

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)



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

For
Second Year - Computer 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)




Chairman, Academic Council
PCET's Pimpri Chinchwad College of
Engineering and Research, Ravet,
Pune - 412 101

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:

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.

EOMS Policy:

We, at PCCOE&R, are committed to:

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

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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.

- i. The medium of instruction throughout the programme shall be English except where it is explicitly mentioned as Regional.
- ii. 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.
- iii. The commencement of first semester for B. Tech shall be governed by the admission schedule declared by DTE, Government of Maharashtra.
- iv. 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).
- v. 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'.
- vi. Academic Calendar shall be prepared and published before the commencement of every Academic year.
- vii. Evaluation norms shall be strictly followed to maintain quality of engineering education. Examination system shall be transparent and governed by Rules and Regulations.
- viii. 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.
- ix. 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:

i. 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.

ii. 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.

iii. 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

Sr. No	Academic Department	Programme Offered	Sanctioned Intake
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.

- i. 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.
- ii. 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.
- iii. 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 5th semester (i.e. 3rd 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 7th semester (i.e. 4th 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.

- iv. 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.
- v. 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:

 - a) 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.
 - b) 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.
 - c) 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.
 - d) 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.
 - e) 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.

- i. The Academic Calendar shall be prepared by Dean Academics and approved by the AC / ASC.
- ii. 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.
- iii. The Academic Calendar shall be disseminated on the notice boards and website of the Institute.
- iv. The academic activities of the institute shall be monitored as per the Academic Calendar
- v. 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.
- vi. 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.

- vii. 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.
- viii. 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

6.1 Semester Registration:

- i. 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.
- ii. 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.
- iii. 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.
- iv. 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.
- v. 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.
- vi. 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.
- vii. 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.

6.2 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

6.3 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%.

- i. 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.
- ii. 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.
- iii. 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.
- iv. 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).
- v. The students will be informed about the attendance status periodically by the Institute notifying the percentage attendance on the notice board.

6.4 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.

6.5 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).

6.6 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.

- i. 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.
- ii. 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
 - a) who have the possibility to complete the prescribed program requirements within the time limits specified by the programme.
 - b) who do not have any outstanding dues /demand at the Institute / University level including tuition fees, any other fees library materials etc.

- iii. 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.
- iv. 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.
 - a. If any candidate is detained for any reason, the period of detention shall not be considered as a “break of study”.
 - b. It may be noted that the fees/charges once paid shall not be refunded.
 - c. 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.

6.7 DETENTION:

- i. A student shall be declared as Detained and shall not be permitted to attend the SA and Practical/Oral Exams if;
 - a. The student who has not attended minimum 75% of all conducted classes like Lectures, Tutorials, Laboratories, Workshops etc.
 - b. Incomplete term work and non-submission of laboratory journal.
- ii. Such students are expected to pay 100% fees of the year in which they are detained.
- iii. 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.

6.8 TERMINATION FROM THE PROGRAMME:

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

- i. Involved in ragging and in any illegal activity as per law defined by the governing authorities.
- ii. 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.
- iii. 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).

- iv. Under following circumstances student admission may be terminated from the programme if;
 - a. Students misbehave with faculty or staff.
 - b. Remain absent without any information for a period of one year.
 - c. 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.

7.1 Credit System:

- i. 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.
- ii. Credit structures for various courses with various combinations of theory/tutorial and Laboratory/Project/Seminar/Mini Project hours are given in Table 7.1.
- iii. 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
Credit = Theory hours + Tutorial hours + 0.5 (Laboratory hours)			

- iv. 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.

7.2 Components of Curriculum:

- i. The structure of curriculum for a programme and course syllabi shall be approved by AC on recommendation of respective BOS.
- ii. 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.
- iii. Curriculum shall have credit and audit (Non-Credit) courses.
- iv. 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.

Sr. No	Course Code	*Component of Curriculum
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

- v. Normally the number of courses in a semester shall not be more than six for theory and four for laboratory courses.
- vi. Audit courses in the curriculum shall offer students to understand the way their expertise/ domain knowledge can be utilized for developing core engineering knowledge.
- vii. 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.
- viii. 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.
 - ix. 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:

- i. To get insights regarding student performance/abilities which helps to identify learning needs and take necessary actions for possible improvement.
- ii. To give feedback to the student about his level of understanding and abilities as per required Graduate Attributes (GAs).
- iii. To allow students to demonstrate their competence which they will practice in their professional career.
- iv. 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 OR	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.

8.1 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:

8.1.1 Formative Assessment (FA) Theory Courses:

- i. 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:
 - a. Formative Assessment 1 (FA 1) [Unit test]
 - b. 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.
 - c. Formative Assessment 1 (FA3) [Quiz]
- ii. Sum of the scores obtained in FA1, FA2 and FA3 shall be considered for computing the final FA of a student in each course.

8.1.2 Internal Evaluation of Practical Term work

- i. 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
 - Attendance and participation in laboratory work.
 - Performance in Evaluation of understanding through viva voce, group discussions, quizzes, etc.
 - The quality of work as prescribed by the course instructor.
 - Timely Submission
 - Report through laboratory journals
- ii. 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.
- iii. Students shall be detained for incomplete Termwork and non-submission of laboratory journals and will require registering the course again.
- iv. 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.

8.1.3 Internal Evaluation of Project/Seminar/Internship:

- i. Project/Seminar Term work will be evaluated based on Reviews scheduled in the semester/s as mentioned in the Guidelines.
- ii. 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.

8.2 External Evaluation:

8.2.1 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:

- a. 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.
- b. Students seeking prior leave on account of
 1. Accident or severe illness leading to hospitalization, which disables the student from writing the examination.
 2. A calamity in the family (first relation Only-Parents, Grandparents and Siblings) barring the student from writing the examination.
- c. 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).

8.2.2 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.

- i. Final examination for laboratory courses will normally be held in the last week of conclusion of teaching as per Academic Calendar.
- ii. These oral/practical examinations will be conducted in the presence of an External Examiner appointed by competent authority.
- iii. 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.
- iv. Re-examination for practical/oral examinations shall be conducted before re-examination of theory courses.

8.2.3 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

9.1 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.

9.2 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.

9.3 Passing, A.T.K.T. and award of class

9.3.1 Rules of Passing

- i. Term work/Practical/Oral
To pass the Termwork/Practical/Oral the student has to earn a minimum of 40% marks in each head.
- ii. Theory Course head
 - a. 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).
 - b. 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:
 - i) continue their FA just by appearing for SA (Reappear)
 - ii) 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.
 - c. 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.

- iii. 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.

9.3.2 Rules of A.T.K.T.:

- i. A student can register for the third semester if he/she earns minimum 60% credits of the total of first and second semesters.
- ii. 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.
- iii. 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

10.1 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)

- i. 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).
- ii. 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

Reason	Letter Grade
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

- iii. 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.

10.2 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

$$SGPA = \frac{\sum_{i=1}^5 C1G1 + C2G2 + C3G3 + C4G4 + C5G5}{C1 + C2 + C3 + C4 + C5}$$

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

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

- i. Obtained eligibility certificate from the University.
- ii. Registered & passed all the prescribed courses & earned minimum credit requirement for the said degree.
- iii. Obtained $\text{CGPA} \geq 4.00$
- iv. Paid all the Institute dues and satisfied all the requirements prescribed.
- v. 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 2nd or 4th or 6th 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 2nd or 4th or 6th 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

- i. 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.
- ii. 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:

- a. Disruption of teaching, examination, administrative work, curricular or extracurricular activity, and any act likely to cause such disruption.
- b. Refusing to provide an identity card when demanded by any institute authority.
- c. Damaging or defacing the property inside or outside the institute campus.
- d. Engaging in any attempt at wrongful confinement of teachers, offices, employees and students of the institute.
- e. Use of abusive and derogatory slogans or intimidatory language or incitement of hatred and violence.
- f. 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 restraining, 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.)
- g. Eve teasing or disrespectful behavior to women or girl’s students.
- h. An assault upon, or intimidation of, or insulting behavior towards a teacher, officer, employee or student or any other person.
- i. Getting enrolled in more than one programme course of study simultaneously.
- j. Committing forgery, tampering with documents or records, identity cards, furnishing false certificate or false information.
- k. Organizing instant agitation/meetings without prior permission in the campus.
- l. Viewing/downloading obscene information/data, images and executable files, sending obscene mails/ messages via facebook / twitter/other social sites using institute servers.
- m. Sharing the login and passwords & other details of IT facilities provided to other students/outsideers.
- n. Consuming or possessing alcoholic drinks, dangerous drugs or other intoxicants in the institute campus.
- o. Possessing or using any weapons and firearms in the institute campus.
- p. Unauthorized occupation of a hostel, Accommodating guests or other persons in hostels without permission.
- q. Malpractice in examination.
- r. Indulging in anti-national activities contrary to the provisions of acts and laws enforced by the Government.
- s. Any other act which may be considered by the Director or the Discipline Committee to be an act of violation of discipline.

- iii. 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:
 - a. Written warning and information to the parents/guardian.
 - b. Imposition of fine ranging from Rs.500/- up to Rs.5000/-
 - c. Suspension from the Institute/Hostel/Mess/Library/ or availing of any other facility.
 - d. Suspension or cancellation of scholarships /fellowship or any financial assistance from any source.
 - e. Recover of loss caused to Institute property.
 - f. Debarring from participation in sports/NSS/student club.
 - g. Disqualifying from holding any representative position in the Class/institute / Hostel / Mess/Sports/ Clubs and in similar other bodies.
 - h. Disqualifying from appearing in placement and receiving any awards.
 - i. Expulsion from the Hostel/Mess/Library/Club/institute for a specified period by forfeiting fees.
 - j. Debarring from an examination.
 - k. Action as per Maharashtra anti-ragging act 1999.

- iv. 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:
 - a) Cancellation of the performance of the student in the course/s in which he/she was involved in malpractice.
 - b) Cancellation of the performance in that examination for all the courses.
 - c) Expulsion/termination from the institute if repeatedly involved.
 - d) Stoppage of scholarships/stipend.
 - e) Issuing warning.
 - f) 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.

14.1 Conduct during Examination:

i. Timing:

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

ii. Identity check-up:

- a. Students will not be allowed into the examination hall without presenting an appropriate photo identity card, Hall ticket issued by the Institute.
- b. Invigilators are responsible to ensure full compliance with such requirements.
- c. 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.

iii. Breaks:

- a. 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.
- b. 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.
- c. No student shall re-enter the examination hall after leaving it unless he/she was under approved supervision during the full period of absence.

iv. Question papers and answer sheets:

- a. 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.
- b. Even a blank answer sheet shall be handed over to the invigilator.
- c. Each answer sheet should contain details as mentioned on the front page.
- d. 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.

v. Other materials:

- a. Students should bring their own pencils, pens, erasers, rulers, non-programmable calculators, and any other tools required for the examination.
- b. 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.
- c. 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.
- d. Exchange of pens, pencils, calculators, study material, etc. is not permitted.
- e. 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.

vi. Disturbance:

- a. 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.
- b. 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.

vii. Miscellaneous:

- a. The students must ensure before they leave the examination hall that they have signed the attendance sheet.
- b. The students with medical problems will be provided Writer in the Examinations only subject to prior permission from the Dean Academics.
- c. The documentary proof along with recommendations of concerned HOD will be required. All such cases will be dealt with as per academic rules.
- d. If you suffer from language difficulties or any disabilities you can apply for an extension of the test time.
- e. Students are not allowed to wear a smart watch during the examination.
- f. 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

- i. 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.
- ii. 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.
- iii. 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.
- iv. 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 iii) emergent cases.

Annexure I

1) Formative Assessment Paper Format

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

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

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:

- deanacademics@pccoer.in
- examcell@pccoer.in
- registrar@pccoer.in
- 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

(An Autonomous Institute affiliated to Savitribai Phule Pune University)

Curriculum Structure and Syllabus

Second Year B. Tech.

Academic Year 2026–2027

Computer Engineering



PCCOER
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-
Computer Engineering) and Academic Council**



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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. Computer 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 (B. Tech.) programs in the AY 2027–28 and 2028–29, respectively.

Computer Engineering is a dynamic discipline that forms the foundation for the design, development, and application of computer systems and advanced computing technologies. This curriculum has been carefully structured to provide students with a strong understanding of the fundamental principles, theories, and practices of computer 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 computer 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. Vijay A. Kotkar
Chairman, Board of Studies
Chairman
BoS, Computer Engineering
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Pune - 412 101



Dr. Harish U. Tiwari
Chairman, Academic Council
Chairman, Academic Council
PCET's Pimpri Chinchwad College of
Engineering and Research, Ravet,
Pune - 412 101

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

Vision Mission of the Department

Vision:

To produce globally competent computer engineering professionals through technical excellence, innovative and research-driven learning, and ethical responsibility, fostering holistic development to meet industry, academic and societal expectations.

Mission:

1. Providing a rigorous, value-based curriculum and hands-on training that develops technically skilled and ethical professionals ready to meet global industry, academic and societal challenges.
2. Fostering a collaborative research culture that encourages innovation, critical thinking and creativity among students and faculty for solving real-world problems.
3. Promoting lifelong learning, leadership and teamwork skills that empower graduates to excel in multidisciplinary environments and contribute positively to society.

4. Program Specific Outcomes

A graduate of the Computer Engineering Program will demonstrate -

PSO1: Problem Solving Skills: The ability to design, develop, deploy, and evaluate computing systems and applications using open-ended programming environments and suitable engineering tools, technologies, and best practices.

PSO2: Professional Skills: The ability to understand, analyse, design and develop computer programs in the areas related to algorithms, system programming, web design, data analytics, internet of things, software management, networking and security.

PSO3: Successful Career and Entrepreneurship: The ability to demonstrate professional ethics, effective communication, teamwork, and leadership skills, along with a commitment to lifelong learning, enabling graduates to excel in industry roles, pursue higher education, contribute to entrepreneurial ventures, and generate IPR and high-quality engineering solutions.

5. Program Educational Objectives

PEO1: To equip graduates with strong computer engineering fundamentals, practical skills, and ethical responsibility to meet / address global industry, academic, and societal challenges.

PEO2: To imbibe innovative, research driven and critical thinking practices in graduates to develop creative solutions to real-world problems.

PEO3: To prepare graduates who will pursue lifelong learning and exhibit leadership, teamwork, and effective communication skills to excel in multidisciplinary environments and contribute to society.

6. Knowledge and Attitude Profile (WK)

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

- WK1 A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
- WK2 Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
- WK3 A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
- WK4 Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice 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)

S. Y. B. Tech. Computer Engineering Syllabus Structure

Level 5															
S.Y. B.Tech. Computer Engineering															
Semester III															
Course Code	Course Name	Course Type	Credits	Credit Scheme			Teaching Scheme (Hrs/Week)			Examination Scheme					Marks
				L	T	P	L	T	P	FA	SA	PR	OR	TW	
PCC-201-COM	Discrete Structures	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-202-COM	Data Structures	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-203-COM	Data Structures Laboratory	PCC	1	–	–	1	–	–	2	–	–	50	–	25	75
PCC-204-COM	Object Oriented Programming and Computer Graphics	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-205-COM	Object Oriented Programming and Computer Graphics Laboratory	PCC	1	–	–	1	–	–	2	–	–	25	–	25	50
MDM-206-COM	MDM-I* (Digital Electronics & Computer Organization)	MDM	2	2	–	–	2	–	–	50	50	–	–	–	100
MDM-207-COM	MDM-I* (Digital Electronics & Computer Organization Laboratory)	MDM	1	–	–	1	–	–	2	–	–	–	25	–	25
	Open Elective – I**	OEC	2	2	–	–	2	–	–	–	–	–	25	25	50
EEM-208-COM	Entrepreneurship Development	EEM	2	–	1	1	–	1	2	–	–	–	–	50	50
VEC-209-COM	Universal Human Values	VEC	2	2	–	–	2	–	–	25	25	–	–	–	50
ELC-210-COM	Web Technology	ELC	2	–	–	2	–	–	4	–	–	–	25	25	50
Total			22	15	1	6	15	1	12	225	225	75	75	150	750



Chairman

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Chairman, Academic Council
 PCET's Pimpri Chinchwad College of
 Engineering and Research, Ravet,
 Pune - 412 101

S. Y. B. Tech. Computer Engineering Syllabus Structure

Level 5															
S.Y. B.Tech. Computer Engineering															
Semester IV															
Course Code	Course Name	Course Type	Credits	Credit Scheme			Teaching Scheme (Hrs/Week)			Examination Scheme					Marks
				L	T	P	L	T	P	FA	SA	PR	OR	TW	
PCC-251-COM	Data Structures and Algorithms	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-252-COM	Data Structures and Algorithms Laboratory	PCC	1	–	–	1	–	–	2	–	–	50	–	–	50
PCC-253-COM	Software Engineering and Modelling	PCC	2	2	–	–	2	–	–	50	50	–	–	–	100
PCC-254-COM	Computer Network	PCC	2	2	–	–	2	–	–	50	50	–	–	–	100
PCC-255-COM	Computer Network Laboratory	PCC	1	–	–	1	–	–	2	–	–	–	25	–	25
MDM-256-COM	MDM-II* Microprocessor	MDM	2	2	–	–	2	–	–	50	50	–	–	–	100
MDM-257-COM	MDM-II* Microprocessor Laboratory	MDM	1	–	–	1	–	–	2	–	–	–	25	–	25
	Open Elective – II**	OEC	2	2	–	–	2	–	–	–	–	–	25	25	50
VSE-258-COM	JAVA Programming	VSEC	2	–	–	2	–	–	4	–	–	25	–	25	50
AEC-259-COM	Modern Indian Language	AEC	2	1	1	–	1	1	–	–	–	–	–	50	50
EEM-260-COM	E-commerce and Digital Business	EEM	2	2	–	–	2	–	–	–	–	–	–	50	50
VEC-261-COM	Environmental Science Studies	VEC	2	2	–	–	2	–	–	25	25	–	–	–	50
AC-262-COM	Aptitude - I	AC	–	–	–	–	2	–	–	–	–	–	–	–	Grade
Total			22	16	1	5	18	1	10	225	225	75	75	150	750



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Pune - 412 101

Semester - III

S. Y. B. Tech. Computer Engineering Syllabus Structure

Level 5															
S.Y. B.Tech. Computer Engineering															
Semester III															
Course Code	Course Name	Course Type	Credits	Credit Scheme			Teaching Scheme (Hrs/Week)			Examination Scheme					Marks
				L	T	P	L	T	P	FA	SA	PR	OR	TW	
PCC-201-COM	Discrete Structures	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-202-COM	Data Structures	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-203-COM	Data Structures Laboratory	PCC	1	–	–	1	–	–	2	–	–	50	–	25	75
PCC-204-COM	Object Oriented Programming and Computer Graphics	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-205-COM	Object Oriented Programming and Computer Graphics Laboratory	PCC	1	–	–	1	–	–	2	–	–	25	–	25	50
MDM-206-COM	MDM-I* (Digital Electronics & Computer Organization)	MDM	2	2	–	–	2	–	–	50	50	–	–	–	100
MDM-207-COM	MDM-I* (Digital Electronics & Computer Organization Laboratory)	MDM	1	–	–	1	–	–	2	–	–	–	25	–	25
	Open Elective – I**	OEC	2	2	–	–	2	–	–	–	–	–	25	25	50
EEM-208-COM	Entrepreneurship Development	EEM	2	–	1	1	–	1	2	–	–	–	–	50	50
VEC-209-COM	Universal Human Values	VEC	2	2	–	–	2	–	–	25	25	–	–	–	50
ELC-210-COM	Web Technology	ELC	2	–	–	2	–	–	4	–	–	–	25	25	50
Total			22	15	1	6	15	1	12	225	225	75	75	150	750

Class- Term	Second Year- Term III (OEC-I)	
CREDITS	2	
OEC	Vastushastra in Modern Realms	Financial Literacy and Digital Finance
	Essentials of Linguistics and Literature	Digital Marketing

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Class: Second Year B.Tech. (2025 Pattern)					Sem: III	
Course Code: PCC-201-COM			Name of Course: Discrete Structures			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
3	–	–		3	–	–
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
50	50	–	–	–	100	

Prerequisite:
1. Engineering Mathematics

Course Objective: In this course we aim to enable student to:

1. Build foundational understanding in set theory, covering continuous/discrete structures, representation methods, set types, operations, cardinality, and logic.
2. Learn relations, binary relations, paths, transitive closure, equivalence relations, and functions and their applications.
3. Learn logic and proof techniques to expand mathematical maturity.
4. Formulate problems precisely, solve the problems, apply formal proof techniques, and explain the reasoning clearly.

