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

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For

Second Year – Information Technology (B. Tech.)

With effect from (AY 2026-27)

National Education Policy (NEP) 2020 Compliant Approved by the Board of Studies (BoS-Information Technology) and Academic Council

(Applicable to Regulations 2023, 2021 and 2020)

(www.pccoer.com)

PREFACE

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

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

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

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

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

Vision:

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

Mission:

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 5^{th} semester (i.e. 3^{rd} year of programme), a student should have earned all credits of the First Year and 60% credits of the Second Year. Similarly, for admission to the 7^{th} semester (i.e. 4^{th} 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).

6.6TEMPORARY 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	Project Reviews (Minimum 2) Rubric based Evaluation	-	Oral and Term Work	50+100	150
	OR	-	-	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

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

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

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

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:

Percentage of Marks = CGPA X 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 CGPA ≥ 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 re-straining, wrongfully confining or injuring him or by using criminal force to him or by holding out to him any threat of such intimidation, wrongful restraint, wrongful confinement, injury or the use of criminal offense. Supreme Court of India has defined ragging as a criminal offense.)
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/outsiders.
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 act1999.

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

	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	**Formative Assessment**	**ACAD/R/11-FA**

Department: **Class:** **Div:**
Subject: **Maximum Marks: 30** **Duration:** 1 hr
Subject Code: **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: **Class:** **Div:**
Subject: **Maximum Marks: 50** **Duration:** 2 Hrs
Subject Code: **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

Information Technology

With effect from (AY 2026-27)

National Education Policy (NEP) 2020 Compliant Approved by the Board of Studies (BoS-Information Technology) and Academic Council

Contents

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. Information Technology will be implemented 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 AY 2028–29, respectively.

Information Technology is a rapidly evolving discipline that plays a crucial role in the design, development, management, and application of computing systems and information infrastructures. The field focuses on the effective use of computing technologies to store, process, secure, and analyze information for solving real-world problems across diverse domains. This curriculum has been carefully designed to provide students with a strong foundation in the fundamental concepts, principles, and practices of information technology while preparing them to meet the demands of the continuously advancing digital ecosystem.

The revised syllabus is aligned with the objectives of the National Education Policy (NEP) 2020, as well as the guidelines of Savitribai Phule Pune University, AICTE, New Delhi, UGC, and other accreditation bodies. It integrates recent technological developments, emerging industry requirements, and modern educational practices. Wherever appropriate, additional learning resources from platforms such as NPTEL have been included at the end of each course to encourage continuous and self-directed learning.

The curriculum is structured to provide learners with sufficient time and opportunities for self-learning, project-based learning, hands-on laboratory work, online certification courses, and interdisciplinary activities. These components aim to enhance students' knowledge, technical competence, problem-solving abilities, and professional skills in accordance with their interests and career aspirations.

This syllabus has been developed through extensive consultations with various stakeholders like - academic experts, industry professionals, alumni, and other stakeholders to ensure both academic rigor and industry relevance. The curriculum is designed not only to meet the current expectations of the IT industry but also to prepare students for higher studies, research, entrepreneurship, and innovation in the field of Information Technology.

We sincerely hope that this curriculum will inspire students to become skilled IT professionals, responsible citizens, and contributors to technological innovation and societal development. We place on record our deep appreciation and gratitude to the faculty members, students, industry experts, and all stakeholders whose valuable inputs and contributions were instrumental in the formulation of this syllabus.

Dr. Santoshkumar V. Chobe
Chairman, Board of Studies

Chairman
BoS, Information Technology
PCET's Pimpri Chinchwad College of Engineering and Research, Ravet, 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 of the Institute:

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 of the Institute:

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 of the Department:

To be a globally recognized centre of excellence in Information Technology education and research, promoting innovation and collaboration for the holistic development of aspirants and fulfilment of stakeholder expectations.

Mission of the Department:

1. To provide cutting-edge, industry-relevant education through experiential learning, ensuring the employability and career success of every aspirant in the field of Information Technology.

2. To foster strong collaborations with industry and global partners, facilitating the transfer and commercialization of the latest technological innovations to support societal, ethical, and economic progress.

