

Pimpri Chinchwad Education Trust's  
**Pimpri Chinchwad College of Engineering and  
Research**

Plot B, Survey No. 110 (P), Laxminagar, Ravet, Pune – 412101

(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)



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Academic and Examination Rules and Regulations,  
Curriculum Structure, and Syllabus

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**For**

**Second Year - Mechanical Engineering (B. Tech.)**

**With effect from (AY 2026-27)**

**National Education Policy (NEP) 2020 Compliant Approved by the Board of Studies  
(BoS- Computer Engineering) and Academic Council**

**(Applicable to Regulations 2023, 2021 and 2020)**

[www.pccoer.com](http://www.pccoer.com)

## PREFACE

Pimpri Chinchwad Education Trust's Pimpri Chinchwad College of Engineering and Research (PCCOE&R) is one of the promising institutes in Quality & Professional Education. Since 2014, PCCOE&R has been imparting value-added quality education to satisfy the needs and expectations of the stakeholders like Students, Parents, Industry etc. Focused efforts are made to achieve this, by providing state-of-the-art Engineering and Management education to Students. PCCOE&R has a student centric academic system to ensure holistic development. Every possible opportunity is provided to the student to progress academically and excel.

PCCOE&R indigenously adheres the philosophy of National Education Policy (NEP)-2020, in curriculum design, as to create an academic system that is flexible, inclusive, and focused on the holistic development of students. NEP-2020 fosters a mindset of continuous growth and lifelong learning. The continuous assessment, which involves regular evaluations throughout the academic year is promoted. This method provides ongoing feedback to students, allowing them to understand their progress and improve over time.

The weightage of stringent Academic Monitoring and Control has led towards Qualitative Results and Placements, thereby becoming the most opted Institute for admissions by engineering aspirants in and around Pune and all over the state of Maharashtra.

This booklet gives comprehensive information on the existing Rules and Regulations for B. Tech. Programmes of all branches. All Undergraduate Programmes will be governed by these Rules and Regulations. The various departments are given a direction to excel in academics through these Rules and Regulations approved by the Academic Council from time to time, keeping in view the ever-growing challenges and new developments. The stakeholders particularly the students, and parents/guardians, are advised to be fully familiar with the Academic System of the Institute. Students should be aware of the Rules and Regulations governing Academic requirements, Evaluation and Assessment policy, and Grading System. These rules may be revised to ensure the optimized learning experience of students to meet the global needs of the industry. These revisions are recommended as per the directives of UGC, AICTE, DTE and BoS. The Academic Council is the final authority to approve the Rules and Regulations, and these are binding on all the interested parties.

It is expected that this booklet would bring transparency in the functioning of the Institute related to Academics, Examinations and Evaluation amongst Students, Faculty members, Administrators, Parents and other Stakeholders.

## **Vision:**

To be a globally recognized Institute of technological education and research for the holistic development of aspirants, through excellence in education, innovation and collaborations to fulfil the expectations of all stakeholders.

## **Mission:**

- To design and deliver state-of-art knowhow through experiential learning based on changing needs of industry and society worldwide, to ensure the employability and employment of each aspirant.
- To enhance the collaborative partnership between Industry and Institute at national and international levels for commercializing and transferring the latest technological know-how towards societal, ethical and economic development.
- To achieve and sustain institute position as one of the topmost recognized and ranked institutes in technical and technological education.

## **EOMS Policy:**

We, at PCCOE&R, are committed to:

- o Develop as a premier institute of technical education & research as per the needs and expectations of all stakeholders.
- o Comply with all applicable requirements.
- o Continual improvement in educational, technical and scientific development, infrastructure and management system.
- o Social responsibility
- o Managing intellectual property
- o We shall strive to maintain an environment conducive to learning and student's overall development with high moral and ethical values.

# TABLE OF CONTENTS

<b>SR. NO</b>	<b>TITLE</b>	<b>PAGE NO.</b>
1	DEFINITIONS	5
2	INTRODUCTION	7
3	ORGANIZATION STRUCTURE AND ACADEMIC DEPARTMENTS	8
4	ADMISSIONS AND CHANGE OF BRANCH	9
5	ACADEMIC CALENDAR	10
6	SEMESTER REGISTRATION, MDM REGISTRATION, COURSE DROPPING, COURSE WITHDRAWAL, ATTENDANCE, TEMPORARY BREAK, DETENTION & TERMINATION	11
7	CURRICULUM	15
8	EXAMINATION AND EVALUATION	17
9	EXAMINATION RULES AND REGULATIONS	23
10	PERFORMANCE INDICES SGPA , CGPA AND PERCENTAGE	24
11	SEMESTER GRADE REPORT	26
12	AWARD OF DEGREE	26
13	EXIT OPTION	27
14	DISCIPLINES AND CONDUCT	28
15	CONCLUSIONS	32
16	FORMATIVE ASSESSMENT PAPER FORMAT	33
17	SUMMATIVE ASSESSMENT PAPER FORMAT	34
18	SYLLABUS STRUCTURE	47
19	SYLLABUS	49

## 1. DEFINITIONS

1. “Institute” means Pimpri Chinchwad College of Engineering and Research (PCCOE&R)
2. “University” means Savitribai Phule Pune University (SPPU), Pune
3. “Bachelor of Technology” B. Tech means, Undergraduate Degree awarded by SPPU
4. “Semester” means the period in which Academic activities are carried out.
5. “Course” means theory/laboratory/seminar/project/mini project/ tutorial etc.
6. “Course Credit” means weightage assigned to a Course.
7. “Course Teacher” means Faculty member assigned to teach a Course.
8. “Grade” means *Single* Letter assigned to indicate the Performance of Student in a Course.
9. “GB” means Governing Body.
10. “Academic Council” means apex Academic Body governing the academic programmes & policies in PCCOE&R.
11. “Board of Studies” (BOS) means departmental Academic Body common for UG and PG Programmes.
12. “Board of Examinations” (BOE) means apex Examination Body responsible for Examination conduction, framing and implementing Rules and Regulations approved by Academic Council.
13. “Grievance Redressal and Discipline Committee” (GRDC) means committee appointed by the Director to deal with cases of Grievances and Indiscipline.
14. “Complaint Redressal Committee” (CRC) means Committee appointed by the Director to deal with cases of Unfair means/Malpractice/s in Examination.
15. “Department Advisory Board” (DAB) means Departmental Advisory Body common for UG.
16. “Programme Assessment Committee” (PAC) means departmental committee for Assessment of Program.
17. “Academic Standing Committee (ASC)” means apex body next to Academic

Council to take decisions under emergent situations subjected to ratification by Academic Council.

18. Semester Grade Performance Average (SGPA)" means the weighted average of Grade Point of a Student in a Semester.
19. "Cumulative Grade Performance Average (CGPA)" means the weighted average of Grade Points for all the Semesters completed by a student.
20. "Allowed to Keep Term (ATKT)" means allowed for admission to higher class after satisfying minimum credits criterion.
21. "Academic Examination and Assessment R&R" means Academics, Examination & Evaluation Rules and Regulations governing system of the Institute.
22. "COE" means Controller of Examinations.
23. "FA" means Formative Assessment
24. "SA" means Summative Assessment
25. "DTE" means Directorate of Technical Education, Mumbai
26. "AICTE" means All India Council for Technical Education, New Delhi
27. "UGC" means University Grant Commission
28. "NEP" means National Education Policy
29. "NBA" means National Board of Accreditation
30. "NAAC" means National Assessment and Accreditation Council, Bangalore

## 2. INTRODUCTION

The provisions made in this document shall govern the Academic Policies and Procedures, Curriculum, Course Delivery, Evaluation System, Continuous Assessment, conduct of the Examinations and declaration of Results.

1. The medium of instruction throughout the programme shall be English except where it is explicitly mentioned as Regional.
2. Semester system shall be adopted for Academic activities in the Institute. Normally, all Odd Semesters shall commence from the first week of July and Even Semesters shall commence from the first week of January.
3. The commencement of first semester for B. Tech shall be governed by the admission schedule declared by DTE, Government of Maharashtra.
4. There are eight semesters having total **168 Credits** for every Undergraduate Programme. Around 14 credits out of 168 credits would be for Multi- Disciplinary Minor (MDM).
5. All seven Undergraduate Engineering Programmes (Civil Engineering, Computer Engineering, Electronics and Telecommunication Engineering, Information Technology and Mechanical Engineering, Bachelor of Business Administration, Bachelor of Computer Applications) shall be governed by Rules and Regulations provided in this version of 'Rules and Regulations for Academic, Examinations and Evaluation'.
6. Academic Calendar shall be prepared and published before the commencement of every Academic year.
7. Evaluation norms shall be strictly followed to maintain quality of engineering education. Examination system shall be transparent and governed by Rules and Regulations.
8. Rules and Regulations hereafter shall be subjected to amendments made by the Academic Council from time to time, based on recommendations of the BOS and BOE. All such amendments shall be applicable from the date of amendment.
9. The Rules and Regulations formulated in this document shall be subjected to revisions/refinement/updates/modifications through the approval by the Academic Council from time to time, and shall be binding on all concerned Stakeholders, including the Students, Faculty, Staff, Departments, and Administrators.

### 3. ORGANIZATION STRUCTURE & ACADEMIC DEPARTMENTS

The organization structure and academic departments are well-established to ensure the proper execution of B. Tech Engineering, BBA & BCA programmes in a qualitative way. Following are details about the various committees and undergraduate programmes:

- The academic administration of the Institute consists of committees and functionaries as below:
  - The Academic Council (AC) is a statutory and supreme body that governs all academic matters of the Institute. The AC is chaired by the AC Chairman (Director of the Institute) and the decisions made by the Chairman of AC in regard to all academic issues shall be final and binding to all the stakeholders. The AC may also form various sub- committees from time to time for specific purposes.
  - The Academic Standing Committee (ASC) shall continuously assess the academic activities and make appropriate revisions / modifications / improvements as and when required. All academic activities shall be scheduled through an approved 'Academic Calendar' notified in the beginning of each Academic Year.
  - Board of Examination (BOE) is constituted as per statutes of Savitribai Phule Pune University to ensure proper organization and conduction of examinations and related processes including moderation, tabulation and declaration of the results.
  - At the department level, the Board of Studies (BOS) is responsible for framing the syllabi for various courses, reviewing and updating syllabi from time to time, introducing new courses of study, determining details of continuous assessment, recommending panels of examiners etc.
  - The Department Advisory Board (DAB) and Programme Assessment Committee (PAC) are responsible to evaluate, assess and monitor the academic practices of the Department.
- The functionaries of the Institutes related to Academics and Examination shall be Director, Deputy Director, Dean Academics, Controller of Examinations and Heads of the Departments.
- Academic Departments and Programmes offered:  
The Institute offers undergraduate programmes in Engineering, management and computer applications as mentioned in Table 3.1.

**Table 3.1: Academic Departments and Programmes Offered**

<b>Sr. No</b>	<b>Academic Department</b>	<b>Programme Offered</b>	<b>Sanctioned Intake</b>
1	Civil Engineering	Bachelor of Technology in Civil Engineering	60
2	Computer Engineering	Bachelor of Technology in Computer Engineering	360
3	Electronics & Telecommunication Engineering	Bachelor of Technology in Electronics & Telecommunication Engineering	60
4	Information Technology	Bachelor of Technology in Information Technology	60
5	Mechanical Engineering	Bachelor of Technology in Mechanical Engineering	60
6	BBA	Bachelor of Business Administration	120
7	BCA	Bachelor of Computer Applications	120

#### **4. ADMISSIONS AND CHANGE OF BRANCH**

The admission to B. Tech. programme at PCCOE&R will take place in regular and lateral entry mode.

1. Regular entry refers to admission of students for first, second (excluding lateral entry), third, and final year of the programme in odd semesters. Lateral entry refers to admission of students for second year B. Tech. Programme directly through Diploma qualification.
2. The admission process and eligibility to various undergraduate programmes for regular entry (First Year) and lateral entry (Second Year) are governed by the norms and procedures of DTE. The candidate shall be provisionally admitted subject to fulfillment of eligibility criteria prescribed by government/University from time to time. Details of admissions are available on weblink, [www.dtemaharashtra.gov.in](http://www.dtemaharashtra.gov.in).
3. Students seeking admission (regular entry) to Second, Third and Final Year should have earned all the necessary credits of the pre-previous year and at least 60% credits of the previous year. For example, for admission to 5<sup>th</sup> semester (i.e. 3<sup>rd</sup> year of programme), a student should have earned all credits of the First Year and 60% credits of the Second Year. Similarly, for admission to the 7<sup>th</sup> semester (i.e. 4<sup>th</sup> year of programme), a student should have earned all the credits of the second year and 60% credits of the third year.

However, if calculation of 60% credits results in a mixed number (integer + proper fraction) then the integer part of that number shall be considered for taking decisions related with this clause.

4. Each student shall be allotted Permanent Registration Number (PRN) at the time of registration / or admission to the Institute and that will be a permanent identification number. Students are required to use this PRN for all purposes and communication.
5. Change of Programme / Branch:  
Students shall be eligible to apply for change of branch after completing the first two semesters. The following rules/guidelines shall be used for considering their application for change:
  1. The process of change of branch shall be carried out purely on merit basis subject to the rules of admissions prevailing at the time of such change.
  2. The candidate seeking for a change in course or shift after completing the first year of studies or both first and second semester examinations in full or failed in one of the heads of passing will be allowed to do so in the same institute subject to the availability of seats and changes will be carried out based on the marks of First year or First and Second semester together.
  3. The request for change of branch by a student from branch A to branch B shall be considered if the number of students of branch B does not exceed the sanctioned capacity of branch B.
  4. All such transfers shall be granted only once at the beginning of third semester. No application for change of branch during subsequent semesters shall be entertained.
  5. Students allotted with a branch of their choice should accept it and complete the bridging courses offered by the branch allotted. No further request for change shall be entertained.

## **5. ACADEMIC CALENDAR**

The academic activities of the Institute are regulated by Academic Calendar approved by the AC / ASC, and are released at the beginning of each Academic Year. It is mandatory for Students and Faculty to strictly adhere to the academic calendar for completion of academic and related activities.

1. The Academic Calendar shall be prepared by Dean Academics and approved by the AC / ASC.
2. The AC sets a definite time schedule for various academic activities, through an Academic Calendar issued and notified to all stakeholders at the beginning of each Academic Year.
3. The Academic Calendar shall be disseminated on the notice boards and website of the Institute.
4. The academic activities of the institute shall be monitored as per the Academic Calendar
5. Academic Calendar shall incorporate schedule of admissions, course registration, course

delivery, examination/evaluation, course feedback, course/graduate exit survey, meeting schedules, student internship, summer examinations.

6. The curriculum shall be typically delivered in two semesters in an Academic Year. Each semester shall be of 20 weeks duration, including evaluation, grade moderation and result declaration. The Academic semester shall provide at least 90 instructional days.
7. All co-curricular and extra-curricular activities shall be scheduled so as not to interfere with the academic activities as stipulated in the academic calendar.
8. The non-conduct of academics on any particular teaching day for whatever reason shall be made up on a suitable day.

## **6. SEMESTER REGISTRATION, ATTENDANCE, COURSE DROPPING, COURSE WITHDRAWAL, TEMPORARY BREAK, DETENTION AND TERMINATION**

### **1. Semester Registration:**

1. Students have to register for courses at the beginning of every semester as per the notification issued by the institute and prescribed dates in the Academic Calendar. The Institute shall notify the process of registration well in advance to the stakeholders.
2. The students admitted through regular entry shall be automatically registered for the Core Courses of the First Semester. Such students have to register separately for Elective/Choice based Courses only.
3. On joining the Institute, each student is assigned to a Proctor. Students are advised to discuss with the proctor about the nature of courses for which he / she can register during the semester, as given in the curriculum, within the framework of guidelines approved by the AC.
4. In case of any delay in registration of courses, due to unforeseen reasons, the student and parent shall take prior approval from the Director well in advance indicating the reason for delay in registration. However, for such students the attendance shall be calculated from the date of commencement of the semester and not from the date of joining.
5. Only those students shall be permitted to register for a course who have:
  - a. Cleared all dues of the Institute, Hostel and Library including fine if any of the previous semester.
  - b. Earned all the credits prior to previous academic year and minimum 60% credits during the previous Academic Year.
  - c. Not been debarred from registration of courses on any other specific ground.
6. If a student does not register in a prescribed schedule, notified by the Institute, his / her admission shall stand canceled in the respective semester. Parents are advised to take a note.
7. Students need to re-register for courses in which they failed in earlier year/s by paying applicable fees, if they wish to go for betterment of Formative Assessment. Students are not permitted to re-register for course/(s), which they have already passed.

## **2. MDM:**

In accordance with the National Education Policy (NEP) of 2020, it is mandatory for every student (from Regulations 2023) to fulfill MDM requirements as part of their B.Tech. degree program. The MDM requirements as part of their B.Tech. degree program. The MDM curriculum consists of around 14 credits distributed across six semesters (Semester III to Semester VIII) and is integrated within the 168-credit course structure. Students are required to select and register for a single MDM from the available options provided to them. MDM registration will commence prior to the beginning of the Second Year of the B.Tech. program. Completion of all courses within the chosen MDM is mandatory for students across the six semesters (Semester III to Semester VIII) in order to fulfill the minimum credit requirement. Due to inter-dependencies among courses, students are not permitted to change their selected MDM in subsequent semesters. The students will be awarded B. Tech. in relevant discipline with respective MDM

## **3. ATTENDANCE REQUIREMENT:**

The Institute expects all B. Tech. students to attend 100% lectures. However, a shortfall of not more than 25% lectures may be condoned if the shortfall is caused by valid reasons and supported by appropriate evidence, such as personal illness or death in the family. Students shall note that academics should not be missed without valid reasons, and the number of sessions missed due to valid reasons cannot exceed 25%.

1. Each semester is considered as a unit and the candidate has to put in a minimum attendance of 75% in each course with a provision for consideration of 15% of the attendance by the Director, for reasons such as serious medical condition or representing the Institute /University / State / Nation in sports, cultural, technical or academic activity with the permission of the Institute authorities.
2. For the students representing the institution at University, National and International level, the attendance can be considered as 'Present' for such cases at the end of semester. However, prior permission must be obtained from the HOD and relevant documents must be submitted upon completion of the activity.
3. The student who has not attended minimum 75% of all conducted classes like Lectures, Tutorials, Laboratories, Workshops etc. shall be declared as Detained and shall not be permitted to attend the SA.
4. The basis for the calculation of the attendance shall be the period prescribed by the Institution through its Academic Calendar. For late admission / transfer of students from other institutes /universities, the date of admission would be considered for the calculation of attendance (this rule does not apply to higher semesters).
5. The students will be informed about the attendance status periodically by the Institute notifying the percentage attendance on the notice board.

#### **4. DROPPING OF COURSES:**

A student can drop an Elective Course (Maximum 2) within 3 weeks of the commencement of the semester, under the guidance of the proctor and recommendation of Course Teacher if the Student and Parent feel that the student cannot cope up with all the courses registered at a time during that semester.

However, the total credits should not fall short of 16 credits which are the minimum number of credits to be registered per semester. The students can register for a new elective course (other than dropped courses) next year.

This dropping of course shall be intimated to the Dean Academics, through the HOD of the department before the dropping date as announced. The dropped courses are not recorded in the grade card. This facility is not applicable for First Year students.

#### **5. WITHDRAWAL FROM COURSES:**

A student can withdraw from the Elective Courses (maximum 2) before MidTerm submission under the guidance of the proctor and recommendation of Course Teacher if the Student and Parent feel that the student cannot cope up with the courses.

However, the total credits should not fall short of 16 credits which are the minimum number of credits to be registered per semester. The student has to re-register for the same course withdrawn in the next year by paying applicable fees. The withdrawn course(s) are recorded in the Grade Cards as “WW” grade. However, such withdrawals will be permitted only twice during the span of the program. This facility is not applicable for first year students. Students who want to utilize this facility must apply with recommendation of course teacher through the HOD of the department to Dean Academics, in consultation with proctor and parent. The Dropping and withdrawal facilities are available only for REGULAR Semester(s).

#### **6. TEMPORARY SEMESTER BREAK OF STUDY FROM THE PROGRAMME:**

A candidate is normally not permitted to break the study. However, if a candidate intends to temporarily discontinue the program in the middle for valid reasons such as entrepreneurship, incubation, start-ups, internships leading to placement, foreign university opportunities, research opportunities etc. and wants to rejoin the programme later in respective semester, he / she shall apply to the Director, well in advance.

- Such application shall be submitted within at least 6 weeks of the commencement of the semester or from the date he/she has attended the classes, whichever is later, stating fully the reason for such a withdrawal, together with supporting documents and endorsement of his/her parents/guardians through the Head of the Department.
- The institute shall examine such an application and if it finds the case to be genuine, it may permit the student to temporarily withdraw from the program.

Such permission is accorded only to those

- who have the possibility to complete the prescribed program requirements within the time limits specified by the programme.
  - who do not have any outstanding dues /demand at the Institute / University level including tuition fees, any other fees library materials etc.
  - Such students are expected to pay 100% fees of the year in which they are taking semester break. The candidate has to rejoin the semester after the break from the commencement of the respective semester as and when it is offered.
  - The total period for completion of the programme is considered from the commencement of the semester to which the candidate was first admitted and shall not exceed the maximum period prescribed for the respective programme. The maximum period includes the break period.
1. If any candidate is detained for any reason, the period of detention shall not be considered as a “break of study”.
  2. It may be noted that the fees/charges once paid shall not be refunded.
  3. Normally, a student will be entitled to avail of the temporary break facility only once for maximum period of two years during his/her studentship of the programme. Hence, the student shall take the advice of the Director to use the above provision only in exceptional cases.

## **7. DETENTION:**

1. A student shall be declared as Detained and shall not be permitted to attend the SA and Practical/Oral Exams if;
  1. The student who has not attended minimum 75% of all conducted classes like Lectures, Tutorials, Laboratories, Workshops etc.
  2. Incomplete term work and non-submission of laboratory journal.
2. Such students are expected to pay 100% fees of the year in which they are detained.
3. Such students are expected to take admission in the next Academic Year by paying applicable fees as below: 100% fees if detained in odd semester and 50% fees if detained in even semester.

## **8. TERMINATION FROM THE PROGRAMME:**

A student shall be terminated from the programme in the following cases:

- Involved in ragging and in any illegal activity as per law defined by the governing authorities.
- Successive failures in first Year: On failure to get admitted in third semester after three successive academic years from the date of admission, he / she shall be declared as Not Fit for Technical Education (NFTE). Such students shall be permitted for only one year to continue the education in the institute provided the permission is accorded by AC. Director shall be authorized to terminate the student from the program.
- Not completing programme in prescribed period: Students will have to complete B. Tech. programme in maximum period of 6 years (12 semesters) for regular entry and 5

years (10 semesters) for lateral entry from the date of first admission. Genuine cases with valid justification may be referred to the Director. On behalf of the Academic Council, the Director is authorized to make decisions regarding such applications for extending the programme completion period for degree award, in accordance with the prevailing rules and guidelines set by professional statutory bodies. Students who are not able to complete the programme in the stipulated period will be declared as Not Fit for Technical Education (NFTE).

- Under following circumstances student admission may be terminated from the programme if;
  1. Students misbehave with faculty or staff.
  2. Remain absent without any information for a period of one year.
  3. In case of termination, the student has to pay all applicable dues.

## 7. CURRICULUM

There shall be a prescribed course structure for each of the academic programmes and in general terms it shall be known as the Curriculum. The Curriculum prescribes all the Courses of study semester-wise with credits assigned, teaching/contact hours, evaluation scheme and minimum requirements for the award of degree. The curriculum revisions/reforms/revamping shall be a continuous process governed by outcome-based education, choice-based credit system and AICTE model curriculum.