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

PCC-201-COM.1	Design and analyze real world engineering problems by applying set theory, propositional logic and mathematical induction
PCC-201-COM.2	Develop skill in expressing mathematical properties of relation and function
PCC-201-COM.3	Apply graph theory concepts and algorithms to model and solve computational problems
PCC-201-COM.4	Analyze and implement tree structures and related algorithms for efficient problem solving.
PCC-201-COM.5	Identify number of logical possibilities of events to design professional engineering Solutions and Analyze properties of binary operations and evaluate Algebraic structures.

Course Content (TH)		
Unit I	Set Theory and Logic	(09 Hours)
Introduction and significance of Discrete Mathematics: Sets– Naïve Set Theory (Cantorian Set Theory), Axiomatic Set Theory, Set Operations, Cardinality of set, Principle of inclusion and exclusion.		

Types of Sets – Bounded and Unbounded Sets, Diagonalization Argument, Countable and Uncountable Sets, Finite and Infinite Sets, Countably Infinite and Uncountably Infinite Sets, Power set.		
Propositional Logic - logic, Propositional Equivalences, Application of Propositional Logic Translating English Sentences, Proof by Mathematical Induction and Strong Mathematical Induction		
Unit II	Relations and Functions	(09 Hours)
Cartesian Product, Relations, Paths and Digraphs, Properties and types of Binary Relations, Manipulation of Relations, Transitive Closure and Warshall’s Algorithm, Equivalence Relations and Partitions, Partially Ordered Sets (Posets) and Hasse Diagram, Lattices, Chains and Anti-Chains Functions, Types of Functions: One-to-One (Injective), Onto (Surjective) and One-to-One Correspondence (Bijective), Invertible Functions		
Unit III	Graph Theory	(07 Hours)
Graph Terminology and Special Types of Graphs, Representing Graphs and Graph Isomorphism, Connectivity, Euler and Hamilton Paths, the handshaking lemma, Single source shortest path Dijkstra's Algorithm, Planar Graphs, Graph Coloring.		
Unit IV	Trees	(07 Hours)
Introduction, properties of trees, Binary search tree, tree traversal, decision tree, prefix codes and Huffman coding, cut sets, Spanning Trees and Minimum Spanning Tree, Kruskal’s and Prim’s algorithms, The Max flow- Min Cut Theorem (Transport network)		
Unit V	Counting Principles & Algebraic Structures	(13 Hours)
The Basics of Counting, rule of Sum and Product, Permutations and Combinations, Binomial Coefficients and Identities, Generalized Permutations and Combinations, Algorithms for generating Permutations and Combinations. Structure of Algebra, Algebraic System, Semi Groups, Monoids, Homomorphism and Normal Subgroups, Congruence relations, Rings, Integral Domain and Fields.		

Learning Resources
Reference Books:
<ol style="list-style-type: none"> 1. Bernard Kolman, Robert C. Busby and Sharon Ross, —Discrete Mathematical Structures, Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450. 2. Narsingh Deo, “Graph with application to Engineering and Computer Science”, Prentice Hall of India, 1990, 0 – 87692 – 145 – 4. 3. Eric Gossett, “Discrete Mathematical Structures with Proofs”, Wiley India Ltd, ISBN:978-81- 265-2758-8. 4.

4. Sriram P & Steven S., “Computational Discrete Mathematics”, Cambridge University Press, ISBN 13: 978-0-521-73311-3. 5.
Kenneth H. Rosen, —Discrete Mathematics and its Applications, Tata McGraw-Hill, ISBN 978- 0-07-288008-3

Text Books:



1. C. L. Liu, —Elements of Discrete Mathematics, TMH, ISBN 10:0-07-066913-9. 2.
2. N. Biggs, --“Discrete Mathematics”, 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8.D.
3. Rogers, “Procedural Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hil Publication, 2001, ISBN 0 – 07 – 047371 – 4.

E-resources:

1. **Unit 1:** <https://discrete.openmathbooks.org/dmoi4.html>
2. **Unit 2:** <https://www.digimat.in/nptel/courses/video/106103205/L08.html>
3. **Unit 3:** <https://www.digimat.in/nptel/courses/video/111106102/L37.html>
4. **Unit 4:** https://discrete.openmathbooks.org/dmoi3/sec_trees.
5. **Unit 5:** <https://dituniversity.digimat.in/nptel/courses/video/106106183/L14.html>

List of Case Studies :

Sr. No.	Unit No.	Content
1	I	Applications for Inventory management, Sports Tournament Management.
2	II	Social Networking Analysis, E-commerce Recommendation System.
3	III	Three utility problem, Web Graph, Google map.
4	IV	Tic-Tac-Toe Game tree.
5	V	Study Sudoku solving algorithms and algorithm for generation of new SUDOKU.

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Class: Second Year B.Tech. (2025 Pattern)	Sem: III
Course Code: PCC-202-COM	Name of Course: Data Structures

Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
3	–	–		3	–	–

Examination Scheme :						
FA	SA	PR	OR	TW	Total	
50	50	–	–	–	100	

Prerequisite:
<ol style="list-style-type: none"> 1. Programming in C (ESC-101-ASH) 2. Python Programming (ESC-151-ASH)

Course Objective: In this course we aim to enable student to:
<ol style="list-style-type: none"> 1. Introduce fundamental data structures and their role in solving real-world engineering problems efficiently. 2. Explore various searching and sorting techniques. 3. Gain knowledge to implement data structures such as linked lists for efficient data organization, manipulation, and problem-solving. 4. Elaborate the concepts of stack and Queue with respect to problem solving.

Course Outcome: On completion of this course, the students will be able to:	
PCC-202-COM.1	Apply data structures to solve engineering problems and measure algorithm performance.
PCC-202-COM.2	Apply sorting and searching algorithms for efficient data organization and retrieval.
PCC-202-COM.3	Apply linked list data structures for problem solving.
PCC-202-COM.4	Apply principles of stack data structures in approaching the problem solution.
PCC-202-COM.5	Apply queue data structure concepts for effective problem solving.

Course Content (TH)		
Unit I	Introduction to Data Structures and Algorithm	(09 Hours)
<p>Data structures, types of data structures, Abstract Data Types, Algorithms: Introduction to algorithm, Characteristics of algorithm, Pseudo-code. Complexity of algorithm: Space complexity, Time complexity, Asymptotic notation- Big-O, Theta and Omega, finding complexity using step count method, Analysis of Programming Constructs-Linear, Quadratic, Cubic, Logarithmic.</p> <p>Algorithmic Strategies: Introduction to algorithm design strategies- Divide and Conquer, Greedy strategy and Dynamic Programming. Sequential data organization, Array as an Abstract Data Type, Address calculation: Row Major and Column major, Multidimensional Arrays: Two-dimensional arrays, n-dimensional arrays. Sparse Matrix.</p>		



Unit II	Searching and Sorting	(09 Hours)
<p>Searching: Search Techniques-Sequential Search/Linear Search, Variant of Sequential Search- Sentinel Search, Binary Search, Fibonacci Search, and Indexed Sequential Search.</p> <p>Sorting: Types of Sorting-Internal and External Sorting, General Sort Concepts-Sort Order, Stability, Efficiency, and Number of Passes, Comparison Based Sorting Methods-Bubble Sort, Insertion Sort, Selection Sort, Quick Sort, Shell Sort.</p>		
Unit III	Linked List	(09 Hours)
<p>Dynamic memory allocation function, Linked List, ADT for Linked List, Operations on Linked List like insertion of node, deletion of node, updating node, searching node, Double linked list, circular linked list. Primitive Operations on Linked List-Create, Traverse, Search, Insert, Delete, Sort, Concatenate.</p>		
Unit IV	Stack	(09 Hours)
<p>Basic concept, stack Abstract Data Type, Representation of Stacks Using Sequential Organization stack operations, Multiple Stacks, Applications of Stack: Expression Evaluation and Conversion, Polish notation and expression conversion, expression evaluation. Recursion-concept, variants of recursion-direct, indirect, tail and tree.</p>		
Unit V	Queue	(09 Hours)
<p>Basic concept, Queue as Abstract Data Type, Representation of Queue using Sequential organization Queue Operations, Circular Queue and its advantages, Multi-queues, Linked Queue and Operations. Deque-Basic concept, types (Input restricted and Output restricted) Priority Queue-Basic concept, types (Ascending and Descending)</p>		

Learning Resources
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Data structures and algorithms in python by Michael T. Goodrich, ISBN-13: 978- 1118290279, ISBN-10: 1118290275, Publisher: Wiley; 1st edition (March 18, 2013). 2. M. Weiss, “Data Structures and Algorithm Analysis in C++”, 2nd edition, Pearson Education, 2002, ISBN-81-7808-670-0.
<p>Text Books:</p> <ol style="list-style-type: none"> 1. Horowitz Sahani, “Fundamentals of Data Structures in C++”, University Press, ISBN 10: 0716782928 ISBN 13: 9780716782926. 2. Data structures and algorithms in python by Michael T. Goodrich, ISBN-13: 978- 1118290279, ISBN-10: 1118290275, Publisher: Wiley; 1st edition (March 18, 2013).
<p>E-resources:</p> <p>E-Resources for Each Unit</p> <ol style="list-style-type: none"> 1. Unit 1: https://nptel.ac.in/courses/106105164 2. Unit 2: https://nptel.ac.in/courses/106/106/106106131/ 3. Unit 3: https://www.geeksforgeeks.org/linked-list-set-1-introduction/ 4. Unit 4: https://nptel.ac.in/courses/106/102/106102064/

5. Unit 5: <https://nptel.ac.in/courses/106/106/106106127/>

List of Case Studies

Sr. No.	Unit No.	Content
1	I	E-commerce Product Sorting using Divide and Conquer strategy Google Calendar application using Greedy strategy
2	II	Use of Fibonacci search in non-uniform access memory storage and in Optimization of Unimodal Functions. Tim sort as a hybrid stable sorting algorithm.
3	III	Garbage Collection
4	IV	Tower of Hanoi, 4 Queens problem
5	V	Priority queue in bandwidth management

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Class: Second Year B.Tech. (2025 Pattern)					Sem: III	
Course Code: PCC-203-COM			Name of Course: Data Structures Laboratory			
Teaching Scheme (Hrs/week):			Credits:			
Lecture	Tutorial	Practical	Lecture	Tutorial	Practical	
–	–	2	–	–	1	
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
–	–	50	–	25	75	
Prerequisite:						
1. Programming in C (ESC-101-ASH) 2. Python Programming (ESC-151-ASH)						
Course Objective: In this course we aim to enable student to:						
1. Understand array-based data structures and explore various searching, sorting techniques. 2. Develop problem-solving skills by selecting appropriate linked list structures for real-world data manipulation scenarios. 3. Develop logical thinking and problem-solving skills using stack- and queue-based techniques. 4. Integrate multiple data structures and algorithmic techniques in the development of a mini project.						
Course Outcome: On completion of this course, the students will be able to:						
PCC-203-COM.1	Apply array-based data structures with searching and sorting algorithms for efficient data storage and manipulation.					
PCC-203-COM.2	Apply linked list variations and their operations for dynamic data organization and manipulation.					
PCC-203-COM.3	Apply the principles of stack and queue data structures to perform operations for effective data management and problem solving.					
PCC-203-COM.4	Apply fundamental data structures and algorithms to implement the solutions for real-world problems in a mini project.					

Course Content (PR)
Group A (Array , Searching and Sorting) [Any three]
Assignment No 1: Write a program to store and manipulate student records (roll no, name, marks) using 1D and 2D arrays. Implement insertion, deletion, and searching operations in an array.
Assignment No 2: Write a program to represent a sparse matrix using triplet form, perform addition and transpose of sparse matrices.
Assignment No 3:

A library stores book accession numbers in a sorted array. A student wants to check whether a particular book is available. Write functions to perform following operations:

1. Store book IDs in a sorted array
2. Search for a given book ID using Linear Search
3. Search for a given book ID using Binary Search
4. Display the location of the book
5. Display "Book Not Available" if not found

Assignment No 4:

Write a Python program to store first year percentage of students in array. Write function for sorting array of floating point numbers in ascending order using

1. Selection Sort
2. Quick sort and display top five scores.

Assignment No 5:

An online retail platform processes thousands of customer orders every day. Each order has a unique order ID represented as an integer. Write functions to perform following operations:

1. Sort orderID's in ascending order using Radix Sort.
2. Sort orderID's in descending order using Bucket Sort.

Group B (Linked List) [Any three]

Assignment No 6:

The Department of Computer Engineering has a student's club named 'Pinnacle Club'. Students of Second, third and final year of department can be granted membership on request. Similarly, one may cancel the membership of a club. First node is reserved for the president of the club and the last node is reserved for the secretary of the club. Write C++ program to maintain club member's information using singly linked list. Store student PRN and Name. Write functions to

1. Add and delete the members as well as president or even secretary.
2. Compute total number of members of club
3. Display members

Assignment No 7:

In a multiplayer game, each player gets a turn one after another in a circular manner. Write C++ program to perform the following operations for turn management using a **Circular Linked List**.

1. Add player
2. Remove player
3. Move to next player
4. Display current turn

Assignment No 8:

An ATM system maintains the transaction history of a user. Implement system using doubly linked list for following functionality:

1. Add transaction.
2. Delete transaction
3. Display transaction in forward and backward direction.

Assignment No 9:

A smart music player maintains a playlist where songs can be played **continuously in a loop**. Implement system using circular doubly linked list for following functionality:

1. Add a new song.

2. Delete a song
3. Display playlist in forward and backward direction.

Group C (Linked List, Stack and Queue) [Assignment 10 or 11, Assignment 12 or 13]

Assignment No 10:

Write C++ program using stack to check whether given expression is well parenthesized or not.

Assignment No 11:

Write C++ program with functions-a) To print original string followed by reversed string using stack b) To check whether given string is palindrome or not

Assignment No 12:

A double-ended queue (deque) is a linear list in which additions and deletions may be made at either end. Obtain a data representation mapping a deque into a one-dimensional array. Write C++ program to simulate deque with functions to add and delete elements from either end of the deque.



Assignment No 13:

Pizza parlor accepting maximum M orders. Orders are served on a first come first served basis. Order once placed cannot be cancelled. Write C++ program to simulate the system using a circular queue using array.

Group D

Assignment No 14: Mini Projects

- **Music Playlist Manager** – Add, delete, and traverse songs using singly or doubly linked lists.
- **Polynomial Calculator** – Represent and perform addition/multiplication of polynomials using linked lists.
- **Dynamic Memory Allocation Simulator** – Simulate allocation and deallocation using linked lists.
- **Hospital Patient Management**- Store patient records dynamically with insertions and deletions.
- **Expression Converter and Evaluator** – Convert infix to postfix/prefix and evaluate expressions.
- **Undo/Redo Operation Simulator** – Text editor style undo/redo using stacks.
- **Balanced Parentheses Checker** – Validate expressions with brackets using stack.
- **Maze Solver** – Backtracking using stack to find paths in a maze.
- **HTML/XML Tag Validator**- Check proper nesting of tags using stacks.

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Class: Second Year B.Tech. (2025 Pattern)					Sem: III	
Course Code: PCC-204-COM			Name of Course: Object Oriented Programming and Computer Graphics			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
3	–	–		3	–	–
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
50	50	–	–	–	100	
Prerequisite:						
1. ESC-101-ASH Programming in C 2. BSC-101-ASH Engineering Mathematics I						
Course Objective: In this course we aim to enable student to:						
1. Apply object-oriented programming principles using C++ to design and implement modular programs. 2. Construct C++ programs using functions, inheritance, and polymorphism to solve computational problems 3. Implement exception handling and file handling techniques to develop robust and reliable applications. 4. Apply fundamental concepts of computer graphics to generate and manipulate graphical primitives. 5. Implement 2-D and 3-D geometric transformations and projection techniques for graphical visualization.						
Course Outcome: On completion of this course, the students will be able to:						
PCC-204-COM.1	Apply object-oriented concepts such as classes, objects, encapsulation, inheritance, and polymorphism using C++ programs.					
PCC-204-COM.2	Implement C++ programs using functions, constructors, pointers, and dynamic memory allocation for problem solving.					
PCC-204-COM.3	Develop robust C++ applications using exception handling and file handling techniques.					
PCC-204-COM.4	Implement algorithms for graphics primitives, scan conversion, polygon filling, windowing, and clipping.					
PCC-204-COM.5	Apply 2-D and 3-D transformation and projection techniques to visualize graphical objects.					
Course Content (TH)						
Unit I	Fundamentals of Object Oriented Programming					(09 Hours)
Programming Paradigms: Introduction to programming paradigms – procedural, object-oriented, functional, and logic & rule-based programming. Need for Object-Oriented Programming. Fundamentals of Object-Oriented Programming:						

Objects and Classes, Namespaces, Data members and Member functions, Access specifiers, Messages, Encapsulation, Data Abstraction, Information Hiding, Inheritance, Polymorphism, Benefits of OOP.

