introduction, statement of Beer's law and Lambert's law, Electronic transitions in organic molecule, terms involved in UV-visible Spectroscopy. Instrumentation (double beam) and its applications. Numerical: Based on Absorption laws i.e. Molar absorptivity and concentration.

Unit III	Advanced Engineering Materials	(08 Hours)

A] Polymers: Introduction, Definition Polymer, Monomer, Functionality of monomers, Classification of polymer (Thermal Behavior-Thermoplastics and Thermosetting).

Specialty polymers: Introduction, preparation, properties and applications of the following polymers: 1. Engineering Thermoplastic: Polycarbonate, 2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalerate), 3. Conducting Polymer: Polyacetylene.

[B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).

Unit IV	Energy Sources	(08 Hours)

Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel), Calorific value, Higher calorific value and Lower calorific value, Determination of calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numerical, Solid fuel. Coal: Analysis of Coal-Proximate and Ultimate analysis, numerical, Alternative fuels: Power alcohol and biodiesel. Hydrogen gas as a future fuel. Lithium Ion Battery, construction, working, advantages, applications.

Unit V	Corrosion and its Prevention	(08 Hours)

Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, Factors influencing rate of corrosion. Methods of corrosion control and prevention: Cathodic Protection (Sacrificial Anode and Impressed Current), metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, electroplating. Corrosion Resistant / Anti corrosive paints.

List of Laboratory Experiments (Any 8 experiments from the given list).

1. To determine hardness of water by EDTA method.
2. To determine alkalinity of water.
3. To determine strength of strong acid using pH meter
4. To determine maximum wavelength of absorption of CuSO4/FeSO4/ KMnO4, verify Beer's law and find unknown concentration of given sample.

5. Titration of a mixture of weak acid and strong acid with strong base using conductometer.
6. Preparation of polystyrene/phenol-formaldehyde/urea-formaldehyde resin.
7. To determine molecular weight/radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
8. Proximate analysis of coal
9. To coat copper and zinc on an iron plate using electroplating.
10. Preparation of biodiesel from oil.
11. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nanoparticles.

Learning Resources

Text Books:

1.Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.

2.Engineering Chemistry by O. G. Palanna, Tata Magraw Hill Education Pvt. Ltd.

3.Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher.

Reference Books:

1.Basic Concept of Analytical Chemistry, 2ed, S. M. Khopkar, New Age-International Publisher.

2.Instrumental Methods of Chemical Analysis, G. R. Chatwal& S. K. Anand, Himalaya Publishing House.

3.Spectroscopy of organic compounds, 2ed, P. S. Kalsi, New Age-International Ltd., Publisher.

4.Polymer Science, V. R. Gowarikar, N. V. Viswanathan, jayadev Sreedhar, Wiley Eastern Limited.

5. Inorganic Chemistry, 5ed, Shriver and Atkins, Oxford University Press.

6. Fundamentals of Nanotechnology, G. L. Hornyak, J. J. Moone, H. F. Tihhale, J. Dutta, CRC press.

e-Books:

1. **https://chem.nju.edu.cn/_upload/article/files/b5/6f/01f0f2434d708df797208aea2613/83f2b441-65ee-44a6-ac47-ed21db462c5d.pdf.**
2. **https://edisciplinas.usp.br/pluginfile.php/5955761/mod_resource/content/1/CORROSION_AND CORROSION_CONTROL_An_Intro%20%20Revie%20and%20Uhlig.pdf**

MOOC / NPTEL/YouTube Links:

1. **https://nptel.ac.in/courses/113104082**

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: ESC-101-ETC Course Name: Basic Electronics Engineering

Teaching Scheme	Credit	Examination Scheme
Theory : 02 Hours/Week **Practical : 02 Hours/Week**	**02** **01**	**CCE : 30 Marks** **End – Sem : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any:
Basic Physics and Mathematics, Semiconductor Physics, Digital Electronics, Circuit Theory, Analog Electronics, Sensors and Transducers

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To **understand** the working principles of PN junction diode and Special purpose diodes.
2. To **study** the operating principle and applications of Bipolar Junction Transistors & MOSFET.
3. To **learn** the concepts of various logic gates, digital circuits, Microprocessor & Controller.
4. To **understand** the concepts of Opamp, its applications and electronic Instruments.
5. To **know** the methods of measurement of physical parameters using sensors and transmission with the help of communication systems.

Course Outcomes:

On completion of the course, learner will be able to:
CO1: Know about the working of P-N Junction diode and its application as rectifier & switch, basics of LED & Photodiode.

CO2: Understand the working of BJT & MOSFET, their characteristics & compare.

CO3: Learn logic gates & realization of the digital circuits.

CO4: **Understand** the functioning of Opamp and electronic instruments.

CO5: Select sensors based on their working principle for specific applications and its implementation with Communication system.

Course Contents

Unit I	Diodes and Applications	(06 Hours)

Evolution of Electronics, Current trends in Electronics, Impact of Electronics in industry and society. Introduction to active and passive components.

P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias conditions, V-I characteristics of P-N junction Diode, Diode as a switch, Half wave rectifier, Full wave and Bridge rectifier.

Special purpose diodes: Light Emitting Diode (LED) and photo diode along with V- I characteristics and their applications.

#Exemplar	LED TV, IR-Remote Controller, Rolling Displays, SMPS, Mobile & Laptop Chargers

Unit II	Transistors and Technology	(06 Hours)

Bipolar Junction Transistor: Construction, type, Operation, V-I Characteristics in common emitter mode, BJT as switch and Common Emitter(CE) amplifier. **Enhancement Metal Oxide Semiconductor Field Effect Transistors (EMOSFET):** Construction, Types, Operation, V-I characteristics, MOSFET as switch & amplifier. Introduction to VLSI Technology, Feature size/Channel Length, N Well method of VLSI CMOS manufacturing.		
#Exemplar	Audio Amplifier / PA System, CMOS ICs in Cell phone & Laptops, Pen Drives.	
Unit III	**Logic Gates and Digital Circuits**	**(06 Hours)**
Number System: Introduction of Binary, Decimal, Octal, Hexadecimal, Conversion of Binary to Decimal, Decimal to Binary, Binary addition. **Logic Gates -** AND, OR, NOT, XOR, XNOR. Universal Gates – NAND, NOR. De-Morgan's theorem. **Logic circuits -** Half & Full adders. SR, JK, T & D Flip Flops. Introduction to Microprocessor and Microcontroller (Only block diagram and explanation). Digital IC design flow, IC Fabrication process flow.		
#Exemplar	Memories in Cell Phone, Laptop, Pen drive, ECU in Advanced car, Automation in manufacturing using PLC, Arduino Boards.	
Unit IV	**Operational Amplifier and Electronic Instruments**	**(06 Hours)**
Operational amplifier: Functional block diagram of operational amplifier, Ideal & practical values of performance parameters, Op-amp applications: Inverting, Non-inverting amplifier. **Electronic Instruments:** Block diagram of Digital Multimeter, Function Generator, Digital Storage Oscilloscope (DSO), DC power supply.		
#Exemplar	Domestic Energy Meter, Battery Charging Station, ICU Monitor in Hospital.	
Unit V	**Sensors and Communication Systems**	**(06 Hours)**
Classification of sensors: Active /Passive Sensors, Selection Criteria/Characteristics of sensor. Motion Sensors (LVDT), Temperature Sensors (Thermocouple, RTD), Mechanical Sensors (Strain Gauge), Biosensors. Block diagram of IoT based Data Acquisition and Automation System. **Communication Systems:** Block Diagram, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Cellular concept, Block diagram of GSM system.		
#Exemplar	Digital Thermometer, Weighing Machine, Green House Automation in Agricultural, Home Automation. 4G & 5G Technology, Satellite Communication, Radar/Military Communication	

List of Laboratory Experiments (Any 8 experiments from the given list)

1.	Electronic Components: Study of Active and Passive components a) Resistors (Fixed &Variable), Calculation of resistor value using color code. b) Capacitors (Fixed &Variable) c) Inductors, Calculation of inductor value using color code.

	d) Devices such as Diode, BJT, MOSFET, various IC packages e) Switches & Relays
2.	Measurements using various measuring instruments: a) Setup CRO and function generator for measurement of AC & DC voltages and frequency b) Measure Voltage, Resistance using digital Multimeter. Also use Multimeter to check diode, BJT.
3.	V-I characteristics of P-N Junction Diode (Study the datasheet of typical PN junction diode)
4.	Rectifier circuits: Implement DC Regulated Power Supply using bridge rectifier & diodes.
5.	Build and test Common Emitter (CE) BJT Amplifier Circuit. a) Calculate the Gain of CE Amplifier
6.	Linear applications of Op-amp: Build inverting and non-inverting amplifier using op-amp(Study the data sheet of typical Op-Amp741)
7.	Test and verify the truth tables of: a) Basic and Universal Gates (Study the datasheet of respective ICs) b) Half & Full Adder
8.	Study of transducers/sensor (Any3)
9.	Build and test any circuit using BJT/MOSFET/Op-Amp/Logic Gates using any one sensor.
10.	Case Study of any one electronics appliances with block diagram, specification etc.