### 1. Credit System:

- The primary purpose of the credit system is continuous evaluation of a student's performance which is measured by the number of credits the student has earned. Typically, credit measures the quantum of work involved in a course.
- Credit structures for various courses with various combinations of theory/tutorial and Laboratory/Project/Seminar/Mini Project hours are given in Table 7.1.
- A student can earn credits for a particular course by fulfilling the minimum academic requirements of attendance, assessment and evaluation. No credits shall be awarded if a student satisfies the minimum attendance requirements but fails to meet minimum assessment & evaluation requirements.

**Table 7.1: Assigned credits for various types of courses**

Hours per week per student for engagement for			Credits Assigned
Theory	Tutorial/Seminar	Laboratory/Project	
1	0	0	1
0	1	0	1
0	0	2	1
0	0	4	2

1	1	0	2
1	0	2	2
3	0	0	3
2	0	2	3
2	1	0	3
3	1	0	4
3	0	2	4
4	0	0	4
2	0	4	4
<b>Credit = Theory hours + Tutorial hours + 0.5 (Laboratory hours)</b>			

- The CGPA & SGPA is calculated based on the course credits and grades obtained by students. A minimum number of earned credits and minimum CGPA should be acquired in order to qualify for the degree.

## 2. Components of Curriculum:

1. The structure of curriculum for a programme and course syllabi shall be approved by AC on recommendation of respective BOS.
2. The entire curriculum is spanned over eight semesters and has thoughtfully designed contents and evaluation methods. Total credits are 168. The exact number of credits required is mentioned in the curriculum structure for the respective programme.
3. Curriculum shall have credit and audit (Non-Credit) courses.
4. Curriculum will have balanced offerings of various courses such as Basic Science, Engineering Science, Professional Core, Professional Electives, Multidisciplinary courses, Skill courses, Humanities Social Science and Management courses, Experiential courses, and Liberal Learning courses. The curriculum offerings include various course types as mentioned in Table 7.2.

**Table 7.2: Curriculum Components.**

<b>Sr. No</b>	<b>Course Code</b>	<b>*Component of Curriculum</b>
1	BSC	Basic Science Course
2	ESC	Engineering Science Course
3	PCC	Programme Core Course
4	PEC	Programme Elective Course
5	MDM	Multidisciplinary Minor

6	OEC	Open Elective Course
7	VSEC	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	EEM	Engineering/Economics/Management Course
10	IKS	Indian Knowledge System Course
11	VEC	Value Education Course
12	ELC	Experiential Learning Course
13	LLC	Liberal Learning Course

5. Normally the number of courses in a semester shall not be more than six for theory and four for laboratory courses.
6. Audit courses in the curriculum shall offer students to understand the way their expertise/ domain knowledge can be utilized for developing core engineering knowledge.
7. The MDM curriculum consists of around 14 credits distributed across six semesters (Semester III to Semester VIII) and is integrated within the 168-credit course structure.
8. A typical description of the programme curriculum shall consist of course title, course code, teaching hours per week for lecture/ tutorial/practical's, credit allotment, pre-requisites, text books, reference books, Course Objectives and Course Outcomes (COs) with relevant Bloom's taxonomy levels, Programme Outcomes (POs), Programme Specific Outcomes (PSOs), mapping of the COs with POs and PSOs and assessment scheme etc.
9. The details of the programme structure and course details shall be published on institute website <https://www.pccoer.com>

## 8. EXAMINATION AND EVALUATION

There shall be continuous evaluation of students. This system will have following objectives:

1. To get insights regarding student performance/abilities which helps to identify learning needs and take necessary actions for possible improvement.
2. To give feedback to the student about his level of understanding and abilities as per required Graduate Attributes (GAs).
3. To allow students to demonstrate their competence which they will practice in their professional career.
4. To award students grades based on their performance and abilities.
  - a. Evaluation processes shall ensure outcome-based education adopted by the institute. All assessment methods will ensure constructive alignment of curriculum with intended outcomes.
  - b. There shall be internal and external evaluation of students as a part of evaluation

to award grades. All assessment of Theory, Practical, Project, Seminar and internship shall be conducted to evaluate GAs essential to meet the needs of engineering graduates at national as well as international level. Appropriate weightages given to these evaluation methods will ensure quality of assessment and evaluation.

- c. Evaluation scheme based on type of course with weightage is mentioned in table 8.1.

**Table 8.1: Scheme of evaluation for courses prescribed in curriculum with weightages**

Sr. No.	Type of course	Method of Formative/Internal Assessment	Formative / Internal Assessment Weightage (%)	Method of Summative / External Assessment	Summative / External Assessment Weightage (%)	Total	
1	BSC/ESC/ PCC/PEC/ OEC/ MDM (Theory)	Assignment/ case study/ Quiz/Poster presentation/ Seminar presentation/ Open book test etc.	50 (20 + 20 + 10)	SA of 50 Marks based on 100% syllabus shall be conducted.	50	100	
2	Term work	Experiment/Assignment / case study report for each Experiment/Assignment	25 or 50	NA		25 or 50	
3	Laboratory	Oral/practical examination	NA	Oral/practical examination	25 or 50	25 or 50	
4	Major Project *TW <b>OR</b>	Project Reviews (Minimum 2) Rubric based Evaluation	-	Oral and Term Work	50+100	150	
		-	-	Viva voce	50+100		
5	Internship*	Rubrics based evaluations along with report.	-	-	200+200	400	
6	Seminar*	Two rubric based reviews along with report	50	Report evaluation by external	30	100	
				Viva	20		
7	MOOCs courses*	Based on submission of assignment and performance	MOOCs Weekly assgs	30%	MOOCs Weekly assgs	30%	25/ 50/ 100
			Certification	70%	Certification	70%	

8	Skill courses	Hands on/Practical test, Live projects, Assignment/case study/Quiz/Poster presentation/Seminar presentation/Open book test/ Class test etc.	50/100	If needed as per the demand of course	-	50/100
9	*Experiential Learning/ Liberal Learning courses	Rubric based Evaluations/ Live task / assignment / Practice/ case study / Quiz / Poster presentation for PP or NP grade	50/100	-	-	50/100

\* As specified in the programme curriculum.

### 1. Internal Evaluation:

Internal Evaluation shall be done continuously by faculty over a span of semester. Structured Evaluation will be done for all programmes with appropriate schedule in Academic Calendar as follows:

#### 1. Formative Assessment (FA) Theory Courses:

1. The FA for Professional Core, Professional Elective, Open Elective, Basic Science Course, Engineering Science Course, HSMC courses and MDM courses, Experiential Learning Courses etc. shall be conducted at department level. FA shall consist of three evaluation instances as follows:
  1. Formative Assessment 1 (FA 1) [Unit test]
  2. Formative Assessment 2 (FA2) [Assignment/ case study/ Quiz/Poster/ Presentation / Seminar presentation/ Open book test etc.] The FA for other type of courses shall be based on feasibility & need of Evaluation.
  3. Formative Assessment 1 (FA3) [Quiz]
2. Sum of the scores obtained in FA1, FA2 and FA3 shall be considered for computing the final FA of a student in each course.

#### 2. Internal Evaluation of Practical Term work

1. Continuous evaluation of each experiment/assignment shall be done throughout the semester, collating as Termwork at the end of each semester. The Evaluation in a laboratory course will be based on the following criteria
  1. Attendance and participation in laboratory work.
  2. Performance in Evaluation of understanding through viva voce, group discussions, quizzes, etc.
  3. The quality of work as prescribed by the course instructor.
  4. Timely Submission
  5. Report through laboratory journals

2. It is mandatory for the student to complete all the experiments/assignments as specified in course curriculum for the grant of Termwork. It is obligatory to maintain and submit laboratory journals as prescribed by the course instructor before the Term End.
3. Students shall be detained for incomplete Termwork and non-submission of laboratory journals and will require registering the course again.
4. Termwork marks assigned for special courses such as Mini Project etc. shall be evaluated based on parameters proposed by respective Department and duly approved by Dean Academics.

**3. Internal Evaluation of Project/Seminar/Internship:**

1. Project/Seminar Term work will be evaluated based on Reviews scheduled in the semester/s as mentioned in the Guidelines.
2. For Internship rubrics-based evaluations along with a report shall be conducted. The marks of this evaluation will be collated as term work with 100% weightage in total Evaluation.

## 2. External Evaluation:

### 1. Theory Evaluation:

**Summative Assessment (SA):** Summative assessment at the end of semester shall be conducted for external evaluation. This SA of 50 Marks and it will be conducted at Institute level.

**Re-examination:** Re-examination shall be conducted after declaration of result of main SA examination for students with failed/acquired transitional grade as per rules and regulations. Students need to pay additional examination fees for such Re-SA examinations.

Re-SA examination shall be provided for those students who are having satisfactory attendance (Minimum 75%), course-wise, but remained absent for the regular SA due to a valid/unavoidable circumstance, like:

1. Students, who have sought due prior permission from concerned HOD and Director through proper channel, and there after permitted by the institute for taking part in important curricular/ co-curricular/ extra-curricular activities like Technical events/NSS/Sports/Cultural/Project Competitions/Paper presentation etc. at University/ State/ National/ International levels (the students/ authorities should exercise enough care that a student shall not remain absent for the makeup examination) After such an event, at the time of reporting to the Institute, the student must submit the proof of participation/ certificate from the competent authority for approval of the prior leave request. The prior leave request shall be converted to official leave and an endorsement will be issued by the Institute, based on which the student shall be eligible for the makeup examination.
2. Students seeking prior leave on account of
  - Accident or severe illness leading to hospitalization, which disables the student from writing the examination.
  - A calamity in the family (first relation Only-Parents, Grandparents and Siblings) barring the student from writing the examination.
3. Students seeking prior leave for attending any competitive examinations (NDA/SSB/UPSC/MPSC etc.) /Placement drives.

In the event of b and c, it is mandatory on the part of the student/parent to inform the respective departmental authorities (Class Teacher/HOD) immediately through email or mobile message and submit a prior leave request. If the information reaches the Class Teacher first, it is the responsibility of the Class Teacher to immediately intimate the HOD and record the same in the examination report without fail. After such an event at the time of reporting to the Institute, the student must submit all the relevant reports/certificates from the competent authority for approval of the prior leave request. The prior leave request will then be converted to official leave and an endorsement will be issued by the Institute, based on which the student becomes eligible for the Re-SA examination. Any intimation after the completion of regular examination and/or non-submission of report/certificate will be construed as absent for the examination and the student will be awarded ZERO marks in the respective examination. No further request will be entertained in this regard.

The Re-SA examination shall not to be treated as an improvement examination.

**Summer Examination:** The Summer examination shall be conducted at the end of even semester. The summer exam includes courses offered in both the semesters. Only Summative examination will be conducted. Students need to register for such examinations by paying specified fees.

If a student fails in the Summer Examination, then he/she may Reregister with FA again or he/she may Reappear with his/her existing FA performance (Latest FA will be considered).

## **2. Practical Evaluation**

Practical/Oral examinations by the internal and external examiners will be conducted for Practical's at the end of each semester as per the schedule in Academic Calendar.

1. Final examination for laboratory courses will normally be held in the last week of conclusion of teaching as per Academic Calendar.
2. These oral/practical examinations will be conducted in the presence of an External Examiner appointed by competent authority.
3. Weightage of 50% each for evaluation by internal and external examiner shall be considered. In case of absence from oral/practical examination, the same rules as those for theory courses are applicable.
4. Re-examination for practical/oral examinations shall be conducted before re-examination of theory courses.

## **3. Major Project/Seminar Evaluation**

The Project is a group activity. Minimum two Internal Reviews per semester shall be conducted. Students shall be evaluated as per the rubric designed by the relevant Programmes. A Viva voce will be conducted at the end of the semester in the presence of an External Examiner. The student team has to submit a hard bound copy of the report summarizing the Problem, Relevant Literature, Design, Analysis, Experimentation, Results, Outcomes and Conclusions as per the guidelines provided by the relevant Programmes.

## 9. EXAMINATION RULES AND REGULATION

### 1. Credit Courses:

Based on the Evaluation student will be awarded letter grades after combining performance of all (FA+SA) evaluations for the respective course. These letter grades will be derived from quantitative and qualitative evaluation converted into a 10-point scale called as grade point for credit courses.

### 2. Noncredit Courses:

Apart from credit courses, Noncredit courses will be awarded letter grades as PP (Pass) and NP (Not Pass) based on quantitative and qualitative Evaluation. In addition to above letter grades students will be awarded dual letter grades in specific circumstances mentioned in rules and regulations for passing, A.T.K.T, award of class.

### 3. Passing, A.T.K.T. and award of class

#### 1. Rules of Passing

##### 1. Term work/Practical/Oral

To pass the Termwork/Practical/Oral the student has to earn a minimum of 40% marks in each head.

##### 2. Theory Course head

1. To pass the Theory Subject head the student must earn a minimum of 40 percent marks in SA and 40 percent average marks (FA+ SA).

2. The failing student can repeat the SA to pass the head in the same semester and the FA marks will be retained as it is. However, grades earned in re- examination (Re-SA) shall be marked with \*(asterisk) for more than 2 attempts except for transitional grades II and XX.

Students failed in re-examination (Re-SA) can:

1. continue their FA just by appearing for SA (Reappear)

2. apply for FA betterment (Re-Registration). This

is irrevocable once opted.

If students have applied for FA betterment (Re-Registration), they need to attend classes and perform their FA and appear for the SA.

3. To earn credits of a course (Theory/term work/practical/oral/presentation) students must pass the course with minimum passing marks/grade.

#### Summary:

Students must earn a minimum of 40 percent marks in SA and 40 percent average marks (FA + SA) for passing.

Students failed in Re-examination need to reappear for the course/s by paying applicable fees in the Summer Examination, if offered by the Department or reappear/re-register by paying applicable fees in respective semester (Odd and Even) of next academic year.

- A student shall be awarded the bachelor's degree if he/she earns 168 credits as per the structure defined by the programme and clears all the audit and noncredit courses specified in the curriculum. In case of lateral entry, students shall be awarded the bachelor's degree if he/she earns 124 credits as per the structure defined by the programme.

## 2. Rules of A.T.K.T.:

- A student can register for the third semester if he/she earns minimum 60% credits of the total of first and second semesters.
- A student can register for the fifth semester if he/she earns a minimum 60% credits of the total of third and fourth semesters and all the credits of first and second semester.
- A student can register for the seventh semester if he/she earns a minimum 60% credits of the total of fifth and sixth semesters and all the credits of third and fourth semester.

## 10. PERFORMANCE INDICES SGPA & CGPA

### 1. Grading and Evaluation:

Grade points and equivalent letter grades for absolute grading will be as mentioned in Table 10.1.

**Table 10.1. Performance with grade points and equivalent letter grades**

Grade Point	Letter Grade
10	O (Outstanding)
9	A+ (Excellent)
8	A (Very Good)
7	B+ (Good)
6	B (Above Average)
5	C (Average)
4	P (Pass)
0	F (Fail)
0	Ab (Absent)

- Apart from credit courses, Noncredit courses will be awarded with letter grades based on quantitative and qualitative evaluations as PP (Pass) and NP (Not Passed).
- Grades in special circumstances: In addition to above letter grades students will be awarded dual letter grades in specific circumstances as mentioned in table 10.2.

**Table 10.2 Grades in special circumstances**

<b>Reason</b>	<b>Letter Grade</b>
Detained due to insufficient attendance or incomplete Termwork (Detained and Repeat)	DR
Withdrawal of course with satisfactory attendance (Willful Withdrawal)	WW
Satisfactory performance in FA but absent in SA due to valid reason (Incomplete due to Illness)	II
Very good performance in FA (more than or equal to 80%) but poor performance in SA leading to fail (F) overall grade	XX
Credit Transfer grades, if student is completing grades for any courses at other Institute/ University etc.	CT
Special Grades to be given to students appearing for special examination, who could not attend earlier examination due to Co- curricular activities/ NSS/ NCC/ Competitions.	SG
Result Reserved due to backlog	RRB

3. Note: ‘II’ and ‘XX’ are transitional grades awarded which will be converted to actual grades earned in re-examination else will automatically get converted into ‘F’ grade. Candidates can avail facility of XX grade only once over the span of program for theory courses.

## 2. Calculation of SGPA and CGPA:

Based on the grade points earned by the students, performance of student in each semester will be calculated as semester grade point average (SGPA) as follows—

$$SGPA = \frac{\sum_{i=1}^n \text{Grade points earned} \times \text{credits of each course}}{\text{Total credits in a semester}}$$

For Example: suppose in a given semester a student has registered for five courses having credits C1, C2, C3, C4, C5 and his / her grade points in those courses are G1, G2, G3, G4, G5 respectively. Then student’s SGPA will be

$$SGPA = \frac{C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

At the end of each academic year cumulative grade point average will be calculated based on the grade points obtained in all the courses (Theory/term work/practical/oral) of first semester to eighth semester for the students admitted in the First year and third to eighth

semesters for the students directly admitted in Second year. It is calculated in the same manner as the SGPA. The class shall be awarded to a student on the CGPA calculated as mentioned in Table 10.3:

**Table 10.3 Class of Degree**

Sr. No.	CGPA	Class of the degree awarded
1	7.75 or More than 7.75	First class with distinction
2	6.75 or more but less than 7.75	First class
3	6.25 or more but less than 6.75	Higher second class
4	5.50 or more but less than 6.25	Second class
5	4.00 or more but less than 5.50	Pass Class

**10.3 Percentage of Marks:** Based on the CGPA earned by the students, percentage of marks of student will be calculated as follows:

$$\text{Percentage of Marks} = \text{CGPA} \times 9.5$$

## 11. SEMESTER GRADE REPORT

- A Grade Report in the form of a Grade Card shall be issued to students at the end of each Semester.
- The Grade Card shall include the following;
  - The list of courses registered for an academic year along with credits.
  - The letter grade obtained in each course.
  - The total number of credits earned by a student.
  - SGPA, CGPA Details.
  - Examination details.
  - Grading System, calculation of performance indices and conversion of CGPA to equivalent percentage shall be provided on the back page of the grade card.
- Grade Cards shall be used to prepare Transcripts of the student.

## 12. AWARD OF THE DEGREE

A student shall be eligible for the award of B.Tech. Degree from the institute and Savitribai Phule Pune University if the student has:

- Obtained eligibility certificate from the University.
- Registered & passed all the prescribed courses & earned minimum credit requirement for the said degree.
- Obtained CGPA  $\geq 4.00$

- Paid all the Institute dues and satisfied all the requirements prescribed.
- No case of indiscipline pending against him/her.

The Academic Council (AC) shall recommend the list of all eligible students to SPPU for award of B.Tech. Degree with additional Honors/Minor certification wherever applicable.

### 13. EXIT OPTION

PCCOE&R recommends a 4 years multidisciplinary Bachelor's programme as the preferred option since it allows the opportunity to experience the full range of holistic and multidisciplinary education in addition to a focus on major and minor subjects as per the student's preference. However, in case of unavoidable circumstances if students need to give up their education they can opt to exit at the end of 2<sup>nd</sup> or 4<sup>th</sup> or 6<sup>th</sup> semester after completing additional 8 credits as prescribed in this document.

The student has to submit a request for exiting the programme to the Director through the Head of the Department within 2 weeks of declaration of results.

Students will be allowed to take the exit option after counseling by class teacher, proctor, academic coordinator and Head of the Department.

**Multiple Exits:** Students will have the flexibility to enter a programme in odd semesters and exit a programme after the successful completion of even semesters as per their future career needs. The student has to earn the minimum credits as mentioned in the below table and should not have any backlogs. The additional 8 credits need to be earned during the Summer Vacation (within 2 months of approval of Exit Request). The table 13.1 gives the summary of the Exit option after even semesters. The reentry option is available as per NEP 2020 guidelines.

**Table 13.1 Exit option after 2<sup>nd</sup> or 4<sup>th</sup> or 6<sup>th</sup> Semester**

Sr. No.	After Semester	Qualification Title	Regular Credit Requirement	Additional Credits to be Earned
1	Second	One Year UG Certificate in the relevant discipline	Minimum 40 credits	8 Credits of VSEC/ Internship/ Apprentice as per the relevant programme
2	Fourth	Two Years UG Diploma in the relevant discipline	Minimum 80 credits	8 Credits of VSEC/ Internship/ Mini Project as per the relevant programme
3	Sixth	Three Years B. Sc. / B. Voc. in the relevant Discipline	Minimum 120	8 Credits of VSEC/ Internship/Mini Project as per the relevant programme

However, the B. Tech. degree can be obtained only within 8 years from the date of registration.

## 14. DISCIPLINE & CONDUCT

- Every admitted student shall be issued a photo identification (ID) card which must be retained by the student while he/she is registered at PCCOE&R. The student must have a valid ID card with him/her while in the Institute.
- Discipline & Conduct: Any act of misconduct committed by a student inside or outside the campus shall be an act of violation of discipline of the institute. Violations of the discipline shall include:
  - Disruption of teaching, examination, administrative work, curricular or extracurricular activity, and any act likely to cause such disruption.
  - Refusing to provide an identity card when demanded by any institute authority.
  - Damaging or defacing the property inside or outside the institute campus.
  - Engaging in any attempt at wrongful confinement of teachers, offices, employees and students of the institute.
  - Use of abusive and derogatory slogans or intimidatory language or incitement of hatred and violence.
  - Ragging in any form (“Ragging” means causing, inducing, compelling or forcing a student, whether by way of a practical joke or otherwise, to do any act which detracts from human dignity or violates his person or exposes him to ridicule or to forbear from doing any lawful act, by intimidating, wrongfully re-straining, wrongfully confining or injuring him or by using criminal force to him or by holding out to him any threat of such intimidation, wrongful restraint, wrongful confinement, injury or the use of criminal offense. Supreme Court of India has defined ragging as a criminal offense.)
  - Eve teasing or disrespectful behavior to women or girl’s students.
  - An assault upon, or intimidation of, or insulting behavior towards a teacher, officer, employee or student or any other person.
  - Getting enrolled in more than one programme course of study simultaneously.
  - Committing forgery, tampering with documents or records, identity cards, furnishing false certificate or false information.
  - Organizing instant agitation/meetings without prior permission in the campus.
  - Viewing/downloading obscene information/data, images and executable files, sending obscene mails/ messages via facebook / twitter/other social sites using institute servers.
  - Sharing the login and passwords & other details of IT facilities provided to other students/outsideers.
  - Consuming or possessing alcoholic drinks, dangerous drugs or other intoxicants in the institute campus.
  - Possessing or using any weapons and firearms in the institute campus.

- Unauthorized occupation of a hostel, Accommodating guests or other persons in hostels without permission.
- Malpractice in examination.
- Indulging in anti-national activities contrary to the provisions of acts and laws enforced by the Government.
- Any other act which may be considered by the Director or the Discipline Committee to be an act of violation of discipline.
- Any act of indiscipline of a student reported to Director/concerned authority shall be referred to Grievance Redressal and Disciplinary Committee (GRDC) of the institute. The Committee shall enquire into the charges and recommend suitable punishment if the charges are substantiated. The penalties/punishment/actions may include:
  - Written warning and information to the parents/guardian.
  - Imposition of fine ranging from Rs.500/- up to Rs.5000/-
  - Suspension from the Institute/Hostel/Mess/Library/ or availing of any other facility.
  - Suspension or cancellation of scholarships /fellowship or any financial assistance from any source.
  - Recover of loss caused to Institute property.
  - Debarring from participation in sports/NSS/student club.
  - Disqualifying from holding any representative position in the Class/institute / Hostel / Mess/Sports/ Clubs and in similar other bodies.
  - Disqualifying from appearing in placement and receiving any awards.
  - Expulsion from the Hostel/Mess/Library/Club/institute for a specified period by forfeiting fees.
  - Debarring from an examination.
  - Action as per Maharashtra anti-ragging act1999.
- If a student is found guilty of malpractice in examinations, then he/she shall be punished as per the recommendations of the Complaint Redressal Committee (CRC) constituted by BOE. The CRC committee shall inquire and decide the punishment by following the guidelines for imposing punishment on examinee/s/others involved in unfair means. However, depending on the situation, committee may quantify the severity of the punishment which may include:
  - Cancellation of the performance of the student in the course/s in which he/she was involved in malpractice.
  - Cancellation of the performance in that examination for all the courses.
  - Expulsion/termination from the institute if repeatedly involved.
  - Stoppage of scholarships/stipend.
  - Issuing warning.
  - Debarring from the examinations for a specified period.