Introduction to C++:

Features of C++, C++ as an Object-Oriented Programming Language, Structure of a C++ Program.

C++ Programming Basics:

Keywords, Identifiers, Constants, Data Types, Structures, Enumerations, Separation of interface and implementation.

Control Statements:

Selection statements (if, switch) and Iteration statements (for, while, do-while).

Unit II	Functions, Inheritance and Polymorphism	(09 Hours)
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Functions in C++: Function definition, function prototype, function call, Inline functions, Default arguments.
Constructors and Destructors: Concept of constructor and destructor, Types of constructors, Object creation and memory requirements.
Static Members: Static data members and static member functions. Friend Functions and Friend Classes.
Pointers in C++: Pointers and objects, Dynamic memory allocation using new and delete.
Inheritance: Base class and Derived class, Protected members, Types of inheritance, Constructor invocation in inheritance.
Polymorphism: Compile-time and Run-time polymorphism Function overloading, Operator overloading, Virtual functions and dynamic binding.

Unit III	Exception Handling, Files and Streams	(09 Hours)
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Exception Handling:
Fundamentals of exception handling, Types of exceptions, try, catch, and throw, Multiple catch blocks, Nested try-catch, User-defined exceptions.

File Handling using C++ Streams:
Streams and file concepts, Stream classes, File I/O using ifstream, ofstream, and fstream, File opening modes, File pointers, Error handling in file operations, File I/O using member functions, Overloading extraction (>>) and insertion (<<) operators for user-defined classes.

Unit IV	Graphics Primitives, Scan Conversion, Windowing and Clipping	(09 Hours)
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Introduction: graphics primitives- pixel, resolution, aspect ratio, frame buffer. Display devices, applications of computer graphics.
Scan conversion: Line drawing algorithms: Digital Differential Analyzer (DDA), Bresenham. Circle drawing algorithms: DDA, Bresenham, and Midpoint.
Polygons: Introduction to polygon, types: convex, concave and complex. Inside test. Polygon Filling: flood fill, seed fill, scan line fill.
Windowing and clipping: viewing transformations, 2-D clipping: Cohen– Sutherland algorithm line Clipping algorithm, Sutherland Hodgeman polygon clipping algorithm.

Unit V	2D, 3D Transformations and Projections	(09 Hours)
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2-D Transformations: 2-D transformations- Translation, Scaling, Rotation, Reflection and Shear, Rotation about an arbitrary point.
3-D Transformations: 3-D transformations- Translation, Scaling, Rotation, Reflection and Shear, Rotation about an arbitrary axis.
Projections: Parallel (Oblique: Cavalier, Cabinet and orthographic: isometric, diametric, trimetric) and Perspective (Vanishing Points– 1 point, 2 point and 3 point)

Learning Resources		
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Reference Books:

1. E. Balagurusamy, "Object-Oriented Programming with C++", 7th edition, Graw-Hill Publication, ISBN 10: 9352607996 ISBN 13: 9789352607990
2. Herbert Schildt, "C++-The complete reference", Eighth Edition, McGraw Hill Professional, 2011, ISBN: 978-00-72226805
3. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
4. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8

Text Books:



1. Deitel, "C++ How to Program", 4th Edition, Pearson Education, ISBN: 81-297-0276-2
2. Robert Lafore, "Object-Oriented Programming in C++", fourth edition, Sams Publishing, ISBN: 0672323087 (ISBN 13: 9780672323089)
3. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07100472 – 6.
4. Donald D. Hearn and Baker, "Computer Graphics with OpenGL", 4th Edition, ISBN-13: 9780136053583.

E-resources:**e-Books:**

1. <https://www.springer.com/gp/book/9781852334505>
2. <https://www.ebookphp.com/object-oriented-programming-in-c-epub-pdf/>
3. <https://www.springer.com/gp/book/9781447133780>

E-Resources for Each Unit

1. <https://nptel.ac.in/courses/106/105/106105151/>
2. https://swayam.gov.in/nd1_noc20_cs07/preview
3. <https://www.classcentral.com/course/swayam-programming-in-c-6704>
4. <https://nptel.ac.in/courses/106/105/106105151/>
5. https://swayam.gov.in/nd1_noc20_cs07/preview
6. <https://www.classcentral.com/course/swayam-programming-in-c-6704>

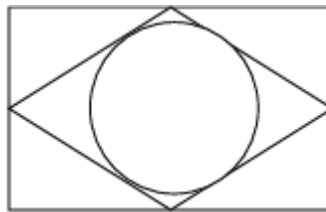
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Class: Second Year B.Tech. (2025 Pattern)					Sem: III	
Course Code: PCC-205-COM			Name of Course: Object Oriented Programming and Computer Graphics Laboratory			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
–	–	2		–	–	1
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
–	–	25	–	25	50	
Prerequisite:						
1. BSC-101-ASH Engineering Mathematics I 2. ESC-101-ASH Programming in C						
Course Objective: In this course we aim to enable student to:						
1. Implement object-oriented programs in C++ using classes, constructors, inheritance, polymorphism, and dynamic memory allocation. 2. Develop C++ programs to handle exceptions and perform file operations for persistent data storage. 3. Implement and test fundamental computer graphics algorithms for drawing, filling, clipping, and transforming graphical objects. 4. Develop a graphics-based application using C++ by integrating object-oriented programming concepts with computer graphics techniques.						
Course Outcome: On completion of this course, the students will be able to:						
PCC-205-COM.1	Implement C++ programs using classes, objects, constructors, destructors, and static members for data modeling problems.					
PCC-205-COM.2	Develop C++ programs using inheritance, function overriding, and runtime polymorphism to solve real-world problems					
PCC-205-COM.3	Implement robust C++ programs using exception handling and file handling techniques for reliable data processing.					
PCC-205-COM.4	Implement fundamental computer graphics algorithms for drawing, filling, and clipping graphical primitives using C++.					
PCC-205-COM.5	Apply 2-D geometric transformations on graphical objects using C++ programming.					
Course Content (PR)						
Group A (All six are compulsory)						

1. Design and implement a C++ program to create a class Student with data members for roll number, name, and marks. Implement member functions to accept and display the student details
2. Design a C++ program to implement a class Bank Account that uses constructors to initialize account details and a destructor to indicate object destruction. Use a static data member to maintain the count of total bank accounts created.
3. Develop a C++ program demonstrating inheritance by creating a base class Employee and derived classes such as Permanent Employee and Contract Employee. Override member functions in derived classes to calculate and display employee salary details.
4. Write a C++ program to demonstrate runtime polymorphism by creating a base class Shape with a virtual function to calculate area. Implement derived classes like Rectangle and Circle that override the base class function.
5. Design a C++ program to perform arithmetic division of two numbers. Handle exceptions such as division by zero and invalid input using exception handling mechanisms
6. Create a C++ program to store and retrieve records of employees using file handling. Implement a class Employee and perform write and read operations on files using C++ file streams.

Group B (Any 4)



1. Write a C++ Program to draw the following pattern using The DDA line and Bresenham's Circle drawing algorithm.



2. Write a **menu-driven C++ program** to draw a **concave polygon** and fill it with a user-defined color using the **Scan Line polygon filling algorithm**
3. Write a **C++ program** to implement the **Cohen–Sutherland line clipping algorithm** for clipping a line against a rectangular clipping window.
4. Write a **C++ program** to implement the **Sutherland–Hodgeman polygon clipping algorithm** to clip a polygon against a rectangular clipping window.
5. Write a **C++ program** to implement **2-D transformations** such as translation, scaling, rotation, reflection, and shearing on a given object.
6. Write a **C++ program** to implement **rotation of a 2-D object about an arbitrary point.**

Group C (Mini Project)

Develop a **graphics-based application in C++** using an **open-source graphics library**, incorporating **object-oriented programming concepts** for design and implementation.

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Class: Second Year B.Tech. (2025 Pattern)	Sem: III
Course Code: MDM-206-COM	Name of Course: Digital Electronics & Computer Organization

Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
2	–	–		2	–	–

Examination Scheme :						
FA	SA	PR	OR	TW	Total	
50	50	–	–	–	100	

Prerequisite:
<ol style="list-style-type: none"> 1. Basic Electrical and Electronics Engineering (ESC-105-ASH) 2. Fundamentals of Computer Engineering (PCC-101-CS/IT)

Course Objective: In this course we aim to enable student to:
<ol style="list-style-type: none"> 1. Introduce students to signed number representations, Boolean function minimization, and implementation of logic functions using programmable logic devices (PLDs). 2. Understand design of combinational logic circuits using gates and multiplexers/demultiplexers. 3. Study flip-flops, registers, and counters for sequential circuit design. 4. Introduce computer organization, evolution of processors, and performance measurement techniques. 5. Study the functional units of a computer system and their interconnection.



Course Outcome: On completion of this course, the students will be able to:	
MDM-206-COM.1	Simplify Boolean functions and implement them using PLDs.
MDM-206-COM.2	Design and implement combinational circuits like adders, subtractors, code converters, and display controllers.
MDM-206-COM.3	Analyze and design sequential circuits such as counters and shift registers.
MDM-206-COM.4	Analyze computer architecture evolution and evaluate performance parameters.
MDM-206-COM.5	Explain memory hierarchy, I/O organization, and system-level interconnections.

Course Content (TH)		
Unit I	Simplification Techniques and PLDs	(06 Hours)
Signed Binary number representation: Signed Magnitude, 1's complement and 2's complement representation, Simplification Techniques: Sum-of-products and Product-of-sums form, Minimization of SOP and POS using K-map, Minimization of Boolean functions using K-map (up to 4 variables). PLDs: PLD, ROM as PLD, Implementing Boolean functions using PLDs.		
Unit II	Combinational Logic Design	(06 Hours)
Code Converters: BCD, Excess-3, Gray code, Binary Code, Adders: Half Adder, Full Adder, Binary Adder (IC 7483), BCD adder, Look ahead carry generator, Multiplexers and Demultiplexers, Implementation of SOP		

and POS using MUX, DMUX, Comparators (2 bit)		
Unit III	Sequential Circuits	(06 Hours)
SR, JK, D, T, Preset and Clear, Master Slave JK Flip Flops, Truth Tables and Excitation tables, Conversion from one type to another type of Flop-Flop. Registers, Applications of shift registers, Counters: Ripple Counter(Asynchronous Counters), Ring Counter, Twisted Ring, BCD Counter (IC 7490)		
Unit IV	Computer Organization and Performance	(06 Hours)
Introduction: Organization and Architecture, Structure and Function, Performance Issues: Designing for performance, Multicore, MICs and GPGPUs, Basic measures of computer performance, Top-Level View of Computer Function and Interconnection: Computer components, Computer Functions, Interconnection Structures, Bus Interconnection (Bus Structure and Multi-bus Hierarchies)		
Unit V	Computer System	(06 Hours)
Processing Unit: Organization of a processor - Registers, ALU and Control unit, Data path in a CPU, Instruction cycle, Organization of a control unit - Operations of a control unit, Hardwired control unit, Microprogrammed control unit. Pipelining: Basic concepts, Data hazards, Instruction Hazards, Influence on Instruction Sets, Datapath and Control Considerations, Superscalar Operation, Performance Considerations		

Learning Resources
Reference Books:
<ol style="list-style-type: none"> 1. John Yarbrough, “Digital Logic applications and Design”, Cengage Learning, ISBN – 13: 978-81- 315-0058-3 2. D. Leach, Malvino, Saha, “Digital Principles and Applications”ll, Tata McGraw Hill, ISBN – 13:978- 0-07-014170-4. 3. Anil Maini, “Digital Electronics: Principles and Integrated Circuits”ll, Wiley India Ltd, ISBN:978- 81-265-1466-3. 4. Norman B and Bradley, “Digital Logic Design Principles”, Wiley, ISBN:978-81-265-1258
Text Books:
<ol style="list-style-type: none"> 1. R.P.Jain, “Modern Digital Electronics”, Tata McGraw Hill 4th Edition, ISBN978-0-07-06691-16 2. Moris Mano, “Digital Logic and Computer Design”, Pearson , ISBN 978-93-325-4252-5
E-resources:
E-Resources for Each Unit
<ol style="list-style-type: none"> 1. Unit 1, 2, 3: Digital Electronics Circuits (NPTEL IIT Kharagpur) https://www.youtube.com/watch?v=oNh6V91zdPY&list=PLbRMhDVUMnge4gDT0vBWjCb3Lz_0HnYKkX 2. Unit 4: Computer Architecture and Organsation (NPTEL IIT Kharagpur) https://www.youtube.com/playlist?list=PL-8LShlBmIjUuI9beQJHZUF14we25NToB 3. Unit 5: Computer Organization (NPTEL IIT Madras) https://www.youtube.com/playlist?list=PL1A5A6AE8AFC187B7
Course Name :
List of Case Studies

Sr. No.	Unit No.	Content
1	I	Prime number detector using basic gates
2	II	Design of BCD to 7-segment display Controller using basic gates
3	III	Design of counter to count vehicles entering and leaving parking
4	IV	Study of 8086 Microprocessor Features and Architecture
5	V	UltraSPARC II

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Class: Second Year B.Tech. (2025 Pattern)				Sem: III		
Course Code: MDM-207-COM			Name of Course: Digital Electronics & Computer Organization Laboratory			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
–	–	2		–	–	1
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
–	–	–	25	–	25	
Prerequisite:						
1. Basic Electrical and Electronics Engineering (ESC-105-ASH) 2. Fundamentals of Computer Engineering (PCC-101-CS/IT)						
Course Objective: In this course we aim to enable student to:						
1. Understand the fundamentals and functionality of electronic circuits 2. Design and implement combinational circuits (MUX, comparators, adders/subtractors) 3. Design and implement sequential circuits (flip-flops, registers, and counters) using various integrated circuits.						
Course Outcome: On completion of this course, the students will be able to:						
MDM-207-COM.1	Apply the knowledge to appropriate IC as per the design specifications.					
MDM-207-COM.2	Design and implement Combinational digital circuits as per the specifications.					
MDM-207-COM.3	Design and implement Sequential circuits as per the specifications.					



Course Content (PR)	
Group A [Any three]	
Assignment No. 1: Realize Full Adder and Subtractor using a) Basic Gates and b) Universal Gates. Assignment No. 2: Design and implement Code Converters-Binary to Gray and BCD to Excess-3. Assignment No. 3: Design and realization of BCD Adder using 4-bit Binary Adder (IC 7483). Assignment No. 4: Realization of Boolean Expressions using MUX 74151/74153, DMUX 74154/74138. Assignment No. 5: Design and realization of two bit comparator using logic gates. Assignment No. 6: Design and Implement Parity Generator and checker using EX-OR.	
Group B [Any three]	
Assignment No. 7: Design and realization of Flip-Flop Conversions. Assignment No. 8: Design and realization of Ripple Counter using suitable Flip Flops. Assignment No. 9: Design and realization of 3 bit Up/Down Counter using MS JK Flip Flop. Assignment No. 10: Design and realization of Mod -N counter using IC-7490. Assignment No. 11: Design and Realization of Ring Counter and Johnson Ring counter.	
Group C	
Assignment No 12: Study of Shift Registers (SISO,SIPO, PISO,PIPO)	

Assignment No 13: Study of Logic Families.



Assignment No 14: Study of Arithmetic State Machines.

Group D

Mini Project / Case Study / Real Time Application Development: Design and develop a digital circuit to solve real life problem. (e.g. Water Level Sensing, Temperature controller etc.).

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Class: Second Year B.Tech. (2025 Pattern)		Sem: III
Course Code: OEC	Name of Course: Open Elective Course-I	
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

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Class: Second Year B.Tech. (2025 Pattern)						Sem: III	
Course Code: EEM-208-COM			Name of Course: Entrepreneurship Development				
Teaching Scheme (Hrs/week):						Credits:	
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical	
–	1	2		–	1	1	
Examination Scheme:							
FA	SA	PR	OR	TW	Total		
–	–	–	–	50	50		
Course Objective: In this course we aim to enable student to:							
<ol style="list-style-type: none"> 1. Introduce students to the fundamentals of entrepreneurship, startup ecosystems, and forms of business organizations. 2. Enable students to generate, evaluate, and refine entrepreneurial ideas by understanding customer needs and market opportunities. 3. Develop the ability to design basic business models, validate ideas through market research, and plan financial and marketing strategies. 4. Enhance students' entrepreneurial mindset, communication skills, and ability to pitch business ideas effectively using storytelling techniques. 							
Course Outcome: On completion of this course, the students will be able to:							
EEM-208-COM.1	Explain the role of entrepreneurship in economic development and describe the startup ecosystem.						
EEM-208-COM.2	Apply creative techniques to viable business ideas based on customer needs.						
EEM-208-COM.3	Develop and validate a basic business model using tools such as the Business Model Canvas and market research methods.						
EEM-208-COM.4	Deliver a concise business pitch using storytelling and effective communication techniques.						
Course Content (TH)							
Unit I	Foundations of Entrepreneurship & Startup Ecosystem					(04 Hours)	
Entrepreneurship Fundamentals: Definition and evolution of entrepreneurship, Role of entrepreneurship in economic development: job creation, innovation, GDP contribution. Key traits: risk-taking, innovation, leadership, perseverance, resilience. Types of Entrepreneurship: Startup, Social, Intrapreneurship, Lifestyle and small business entrepreneurship. Forms of Business Organization: Sole proprietorship, Partnership, Private limited company, Public limited company. Startup Ecosystem: Key stakeholders: incubators, accelerators, angel investors, venture capitalists, Government support initiatives: Startup India, Atal Innovation Mission							
Unit II	Idea Generation & Opportunity Recognition					(04 Hours)	

Creativity and Ideation Techniques: Importance of creativity in entrepreneurship, Brainstorming: rules, individual vs. group brainstorming, Mind mapping: concept, tools, and applications. **Understanding Customer Needs:** Identifying customer pain points, Problem–solution fit, Techniques: observation, user interviews, empathy mapping. **Opportunity Evaluation:** Idea vs. opportunity, Evaluation criteria: desirability, feasibility, viability, Tools: SWOT analysis, opportunity matrix, industry and market gap analysis.