Guidelines for Instructor's Manual

- The instructor's manual is to be developed as a hands-on resource and reference.
- Copy of Curriculum, Conduction & Assessment guide lines, List of Experiments to be attached.

Guidelines for Student's Lab Journal

The students Lab Journal should contain following related to every experiment –

1. Title of the experiment
2. Objective
3. Apparatus with their detailed specifications.
4. Brief theory related to the experiment.
5. Connection diagram /circuit diagram.
6. Observation table
7. Sample calculations for one/two reading.
8. Result tabl
9. Graph and Conclusions.

Guidelines for Laboratory Conduction

- All the experiments (Any Eight) mentioned in the syllabus are compulsory.
- Use of open source software and recent version is to been courage.

Guidelines for Lab/TW Assessment

- Continuous assessment of laboratory work is to be done based on overall performance.
- Each lab assignment/experiment assessment will assign grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each laboratory assignment include:
  - ✓ Timely completion.
  - ✓ Performance.
  - ✓ Punctuality and neatness.

Learning Resources

Text Books:

1. Electronics Devices by Thomas.` L. Floyd, 9th Edition, Pearson
2. Modern Digital Electronics by R. P. Jain, 4th Edition, Tata McGraw Hill
3. Electronic Instrumentation by H. S. Kalsi, 3rd Edition, Tata McGraw Hill
4. Sensors and Transducers by D. Patrnabis, 2nd Edition, PHI
5. Electronic Communication Systems by Kennedy & Davis, 4th Edition, Tata McGraw Hill
6. Mobile Wireless communication by M. Schwartz, Cambridge University Press

Reference Books:

1. Digital Fundamentals by Thomas. L. Floyd, 11th Edition, Pearson
2. Mobile Communication by J. Schiller, 2nd Edition, Pearson
3. Sensors Handbook, by S. Soloman, 2nd Edition.
4. CMOS Circuit Design, Layout & Simulation, by Baker, 2nd Edition, Wiley IEEE Press

e-Books:

1. https://www.pearson.com/en-us/subject-catalog/p/electronic-devices-electron-flow-version/P200000001048

MOOC / NPTEL/YouTube Links:

1. https://nptel.ac.in/courses/117103063
2. https://nptel.ac.in/courses/117103064
3. 3. https://archive.nptel.ac.in/courses/106/105/106105166/

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: ESE-102-ELE Course Name: Basic Electrical Engineering

Teaching Scheme	Credit	Examination Scheme:
Theory : 02 Hours/Week **Practical : 02 Hours/Week**	**02** **01**	**CCE : 30 Marks** **End - Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any: Electric charges and fields, Coulomb's laws, Voltage, Potential, Current, Ohms law, Magnetism, EMF, Faraday's Laws, Alternating current, AC Generator, Power.

Companion Course, if any: **Laboratory Practical**

Course Objectives:

To impart the fundamental knowledge of electrical engineering to all the students of various disciplines and give comprehensive idea about AC and D C circuit analysis, working principles and applications of basic electric machines. The aim is also to familiarize students with different wiring components, wiring schemes and electricity bill.

Course Outcomes:

On completion of this course, learners will be able to:

CO1: Apply Kirchhoff's Laws, Superposition theorem and network simplification techniques for DC circuit analysis.

CO2: Analyze the magnetic circuit parameters, self-Inductance, mutual Inductance and Electromotive Forces (EMF's).

CO3: Calculate AC quantities using mathematical equations, waveforms and phasor diagrams.

CO4: Compute the voltage, current and power of the given 1-phase and 3-phase AC circuits

CO5: Understand the working principle of 1-Phase Transformer, Motors (DC, Induction) and their practical applications.

Course Contents

Unit I	Elementary Concepts and DC Circuits	(06 Hours)

Elementary concepts: Resistance, EMF, current, potential difference, Ohm's law. Overview of elementary power system showing stages such as Generation, Transmission, and Distribution of electrical energy.

DC Circuits: Classification of electrical networks, simplifications of networks using series-parallel combinations and star delta transformation technique, Kirchhoff's Laws and their applications for network solutions using loop analysis, Superposition theorem

#Exemplar	Electric power system, Electrical Load Distribution box, Robotics

Unit II	Electromagnetism	(06 Hours)

Magnetic Circuit: Concept of flux density, field strength, permeability, MMF, reluctance, their units, and relationships. Simple series magnetic circuit, comparison of electric and magnetic circuit.

Electromagnetic Induction: Faradays Laws of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced emf, self and mutual inductance, coefficient of coupling. Energy stored in magnetic field.

#Exemplar	Loudspeaker, Motor, Generator, Transformer

Unit III	AC Fundamentals	(06 Hours)
Generation of single-phase sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, period, frequency, instantaneous, peak, average and RMS. values, peak factor and form factor. Phase, Phase difference, lagging, leading in phase quantities and their phasor representation. Rectangular and polar representation of phasor. Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance.		
#Exemplar	Generator, Electrical appliances response, Electrical heater, radio circuits, capacitor	
Unit IV	**AC Circuits**	**(06 Hours)**
Single Phase AC Circuits: Series R-L, R-C and R-L-C circuits, concept of impedance, power factor, phasor diagrams, Voltage, current and power waveforms. Concept of active, reactive and apparent power. Resonance in RLC series circuits. **Three Phase AC Circuits**: Concept of three-phase AC symmetrical system, phase sequence, balanced and unbalanced load. Voltage, current and power relations in three phase balanced star and delta connected loads along with phasor diagrams.		
#Exemplar	Machine windings, Electric power network	
Unit V	**Introduction to Electric Machines**	**(06 Hours)**
Single Phase Transformer: Construction, working principle, EMF equation, transformation ratio, rating, types, losses, regulation and efficiency at different loading conditions. **Electrical Motors :** a) **D.C. Motors**: Construction, working principle, types, voltage equation, characteristics and Applications. b) **Three Phase Induction Motor**: Working principle using rotating magnetic field theory, types and applications. c) **Single Phase Induction Motor**: Construction, working principle of single phase Induction motor. Applications of split phase, capacitor start and capacitor run motors.		
#Exemplar	Mobile charger, electric substations, UPS, Lathe machine, compressor, lifts, hoists, ceiling fan etc	

List of Laboratory Experiments (Any 8 experiments from the given list).

1. To study safety precautions while working on electrical systems, handling of various equipment's such as rheostat, multi-meter, ammeters, voltmeters, wattmeter's etc.
2. Study of wiring materials, switch board and different wiring schemes. (Simple wiring & staircase wiring).
3. To verify Kirchhoff's laws experimentally
4. To verify Superposition theorem experimentally
5. To determine efficiency and regulation of transformer by using direct loading test experimentally
6. To measure steady state response of series RL and RC circuits experimentally

7. To study RLC series resonance experimentally
8. To verify the relation between phase and line quantities in three phase balanced star delta connections of load experimentally
9. Study of cut view section of single phase/ three phase Induction motor.
10. To measure insulation resistance by using megger and study of Single-Phase LT electricity bill.

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about university / program/ institute / department / foreword / preface), University syllabus, conduction & Assessment guidelines, topics under consideration-concepts, objectives, and outcomes.

Guidelines for Student's Lab Journal

The students Lab Journal should contain following related to every experiment –

1. Title of the experiment
2. Objective
3. Apparatus with their detailed specifications
4. Brief theory related to the experiment
5. Connection diagram /circuit diagram
6. Observation table
7. Sample calculations for one/two reading
8. Result table
9. Graph and Conclusions.