Student/s involved in acts of indiscipline/malpractice in examination shall be issued notice

asking him/her to be present before the respective committee (CRC) on the day at specified time and venue with his/her parents/guardian. He/she shall give written reply/oral explanation to the charges leveled against him/her for consideration. If the implicated students fail to appear before the committee, then a decision shall be taken in absentia, based on available evidence/documents, which shall be binding on the concerned student.

**1. Conduct during Examination:**

**1. Timing:**

1. The students are required to be present outside the examination hall exactly 20 minutes before the start of the examination.
2. Students will only be allowed to enter the examination hall 15 minutes prior to commencing the examination.
3. The students will not be allowed to appear in the examination if they reach the examination center 30 minutes after commencement of examination.
4. No student can leave for 30 minutes after the commencement of the examination.
5. Students are not permitted to leave the examination hall during the last 10 minutes.
6. Students are responsible for keeping themselves informed about exam dates, as well as the time and place of the examination.
7. Differently abled students will be given additional time of 20 minutes/ hour of examination.

**2. Identity check-up:**

1. Students will not be allowed into the examination hall without presenting an appropriate photo identity card, Hall ticket issued by the Institute.
2. Invigilators are responsible to ensure full compliance with such requirements.
3. If a student forgets his/her Institute Identity Card, the driving license/ other photo identity card will be accepted in place subject to verification by the concerned teacher/ examination coordinator/ Head of the Department concerned.

**3. Breaks:**

1. Breaks for visits to the bathroom may be taken only after permission from the invigilator and under the condition that the invigilator's instructions given on the occasion are followed.
2. If a student falls ill during the examination and is unable to complete the examination, the concerned student should alert the invigilator and senior supervisor in consultation with the concerned Head of the Department may make suitable arrangements for proper medical attention.
3. No student shall re-enter the examination hall after leaving it unless he/she was under approved supervision during the full period of absence.

#### **4. Question papers and answer sheets:**

1. During an ongoing examination students are not allowed to take the examination question paper outside the examination hall. After the examination, the student should personally submit his/her examination answer sheet to the invigilator.
2. Even a blank answer sheet shall be handed over to the invigilator.
3. Each answer sheet should contain details as mentioned on the front page.
4. If there are any queries regarding the exam questions the students must ask the invigilators who will contact the course teacher through the proper channel.

#### **5. Other materials:**

1. Students should bring their own pencils, pens, erasers, rulers, non- programmable calculators, and any other tools required for the examination.
2. Students are advised not to bring valuables for examination. Students shall keep their handbags, cases, outdoor clothes, etc. at identified locations for the same. Students are responsible for the safekeeping of all personal belongings they bring to the examination hall. The Institute takes no responsibility for the loss or damage of such belongings.
3. Pencil cases, mobile phones, smart watches, earbuds/neck bands/headphones, dictionaries, electronic dictionaries, written or electronic media, digital media, or any other materials are not permitted/ allowed into the examination hall, with the exception of devices used for assisting students with hearing visual or other physical difficulties.
4. Exchange of pens, pencils, calculators, study material, etc. is not permitted.
5. Calculators with more than one-line display or with alphanumeric display (programmable calculators) are not permitted into the examination hall unless specified in advance by the examiner. If the invigilator reasonably believes that a student is using a calculator that does not conform to the rules, he/she has the discretion to replace the calculator and a report on the matter will be made on the invigilator's declaration form.

#### **6. Disturbance:**

1. During the examination period, there must be no communications among students or between a student and an outsider by any means, such as phones. This rule applies to students in the examination hall and those on supervised breaks for visits to bathroom/s.
2. No student shall leave his/her assigned seat without the permission of the invigilator. It is the invigilator's discretion to decide whether there is enough reason to remove a student from the examination hall owing to disorderly conduct.

#### **7. Miscellaneous:**



1. The students must ensure before they leave the examination hall that they have signed the attendance sheet.
2. The students with medical problems will be provided Writer in the Examinations only subject to prior permission from the Dean Academics.
3. The documentary proof along with recommendations of concerned HOD will be required. All such cases will be dealt with as per academic rules.
4. If you suffer from language difficulties or any disabilities you can apply for an extension of the test time.
5. Students are not allowed to wear a smart watch during the examination.
6. Cheating, and attempts at cheating, will immediately be reported to the Examination Office. Consequences of proven cheating or attempts at cheating will be dealt with separately by the malpractice and grievance handling committee.

## **15. CONCLUSIONS**

1. The Academic, Examination and Evaluation Policies/Rules and Regulations regarding conduct of undergraduate programmes at PCCOE&R are published in this document. The Academic Council reserves the right to modify these policies/ regulations as and when required from the point of achieving academic excellence.
2. The rules for grace marks, consideration of extracurricular activities, condonation, amendment of results, unfair means resorted to by the students and punishments, physically challenged students will be governed by the ordinance approved in Academic Council. These policies will be in concurrent with the rules and guidelines of professional statutory bodies such as AICTE, UGC and affiliating university SPPU etc.
3. Interpretation: Any question as to the interpretation of these guidelines shall be decided by the institute head, whose decision shall be final and binding in the matter. The institute head shall also have the power to issue clarifications to remove any doubt, difficulty or anomaly, which may arise regarding the implementation of these Guidelines.
4. The decision of the Director (Chairman, Academic council) shall be final and binding on all concerned i) for the cases not covered through this document; ii) in case of dispute, difference of opinion in interpretation of this regulation; and
  - a. emergent cases.

# Annexure I

## 1. Formative Assessment Paper Format

	<p><b>Pimpri Chinchwad Education Trust's</b>  <b>Pimpri Chinchwad College of Engineering &amp; Research Ravet,</b>  <b>Pune</b></p> <p>An Autonomous Institute   NBA Accredited (4 UG Programs)   NAAC A++          Accredited   ISO 21001:2018 Certified  <b>IQAC PCCOER</b></p>	
Academic Year:2025-26 Term-I	<b>Formative Assessment</b>	ACAD/R/11-FA

**Department:**  
**Subject:**  
**Subject Code:**

**Class:**  
**Maximum Marks: 30**

**Div:**  
**Duration: 1 hr**  
**Date:**

- Note:* 1. Attempt all Questions  
 2. Give explanation or justification wherever required.  
 3. Neat diagrams must be drawn wherever necessary.

**Course Outcomes:**



CO No.	Course Outcomes	BT Level

Question No.	Question	CO / BTL /PI	Marks
Q1	Attempt any Three (Unit 1)		15 Marks
	a b c d e		
Q2	Attempt any Three (Unit 2)		15 Marks
	a b c d e		

\*\*\*\*\*END\*\*\*\*\*

Department Seal

## 2. Summative Assessment Paper Format

	<b>Pimpri Chinchwad Education Trust's</b> <b>Pimpri Chinchwad College of Engineering &amp; Research Ravet,</b> <b>Pune</b> An Autonomous Institute   NBA Accredited (4 UG Programs)   NAAC A++ Accredited   ISO 21001:2018 Certified <b>IQAC PCCOER</b>	
<b>Academic Year: 2025-26 Term-I</b>	<b>Summative Assessment</b>	<b>ACAD/R/11-SA</b>

**Department:**  
**Subject:**  
**Subject Code:**

**Class:**  
**Maximum Marks: 50**

**Div:**  
**Duration: 2 Hrs**  
**Date:**

- Note:** 1. Attempt all Questions  
 2. Give explanation or justification wherever required.  
 3. Neat diagrams must be drawn wherever necessary  
 4. Figures to the right indicate full marks

### Course Outcomes:

CO No.	Course Outcomes	BT Level

Question No.	Question	CO & BT	Marks
Q1	Attempt any Two (Unit 1)		10 Marks
	a		
	b		
	c		
Q2	Attempt any Two (Unit 2)		10 Marks
	a		
	b		
	c		
Q3	Attempt any Two (Unit 3)		10 Marks
	a		
	b		
	c		
Q4	Attempt any Two (Unit 4)		10 Marks

- a
- b
- c

**Q5**

**Attempt any Two (Unit 5)**

**10 Marks**

- a
- b
- c

\*\*\*\*\*

**These Academics, Examinations and Evaluation Guidelines are applicable for all years and all batches under autonomy, as per NEP 2020 guidelines commencing from the Academic Year 2025-26.**

For any difficulty in understanding rules and regulations, please write to:

- i. deanacademics@pccoer.in
- ii. examcell@pccoer.in
- iii. registrar@pccoer.in
- iv. principal@pccoer.in

**Note:**

**The above rules and regulations are also applicable to BBA and BCA courses with obvious changes wherever required/applicable.**



**Dr. Harish Tiwari**

**Director  
PCET's Pimpri Chinchwad College of  
Engineering and Research, Ravet,  
Pune - 412 101**



Pimpri Chinchwad Education Trust's  
**Pimpri Chinchwad College of Engineering and  
Research, Ravet, Pune - 412101**

(An Autonomous Institute affiliated to Savitribai Phule Pune University, Pune)

**Department of Mechanical Engineering**

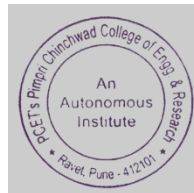
**Curriculum Structure and Syllabus**

Second Year B. Tech.

Academic Year 2026–2027



पिंपरी चिंचवड कॉलेज ऑफ इंजिनीअरिंग अँड रिसर्च



**With effect from (AY 2026-27)**

**National Education Policy (NEP) 2020 Compliant Approved by the Board of Studies**

**(BoS- Mechanical Engineering) and Academic Council**

## Contents

1.	Nomenclature	42
2.	Preface by Board of Studies.	43
3.	Vision Mission of the Institute and Department	44
4.	Program Specific Outcomes.	45
5.	Program Educational Objectives.	45
6.	Knowledge and Attitude Profile (WK)	46
7.	Programme Outcomes (PO)	47
8.	Syllabus for Semester-III.....	49
9.	Syllabus for Semester-IV.....	91

## 1. Nomenclature

AEC	Ability Enhancement Course
AICTE	All India Council for Technical Education
CEP	Community Engagement Project
EEM	Entrepreneurship/Economics/Management Courses
MDM	Multidisciplinary Minor
MOOC	Massive Open Online Course
NEP	National Education Policy
NPTEL	National Programme on Technology Enhanced Learning
OEC	Open Elective Course
PCC	Program Core Course
PEO	Programme Educational Objectives
PSO	Program Specific Outcomes
SWAYAM	Study Webs of Active learning for Young Aspiring Minds
UGC	University Grants Commission
VEC	Value Education Course
VSE	Vocational and Skill Enhancement Course
WK	Knowledge and Attitude Profile

## 2. Preface by Board of Studies

The syllabus for S.Y. B.Tech. Mechanical Engineering will be effective from the Academic Year (AY) 2026–27. Subsequently, this curriculum will be extended to the Third Year (TY) and Final Year (FY) programs in the AY 2027–28 and 2028–29, respectively.

Mechanical Engineering is a dynamic discipline that forms the foundation for the design, development, and application of Mechanical systems and advanced Mechanical and computing technologies. This curriculum has been carefully structured to provide students with a strong understanding of the fundamental principles, theories, and practices of mechanical engineering, while equipping them to address the challenges of an ever-evolving technological landscape. The revised syllabus is aligned with the objectives of the National Education Policy (NEP) 2020, guidelines of Savitribai Phule Pune University, AICTE, New Delhi, UGC, and other accreditation bodies. It incorporates recent technological advancements, emerging industry requirements, and innovative educational practices. Wherever appropriate, additional learning resources from platforms such as NPTEL and SWAYAM have been included at the end of each course to encourage self-directed learning.

The curriculum is designed to provide learners with adequate time and opportunities for self-learning through online courses, hands-on projects, and interdisciplinary activities, thereby enhancing their knowledge, technical competence, and skill sets according to their individual interests.

This syllabus has been formulated through extensive consultations with academic experts, industry professionals, alumni, and other stakeholders to ensure both academic rigor and industry relevance. The curriculum not only meets contemporary industry expectations but also prepares students for higher studies, research, and innovation in the field of mechanical engineering.

We sincerely hope that this curriculum will inspire students to become competent professionals, responsible citizens, and contributors to technological advancement and societal development. We place on record our deep appreciation and gratitude to the faculty members, students, industry experts, and stakeholders who contributed significantly to the formulation of this syllabus.



**Dr. Gulab Siraskar**  
Chairman, Board of Studies



**Dr. Harish U. Tiwari**  
Chairman, Academic  
Council

### **3. Vision Mission of the Institute and Department**

#### **VISION**

To be a globally recognized Institute of technological education and research for the holistic development of aspirants, through excellence in education, innovation and collaborations to fulfil the expectations of all stakeholders.

#### **MISSIONS**

1. To design and deliver state-of-art knowhow through experiential learning based on changing needs of industry and society worldwide, to ensure the employability and employment of each aspirant.
2. To enhance the collaborative partnership between Industry and Institute at national and international levels for commercializing and transferring the latest technological know-how towards societal, ethical and economic development
3. To achieve and sustain institute position as one of the topmost recognized and ranked institutes in technical and technological education

#### **3.1 Vision Mission of the Department**

##### **Vision of the Department:**

To be a leading Mechanical Engineering Department that fosters technical education, research excellence, innovation and industry-ready competencies through collaborations for comprehensive development of the students, to contribute responsibly to the society and all the stakeholders.

**Mission of the Department:**

**M1:** To design and deliver state-of-the-art curricula through experiential, multidisciplinary, and outcome-based learning.

**M2:** To strengthen collaborative partnerships with national and international industries, research organizations, and academic institutions for the development, transfer, and commercialization of emerging technologies.

**M3:** To contribute to pursuit of national and global excellence by delivering high-quality education, advancing impactful research, and nurturing innovation and professionalism and to inculcate high moral, ethical values and national pride in students and faculties.

**4. Program Specific Outcomes (PSOs)**

**PSO-1:** Develop the knowledge and skills relevant to the field of Robotics and Automation by undergoing hands-on training.

**PSO-2:** Execute new ideas on product design and development with the help of modern Computer aided tools and other modern and emerging technology in the field of Mechanical Engineering.

**5. Program Educational Objectives (PEOs):**

**PEO-1:** To develop the students' sound in academic fundamentals to understand, analyze and solve problems related to Mechanical Engineering.

**PEO-2:** To build up student's ability to enhance their competence in research and innovation to design product and process.

**PEO-3:** To enhance employability of students to meet the employer's requirements at large and prepare them towards quality higher education.

**PEO-4:** To create awareness amid the students about professional ethics, managerial skills, social commitment and lifelong learning.

## 6. Knowledge and Attitude Profile (WK)

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

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

## 7. Programme Outcomes (PO)

- PO1 **Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
- PO2 **Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
- PO3 **Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
- PO4 **Conduct Investigations of Complex Engineering Problems:** Using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
- PO5 **Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
- PO6 **The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
- PO7 **Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
- PO8 **Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
- PO9 **Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
- PO10 **Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
- PO11 **Life-Long Learning:** Recognize the need for, and have the preparation and ability for (i) independent and life-long learning, (ii) adaptability to new and emerging technologies and (iii) critical thinking in the broadest context of technological change. (WK8)

**A. Credit Distribution Guidelines by Sukanu Samiti, Maharashtra State, NEP2020 Framework.**

		Guidelines									Credits Provided
Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits	
Basic Science Course	BSC/ESC	06-08	08-10		--	--	--	--	--	14-18	14
Engineering Science Course		08-10	04-06		--	--	--	--	--	12-16	15
Programme Core Course (PCC)	Program Courses	--	2	08-10	08-10	10-12	08-10	04-06	04-06	44-56	49
Programme Elective Course (PEC)		--	--	--	--	4	8	2	6	20	20
Multidisciplinary Minor (MDM)	Multidisciplinary Courses		--	2	2	4	2	2	2	14	14
Open Elective (OE) Other than a particular program		--	--	4	2	2	--	--	--	8	8
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	2	2	--	2	--	2	--	--	8	6
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	2	--	--	2	--	--	--	--	4	6
Entrepreneurship/Economics/Management Courses		--		2	2	--	--	--	--	4	4
Indian Knowledge System (IKS)			2	--	--	--	--	--	--	2	2
Value Education Course (VEC)		--	--	2	2	--	--	--	--	4	4
Research Methodology	Experiential Learning Courses	--	--	--	--	--	--		4	4	2
Comm. Engg. Project (CEP)/Field Project (FP)		--	--	2	--	--	--	-	-	2	2
Project		--	--	--	--	--	--		4	4	6
Internship/ OJT		--	---			--	--	12	-	12	12
Co-curricular Courses (CC)	Liberal Learning Courses	2	2		--	--	--	--	-	4	4
Total Credits (Major)		20-22	20-22	20-22	20-22	20-22	20-22	20-22	20-22	160-176	168

DEPARTMENT OF MECHANICAL ENGINEERING

**B) Credit Distribution of Mechanical Engineering across Eight Semesters.**

<b>B. Tech. in Mechanical Engineering</b>										
<b>Semester</b>		<b>Offered Credit</b>	<b>I</b>	<b>II</b>	<b>III</b>	<b>IV</b>	<b>V</b>	<b>VI</b>	<b>VII</b>	<b>VIII</b>
Basic Science Course	BSC/ESC	14	7	7	--	--	--	--	--	--
Engineering Science Course		15	9	6	--	--	--	--	--	--
Programme Core Course (PCC)	Program Courses	49	--	3	11	9	11	5	10	
Programme Elective Course (PEC)		20	--	--	--	--	4	8	8	
Multidisciplinary Minor (MDM)	Multidisciplinary Courses	14	--	--	3	3	3	3	2	
Open Elective (OE) Other than a particular program		8	--	--	2	2	2	2	--	--
Vocational and Skill Enhancement Course (VSEC)	Skill Courses	6	2	--	--	2	--	2	--	--
Ability Enhancement Course (AEC -01, AEC-02)	Humanities Social Science and Management (HSSM)	6	2	2	--	2	--	-	--	--
Entrepreneurship/Economics/Management Courses		4	--	--	2	2	--	--	--	--
Indian Knowledge System (IKS)		2	--	2	--	--	--	--	--	--
Value Education Course (VEC)		4	--	--	2	2	--	--	--	--
Research Methodology		Experiential Learning Courses	2	--	--	--	--	--	--	--
Comm. Engg. Project (CEP)/Field Project (FP)	2		--	--	2	--	--	--	--	--
Project	6		--	--	--	--	--	--	-	6
Internship/ OJT	12		--	--	--	--	--	--	--	12
Co-curricular Courses (CC)	Liberal Learning Courses	4	2	2	--	--	--	--	--	--
Total Credits (Major)		168	22	22	22	22	20	20	20	20

DEPARTMENT OF MECHANICAL ENGINEERING

C. Curriculum Structure of S.Y.B.Tech. Semester III

SY BTech Mechanical Engineering ( Level 5 )															
Semester III															
Course Code	Course Name	Course Type	Total Credits	Credit Scheme			Teaching Scheme (Hours/Week)			Examination Scheme (Marks)					MARKS
				L	T	P	L	T	P	FA	SA	PR	OR	TW	
PCC-201-MEC	Solid Mechanics	PCC	3	3	-	-	3	-	-	50	50	-	-	-	100
PCC-202-MEC	Thermal system and Energy Transfer	PCC	3	3	-	-	3	-	-	50	50	-	-	-	100
PCC-203-MEC	Engineering Materials and Metallurgy	PCC	3	3	-	-	3	-	-	50	50	-	-	25	125
PCC-204-MEC	Material Testing and Technology lab	PCC	1	-	-	1	-	2	-	-	50	-	-	-	50
PCC-205-MEC	Thermal Engineering Lab	PCC	1	-	-	1	-	2	-	-	25	-	25	-	50
MDM-206-MEC	MDM I:(Engineering Mathematics-III)	MDM	3	2	1	-	2	1	-	50	50	-	-	25	125
-	Open Elective-I	OEC	2	2	-	-	2	-	-	-	-	-	25	25	50
EMC-207-MEC	Entrepreneurship and Startups	EMC	2	1	1	-	1	1	-	-	-	-	25	25	50
VEC-208-MEC	Universal Human Values	VEC	2	2	-	-	2	-	-	25	25	-	-	-	50
CEP-209-MEC	Community Engagement Project	CEP	2	-	-	2	-	4	-	-	-	-	25	25	50
AC-210-MEC	Audit course (Foreign Language-I)	AC	0	-	-	-	2	-	-	-	-	-	-	-	Grade
	<b>Total</b>		<b>22</b>	<b>16</b>	<b>2</b>	<b>4</b>	<b>18</b>	<b>2</b>	<b>8</b>	<b>225</b>	<b>225</b>	<b>75</b>	<b>75</b>	<b>150</b>	<b>750</b>



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PCET's Pimpri Chinchwad College of  
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Pune - 412 101

DEPARTMENT OF MECHANICAL ENGINEERING

D. Curriculum Structure of S.Y.B.Tech. Semester IV

SY BTech Mechanical Engineering ( Level 5 )															
Semester IV															
Course Code	Course Name	Course Type	Total Credits	Credit Scheme			Teaching Scheme (Hours/Week)			Examination Scheme (Marks)					MARKS
				L	T	P	L	T	P	FA	SA	PR	OR	TW	
PCC-251-MEC	Fluid Mechanics and Machinery	PCC	3	3	-	-	3	-	-	50	50	-	-	-	100
PCC-252-MEC	Manufacturing Process-I	PCC	2	2	-	-	2	-	-	50	50	-	-	-	100
PCC-253-MEC	Mechanisms and Machines	PCC	2	2	-	-	2	-	-	50	50	-	-	-	100
PCC-254-MEC	Mechanisms and Machines lab	PCC	1	-	-	1	-	-	2	-	-	-	25	25	50
PCC-255-MEC	Fluid Mechanics and Machinery lab	PCC	1	-	-	1	-	-	2	-	-	-	25	25	50
MDM-256-MEC	MDM-II (Artificial Intelligence and Machine Learning)	MDM	3	3	-	-	3	-	-	50	50	-	-	-	100
	Open Elective-II	OEC-II	2	2	-	-	2	-	-	-	-	-	25	25	50
VSEC-257-MEC	Workshop Practice	VSE	1	-	-	1	-	-	2	-	-	25	-	-	25
VSEC-258-MEC	Data Science & AIML lab	VSE	1	-	-	1	-	-	2	-	-	25	-	-	25
AEC-259-MEC	Modern Indian Language	AEC	2	2	-	-	2	-	-	-	-	-	-	50	50
EMC-260-MEC	Principles of Economics	EMC	2	2	-	-	2	-	-	-	-	-	25	25	50
VEC-261-MEC	Environmental study	VEC	2	2	-	-	2	-	-	25	25	-	-	-	50
AC-262-MEC	Audit course (Foreign Language-II)	AC	0	-	-	-	2	-	-	-	-	-	-	-	Grade
	<b>Total</b>		<b>22</b>	<b>18</b>	<b>0</b>	<b>4</b>	<b>20</b>	<b>0</b>	<b>8</b>	<b>225</b>	<b>225</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>750</b>



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# Semester III



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: PCC-201-MEC</b>			<b>Name of Course: Solid Mechanics</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
3	-	-		3	-	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
50	50	-	-	-		100
<b>Pre-requisites:</b>						
Engineering Mathematics, Engineering Mechanics, Engineering Physics						
<b>Course Objectives:</b>						
By the end of the course, students should be able to;						
<ol style="list-style-type: none"> <li>1. To ACQUIRE basic knowledge of stress, strain due to various types of loading.</li> <li>2. To DRAW Shear Force and Bending Moment Diagram for transverse loading.</li> <li>3. To DETERMINE Bending and Shear stress.</li> <li>4. To DETERMINE the Torsional shear stress for shaft and Buckling of column.</li> <li>5. To APPLY the concept of Principal Stresses and Theories of Failure.</li> </ol>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
1	INVESTIGATE various types of stresses and strain developed on determinate and indeterminate members.					