3. To establish and maintain the Department as a leading center in Information Technology education, research and innovation, recognized for its excellence and contributions to the advancement of technology and society.

4. Program Specific Outcomes

A graduate of Information Technology Program will demonstrate -

PSO1: Exhibit specialized knowledge in the field of Information Technology and its allied areas and use this specialized knowledge base to solve computationally advanced problems.

PSO2: Perform systemic and technological analysis to create roadmaps for integrating cutting-edge technology into system design, analysis, implementation, and performance.

PSO3: Demonstrate analytical skills needed to bring in amalgamation of latest technologies, humanities and social science for formulating innovative solutions for real life problems in the form of futuristic software systems and products thus providing opportunities for entrepreneurship and research.

5. Program Educational Objectives

PEO1: Possess strong fundamental concepts in mathematics, science, engineering and Technology to address technological challenges.

PEO2: Possess knowledge and skills in the field of Computer Science and Information Technology for analyzing, designing and implementing complex engineering problems of any domain with innovative approaches.

PEO3: Possess an attitude and aptitude for research, entrepreneurship and higher studies in the field of Computer Science and Information Technology.

PEO4: Have commitment ethical practices, societal contributions through communities and life-long learning.

PEO5: Possess better communication, presentation, time management and team work skills leading to responsible & competent professional sand will be able to address challenges in the field of IT at global level.

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 Problems:** 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. Information Technology Syllabus Structure

Level 5															
S. Y. B.Tech. Information Technology															
Semester III															
Course Code	Course Name	Course Type	Credits	Credit Scheme			Teaching Scheme (Hours/Week)			Examination Scheme					Marks
				L	T	P	L	T	P	FA (50)	SA (50)	PR	OR	TW	
PCC-201-ITT	Discrete Mathematics	PCC	3	3	-	-	3	-	-	50	50	-	-	-	100
PCC-202-ITT	Object Oriented Programming	PCC	2	2	-	-	2	-	-	50	50	-	-	-	100
PCC-203-ITT	Object Oriented Programming Laboratory	PCC	1	-	-	1	-	-	2	-	-	50	-	-	50
PCC-204-ITT	Data Structures and Algorithms	PCC	3	3	-	-	3	-	-	50	50	-	-	-	100
PCC-205-ITT	Data Structures and Algorithms Laboratory	PCC	2	-	-	2	-	-	4	-	-	50	-	25	75
MDM-206-ITT	MDM-I (Digital Electronics & Computer Organization)	MDM	2	2	-	-	2	-	-	50	50	-	-	-	100
MDM-207-ITT	MDM-I (Digital Electronics & Computer Organization) Laboratory	MDM	1	-	-	1	-	-	2	-	-	-	-	25	25
	Open Elective Course-I	OEC	2	2	-	-	2	-	-	-	-	-	25	25	50
EEM-208-ITT	Engineering Economics	EEM	2	1	1	-	1	1	-	-	-	-	-	25	25
VEC-209-ITT	Environmental Science Studies	VEC	2	2	-	-	2	-	-	25	25	-	-	-	50
ELC-210-ITT	Community Engagement Project	ELC	2	-	-	2	-	-	4	-	-	-	25	50	75
Total			22	15	1	6	15	1	12	225	225	100	50	150	750

Chairman
BoS, Information Technology
PCET's Pimpri Chinchwad College of Engineering and Research, Ravet, Pune - 412 101