Guidelines for Laboratory/ TW Assessment

1. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student.
2. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.
3. Suggested parameters for overall assessment as well as each Laboratory assignment include- timely completion, performance, efficiency, punctuality, and neatness.

Learning Resources

Textbooks:

1. B.L. Theraja,A K Theraja "ABC of Electrical Engineering", S Chand Publications,2012
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill Education, 2nd edition 2019.

Reference Books:

1. C. L. Wadhwa, "Basic Electrical Engineering", New Age International (P) Limited 5th edition 2024
2. S K Bhattacharya, "Electrical Machines", McGraw Hill Education, 2nd edition, 2008
3. T. K. Nagsarkar, M. S. Sukhija, "Basic Electrical Engineering", Oxford University Press, 2nd edition 2018.

e-Books: https://www.schandpublishing.com/books/tech-professional/electrical-engineering-electronics/abc-electrical-engineering/9788121939096/

MOOC / NPTEL/YouTube Links: https://nptel.ac.in/courses/108105112

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: ESC-103-MEC Course Name: Engineering Graphics

Teaching Scheme		Credit	Examination Scheme		
Theory	: 02 Hours/Week	02	CCE	:	30 Marks
Practical	: 02 Hour/Week	01	End-Semester	:	70 Marks
			Term Work	:	25 Marks

Prerequisite Courses, if any:

- Basic Geometric Shapes
- Basic geometrical measurements (linear and angular), Construction
- Deviation of line, circle and polygon, Co-ordinate geometry.
- Computer literacy.

Course Objectives:

This course aims to cultivate students' ability to conceptualize physical objects and effectively translate them onto paper for communication in engineering contexts. It focuses on enhancing manual drawing skills, honing drawing interpretation abilities, and fostering a practical understanding of object dimensions. Additionally, the course seeks to introduce students to essential drawing and design software tools for a well-rounded skill set.

Course Outcomes:

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

CO 1 – **Explain** the fundamentals of Engineering Graphics and basic principles of geometric construction and apply the knowledge of Projections, Methods to prepare the drawings for points and lines.

CO 2 - Apply the types of Projections, Methods to prepare the drawings for planes.

CO 3 – **Construct** the various engineering curves and illustrate the application of various engineering curves and draw the development of the lateral surface of solid.

CO 4 - Apply the concept of orthographic projection of an object to draw several 2D views for visualizing the physical state of the object.

CO 5 - Apply the visualization skill to draw an isometric projection from given orthographic views.

Course Contents

Unit I	Fundamentals of Engineering Drawing and Projection of Point and Line	(06 Hours)

Fundamentals of Engineering Drawing: Introduction to drawing instruments and their uses, Drawing sheets sizes and their layouts, Types of Lines, Dimensioning methods, General rules of dimensioning. Projection of Point and Line.

Theory of projection - Projection of points in all possible quadrants. Projection of line when parallel to both the reference planes, Projections of lines when it is perpendicular to one of the reference planes, when line is inclined to one and parallel to other reference plane, Line inclined to both reference planes (first angle projection).

Unit II	Projection of Plane	(06 Hours)

Introduction, Projection of plane when plane is Parallel to one and perpendicular to other, Projection of plane when plane is inclined to one plane and perpendicular to other Projections of planes when it is inclined to both reference planes.

Unit III	Engineering Curves and Development of Lateral Surfaces	(06 Hours)

Engineering Curves: Conic Sections- Ellipse, Parabola and Hyperbola by directrix and focus and rectangle method, Helix (one convolution) on Cylinder and Cone, Cycloid, Involute of a circle, Archimedean spiral (one convolution)

Development of Lateral Surfaces: Introduction, Method of development, development of lateral surfaces of right solids, cube, prisms, cylinder, pyramids, and cone.(No sectioned solids)

Unit IV	Orthographic Projection	(06 Hours)

Introduction, Principle of projection, Plane of Projection, Method of Projection, Orthographic Projection First and Third angle method of projection, Hidden features, curved features, circular features. etc. Typical problems by first angle projection method

Unit V	Isometric Projection	(06 Hours)

Introduction of isometric projection, Isometric lines, planes, non-isometric lines and planes, Isometric scale, Isometric projection and view, Construction of isometric view/ projection from given orthographic views.

List of Laboratory Experiments

Guidelines for Practical Evaluation: Assignment problems to be drawn on A2 size drawing sheet and two problems must be drawn by using any CAD software.

List of Assignments

1. Draw two problems on projection of lines
2. Draw two problems on projection of planes
3. Draw two problems on Engineering curves and development of lateral surfaces
4. Draw two problems on Orthographic projections
5. Draw two problems on Isometric projections

Learning Resources

Text Books:

1. Bhatt, N. D. and Panchal, V. M., (2016), “Engineering Drawing”, Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), “Engineering and Graphics”, New Age International, New Delhi
3. Jolhe, D. A., (2015), “Engineering Drawing with introduction to AutoCAD”, Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), “A First Course in Engineering Drawing”, Springer Nature Singapore Pte. Ltd., Singapore

Reference Books:

1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), "Machine Drawing", Charotor Publishing House, Anand, India
3. Dhawan, R. K., (2000), "A Textbook of Engineering Drawing", S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA
5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), "Principles of engineering graphics", McMillan Publishing, USA

e-Books:

MOOC / NPTEL/YouTube Links:

NPTEL Course: Engineering Graphics and Design
https://onlinecourses.nptel.ac.in/noc21_me128/preview

NPTEL Course: Introduction and Geometric Construction
https://archive.nptel.ac.in/content/storage2/courses/112103019/module1/lec3/1.html

NPTEL Course: Computer Aided Design and Manufacturing".
https://archive.nptel.ac.in/courses/112/102/112102101/

Note: Some units of theory can be taught during practical sessions and more emphasis can be given on hands on skills.

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: ESC-104-CVL Course Name: Engineering Mechanics

Teaching Scheme	Credit	Examination Scheme
Theory : 2 Hours/Week **Practical : 2 Hours/Week**	**02** **01**	**CCE : 30 Marks** **End-Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any:

- Basic Calculus, Trigonometry, Geometrical expressions, Laws of motion, Concept of mass, acceleration with Fundamental knowledge of Engineering Mathematics and Physics.

Companion Course, if any: **Laboratory Practical.**

Course Objectives:

The objectives of this course is to make students to learn basics of engineering Mechanics concepts and its application to the real-world problems, solve problems involving Forces, loads and Moments and know their applications in allied subjects.

Course Outcomes:

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

CO1. Understand basic concept of forces, moments and couples in two-dimension force system
CO2. Apply concept of free body diagram for static equilibrium in two-dimension force system
CO3. Analyze the practical example involving friction and application of two force members
CO4. Analyze rectilinear and curvilinear motion of particle
CO5. Apply Newton's second law, work energy and impulse momentum principles for particles

Course Contents

Unit I	Force systems and its resultants	(06 Hours)

Introduction, type of motion, fundamental concepts and principle, force system, resolution and composition of forces, resultant of concurrent force system, moment of a force, Varignon's theorem, resultant of parallel force system, couple and resultant of general force system. Introduction, centroid of basic figures, centroid of composite figure, moment of inertia of simple geometrical figure, parallel axis theorem, perpendicular axis theorem, moment of inertia of composite figure.

Unit II	Equilibrium	(06 Hours)

Introduction, free body diagram, equilibrium of coplanar forces, equilibrium of two forces, three force principle, equilibrium of concurrent, parallel and general force system, type of load, type of support, type of beam and support reaction.

UNIT III	Friction and trusses	(06 Hours)

Introduction, sliding and rolling friction, laws of coulomb friction, coefficient of friction, angle of repose, angle of friction, cone of friction, friction on inclined plane, ladder friction and belt friction.

Trusses: two force and multi force member, assumption of analysis, analysis of truss, identification of zero force members, method of joint and method of section.