2	CALCULATE Shear force and bending moment for various types of transverse loading and support
3	COMPUTE the bending stresses and shear stresses on a beam.
4	DETERMINE torsional shear stress in shaft and buckling on the column.
5	APPLY the concept of principal stresses and theories of failure to determine stresses on a 2-D element

### Course Content

Unit I	Simple Stresses & Strains	(08 Hours)
Introduction to types of loads (Static, Dynamic & Impact Loading) and various types of stresses with applications, Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants, factor of safety, Thermal stresses in plane and composite members.		
Unit II	Shear Force & Bending Moment in Beams	(08 Hours)
SFD & BMD: Introduction to SFD, BMD with application, SFD & BMD for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load, couple and combined loading, Concept of zero shear force, Maximum bending moment, point of contra-flexure.		
Unit III	Bending Stresses & Shear Stresses in Beams	(08 Hours)
Bending Stress on a Beam: Introduction to bending stress on a beam with application, Theory of Simple bending, assumptions in pure bending, Moment of inertia of common cross section (Circular, Hollow circular, Rectangular, I & T), Bending stress distribution along the same cross section  Shear Stress on a Beam: Introduction to transverse shear stress on a beam with application, shear stress distribution diagram along the Circular, I & T cross-section		
Unit IV	Torsion & Buckling	(08 Hours)

<p>Torsion of circular shafts: Introduction to torsion on a shaft with application, Basic torsion formulae and assumption in torsion theory, Torsion in stepped and composite shafts, Torque transmission on strength and rigidity basis.</p> <p>Torsion on Thin-Walled Tubes: Introduction of Torsion on Thin-Walled Tubes Shaft and its application (Theoretical treatment only)</p> <p>Buckling of columns: Introduction to buckling of column with its application, Different column conditions and critical, safe load determination by Euler's theory. Limitations of Euler's Theory.</p>		
<b>Unit V</b>	<b>Principal Stresses, Theories of Failure</b>	<b>(08 Hours)</b>
<p>Principal Stresses: Introduction to principal stresses with application, Principal Stresses and planes (Analytical method and Mohr's Circle), Stresses due to combined Normal and Shear stresses</p> <p>Theories of Elastic failure: Introduction to theories of failure with application, Maximum principal stress theory, Maximum shear stress theory, Maximum distortion energy theory, Maximum principal strain theory and Maximum strain energy theory (Theoretical treatment only).</p>		
<b>Self Learning Exercise</b>		
<p>Research on the latest advancements in the field of Strength of Materials is to be done by students and to be submitted as Assignment for Teamwork.</p>		
<b>Learning Resources</b>		
<b>Text Books</b>		
<ol style="list-style-type: none"> <li>6. R. K. Bansal, "Strength of Materials", Laxmi Publication</li> <li>7. S. Ramamurtham, "Strength of material", Dhanpat Rai Publication</li> <li>8. S.S. Rattan, "Strength of Material", Tata McGraw Hill Publication Co. Ltd.</li> <li>9. S S Bhavikatti, "Strength of Material", Vikas publishing house Pvt Ltd</li> <li>10. Singer and Pytel, "Strength of materials", Harper and row Publication</li> <li>11. R. C. Hibbeler, "Mechanics of Materials", Prentice Hall Publication</li> <li>12. R. S. Khurmi, "Strength of Materials", S. Chand Publication</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Egor. P. Popov, "Introduction to Mechanics of Solids", Prentice Hall Publication</li> <li>2. G. H. Ryder, "Strength of Materials", Macmillan Publication</li> <li>3. Beer and Johnston, "Strength of materials", CBS Publication</li> <li>4. James M. Gere, "Mechanics of Materials", CL Engineering</li> <li>5. Timoshenko and Young, "Strength of Materials", CBS Publication, Singapore</li> </ol>		

**e-resources:**

**10.** Prof. S.K. Bhattacharyya, IIT Kharagpur , “NPTEL Web course material”

<https://drive.google.com/file/d/1N2Eyv9ofPimIT2OSMZeMrSxe68Ulclei/view?usp=sharing>



### Pimpri Chinchwad Education Trust's

Pimpri Chinchwad College of Engineering and Research, Ravet, Pune

### Department of Mechanical Engineering



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: PCC-202-MEC</b>			<b>Name of Course: Thermal Systems and Energy Transfer</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:03</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
3	-	-		3	-	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
50	50	-	-	-		100
<b>Pre-requisites:</b>						
<ul style="list-style-type: none"> <li>Basics of Engineering Thermodynamics, Engineering Chemistry &amp; Engineering Mathematics.</li> </ul>						
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>Introduce the fundamentals of IC engines, their construction, working, and combustion processes.</li> <li>Develop understanding of air standard cycles and their role in engine performance evaluation.</li> <li>Enable students to analyze IC engine performance using basic testing methods.</li> <li>Provide knowledge of heat transfer mechanisms with practical engineering applications.</li> <li>Establish foundational concepts required for advanced thermal engineering courses.</li> </ul>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
CO1	<b>Understand</b> classification, construction, and combustion processes of IC engines.					
CO2	<b>Analyze</b> air-standard cycles to evaluate the performance of IC engines.					
CO3	<b>Determine</b> IC engine performance parameters using engine testing data.					
CO4	<b>Apply</b> principles of heat conduction and convection to solve engineering problems.					

CO5	<b>Evaluate</b> radiation heat transfer and heat exchanger performance using fundamental laws, LMTD calculations, and understand conventional and advanced heat exchanger concepts.	
<b>Course Content</b>		
<b>Unit I</b>	<b>IC Engines – Classification, Construction and Combustion</b>	<b>(08 Hours)</b>
<p>Classification of IC engines based on cycle, strokes, fuel, ignition system, cooling and applications, Construction and working of four-stroke SI and CI engines, Comparison of SI and CI engines; two-stroke and four-stroke engines, Main engine components and their functions, Combustion in SI and CI engines, Knocking in SI and CI engines – causes, effects and control, Fuel rating: Octane number and Cetane number.</p>		
<b>Unit II</b>	<b>Air Standard Cycles and Engine Thermodynamics</b>	<b>(09 Hours)</b>
<p>Air standard cycle assumptions, Otto, Diesel and Dual cycles, P–V and T–S diagrams, Effect of compression ratio and cut-off ratio on efficiency, Comparison of air standard cycles. Fuel injection system in SI &amp; CI Engines. Fuel Technology: Biofuels, hydrogen, synthetic fuels, LPG, CNG, ethanol blends. Role of octane and cetane numbers, fuel additives.</p> <p><b>Numerical limited to:</b> Thermal efficiency, Mean effective pressure (MEP).</p>		
<b>Unit III</b>	<b>IC Engine Performance and Testing</b>	<b>(09 Hours)</b>
<p>Performance parameters: IP, BP, FP. Indicated brake and mechanical efficiencies, Performance curves of IC engines, Engine testing: Morse test and Willan’s line method, Heat balance sheet – components and significance. Characteristic curves.. Role of supercharging and turbocharging in engine performance improvement. Emission Control Technologies: Pollutants from engines- CO, HC, NO<sub>x</sub>, PM, and their impact on air quality, Emission reduction strategies: Exhaust Gas Recirculation (EGR), Selective Catalytic Reduction (SCR), Diesel Particulate Filters (DPF), Three-Way Catalysts (TWC), BS-VI and Euro 6 emission standards</p> <p><b>Numerical limited to:</b> Numerical on Engine parameters &amp; HBS</p>		
<b>Unit IV</b>	<b>Heat Transfer – Conduction and Convection</b>	<b>(10 Hours)</b>

Modes of heat transfer, Fourier's law of heat conduction, Thermal resistance concept, One-dimensional steady-state heat conduction (plane wall and hollow cylinder), Composite walls and cylinders, Convection: Newton's law of cooling; free and forced convection (conceptual)

**Numerical limited to:** Steady-state conduction, Composite wall problems

**UNIT V**

**Radiation Heat Transfer and Introduction to Heat Exchangers**

**(09 Hours)**

Radiation fundamentals: black body, grey body, emissivity, Stefan–Boltzmann law, Radiation heat exchange between two large parallel plates, Heat exchangers: classification, parallel flow and counter flow, Log Mean Temperature Difference (LMTD), Effectiveness–NTU method (concept only), Introduction to Heat Pipes. Printed Circuit Heat Exchangers (PCHEs), Microchannel Heat Exchangers (MCHEs), Additive Manufactured (3D Printed) Heat Exchangers, Polymer Heat Exchangers, Smart/IIoT-Enabled Heat Exchangers, Phase Change Materials.

**Numerical limited to:** Radiation heat exchange, LMTD calculations

**Self Learning Exercise**

Analyzing the various engine parameters which affect performance and emission characteristics.

Case study on Revolutionizing Carbon Management: Generation, Emission Control, Capture, and Reuse.

**Learning Resources**

**Text Books**

6. V. Ganesan, *Internal Combustion Engines*, McGraw-Hill Education
7. R.S. Khurmi & J.K. Gupta, *A Textbook of Thermal Engineering*, S. Chand
8. D.S. Kumar, *Heat and Mass Transfer*, S. K. Kataria & Sons.

**Reference Books:**

1. Heywood, J.B., *Internal Combustion Engine Fundamentals*, McGraw-Hill.
2. Holman, J.P., *Heat Transfer*, McGraw-Hill.
3. Çengel & Ghajar, *Heat and Mass Transfer*, McGraw-Hill.

**e-resources:**

**.MOOC / NPTEL/ YouTube Links: -**

1. Introduction to Engine Performance and its Measurement-  
<https://www.youtube.com/watch?v=1X20Rdi4Vnk>
2. Emission Control- <https://www.youtube.com/watch?v=QoruG4ma210>
3. Applied thermodynamics courses- <https://nptel.ac.in/courses/107106088> 4
4. Compressor- <https://www.youtube.com/watch?v=MVQ1wbQELJM>
5. Single Stage Compressor- <https://www.youtube.com/watch?v=NakOoD-G0IY>



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: PCC-203-MEC</b>			<b>Name of Course: Engineering Materials &amp; Metallurgy</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
3	-	-		3	-	-
<b>Examination Scheme:</b>						
SA	FA	PR	OR	TW		Total
50	50	-	-	25		125
<b>Pre-requisites:</b>						
Higher Secondary Science courses, Engineering Physics, Engineering Chemistry, Engineering Maths etc.						
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>To IMPART fundamental knowledge of material science and engineering.</li> <li>To ESTABLISH significance of structure property relationship.</li> <li>To EXPLAIN various characterization techniques.</li> <li>To INDICATE the importance of heat treatment on structure and properties of materials.</li> <li>To EXPLAIN the material selection process.</li> </ul>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
CO1	COMPARE crystal structures and ASSESS different lattice parameters.					
CO2	CORRELATE crystal structures and imperfections in crystals with mechanical behavior of materials.					
CO3	DIFFERENTIATE and DETERMINE mechanical properties using destructive and nondestructive testing of materials.					
CO4	IDENTIFY & ESTIMATE different parameters of the system viz., phases, variables, Component, grains, grain boundary, and degree of freedom. etc.					
CO5	ANALYSE effect of alloying element & heat treatment on properties of ferrous & nonferrous alloy.					
CO6	SELECT appropriate materials for various applications					
<b>Course Content</b>						

<b>Unit I</b>	<b>Crystal Structures, Materials Properties and Characterization Technique</b>	<b>(08 Hours)</b>
<ul style="list-style-type: none"> <li>● Crystal Structures: Introduction to crystal structure, Miller indices, Crystal imperfections, and Diffusion Mechanisms, introduction to Material Properties</li> <li>● Destructive Testing: Impact test, Cupping test, Non-Destructive Testing: Eddy current test, Sonic, Ultrasonic testing, X-ray Radiography testing (Principle and Applications only)</li> <li>● Microscopic Techniques: Sample Preparation and etching procedure, optical microscopy, Electronic microscopy - only SEM, TEM and X-ray diffraction (Principle and Applications only)</li> <li>● Macroscopy: Sulphur printing, flow line observation, spark test</li> </ul>		
<b>Unit II</b>	<b>Phase Diagrams and Iron-Carbon Diagram</b>	<b>(07 Hours)</b>
<ul style="list-style-type: none"> <li>● Solid solutions: Introduction, Types, Hume-Rothery rule for substitutional solid solutions</li> <li>● Solidification: Nucleation, crystal growth, solidification of pure metals and alloys.</li> <li>● Phase Diagrams: Cooling curves, types of phase diagrams, Gibbs phase rules</li> <li>● Iron-Carbon Diagram: Iron-carbon equilibrium diagrams in detail with emphasis in the invariant reactions.</li> </ul>		
<b>Unit III</b>	<b>Heat Treatments</b>	<b>(07Hours)</b>
<ul style="list-style-type: none"> <li>● Austenite transformation in steel: Time temperature transformation diagrams, continuous cooling transformation diagrams. Retained austenite and its effect, Steps in Heat Treatment and Cooling Medium</li> <li>● Heat Treatment Processes: Introduction, Annealing (Full annealing, Process annealing, Spheroidise annealing, isothermal annealing, stress relief annealing), Normalizing, Hardening, Tempering, Austempering, Martempering, Sub-Zero Treatment, Hardenability</li> <li>● Surface Hardening: Classification, Flame hardening, Induction hardening, Carburizing, Nitriding, Carbonitriding</li> </ul>		
<b>Unit IV</b>	<b>Ferrous Materials</b>	<b>(07 Hours)</b>
<ul style="list-style-type: none"> <li>● Carbon Steel: Classification, types &amp; their composition, properties and Industrial application</li> <li>● Alloy Steels: Classification of alloy steels &amp; Effect of alloying elements, examples of alloy steels, (Stainless steel, Tool steel) sensitization of stainless steel ,Designation of carbon steel and alloy steels as per IS, AISI, SAE Standards</li> <li>● Cast Iron: Classification, types; their composition, properties and Industrial application of (White CI, Gray CI, SG CI, Malleable Cast and alloy Cast Iron) Microstructure and property relationship of various ferrous Materials</li> </ul>		
<b>Unit V</b>	<b>Non-Ferrous Materials</b>	<b>(07 Hours)</b>

- Classification of Non-Ferrous Metals: Study of Non-ferrous alloys with Designation, Composition, Microstructure.
- Mechanical & other properties for Industrial Applications: Copper and its Alloys (Gilding Metal, Cartridge Brass, Muntz Metal, Tin Bronze, Beryllium Bronze), Aluminium and its Alloy (LM5, Duralumin, Y-Alloy, Hinduminium), Nickel and its Alloys (Invar, Inconel), Titanium and its Alloys (Classification, lead based alloys, tin based alloys), Age Hardening. Microstructure and Property relationship of various Non-ferrous Materials.
- Recent Material used in Additive Manufacturing: Properties, Composition and Application only

- An Industrial visit to company having heat treatment operations OR
- NABL certified Lab having mechanical testing facilities (Microscopic testing).

### Learning Resources

#### Text Books

1. Dr. V. D. Kodgire & S. V. Kodgire, "Material Science & Metallurgy For Engineers", Everest Publication.
2. William D. Callister, "Materials Science and Engineering an Introduction", Jr, John Wiley & Sons, Inc

#### Reference Books:

- A. K. Bhargava, C.P. Sharma, "Mechanical Behaviour & Testing of Materials", P H I Learning Private Ltd.
- Raghvan V., "Material Science & Engineering", Prentice Hall of India, New Delhi. 2003
- Avner, S.H., "Introduction to Physical Metallurgy", Tata McGraw-Hill, 1997.
- Higgins R. A., "Engineering Metallurgy", Viva books Pvt. Ltd.
- George Ellwood Dieter, "Mechanical Metallurgy", McGraw-Hill 1988
- Smith, W.F, Hashemi, J., and Prakash, R., "Materials Science and Engineering in SI Units", Tata McGraw Hill Education Pvt. Ltd



**Pimpri Chinchwad Education Trust's  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: PCC-204-MEC</b>			<b>Name of Course: Material Testing and Technology lab</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
-	2	-		-	1	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
-	-	25		25		50
<b>Pre-requisites:</b>						
Basic concepts from Physics and Mathematics						
<b>Course Objectives:</b>						
By the end of the course, students should be able to;						
<ol style="list-style-type: none"> <li>1. To ACQUIRE basic knowledge of stress, strain due to various types of loading for different types of materials</li> <li>2. To DRAW Shear Force and Bending Moment Diagram for transverse loading and to DETERMINE Bending, Shear stress, Slope and Deflection on Beam.</li> <li>3. To IMPART fundamental knowledge of material science and engineering and to ESTABLISH significance of structure property relationship.</li> <li>4. To INDICATE the importance of heat treatment on structure and mechanical properties of materials.</li> <li>5. To EXPLAIN the material selection process</li> <li>6. To UTILIZE the concepts of Solid Mechanics and Engineering Materials on application based combined mode of loading and failures</li> </ol>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
1	DETERMINE various types of stresses and strain developed on determinate and indeterminate members.					
2	CALCULATE Shear force and bending moment for various types of transverse loading and Support and COMPUTE the slope & deflection, bending stresses and shear stresses on a beam.					

3	EXAMINE micro structures and different phases also LINK phase distribution with mechanical properties of materials.
4	DIFFERENTIATE and TEST mechanical properties using destructive and nondestructive methods
5	CATEGORIZE and RECOMMEND appropriate materials for various applications.
6	UTILIZE the concepts of SFD & BMD, principal stresses, heat treatment and microstructure to SOLVE combined loading application-based problems virtually IoT based tools

### Course Content

#### List of Practical Experiments

1. Tension test on ductile material
  2. Compression Test on Brittle material
  3. Shear (Single / Double) test on engineering material
  4. Torsion test on engineering material.
  5. Bending test on engineering material.
  6. Impact (Izod and Charpy) test on mild steel, aluminum, brass.
  7. Material Hardness measurement using Brinell's / Vicker's / Rockwell / Poldi's Hardness testing set up.
  8. Analysis of given sample using any one of the Non-destructive tests: Dye Penetrant Test/ Magnetic Particle test/ Ultrasonic Test.
- Note: Conduction of any one test on VLab from the list: Tensile Test on Mild steel, Tensile Test on Cast Iron, Compression Test on Mild Steel, Compression Test on Cast Iron, Direct shear test on Mild steel Rod, Direct Shear test on Timber Specimen, Direct shear test on Mild steel Plate, Bending Test on Mild steel, Torsion Test on Mild Steel, flexural formula in bending for simply supported and cantilever beam, stress strain measurement through strain gauge, torsion formula for bar, flexural formula validation through other software.

#### Assignments

1. Assignment containing 5 questions on each unit from the theory course **PCC-201-MEC**

#### PR Examination

6. Students shall have laboratory manual and assignment book
7. Students will perform any PR allocated during exam from the above list.



## PimpriChinchwad Education Trust's

Pimpri Chinchwad College of Engineering and Research, Ravet, Pune



### Department of Mechanical Engineering

**Class: Second Year Engineering (2025 Pattern)**

**Sem: III**

**Course Code: PCC-205-MEC**

**Name of Course: Thermal Engineering Lab**

#### Teaching Scheme (Hrs/week):

#### Credits:

Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
-	2	-		-	1	-

#### Examination Scheme:

FA	SA	PR	OR	TW		Total
-	-	25	-	25		50

#### Pre-requisites:

Engineering Mathematics - I, Engineering Mathematics - II, Engineering Physics, Engineering Chemistry.

#### Course Objectives:

By the end of the course, students should be able to;

1. To **ANALYZE** steam properties and boiler performance through experiment.
2. To **ANALYZE** engine and compressor performance characteristics using test procedures and calculations.
3. To **UNDERSTAND** the recent technologies in IC engines through presentation and surveys.
4. To **ANALYZE** performance characteristics of VCERS using test procedures and calculations.
5. To **UNDERSTAND** the working of importance of engine components and its servicing.

#### Course Outcomes:

On completion of this Course, the Learners will be able to;

<b>CO.1</b>	<b>ANALYZE</b> steam properties and boiler performance through experimental analysis.
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<b>CO.2</b>	<b>ANALYZE</b> engine and compressor performance characteristics using test procedures and calculations.
<b>CO.3</b>	<b>UNDERSTAND</b> the recent technologies in IC engines through presentation and surveys.
<b>CO.4</b>	<b>ANALYZE</b> performance characteristics of VCRS using test procedures and calculations.
<b>CO.5</b>	<b>UNDERSTAND</b> the working of importance of engine components and its servicing.

### List of Experiments

#### Experiment 01

**Trial on boiler to determine boiler efficiency, equivalent evaporation and Energy Balance (Trial on actual set up or on some suitable software.**

**Description:** The boiler trial helps evaluate the performance of the boiler and identify possible inefficiencies due to losses through flue gases.

To conduct a trial on a boiler in order to:

1. Determine boiler efficiency
2. Calculate equivalent evaporation
3. Prepare an energy balance sheet

Boiler Trial for Efficiency and Energy Balance:

**Assignment:** Calculate and compare energy efficiency for a packaged boiler and a power plant boiler.

Suggest improvements based on observed losses

**Exemplars / Practical Applications:** In steam power plants for power generation. In textile industries for

processes like dyeing and finishing fabrics. In food industries for steaming and sterilizing food.

#### Experiment 02

**Performance and Morse Test on multi cylinder Petrol engine.**

**Description:** The performance test provides the overall efficiency and fuel consumption characteristics of the engine. Morse test enables measurement of individual cylinder performance, helping in diagnosing imbalance or poor performance in one or more cylinders

**Performance and Morse Test on Petrol Engine:**

Assignment: Analyze engine data from a car service center and evaluate the impact of misfiring cylinders on performance using Morse Test logic

**Exemplars / Practical Applications:**

In automobiles like cars and motorcycles.

In smaller and portable machinery like lawn movers and generators.

**Experiment 03**

**Performance test on Diesel engine and to draw heat balance sheet**

**Description:** The Performance test on Diesel engine provides insight into engine efficiency and energy distribution. A good-performing diesel engine will have brake thermal efficiency around 30-40%, and remaining losses in cooling, exhaust, and radiation.

1. To determine brake power, fuel consumption, thermal efficiencies, and specific fuel consumption.
2. To prepare a heat balance sheet for the engine.

Performance Test on Diesel Engine (Heat Balance Sheet)

**Assignment:** Collect real-time data from a generator at your institute and prepare a heat balance sheet comparing theoretical and actual efficiency

**Exemplars / Practical Applications:** In automobiles like heavy vehicles such as Trucks and buses. In Power plants for generation of power. Tractors and other farm machineries use diesel engines.

**Experiment 04**

**Trial on Multi stage Positive displacement air compressor.**

**Description:** The air compressor trial demonstrates the effectiveness of multi-stage compression in reducing work input per kg of air and increasing efficiency. Deviations in efficiency point to heat losses, friction, and imperfect intercooling.

To conduct a trial on a multi-stage positive displacement air compressor in order to determine:

1. Volumetric efficiency
2. Isothermal efficiency
3. Mechanical efficiency
4. Power consumption

**Multi-stage Positive Displacement Air Compressor:**

**Assignment:** Conduct a case study on the use of multistage compressors in bottling plants or refrigeration units and evaluate energy savings.