Unit III	Business Model Development	(04 Hours)
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Business Model Concepts: Definition and importance of business models, Introduction to Business Model Canvas (BMC), Advantages of BMC for startups. **Key Components of BMC:** Value proposition, Customer segments and personas, Revenue models: subscription, freemium, direct sales, licensing. **Market Research & Validation:** Importance of early-stage market research, designing surveys and feedback forms, conducting interviews and analyzing data, Introduction to MVP (Minimum Viable Product) and feedback loops.

Unit IV	Marketing Strategies & Customer Acquisition	(04 Hours)
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Branding and Marketing Basics: Brand identity: name, logo, tone, values, Positioning strategies and positioning maps, Startup branding challenges. **Digital Marketing & Customer Acquisition:** Traditional vs. digital distribution channels, Social media marketing: Instagram, LinkedIn, Facebook, X, SEO fundamentals and digital presence, Customer journey: awareness to action, Early-stage acquisition tactics: referrals, influencer marketing, email marketing, landing pages. **Pitching & Business Communication:** Elevator pitch: structure and delivery, Storytelling in business: setup, conflict, resolution, Overview of funding sources: bootstrapping, angel investors, venture capital, government schemes.

Learning Resources

Reference Books:

1. Ries, Eric. The Lean Startup: How Today’s Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses, 1st Edition, Crown Business, 2011. ISBN: 9780307887894.
2. Kawasaki, Guy. The Art of the Start 2.0: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything, Portfolio (Penguin Random House), 2015. ISBN: 9781591847847.

Text Books:

1. Bygrave, W.D., Zacharakis, A., & Corbett, A.C. Entrepreneurship, 6th Edition, Wiley, 2025. ISBN: 9781394262809.
2. Drucker, Peter F. Innovation and Entrepreneurship: Practice and Principles, Reprint Edition, Harper Business, 2006. ISBN: 9780060851132.
3. Osterwalder, Alexander & Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, 1st Edition, Wiley, 2010. ISBN: 9780470876411

3.

E-resources:

- 1 Entrepreneurship Essentials By Prof. Manoj Kumar Mondal IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc20_ge08/preview
- 2 Entrepreneurship By Prof. C Bhaktavatsala Rao IIT Madras
https://onlinecourses.nptel.ac.in/noc21_mg70/preview

- 3 https://onlinecourses.nptel.ac.in/noc20_mg35
 4 <https://www.coursera.org/learn/entrepreneur-guide-beginners>
 5 <https://wadhwanifoundation.org>

Course Name : Entrepreneurship Development

List of Case Studies

Sr. No.	Unit No.	Content
1	I	Ritesh Agarwal (OYO Rooms) – Scaling a hospitality startup, Falguni Nayar (Nykaa) – Building a digital-first beauty brand. Nandan Nilekani (Infosys & Aadhaar) – Technology-driven nation building.
2	II	Dunzo / BigBasket – Identifying and solving urban convenience problems. Zerodha – Digital disruption in financial services.
3	III	Zomato / Uber – Business Model Canvas analysis. Airbnb – Validating demand through MVP
4	IV	Shark Tank India – Startup pitch evaluation. Mamaearth – Digital-first customer acquisition. Dropbox – Storytelling through product demonstration. Dunzo – Evolution of investor pitching

Course Name : Entrepreneurship Development



List of Assignment

Sr. No.	Title	Objective	Description
1	Entrepreneurial Mindset Reflection	To encourage students to explore their personal views on entrepreneurship and recognize the key characteristics of an entrepreneurial mindset by studying the journey of a real-world entrepreneur	Write a reflective essay (500–600 words) based on the following: <ul style="list-style-type: none"> • Explain what entrepreneurship means to you personally. • Identify an entrepreneur (Indian or global) whom you admire and explain the reasons for your admiration. • Highlight specific mind set traits (e.g. Risk-taking, resilience, innovation, adaptability) that contributed to this entrepreneur’s success. • Reflect on how the straits align with your own strengths or indicate are as you wish to develop.
2	Idea Generation Challenge	To foster creativity, structured brainstorming, and the ability to identify potential business opportunities based on real-world problems.	Generate 10 Business Ideas 1. Use any structured brainstorming technique Ideas can be tech-based, social impact, service-based, or product-based 2. Select One Idea-Choose the most

			<p>promising idea from your list.</p> <p>3. Write a 1-page Concept Summary, include the following:</p> <ul style="list-style-type: none"> • Problem Identified: Describe the specific problem or pain point your idea addresses. • Solution Overview: Briefly describe your business idea. • Target Audience: Identify the group of people or organizations that would benefit. • Market Potential: Discuss the viability and scalability of the idea.
3	Business Model & Customer Validation	To help students develop a clear, structured business model and test its assumptions through customer conversations. The goal is to learn how to validate ideas through real-world feedback and refine the business concept accordingly.	<p>Part A: Business Model Canvas</p> <p>1. Choose a business idea (from Assignment 2 or a new one).</p> <p>2. Create a Business Model Canvas with all 9 key blocks:</p> <ul style="list-style-type: none"> • Customer Segments • Value Propositions • Channels • Customer Relationships • Revenue Streams • Key Resources • Key Activities • Key Partnerships • Cost Structure <p>3. Present the BMC in visual or tabular format.</p> <p>Part B: Customer Interviews & Insights</p> <p>1. Identify 2–3 potential customers from your target segment.</p> <p>2. Conduct brief interviews (5–10 minutes each) to gather insight on their pain points, their reaction to your proposed solution, and their willingness to pay or use your product/service.</p> <p>3. Summarize findings in a 1–15-page report that includes:</p> <ul style="list-style-type: none"> • Key customer quotes or paraphrased insights • A revised Value Proposition or Customer Segment block (if needed) • A short reflection: key learning and potential changes to your idea.

4	Business Launch Plan–Marketing & Financial Snapshot	To develop a practical understanding of how marketing strategy and financial planning go hand-in-hand launching a startup. Students will define a basic marketing campaign and align it with estimated costs, pricing, and projected revenue	<p>You are preparing to launch your business idea. Prepare a combined Marketing and Financial Snapshot including the following</p> <p>Part A: Marketing Campaign Plan</p> <ul style="list-style-type: none"> • Define your target market by identifying primary customers. • Design a mini-campaign using one or more of the following channels: Social media (e.g., Instagram, LinkedIn) Print/digital flyers Email marketing • Describe the campaign content, including the message or offer to be promoted. • Optionally, create 1-2 sample marketing materials. • Write a 300- word explanation outlining your marketing strategy and expected impact. <p>Part B: Financial Snapshot</p> <ol style="list-style-type: none"> 1. Startup Costs–Estimate your initial costs (fixed+ variable) 2. Pricing Strategy–State your pricing model and justification 3. Break-even Analysis–Basic cost vs. sales estimate. 4. 6-Month Revenue Projection–Expected sales and income 5. Format: Use a simple table or spreadsheet(optional)
5	Elevator Pitch Video	To help students develop confidence and clarity in presenting their business idea in a short, compelling format. The exercise simulates real-world investor or networking scenarios where entrepreneurs must grab attention quickly.	<p>Prepare a 90-second elevator pitch for your business idea (the same or refined idea used in earlier assignments). Your pitch should cover the following elements:</p> <ul style="list-style-type: none"> • The Problem–Problem Identification • The Solution–Description of your product/service. • Value Proposition–The unique value proposition. • Target Audience–Audience for your idea. • Call to Action–E.g. request for support, funding, feedback, etc. <p>Deliver Your Pitch:</p> <ul style="list-style-type: none"> • Record a video and submit it with written version of your pitch.

			<ul style="list-style-type: none">• Ensure clear speech, confident body language (for video), and persuasive one. Reflection (Short Write-up):• Share what you learned about communicating your idea• Describe challenges or rewards you experienced in the process
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	Pimpri Chinchwad Education Trust's Pimpri Chinchwad College of Engineering & Research Ravet, Pune An Autonomous Institute NBA Accredited (4 UG Programs) NAAC A++ Accredited ISO 21001:2018 Certified IQAC PCCOER Department of Computer Engineering	
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Class: Second Year B.Tech. (2025 Pattern)						Sem: III	
Course Code: VEC-209-COM			Name of Course: Universal Human Values				
Teaching Scheme (Hrs/week):				Credits:			
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical	
2	–	–		2	–	–	
Examination Scheme :							
FA	SA	PR	OR	TW	Total		
25	25	–	–	–	50		
Prerequisite:							
1. Life Skills-I (CCC-101-ASH)							
2. Life Skills-II(CCC-151-ASH)							
Course Objective: In this course we aim to enable student to:							
1. Help students develop a holistic perspective of life, profession, and happiness based on correct understanding of human reality.							
2. Enable students to understand harmony at different levels of existence – individual, family, society, and nature.							
3. Promote ethical human conduct through right understanding, relationships, and responsible use of physical facilities.							
4. Encourage self-exploration as a process for internalizing universal human values.							
Course Outcome: On completion of this course, the students will be able to:							
VEC-209-COM.1	Understand the concepts of Universal Human Values						
VEC-209-COM.2	Differentiate between the needs of the Self and the Body and align actions accordingly.						
VEC-209-COM.3	Adapt harmonious relationships in family based on trust, respect, and justice.						
VEC-209-COM.4	Apply universal human values to professional and social life for ethical decision-making.						
VEC-209-COM.5	Interpret the interconnectedness, harmony in nature and existence leading to sustainable living.						
Course Content (TH)							
Unit I	Introduction to Universal Human Values					(06 Hours)	
Value Education: Meaning, need, and relevance, Holistic development and role of education, Difference between value-based education and skill based education, Self-exploration as the process for value education, Continuous happiness and prosperity as basic human aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Natural acceptance and experiential validation https://www.iitk.ac.in/hvhe/images/fcourse/course3.pdf https://bitmesra.ac.in/UploadedDocuments/adminvec/files/02_AICTE%20Model%20Curriculum%20UHV%20Courses.pdf							

https://www.bcp.edu.in/UHV%20-2%20Syllabus-BCP.doc.pdf		
Unit II	Harmony in the Human Being	(06 Hours)
<p>Human being as co-existence of Self (I) and Body (Sukh and Suvidha), Needs of Self vs Needs of Body, Body as an instrument of the Self, Harmony of Self with Body, Self-regulation (Sanyam), health, and well-being, Understanding the characteristics and activities of 'I' and harmony in 'I', correct appraisal of Physical needs, meaning of Prosperity in detail</p> <p>https://www.iitk.ac.in/hvhe/images/fcourse/course3.pdf https://vtu.ac.in/pdf/2022common3to8/BUHK408.pdf https://sppuengineers.in/syllabus</p>		
Unit III	Harmony in Family	(05 Hours)
<p>Family as the basic unit of human interaction, Trust as the foundational value in relationships, Understanding the meaning of Trust (Vishwas), Difference between intention and Competence, Respect as right evaluation, Understanding the meaning of Respect (Samman), Difference between respect and Differentiation, Justice in Human-to-Human Relationship</p> <p>Other values in relationship: Affection, care, guidance, reverence, glory, gratitude, love, Justice and mutual fulfillment in relationships</p> <p>https://www.iitk.ac.in/hvhe/images/fcourse/course3.pdf https://vtu.ac.in/pdf/2022common3to8/BUHK408.pdf https://sppuengineers.in/syllabus</p>		
Unit IV	Harmony in Society and Universal Human Order	(06 Hours)
<p>Understanding the harmony in the society (society being an extension of family),</p> <p>Comprehensive human goals: Resolution, Prosperity, Fearlessness, Co-existence (Samadhan, Samridhi, Abhay, Sah-astitva), Undivided society (Akhand Samaj), and universal human order (Sarvabhaum Vyawastha)- Nyaya, Swasthya, Shiksha, Sankriti, Role of institutions in ensuring harmony, Vision for the Universal Human Order</p> <p>https://www.iitk.ac.in/hvhe/images/fcourse/course3.pdf https://vtu.ac.in/pdf/2022common3to8/BUHK408.pdf https://sppuengineers.in/syllabus https://bitmesra.ac.in/UploadedDocuments/adminvec/files/02_AICTE%20Model%20Curriculum%20UHV%20Courses.pdf</p>		
Unit V	Harmony in Nature, Existence and Professional Ethics	(07 Hours)
<p>Understanding the harmony in the Nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Sustainable development and ecological balance, Ethical human conduct and professional responsibility, Competence in Professional Ethics, Holistic perception of harmony at all levels of existence,</p> <p>Strategies for Transition towards Value-based Life and Profession: At the level of individual: as socially</p>		

and ecologically responsible engineers, technologists and managers

At the level of society: as mutually enriching institutions and organizations

<https://www.iitk.ac.in/hvhe/images/fcourse/course3.pdf>

https://bitmesra.ac.in/UploadedDocuments/adminvec/files/02_AICTE%20Model%20Curriculum%20UHV%20Courses.pdf

<https://sppuengineers.in/syllabus>

Learning Resources

Reference Books:

1. M. K. Gandhi, “The Story of my Experiments with Truth”, Discovery Publisher
2. P. L. Dhar, R. R. Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. B. P. Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
4. A. N. Tripathy, 2003, Human Values, New Age International Publishers.
5. E. G. Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
6. M. Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics and Human Values, Eastern Economy Edition, Prentice Hall of India Ltd.
7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
8. A.N. Tripathy, 2003, Human Values, New Age International Publishers

Text Books

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Passer, M.W. and Smith, R.E. (2010). Psychology: The science of mind and behavior. New Delhi: Tata McGraw-Hill
3. A. Nagaraj, Universal Human Values and Professional Ethics, PHI Learning.

E-resources:



1. AICTE – Universal Human Values Course Material
2. Swayam Course on “Understanding Human Being Nature and Existence Comprehensively” by Dr. Kumar Sambhav, https://onlinecourses.swayam2.ac.in/aic22_ge23/preview
3. NPTEL Course on “Exploring Human Values: Visions of Happiness and Perfect Society” by Prof.A. K. Sharma IIT Kanpur, <https://nptel.ac.in/courses/109104068>
4. <https://fdp-si.aicte-india.org/download.php#1/>

5. <https://fdp-si.aicte-india.org/8dayUHVdownload.php>

Course Name : Universal Human Values

List of Case Studies

Sr. No.	Unit No.	Content
1	1	Case study with real life scenario on Self-Exploration
2	2	Case study with real life scenario on Achieving Balance – Understanding Self and Body List down all your desires. Observe whether the desire is related to Self (I) or Body. If it appears to be related to both, see which part of it is related to Self (I) and which part is related to Body. Students maintain a log of the time and money spent in satisfying the needs of the Self and the needs of the body. OR Observe that any physical facility you use, follows the given sequence with time : Necessary & tasteful → unnecessary & tasteful → unnecessary & tasteless → intolerable
3	3	Case study with real life scenario on from Conflict to Coexistence 1. Observe on how many occasions you are respecting your related ones (by doing the right evaluation) and on how many occasions you are disrespecting by way of under evaluation, over-evaluation or otherwise evaluation. 2. Also observe whether your feeling of respect is based on treating the other as yourself or on differentiations based on body, physical facilities or beliefs.
4	4	Case study with real life scenario on from Community Conflict to Collective Harmony Consider Real life riots in community
5	5	Case study with real life scenario on Engineering in Harmony with Nature – A Sustainable Choice with Exploring Ethical Human Conduct, Exploring Humanistic Models in Education. OR Case study on "Four Orders of Nature" Model Using the idea of four orders (Material, Pranic/Plant, Animal, Human) and their mutual fulfillment.

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Class: Second Year B.Tech. (2025 Pattern)					Sem: III	
Course Code: ELC-210-COM			Name of Course: Web Technology			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
–	–	4		–	–	2
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
–	–	–	25	25	50	
Prerequisite:						
1. Fundamentals of Computer Engineering (PCC-101-COMP)						
Course Objective: In this course we aim to enable student to:						
1. Learn the fundamentals of web essentials and markup languages						
2. Use the Client side technologies in web development						
3. Use the Server side technologies in web development						
Course Outcome: On completion of this course, the students will be able to:						
ELC-210-COM.1	Implement and analyze behavior of web pages using HTML and CSS					
ELC-210-COM.2	Apply the client side technologies for web development					
ELC-210-COM.3	Analyze various JavaScript frameworks					
ELC-210-COM.4	Apply the server side technologies for web development					
ELC-210-COM.5	Create the web based system which will serve any existing business functioning					

Course Content (PR)						
Group A (Any 3 assignments)						
Theory: Website Design issues, Basic HTML Tags, Advanced HTML tags: Image, Table, Anchor Tag, form etc., CSS: CSS Concept, Types of CSS with Syntax						
Assignment No 1: Case study: Before coding of the website, planning is important, students should visit different websites (Min. 5) for the different client projects and note down the evaluation results for these websites, either good website or bad website in following format:						
Sr. No.	Website URL	Purpose of Website	Things liked in the website	Things disliked in the website	Overall evaluation of the website (Good/Bad)	
From the evaluation, students should learn and conclude different website design issues, which should be considered while developing a website.						

Assignment No 2: Design the following static web pages required for an online book store web site using HTML and CSS.

1) HOME PAGE: The static home page must contain three frames. 1) REGISTRATION PAGE 2) LOGIN PAGE 3) CATALOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table.

Assignment No 3: Design the following static web pages required for an e-commerce website using HTML and CSS.

The static web pages should consist of various categories of product links which get directed towards a list of products in that category, various offers, images, tables and links to product information. The product information page must contain all the information about the product including images, description, cost etc.

Assignment No 4: Build the Personal resume using HTML and CSS.

Use all necessary HTML tags and CSS elements and build a personal resume containing personal information with photo, academics information, co-curricular and extra-curricular achievements, experience and declaration for T & P purpose.

Group B (Any 2 assignments)

Theory: JavaScript: Syntax, Control Statements, Functions, Validation, Event Handling.

Assignment No 5: Write JavaScript to validate the following fields of the Registration page.

1. First Name (Name should contain alphabets and the length should not be less than 6 characters).
2. Password (Password should not be less than 6 characters length).
3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com).
4. Mobile Number (Phone number should contain 10 digits only).
5. Last Name and Address (should not be Empty).

Assignment No 6: Implement an application in Java Script using following:

- a) Design UI of application using HTML, CSS etc.
 - b) Include Java script validation
 - c) Use of prompt and alert window using Java Script
- e.g. Design and implement a simple calculator using Java Script for operations like addition, multiplication, subtraction, division, square of number etc. a) Design calculator interface like text field for input and output, buttons for numbers and operators etc. b) Validate input values c) Prompt/alerts for invalid values etc.