UNIT IV	Kinematics of particle	(06 Hours)
Introduction, basic concept, rectilinear motion: motion with uniform acceleration, gravitational acceleration and variable acceleration, curvilinear motion: rectangular components, motion of projectile, normal and tangential components.		
UNIT V	**Kinetics of particle**	**(06 Hours)**
Introduction, Newton's second law of motion, equation of motion, Newton's law of gravitation, application of Newton's second laws to rectilinear and curvilinear motion, conservative and non-conservative forces, work energy principle, conservation of energy, impulse momentum principle and impact		

List of Laboratory Experiments

Journal consist of the following

A. Compulsory experiments as per following list

1. Verification of the Polygon law of forces
2. To find support reaction of beam
3. To determine coefficient of friction
4. Determination of coefficient of restitution

B. Graphical Solution of the following

1. Equilibrium of concurrent force system
2. Equilibrium of parallel force system
3. Forces in the member of pin jointed truss
4. Moment of Inertia

C. Assignment on each unit: minimum four example on each unit

Guidelines for Student's Lab Journal

The students Lab Journal should contain following related to every experiment –

1. Title of the experiment
2. Objective
3. Apparatus with their detailed Drawing.
4. Brief theory related to the experiment.
5. Observation table
6. Sample calculations for one/two reading.
7. Result table
8. Graphs (if any) and Conclusions.

Guidelines for Laboratory/ TW Assessment

a. Continuous assessment of laboratory work is to be done based on overall performance and Laboratory performance of student.

b. Each Laboratory assignment assessment should assign grade/marks based on parameters with appropriate weightage.

Suggested parameters for overall assessment as well as each Laboratory assignment include timely completion, performance, efficiency, punctuality, and neatness.

Learning Resources

Text Books:

1. Engineering Mechanics, Ferdinand Singer, 3rd edition, Harper and Row
2. Engineering Mechanics (Statics and Dynamics) by Hibbeler R. C., Pearson Education

Reference Books:

1. Engineering Mechanics, S Timoshanko and Young, Tata McGraw Hill Education Pvt. Ltd. New Delhi.
2. Vector Mechanics for Engineers – Statics, Beer and Johnston, Tata McGraw Hill
3. Vector Mechanics for Engineers – Dynamics, Beer and Johnston, Tata McGraw Hill.
4. Engineering Mechanics - Statics and Dynamics, Meriam J. L. and Kraige L.G., John Wiley and Sons

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: ESC-105-COM Course Name: Fundamentals of Programming Languages

Teaching Scheme	Credit	Examination Scheme
Theory : 2 Hours/Week **Practical : 2 Hours/Week**	**02** **01**	**CCE : 30 Marks** **End – Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any:

- Basics of Computers
- Basic Mathematics

Companion Course, if any: Fundamentals of Programming Languages Lab

Course Objectives:

1. To understand the fundamental Concepts of C Programming
2. To acquire knowledge and Compare usage of Operators and Expressions in C Programming
3. To apply Control Flow structures in C Programming for Problem solving
4. To design a solution using Arrays, Character and String Arrays in C programming
5. To design a develop solution for simple computational problems using User Defined Functions and structures in C Programming

Course Outcomes:

On completion of the course, students will be able to:

CO1: To **Design** algorithms for simple computational problems.

CO2: To **Use** mathematical, Logical Operators and Expressions.

CO3: To **apply** Control Flow structures for decision making.

CO4: To **design** a solution using Arrays, Character and String Arrays.

CO5: To **D**esign and apply user defined functions and structures.

Unit I	Introduction to Program Planning & C Programming	(06 Hours)

Program Design Tools: Art of Programming through Algorithms, Flowcharts.

Overview of C: History and importance C, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of variables, Storage Class, Assigning Values to variables, Defining Symbolic Constants, declaring a Variable as Constant, Declaring a Variable as Volatile.

#Exemplar/Case Studies	Study of "C" Program compilation Process, testing and debugging.

Unit II	Operators and Expressions	(06 Hours)

Operators and Expressions: Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operators, Bitwise Operators,

Special Operators. Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators, Operator Precedence and Associativity, Mathematical Functions.		
#Exemplar/Case Studies	Study of Infix, Prefix and Postfix expressions.	
Unit III	**Control Flow**	**(06 Hours)**
Decision Making and Branching: Simple If Statement, If-Else,Else-If,Switch Statement, Goto Statement **Decision Making and Looping:** While Statement, Do-While, For Statement, Break and Continue		
#Exemplar/Case Studies	Design simple calculator and Generating a Calendar	
Unit IV	**Arrays**	**(06 Hours)**
Arrays: One Dimensional Arrays, Declaration of One-dimensional Arrays, Initialization of One-dimensional Arrays, Two –dimensional Arrays, Initialization of Two- dimensional Arrays. **Character Arrays and Strings:** Declaration and Initialization String Variables, Reading Strings from Terminal, Writing Strings to Screen, Putting Strings Together, Comparison of Two Strings, Introduction to String handling Functions		
#Exemplar/Case Studies	Matrix multiplication	
Unit V	**User Defined Functions**	**(06 Hours)**
User Defined Functions: Need for User-defined Functions, A Multi-Function Program, Elements of User defined Functions, Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but No Return Values, Arguments with Return values, No Arguments but Returns a Value, Functions that Return Multiple Values, Nesting of Functions, Recursion **Structures :** What is a Structure? Structure Type Declarations, Structure Declarations, Referencing Structure Members, Referencing Whole Structures, Initialization of Structures.		
#Exemplar/Case Studies	Tower of Hanoi, Generation of Monthly balance sheet	

List of Laboratory Experiments/Assignments (Any 6 to 8 laboratory assignments) based on Programming	
1	To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors.
2	To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series.
3	To accept an object mass in kilograms and velocity in meters per second and display its Momentum. Momentum is calculated as $e=mc^2$ where m is the mass of the object and c is its velocity.

4	In array do the following: 1. Find given element in array 2. Find Max and Min element 3. Find frequency of given element in array 4. Find Average of elements in Array.
5	Write a C program for employee salary calculation given, Basic, H.R.A. 20 % of Basic and D.A. 150 % of Basic.
6	To accept a student's marks for five subjects, compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinguished. If aggregate is 60>= and <75 then the Grade of first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.
7	To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
8	Write a C program that accepts a string from the user and performs the following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two Strings iii. Check palindrome ii. Check substring
9	Create Structure EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary), and store the data and update the data in structure.
10	Create class STORE to keep track of Products (Product Code, Name and price). Display menu of all products to users. Generate bills as per order.
Mini-Projects	
1	Calculator with basic functions. Add more functionality such as graphic user interface and Complex calculations.
2	Program that simulates rolling dice. When the program runs, it will randomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.
3	Guess Number: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user's guess is wrong, the program should return some sort of indication as to how wrong (e.g. the number is too high or too low). If the user guesses correctly, a positive indication should appear. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.
4	To calculate the salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employees pay professional tax as 2% of total salary. Calculate net salary payable after deductions.

Learning Resources for Practical

Text Books: Programming in ANSIC, 8e –E. Balagurusamy

Reference Books:

1. B. S. Gottfried, Programming with C (Schaum's Outline Series), 2nd ed. McGraw-Hill, 1996.
2. S. C. Kochan, Programming in C, Sams Publishing, 3rd ed. 2004.
3. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2 nd ed. UK: Prentice Hall, 1988.
4. W. Kernighan and B. Pike, The Practice of Programming, UK: Addison-Wesley, 1999
5. H. M. Deitel and P. J. Deitel, C: How to program, 8 th ed. Pearson Education, 2015.
6. P. Prinz & T. Crawford, C in a Nutshell: The Definitive Reference, 2nd ed., O'Reilly Media, 2016

e-Books:https://studylib.net/doc/25796931/programming-in-ansic--8e---balagurusamy

MOOC / NPTEL/YouTube Links: https://onlinecourses.nptel.ac.in/noc22_cs40/preview
: https://onlinecourses.nptel.ac.in/noc23_cs53/preview

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual needs to include prologue (about University/program/ institute/ department/foreword/ preface etc), copy of curriculum, conduction & Assessment guidelines, topics under consideration- concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of tool/framework/language used, Design, test cases, conclusion. Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journals may be avoided. Use of Drive containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of students. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

List of laboratory assignments is provided below for reference. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy should address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute them among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of coding style, proper indentation and comments.

Use of open source software and recent versions is to be encouraged.

In addition to these, instructors may assign one real life application in the form of a mini-project.

based on the concepts learned. Instructors may also set one assignment or mini-project that is suitable to each branch beyond the scope of the syllabus.