**Exemplars / Practical Applications:** In operating or powering the pneumatic tools in construction and automobile service station and spray painting. In various industries for processes like metal fabrication and working.

**Experiment 05**

**Survey (Minimum one)**

**1. Practical Survey of various fuel supply systems.**

This survey studies the construction and working of different fuel supply systems used in IC engines, focusing on fuel delivery, metering, and efficiency.

**2. Practical Survey of supercharged and turbocharged engines.**

This survey examines the working principles and components of supercharged and turbocharged engines and their role in improving engine power and performance.

**Experiment 06**

**Activity: Presentation based**

Compulsory study of following topics must be done by students during semester to gain awareness and further understanding of the course and a presentation of the same should be included in the TW:

1. Engines: (any one) Homogeneous charge compression ignition (HCCI)/Variable valve timing (VVT)/Variable geometry turbocharger (VGT), etc.
2. Automotive Field: (any one) Hydrogen vehicles / CNG vehicles / Adaptive cruise control system / On-board diagnostic system (OBD) / Electric Battery classification / Fuel Cell vehicle / Electric Vehicle system.

**Experiment 07****Trial on Vapour Compression Refrigeration System**

This trial involves studying the working principle and components of a vapour compression refrigeration system. Performance parameters such as pressure, temperature, and coefficient of performance (COP) are observed and analyzed to understand system efficiency.

**Experiment 08****Trial on Air-Conditioning Test Rig.**

This trial involves studying the working and components of an air-conditioning test rig. Various parameters such as temperature, humidity, and air flow rate are measured to evaluate cooling performance and system efficiency.

**Experiment 09**

## Industrial Visit

**A Compulsory industrial visit must be arranged to automobile manufacturing or servicing.**

**Students must submit a properly documented Detailed Industrial Visit Report in his/her own words.**

**Description:** Idea about the visit to a Plant equipped with the working of Internal Combustion engines, transmission system, method of cooling system employed, lubrication and various parts of an engine and their working can be understood with the visit to any service station.

### Industrial Visit Report:

Assignment: Submit a detailed case study of the visited plant, identifying types of engines, working conditions, type of cooling, and safety measures.

**Exemplars / Practical Applications:** Automobiles manufacturing industry, automobile servicing center.

### Important Note:

4. Experiment no. 9 is compulsory.
5. Perform any 7 experiment from experiment No. 1 to 8

### Reference Books

1. Heywood, Internal Combustion Engine Fundamentals , Tata McGraw-Hill
2. Domkundwar & Domkundwar Internal Combustion Engine , Dhanpat Rai & Co.
3. R. Yadav Internal Combustion Engine , Central Book Depot, Ahmedabad.
4. S. Domkundwar,C.P. Kothandaraman,A.Domkundwar, Thermal Engineering ,DhanpatRai & Co.
5. Dossat Ray J, Principles of refrigeration, S.I. version , Willey Eastern Ltd, 2000

Text Books:

1. Arora C. P., Refrigeration and Air Conditioning , Tata McGraw-Hill
2. V. Ganesan Internal Combustion Engines , Tata McGraw-Hill
3. M. L. Mathur and R.P. Sharma A course in Internal combustion engines Dhanpat Rai & Co.
4. H.N. Gupta, Fundamentals of Internal Combustion Engines , PHI Learning Pvt. Ltd.

MOOC / NPTEL/ YouTube Links: -

9. <https://nptel.ac.in/courses/112105275>
10. <https://nptel.ac.in/courses/112104118>
11. <https://archive.nptel.ac.in/courses/112/103/112103316/>
12. <https://www.youtube.com/watch?v=qa-PQOjS3zA&list=PL5F4F46C1983C6785>
13. <https://www.youtube.com/watch?v=qa-PQOjS3zA&list=PL5F4F46C1983C6785>
14. [https://www.youtube.com/watch?v=J\\_zqOcnCAu4&index=3&list=PLpCr5N2IS7Nmu22MOgDWOr0sSIpUNUz3](https://www.youtube.com/watch?v=J_zqOcnCAu4&index=3&list=PLpCr5N2IS7Nmu22MOgDWOr0sSIpUNUz3)



**PimpriChinchwad Education Trust's**

Pimpri Chinchwad College of Engineering and Research, Ravet, Pune



**Department of Mechanical Engineering**

**Department: Mechanical Engineering (SE-2025 Pattern) | SEM: III**

**Course Code: MDM-206-MEC | Name of Course: MDM I:(Engineering Mathematics-III)**

Teaching Scheme (Hrs./week):			Credits:		
Lecture	Practical	Tutorial	Lecture	Practical	Tutorial
2	-	1	2	-	1

Examination Scheme:								
FA	SA		PR	OR	TW			Total
50	50		-	-	25			125

**Pre-requisites:**  
Engineering Mathematics – I & II

**Course Objective:**  
This course aims to acquaint students with

1. Provide a strong mathematical foundation for modeling and analysis of mechanical and thermal systems.
2. Develop analytical skills required to solve differential equations arising in mechanical engineering.
3. Enable students to apply transform techniques to real-life engineering problems.
4. Equip students with statistical tools for experimental analysis and quality control in mechanical systems.
5. To introduce the fundamental principles of probability theory.



**Course Outcome:**  
On completion of this course, the students will be able to:

<b>CO1</b>	<b>Apply</b> linear differential equations to solve problems in mechanical and thermal systems.
<b>CO1</b>	<b>Apply</b> Laplace and Fourier transforms to analyze dynamic and periodic mechanical phenomena.
<b>CO.3</b>	<b>Formulate and solve</b> partial differential equations arising in heat transfer, vibrations, and fluid flow.
<b>CO.4</b>	<b>Analyze</b> experimental, manufacturing, and quality-control data using statistical techniques.
<b>CO.5</b>	<b>Apply</b> probability laws and distributions to analyze data and test hypotheses in mechanical engineering.

Course Content		
<b>Unit I</b>	<b>Linear Differential Equations</b>	<b>(06 Hours)</b>

<b>Linear &amp; Non-linear DEs</b> ; general & particular solutions; Cauchy's, Legendre's, simultaneous DEs; applications in spring–mass–damper, vibration, heat conduction.		
<b>Unit II</b>	<b>Laplace and Fourier Transforms</b>	<b>(06 Hours)</b>
Laplace transform definition, existence, properties, <b>Inverse Laplace transform</b> ; solving ODEs via Laplace. <b>Fourier transform</b> : Sine and Cosine Transforms, Integral Equations..		
<b>Unit III</b>	<b>Partial Differential Equations</b>	<b>(06 Hours)</b>
Formation of PDEs; first-order linear solutions; separation of variables; applications in one dimensional heat equation, wave equation (string/rod vibration), and Laplace equation (steady-state heat conduction).		
<b>Unit IV</b>	<b>Linear Differential Equations</b>	<b>(07 Hours)</b>
Basic concepts and data representation; measures of central tendency and dispersion (RMS, SD, variance, standard error, IQR box-whisker plot, coefficient of variance); moments, skewness, kurtosis with engineering significance; correlation and regression analysis, applications in experimental data analysis and quality control.		
<b>Unit V</b>	<b>Probability</b>	<b>(05 Hours)</b>
Probability – Bayes theorem, Law of total probability, conditional, joint probability, probability distribution – binomial, Poisson, exponential, geometric, normal, hypothesis testing – different techniques.		
<b>Learning Resources</b>		
<b>Text Books:</b>		
<ul style="list-style-type: none"> <li>• B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers</li> <li>• Erwin Kreyszig, Advanced Engineering Mathematics, Wiley</li> </ul>		
<b>Reference Books:</b>		
<ul style="list-style-type: none"> <li>• S. L. Ross, “Differential Equations”, 3E by Wiley India.</li> <li>• Miller &amp; Freund, Probability and Statistics for Engineers, Pearson</li> <li>• K.A. Stroud, Engineering Mathematics, Palgrave Macmillan</li> <li>• Sheldon M. Ross, “Introduction to Probability and Statistics for Engineers and Scientists”, 5E, by Elsevier Academic Press.</li> </ul>		
<b>E-resources:</b>		
4. <b>Linear Differential Equations:</b> <a href="http://nptel.ac.in/courses/111104521">nptel.ac.in/courses/111104521</a>		
5. <b>Laplace and Fourier Transform:</b> <a href="http://nptel.ac.in/courses/111106111">nptel.ac.in/courses/111106111</a>		
6. <b>Partial Differential Equations:</b> <a href="http://nptel.ac.in/courses/111108144">nptel.ac.in/courses/111108144</a>		
7. <b>Statistics and Data Analysis:</b> <a href="http://nptel.ac.in/courses/111102160">nptel.ac.in/courses/111102160</a>		
8. <b>Probability:</b> <a href="http://nptel.ac.in/courses/111102160">nptel.ac.in/courses/111102160</a>		

<b>List of Tutorials:</b>	
<b>Tutorial No.</b>	<b>Content</b>
<b>01</b>	Examples on Linear DE using general and shortcut methods.
<b>02</b>	Examples on Cauchy's and Legendre's, Simultaneous Equations and Non- Linear Equations.
<b>03</b>	Examples on Laplace and Inverse Laplace transform to solve Differential Equations.
<b>04</b>	Examples on Fourier Sine and Cosine transform and Inverse Fourier transform
<b>05</b>	Examples on formation of PDE, Solutions to First order PDE and separation of variables.
<b>06</b>	Examples on one dimensional heat equation, wave equation using PDE.
<b>07</b>	Examples on Measures of central tendencies and dispersion including RMS, Variance and SD.
<b>08</b>	Examples on IQR box-whisker plot, Moments, Skewness & kurtosis
<b>09</b>	Examples on correlation and regression.
<b>10</b>	Examples on basic probability, Bayes theorem, conditional and joint probability .
<b>11</b>	Examples on Probability Distributions namely, Binomial, Poissons and Normal
<b>12</b>	Examples on Hypothesis testing with different techniques.

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<b>Class:</b> Second Year B.Tech. (2025 Pattern)		<b>Sem:</b> III
<b>Name of Course:</b> <a href="#">OEC</a>		

Course Code	Course Name	Course Type
OEC-220-CVL	Vastushastra in Modern Realms	OEC
OEC-221-COM	Essentials of Linguistics and Literature	OEC
OEC-222-ITT	Financial Literacy and Digital Finance	OEC
OEC-223-MEC	Digital Marketing	OEC



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: EMC-207-MEC</b>			<b>Name of Course: Entrepreneurship and Start ups</b>			
<b>Teaching Scheme (Hrs/week):</b>				<b>Credits:</b>		
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
1	-	1		1	-	1
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
-	-	-	25	25		50
<b>Pre-requisites:</b>						
Design Thinking, Life Skills, Basic Business Awareness, Communication Skills						
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>● APPLY innovation techniques to develop solutions to real-world problems.</li> <li>● DESIGN a viable business model using structured tools.</li> <li>● EVALUATE the feasibility of a startup idea from technical, financial, and market perspectives.</li> <li>● COLLABORATE in teams to develop and pitch an entrepreneurial solution</li> </ul>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
CO1	DESCRIBE Entrepreneurial traits and innovation processes (Remember/Understand),					
CO2	IDENTIFY business opportunities through design thinking (Apply)					
CO3	DEVELOP a lean business model and MVP (Apply/Analyze)					
CO4	CREATE a startup pitch and demonstrate entrepreneurial mindset (Create)					
<b>Course Content</b>						
<b>Unit I</b>	<b>Entrepreneurial Mindset and Creativity</b>					<b>(03 Hours)</b>
Entrepreneurship: Meaning and importance, Entrepreneurial mindset: curiosity, resilience, risk-taking, leadership, Types of entrepreneurs: Technical, Non-technical Social Entrepreneur, Creativity tools: Mind Mapping, SCAMPER, TRIZ						

<b>Unit II</b>	<b>Innovation and Product Development</b>	<b>(03 Hours)</b>
Innovation types: product, service, process, frugal (Jugaad) innovation, Design Thinking: Empathize, Define, Ideate, Prototype, Test, Success stories from Indian innovators, Case studies: Innovative Indian products/startups		
<b>Unit III</b>	<b>Opportunity Identification Tools and Techniques</b>	<b>(03 Hours)</b>
Opportunity Recognition and Idea Generation-Problem identification and need analysis, Market research: tools and techniques: Primary and secondary Market Research Techniques, Digital Market Research Tools		
<b>Unit IV</b>	<b>Startup and Business Modeling</b>	<b>(03 Hours)</b>
Business Model Canvas: Customer segments, value proposition, channels, Lean Startup methodology & Minimum Viable Product (MVP), Cost estimation, revenue models, and unit economics, Funding options: Government schemes (Startup India, MSME), VC, Angel Investors, crowd funding, Basics of financial literacy: Profit-Loss, Break-even, cash flow		
<b>Real World Assignments</b>		

### 1. Assignment-1: Opportunity Recognition and Need Analysis

**Activity:** Identify 3 real-life problems they or their community face (e.g. water waste, long queues, and costly transportation) or college.

- Conduct informal interviews or surveys to understand the need.
- Analyze user pain points and existing gaps.
- Select one high-potential problem and formulate an idea to solve it.

**Deliverable:** Opportunity report with problem statement, user quotes, and proposed idea.

### 2. Assignment-2: Business Model Canvas + MVP Design

**Activity:** Choose a startup idea and:

- Create a detailed **Business Model Canvas** (cover all blocks).
- Develop a basic **Minimum Viable Product (MVP)**—this could be a sketch, clickable prototype, Or service flow.

**Deliverable:** BMC template filled + MVP mock-up/photo/video + short explanation of lean features.

### 3. Assignment-3: Business Plan + Funding Strategy + Pitch Activity:

Prepare a **business plan** including:

- Executive summary
- Product/service details
- Market research insights
- Costing and basic unit economics
- Revenue model
- Funding plan (choose and justify one: govt. scheme, VC, angel, crowd funding)
- Prepare elevator pitch/1 minute pitch

**Deliverable:** 4–6 page business plan document + pitch deck (5–7 slides)

## Exemplars/Practical Applications

### 5. Arrange a Guest Talk– From Idea to Investment

**Application:** Invite a successful entrepreneur to share their journey covering:

- Business Model Canvas
- MVP development
- Business Plan creation
- Funding strategy (e.g. Startup India, VC, angel investors)
- Invest or pitch experience

**Outcome:** Students submit a brief reflection highlighting key learning from BMC, MVP, funding, and pitching strategies.

### 2. Conduct Startup Financials Workshop

**Application:** Hands-on session using a fictional startup (e.g., chai café):

- Calculate fixed and variable costs
- Identify breakeven point
- Build a simple cash flow chart for 6 months

**Outcome:** Submit an Excel sheet with key financial metrics and a one – page interpretation.

### 3. Government Funding Scheme Research

**Application:**

- Each group explores one government scheme (e.g., Startup India Seed Fund, MUDRA loan, PMEG Scheme, MSME credit)
- Analyze eligibility, application process, benefits, and success stories

**Outcome:** Deliver a 5-minute pitch to a panel of faculty/peers acting as investors.

## Learning Resources

### Text Books

1. Entrepreneurship Development– S.S. Khanka
2. Entrepreneurship Development and Small Business Enterprises– Poornima M.Charantimath
3. Entrepreneurship:New VentureCreation–DavidH.Holt(IndianEditionbyVikasPublishing)
4. Innovation and Entrepreneurship – Dr. R. G. Desai
5. Essentials of Entrepreneurship and Small Business Management– Nandan H.

#### Reference Books:

4. The Lean Startup–Eric Ries
5. Disciplined Entrepreneurship: 24 Steps to a Successful Startup–Bill Aulet (MIT)
6. Zero to One–Peter Thiel
7. The Startup Owner's Manual–Steve Blank & Bob Dorf
8. Jugaad Innovation– Navi Radjou, Jaideep Prabhu, and Simone Ahuja
9. Stay Hungry Stay Foolish– Rashmi Bansal
10. Connect the Dots– Rashmi Bansal
11. Innovation and Entrepreneurship– Peter F. Drucker
12. Startup Sutra– Rohit Prasad
13. Dream With Your Eyes Open–Ronnie Screwvala

#### MOOCs/NPTEL/SWAYAM Courses (Free)

1. Entrepreneurship Essentials–Offered by IIT Kharagpur (NPTEL) Duration: 8 weeks | Level: UG/PG  
Covers: Entrepreneurial process, business models, marketing, funding.
2. Entrepreneurship and Innovation–IIT Roorkee  
Duration: 12 weeks  
Covers: Types of innovation, design thinking, ecosystem, and scaling.
3. Product Management and Entrepreneurship – IIM Bangalore  
Duration: 8 weeks  
Focus: Customer discovery, MVPs, and product-led growth.
4. Innovation, Business Models and Entrepreneurship– IIT Madras Explores innovation in products and services, and lean canvas approach.
5. Design Thinking-A Primer–IIT Madras  
Ideal for teaching creativity and problem- solving using design thinking.
6. Coursera: Design Thinking for Innovation by University of Virginia
7. edX: Entrepreneurship in Emerging Economies by Harvard



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Department: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: VEC-208-MEC</b>			<b>Name of Course: Universal Human Values</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
2				2		
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
			25	25		50
<b>Pre-requisites:</b>						
Student Induction Program (SIP)						
<b>Course Objective:</b>						
<ol style="list-style-type: none"> <li>To help the students develop a holistic, humane world-vision, and appreciate the essential complementarity between values and skills to ensure mutual happiness and prosperity</li> <li>To elaborate on 'Self-exploration' as the process for Value Education</li> <li>To facilitate the understanding of harmony at various levels starting from self and going towards family and society.</li> <li>To Identify the core values that shape the ethical behavior of an engineer and create an awareness on professional ethics and Human Values</li> </ol>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
1	Recognize the concept of self-exploration as the process of value education and see they have the potential to explore on their own right.					
2	Explore the human being as the coexistence of self and body to see their real needs / basic aspirations clearly.					
3	Explain the relationship between one self and the other self as the essential part of relationship and harmony in the family					
4	Understood the core values that shape the ethical behavior of an engineer Exposed awareness on professional ethics and human values.					

<b>Course Content</b>		
<b>Unit I</b>	<b>Introduction to Value Education</b>	<b>(07 Hours)</b>
Understanding Value Education Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations and their Fulfilment, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity - Current Scenario, Method to Fulfil the Basic Human Aspirations		
<b>Unit II</b>	<b>Harmony in the Human Being</b>	<b>(07 Hours)</b>
Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health		
<b>Unit III</b>	<b>Harmony in the Family and Society</b>	<b>(08 Hours)</b>
Harmony in the Family - the Basic Unit of Human Interaction "Trust" - the Foundational Value in Relationship, 'Respect' - as the Right Evaluation, Values in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order		
<b>Unit IV</b>	<b>Professional Ethics</b>	<b>(08 Hours)</b>
Value-based Life and Profession Identify the core values that shape the ethical behavior of an engineer to create an awareness on professional ethics and Human Values To appreciate the rights of others Professional Ethics in the light of Right Understanding Strategies for Transition towards		
<b>Learning Resources</b>		
<b>Text Books:</b>		
<p>10. A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), 978-81- 957703-6-6 (e-book)</p> <p>11. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, RR Gaur, R Asthana, GP Bagaria, 3rd revised edition, UHV Publications, 2023, ISBN: 978-81-957703-5-9 (Printed Copy), 978-81-957703-0-4 (e-Book)</p>		

**Reference Books:**

3. Mike Martin and Roland Schinzinger, “Ethics in Engineering”, McGraw Hill, New York (2005).
4. Charles E Harris, Michael S Pritchard and Michael J Rabins, “Engineering Ethics – Concepts and Cases”, Thompson Learning, (2000).
5. Charles D Fleddermann, “*Engineering Ethics*”, Prentice Hall, New Mexico, (1999).
6. John R Boatright, “*Ethics and the Conduct of Business*”, Pearson Education, (2003).
7. Edmund G Seebauer and Robert L Barry, “*Fundamentals of Ethics for Scientists and Engineers*”, Oxford University Press, (2001).

**e-resources:**

1. <https://fdp-si.aicte-india.org/download.php#1/>
2. [https://www.youtube.com/channel/UCQxWr5QB\\_eZUnwxSwxXEKQw](https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEKQw)

**(Course Name) Practical/Tutorial****List of Tutorials:**

Pr/Tut No.	Content
01	Explain the concept of Value Education. Discuss why value education is essential for Mechanical engineering students in today’s scenario. Support your answer with real-life examples.
02	Define self-exploration. Explain how self-exploration helps an individual achieve continuous happiness and prosperity. Write a short reflection (200–300 words) on your own basic aspirations.
03	Differentiate between happiness and prosperity. Analyze the current societal scenario where material prosperity is prioritized over happiness. Suggest methods to fulfill basic human aspirations correctly.
04	Explain the concept of the human being as a coexistence of the self and the body. Distinguish clearly between the needs of the self and the needs of the body with suitable examples.
05	Describe how disharmony between self and body affects health and performance. Propose a practical program to ensure self-regulation and physical health for engineering students.

06	Define trust as a foundational value in human relationships. Explain its role in maintaining harmony in the family. Illustrate with real-life examples from family or society.
07	Explain the values of respect, affection, care, guidance, and gratitude in human relationships. Discuss how these values help in building a harmonious society.
08	What is meant by Universal Human Order? Explain its characteristics and significance. How can engineers contribute towards achieving harmony at societal and global levels?
09	Identify and explain the core ethical values required in the Mechanical engineering profession (such as honesty, responsibility, safety, sustainability). Provide examples related to construction projects.
10	Discuss professional ethics in the light of right understanding. Explain how unethical practices in Mechanical engineering affect society, environment, and future generations. Suggest strategies for ethical professional conduct.



**Pimpri Chinchwad Education Trust's**  
**Pimpri Chinchwad College of Engineering and Research, Ravet, Pu**  
**Department of Mechanical Engineering**



**Class: Second Year Engineering (2025 Pattern)**

**Sem: III**

**Course Code: CEP-209-MEC**

**Name of Course: Community Engagement Project**

**Teaching Scheme (Hrs/week):**

**Credits:**

Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
-	4	-		-	2	-

**Examination Scheme:**

FA	SA	PR	OR	TW		Total
-	-	-	25	25		50

**Pre-requisites:**

Design Thinking, Life Skills, Fundamentals of science, Fundamentals of Mathematics etc.

**Course Objectives:**

- Establish social and academics relationship.
- Avail Opportunities to learners to engage with their local community, fostering empathy, teamwork, and problem solving.
- Understand of the challenges faced by the local community and the role of engineering in addressing those challenges.
- The skills to evaluate and critically analyze the outcomes of their engagement activities, deriving actionable insights for sustainable impact.

**Course Outcomes:**

On completion of this Course, the Learners will be able to;

CO1	<b>ANALYZE</b> and identify the needs and challenges of local community by engaging with stakeholders.
CO2	<b>DESIGN</b> and Implement practical, creative, and context-specific solutions to identified community issue.
CO3	<b>EVALUATE</b> the effectiveness of their interventions through reports and presentations.

**Course Content****Implementation**

- A group of 5 to 7 students could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay/college premise.
- The group of students will be associated with a government official / village authorities /NGOs /private firms etc. concerned, during the duration of the project.
- An activity book has to be maintained by each of the students to record the activities undertaken/involved and will be countersigned by the concerned mentor/HoD.
- Project report shall be submitted by each group of students at the end of semester.
- Students in a group should give presentation of the work done along with the proofs of the same, at the end of semester.

**Suggestive list of topics under Community Engagement Project**

The list of topics can be covered (not exhaustive and open for addition, deletion or modification in it).