Assignment No 7: Write an HTML page including any required JavaScript that takes a number from a text field in the range of 0 to 999 and shows it in words. It should not accept four and above digits, alphabets and special characters.

Group C (Any 2 assignments)

Theory: React JS: Introduction, Syntax, Components, JSX, States, Routing, Props, Hooks.

Assignment No 8: Perform following using reactJS:

Create a "Customer Satisfaction" tool where users can click on rating buttons (1-5). The UI must display the average rating and the total number of votes in real-time.

Assignment No 9: Perform following using reactJS:

Develop a Length Converter (Meters to Feet). The app must have two input fields. Changing the value in the "Meters" box must instantly update the "Feet" box and vice versa.

Assignment No. 10: Perform following using reactJS:

Build a 1-minute timer with "Start," "Pause," and "Reset" functionality. The background color of the page should change when the timer hits zero.

	Group D (Any 2 assignments)	
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Theory: PHP: Introduction, Syntax, Control Statements, Arrays, Session Management, PHP and MySQL

Assignment No 11:

Develop a web-based student registration system using PHP that accepts student details through a form and displays the stored information dynamically.

Assignment No 12:

Create a mini job portal using PHP where jobs are posted and users apply online

Assignment No. 13:

Design a basic chat website using PHP where users can send and view messages.

	Group E (Mini Project)	
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Design and develop a **real-time web-based application** using **Node.js / Express.js** for a **retail store / e-commerce platform / dealer shop / enterprise / business organization** to automate and manage its core business operations.

The system should address real-world business requirements such as **product management, customer management, order processing, billing, inventory tracking, and reporting**, thereby improving operational efficiency and digital presence of the organization.

The application must be **developed for a real client or sponsoring organization**, and should be capable of functioning in a **real-time environment**.

The final submission should include:

- Project Report (as per Institute/department format)
- Source Code with execution instructions
- Presentation/Demonstration of the application
- Utility certificate of client (for whom it is developed) or sponsoring organization

Guidelines:

The learners should implement the assignments for the given problem statements from each group as mentioned above. These assignment statements are sample statements and the instructor can also frame other problem statements covering the fundamentals which are expected in each assignment. The learners should implement a total of 9 assignments and one mini project. The Teamwork should be submitted by learners in a journal with 10 write-ups, CD of source code of all assignments, mini project report as per format shared by instructor, mini project sponsorship or client utility certificate. The external oral examination should be conducted in the form of mini project presentations in a group of 2 to 3 students. The instructor must maintain the record of groups and their titles. The mini project statements must be a real time system as mentioned and the IPRs of the same must be registered under the guidance of the course faculty. The instructor is also suggested to arrange a one-day industry visit for students to learn about the process of software development and latest industry trends in web development. The students will generate a one-page report on learning through industry visit and attach it in a file. The mini project activity is an activity that must be carried out throughout the semester starting from formulation of the problem statement, survey, analysis, design and implementation. The course is intended to give complete hands on industry based web development.

Learning Resources

Reference Books:

1. Wolf, J. (2024). *HTML and CSS: The Comprehensive Guide*. Rheinwerk Computing. ISBN -978 .1493224227
2. Flanagan, D. (2020). *JavaScript: The Definitive Guide* (7th ed.). O'Reilly Media. ISBN 9781491952023.
3. Sakhniuk, M., & Boduch, A. (2024). *React and React Native* (5th ed.). Packt Publishing. ISBN 9781805127307.
4. Lockhart, J. (2023). *Modern PHP: New Features and Good Practices*. O'Reilly Media. ISBN 978-1491905012.

Text Books:

1. Frain, B. (2025). *Responsive Web Design with HTML5 and CSS* (5th ed.). Packt Publishing. ISBN 9781837028238.
2. Snell, J. M. (2025). *JavaScript in Depth*. Manning Publications. ISBN 9781633434783.
3. Schwarzmüller, M. (2025). *React Key Concepts: An In-Depth Guide to React's Core Features* (2nd ed.). Packt Publishing. ISBN 978-1-83620-226-4.
4. Nixon, R. (2025). *Learning PHP, MySQL & JavaScript* (5th ed.). O'Reilly Media. ISBN 9781492053958.

E-resources:



1. **HTML:** <https://www.w3schools.com/html/default.asp>
2. **CSS:** <https://www.w3schools.com/css/default.asp>
3. **JavaScript:** <https://javascript.info/>
4. **React JS:** <https://react.dev/learn>
5. **PHP:** <https://www.php.net/manual/en/>
6. **Web Development:** <https://www.youtube.com/watch?v=8sXRyHI3bLw>

Semester - IV

S. Y. B. Tech. Computer Engineering Syllabus Structure

Level 5															
S.Y. B.Tech. Computer Engineering															
Semester IV															
Course Code	Course Name	Course Type	Credits	Credit Scheme			Teaching Scheme (Hrs/Week)			Examination Scheme					Marks
				L	T	P	L	T	P	FA	SA	PR	OR	TW	
PCC-251-COM	Data Structures and Algorithms	PCC	3	3	–	–	3	–	–	50	50	–	–	–	100
PCC-252-COM	Data Structures and Algorithms Laboratory	PCC	1	–	–	1	–	–	2	–	–	50	–	–	50
PCC-253-COM	Software Engineering and Modelling	PCC	2	2	–	–	2	–	–	50	50	–	–	–	100
PCC-254-COM	Computer Network	PCC	2	2	–	–	2	–	–	50	50	–	–	–	100
PCC-255-COM	Computer Network Laboratory	PCC	1	–	–	1	–	–	2	–	–	–	25	–	25
MDM-256-COM	MDM-II* Microprocessor	MDM	2	2	–	–	2	–	–	50	50	–	–	–	100
MDM-257-COM	MDM-II* Microprocessor Laboratory	MDM	1	–	–	1	–	–	2	–	–	–	25	–	25
	Open Elective – II**	OEC	2	2	–	–	2	–	–	–	–	–	25	25	50
VSE-258-COM	JAVA Programming	VSEC	2	–	–	2	–	–	4	–	–	25	–	25	50
AEC-259-COM	Modern Indian Language	AEC	2	1	1	–	1	1	–	–	–	–	–	50	50
EEM-260-COM	E-commerce and Digital Business	EEM	2	2	–	–	2	–	–	–	–	–	–	50	50
VEC-261-COM	Environmental Science Studies	VEC	2	2	–	–	2	–	–	25	25	–	–	–	50
AC-262-COM	Aptitude - I	AC	–	–	–	–	2	–	–	–	–	–	–	–	Grade
Total			22	16	1	5	18	1	10	225	225	75	75	150	750

Class- Term	Second Year- Term III (OEC-II)	
CREDITS	2	
OEC	Biology for Engineers	Financial management
	Critical Thinking and Problem Solving	Media, Society, and Digital Culture

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Class: Second Year B. Tech. (2025 Pattern)		Sem: IV
Course Code: PCC-251-COM		Name of Course: Data Structures and Algorithms
Teaching Scheme (Hrs/week):		
Lecture	Tutorial	Practical
3	-	-
Credits:		
Lecture	Tutorial	Practical
3	-	-
Examination Scheme:		
FA	SA	PR
50	50	-
OR	TW	Total
-	-	100
Prerequisite:		
Programming in C, Python Programming, Data Structures		
Course Objective: In this course we aim to enable student to:		
<ol style="list-style-type: none"> 1. Enable students to analyze the efficiency of fundamental algorithms such as searching, sorting, hashing algorithms. 2. Develop skills in designing, implementing, and applying tree-based data structures for efficient data management. 3. Enhance problem-solving abilities through the application of graph algorithms to complex computing problems. 4. Provide knowledge of file handling and indexing techniques for effective storage, retrieval, and organization of structured data. 		
Course Outcome: On completion of this course, the students will be able to:		
PCC-251-COM.1	Analyze the performance of searching, sorting, and hashing techniques.	
PCC-251-COM.2	Implement and evaluate various tree-based data structures.	
PCC-251-COM.3	Apply graph algorithms for problem solving in computer science.	
PCC-251-COM.4	Implement balanced and advanced search trees for efficient data management.	
PCC-251-COM.5	Apply file handling and indexing techniques for storage and retrieval of structured data.	
Course Content (TH)		
Unit I	Hashing	(09 Hours)
Hashing: Concepts-hash table, hash function, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions-properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision		

resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing. Applications of Hashing.

Unit II	Trees	(09 Hours)
<p>Tree: basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals: inorder, preorder, post order, level wise -depth first and breadth first, Operations on binary tree. Binary Search Tree (BST), BST operations, Threaded binary tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary tree, in order traversal of in-order threaded binary tree.</p>		
Unit III	Graphs	(09 Hours)
<p>Graphs: Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Introduction to Greedy Strategy, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms, Dijkstra's Single source shortest path, A+ (G-map), Topological ordering, Applications of Graphs: Network routing, scheduling, social networks.</p>		
Unit IV	Search Tree	(09 Hours)
<p>Weight balanced tree, Optimal Binary Search Tree (OBST), Height Balanced Tree- AVL tree, Multiway search tree, B-Tree Structure, properties, operations (insert, delete, search), B+Tree (Structure, differences from B-trees, insertion and deletion operations), Red-Black Tree, K-dimensional tree, AA tree.</p> <p>Heap: Heap data structure, Min and Max Heap, Heap sort, applications of heap</p>		
Unit V	File Handling	(09 Hours)
<p>Sequential file organization: concept and primitive operations, Direct Access File: Concepts and Primitive operations, Indexed sequential file organization: concept, types of indices, structure of index sequential file, Linked Organization: multi list files, coral rings, inverted files and cellular partitions, External Sort: Consequential processing and merging two lists, multiday merging- a k way merge algorithm.</p>		

Learning Resources

Text Books:

1. Goodrich, Tamassia, Goldwasser, —Data Structures and Algorithms in C++/l, Wiley publication, ISBN-978-81-265-1260-7
2. Data Structures and Algorithms in C++ by Adam Drozdek
3. Data Structures and Algorithms in Python by Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser.
4. Introduction to Algorithms (CLRS) by Cormen, Leiserson, Rivest, and Stein

Reference Books:

1. Algorithms by Robert Sedgewick and Kevin Wayne.
2. Grokking Algorithms by Aditya Bhargava

3. Algorithm Design Manual by Steven S. Skiena

E-resources:

E-Resources for Each Unit

Unit 1: <https://www.cse.iitb.ac.in/~akg/courses/2023-ds/lec-01-why-ds.pdf>

<https://moss.cs.iit.edu/cs331/slides/introduction.pdf>

Unit 2: <https://www.cse.iitd.ac.in/~mausam/courses/coll106/spring2021/lectures/07-trees.pdf>

<https://www.cdeep.iitb.ac.in/slides/A13/EE717/EE717-L6.pdf>

Unit 3: https://cse.iitkgp.ac.in/~bivasm/cnt_notes/Basic-graph-theory-2.pdf



<https://nptel.ac.in/courses/106102064>

Unit 4: <https://nitbase.github.io/docs/Misc/B+%20Trees>

Unit 5: <https://www.studocu.com/in/course/indian-institute-of-technology-kharagpur/file-organization-and-database-systems/5028038>

List of Case Studies

Sr. No.	Unit No.	Content
1	I	Hashing techniques for expandable Files(Extendible, Dynamic and Linear Hashing)
2	II	Use of binary tree in expression tree-evaluation and Huffman's coding
3	III	Data structure used in Webgraph and Google map.
4	IV	Advanced Search Trees for Scalable Data Management
5	V	File Handling in a database handling system.

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Class: Second Year B.Tech. (2025 Pattern)		Sem: IV
Course Code: PCC-252-COM	Name of Course: Data Structures and Algorithms Laboratory	
Teaching Scheme (Hrs/week):		
Lecture	Tutorial	Practical
-	-	2
Credits:		
Lecture	Tutorial	Practical
-	-	1
Examination Scheme :		
FA	SA	PR
-	-	50
OR	TW	Total
-	-	50
Prerequisite:		
Programming in C, Python Programming		
Course Objective: In this course we aim to enable student to:		
<ol style="list-style-type: none"> 1. Provide students with knowledge of searching, sorting, and hashing techniques for efficient data organization and retrieval. 2. Develop the ability to design and implement tree and graph data structures for solving computational and real-world problems. 3. Introduce B-Tree and B+ Tree structures for efficient indexing and range-based queries in large-scale datasets. 4. Familiarize students with different file organization methods and operations for effective data storage, access, and management. 		
Course Outcome: On completion of this course, the students will be able to:		
PCC-252-COM.1	Apply hashing techniques to organize and retrieve data efficiently.	
PCC-252-COM.2	Implement tree and graph data structures for solving computational and real-world problems.	
PCC-252-COM.3	Implement B-Tree and B+ Tree structures for efficient indexing and range-based queries in large datasets.	
PCC-252-COM.4	Demonstrate different file organization methods and operations for effective data storage, access, and management.	
Course Content (PR)		

Group A (Core algorithms) [Any three]		
<p>Assignment No 1: Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client's telephone number. Make use of two collision handling techniques and compare them using number of comparisons required to find a set of telephone numbers.</p> <p>Assignment No 2: Implement a hash table of size 10 and use the division method as a hash function. In case of a collision, use chaining. Implement the following operations:</p> <p>Insert(key): Insert key-value pairs into the hash table.</p> <p>Search(key): Search for the value associated with a given key.</p> <p>Delete(key): Delete a key-value pair from the hash table</p> <p>Assignment No 3: Design and implement a hash table of fixed size. Use the extraction/mid-square/folding method for the hash function and resolve collisions using double hashing. Allow the user to perform the following operations:</p> <ul style="list-style-type: none"> • Insert a key • Search for a key • Delete a key • Display the table <p>Assignment No 4: Implement a Hash Table for storing Student Records (Roll Number, Name, CGPA). Demonstrate collision handling using: Chaining, Linear Probing, Quadratic Probing, Double Hashing</p>		
Group B (Non-linear structures) [Any three]		
<p>Assignment No 6: Create a BST of student records (Roll Number, Name, CGPA). Implement insertion, searching, and display using inorder, preorder, and postorder traversals.</p> <p>Assignment No 7: Represent your college campus as a graph using an adjacency list or an adjacency matrix, where nodes represent various departments or institutes and edges represent the distances between them. Then, find the Minimum Spanning Tree (MST): (a) using Kruskal's algorithm, and (b) using Prim's algorithm.</p> <p>Assignment No 8: Use a Max-Heap to generate a merit list (Top K students with highest CGPA). Use a Min-Heap to display Bottom K students.</p> <p>Assignment No 9: Represent a social network of students as a graph. Implement: Adjacency Matrix, Adjacency List. Demonstrate BFS and DFS traversals.</p> <p>Assignment No 10: Implement Dijkstra's Algorithm to find the shortest path between two students (nodes) in a campus map graph.</p>		
Group C (Advanced indexing & storage) [Any three]		
<p>Assignment No 11: Create a B-Tree for indexing Book IDs in a library system. Implement insertion and search operations. Display the tree structure.</p>		

Assignment No 12: Implement a B+ Tree to store library records. Demonstrate insertion, search, and range queries.

Assignment No 13: Implement a file system to store student records sequentially. Support operations: create, read, write, modify.

Assignment No 14: Implement an Indexed File System where student records can be quickly accessed using an index on Roll Numbers.

Assignment No 15: Implement a Direct Access File where student records are stored using hashing. Demonstrate insertion, search, and deletion with collision resolution.

Group D

Assignment No 16: A menu-driven mini project that allows:

1. Adding, updating, deleting, and displaying student records.
2. Searching and sorting students using different algorithms.
3. Storing and retrieving records using hashing.
4. Displaying student data using trees and graphs.
5. Using B & B+ trees for efficient indexing.
6. Maintaining student records in different file organizations.
7. Displaying a comparative analysis table of algorithm efficiencies.

Learning Resources

Text Books:



1. Data Structures and Algorithms in C++ by Adam Drozdek
2. Data Structures and Algorithms in Python by Michael T. Goodrich, Roberto Tamassia, and Michael H. Goldwasser.