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: VSE-101 Course Name: Manufacturing Practice Workshop

Teaching Scheme	Credit	Examination Scheme
Practical : 02 Hours/Week	**01**	**Term Work : 25 Marks**

Prerequisite Courses, if any:

- Basic Science
- Drawing

Course Objectives:

1. To acquire the basic knowledge of Machine Tools.
2. To inculcate the basics of various manufacturing processes.
3. To impart practical aspects of Machine Tools and Manufacturing processes used in industrial applications
4. To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop

Course Outcomes:

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

CO1	Illustrate various sections of a typical workshop and different types of tools and machinery commonly found in a workshop	2-Understand
CO2	Explain the importance of workshop safety and apply general workshop safety rules and guidelines.	3-Apply
CO3	Demonstrate proficiency in various cutting techniques such as sawing, shearing, and laser cutting.	3-Apply
CO4	Plan and complete a simple sheet metal job from start to finish, incorporating shearing, bending, and joining operations.	3-Apply
CO5	Describe the applications, advantages and operation of advanced computerized machine tools in modern manufacturing.	2-Understand
CO6	Apply 3D Printing Technology including setup, operation, and post-processing to print simple mechanical component.	3-Apply

List of Laboratory Experiments/Assignments

01	Draw a typical layout of workshop with arrangement of equipment's considering a specific application
02	Identify and explain the following safety related consideration, 1) Potential hazards present in workshop 2) General workshop safety rules and guidelines 3) List various safety devices used in workshop Note : Photo evidences of above are expected in report
03	Develop any Mechanical component using the tools available in the workshop which includes any five of he following operations, 1) Cutting

	2) Shearing 3) Bending 4) Welding 5) Rivetting 6) Filing 7) Drilling Note: Product must be usable for Institute of domestic also write a sequence of operation in the report with its production time.
04	Demonstration (construction and operation) of any one advance machine tool such as CNC turn / mill, VMC, plasma arc machining, Laser cutting, CNC wood router etc.
05	Write program on sequence of operations performed to develop any mechanical component using any suitable programming language.
06	Create simple 3D models using CAD software and print using 3D printer including pre and post processes (Component manufactured should be related to specific branch)
	Note: Above experiments to be performed in group of four to five students. There should not be any repetition of layout/ jobs/ programs and models. For Experiment No. 1 and 2 students supposed to visit nearby workshop or industry.

Learning Resources

Text Books:

1. H.S.Bawa, "Workshop Practice", Tata McGraw Hill Education (Publisher)
2. S. K. Hajra Choudhary, Nirjhar Roy, "Element of Workshop Technology: Vol.1 and 2", Media Promoters and Publishers Pvt. Ltd., 15th Edition, 2012

Reference Books:

1. MikellP.Groover,"IntroductiontoManufacturingProcesses",WileyPublications
2. John,K.C., "Mechanical Workshop Practice", Prentice Hall Publication, New Delhi
3. Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015.
4. Automation, Production system & Computer Integrated manufacturing, M. P. Groover Person India, 2007 2nd edition.

e-Books:-

MOOC / NPTEL/YouTube Links: -

- NPTEL Course on Fundamentals of Additive Manufacturing Technologies by Prof. Sajan Kapil, IIT Guwahati, https://onlinecourses.nptel.ac.in/noc21_me115/preview
- NPTEL Course on Fundamentals of Industrial safety by Prof. Thomas, IIT Madras https://www.youtube.com/watch?v=3VReVbsmjKI
- NPTEL Course on Computer Numeric Control Of Machine Tools And Processes by Prof. A. Roy Chaodhary, IIT Kharagpur https://www.youtube.com/watch?v=ImtSsDLgAaI&list=PLSGws_74K01KX9YtVZACpOoFYy6oaJIC

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: VSE-102 Course Name: Design Thinking and Idea Lab

Teaching Scheme	Credit	Examination Scheme
Practical : 2 Hour/Week	**02**	**Term Work : 25 Marks**

Course Objectives:

- **Understand** the core principles of design thinking and its role in engineering.
- **Apply** the six hats of design thinking to analyze and solve complex problems.
- **Develop** creative and user-centered solutions to real-world challenges.
- **Demonstrate** effective communication and collaboration in multidisciplinary teams.
- **Evaluate** and analysis design concepts and prototypes.
- **Develop** a mindset for continuous innovation and improvement.

Course Outcomes:

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

CO1 Identify and define problems from a user's perspective and articulate design criteria.

CO2 Apply empathy and observation to gain insights into user needs and behaviors

CO3 Generate innovative ideas and solutions through brainstorming and ideation.

CO4 Prototype and test design solutions to refine and improve them

CO5 Present and communicate design ideas effectively using visual aids and storytelling

CO6 Collaborate with peers and industry professionals to address real-world design challenges

Note: -

1. The practical lab is designed to provide students with hands-on experience in applying the theoretical concepts they have learned in the course. The session aims to enhance their understanding, critical thinking, and problem-solving skills. (1 hour for explaining the concept and 1 hour for activity/ assignment / group discussion / brainstorming session)
2. Incorporating hands-on labs with access to various lab and workshop facilities in the Institute, can enhance the practical aspect of the course and provide students with opportunities to prototype and test their designs.

Laboratory Experiments/Assignments

Week	**1-2**	**Introduction to Design Thinking** • Understanding the design thinking process • Role of empathy and user-centric design • Practical Lab: Empathy mapping and user interviews • Assignment 1: Problem identification

Week	**3-4**	**Ideation and Creativity** • Techniques for idea generation and brainstorming • Practical Lab: Brainstorming sessions • Assignment 2: Idea generation and selection
Week	**5-6**	**Prototyping and Testing** • Creating prototypes to validate design concepts • Practical Lab: Rapid prototyping • Assignment 3: Prototyping and user testing
Week	**7-8**	**Analysis and Evaluation** • Applying the six hats of design thinking • Practical Lab: Six thinking hats analysis • Assignment 4: Six hats analysis of a case study
Week	**9-10**	**Communication and Collaboration** • Visual communication and storytelling • Group project and industry collaboration • Assignment 5: Design project presentation • Assignment 6: Reflection and lessons learned

Learning Resources

Reference Books:

1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross
2. Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation" by Tim Brown
3. Design Thinking for Visual Communication" by Ranjan Nayar and Jaidip Subedi
4. The Design of Everyday Things" by Don Norman• "Design Thinking: Creativity and Innovation" by S. Balaram
5. Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days" by Jake Knapp
6. Creative Confidence: Unleashing the Creative Potential Within Us All" by Tom Kelley and David Kelley (with a foreword by Ratan Tata)

Case Studies:

- **Design Thinking in Healthcare:** Redesigning a patient's waiting room experience.
- **Design Thinking in Product Development:** The evolution of the smartphone.
- **Design Thinking in Social Innovation:** Improving access to clean drinking water in rural areas.

- **Tata Nano:** The People's Car: Explore how Tata Motors aimed to revolutionize the automobile industry by creating an affordable and compact car for the masses, known as the Tata Nano.
- **Aravind Eye Care System:** Investigate how Aravind Eye Care System in India used innovative design thinking to provide high-quality, affordable eye care services to a large population, often in remote areas.
- **Project Shakti by Hindustan Unilever:** Analyze how Hindustan Unilever's Project Shakti empowered rural women in India by turning them into micro-entrepreneurs, distributing Unilever products in their communities.
- **Aadhaar: India's Unique Identification Program:** Explore how the Aadhaar program used biometric data and design thinking to provide millions of Indians with a unique identification system, enhancing access to government services and benefits.
- **Ola Cabs:** Transforming Transportation in India: Learn how Ola, an Indian ride-sharing platform, disrupted the traditional taxi industry by applying innovative design thinking to its services and business model.
- **Swiggy: Redefining Food Delivery:** Investigate how Swiggy, an Indian food delivery platform, leveraged design thinking to enhance the food delivery experience for customers and partner restaurants.
- **Lifebuoy: Promoting Hygiene in Rural India:** Explore how Lifebuoy, a brand under Unilever, used design thinking to develop innovative marketing campaigns and products to promote handwashing and hygiene in rural India.
- **Amul: The White Revolution in India:** Analyze how the Amul cooperative transformed the dairy industry in India through a unique business model, design thinking, and innovative marketing strategies
- **Flipkart: E-commerce Success Story:** Study how Flipkart, one of India's leading e-commerce platforms, employed design thinking to grow its business and offer a wide range of products and services.
- **ISRO's Mars Orbiter Mission**: Learn about how the Indian Space Research Organisation (ISRO) successfully launched the Mars Orbiter Mission (Mangalyaan) on a limited budget, showcasing innovation and design thinking in space exploration.
- **Designing Google's Self-Driving Car:** Explore how Google used design thinking to develop autonomous vehicles that redefine transportation.
- **Dyson**: Revolutionizing Vacuum Cleaners and Hand Dryers: Investigate how Dyson's innovative design thinking has transformed household appliances.