1. Water facilities and drinking water availability
2. Health and hygiene of the school going students, home makers and old personals
3. Health intervention and awareness programmes
4. Horticulture
5. Herbal and Nutrition
6. Food habits
7. Air /Sound /Water pollution
8. Plantation and Soil protection
9. Renewable energy and Solar Systems
10. Yoga awareness and practice
11. Organic farming
12. Food adulteration
13. Chemicals in daily life
14. Women education and empowerment

	<b>Project Scope</b>	
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- A group of students can conduct workshops or awareness drives or street show etc. on topics and maintain the proofs of that activity.
- A group of students should make posters or presentation material for field activity
- A group of students can develop a simple prototype or solution that addresses a real-world problem (e.g., a water-saving device, simple mobile apps, or tools for community use).
- Utilize one session of 2 hours in a week for monitoring and evaluation of the previous week work by group and other session of 2 hours for field activity of group.

	<b>Proposal Submission</b>	
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CEP Group should Submit a two-page project proposal, preferably prior to the term commencement outlining the following:-

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Place of the CEP and involvement of any local authority, NGP
- Required resources (if any).
- Get approval from the designated faculty mentor.

### **Self Learning Exercise**

Each student need to submit at least one page summary sheet of the overall experience and new learning from the project at the end of semester.

### **Learning Resources**

#### **Text Books**

1. Waterman, A. Service-Learning: A Guide to Planning, Implementing, and Assessing Student Projects. Routledge, 1997.
2. Beckman, M., and Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, 2016.
3. Design Thinking for Social Innovation. IDEO Press, 2015.
4. Dostilio, L. D., et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Stylus Publishing, 2017

**e-resources:**

1. NPTEL course: Ecology and Society, [https://onlinecourses.nptel.ac.in/noc20\\_hs77/preview](https://onlinecourses.nptel.ac.in/noc20_hs77/preview)
2. UNESCO: Education for Sustainable Development <https://www.unesco.org>
3. EPICS (Engineering Projects in Community Service) <https://engineering.purdue.edu/EPICS>
4. Ashoka: Innovators for the Public <https://www.ashoka.org>
5. Design for Change <https://www.dfcworld.com>



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**Department of Mechanical Engineering**



**Department: Second Year Engineering (2025 Pattern)**

**Sem: III**

**Course Code: AC-210-MEC**

**Name of Course: Audit course (Foreign Language-I)**

**Teaching Scheme (Hrs/week):**

**Credits:**

Lecture	Practical	Tutorial	Lecture	Practical	Tutorial
2			0		

**Examination Scheme:**

FA	SA	PR	OR	TW	Total
			-	-	NA

**Pre-requisites:**

English language

**Course Objective:**

- To acquaint the students with the basic sentence patterns of German language so that they can converse in German.
- To make the students able to read, write, understand and speak German.
- To make the students understand the daily life conversations at public places, viz. railway station, air ports, Cinema Hall, restaurants etc.
- To increase the German vocabulary of the students through conduct of different activities.

**Course Outcomes:**

On completion of this Course, the Learners will be able to;

1	Fundamental Communication: Students will be able to understand and use familiar everyday expressions and simple sentences in German.
2	Grammatical Proficiency: Ability to comprehend and apply basic German grammatical structures and rules in writing and speaking.
3	Cultural Awareness: Understanding basic social, cultural, and professional norms of German-speaking countries.

4	<b>Functional Skills:</b> Ability to interact in a basic, professional, or academic setting, preparing learners for further language study or vocational opportunities	
<b>Course Content</b>		
<b>Week 1</b>	<b>Introduction to German language</b>	<b>(02 Hours)</b>
Themes: Introducing oneself and others; Grammar: W questions, personal pronouns, simple sentences, verb conjugation .		
<b>Week 2</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Themes: hobbies, the week, numbers, the alphabet, months, seasons /Grammar : articles , plural, the verbs to have and to be.		
<b>Week 3</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Theme: In the city / naming places and buildings, means of transport, basic directions / Grammar : definite and indefinite articles; negation - kein and nicht; imperative .		
<b>Week 4</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Themes: food, drink, family / groceries and meals / Grammar : the accusative.		
<b>Week 5</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Theme: Everyday life, telling time, making appointments / Grammar :prepositions am, um, von..bis; modal verbs, possessive articles.		
<b>Week 6</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Leisure activity, celebrations / Grammar: separable verbs, the accusative, past tense of to have and to be.		
<b>Week 7</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Contacts, writing letters / Grammar: dative .		
<b>Week 8</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
My apartment, rooms, furniture, colours / Grammar: changing prepositions .		
<b>Week 9</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Professions / Grammar : perfect tense.		

<b>Week 10</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Clothes / Grammar: perfect tense and dative.		
<b>Week 11</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Health and the body / Grammar: the imperative and modal verbs.		
<b>Week 12</b>	<b>German language-A1</b>	<b>(02 Hours)</b>
Holiday and weather.		
<b>Learning Resources</b>		
<b>Text Books:</b>		
Prescribed Textbook: NETZWERK Deutsch als Fremdsprache A1(Goyal, New Delhi, 2015)		
Other recommended books:		
Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)		
<b>e-resources:</b>		
FACTS ABOUT GERMANY <a href="https://www.tatsachen-ueber-deutschland.de/en">https://www.tatsachen-ueber-deutschland.de/en</a>		
ONLINE GERMAN-ENGLISH DICTIONARY <a href="http://www.leo.org">www.leo.org</a>		
PRACTICE MATERIAL		
<a href="https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html">https://www.goethe.de/en/spr/kup/prf/prf/sd1/ueb.html</a>		
<a href="http://www.deutschkurse-passau.de/JM/images/stories/SKRIPTEN/a1_skript_gr.pdf">http://www.deutschkurse-passau.de/JM/images/stories/SKRIPTEN/a1_skript_gr.pdf</a>		
<a href="https://www.schubert-verlag.de/aufgaben/arbeitsblaetter_a1_z/a1_arbeitsblaetter_index_z.htm">https://www.schubert-verlag.de/aufgaben/arbeitsblaetter_a1_z/a1_arbeitsblaetter_index_z.htm</a>		

# Semester IV



**Pimpri Chinchwad Education Trust's**  
**Pimpri Chinchwad College of Engineering and Research, Ravet, Pune**  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: IV</b>	
<b>Course Code: PCC-251-MEC</b>			<b>Name of Course: Fluid Mechanics and Machinery</b>			
<b>Teaching Scheme (Hrs/week):</b>				<b>Credits:</b>		
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
3	-	-		3	-	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
50	50	-	-	-		100
<b>Pre-requisites:</b>						
Engineering Mathematics - I, Engineering Mathematics - II, Engineering Mechanics, Engineering Physics						
<b>Course Objectives:</b>						
By the end of the course, students should be able to;						
1. To <b>understand</b> fundamental principles of fluids and fluid Statics.						
2. To <b>understand</b> fluid kinematics and dynamics						
3. To <b>apply</b> the principles of fluid dynamics to Internal & External Flow						
4. To <b>study</b> the performance of steam turbines						
5. To <b>study</b> the Hydraulic Turbines and Pumps						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
CO.1	<b>Explore</b> concepts of fluid properties and Hydrostatics.					
CO.2	<b>Explore</b> the detailed analysis of kinematics and dynamics of fluid.					
CO.3	<b>APPLY</b> principles of fluid dynamics to Internal & External Flow.					
CO.4	<b>Analyze</b> the performance of steam turbines.					

CO.5	Analyze the performance of Hydraulic Turbines and Pumps.
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<b>Course Content</b>		
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<b>Unit I</b>	<b>Fundamental Principles of Fluid Mechanics</b>	<b>(07 Hours)</b>
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**Properties of Fluid:** Definition of fluid, density, specific weight, specific gravity, viscosity laws, types of fluid and rheology, vapor pressure, surface tension, capillarity, compressibility.

**Laws of fluid statics:** forces acting on fluid elements, Pascal’s law, hydrostatics law.

**Pressure measurement:** pressure scale, piezometer, barometer, manometer - simple, differential, manometer, Bourdon Tube Pressure Gauge.

**Forces acting on surfaces immersed in fluid:** total pressure and center of pressure on submerged plane surfaces,

**Buoyancy:** Archimedes Principle, flotation, stability of bodies, Metacenter and Metacentric Height.

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<b>Unit II</b>	<b>Fluid Kinematics &amp; Dynamics</b>	<b>(08 Hours)</b>
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Flow description methods, types of flows, velocity and acceleration fields, continuity equation in 1D & 3D flow, flow visualization (path line, stream line and streak line), stream function and velocity potential function, flow net

Introduction to Navier Stokes equation, Euler’s equation of motion along streamline, Bernoulli’s theorem and modified Bernoulli’s theorem, stagnation pressure, HGL, TEL

Flow measurement: venturimeter.

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<b>Unit III</b>	<b>Internal Flow &amp; External Flow</b>	<b>(08 Hours)</b>
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**Internal Flow:**

Laminar flow: Entrance region theory, velocity and shear Stress distribution for laminar flow through pipe, fixed parallel plates and Couette flow, velocity profile of turbulent flow.

Losses - major (Darcy-Weisbach equation) & minor losses (without expressions), hydro dynamically smooth and rough boundaries, compounding of pipes & equivalent pipe, Transmission of Power, siphons

**External Flow:**

Boundary layer formation over a flat plate, boundary layer thickness, displacement thickness, momentum thickness and energy thickness, boundary layer separation and methods to control separation, drag and lift concepts. aerofoil, bluff body, streamline body

**Unit IV****Steam Turbines****(08 Hours)**

Steam nozzles: types and applications, Equation for velocity and mass flow rate, Steam Turbines: Classifications, construction details, compounding of steam turbines, velocity diagrams and analysis of Impulse and reaction turbines (single & multi stage), governing, performance characteristics. Losses in steam turbines, selection of turbines, governing of steam turbines.

**Unit V****Hydraulic Turbines and Pumps****(08 Hours)**

**Hydraulic Turbines:** Classification, various efficiencies, Pelton turbine – velocity triangles, design parameters, Maximum efficiency, Francis turbine - velocity triangles, design parameters, runner shapes for different blade speeds. Kaplan and Propeller turbines Draft tubes- Types and functions.

**Pumps:** Different heads and efficiencies of centrifugal pump, Maximum suction lift, Net positive suction head, Need for priming, Pumps in series and parallel.

Introduction Positive displacement pumps, Cavitation.

**Learning Resources**

### Text Books

31. Sukumar Pati, "Fluid Mechanics and Hydraulics Machines", TATA McGraw Hill.
32. Munson, Young and Okiishi, "Fundamentals of Fluid Mechanics", Wiley India
33. Potter Wiggert, "Fluid Mechanics", Cengage Learning
34. Fox, Pichard, "Introduction to Fluid Mechanics", McDonald- Wiley
35. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics", Standard Book House.
36. Cengel & Cimbala, "Fluid Mechanics", TATA McGraw-Hill
37. F. M. White, "Fluid Mechanics", TATA McGraw-Hill
38. R. K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publication

### Reference Books:

1. Kundu, Cohen, Dowling, "Fluid Mechanics", Elsevier India
2. Chaim Gutfinger David Pnueli, "Fluid Mechanics" Cambridge University press.
3. Edward Shaughnessy, Ira Katz James Schaffer, "Introduction to Fluid Mechanics", Oxford University Press

**e-resources:**

**MOOC / NPTEL/YouTube Links: -**

1. <https://www.youtube.com/watch?v=HGbbdXNcIQ&list=PLbMVogVj5nJQEGl1sHuY24d6omOqXIinnt> (Prof. Suman Chakraborty, Department of Mechanical Engineering, IIT Kharagpur)
2. <https://www.youtube.com/watch?v=fa0zHI6nLUo&list=PLbMVogVj5nJTZJHsH6uLCO00I-ffGyBEem> (Prof. S. K. Som, Department of Mechanical Engineering, IIT Kharagpur)
3. <https://www.youtube.com/watch?v=IJSUeEqGNY0&list=PLwdnzlV3ogoV-ATGY2ptuLS9mwLFOJoDw> (Prof. Subasisa Dutta, IIT Guwahati)
4. [https://www.youtube.com/watch?v=-D9EEBK7F4&list=PLbRMhDVUMngdckEfiomSL-RfpmFVu\\_O-](https://www.youtube.com/watch?v=-D9EEBK7F4&list=PLbRMhDVUMngdckEfiomSL-RfpmFVu_O-) (Prof. Suman Chakraborty, Department of Mechanical Engineering, IIT Kharagpur)
5. <https://www.youtube.com/watch?v=wIPXZrP9vR8&list=PLCoE5wxWtHFYiVGswvsWRaHjv18vxZzE2> (Prof. Shamit Bakshi, Department of Mechanical Engineering, IIT Madras)
6. [https://www.youtube.com/watch?v=MNXU2thk\\_zU&list=PLyqSpQzTE6M-OznIof4z0w6TYA-gc-x8](https://www.youtube.com/watch?v=MNXU2thk_zU&list=PLyqSpQzTE6M-OznIof4z0w6TYA-gc-x8) (Prof. Sumesh Thampi, Department of Chemical Engineering, IIT Madras)
7. [https://www.youtube.com/watch?v=cIVwKynHpB0&list=PLZOZfX\\_TaWAGocs2k5QmTL44OKO17rn34](https://www.youtube.com/watch?v=cIVwKynHpB0&list=PLZOZfX_TaWAGocs2k5QmTL44OKO17rn34) (Prof. John Biddle, Department of Mechanical Engineering, MIT Boston, USA)
8. [https://www.youtube.com/watch?v=SrpX7m89\\_-I&list=PLQR3QcO-W5he1X1GHd\\_IutnslXcr4mlh8](https://www.youtube.com/watch?v=SrpX7m89_-I&list=PLQR3QcO-W5he1X1GHd_IutnslXcr4mlh8) (Prof. John Cimbala, Penn State University, USA)



**Pimpri Chinchwad Education Trust's**  
**Pimpri Chinchwad College of Engineering and Research, Ravet, Pune**  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering</b>					<b>Sem: IV</b>	
<b>Course Code: PCC-252-MEC</b>			<b>Name of Course: Manufacturing Processes I</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
3	-	-		2	-	-
<b>Examination Scheme:</b>						
SA	FA	PR	OR	TW		Total
50	50	-	-	-		100
<b>Pre-requisites:</b>						
<ul style="list-style-type: none"> <li>● Engineering Physics ● Basics of Engg. Mathematics</li> <li>● Material Science and Metallurgy ● Manufacturing Practice Workshop</li> </ul>						
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>● To KNOW about fundamentals of metal cutting process, tool wear and tool life.</li> <li>● To DESCRIBE various casting methods and aspects related to mold design</li> <li>● To UNDERSTAND basics of metal forming processes and tooling</li> <li>● To DESCRIBE and CONFIGURE the principles of various welding techniques</li> <li>● To EXPLAIN various grinding and advanced finishing techniques</li> </ul>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
CO1	APPLY metal cutting theory and do tool wear analysis to optimize machining processes.					
CO2	DESIGN gating systems, risers, and ANALYZE casting defects for efficient metal casting processes.					
CO3	COMPUTE forces, power, and deformation in rolling, forging, and sheet metal operations.					
CO4	COMPARE welding techniques, interpret weld symbols, and EVALUATE defects for quality joining.					

CO5	SELECT appropriate grinding and super finishing processes based on surface finish requirements	
<b>Course Content</b>		
<b>Unit I</b>	<b>Theory of metal cutting</b>	<b>(08 Hours)</b>
<ul style="list-style-type: none"> <li>● Basics of subtractive manufacturing, operations on Lathe, Milling. Basics of metal cutting mechanics</li> <li>● Chip formation and types of chips, Orthogonal and oblique cutting</li> <li>● Shear angle and Merchant's theory, Cutting Forces and Power Estimation</li> <li>● Properties of cutting tool materials, Tool signature, Tool wear and tool life, Taylor's tool life equation</li> </ul>		
<b>Assignment :</b> Calculation of Power and Energy Calculations: Cutting power, shear power, and friction power, Calculation of cutting force components using experimental data		
<b>Unit II</b>	<b>Metal Casting Technology</b>	<b>(08 Hours)</b>
<ul style="list-style-type: none"> <li>● Introduction to casting processes</li> <li>● Patterns: Pattern materials, types of pattern, allowances in pattern design,</li> <li>● Moulding sand, Properties of moulding sands, Core making</li> <li>● Melting practices and furnaces, Pouring and Gating system design, Numerical estimation to find mold filling time,</li> <li>● Gating System: Riser design and placement, Principles of cooling and solidification of casting, Directional and Progressive solidification, Estimation of solidification rate</li> <li>● Cleaning and Finishing of casting, Defects and remedies</li> <li>● Principle and equipments of Permanent mold casting (Die casting) Investment casting, Centrifugal casting, Continuous casting</li> </ul>		
<b>Assignment :</b> Designing of Gating System & Raisers, Calculation of riser size using Caine's method and modulus method, Comparing riser efficiency for different shapes. Estimating pouring time and metal flow rate.		
<b>Unit III</b>	<b>Metal Forming Technology</b>	<b>(08 Hours)</b>

- Introduction to Metal Forming- Stress-Strain Analysis in Metal Forming, Bulk Deformation Processes, Defects in Metal Forming
- Rolling: Types, defects, and applications, Rolling force estimation, Torque and power requirements for rolling mills
- Forging: Open-die, Closed-die, and Impression-die forging, Estimation of Forging Load using uniform deformation energy equation
- Sheet Metal Working: Types of sheet metal operations, Press working equipment and terminology, design of simple progressive die: strip lay-out and percentage utilization, clearance analysis, center of pressure, estimation of cutting forces and press capacity

**Assignment :** Load calculation for open-die forging and closed-die forging or Design of simple drawing dies

<b>Unit IV</b>	<b>Joining Technology</b>	<b>(08Hours)</b>
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- Classification of joining process ( welding soldering, brazing),welding symbols, types of joint, Electrodes- types and purpose of electrodes, electrode coatings (flux), welding defects, testing and inspection of welds
- Working principles & applications of welding processes: Arc welding: MIG, TIG, Resistance welding: Spot, Seam, projection welding, Heat generation in resistance welding,
- Gas Welding: Types of flames, oxy-acetylene gas welding. Solid State Welding: Friction Welding
- Modern Welding Processes: Laser welding plasma arc welding, submerged arc welding, projection welding, and electron beam welding, ultrasonic welding.

**Assignment :** Selection of non-conventional welding process for particular applications like plasma arc welding, submerged arc welding, projection welding, electron beam welding, ultrasonic welding

<b>Unit V</b>	<b>Finishing and Fine finishing processes</b>	<b>(08Hours)</b>
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- Grinding Process: Introduction, types of grinding machines
- Grinding wheel: Introduction, types, shapes, designation and selection, grit, grade & structure of wheels, mounting, glazing, loading, dressing, truing, balancing, Surface Finish Measuring Instruments.
- Super finishing processes: (working and process parameters) Introduction to Honing and Lapping, Magnetic abrasive finishing, Ultrasonic finishing, Abrasive flow machining.

**Assignment :** Machining time calculation for cylindrical and plunge grinding, Appropriate selection finishing process for given application

- Industrial visit to any foundry shop covering pattern shop, Moulding, melting, pouring and solidification processes. **OR**
- Any company having rolling or forging, and other metal forming processes.

### Learning Resources

#### Text Books

1. Manufacturing Technology, Metal Cutting and Machine Tools, P. N. Rao, Vol. 2nd edition, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 2002
2. Manufacturing Technology Vol. I & II", P. N. Rao Tata McGraw Hill Publishers
3. Production Engineering, P. C. Sharma, Khanna Publishers

#### Reference Books:

1. Theory of Metal Cutting, M. C. Shaw, 1st Edition, Oxford and I.B.H. publishing, 1994
2. Hand book of Production Technology - HMT, Tata McGraw Hill publication

#### NPTELlinks: -

- <https://nptel.ac.in/courses/112103248>
- <https://nptel.ac.in/courses/112104028>
- <https://nptel.ac.in/courses/112107215>
- <https://nptel.ac.in/courses/112104301>
- <https://nptel.ac.in/courses/112104195>
- <https://nptel.ac.in/courses/112103420>
- <https://nptel.ac.in/courses/112107250>
- <https://nptel.ac.in/courses/112103528>
- <https://nptel.ac.in/courses/112104162>
- <https://nptel.ac.in/courses/112103244>
- <https://nptel.ac.in/courses/112103263>
- <https://nptel.ac.in/courses/112103305>
- <https://nptel.ac.in/courses/112103250>



**Pimpri Chinchwad Education Trust's**  
**Pimpri Chinchwad College of Engineering and Research, Ravet, Pune**  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: IV</b>	
<b>Course Code: PCC-253-MEC</b>			<b>Name of Course: Mechanisms and Machines</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
2	-	-		2	-	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
50	50	-	-	-		100
<b>Pre-requisites:</b>						
<ol style="list-style-type: none"> <li>1. Engineering Physics,</li> <li>2. Engineering Mechanics</li> <li>3. Geometric Modeling &amp; Drafting</li> </ol>						
<b>Course Objectives:</b>						
By the end of the course, students should be able to;						
<ol style="list-style-type: none"> <li>1. To identify mechanisms from real-life applications and perform kinematic analysis.</li> <li>2. To develop the competency to analyze the velocity and acceleration in mechanisms using analytical and graphical approach.</li> <li>3. To develop the skill to propose and synthesize the mechanisms using analytical techniques.</li> <li>4. To develop the competency to understand &amp; apply the principles of gear theory to design various applications.</li> <li>5. To develop the competency to design a cam profile for various follower motions.</li> </ol>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
1	APPLY kinematic analysis to simple mechanisms					
2	ANALYZE velocity and acceleration in mechanisms by vector and graphical method					
3	SYNTHESIZE a four bar mechanism with analytical methods.					
4	APPLY fundamentals of gear theory as a prerequisite for gear design					
5	CONSTRUCT cam profile for given follower motion					
<b>Course Content</b>						
<b>Unit I</b>	<b>Fundamentals of Mechanism</b>					<b>(07 Hours)</b>

Kinematic link, Types of links, Kinematic pair, Types of constrained motions, Types of Kinematic pairs, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom, Inversion, Grashoff's law, Four-Bar Chain and its Inversions		
<b>Unit II</b>	<b>Kinematic Analysis of Mechanisms</b>	<b>(07 Hours)</b>
Analytical methods for displacement, velocity and acceleration analysis of slider crank Mechanism, Instantaneous Centre of Velocity, Kennedy's Theorem, Angular Velocity ratio Theorem, Analysis of mechanism by ICR method (Mechanisms up to 6 Links)		
<b>Unit III</b>	<b>Synthesis of Mechanisms</b>	<b>(07 Hours)</b>
Steps in Synthesis: Type synthesis, Number Synthesis, Dimensional synthesis, Tasks of Kinematic synthesis - Path, function and motion generation (Body guidance), Precision Positions, Chebychev spacing, Mechanical and structural errors, Analytical Synthesis: Three position synthesis of Four-Bar mechanism using Freudenstein's equation		
<b>Unit IV</b>	<b>Gears and Gear Train</b>	<b>(07 Hours)</b>
Fundamental law of gearing and Spur gear contact ratio and interference, methods to avoid interference – Minimum number of teeth. Kinematics of simple, Compound and Epicyclic gear train (limited to spur gear trains only)		
<b>Unit V</b>	<b>Cams &amp; Followers</b>	<b>(07 Hours)</b>
Introduction, Classification of Followers and Cams, Terminology of Cam, Displacement diagram for the Motion of follower as Uniform velocity, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion (UARM), Cycloid motion, Cam Profile construction for Knife-edge Follower and Roller Follower, Cam jump Phenomenon.		
<b>Learning Resources</b>		
<ol style="list-style-type: none"> <li>1. S. S. Rattan, "Theory of Machines", Third Edition, McGraw Hill Education (India) Pvt. Ltd., New Delhi.</li> <li>2. Bevan T, "Theory of Machines", Third Edition, Longman Publication</li> <li>3. G. Ambekar, "Mechanism and Machine Theory", PHI</li> <li>4. J. J. Uicker, G. R. Pennock, J. E. Shigley, "Theory of Machines and Mechanisms", Fifth Edition, International Student Edition, Oxford</li> </ol>		

**Reference Books:**

1. Ghosh Malik, "Theory of Mechanism and Machines", East-West Pvt. Ltd.
2. Sadhu Singh, "Theory of Machines", Pearson
3. Dr. V. P. Singh, "Theory of Machine", Dhanpatrai and Sons
4. C. S. Sharma & Kamlesh Purohit, "Theory of Machine and Mechanism", PHI
5. M.P. Groover, "Automation, production systems and computer-integrated manufacturing", Prentice-Hall of India Pvt. Ltd, New Delhi

**e-resources:**

4. <https://nptel.ac.in/courses/112104121/> (NPTEL1, Kinematics of Machines, Prof. Ashok K Mallik, IIT Kanpur)
5. <https://nptel.ac.in/courses/112/106/112106270/> (NPTEL2, Theory of Mechanism, Prof. Sujatha Srinivasan, IIT Madras)
6. <https://nptel.ac.in/courses/112/105/112105268/> (NPTEL3, Kinematics of Mechanisms and Machines, Prof. Anirvan DasGupta, IIT Kharagpur)



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>	<b>Sem: IV</b>
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<b>Course Code: PCC-254-MEC</b>	<b>Name of Course: Mechanisms and Machines Lab</b>
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<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>		
Lecture	Practical	Tutorial	Lecture	Practical	Tutorial
-	2	-	-	1	-

<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
-	-		25	25		50

**Pre-requisites:**  
Basic concepts from Physics and Mathematics

**Course Objectives:**  
By the end of the course, students should be able to;

1. To impart practical skills in analyzing mechanisms applied to real-life applications.
2. To develop the competency for kinematic analysis of Mechanism.
3. To synthesize the mechanisms using analytical technique.
4. To perform kinematic analysis of gear trains.
5. To synthesize the cams.