Reference Books:

1. Grokking Algorithms by Aditya Bhargava
2. Algorithm Design Manual by Steven S. Skiena

E-resources:

1. <https://www.cse.iitd.ac.in/~mausam/courses/col106/spring2021/lectures/07-trees.pdf>
2. <https://www.cdeep.iitb.ac.in/slides/A13/EE717/EE717-L6.pdf>

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Class: Second Year B. Tech. (2025 Pattern)					Sem: IV	
Course Code: PCC-253-COM			Name of Course: Software Engineering and Modelling			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
2	-	-		2	-	-
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
50	50	-	-	-	100	
Prerequisite:						
Web Technology						
Course Objective: In this course we aim to enable student to:						
<ol style="list-style-type: none"> 1. Understand the principles and process models of Software Engineering. 2. Understand and apply various approaches for eliciting, specifying, modeling, and evaluating software requirements. 3. Develop an understanding of software estimation techniques, scheduling techniques, and risk management practices for software project development. 4. Understand software architecture styles and design patterns, and apply them to build effective and scalable software systems. 5. Apply software testing techniques and explore the emerging AI-driven trends for developing efficient software systems. 						
Course Outcome: On completion of this course, the students will be able to:						
PCC-253-COM.1	Apply the fundamentals of Software Engineering and different software process models for real time projects.					
PCC-253-COM.2	Analyze software requirements and model system functionality using UML diagrams.					
PCC-253-COM.3	Apply estimation and scheduling techniques, and identify risks to ensure quality project delivery.					
PCC-253-COM.4	Apply architectural styles and design patterns to solve design problems.					
PCC-253-COM.5	Apply software testing techniques to ensure the quality of software systems and understand emerging trends in Software Engineering.					
Unit I	Foundation of Software Engineering and Software Process Models					(06 Hours)
Introduction to Software Engineering, Software Quality Attributes, Different types of Software, Software Development Life Cycle, Umbrella Framework Activity, Software Process Model: Waterfall model, Incremental Model, Rapid Application Development (RAD) Model, Prototyping Process Model, Spiral						

Model, The Unified Process, Agile Software Development Process : Principles, Agile Methodologies Agile tool: SCRUM, Sprint Cycle, Sprint Cycle stages, SCRUM master, Extreme Programming.		
Unit II	Software Requirement Specification and Modeling	(06 Hours)
<p>Introduction to Requirements Engineering: Functional requirements and Non -Functional requirements, Requirement Engineering Phases: Problem Analysis, Establishing the Groundwork, Elicitation, Negotiation, Validation, and Modeling.</p> <p>UML Modelling: Use Case Diagrams, Class Diagrams, Sequence Diagrams, Activity Diagrams, Package Diagrams, Component Diagrams, Deployment Diagrams.</p> <p>Software Requirement Specification (SRS): IEEE SRS structure, quality attributes, document guidelines.</p>		
Unit III	Software Project Estimation and Project Scheduling	(06 Hours)
<p>Importance of software project estimation, Size Estimation Techniques: Lines of Code (LOC), Function Point Analysis (FPA), Use Case Points Effort Estimation Techniques: COCOMO, Agile Estimation Practices.</p> <p>Project Scheduling: Activities in project planning, Work Breakdown Structure (WBS), Critical Path Method (CPM), Program Evaluation and Review Technique (PERT), Agile planning technique.</p> <p>Risk Management: Categories of Risks, The RMMM Plan. Software Configuration Management, SCM tools.</p>		
Unit IV	Software Architecture and Design Patterns	(06 Hours)
<p>Software Architecture: What is Software Architecture, Principles of designing, Architectural Styles: Layered Architecture, Client–Server Architecture, Microservices Architecture, Service-Oriented Architecture.</p> <p>Design pattern: Introduction to design Pattern, How design patterns solve design problems, Creational Patterns(Abstract Factory, builder, factory Method, prototype, Singleton), Structural Patterns(Adapter, bridge, composite, decorator, façade, proxy), Behavioral Patterns(interpreter, iterator, mediator, observer), Relation between Software Architecture and Patterns.</p>		
Unit V	Software Testing and Emerging Trends in Software Engineering	(06 Hours)
<p>Software Testing: Importance of Testing, Testing Principles, Validation and Verification activities, Unit Testing, Integration Testing, White Box & Black Box Testing, Alpha Testing and Beta Testing, Difference between Manual and Automation Testing.</p> <p>Emerging Trends: AI Applications in Software Engineering, LLM in Software Engineering, DevOps.</p>		
Learning Resources		
<ol style="list-style-type: none"> 1. Roger Pressman, “Software Engineering: A Practitioner’s Approach”l, McGraw Hill, ISBN 0– 07– 337597–7 2. Hassan Goma , “Software Modeling and Design UML,Use Case,Patterns,Software Architecture”, Cambridge University Press. 3. “Design Patterns: Elements of Reusable Object Oriented Software”, Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, Pearson 1st edition. ISBN-13: 078-5342633610 4. Software configuration management handbook by Alexis Leon, third edition 2015 5. Srinivasan Desikan ,“Software Testing:Principles and Practices”, Prentice Hall. 		

Reference Books:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", PHI, ISBN10: 0133056996
2. Rajib Mall, "Fundamentals of Software Engineering", PHI, ISBN13: 9788120348981
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715.
4. S K Chang, "Handbook of Software Engineering and Knowledge Engineering", World Scientific, Vol I, II, ISBN: 9789810249731
5. "Head First Design Patterns", Eric Freeman and Elisabeth Freeman, O'Reilly, 2004. ISBN-13. 978-0596007126
6. Jessica Keyes – Software Configuration Management (2008)

E-resources:

Unit 4:-Software Project Management By Prof. Rajib Mall & Prof. Durga Prasad Mohapatra | IIT Kharagpur



Unit 5: What Is Agentic Architecture? | IBM Agentic AI Architecture: A Deep Dive - Markovate

Research paper-

1. Large Language Models for Software Engineering(ACM)
2. AI-Driven Innovations in Software Engineering(MDPI)

List of Case Studies

Sr. No.	Unit No.	Content
1	I	1. Comparison of Process models and selection of appropriate model for software development. (apply to minor project) 2. Food Delivery Application using Scrum.
2	II	Design SRS in IEEE format and include UML diagram for any real time software system using StarUML tool.(Apply to minor project).
3	III	Study and analyze Azure DevOps (Microsoft) tool for estimation and project planning.(Apply any one of the Estimation technique to the minor project).
4	IV	Identify software architecture and design suitable design patterns for any real-time application.
5	V	McKinsey's Integration of Generative AI in Software Development , Manual test cases for real time project

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Class: Second Year B.Tech. (2025 Pattern)		Sem: IV			
Course Code: PCC-254-COM	Name of Course: Computer Networks				
Teaching Scheme (Hrs./week):					
Lecture	Tutorial	Practical	Lecture	Tutorial	Practical
2	-	-	2	-	-
Examination Scheme :					
FA	SA	PR	OR	TW	Total
50	50	-	-	--	100
Prerequisite:					
1. Fundamentals of Computer Engineering					
Course Objective: In this course we aim to enable student to:					
<ol style="list-style-type: none"> 1. To understand the fundamental concepts, technologies, architectures, and challenges of computer networks and communication systems. 2. To apply the principles of data communication and basic network security mechanisms to enable reliable and secure information exchange. 3. To analyze standard networking protocols, models, and schemes to determine their suitability in different contexts. 4. To understand network performance using transport protocols, flow/congestion control techniques, and quality of service (QoS) parameters. 5. To apply essential skills for using modern network tools and simulators to demonstrate networking and security concepts. 					
Course Outcome: On completion of this course, the students will be able to:					
PCC-254-COM.1	Explain computer network models, architectures, and the services offered at different layers of the protocol stack.				
PCC-254-COM.2	Apply knowledge of data communication and transmission techniques using various media to achieve reliable and error-free communication.				
PCC-254-COM.3	Analyze different routing methods to determine effective routing protocols for various networking scenarios.				
PCC-254-COM.4	Evaluate network performance using transport protocols, flow/congestion control techniques, and quality of service (QoS) parameters.				
PCC-254-COM.5	Implement simple computer network applications using modern network tools and simulation software.				
Course Content (TH)					
Unit I	Introduction and Basics of Communication				(06 Hours)

Introduction to computer networks and layered architecture. Definition and advantages of computer networks, Types of networks such as LAN, MAN, WAN, and wireless networks. Network software, protocols, and services. Design issues of network layers, interconnection devices such as gateways, Hubs, Switches, Bridges, Routers, and proxy servers. Basics of data communication: signals, bandwidth, transmission modes, and encoding techniques (Manchester, Differential Manchester).		
Unit II	Data Link Layer	(06 Hours)
Functions and design issues of the Data Link Layer. Framing techniques. Error control: parity check, checksum, CRC, Hamming code. Flow control methods: Stop-and-Wait, Sliding Window. Medium Access Control (MAC) sublayer. Multiple access protocols: ALOHA, Slotted ALOHA, CSMA, CSMA/CA, CSMA/CD, TDMA, FDMA, and CDMA. Point-to-Point Protocol (PPP) and High-Level Data Link Control (HDLC). Logical Link Control (LLC) and LLC Protocol Data Units. Layer 2 switches and switching concepts.		
Unit III	Network Layer	(06 Hours)
Functions and services of the Network Layer. Network layer design issues. IP addressing, IPv4 and IPv6 addressing schemes. Subnetting and supernetting. Routing concepts and routing algorithms (distance vector and link state). Packet switching and internetworking concepts, Header format of IPv4, IPv6, ICMP, IGMP Introduction to WAN technologies, ATM basics and routing in WANs.		
Unit IV	Transport Layer	(06 Hours)
Services and design issues of the Transport Layer. Process-to-process delivery. User Datagram Protocol (UDP) and Transmission Control Protocol (TCP). Connection establishment and termination. Flow control and error control mechanisms. Congestion control techniques. Quality of Service (QoS) overview, Socket communication and API, Introduction to wireless communication concepts related to transport services.		
Unit V	Application Layer	(06 Hours)
Client–Server model and application layer services. Domain Name System (DNS). Hypertext Transfer Protocol (HTTP and HTTPS – overview). Electronic mail system: SMTP, MIME, POP3, File Transfer Protocol (FTP) and TELNET. Dynamic Host Configuration Protocol (DHCP). Simple Network Management Protocol (SNMP). Overview of recent developments in networking applications.		
Learning Resources		
Text Books:		
<ol style="list-style-type: none"> 1. Andrew S. Tanenbaum and David J. Wetherall, “Computer Networks”, 5th edition, Prentice Hall, 2010 2. W. Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, 2007 		
Reference Books:		
<ol style="list-style-type: none"> 1. Behrouz A. Foruzan, “Data Communication and Networking”, 5th edition, Science Engineering & Math Publications, 2012 2. William Stallings, "Data and Computer Communication", 10/E, Pearson India, 2017. 		

3. Andrew S. Tanenbaum, "Computer Network", 5/E, Pearson India, 2013.

E-resources:

E-Resources for Each Unit

Unit 1: https://onlinecourses.nptel.ac.in/noc22_cs19/preview

Unit 2: https://onlinecourses.nptel.ac.in/noc22_cs19/preview



Unit 3: https://onlinecourses.nptel.ac.in/noc25_cs125/preview

Unit 4: <https://www.coursera.org/specializations/computer-network-security>

Unit 5: <https://www.udemy.com/course/network-security>

List of Case Studies

S. N	Unit No.	List of Case Studies
1	I	A university with multiple departments, hostels, and administrative offices requires a secure, scalable, and high-speed network to support online learning platforms, ERP systems, and research activities.
2	II	An enterprise experienced unauthorized access to internal servers, resulting in data leakage.
3	III	A data center required centralized control and dynamic network configuration.
4	IV	A corporate office experienced frequent network slowdowns during peak hours.
5	V	A hospital required a reliable wireless network to support medical devices, patient records, and staff communication.

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Class: Second Year B.Tech. (2025 Pattern)	Sem: IV
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Course Code: PCC-255-COM	Name of Course: Computer Network Laboratory
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Teaching Scheme (Hrs/week):			Credits:		
Lecture	Tutorial	Practical	Lecture	Tutorial	Practical
-	-	2	-	-	1

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

Prerequisite:
1. Fundamentals of Computer Engineering

Course Objective: In this course we aim to enable student to:
<ol style="list-style-type: none"> To explain knowledge of fundamental computer network hardware and software components. To introduce various network topologies and different types of computer networks. To enable understanding of networking protocols, modern networking technologies, and network-based applications. To demonstrate students with modern tools for network monitoring and traffic analysis. To develop basic skills in network programming using standard networking APIs and socket programming techniques

Course Outcome: On completion of this course, the students will be able to:	
PCC-255-COM.1	Explain the fundamental hardware and software components of computer networks.
PCC-255-COM.2	Describe and analyze various network topologies and types of computer networks.
PCC-255-COM.3	Interpret and compare networking protocols, modern networking technologies, and network-based applications.
PCC-255-COM.4	Apply modern network monitoring and traffic analysis tools to evaluate network performance and issues.
PCC-255-COM.5	Design and implement basic network programs using standard networking APIs and socket programming concepts.

Course Content (PR)
Group A (Any 3)

Practical 1:
To set up a wired LAN using a Layer-2 switch, which includes preparation of network cable, testing of cable using a line tester, configuration of machines with IP addresses, testing connectivity using the PING utility, and demonstrating PING packet traces captured using the Wireshark Packet Analyzer tool.

Practical 2:

To demonstrate different types of network topologies and transmission media using the Packet Tracer simulation tool.

Practical 3:

To set up a WAN consisting of both wired and wireless LANs using the Packet Tracer tool and demonstrate packet transfer from LAN-1 (wired LAN) to LAN-2 (wireless LAN).

Practical 4:

To write a program for error detection and correction for 7/8-bit ASCII codes using Hamming Codes or CRC.

Practical 5:

To write a program to simulate Go-Back-N and Selective Repeat modes of the Sliding Window Protocol in peer-to-peer mode.

Group B (Any 4)**Practical 6:**

To write a program to demonstrate subnetting and determine subnet masks.

Practical 7:

To write a program to implement the Link State or Distance Vector routing protocol to determine the optimal path for data transmission.

Practical 8:

To configure a three-router network using the Packet Tracer tool with any one routing protocol such as RIP, OSPF, or BGP.

Practical 9:

To write a program using TCP sockets for a wired network to implement the following applications:

- a) Peer-to-peer greeting (Say Hello)
- b) File transfer
- c) Calculator

Practical 10:

To write a program using UDP sockets to enable file transfer of script, text, audio, and video files between two machines.

Group C (Any 5)

(Practical No. 11 is compulsory, and attempt any four from Practical No. 12 to 17)

Practical 11 (Compulsory):

To write a program for DNS lookup such that, for a given IP address, the corresponding URL is obtained and vice versa.

Practical 12:

To install and configure a DHCP server and demonstrate the installation of the required software on a remote machine.

Practical 13:

To capture packets using Wireshark and apply appropriate capture and display filter expressions to analyze TCP and HTTP traffic during Facebook login, including evaluation of TCP flags and packet statistics.

Practical 14:

To study and analyze the performance of HTTP, HTTPS, and FTP protocols using the Packet Tracer simulation tool.

Practical 15:

To study the SSL protocol by capturing and analyzing packets using the Wireshark tool while accessing an SSL-secured website, such as banking or e-commerce portals.

Practical 16:



To illustrate the steps involved in implementing S/MIME email security using Microsoft® Office Outlook.

Practical 17:

To study the IPsec protocol (ESP and AH) by capturing and analyzing packets using the Wireshark Packet Analyzer tool.

E-resources:

- <https://www.nist.gov/cyberframework>
- <https://www.cisco.com/site/in/en/learn/training-certifications/resources/networking-security.html>
- <https://www.kali.org/docs/>
- <https://www.wireshark.org/docs/>
- <https://nmap.org/book/man.html>
- <https://www.cloudflare.com/learning/security/what-is-cyber-security/>
- <https://www.geeksforgeeks.org/computer-network-security/>
- <https://www.ibm.com/topics/network-security>
- <https://owasp.org/www-project-top-ten/>
- <https://www.youtube.com/watch?v=inWWhr5tnEA>

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Class: Second Year B. Tech. (2025 Pattern)	Sem: IV
Course Code: MDM-256-COM	Name of Course: MDM-II Microprocessor

Teaching Scheme (Hrs/week):			Credits:		
Lecture	Tutorial	Practical	Lecture	Tutorial	Practical
02	-	-	02	-	-

Examination Scheme :					
FA	SA	PR	OR	TW	Total
50	50	--	-	--	100

Prerequisite:
Digital Electronics and Computer Organization (MDM-206-COM)

Course Objective: In this course we aim to enable student to:
<ol style="list-style-type: none"> To understand the architecture and organization of the Intel 80386 microprocessor, including its registers, addressing modes, and instruction set. To explore the mechanisms of multitasking, task switching, privilege levels, and protection mechanisms in 80386. To provide knowledge of advanced processor features such as hyper-threading and virtualization technologies for efficient system utilization.

Course Outcome: On completion of this course, the students will be able to:	
MDM-256-COM.1	Illustrate the features, architecture, programmer's model, and pin configuration of the Intel 80386DX microprocessor.
MDM-256-COM.2	Analyze the role of system registers (system flags, Memory management registers, control registers, debug registers, test registers) in processor operations.
MDM-256-COM.3	Evaluate the advantages and limitations of segmentation and paging schemes.
MDM-256-COM.4	Analyze the role of task linking and task address space in efficient multitasking.
MDM-256-COM.5	Elaborate the evolution from single-core to multicore architectures and the role of bus connections in processor design.

Course Content (TH)		
Unit I	Microprocessor Introduction and Programming	(06 Hours)
80386 DX Features and Architecture, Programmers Model, Pin Description, Register Overview. Operating modes: Real Mode, Protected Mode and V86 Mode, Addressing modes and data types. Applications Instruction Set: Data Movement Instructions, Binary Arithmetic Instructions, Decimal Arithmetic Instructions, Logical Instructions, Control Transfer Instructions, String and Character Transfer Instructions, Instructions for Block Structured Language, Flag Control Instructions, Co-processor Interface Instructions, Segment Register Instructions, System Call, Miscellaneous Instructions.		