- **SpaceX**: Advancing Space Exploration Through Design Thinking: Analyze SpaceX's approach to space technology and how it has disrupted the aerospace industry.
- **Red Bull**: Creating an Energy Drink Empire: Learn how Red Bull's unique design thinking approach contributed to the success of their energy drink and brand.
- **McDonald's**: Evolution of Fast Food Service: Study the design thinking principles applied by McDonald's to enhance their customer experience and streamline operations.
- **Nest**: Reinventing Thermostats and Home Automation: Examine how Nest Labs, a subsidiary of Google, reimagined home automation with their smart thermostats and other products.
- **LEGO:** Building a Design-Centric Toy Empire: Investigate how LEGO has used design thinking to create a global brand that fosters creativity and learning through play.
- **IBM Design Thinking:** A Cultural Transformation: Explore IBM's adoption of design thinking to reshape its corporate culture and enhance its software and services.
- **Starbucks**: Brewing Design Innovation in the Coffee Industry: Analyze how Starbucks incorporates design thinking into its store layouts, product offerings, and customer experiences.
- **Amazon: Customer-Centric** Design in E-commerce: Discover how Amazon's design thinking philosophy has played a pivotal role in its e-commerce dominance

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: AEC-101 Course Name: Professional Communication Skills

Teaching Scheme	Credit	Examination Scheme
Tutorial : 2 Hour/Week	**02**	**Term Work : 25 Marks**

Prerequisite Courses, if any:

- 12th English - Basic knowledge of Listening, Speaking, Reading, and Writing. (LSRW) skills.

Course Objectives:

To train the students in acquiring interpersonal communication skills by focusing on language skill acquisition techniques and error feedback.

Course Outcomes:

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

CO1: Recognize, identify, and express advanced skills of Technical Communication in English through Language Laboratory.

CO2: Understand, categorize, differentiate, and infer listening, speaking, reading, and writing skills in societal and professional life.

CO3: Articulate and present the skills necessary to be a competent Interpersonal communicator.

CO4: Deconstruct, appraise, and critique communication behaviors.

CO5: Adapt, negotiate, and facilitate with multifarious socio-economical and professional arenas with effective communication and interpersonal skills.

Laboratory work should cover the following guideline topics for conduction of Laboratory activities:

Unit I	**Introduction to the Language Lab**
	a) The Need for a Language Laboratory b) Tasks in the Lab c) Writing a Laboratory Notebook
Unit II	**Active Listening Skills** Basic Listening Skills: Introduction, the process, importance and types of listening, Effective Listening: Principles and Barriers, Guidelines to increase listening, a) What is Active Listening? b) Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking c) Listening in Business Telephony
Unit III	**Speaking**

	a) Speaking—Accuracy and Fluency Parameters b) Pronunciation Guide—Basics of Sound Scripting, Stress, and Intonation c) Fluency-focussed activities—JAM (Just a Minute), Conversational Role Plays, Speaking using Picture/Audio Visual inputs. d) Group Discussion: Principles and Practice e) Giving a Presentation—Learning Presentation Basics and Giving Micro Presentations f) Activities to enhance listening Speaking Skills: Introducing yourself, describing a person, place, situation and event, giving instruction, Making inquiries – at a bank, post- office, air-port, hospital, reservation, counter
Unit IV	**Reading and Writing Skills**
	Effective Reading: Process, types and reading rate adjustment, Tips for improving reading skills, Reading Comprehension.
	Effective Written Communication: **Introduction**, Importance of written communication, Writing a Book/ small article/ Film Review, Scripting a Short Presentation
	Letter Writing: Types, Formats, Official Correspondence: Memo, Notice and Circulars, Agenda and Minutes, **Report Writing:** Purpose and Scope of a Report, Fundamental Principles of Report Writing, Project Report Writing, Summer Internship Reports. sentences Precise writing through meticulous editing, proofreading Writing abstracts and conclusions.
Unit V	**Workplace Communication**
	Greeting, Welcoming, Dealing with Complaints, Giving Instructions or Directions, Giving Information: About Various Facilities, Distance, Area, Local Specialties Consultation and Solution of Problems, Accepting Praises and Criticism, Apologizing. Fluency and Etiquette, Polite sentences and Words, Use of Persuading words, Intonation and Voice Modulation, Developing.

List of Laboratory Experiments/Assignments

Minimum eight practical/ assignments should be performed to cover entire curriculum of the course. The list of practical given below is just a guideline.

1. Speech/Seminar presentation
2. Observation of a recorded seminar and suggestions for improvement.
3. Technical Report Writing and presentation.
4. Role Plays
5. Interview Simulations
6. Reading and Listening Comprehension

7. Group Discussions
8. Resume Building
9. Business Correspondence
10. Cross-Cultural Communication
11. Situational Writing
12. SWOT analysis
13. Public Speaking Exercises
14. Greetings for different occasions.
15. Participation in institute/National level Elocution/Essay/G.D. Competitions

Guidelines for compressive continuous assessment (CCE)

- CCE should support for regular performance of practical by student and his/her regular assessment with proper understanding of practical carried out.
- It is a representative list of practical. The instructor may choose practical as per his requirements (so as to cover entire contents of the course) from the list.

Learning Resources

Text Books:

1. Communication Skills for Engineers by S. Mishra & C. Muralikrishna (Pearson)
2. Communication Skills for Technical Students by T.M. Farhatullah (Orient Longman)
3. Written Communication in English by Saran Freeman (Orient Longman)
4. Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)
5. Communication for Business: A Practical Approach by Shirley Tailor (Longman)

Reference Books:

1. Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan)
2. Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: CCC-101 Course Name Co-Curricular Course – I

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

Objectives:

Students are required to go through the list of following Co-curricular Courses and select any one of their interests. They will be allocated one course from the list. Experts from respective course will conduct classes on campus/Online through activities, discussions, presentations, and lecture methods. Students are required to **submit hard copy of a report along with certificate on the activities performed** related to topics of opted Co-curricular Course.

Evaluation will be done based on the report of activities submitted by student. Faculty members will be allotted for mentoring the activities related to Co-curricular Course topic. Faculty members will frame the **list activities to be performed by students** with the help of experts in respective course.

Selecting co-curricular courses that align with your interests and goals can significantly enrich your educational journey. Remember to maintain a balance and choose courses that you are genuinely excited about. This approach will help you gain the most from your co-curricular activities.

Basket of Co-curricular Courses :

1. Health and Wellness
2. Yoga education
3. Meditation
4. Dancing
5. Cultural Activities
6. Basics of Music Composition
7. Physical Fitness
8. Visual Arts
9. Painting
10. Personality Development
11. Art of Short Film Making / Cinematography

Here are some tips and ideas to help you choose the right courses

1. Consider Your Interests and Hobbies

Think about what you enjoy doing in your free time or what activities you have always wanted to try. Co-curricular courses can be a great opportunity to pursue passions outside your major.

2. Explore Different Fields

Choosing courses from different areas can provide a well-rounded experience. For instance, you might pick one course related to arts, another in sports, and a third in community service.

. Balance Your Schedule

Ensure that the co-curricular courses fit well with your academic schedule and personal commitments. Avoid overloading yourself, as these courses should enhance your experience, not add undue stress.

4. Look at Course Benefits

Some co-curricular courses offer skills that can be beneficial in your future career or personal development. For example, leadership training, public speaking, or project management.

5. Consult with Advisors or Seniors

Talking to academic advisors, professors, or senior students can give you insights into which courses are popular, have good instructors, or offer valuable experiences.