**Course Outcomes:**  
On completion of this Course, the Learners will be able to;

1	Build the mechanisms and perform kinematic analysis.
2	ANALYZE mechanisms kinematically by graphical method
3	SYNTHESIZE a four bar mechanism with graphical methods
4	Analyze the Epicyclic Gear Train for torques.
5	Synthesize Cam for a given application using the simulation tool.

**Course Content**

**List of Practical Experiments**

**Practical**

1. To make a model of any mechanism by using waste material by the group of 4 to 6 students and to give a presentation using PPTs.
2. Speed and torque analysis of epicyclic gear train to determine holding torque.
3. To study and verify the cam jump phenomenon.
4. To study and demonstrate various types of gearboxes.

**Assignments using Drawing Aids**

5. To solve two problems on velocity and acceleration analysis using relative velocity and acceleration method.

**Assignments using Software ( Three Assignments - computer programming based and based on use of software)**

6. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for Kinematic Analysis of Slider Crank Mechanism using Analytical Method
7. To do computer programming (using software/programming languages like C, Python, Scilab, Matlab etc.) for Kinematic Analysis of Hooke's joint Mechanism using Analytical Method
8. To generate a Cam Profile using any Modelling Software (Mech Analyser, any 3D Modelling Software)

**e-Resources:** <https://www.vlab.co.in/broad-area-mechanical-engineering>



**Pimpri Chinchwad Education Trust's**  
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**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>	<b>Sem: IV</b>
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<b>Course Code: PCC-255-MEC</b>	<b>Name of Course: Fluid Mechanics and Machinery Lab.</b>
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<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>		
Lecture	Practical	Tutorial	Lecture	Practical	Tutorial
-	2	-	-	1	-

<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW	Total	
-	-	-	25	25	50	

**Pre-requisites:**  
 Engineering Mathematics - I, Engineering Mathematics - II, Engineering Mechanics, Engineering Physics

**Course Objectives:**  
 By the end of the course, students should be able to;

1. To **INVESTIGATE** lubricant properties like viscosity and viscosity index.
2. To **APPLY** Bernoulli's Theorem to evaluate the discharge coefficients using standard instruments.
3. To **INVESTIGATE** the performance and efficiency of turbines and pumps through actual test methods.
4. To **DEVELOP** practical insights into industrial applications of thermo-fluid systems through plant visits and technical documentation.

**Course Outcomes:**  
 On completion of this Course, the Learners will be able to;

<b>CO.1</b>	<b>EVALUATE</b> the fluid viscosity and viscosity index.
<b>CO.2</b>	<b>EVALUATE</b> the discharge coefficients using standard instruments.
<b>CO.3</b>	<b>INVESTIGATE</b> the performance and efficiency of turbines and pumps
<b>CO.4</b>	<b>DEVELOP</b> practical insights into industrial applications of thermo-fluid systems through plant visits and technical documentation.

### List of Experiments

#### Experiment 01

##### **Determination of dynamic and kinematic viscosity of any oil using Redwood Viscometer.**

**Description:** Viscosity is the resistance offered by the fluid for its own flow. It quantifies the internal resistance offered by one layer of fluid to the other. The flow rate or velocity of the fluid will be more if the viscosity is less.

##### **Viscosity Using Redwood Viscometer:**

**Assignment:** Collect samples of different lubricants used in automotive workshops and compare their viscosities and suitability for engine parts.

**Exemplars / Practical Applications:** It is used in selection of lubricants, hydraulic brake system, coating and spray painting. In manufacturing processes like ink production, adhesives and food processing.

#### Experiment 02

### **Bernoulli's Theorem Experimental Demonstration and verification**

**Description:** When the fluid flows in a horizontal pipe so that there is no change in potential energy or head, then the increase in the fluid velocity is associated with the decrease in fluid pressure.

- Bernoulli's Theorem Experimental Demonstration.
- Assignment: Create a video or presentation showing real life application of Bernoulli's Theorem in aircraft wing design.

**Exemplars / Practical Applications:** The principle is used in atomizers like perfume bottles. In designing the wings of the aeroplanes.

### **Experiment 03**

**Determination of Coefficient of discharge, Coefficient of velocity of venturimeter / orifice meter.**

**Description:** Orifice meter and venturimeter are flow measuring devices. The devices work on the principle of coefficient of velocity of the devices.

**Flow Measurement (Venturimeter/Orifice Meter):**

**Assignment:** Compare different flow measurement devices used in municipal water supply systems and justify the use of each based on discharge coefficients.

**Exemplars / Practical Applications:** For accurate measurement of flow of fluids in pipelines in various industries like chemical processing, Oil and gas, food processing, automotive and aerospace etc.

### **Experiment 04**

**Determination of Major and Minor Losses in Pipe Lines (Metal / Plastic).**

**Description:** The major losses when the fluid is flowing through the pipe is mainly due to friction and minor losses are due to geometry and pipe fittings. The losses reduce the power transmitting capacity of the flow. Hence the losses should be as minimum as possible

**Major and Minor Losses in Pipelines:**

**Assignment:** Design a small-scale piping system (e.g. for a water purification unit) and identify areas with potential major/minor losses.

**Exemplars / Practical Applications:** In food processing industries, chemical industries, piping industries and hydraulic power plants.

**Experiment 05**

Study and trial on Steam turbine and estimation of performance parameters on actual Test Rig or with suitable Software.

**Experiment 06**

Study and trial on Impulse water turbine( Pelton Wheel Turbine) and plotting of performance characteristics curves.

**Experiment 07**

Study and trial on Centrifugal Pump and plotting of performance characteristics curves.

**Experiment 08**

Study and trial on Positive Displacement Pump and plotting of performance characteristics curves.

**Experiment 09**

**Visit to pumping station/water treatment plant/sewage treatment Plant and preparation of report on operation, monitoring, controlling and troubleshooting.**

### Important Note:

1. Experiment No. 9 is compulsory.
2. Perform any 7 Experiments from 1 to 8.

### Text Books

1. Sukumar Pati, "Fluid Mechanics and Hydraulics Machines", TATA McGraw Hill.
2. Munson, Young and Okiishi, "Fundamentals of Fluid Mechanics", Wiley India
3. Potter Wiggert, "Fluid Mechanics", Cengage Learning
4. Fox, Pichard, "Introduction to Fluid Mechanics", McDonald- Wiley
5. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics", Standard Book House.
6. Cengel & Cimbala, "Fluid Mechanics", TATA McGraw-Hill
7. F. M. White, "Fluid Mechanics", TATA McGraw-Hill
8. R. K. Bansal, "Fluid Mechanics & Hydraulic Machines", Laxmi Publication

### Reference Books:

8. Kundu, Cohen, Dowling, "Fluid Mechanics", Elsevier India
2. Chaim Gutfinger David Pnueli, "Fluid Mechanics" Cambridge University press.
3. Edward Shaughnessy, Ira Katz James Schaffer, "Introduction to Fluid Mechanics", Oxford University Press

### e-resources:

#### MOOC / NPTEL/YouTube Links: -

1. <https://archive.nptel.ac.in/courses/112/104/112104118/#>
2. <https://archive.nptel.ac.in/courses/112/105/112105269/>
3. <https://archive.nptel.ac.in/courses/112/105/112105171/>
4. <https://www.youtube.com/watch?v=fa0zHI6nLUo>



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: IV</b>	
<b>Course Code: MDM-256-MEC</b>			<b>Name of Course: Artificial Intelligence and Machine Learning</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
3	-	-		3	-	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
50	50	-	-	-		100
<b>Pre-requisites:</b>						
Probability & Statistics, Basic language (Python) Programming						
<b>Course Objectives: students shall,</b>						
<ol style="list-style-type: none"> <li>1. Learn different feature engineering techniques to mechanical datasets.</li> <li>2. Explore ML algorithms for mechanical engineering problems</li> <li>3. Learn steps involved in development of Machine learning model and its performance enhancement.</li> <li>4. Demonstrate AI-based intelligent and autonomous mechanical systems for advanced AIML technologies.</li> </ol>						
<b>Course Outcomes:</b>						
After completion of the Course, the learners will be able to;						
<b>CO1</b>	<b>Apply</b> feature extraction and feature selection techniques to dataset in mechanical systems (Apply)					
<b>CO2</b>	<b>Select</b> different machine learning algorithms for classification, regression, and clustering in mechanical systems. (Apply)					
<b>CO3</b>	<b>Evaluate</b> performance for devolved ML model for classification and regression problem using different evaluation metrics. (Evaluate)					
<b>CO4</b>	<b>Demonstrate</b> intelligent mechanical systems using reinforcement learning, deep learning, and advanced AI. (Apply)					
<b>Course Content</b>						
<b>Unit I</b>	<b>Introduction to AIML and Feature Engineering</b>					<b>(10 Hours)</b>

**Learning Focus:**

*Converting raw mechanical data into meaningful features suitable for ML models.*

**Introduction to AIML** –Introduction to Artificial Intelligence and Machine Learning; Need of AIML in Mechanical Engineering: design, manufacturing, predictive maintenance, quality inspection, energy systems; **AI approaches** (short discussion only)

**Mechanical Engineering Data** - Types of data: Sensor and time-series data (vibration, temperature, pressure), Image data (surface cracks), Simulation data (CFD, FEA, CAE), Dataset elements: features, labels, samples

**Machine Learning approaches** (overview)

**Feature extraction techniques: Statistical feature extraction:** mean, RMS, variance, skewness, kurtosis; Time-domain vs frequency-domain features; **Signal processing basics for mechanical data:** FFT concept and interpretation (no derivations), intro to Wavelets (conceptual) **Dimensionality reduction:** Principal Component Analysis (PCA) (conceptual).

**Feature selection techniques:** correlation analysis for redundancy removal, Multicollinearity and heatmap analysis, tree-based feature importance for identifying influential features (Including small data Numerical on Information Gain and Gini Index).

**Activity Assignment**

Identify a mechanical system dataset and propose feature extraction and feature selection strategies with justification.

<b>Unit II</b>	<b>Machine Learning Algorithms – Classification, Regression and Clustering</b>	<b>(08 Hours)</b>
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**Learning Focus:**

*Selecting appropriate ML algorithms based on mechanical problem characteristics.*

**Classification Algorithms:** Decision Trees, Random Forest, XGBoost, Support Vector Machines (conceptual), Logistic Regression, Naïve Bayes classifier (including Numerical)

**Regression Algorithms:** Linear and Polynomial Regression, Regularized regression: Ridge and Lasso (conceptual understanding)

**Clustering Algorithms:** k-Means clustering, DBSCAN for anomaly and fault detection (conceptual)

**Algorithm selection concepts:** bias–variance trade-off, effect of noise and dataset size, suitability of algorithms for mechanical engineering problem.

**Activity Assignment**

Select appropriate ML algorithm for classification, Linear Regression on a small mechanical dataset.

<b>Unit III</b>	<b>Development of ML Models and Performance Evaluation</b>	<b>(08 Hours)</b>
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**Learning Focus:**

*Building reliable ML models and interpreting results from an engineering perspective.*

**Machine learning model development pipeline:** problem identification and formulation, data preprocessing, feature engineering, model training, testing and validation

**Performance evaluation metrics: Classification:** accuracy, precision, recall, F1-score, confusion matrix; Type I and Type II errors and their impact on mechanical systems; **Regression:** MAE, MSE, RMSE, R<sup>2</sup>

**Model performance improvement techniques:** overfitting and underfitting, Bias–variance diagnostics, cross-validation, feature scaling and normalization, regularization techniques (L1, L2); Introduction to hyperparameter tuning (conceptual); Deployment of Model and challenges (conceptual).

**Activity Assignment**

Develop an ML model for a mechanical problem and improve performance using at least two tuning techniques.

**Unit IV      Reinforcement Learning, Deep Learning and Advanced AIML      (10 Hours)**

**Learning Focus:**

*Understanding modern AI technologies used in intelligent and autonomous mechanical systems.*

**Reinforcement Learning fundamentals:** Basic Elements of RL, Markov Decision Process (Conceptual), Exploration vs exploitation, Types of RL - Q-learning and SARSA, DQN, Applications in robotic path planning.

**Deep Learning:** Introduction to Artificial Neural Networks and Deep Neural Networks, **Convolutional Neural Networks (CNN):** architecture and concept of CNN, Applications in crack detection and surface defect inspection, Time-series deep learning: LSTM overview and limitations, introduction to attention mechanism and transformer models (awareness level).

**Generative AI overview:** autoencoders for anomaly detection, synthetic data generation, Generative Adversarial Networks (GANs).

**Agentic AI in Mechanical Engineering: Digital twins and Industry 5.0:** human - AI collaboration in mechanical systems (conceptual).

**Activity Assignment**

- 1) CNN-based crack classification/detection
- 2) RL-based HVAC energy optimization/Robot path optimization

**Learning Resources:**

**Text Books**



1. *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow* by Aurélien Géron (Best for practical code alignment).
2. *Artificial Intelligence: A Modern Approach* by Stuart Russell and Peter Norvig (The "Bible" of AI concepts).
3. *Machine Learning for Engineering and Science Applications* (Swayam/NPTEL Textbook).

#### Reference Books:

16. *The Hundred-Page Machine Learning Book* by Andriy Burkov (Excellent for quick concept revision).
17. *Python Machine Learning* by Sebastian Raschka (Great for the programming aspect).
18. *AI and Machine Learning for Mechanical and Electrical Engineering* (Routledge/CRC Press).

#### e-resources:

1. **Coursera:** *AI for Mechanical Engineers Specialization* (University of Michigan).
2. **Swayam/NPTEL:** *Machine Learning for Engineering and Science Applications* (IIT Madras).
3. **Coursera:** *Machine Learning Specialization* by Andrew Ng (Foundational for all engineering students).

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<b>Department:</b> Second Year B.Tech. (2025 Pattern)		<b>Sem: IV</b>
<b>Name of Course:</b> <a href="#">OEC</a>		

Course Code	Course Name	Course Type
OEC-270-CVL	Biology for Engineers	OEC
OEC-271-COM	Critical Thinking and Problem Solving	OEC
OEC-272-ETC	Financial management	OEC
OEC-273-ITT	Media, Society, and Digital Culture	OEC



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**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>				<b>Sem: IV</b>		
<b>Course Code: VSEC-257-MEC</b>			<b>Name of Course: Workshop Practice</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:01</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
-	2	-		-	01	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total Marks
-	-	25	-	-		25
<b>Pre-requisites Courses:</b>						
Manufacturing Processes, Manufacturing Practice Workshop, Engineering Physics, Chemistry, Engineering Graphics, Engineering Materials and Metallurgy.						
<b>Course Objectives:</b>						
<ul style="list-style-type: none"> <li>• <b>To UNDERSTAND</b> the safety standards and safety measures used in the various sections of a Mechanical Workshop.</li> <li>• <b>To UNDERSTAND</b> the sequence of machining operations for production of an assembly job, while selecting appropriate materials and processes to meet functional and assembly requirements</li> <li>• <b>To UNDERSTAND</b> the surface finish and welding symbols to enhance design accuracy and manufacturability.</li> <li>• <b>To UNDERSTAND</b> the important steps in casting / forging process, also study the defects in cast product.</li> <li>• <b>To UNDERSTAND</b> the process of sheet metal operations used in components manufacturing process.</li> </ul>						

**Course Outcomes:**

On completion of this Course, the Learners will be able to;

CO1	<b>INTERPRET and APPLY</b> the safety standards and safety measures used in the various sections of a Mechanical Workshop.
CO2	<b>PLAN and EXECUTE</b> the production of an assembly job by performing a sequence of machining operations while selecting appropriate materials and processes to meet functional and assembly requirements
CO3	<b>INTERPRET</b> surface finish and welding symbols to enhance design accuracy and manufacturability.
CO4	<b>ANALYZE</b> the important steps in casting / forging process, also study the defects in cast product.
CO5	<b>ANALYZE</b> the process of sheet metal operations used in components manufacturing process.

### List of Experiments

**Experiment No.1****(02 Hours)**

Study and analyze the safety standards and safety measures implemented in various sections of a mechanical workshop, prepare informative posters or comprehensive reports. Prepare a report/presentation on safety precautions in workshop/industry/power plants/service centers etc.

**Experiment No.2****(12 Hours)**

Production/machining of assembly job containing 2-3 components and suitable for assembly with standard components viz. nut, screw, bearing etc. consisting at least 4-5 operations from the following list:  
**1.** Raw material selection (Suitable for job in assignment) **2.** Raw material preparation like hacksaw cutting, etc. **3.** Rough turning on lathe/CNC **4.** Rough milling on a Milling machine or VMC viz. machining flats, gear cutting, keyways, etc. **5.** Drilling/tapping/threading **6.** Finishing on CNC/VMC (or combined operations from step 3 to 6 on CNC/VMC) **7.** Surface finishing using Grinding/Polishing/Buffing, etc. **8.** Surface treatment for corrosion/wear resistance, aesthetics, etc.

**Experiment No.3****(04 Hours)**

Fabrication of a component by joining two similar or dissimilar metals using TIG, MIG, or gas welding techniques. a) Comparative study of soldering, brazing & welding processes and respective applications b) Study of defects and case studies Exemplars / Practical Applications Automotive exhaust system fabrication, Aerospace frame assembly, Bicycle frame welding, Industrial piping and tubing fabrication, Custom metal furniture manufacturing

**Experiment No.4**

**(04 Hours)**

1. Manufacturing one engineering component using casting/forging in available workshop facilities of any engineering material like wax, tin, etc.

**OR**

1. Observe and demonstrate the manufacturing processes of castings and forgings during an industrial visit. 2. Casting considerations, study of defects in the cast product.

3. Demonstration of defects/temperature distributions using suitable mold flow analysis or equivalent simulations.

4. Industrial visit report in case of demonstration

**Experiment No.5**

**(04 Hours)**

1. Calculation on sheet metal layout, finishing process of sheet metal parts. 2. Manufacture a simple component using a press machine involving operations such as punching, blanking, bending, and shearing, using any suitable engineering material. OR 2. Observe and demonstrate the manufacturing processes of sheet metal components during an industrial visit.

**Self-Learning Exercise**

**(02 Hours)**

Self-study – Students will choose an engineering-related domestic product composed of at least 4–5 components and prepare detailed material selection and manufacturing plans, considering a broad range of materials including ferrous and non-ferrous metals, as well as non-metallic materials.

\* Students are required to prepare a brief report summarizing the processes studied throughout the course and providing a cost analysis related to the selected project. Students are expected to select available products viz. i. Domestic products viz. Oven/Microwave/Blender/Cooker/Kitchen Sink, Kettle, etc. ii. Robotic floor cleaner, Electric razors, etc. iii. Ceiling fans/table fan/exhaust fans, etc.

\*\*\*Note: Students can choose engineering products of their interest consisting of 4-5 components manufactured by variety of manufacturing processes and materials.



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



**Class: Second Year Engineering (2025 Pattern)** **Sem: IV**

**Course Code: VSEC-258-MEC** **Name of Course: Data Science and Artificial Intelligence & Machine Learning Laboratory**

<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>		
Lecture	Practical	Tutorial	Lecture	Practical	Tutorial
-	2	-	-	1	-

<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
-	-	25	-	-		25

**Pre-requisites:**  
Probability & Statistics, Basic language (Python) Programming

**Course Objectives: students shall,**

6. Perform basic data handling, visualization, and preprocessing for mechanical engineering datasets.
7. Implement feature extraction and selection techniques using engineering intuition.
8. Apply machine learning algorithms for classification, regression, and clustering problems.
9. Evaluate and improve machine learning model performance using suitable metrics.
10. Gain hands-on exposure to AI-based intelligent mechanical systems through guided experiments and open ended assignments.

**Course Outcomes:**  
After completion of this Course, the Learners will be able to;

CO1	<b>Preprocess</b> the acquired mechanical engineering data for ML applications (Apply)
CO2	<b>Apply</b> Feature Extraction and relevant features selection techniques for mechanical dataset. (Apply)
CO3	<b>Implement</b> ML algorithms for mechanical engineering problems (Apply)
CO4	<b>Evaluate</b> performance of developed ML model and interpret results (Evaluate)
CO5	<b>Develop</b> RL and DL Models for mechanical engineering problems (Create)

**Course Content**

**List of Practical Experiments**

**REVISION SESSION:** *Introduction to python IDE, revision - Basics of Python programming*

**EXPERIMENT 1:** Data Acquisition for Mechanical Engineering, Understanding & Preprocessing the dataset

<b>EXPERIMENT 2:</b> Statistical Feature Extraction from Mechanical Data
<b>EXPERIMENT 3:</b> Dimensionality Reduction using PCA
<b>EXPERIMENT 4:</b> Feature Selection using suitable Techniques
<b>EXPERIMENT 5:</b> Splitting Dataset into training and testing dataset and selecting suitable model
<b>EXPERIMENT 6:</b> Development of Classification Model and Evaluate performance
<b>EXPERIMENT 7:</b> Development of Regression Model and Evaluate performance
<b>EXPERIMENT 8:</b> CNN-Based Image Classification
<b>EXPERIMENT 9:</b> Reinforcement Learning Conceptual Implementation in Robot path planning (grid world Problem)
<p><b>Self-Study - Open-Ended Assignment: (to be performed by students independently)</b></p> <p><b>Reference Examples:</b> (Students can also select any other problem statement and relevant dataset than following from mechanical engineering domain)</p> <ul style="list-style-type: none"> <li>● Predictive maintenance system</li> <li>● machine health prediction</li> <li>● Intelligent quality inspection system</li> <li>● Energy optimization system</li> </ul> <p><b>Expected deliverable outcomes:</b></p> <ul style="list-style-type: none"> <li>● Identify and Frame problem statement</li> <li>● Dataset description</li> <li>● Model selection justification</li> <li>● Performance evaluation (expected more than 80 %)</li> <li>● Engineering inference</li> </ul> <p><b>Model Deployment – (optional)</b></p> <ul style="list-style-type: none"> <li>● Model versioning</li> <li>● Training vs inference</li> <li>● Concept of Docker, cloud ML platforms</li> </ul>
<b>References:</b>
<b>Text Books:</b>
<ol style="list-style-type: none"> <li>1. Aurélien Géron, <i>Hands-On Machine Learning with Scikit-Learn, Keras &amp; TensorFlow</i>, O’Reilly.</li> <li>2. Jake VanderPlas, <i>Python Data Science Handbook</i>, O’Reilly.</li> </ol>
<b>Reference Books:</b>
<ol style="list-style-type: none"> <li>1. Pradeep K. Giri, <i>Machine Learning for Mechanical Engineers</i>, CRC Press.</li> <li>2. Sebastian Raschka and Vahid Mirjalili, <i>Python Machine Learning</i>, Packt.</li> </ol>
<b>MOOCs and Online Resources:</b>

NPTEL and Coursera courses on Machine Learning and Data Science; MATLAB Academy.