Unit II	Initialization and Systems Architecture	(06 Hours)
<p>Initialization- Processor State after Reset. Functional pin Diagram, functionality of various pins, I/O Organization, Memory Organization (Memory banks), Basic memory read and writes cycles with timing diagram.</p> <p>Systems Architecture- Systems Registers (Systems flags, Memory Management registers, Control registers, Debug registers, Test registers), System Instructions.</p>		
Unit III	Memory Management	(06 Hours)
<p>Global Descriptor Table, Local Descriptor Table, Interrupt Descriptor Table, GDTR, LDTR, IDTR. Formats of Descriptors and Selector, Segment Translation, Page Translation, Combining Segment and Page Translation.</p>		
Unit IV	Protection and Multitasking	(06 Hours)
<p>Overview of 80386DX Protection Mechanisms, Privileged Instructions, Concept of DPL, CPL, RPL, EPL. Multitasking: Task State Segment, TSS Descriptor, Task Register, Task Switching, Task Linking, Task Address Space, Segment Level Protection, Page Level Protection, Combining Segment and Page Level Protection.</p>		
Unit V	Multi-core Architectures	(06 Hours)
<p>Multicore Architectures, The Software Developer's Viewpoint, The Bus Connections, Single Core to Multicore.</p> <p>Intel 64bit Architecture: Block Diagram, Basic Execution Environment, Data Types, Specific advances: Instruction set, Intel Microarchitecture code name Nehalem, SIMD Instructions, Hyper threading Technology, Virtualization Technology.</p>		
Learning Resources		
Text Books:		
<ol style="list-style-type: none"> 1. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995. 2. Intel 80386 Hardware Reference Manual 1986, Intel Corporation, Order no.: 231732-001, 1986. 3. James Turley- "Advanced 80386 Programming Techniques", McGraw-Hill, ISBN: 10:0078813425, 13: 978-0078813429. 4. A. Ray, K.Bhurchandi, "Advanced Microprocessors and peripherals: Arch, Programming & Interfacing", Tata McGraw Hill,2004 ISBN 0-07-463841-6 5. Intel® 64 and 32 bit Architectures Software Developer's Manual, Volume –I, Intel, (Digital Content PDF, 253665.pdf) 		
Reference Books:		
<ol style="list-style-type: none"> 1. Chris H. Pappas, William H. Murray, "80386 Microprocessor Handbooks", McGraw-Hill Osborne Media, ISBN-10: 0078812429, 13: 978-0078812422. 2. Walter A. Triebel, "The 80386Dx Microprocessor: Hardware", Software, and Interfacing, Pearson Education, ISBN: 0137877307, 9780137877300. 3. Brey, Barry B, "8086/8088, 80286, 80386 and 80486 Assembly Language Programming", Prentice Hall, ISBN: 13: 9780023142475. 4. Introduction to 64 bit Intel Assembly Language Programming for Linux, 2nd Edition, Ray Seyfarth, ISBN10: 1478119209, ISBN-13: 9781478119203, 2012. 5. Intel 64 and IA-32 bit architectures Software Developer's Manual, Volume 3A, Intel, (Digital Content PDF: 253668.pdf) 		
E-resources:		

1. https://onlinecourses.nptel.ac.in/noc22_ee12

2. <https://nptel.ac.in/courses/108107029>

Intel 80386 Programmer's Reference Manual:

- <http://intel80386.com/386htm/toc.htm>
- <https://css.csail.mit.edu/6.858/2014/readings/i386.pdf>

List of Case Studies

Sr. No.	Unit No.	Content
1	I	Instruction Formats of 80386
2	II	Systems Architecture of Pentium
3	III	Explore Intel Core i3/i5/i7



Pimpri Chinchwad Education Trust's
Pimpri Chinchwad College of Engineering & Research Ravet, Pune
 An Autonomous Institute | NBA Accredited (4 UG Programs) | NAAC
 A++ Accredited | An ISO 21001:2018 Certified
IQAC PCCOER
Department of Computer Engineering



Class: Second Year B. Tech. (2025 Pattern)				Sem: IV		
Course Code: MDM-257-COM		Name of Course: Microprocessor Laboratory				
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	02		-	-	01
Examination Scheme :						
SA	FA	PR	OR	TW	Total	
-	-	-	25	-	25	
Prerequisite:						
1. Digital Electronics and Computer Organization Laboratory (MDM-207-COM)						
Course Objective: In this course we aim to enable student to:						
1. To provide practical exposure to microprocessor features, instruction sets, addressing modes and operating modes. 2. To provide practical exposure descriptor tables, and system registers, multiplication, BCD to Hex and Vice Versa operations. 3. To enable students to implement data representation, arithmetic operations, number system conversions and block transfers at the assembly level.						
Course Outcome: On completion of this course, the students will be able to:						
MDM-257-COM.1	Perform arithmetic and logical operations such as addition, subtraction, multiplication (successive addition, add-and-shift), division, complements, and factorial using recursion.					
MDM-257-COM.2	Illustrate efficient memory block transfers in both overlapped and non-overlapped condition using appropriate assembly instructions.					
MDM-257-COM.3	Demonstrate system-level programming skills by detecting processor modes, accessing system registers (GDTR, LDTR, IDTR, TR, MSW), and identifying CPU type using CPUID, along with implementing OS-level commands and file operations.					
MDM-257-COM.4	Design and implement OS-level file operations using command-line arguments and apply modular programming concepts using FAR procedures.					
Course Content (PR)						
Group A (Any 3)						
Assignment No 1: Write an X86/64 ALP to accept a 16 digit Hexadecimal number from the user, store it in a memory and display the accepted number. Use appropriate procedures to convert ASCII code to HEX code and Vice Versa.						

Assignment No 2: Write a switch case driven X86/64 ALP to perform 64-bit hexadecimal arithmetic operations (+, -, *, /) using suitable macros. Define procedure for each operation.

Assignment No 3: Write an X86/64 ALP to Find the 1's and 2's complement of a given number.

Assignment No 4: Write X86/64 ALP to Find the smallest and largest number from a given list.

Group B(Any 3)

Assignment No 5: Write an X86/64 ALP to count number of positive and negative numbers from the array.

Assignment No 6: Write X86/64 ALP to detect protected mode and display the values of GDTR, LDTR, IDTR, TR and MSW Registers also identify CPU type using CPUID instruction.

Assignment No 7: Write X86/64 ALP to perform non-overlapped block transfer without string specific instructions. Block containing data can be defined in the data segment.

Assignment No 8: Write X86/64 ALP to perform overlapped block transfer with string specific instructions. Block containing data can be defined in the data segment.

Group C (Any 3)

Assignment No 9: Write X86/64 ALP to convert 4-digit Hex number into its equivalent BCD number.

Assignment No 10: Write X86/64 ALP to convert 5- digit BCD number into its equivalent HEX number.

Assignment No 11: Write X86/64 ALP to find the factorial of a given integer number on a command line by using recursion. Explicit stack manipulation is expected in the code.

Assignment No 12: Write X86/64 ALP to perform multiplication of two 8-bit hexadecimal numbers. Use successive addition and add and shift method. (use of 64-bit registers is expected)

Group D (Any one)

Assignment 13: Write X86/64 Assembly Language Program (ALP) to implement following OS commands

i) COPY ii) TYPE Using file operations. User is supposed to provide command line arguments.

Assignment 14: Write X86 ALP to find a) Number of Blank spaces b) Number of lines c) Occurrence of a particular character. Accept the data from the text file. The text file has to be accessed during Program_1 execution and write FAR PROCEDURES in Program_2 for the rest of the processing. Use of PUBLIC and EXTERN directives is mandatory.

Learning Resources

Text Books:



1. Intel 80386 Programmer's Reference Manual 1986, Intel Corporation, Order no.: 231630-011, December 1995.
2. Intel 80386 Hardware Reference Manual 1986, Intel Corporation, Order no.: 231732-001, 1986.
3. Intel® 64 and 32 bit Architectures Software developer's Manual, Volume –I, Intel, (Digital Content PDF, 253665.pdf)

Reference Books:**Intel 80386 Programmer's Reference Manual:**



- <http://intel80386.com/386htm/toc.htm>
- <https://css.csail.mit.edu/6.858/2014/readings/i386.pdf>

E-resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee12
2. <https://nptel.ac.in/courses/108107029>
3. <https://cs.lmu.edu/~ray/notes/nasmtutorial/>

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Department: Second Year B.Tech. (2025 Pattern)		Sem: IV
Name of Course: OEC		

Course Code	Course Name	Course Type
OEC-270-CVL	Biology for Engineers	OEC
OEC-271-COMP	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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Class: Second Year B.Tech. (2025 Pattern)					Sem: IV	
Course Code: VSE-258-COM			Name of Course: Java Programming			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Tutorial	Practical	Lecture	Tutorial	Practical	
-	-	4	-	-	2	
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
-	-	25	-	25	50	
Prerequisite:						
<ol style="list-style-type: none"> 1. Programming in C 2. Python Programming 						
Course Objective: In this course we aim to enable student to:						
<ol style="list-style-type: none"> 1. To introduce students to core Java programming constructs and object-oriented principles for developing modular and real-world software systems. 2. To enable students to design robust Java applications using exception handling, file processing, multithreading, and the Java Collections Framework. 3. To equip students with skills to develop enterprise-level, database-driven, and web-based Java applications using JDBC, Servlets, JSP, testing frameworks, and ORM technologies 						
Course Outcome: On completion of this course, the students will be able to:						
VSE-258-COM.1	Implement core Java programming constructs and object-oriented principles to design and implement modular, real-world software systems.					
VSE-258-COM.2	Develop exception handling; file processing, multithreading, and the Java Collections Framework to design robust applications.					
VSE-258-COM.3	Develop scalable, database-driven, and web-based Java applications using enterprise technologies, testing frameworks, and ORM tools.					
Course Content (TH)						
Unit I	Core Java Programming and Object-Oriented Design				(04 Hours)	
Java fundamentals, control structures, methods, arrays, strings, Classes, objects, encapsulation, constructors, Constructor overloading, Inheritance, interfaces, packages, polymorphism						

Case Study: Student Information Management System and Banking (Core Java) / E-Commerce Order Processing System(Object Oriented Design)		
Unit II	Advanced Core Java Programming	(04 Hours)
Exception handling, user-defined exceptions, file handling, File-based Inventory Management System, Multithreading, thread lifecycle, synchronization, Java Collections Framework		
Case Study: Inventory Management System (File + Exceptions) , Railway Ticket Reservation System (Multithreading), Online Shopping Cart System (Collections)		
Unit III	Enterprise Java and Software Quality	(04 Hours)
JDBC architecture, CRUD operations, database integration, Servlets, JSP, MVC architecture, session management, JUnit testing, assertions, test lifecycle, Hibernate ORM, entity mapping, transaction management		
Case Study: Student Database Management System (JDBC), Online Course Registration System (Servlet + JSP + MVC), Automated Testing System (JUnit), Employee Management System (Hibernate ORM)		
Learning Resources		
Text Books:		
<ol style="list-style-type: none"> 1. E Balaguruswamy, (2023). Programming with Java: A Primer. 7th edition. India: McGraw Hill Education 2. Herbert Schildt, (2021). Java: The complete reference, 13th edition. McGraw-Hill Education. 		
Reference Books:		
<ol style="list-style-type: none"> 1. Paul Deitel and Harvey Detail, Java: How to Program, Pearson’s Publication, 9thEdition 2. Horstmann, C. S. (2023). Core Java- Vol. I– Fundamentals (Vol. 12). Pearson Education 		
E-resources:		
E-Resources		
https://www.nptelprep.in/courses/106105191/materials https://www.programiz.com/java-programming/online-compiler/ https://www.youtube.com/watch?v=Nckx9qMy_kw&list=PL9gnSGHSqcnr_DxHsP7AW9ftq0AtAyYqJ&index=2		
List of Case Studies		
Sr. No.	Unit No.	Content
1	I	Student Information Management System and Banking (Core Java) / E-Commerce Order Processing System(Object Oriented Design)
2	II	Inventory Management System (File + Exceptions) , Railway Ticket Reservation System (Multithreading), Online Shopping Cart System (Collections)

3	III	Student Database Management System (JDBC), Online Course Registration System (Servlet + JSP + MVC), Automated Testing System (JUnit), Employee Management System (Hibernate ORM)
Course Content (PR)		
Group A (All)		
<p>Assignment No 1: Student Information Management System</p> <p>System Description: Develop a Java console-based Student Information Management System to manage academic records of students within an institution.</p> <ul style="list-style-type: none"> • Accept student details such as roll number, name, marks, and department • Store data using arrays • Calculate total marks, average, and grade using methods • Perform string operations such as name formatting and searching • Display a formatted student report <p>Assignment No 2: Banking System Using Inheritance, Interfaces, and Packages</p> <p>System Description: Develop a Banking System that supports different types of accounts using inheritance and interfaces, organized into packages.</p> <ul style="list-style-type: none"> • Define a base Account class • Create derived classes such as SavingsAccount and CurrentAccount • Use an interface for common banking operations • Organize classes into packages • Demonstrate runtime polymorphism during transactions <p>Assignment No 3: Inventory Management System with Exception Handling and File Handling</p> <p>System Description: Develop an Inventory Management System that stores product data persistently using files and handles runtime errors gracefully.</p> <ul style="list-style-type: none"> • Add, update, and delete product records • Store inventory data in files • Read inventory data on program startup • Handle invalid inputs and file-related errors • Create and use custom exceptions 		
Group B (All)		
<p>Assignment No 4: Railway Ticket Reservation System Using Multithreading</p> <p>System Description: Develop a Railway Ticket Reservation System that simulates multiple users booking tickets simultaneously.</p> <ul style="list-style-type: none"> • Create multiple booking threads • Allow concurrent ticket booking • Synchronize access to shared resources • Prevent overbooking 		

- Display booking results

Assignment No 5: Online Shopping Cart Using Java Collections Framework

System Description: Develop a Shopping Cart System that manages products and orders using Java Collections.

- Store products using ArrayList
- Prevent duplicate items using Set
- Map product IDs to products using HashMap
- Sort products by price or name
- Generate cart summary and total bill

Assignment No 6: Student Database Management System Using JDBC

System Description: Develop a Student Database Management System that interacts with a relational database using JDBC.

- Connect to a database
- Insert, update, delete, and retrieve student records
- Use PreparedStatement
- Handle SQL exceptions
- Display records dynamically

	Group C (All)	
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Assignment No 7: Online Course Registration System Using Servlets and JSP (MVC)

System Description: Develop a web-based Course Registration System using Servlets and JSP following the MVC architecture.

- Allow students to register and log in
- Display available courses
- Allow course enrollment
- Store and retrieve data using JDBC
- Manage sessions
- Separate logic using MVC

Assignment No 8: Automated Testing System Using JUnit

System Description: Develop a **JUnit-based testing module** for validating the business logic of an existing Java system.

- Write unit tests for core methods
- Use assertions to verify results
- Implement setup and teardown methods
- Generate test reports
- Identify edge cases

Assignment No 9: Employee Management System Using Hibernate (ORM)

System Description: Develop an Employee Management System using Hibernate for object–relational mapping.

- Map Java classes to database tables
- Perform CRUD operations using Hibernate
- Manage sessions and transactions

Learning Resources

Text Books:

1. E Balaguruswamy, (2023). Programming with Java: A Primer. 7th edition. India: McGraw Hill Education
2. Herbert Schildt, (2021). Java: The complete reference, 13th edition. McGraw-Hill Education.

Reference Books:

1. Paul Deitel and Harvey Detail, Java: How to Program, Pearson’s Publication, 9thEdition
2. Horstmann, C. S. (2023). Core Java- Vol. I– Fundamentals (Vol. 12). Pearson Education



E-resources:

E-Resources

<https://www.nptelprep.in/courses/106105191/materials>

<https://www.programiz.com/java-programming/online-compiler/>

https://www.youtube.com/watch?v=Nckx9qMy_kw&list=PL9gnSGHSqcnr_DxHsP7AW9ftq0AtAyYqJ&index=2

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Class: Second Year B.Tech. (2025 Pattern)	Sem: IV
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Course Code: AEC-259-COMP	Name of Course: Modern Indian Language
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Teaching Scheme (Hrs/week):			Credits:		
Lecture	Tutorial	Practical	Lecture	Tutorial	Practical
1	1	-	1	1	-

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

Course Objective: In this course we aim to enable student to: <ul style="list-style-type: none"> विद्यार्थ्यांमध्ये प्रभावी संवाद कौशल्य विकसित करणे. विद्यार्थ्यांमध्ये माध्यम साक्षरता आणि संहिता लेखन शिकवणे. विद्यार्थ्यांना नवीन तंत्रज्ञान, सोशल मीडिया, आणि सॉफ्टवेअर लोकलायझेशनमध्ये मराठीचा वापर करण्यास सक्षम करणे.

Course Outcome: On completion of this course, the students will be able to:
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AEC-259-COM.1	विविध प्रकारचे व्यावसायिक लेखन.
AEC-259-COM.2	प्रभावी सादरीकरण आणि सूत्रसंचालन.
AEC-259-COM.3	डिजिटल आशय निर्मिती .

Course Content		
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घटक १	मराठी भाषेची मूलभूत क्षमता व संवाद कौशल्ये	(06 Hours)
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<ul style="list-style-type: none"> वाचन समज: मराठीतून लघुनिबंध वाचून त्याचे अर्थ, संदर्भ, आणि थीम समजून त्यावर चर्चा करणे लेखन: पत्र लेखन (औपचारिक आणि अनौपचारिक), अर्थपूर्ण निबंध लेखन - सध्याच्या सामाजिक, तंत्रज्ञानाशी संबंधित किंवा साहित्यिक विषयावर लेखन. प्रकल्प लेखन: तांत्रिक विषयावर अहवाल किंवा प्रस्ताव लेखन. मुद्रित माध्यमांसाठी लेखन: बातमी लेखन, संपादकीय आणि मुद्रितशोधन (Proofreading) प्रक्रिया. अनुवाद विद्या: इंग्रजी किंवा हिंदीतील बातम्यांचा मराठीत अचूक अनुवाद करण्याची कौशल्ये.
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घटक २	श्राव्य-दृश्य माध्यमे आणि कार्यालयीन व्यवहार	(06 Hours)
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- **आकाशवाणी (Radio):** रेडिओवरील भाषणे, मुलाखती आणि उद्घोषणांसाठी संहिता लेखन (Script Writing).
- **दूरचित्रवाणी (Television):** माहितीपट (Documentary) आणि बातम्यांसाठी संहिता लेखन व सादरीकरण.
- **कार्यालयीन पत्रव्यवहार:** नोकरीसाठी अर्ज, औपचारिक पत्रे आणि ई-मेल लेखनाचे नियम.
- **मुलाखत तंत्र:** दूरचित्रवाणी किंवा डिजिटल माध्यमांसाठी मुलाखत घेण्याची आणि देण्याची कला..
- **सूत्रसंचालन (Anchoring):** सांस्कृतिक कार्यक्रम किंवा व्यावसायिक सोहळ्यांचे प्रभावी सूत्रसंचालन करण्याची कौशल्ये.

घटक ३	नवीन माध्यमे, सोशल मीडिया आणि डिजिटल साक्षरता	(06 Hours)
<ul style="list-style-type: none"> • नव-माध्यमे (Digital Media): इंटरनेटवरील भाषेचे स्वरूप आणि ब्लॉग (Blog) लेखनाचे तंत्र. • सोशल मीडिया: फेसबुक (Facebook), ट्विटर (X) आणि इंस्टाग्राम यांसारख्या प्लॅटफॉर्मसाठी आशय निर्मिती. • ऑनलाईन ब्लॉगिंग मध्ये मराठी भाषा वापर. • तंत्रज्ञानाचे मराठीत रूपांतरण: सॉफ्टवेअर लोकलायझेशन, वेब डेव्हलपमेंट, आणि एप्लिकेशन विकास मध्ये मराठीचा वापर. • मराठी भाषेतील साधने: ऑटोमेटेड भाषांतर व चॅटबॉट्स चा मराठीत वापर • डिजिटल साक्षरता आणि नैतिकता: सायबर सुरक्षा, डिजिटल माध्यमांचे धोके आणि नैतिक वापर. 		
Learning Resources		
Text Books:		
<ol style="list-style-type: none"> 1. "उपयोजित मराठी" डॉ. केतकी मोडक, डॉ. सुहासकुमार बोबडे, डॉ. संजय विठ्ठल 2. "व्यावहारिक मराठी" ,डॉ. ल. रा. नसिराबादकर,फडके प्रकाशन 3. " मराठी भाषा : संवादाचे स्वरूप आणि माध्यमे" , डॉ. नागनाथ कोत्तापल्ले 		
Reference Books:		
<ol style="list-style-type: none"> 1. "व्यावहारिक उपयोजित मराठी आणि प्रसारमाध्यमांची कार्यशैली", डॉ. संदीप सांगळे 2. "प्रसारमाध्यमे आणि मराठी भाषा" , डॉ. भास्कर शेळके 3. "सायबर संस्कृती", डॉ. रमेश वरखेडे 4. "भाषांतर मीमांसा", कल्याण काळे आणि अंजली सोमण 		
Modern Indian Language		
List of Assignments		
1	बातमी लेखन आणि मुद्रितशोधन (News Writing & Proofreading) <ul style="list-style-type: none"> • कार्य: तुमच्या परिसरातील एखाद्या घटनेची (उदा. वृक्षारोपण किंवा व्याख्यान) बातमी तयार करा आणि त्या बातमीचे 'मुद्रितशोधन चिन्हांसह' (Proofreading Marks) शुद्धीकरण करा. 	
2	औपचारिक पत्रव्यवहार आणि ई-मेल (Formal Letter & Email) <ul style="list-style-type: none"> • कार्य: एखाद्या कंपनीत 'मराठी कंटेंट रायटर' या पदासाठी नोकरीचा अर्ज (Resume सह) आणि त्यासोबत पाठवण्यायोग्य एक औपचारिक ई-मेल मसुदा तयार करा. 	