सावित्रीबाई फुले पुणे विद्यापीठ

Savitribai Phule Pune University

Faculty of Science and Technology

National Education Policy (NEP) Compliant Curriculum

Semester - II

First Year Engineering

(2024 Pattern)

www.unipune.ac.in

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: BSC-151-BES Course Name: Engineering Mathematics – II

Teaching Scheme	Credit	Examination Scheme
Theory : 03 Hours/Week **Tutorial : 01 Hour /Week**	**03** **01**	**CCE : 30 Marks** **End-Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisites:

- Integration, Differential Equation, Three-dimensional coordinate systems

Course Objectives:

To familiarize the students with Advanced techniques of integration, Tracing of curve, Solid geometry, Multiple integrals and their applications, Mathematical modeling of physical systems using differential equations. The aim is to equip them with the concept and tools to understand advanced level mathematics and its applications, that would enhance thinking power, useful in their disciplines.

Course Outcomes:

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

CO1: Apply advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions useful in evaluating multiple integrals and their applications.

CO2: Trace the curve for a given equation and measure arc length of various curves. **Apply** the concepts of solid geometry to solve problems on sphere, cone and cylinder in a comprehensive manner.

CO3: Evaluate multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.

CO4: Apply the effective mathematical tools for solving first order ordinary differential equations such as Exact and Reducible to exact Linear and reducible to Linear.

CO5: Model physical systems using ordinary differential equations, **solve and analyze** the solutions apply to Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.

Course Contents

Unit I	Integral Calculus	(08 Hours)

Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions.

Unit II	Curve Tracing and Solid Geometry	(08 Hours)

Tracing of Curves – Cartesian, Polar and Parametric curves, Rectification of curves.

Cartesian, Spherical polar and Cylindrical coordinate systems, Sphere, Cone and Cylinder.

Unit III	Multiple Integrals and Applications	(08 Hours)

Double and Triple integrations, change of order of integration, Applications to find Area, Volume, Mass, Centre of Gravity and Moment of Inertia.

Unit IV	First Order Ordinary differential Equation	(08 Hours)
Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form and Bernoulli's equation.		
Unit V	**Applications of Differential Equations**	**(08 Hours)**
Applications of Differential equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, Rectilinear Motion, Simple Harmonic Motion, One dimensional Conduction of Heat.		

Learning Resources

Text Books:

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

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.).
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education).
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning).
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson).
5. Applied Mathematics (Vol. I and II) by P.N. Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Differential Equations by S. L. Ross (John Wiley and Sons).

MOOC / NPTEL/YouTube Links:

https://youtube.com/playlist?list=PLbRMhDVUMngeVrxtbBz-n8HvP8KAWBpI5&si=3xAONJdT2ph_jcvG

Tutorial and Term Work:

1. Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division.
2. Term work shall consist of six assignments each on unit-I to unit-VI and is based on performance and continuous internal assessment.

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: PCC-151-ITT Course Name: Programming and Problem Solving

Teaching Scheme	Credit	Examination Scheme
Theory : 02 Hours/Week **Practical : 02 Hours/Week**	**02** **02**	**CCE : 30 Marks** **End – Semester : 70 Marks** **Term Work : 25 Marks**

Prerequisite Courses, if any:

- Basics of Computers and Basic Mathematics
- Fundamentals of Programming Languages (COM108)

Companion Course, if any: Fundamentals of Programming Languages Lab

Course Objectives:

To understand problem solving aspects and to know python programming with learning data types, decision control statements, function, strings, file handling in Python. To learn features of object oriented programming concepts using python.

Course Outcomes:

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

CO1: Inculcate and **apply** various skills in problem solving.

CO2: Choose appropriate programming constructs and features to **solve** the problems in diversified domains.

CO3: Exhibit the programming skills for the problem-solving using functions and string manipulations.

CO4: Demonstrate File handling and dictionaries in Python.

CO5: Apply Object Oriented concepts in Python.

Course Contents

Unit I	Unit I : Problem Solving, Programming and Python Programming	(04 Hours)

General Problem Solving Concepts- Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies,

Basics of Python Programming: Features of Python, History and Future of Python, Programming Paradigm, Features of Object Oriented Programming, Applications of Python Languages.

Unit II	Advance Data Types and Decision Control Statements	(04 Hours)

Advance data types- Tuples, Lists, Sets and Dictionary. Decision Control Statements: Decision control statements, Selection/conditional branching

Statements: if, if-else, nested if, if-elif-else statements. Basic loop Structures/Iterative

Statements, while loop, for loop, selecting appropriate loop. Nested loops, The break, continue, pass, else statement used with loops.

Unit III	Functions and Strings	(03 Hours)

Need for functions, Function: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices.

Introduction to modules, Introduction to packages in Python, Introduction to standard library modules. Strings and Operations- concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Unit IV	File Handling and Dictionaries	(04 Hours)

Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. File Positions, Renaming and deleting files. Directory Methods, Dictionaries creating, assessing, adding and updating values. Case Study: Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination)

Unit V	Object Oriented Programming	(04 Hours)

Structured and object oriented: Features of Object oriented programming-classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation.

Classes and Objects: classes and objects, class method and self-argument, __init__() method, class variables and object variables, __del__() method, public and private members, Built in function to check, Get, Set and Delete class attribute, Garbage collection, class methods, Static Method.

List of Laboratory Experiments/Assignments

Group A

Practical on Unit I

Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms. Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.

1. Installation of Python
2. Program to display data of different types using variable and literal constants.
3. Program to read variables from the user.
4. Program to exhibit indentation errors.
5. Program to perform all operation (addition, multiplication, subtraction, division, modules) and expression.
6. Program to convert degree Fahrenheit into degree Celsius.
7. To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions

Practical on Unit II

1. Type Conversion, Type casting, Comment
2. Program to demonstrate operation on lists
3. Program to determine whether a person is eligible to vote or not
4. Program to find whether the given number is even or odd
5. Program to determine whether the character entered is a vowel or not.
6. Program to calculate the sum and average of first 10 numbers
7. Program to find whether the given number is an Amstrong number or not.
8. Program to enter a number and then calculate the sum of its digits.
9. Program to print the multiplication table of n, where n value is entered by user.

Practical on Unit III

1. Program to concatenate two string using + operator.
2. Program to append a string using += operator.
3. Program to display power of a number without using formatting characters.
4. Program to display power of a number using formatting characters.
5. Program to demonstrate slice operation on string objects.
6. Program to understand how characters in a string are accessed using negative indexes.
7. Program to understand ord() and char() function.
8. Program that uses split() to split a multiline string.
9. Program that counts the occurrences of a character in a string. Do not use built in function.
10. Program to reverse of string by user defined function.
11. Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring

Practical on Unit IV

1. Program to open a file and print its attribute values.
2. Program to access a file after it is closed
3. Program to write a file using the writelines() method.
4. Program to append data to an already existing file.
5. Program to display the contents of a file.
6. Program to split the line into a series of words and use space to perform the split operation.
7. Program that tells and sets the position of the file pointer.
8. Program that reads data from a file and calculates the percentage of vowels and consonants in the file.
9. Program that changes the current directory to our newly created directory.
10. Program to print the absolute path of a file using os.path.join
11. Program that counts the number of tabs, space and newline character in a file.
12. To copy contents of one file to another. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.

Practical on Unit V

1. Program to access class variable using class object.
2. Program to access class members using class object.
3. Program to illustrating the use of __int__() method.
4. Program to differentiate between class and object variable.
5. Program to illustrating the use of __del__() method.
6. Program to illustrating the difference between public and private variable.
7. The program should subtract the DOB from todays date to find out whether a person is eligible to vote or not.
8. Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation “Asst Manager”

Group B

Teachers should frame assignments from Mechanical Engineering, Civil Engineering, Electrical Engineering application domains.

Faculty from these course branches to design and conduct the practical sessions.

Electrical Engineering:

1. Develop algorithms, draw flow chart, and write a program to solve electrical network (KVL/KCL) using python.
2. Develop algorithms, draw flow chart, and write a program for star delta conversion using python.
3. Develop algorithm, draw flow chart, and write a program to calculate the impedance of RLC circuit using python.
4. Develop algorithm, draw flow chart, and write a program to calculate efficiency of single-phase transformer using python.