Data may be obtained from open repositories such as UCI Machine Learning Repository, Kaggle, industry case studies, simulation tools (CFD/FEA), and instructor-prepared datasets.

### **PR Examination**

3. Learners shall maintain laboratory manual and assignment book
4. Learners will perform any PR allocated during exam from the above list.
5. Learners can use **Recommended Software Tools:** Python (Anaconda, Jupyter Notebook / Spyder), Google Colab (need internet access), MATLAB (optional)
6. Learners will be evaluated based on following rubrics

### **Practical Examination Scheme (25 Marks)**

<b>Component</b>	<b>Marks</b>
Execution of Assigned Experiment	10
Output, Results & Interpretation	5
Viva-Voce (Conceptual Understanding)	5
Record / Journal	5



**Pimpri Chinchwad Education Trust's**  
Pimpri Chinchwad College of Engineering and Research, Ravet, Pune  
**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>					<b>Sem: III</b>	
<b>Course Code: AEC-259-MEC</b>			<b>Name of Course: Modern Indian Language</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
2				2		
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
-	-	-	-	50		50
<b>Pre-requisites:</b>						
१. प्रगत भाषिक कौशल्यांची क्षमता विकसित करणे. २. प्रसारमाध्यमांतील संज्ञापनाचे स्वरूप आणि स्थान स्पष्ट करणे. ३. व्यक्तिमत्त्व विकास आणि भाषा यांमधील सहसंबंध स्पष्ट करणे. ४. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे यांतील परस्पर संबंध स्पष्ट करणे. ५. प्रसारमाध्यमांसाठी लेखनक्षमता विकसित करणे.						
<b>Course Content</b>						
<b>Unit I</b>						
१. भाषा आणि व्यक्तिमत्त्व विकास : सहसंबंध २. लोकशाहीतील जीवनव्यवहार आणि प्रसारमाध्यमे						
<b>Unit II</b>	<b>Digital Marketing Terminology</b>					

प्रसारमाध्यमांसाठी लेखन

१. वृत्तपत्रासाठी बातमी लेखन आणि मुद्रितशोधन
२. नभोवाणीसाठी भाषणाचे साहित्यलेखन
३. दूरचित्रवाणीसाठी माहितीपटासाठी संहितालेखन

### Unit III

भाषा, जीवनव्यवहार आणि नवमाध्यमे

१. भाषा, जीवनव्यवहार आणि नवमाध्यमे, समाजमाध्यमे
२. नवमाध्यमे आणि समाजमाध्यमांचे प्रकार :
  - ब्लॉग
  - फेसबुक
  - ट्विटर
३. नवमाध्यमे आणि समाजमाध्यमांबाबत साक्षरता, दक्षता, वापर आणि परिणाम

### Unit IV

लेखनाचे प्रकार

१. वेबसाईट, ब्लॉग आणि ट्विटर साठी लेखन
२. व्यावसायिक पत्रव्यवहार

### Learning Resources

संदर्भ ग्रंथ / पुस्तक

१. सायबर संस्कृती – डॉ. रमेश इरखेडे
२. उपयोजित मराठी –संपादक : डॉ. केतकी मोडक, संतोष शेणई, सुजाता शेणई
३. ओळख माहिती तंत्रज्ञानाची –रटमोथी जे. ओ. शिलअरी
४. संगणक- अच्युत गोडबोले, मौज प्रकाशन, मुंबई
५. इंटरनेट – डॉ. प्रबोध चौबे, मनोरमा प्रकाशन, मुंबई
६. व्यावहारिक मराठी –डॉ. ल. रा. नसीराबादकर, फडके प्रकाशन, कोल्हापूर
७. आधुनिक माहिती तंत्रज्ञानाच्या विश्वात - शिक्रापुरकर दीपक, मराठे उज्ज्वल, उत्कर्ष प्रकाश

**Guidelines for Ability Enhancement Courses - Modern Indian Language (Marathi)**

**Term Work Evaluation**

1. The subject teacher should frame a minimum 08 assignments covering all four units.
2. They can identify students depending on the degree of difficulty in understanding the Marathi language and frame the assignments accordingly.

### **Suggested List of Assignments**

- 1. "**Samvad Sadara Kara**" (Present a Dialogue): Role-Playing Everyday Scenarios: Objective is to practice conversational Marathi, understanding social cues. In pairs or small groups, students create and perform a short dialogue based on a given scenario.
- 2. Read a daily newspaper column (Sports, political, finance, editorial, education, international news etc) in the daily Marathi newspapers, summarize and present in the practical. A summary should be added as part of the journal.
- 3. **Creative writing:** Write blogs and posts on social media upto 200 words on recent development in their field of study
- 4. "**Mala He Sangayche Aahe**" (I Want to Say This): Students show the object and describe it to the class in Marathi. They should mention its color, size, use, why it's important to them, etc.
- 5. **Professional letter/report writing**
  - a. Write a letter to the principal/director for organizing the NSS camp in the nearby village. Preparation of the budget, permission letters, and report submission to the University
  - b. Write a letter of sponsorship for an internship to any organization.
- 6. **Book Review** – Students are expected to read any novel, fiction, or literature book of their choice and write a review on social media of their choice.
- 7. **Participation in Competitions** (in college/outside the college), debate, declamation, elocution – A Report should be submitted
- 8. **Group Activity:** Road show, skit play, one-act play
- 9. **Participation in One-Act-Play** - Participation in Purushottam karandam, Firodia karandak, Dajikaka Gadgil Karandak, and Shreetej Karandak.
- 10. **Marathi Film Review** – Watch the Marathi movie widely available on an OTT (Over-The-Top) platform, broadcaster on television, or available on YouTube, and write a review



**Pimpri Chinchwad Education Trust's**  
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**Department of Mechanical Engineering**



<b>Class: Second Year Engineering (2025 Pattern)</b>				<b>Sem. : IV</b>		
<b>Course Code: EMC-260-MEC</b>				<b>Name of Course: Principles of Economics</b>		
<b>Teaching Scheme (Hrs/week):</b>				<b>Credits:</b>		
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
2	-	-		1	-	-
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
-	-	-	25	25		50
<b>Pre-requisites:</b>						
<ul style="list-style-type: none"> <li>• Knowledge of company Operations, Design and Manufacturing, Basic principles and practices of Accounting and Budgeting, Analytical and Logical Thinking</li> </ul>						

**Course Objectives:**

1. **To INTRODUCE** the fundamental principles of economics and finance relevant to core engineering industries.
2. **To DEVELOP** an understanding of basic financial management concepts and enhance analytical skills for interpreting financial statements.
3. **To FAMILIARIZE** students with key financial terminologies and enable them to prepare and analyze various financial statements.
4. **To EXPLORE** the financial dimensions of national and international business environments and their implications on engineering decisions.

**Course Outcomes:**

On completion of this Course, the Learners will be able to;

CO1	<b>DEMONSTRATE</b> an understanding of the business environment, fundamental economic concepts, and the demand-supply framework
CO2	<b>COMPREHEND</b> accounting principles and effectively <b>ANALYSE</b> financial statements through ratio analysis.
CO3	<b>INTERPRET</b> key financial terms and ratios, and competently <b>PREPARE</b> various types of financial statements.
CO4	<b>UNDERSTAND</b> the structure and functioning of national and international trade systems and their financial implications

**Course Content**

<b>Unit I</b>	<b>Introduction to Business Economics and Finance</b>	<b>(08 Hours)</b>
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**Business Economics Basics:** Definition, scope, and role in engineering, Microeconomics vs. Macroeconomics Demand, Supply & Market Equilibrium: Laws of demand & supply, elasticity, market forces.

**Cost Concepts & Decision Making:** Fixed, variable, marginal, sunk costs, Break-even analysis, profit maximization.

**Basics of Financial Management:** Financial statements (Balance Sheet, Income Statement, Cash Flow), Financial planning & decision-making for engineers.

<b>Unit II</b>	<b>Cost Accounting</b>	<b>(06 Hours)</b>
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**Introduction:** Importance and difference between cost and financial accounting.

**Cost Accounting:** Types of costs: Fixed, variable, direct, indirect.

**Costing methods:** Job costing, process costing, & budgeting for cost control.

**Engineering Applications:** Cost estimation, project budgeting, financial decision-making

<b>Unit III</b>	<b>Financial Accounting and Budget</b>	<b>(08 Hours)</b>
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**Introduction:** Importance of financial accounting.

**Financial Accounting:** Key financial statements: Balance Sheet, Income Statement, Cash Flow Statement. **Key**

**Financial Terms:** Revenue, Cost of Goods Sold (COGS), Operating Expenses like rent, utilities, salaries. Depreciation in asset value over time, Capital Expenditure. **Financial**

**ratios:** Profitability, liquidity, efficiency.

**Introduction to Budget:** Definition, purpose, and importance in engineering and business.

**Types of budgets:** Fixed, flexible, zero-based, capital, and operational budgets.

Unit IV	National and International Business and Finance	(06 Hours)
<p>National Income (National Income Accounting – GDP, GNP, Real and Nominal Income) Fiscal Policy (Government Revenue, Expenditure and Financing). Concept of globalization, factors influencing globalization, concept of international business and motives, international trade, institutional framework in international business, the significance of foreign trade policy, export-import procedures.</p>		
<p></p>		
<p><b>Term work :</b></p> <p><b>Assignment (Any Five):</b></p> <ol style="list-style-type: none"> <li>1. Case study on micro economics business environment.</li> <li>2. Analyze demand and supply fluctuations for any business of your choice and Propose pricing or inventory strategies based on findings.</li> <li>3. List and classify the different types of costs involved in manufacturing a mechanical part.</li> <li>4. Calculate the cost per unit by considering material cost, labor, and overheads of any mechanical element. Also estimate the total cost to produce 500 units.</li> <li>5. For the nearby industry, using fixed and variable costs, calculate the break-even point for their production setup for any one item and suggest how many items must be sold to cover all costs.</li> <li>6. Prepare a financial statement of any organization.</li> <li>7. Choose a company or firm and analyze its latest financial statements.</li> <li>8. Prepare a balance sheet for any engineering organization.</li> <li>9. Choose any industry sector and research how GDP growth or decline has affected investments and job opportunities in this sector.</li> <li>10. Visit an official economic data website (e.g., World Bank, IMF, National Bureau of Statistics) and collect the latest GDP and GNP data of our country. Compare the values and explain your findings about the country's economy.</li> </ol>		
<p><b>Learning Resources</b></p>		

## Text Books

1. Hay, Donald A. and Derek J. Morris. Industrial Economics and Organization: Theory and Evidence, 2nd Edition (Oxford: Oxford University Press), 1991.
2. Lall, Sanjaya. Competitiveness, Technology and Skills (Cheltenham: Edward Elgar), 2001.
3. Scherer, F. M. and D. Ross. Industrial Market Structure and Economic Performance, 3rd Edition (Houghton: Mifflin), 1990.
4. Financial Accounting”, Dr. Kaustubh Sontakke [Himalaya Publishing House]
5. Chandra, Prasanna (2004). Financial Management: Theory and Practice. New Delhi: TATA McGraw Hill

### Reference Books:

1. Accounting Theory & Practice Prof Jawahar Lal [Himalaya Publishing House]
2. Brearley, Richard A. and Myers, Stewart C. (1988). "Principles of Corporate Finance", New Delhi: McGraw Hill
3. Engineering Economics, Tara Chand, Nem Chand and Brothers, Roorkee
4. Engineering Economy, Thuesen, G. J. and Fabrycky, W. J., Prentice Hall of India Pvt. Ltd.
5. Mechanical Estimating and Costing, T. R. Banga and S. C. Sharma, Khanna Publishers, Delhi
6. Industrial Organization and Engineering Economics, T. R. Banga and S. C. Sharma, Khanna Publishers, New Delhi
7. Mechanical Estimating and Costing, D. Kannappan et al., Tata McGraw Hill Publishing Company Ltd., New Delhi
8. A Text Book of Mechanical Estimating and Costing, O. P. Khanna, Dhanpat Rai Publications Pvt. Ltd., New Delhi
9. Industrial Engineering and Management, O. P. Khanna, Dhanpat Rai and Sons, New Delhi
10. Financial Management, I. M. Pandey, Vikas Publishing House Pvt. Ltd., New Delhi
11. Engineering Economics, James L. Riggs, David D. Bedworth and Sabah U. Randhawa, Tata McGraw Hill Publishing Co. Ltd., New Delhi
12. Engineering Economy, Paul DeGarmo, Macmillan International Inc., New York

### MOOC / NPTEL/ YouTube Links

1. [https://onlinecourses.nptel.ac.in/noc22\\_ma44/](https://onlinecourses.nptel.ac.in/noc22_ma44/)
2. [https://onlinecourses.nptel.ac.in/noc22\\_hs72/](https://onlinecourses.nptel.ac.in/noc22_hs72/)
3. [https://onlinecourses.nptel.ac.in/noc22\\_mg63/](https://onlinecourses.nptel.ac.in/noc22_mg63/)



**Pimpri Chinchwad Education Trust's**  
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**Department of Mechanical Engineering**



**Class: Second Year Engineering (2025 Pattern)** **Sem: IV**

**Course Code: VEC-261-MEC** **Name of Course: Environmental study**

<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>		
Lecture	Practical	Tutorial	Lecture	Practical	Tutorial
2	-	-	2	-	-

**Examination Scheme:**

FA	SA	PR	OR	TW	Total
25	25	-	-		50

**Pre-requisites:**

Knowledge of Chemistry, Biology and Earth Sciences

**Course Objectives:**

By the end of the course, students should be able to;

1. To INTRODUCE students to the fundamental concepts of environmental science, including the relationship between natural systems and human activities, concept of sustainable development and its significance in the day today life.
2. To FOSTER critical thinking skills regarding environmental issues such as climate change, pollution, resource depletion, deforestation, and habitat destruction.
3. To EVALUATE the role of renewable energy, green technologies, and conservation efforts in promoting sustainability.
4. To ENCOURAGE students to apply their knowledge to real-world environmental challenges and sustainable development problems, through case studies, projects, and fieldwork.

**Course Outcomes:**

On completion of this Course, the Learners will be able to;

1	To UNDERSTAND and EVALUATE the interdependence between environment, ecology, and natural resources, assess the impact of air pollution and ecological footprints, and ANALYZE the dynamic interactions between socio-economic systems.
2	To IDENTIFY various water sources, ANALYZE issues related to water availability and quality, and APPLY sustainable water management practices to support environmental conservation and meet societal needs.

3	To UNDERSTAND the principles of sustainability, EVALUATE environmental, social, and economic challenges, and APPLY practical sustainability practices to promote responsible resource use.
4	To ANALYZE the principles of sustainable habitat design and sustainable energy systems, and APPLY environmentally responsible solutions such as green buildings, energy-efficient technologies, and renewable energy sources to promote sustainable living and reduce ecological impact.
<b>Course Content</b>	
<b>Unit I</b>	<b>Introduction to ESD</b> <span style="float: right;"><b>(06 Hours)</b></span>
<p>Environment, ecology, natural resources, Air pollution, Ecological footprint, Interactions between socio economic systems and eco-systems, Human health and the environment</p> <p>Real World Assignment</p> <p>1) Weather survey of your region of last 10 years</p> <p>2) Air pollution and its effect on human health.</p>	
<b>Unit II</b>	<b>Water Sources and Management</b> <span style="float: right;"><b>(06 Hours)</b></span>
<p>Hydrological cycle and water resources- surface, ground, desalination, Water pollution, Integrated water resources management, Usage and efficiency</p> <p>Real World Assignment</p> <p>Development of greywater recycling system Exemplars</p>	
<b>Unit III</b>	<b>Sustainability and Sustainability Practices</b> <span style="float: right;"><b>(06Hours)</b></span>
<p>Sustainability- concept, needs and challenges-economic, social, Aspects of sustainability- from unsustainability to sustainability, Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Zero waste concept, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment.</p> <p>Real World Assignment</p> <p>1. Effect of global warming on human health</p> <p>2. Indian government policies for sustainable development.</p>	
<b>Unit IV</b>	<b>Sustainable Habitat and Sustainable Energy</b> <span style="float: right;"><b>(06 Hours)</b></span>

Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports,  
Sustainable energy: Non-conventional Sources, Energy Cycles- carbon cycle, emission and sequestration  
Real World Assignment  
Calculation of carbon foot print.

### Learning Resources

1. P. D. Sharma; Ecology and Environment; Volume 22 of Popular Biology Text Books Rastogi Publications, 2007
2. D.D. Mishra-Fundamental of Environmental Studies, S Chand & Co Ltd (1 December 2010).
3. M. Dayal- Renewable Energy; Environment and Development, Konark Pub.Pvt.Ltd.
4. Fulekar; Fundamental of Air pollution. 4th Edition, Daniel Vallero, Academic Press, Elsevier .
5. Ambasht R.S.; Environment and Pollution: An Ecological Approach, CBS Publishers & Distributors; 1st Ed. edition 2014

### Reference Books:

1. Stanley E. Manahan; Fundamentals of Environmental Chemistry; Publisher: CRC Press 1993
2. E.D. Enger, B. E. Smith; Environmental Sciences-A study of Inter relationships, WCB Publication.
3. Kathy Wilson Peacock; Natural Resources and Sustainable Development.
4. Elizabeth Berner, Robert Berner; Global Environment - Water, Air, and Geochemical Cycles, Princeton University Press; 2nd Revised edition edition 2012.
5. Bruce Rittman, Perry L. McCarty. Environmental Biotechnology: Principles and Applications, 2nd Edition, McGraw-Hill, 2000.
6. Andrew Dessler, Introduction to Modern Climate Change, 2nd Edition, Cambridge University Press, 2015.
7. Bruce Glavovic, Mick Kelly, Robert Kay, Ailbhe Travers, Climate Change and the Coast: Building Resilient Communities, CRC Press, 2015.

### MOOC / NPTEL/ YouTube Links: -

1. Environmental and Sustainability Studies - Raquel Friedmann - YouTube
2. Lecture 1 - Sustainable Development Concepts – YouTube
3. Climate Change - A Short Film [4K]



**Pimpri Chinchwad Education Trust's**  
**Pimpri Chinchwad College of Engineering and Research, Ravet, Pune**  
**Department of Mechanical Engineering**



<b>Department: Second Year Engineering (2025 Pattern)</b>					<b>Sem: IV</b>	
<b>Course Code: AC-262-MEC</b>			<b>Name of Course: Audit course (Foreign Language-II)</b>			
<b>Teaching Scheme (Hrs/week):</b>			<b>Credits:</b>			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial
2				0		
<b>Examination Scheme:</b>						
FA	SA	PR	OR	TW		Total
			-	-		NA
<b>Pre-requisites:</b>						
English language						
<b>Course Objective:</b>						
<ul style="list-style-type: none"> <li>To provide a strong foundation in the German language at the A2 level, emphasizing grammar, vocabulary, and communication skills.</li> <li>To enable students to engage in basic conversations, write simple texts, and understand fundamental grammar concepts.</li> <li>To prepare students for self-employment opportunities, such as freelance translation or interpretation services.</li> </ul>						
<b>Course Outcomes:</b>						
On completion of this Course, the Learners will be able to;						
1	Learn how to Read, write, understand and converse in Advanced Beginners level of German language, understand the main messages in simple short instructions, messages, newspaper texts, etc. Can understand the main messages in simple business letters and short texts. Can understand basic information and instructions in simple business letters and short texts					
2	Write short texts on familiar topics and everyday routine activities. Can fill in forms with personal and professional information. Can describe in simple terms work processes and activities, etc					

3	Understand and comment on a text or given passage, and answer the questions pertaining to the passage
4	Understand contextual based conversations and reply to speaker by using the suitable vocabulary and advanced elementary grammar of German
5	Initiate and maintain short conversations on everyday topics and present basic information on familiar topics. Can formulate plans and intentions (work processes), express attitudes and preferences and give reasons for them in a simple way.

### Course Content

Week 1	Introduction to German language-A2	(02 Hours)
Cooking and cuisine, eating habits, expressing feelings / Grammar : clauses with 'because', reflexive verbs, possessive articles with dative.		
Week 2	German language-A2	(02 Hours)
School and after, subjects, school types / Grammar : past tense of modal verbs, changing prepositions – position and movement.		
Week 3	German language-A2	(02 Hours)
Media in daily life, film / Grammar : comparative and superlative, clauses with 'that'.		
Week 4	German language-A2	(02 Hours)
Festivals and events, invitations and responses / Grammar : clauses with 'if', adjective declension.		
Week 5	German language-A2	(02 Hours)
Professions, work, train travel / Grammar : adjective declension, the verb 'werden'.		
Week 6	German language-A2	(02 Hours)
Public transport, cars, getting to work / Grammar: clauses and prepositions be.		
Week 7	German language-A2	(02 Hours)
Learning, presentations, exams / Grammar: subjunctive, genitive.		
Week 8	German language-A2	(02 Hours)

Sports, fans / Grammar: clauses, verbs with dative and accusative.		
<b>Week 9</b>	<b>German language-A2</b>	<b>(02 Hours)</b>
Living, shifting, conflicts at home, pets / Grammar : subjunctive, ‘als’ and ‘wenn’.		
<b>Week 10</b>	<b>German language-A2</b>	<b>(02 Hours)</b>
Music, describing pictures / Grammar: interrogative ‘what kind of’ in definite pronouns, relative clauses.		
<b>Week 11</b>	<b>German language-A2</b>	<b>(02 Hours)</b>
Time / Grammar: subjunctive, verbs with prepositions, W questions with prepositions.		
<b>Week 12</b>	<b>German language-A2</b>	<b>(02 Hours)</b>
Festivals, stereotypes / Grammar: clauses, relative clauses.		
<b>Learning Resources</b>		
<b>Text Books:</b>		
1 Prescribed Textbook: NETZWERK Deutsch als Fremdsprache A2 (Goyal, New Delhi, 2015)		
2 Schulz-Griesbach: Deutsch als Fremdsprache. Grundstufe in einem Band (for Grammar)		
<b>e-resources:</b>		
FACTS ABOUT GERMANY <a href="https://www.tatsachen-ueber-deutschland.de/en">https://www.tatsachen-ueber-deutschland.de/en</a>		
ONLINE GERMAN-ENGLISH DICTIONARY		
<a href="http://www.leo.org">www.leo.org</a>		
PRACTICE MATERIAL		
<a href="https://www.goethe.de/en/spr/kup/prf/prf/gzsd2/ub2.html">https://www.goethe.de/en/spr/kup/prf/prf/gzsd2/ub2.html</a>		
<a href="http://www.deutschkurse-passau.de/JM/images/stories/SKRIPTEN/a2_skript_gr.pdf">http://www.deutschkurse-passau.de/JM/images/stories/SKRIPTEN/a2_skript_gr.pdf</a>		
<a href="https://www.schubert-verlag.de/aufgaben/uebungen_a2/a2_uebungen_index.htm">https://www.schubert-verlag.de/aufgaben/uebungen_a2/a2_uebungen_index.htm</a>		