3	<p>भाषांतर कौशल्य (Translation Skills)</p> <ul style="list-style-type: none"> कार्य: इंग्रजी किंवा हिंदीतील एका प्रसिद्ध तांत्रिक लेखाचा किंवा बातमीचा (किमान ३०० शब्द) ओघवत्या मराठी भाषेत अनुवाद करा.
4	<p>ब्लॉग लेखन (Blog Writing)</p> <ul style="list-style-type: none"> कार्य: 'आधुनिक शेती आणि तंत्रज्ञान' किंवा 'माझी आवडती साहित्यकृती' या विषयावर मराठीत एक माहितीपूर्ण ब्लॉग पोस्ट तयार करा (किमान ५०० शब्द).
5	<p>सोशल मीडिया आशय निर्मिती (Social Media Content Creation)</p> <ul style="list-style-type: none"> कार्य: एका शैक्षणिक संस्थेच्या जाहिरातीसाठी फेसबुक पोस्ट, इंस्टाग्राम कॅप्शन आणि ट्विटर (x) साठी ३ प्रभावी 'थ्रेड्स' मराठीत तयार करा.
6	<p>मुलाखत प्रश्नावली तयार करणे (Interview Questionnaire)</p> <ul style="list-style-type: none"> कार्य: एखाद्या यशस्वी उद्योजकाची किंवा लेखकाची दूरचित्रवाणीसाठी मुलाखत घ्यायची आहे असे मानून, १० प्रश्नांची एक सुनियोजित प्रश्नावली तयार करा.
7	<p>सूत्रसंचालन संहिता (Anchoring Script)</p> <ul style="list-style-type: none"> कार्य: महाविद्यालयाच्या वार्षिक स्नेहसंमेलनाच्या (Gathering) उद्घाटन सोहळ्यासाठी एक प्रभावी आणि रंजक सूत्रसंचालन संहिता लिहा.
8	<p>सॉफ्टवेअर लोकलायझेशन प्रकल्प (Software Localization Project)</p> <ul style="list-style-type: none"> कार्य: एखाद्या मोबाइल ॲप्लिकेशनमधील (उदा. ई-कॉमर्स किंवा बँकिंग ॲप) १० महत्वाच्या कमांड्स किंवा संज्ञांचे (उदा. Settings, Add to Cart, Proceed) चपखल मराठीत रूपांतर करा.
9.	<p>प्रकल्प अहवाल/रिपोर्ट लेखन (Technical Report Writing)</p> <ul style="list-style-type: none"> कार्य: 'तुमच्या गावातील/शहरातील कचरा व्यवस्थापन' या तांत्रिक विषयावर एक औपचारिक अहवाल किंवा प्रस्ताव (Proposal) तयार करा.

10.	<p>डिजिटल साक्षरता आणि सायबर सुरक्षा जाणीव (Cyber Security Awareness)</p> <ul style="list-style-type: none">● कार्य: 'ऑनलाइन आर्थिक फसवणूक कशी टाळावी?' या विषयावर सामान्य लोकांसाठी एक माहितीपत्रक (Brochure) किंवा पीपीटी (PPT) सादरीकरण तयार करा.
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Class: Second Year Engineering (2025 Pattern)					Sem: IV	
Course Code: EEM-260-COM			Name of Course: E- Commerce and Digital Business			
Teaching Scheme (Hrs/week):				Credits:		
Lecture	Practical	Tutorial	Lecture	Tutorial	Practical	
2	-	-	2	-	-	
Examination Scheme :						
FA	SA	PR	OR	TW	Total	
-	-	-	-	50	50	
Prerequisite:						
<ol style="list-style-type: none"> 1. Communication Skills /Indian Knowledge System 2. Principles of Programming Languages 3. Soft Skills 						
Course Objective: In this course we aim to enable student to:						
<ol style="list-style-type: none"> 1. Understand E-commerce concepts, business models, and infrastructure. 2. Learn fundamentals, tools, and channels of digital marketing. 3. Develop skills to create effective strategies using social media and SEO. 4. Explore payment systems, security, and legal aspects of online commerce. 5. Apply analytics and case-based approaches to E-commerce and digital marketing. 						
Course Outcome: On completion of this course, the students will be able to:						
EEM-260-COM.1	Understand E-commerce concepts, models, and infrastructure.					
EEM-260-COM.2	Apply SEO, CRO, CRM, and analytics to boost business performance.					
EEM-260-COM.3	Analyze digital marketing channels to evaluate their role in business growth.					
EEM-260-COM.4	Design effective social media strategies for brand building and engagement.					
EEM-260-COM.5	Evaluate payment systems, security, privacy, and legal frameworks in E-commerce.					
Course Content (TH)						
Unit I	Introduction to E-Commerce					(08 Hours)
Overview of E-commerce:- Definition, evolution, and types of e-commerce-Importance and benefits of e-commerce- E-commerce Business Models:- B2B, B2C,C2C, and other models-Case studies of successful e-commerce businesses- E-commerce Infrastructure:- Website development and hosting-E-commerce User Experience (UX)-Design principles for e-commerce websites-Customer journey mapping						
Unit II	E-commerce Marketing Strategies					(08 Hours)
E-commerce SEO:- Optimizing product pages for search engines-Link building and keyword strategies. Conversion Rate Optimization (CRO):- Understanding the sales funnel-A/B testing and improving conversion rates.- Customer Relationship Management (CRM) for E-commerce:- Managing customer data-						

Retention strategies and loyalty programs.- Mobile Commerce (M-commerce) :-Mobile-friendly websites and apps-Mobile marketing strategies- Commerce Analytics and Reporting :-Tools for tracking sales, customer behavior, and trends-Interpreting and using analytics for decision-making		
Unit III	Digital Marketing Fundamentals	(08 Hours)
Introduction to Digital Marketing :-Definition and significance-Traditional vs. digital marketing. Digital Marketing Channels :-SEO (Search Engine Optimization)-SEM (Search Engine Marketing). 7 Cs of digital marketing, Social Media Marketing. Content Marketing, Email Marketing. Analytics and Data-driven Decision Making :-Tools for tracking and analyzing digital marketing performance-Key performance indicators (KPIs)		
Unit IV	Social Media Marketing	(08 Hours)
Social Media Strategy :-Identifying target audience-Choosing the right social platforms.- Content Creation for Social Media :-Visual content, graphics, and video-Copywriting for social media- Community Building and Engagement :-Building and managing online communities-Responding to customer feedback- Social Media Advertising :-Paid advertising on platforms like Facebook, Instagram, and LinkedIn-Budgeting and targeting options- Social Media Analytics :-Measuring the effectiveness of social media campaigns-Adjusting strategies based on analytics.		
Unit V	Payment, Security, Privacy & Legal Issues	(08 Hours)
Payment gateways and security considerations-Legal and Ethical Issues in E-commerce-Digital property rights-Privacy, security, and compliance, Payment Security Basics : Encryption techniques –SSL certificates-Secure payment gateways		
Fraud Prevention Measures : Identity verification-address verification systems-Multi-factor authentication Customer Data Handling, Data collection and storage-Cookie policies		
Learning Resources		
Text Books:		
<ol style="list-style-type: none"> 1. Fundamentals of E-Commerce. ; Publisher. KALYANI; Publication date. January 1, 2014; E – Commerce by Deepshikha Bhargava (Ramesh Book Depot, 2009) E-commerce . 2. Damian Ryan& Calvin Jones. Understanding DIGITAL Marketing, 2009, ISBN 9780749453893 3. Vandana Ahuja, Digital Marketing, Oxford University Press, New Delhi, 2015, ISBN: 9780199455447. 		

Reference Books:

1. Gupta Seema (2020), Digital Marketing, Mc Graw Hill Publications.
2. Puthussery Antony (2020), Digital Marketing. Notion Press.
3. Bhatia Puneet (2019), Fundamentals of Digital Marketing, Pearson Publications.
4. Greenstein, Electronic Commerce, Tata McGraw Hill, New Delhi.
5. Norton, Peter: Introduction to Computer 4/E, Tata McGraw Hill (P) Ltd., New Delhi.
6. Dave Evans., Susan Bratton, Social Media Marketing: The Next Generation of Business Engagement. Wiley,2010, ISBN: 978-0-470-63403-5
7. George Pain(2019). Marketing Automation and Online Marketing: Automate Your Business through Marketing Best Practices such as Email Marketing and Search Engine Optimization, 2019, ISBN-10 1922301132
8. By author, anshul wadhwa, payal wadhwa Digital Marketing- Dr. Makarand Wazal, Prof. Deepika Abhijeet Kinige) Publisher: Thakur Publication Pvt

E-resources:**E-Resources for Each Unit**

Unit 1: https://onlinecourses.nptel.ac.in/noc19_mg54

Unit 2: https://onlinecourses.nptel.ac.in/noc25_mg29



Unit 3: <https://www.coursera.org/learn/foundations-of-digital-marketing-and-e-commerce>

Unit 4: https://onlinecourses.nptel.ac.in/noc24_mg56

Unit 5: https://onlinecourses.nptel.ac.in/noc19_mg54

List of Case Studies

Sr. No.	Unit No.	Content
1	I	Myntra's Personalized Shopping Experience How Myntra built a user-friendly e-commerce platform with personalized recommendations and seamless UX.
2	II	Nykaa's Omnichannel Strategy Study of Nykaa's use of SEO, CRM, influencer marketing, and analytics to grow from an online startup to a leading beauty brand.
3	III	Swiggy's Digital Campaigns How Swiggy leveraged content marketing, push notifications, email marketing, and storytelling ads to increase engagement.
4	IV	Ola's #FarakPadtaHai Campaign Analysis of Ola's campaign on Twitter, Instagram, and Facebook highlighting environmental sustainability with ride-sharing.
5	V	Razorpay's Secure Payment Solutions How Razorpay addressed payment gateway security, fraud prevention, and compliance with RBI guidelines.

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Class: Second Year B.Tech. (2025 Pattern)	Sem: IV
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Course Code: VEC-261-COM	Name of Course: Environmental Science Studies
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Teaching Scheme (Hrs/week):			Credits:		
Theory	Tutorial	Practical	Theory	Tutorial	Practical
02	-	-	02	-	-

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

Course Objective: In this course we aim to enable student to:

1. Provide fundamental knowledge of environmental systems, ecosystem structure, and sustainability principles relevant to engineering disciplines.
2. Develop understanding of natural resources, biodiversity, and ecological processes essential for environmental balance.
3. Introduce concepts of climate change, environmental impacts, and risk assessment in the context of development and industrialization.
4. Familiarize students with waste management practices, pollution control technologies, and environmental monitoring approaches.
5. Create awareness of environmental regulations, ethical responsibilities, and the role of engineers in achieving sustainable development.

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

VEC-261-COM.1	Explain environmental systems, ecosystem interactions, and sustainability concepts in relation to human and engineering activities.
VEC-261-COM.2	Analyze natural resource utilization, biodiversity concerns, and conservation strategies for sustainable environmental management.
VEC-261-COM.3	Evaluate environmental impacts, climate change issues, and associated risks arising from industrial and developmental activities.
VEC-261-COM.4	Apply basic principles of waste management and pollution control to address real-world environmental challenges.
VEC-261-COM.5	Interpret environmental laws and regulatory frameworks and demonstrate ethical responsibility in professional engineering practice.

Course Content		
Unit I	Environment, Ecosystems and Sustainability	(06 Hours)
<p>Environment: Basic, components (atmosphere, hydrosphere, lithosphere, biosphere) and scope of environmental studies; Ecology and ecosystems: structure, components, and functions of ecosystems; Energy flow in ecosystems: food chains, food webs, ecological pyramids, ecological succession; Man environment relationship and interactions between socio-economic systems and ecosystems; Concept of sustainability and sustainable development; environmental ethics and need for public awareness; ecological footprint concept, Major ecosystems and Case studies on Forest, Grassland, Desert, Aquatic ecosystems.</p>		
Unit II	Natural Resources, Biodiversity & Conservation	(06 Hours)
<p>Natural resources: Land, water, air, energy resources: renewable and non-renewable; Over-exploitation, land degradation & deforestation, soil erosion, conflicts over water; Definition, types, importance of biodiversity, Biodiversity: levels (genetic, species, ecosystem), biogeographic zones in India; Threats to biodiversity: habitat loss, poaching, invasive species; overview of Biogeochemical cycles: carbon, nitrogen, phosphorus; Conservation: in-situ and ex-situ strategies, role of communities, Sustainable water management: rainwater harvesting, reuse, and efficiency. Case studies on Impacts of mega projects such as mining, bridges and dam projects on forests and biodiversity.</p>		
Unit III	Climate Change, Environmental Impacts and Risk Assessment	(06 Hours)
<p>Climate change and global environmental change: causes, greenhouse effect & mitigation, global warming, ozone depletion, acid rain, and their impacts on ecosystems, agriculture, and human health; Environmental impacts of urbanization and industrialization; Environmental impact assessment (EIA): concept, need, stages and significance; Risk assessment concepts: hazard identification, exposure pathways, risk characterization and risk management; Environmental monitoring and indicators; Carbon footprint and strategies for climate mitigation and adaptation; Role of sustainable development goals (SDGs) in addressing environmental challenges; Case studies on environmental impacts of infrastructure and industrial projects.</p>		
Unit IV	Waste Management	(06 Hours)
<p>Classification of wastes: municipal, industrial, hazardous, biomedical and electronic waste; E-waste management: Sources and generation of e-waste, Composition of e-waste and hazardous constituents, Environmental and health impacts of improper e-waste handling, Principles of e-waste management: reduction, reuse, recycling, recovery; Mechanical processing and material recovery techniques, Solid waste management practices; Case studies on Solid waste management in Indore and Pune.</p>		
Unit V	Pollution Control and Environmental Regulations	(06 Hours)
<p>Pollution control overview: air, water, soil, noise; Environmental laws and regulations: Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act & E-Waste Management Rules and Extended Producer Responsibility (EPR), Role of engineers in sustainable waste management and circular economy; Case Study: Air Pollution Control and Regulatory Enforcement – Delhi NCR and BS-VI Implementation.</p>		
Learning Resources		

Text Books:



1. A Textbook of Environmental Studies by Asthana D.K. & Asthana Meera, S. Chand Publishing
2. Environmental Studies: From Crisis to Cure by R. Rajagopalan, Oxford University Press
3. P. D. Sharma, Ecology and Environment; 13th Edition, Rastogi Publications

Reference Books:

1. Environmental Studies by Erach Bharucha, Universities Press
2. Environmental Studies by Anubha Kaushik and C.P. Kaushik, New Age International Publishers
3. E.D. Enger, B. E. Smith; Environmental Sciences-A study of Inter relationships, WCB Publication

E-BOOKS:

1. <https://nptel.ac.in/courses/109105203>
2. <https://nptel.ac.in/courses/127105018>
3. <https://nptel.ac.in/courses/105105169%20>

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Class: Second Year Engineering (2025 Pattern)						Sem: IV	
Course Code: AC-262-COM			Name of Course: Aptitude I				
Teaching Scheme (Hrs/week):				Credits:			
Lecture	Practical	Tutorial		Lecture	Practical	Tutorial	
2	-	-		-	-	-	Grade
Examination Scheme:							
FA	SA	PR	OR	TW	Total		
-	-	-	-	--	Grade		
Prerequisite:							
1. Basic mathematical foundation							
Course Objective: In this course we aim to enable student to:							
1. Enhance analytical and computational techniques for solving complex problems							
2. Apply analytical and logical reasoning for solving complex problem							
3. Enhance English communication skills for industry readiness							
Course Outcome: On completion of this course, the students will be able to:							
AC-262-COM.1	Apply basic arithmetic and numerical computation techniques to solve real-world quantitative problems.						
AC-262-COM.2	Apply logical reasoning and analytical thinking skills through puzzles, coding-decoding, series, and pattern recognition.						
AC-262-COM.3	Apply verbal reasoning skills to comprehend, analyze, and draw logical conclusions from textual information.						
Course Content (TH)							
Unit I	Quantitative Aptitude - I					(08 Hours)	
Arithmetic- Numbers ,Work and ,Time, Speed, and Distance, LCM and HCF , Percentages , Ratio, Proportion,, Problem on Age, Profit and Loss ,Simple Interest , Compound Interest, Clocks							
Unit II	Logical Reasoning - I					(08 Hours)	
Number Series ,Letter and Symbol Series, Verbal Classification, Analogies, Logical Problems, Course of Action, Statement and Conclusion , Theme Detection, Blood Relations, Directions Statement and Argument.							
Unit III	Verbal Ability - I					(08 Hours)	

Synonyms ,Antonyms ,Selecting Words, Spellings, Sentence Formation, Sentence Completion, Ordering of Words ,Sentence Correction ,Sentence Improvement, Completing Statements, Para Jumbles ,Spotting Errors.

Learning Resources

Text Books:

1. Manhattan Prep's "5 lb. Book of GRE Practice Problems
2. Quicker Maths by M. Tyra
3. Bigbook

Reference Books:

1. Quantitative Aptitude for Competitive Examinations" by R.S. Aggarwal
2. How to Prepare for Quantitative Aptitude for the CAT" by Arun Sharma
3. A Modern Approach to Verbal & Non-Verbal Reasoning" by R.S. Aggarwal.

E-resources:

E-Resources for Each Unit

Unit 1: <https://prepinsta.com/learn-aptitude/>

Unit 2: <https://prepinsta.com/learn-aptitude/>

Unit 3: <https://www.indiabix.com/data-interpretation/questions-and-answers/>

Unit 4: <https://www.indiabix.com/logical-reasoning/questions-and-answers/>

Unit 5: <https://www.indiabix.com/verbal-ability/questions-and-answers/>