Civil Engineering:

1. A concentrated load of 1000KN is applied at the ground surface. Write a program to compute the vertical pressure (i) at a depth of 4m below the load , (ii) at a distance of 3m at the same depth. Use Boussinesq's equation.
2. A Filtered water discharge of 1MLD has a chlorine demand of 4.8 mg/l. It is required to maintain a chlorine residual of 0.2 mg/l. Write a program to determine the quantity of bleaching powder necessary of 6 months (Chlorine Available-25%).
3. A simply supported beam AB having spam of 4 meters loaded with following cases: Case 1) 100 KN at centre. Case 2) 50 KN at 1 meter from A support. Write a program to determine support reactions at A and B.
4. Two forces P and Q acting on a body 180 KN and 240 KN respectively. The angle between the two forces is 60 degrees. Determine the resultant of force P and Q and it's direction with respect to Q force.

Mechanical Engineering:

1. On a certain planet a correctly calibrated spring balance shows the weight of a body 12 N, the mass of which is 4.893 kg. Write a program to find the value of gravity on this planet.
2. Write a program to estimate the heat loss through a red brick wall of length 5m, height 4m and thickness 0.25m, if the temperatures of the wall surfaces are maintained at 110 degree centigrade and 40 degree centigrade respectively. K for red brick is 0.70 W/mk.
3. Assume five liters of Oil weigh 61.80 N. Write a program to calculate i) Specific Weight ii) Specific mass using python.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory Concept in brief, features of tool/framework/language used, Design, test cases, conclusion.

Program codes with sample output of all performed assignments are to be submitted as softcopy. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

All students should submit the term work consisting of 14 programming assignments. At least 2 assignments from each unit for Group A. Faculty can select any 4 assignments from Group B.

Learning Resources

Text Books:

1. Reema Thareja, “Python Programming Using Problem Solving Approach”, Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, “Core Python Programming”, Dreamtech Press; Second edition ISBN10:938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

1. R. G. Dromey, “How to Solve it by Computer”, Pearson Education India; 1st edition, ISBN10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, “Problem Solving and Programming Concepts”, Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978-0132492645
2. Romano Fabrizio, “Learning Python”, Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, “Head First Python- A Brain Friendly Guide”, SPD O’Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, “Python: The Complete Reference”, McGraw Hill Education, ISBN-10:9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, “Introduction to Computing & Problem Solving with Python”, Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978-9382609810

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: IKS-151 Course Name: Indian Knowledge System

Teaching Scheme	Credit	Examination Scheme
Tutorial : 02 Hours/Week	**02**	**Term Work : 25 Marks**

Course Objectives:

1. To introduce students to the foundational concepts of Indian knowledge systems and their significance.
2. To familiarize students with key dates in Indian history and the historical timeline.
3. To provide an overview of Indian philosophical systems and their relevance.
4. To explore significant scientific achievements in ancient India and analyze scientific texts and inventions.
5. To examine the role of engineering in ancient India and its contributions to metallurgy, materials science, and architectural techniques.

Course Outcomes:

On completion of this course, learners will be able to:

CO 1 - Understand the significance and historical context of Indian knowledge systems.

CO 2 - Comprehend Indian philosophical concepts, scientific achievements, and their interplay.

CO 3- Recognize the role of engineering in ancient India and its impact on architecture and materials.

CO 4- Apply ancient Indian engineering principles in modern practices while considering cultural and environmental aspects.

IKS Syllabus should be followed from the following link:
http://collegecirculars.unipune.ac.in/sites/documents/Syllabus2024/Indian%20Knowledge%20Systems%20(IKS)%20(Generic)%20Academic%20Year%202024-25_03062024.pdf

Note: This course will be available in online mode on SPPU portal for the all students.

Assignments for Term Work

Note: Students have to complete all Assignments and two activates from the following given list.

Assignment 1: Students should search for literature and create a presentation on a specific key date or event in Indian history. They should explain its significance and how it contributed to Indian knowledge systems.

Learning Outcome: Enhances research skills and understanding of the historical context.

Assignment 2: Assign groups to compare and contrast the BC/CE dating system with other historicaldating systems from different cultures.

Learning Outcome: Promotes critical thinking and cross-cultural understanding.

Assignment 3: Students should study and create presentations or reports on significant scientific inventions or discoveries from ancient India.

Learning Outcome: Develops research and presentation skills while enhancing knowledge of Indian scientific achievements

Assignment 4: Ask students to work in groups to research and present on ancient Indian contributionsto metallurgy and materials science. They can also create simple experiments to demonstrate metallurgical processes.

Learning Outcome: Enhances research and experimentation skills while deepening understanding of materials science

Assignment 5: Assign students to choose a modern engineering project in India that incorporates sustainability principles. They should analyze the project's design, materials, and environmental impact.

Learning Outcome: Develops critical analysis skills and an understanding of sustainable engineering practices.

Assignment 6: A group of students should present case studies on modern engineering projects that consider cultural and environmental aspects. Discuss how cultural sensitivity is integrated into these projects.

Learning Outcome: Promotes teamwork, presentation skills, and cultural awareness

Assignment 7: Encourage students to propose and discuss how ancient Indian engineering principles could be integrated into a modern construction project. They should consider cultural, environmental,and sustainability aspects.

Learning Outcome: Encourages creative problem-solving and understanding of cultural relevance in engineering.

Activities (At least 4 Activities to be performed)

Activity 1: Organize in-class debate on Mathematics in Indus Valley Civilization

Activity 2: Organize in-class debate Aryabhata and His Contributions

Activity 3: Students to submit a report on Innovations in Number Systems and Zero

Activity 4: Aryabhata: The Pioneer of Indian Astronomy

Activity 5: Rise of Trade Centers and Urbanization

Activity 6: The Role of Poetry in Ancient Indian Literature

Case Studies (At least 4 case studies by an individual or group of students)

Case Study 1: The Sun Temple, Konark

Case Study 2: Evolution of Regional Dance Forms

Case Study 3: Training and Discipline in the Military

Case Study 4: Influence on Medicine and Wellness

Case Study 5: Indian Knowledge Systems: Global Influence

Case Study 6: Ancient Indian Sciences

Savitribai Phule Pune University
First Year of Engineering (2024 Pattern)
Course Code: CCC-151 Course Name: Co-Curricular Courses - II

Teaching Scheme	Credit	Examination Scheme
Practical : 04 Hours/Week	**02**	**Term Work : 25 Marks**

Course Objectives:

Students are required to go through the list of following Co-curricular Courses and select any one of their interests. They will be allocated one course from the list. Experts from respective course will conduct classes on campus/Online through activities, discussions, presentations, and lecture methods.

Students are required to **submit hard copy of a report along with certificate** on the activities performed related to topics of opted Co-curricular Course. Evaluation will be done based on the report of activities submitted by student.

Faculty members will be allotted for mentoring the activities related to Co-curricular Course topic. Faculty members will frame the list activities to be performed by students with the help of experts in respective course.

Selecting co-curricular courses that align with your interests and goals can significantly enrich your educational journey. Remember to maintain a balance and choose courses that you are genuinely excited about. This approach will help you gain the most from your co-curricular activities.

Basket of Co-curricular Courses

1. Sports
2. NSS
3. NCC
4. Fine Arts
5. Applied Arts
6. Performing Arts
7. Self Defense for Women
8. Jeevan Vidya (Work Life Balance)
9. Integrated
10. Design Thinking
11. Innovation and Creativity
12. Principle Centered Leadership
13. Mentoring of School Children
14. Basics of Fire Safety

Here are some tips and ideas to help you choose the right courses:

1. Consider Your Interests and Hobbies

Think about what you enjoy doing in your free time or what activities you have always wanted to try. Co-curricular courses can be a great opportunity to pursue passions outside your major.

2. Explore Different Fields

Choosing courses from different areas can provide a well-rounded experience. For instance, you might pick one course related to arts, another in sports, and a third in community service.

3. Balance Your Schedule

Ensure that the co-curricular courses fit well with your academic schedule and personal commitments. Avoid overloading yourself, as these courses should enhance your experience, not add undue stress.

4. Look at Course Benefits

Some co-curricular courses offer skills that can be beneficial in your future career or personal development. For example, leadership training, public speaking, or project management.

5. Consult with Advisors or Seniors

Talking to academic advisors, professors, or senior students can give you insights into which courses are popular, have good instructors, or offer valuable experiences.

FE – 2024 Pattern –National Education Policy (NEP)-2020 Compliant Syllabus

Task Force for Curriculum Design and Development

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