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

S. Y. B. Tech. Information Technology Syllabus Structure

Level 5																
S. Y. B.Tech. Information Technology																
Semester IV																
Course Code	Course Name	Course Type	Credits	Credit Scheme			Teaching Scheme (Hours/Week)			Examination Scheme					Marks
				L	T	P	L	T	P	FA (50)	SA (50)	PR	OR	TW	
PCC-251-ITT	Software Engineering and Project Management	PCC	2	2	-	-	2	-	-	50	50	-	-	-	100
PCC-252-ITT	Database Management System	PCC	3	3	-	-	3	-	-	50	50	-	-	-	100
PCC-253-ITT	Database Management System Laboratory	PCC	2	-	-	2	-	-	4	-	-	50	-	50	100
PCC-254-ITT	Computer Networks	PCC	2	2	-	-	2	-	-	50	50	-	-	-	100
MDM-255-ITT	MDM-II (Microprocessor)	MDM	2	2	-	-	2	-	-	50	50	-	-	-	100
MDM-256-ITT	MDM-II (Microprocessor) laboratory	MDM	1	-	-	1	-	-	2	-	-	-	25	-	25
	Open Elective Course-II	OEC	2	2	-	-	2	-	-	-	-	-	25	25	50
VSE-257-ITT	JAVA Programming	VSEC	2	-	-	2	-	-	4	-	-	50	-	-	50
AEC-258-ITT	Modern Indian Language	AEC	2	1	1	-	1	1	-	-	-	-	-	25	25
EEM-259-ITT	Business and Entrepreneurship	EEM	2	1	1	-	1	1	-	-	-	-	-	50	50
VEC-260-ITT	Universal Human Values	VEC	2	2	-	-	2	-	-	25	25	-	-	-	50
AC-261-ITT	Aptitude Skills-I	AC	-	-	-	-	1	-	-	-	-	-	-	-	Grade
Total			22	15	2	5	16	2	10	225	225	100	50	150	750

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SEMESTER - III

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** III
Course Code: PCC-201-ITT	**Name of Course:** Discrete Mathematics					
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:

Engineering Mathematics I (BSC-101-BSH)

Course Objective:

1. To introduce propositional logic, sets, and proof techniques to help students validate statements and program correctness.
2. To introduce relations, functions, and recurrence relations to model data and solve computational problems.
3. To develop understanding of combinatorics and probability to solve counting problems and model uncertainty.
4. To understand graph concepts and apply algorithms for efficient network routing and optimization.
5. To learn tree structures and apply them in data compression, decision-making, and network flow problems.
6. To develop understanding of algebraic structures to analyze relationships and apply concepts in computational systems.

Course Outcome: On completion of course, student will be able to

PCC-201-ITT.1	Understand logical connectives, truth tables, and set operations to represent and validate statements.
PCC-201-ITT.2	Apply properties of relations and functions to represent and model data dependencies.
PCC-201-ITT.3	Apply combinatorial and probability techniques to solve counting problems, model uncertainty, and design computational systems.
PCC-201-ITT.4	Understand graph types, use shortest path algorithms, and analyze routing efficiency in networks.

PCC-201-ITT.5	Construct Huffman and decision trees, examine their role in compression and machine learning, and analyze transport networks using max-flow/min-cut.
PCC-201-ITT.6	Understand algebraic structures and their properties to model, analyze, and solve computational problems.

Course Content

Unit I | **Mathematical Logic and Sets** | **(07 Hours)**

- **Propositional Logic:** Propositional Statements, Logical Connectives, Truth tables, Logical Equivalence, Tautology, Contradiction, Contingency, Normal Forms: Disjunctive Normal Forms, Conjunctive Normal Forms, Predicates and Quantifiers
- **Sets:** Representation of a set, Types of Sets, Operations on Sets, Properties, Venn Diagrams, Cartesian Products, Power Set
- **Methods of proof:** Introduction to mathematical induction with examples on sequences, series, and loops.
- **Case study:** Verification of correctness of conditional logic in a program or algorithm using propositional statements and truth tables.

Unit II | **Relations and Functions** | **(08 Hours)**

- **Relations:** Representation of a Relation, Types of Relations, Properties of Relations (reflexive, Symmetric, Transitive, Antisymmetric), Equivalence Relations, Closure of Relations, Closure Properties of Relations, Warshall's algorithm, Partial order Relations, Hasse Diagrams, Lattices, Chains and Anti-Chains
- **Functions:** Types of Functions, (Injective, Surjective, Bijective), Composition, Inverse
- **Recurrence Relations:** Types of Recurrence Relations, Solving techniques: Characteristic Equation Method
- **Case study:** Students enroll in courses at a university. Enrollment is modeled using **sets and relations**. A relation is defined: two students are related if they take the **same courses.** This relation is an **equivalence relation,** and its **equivalence classes** group students with identical enrollments. The task is to represent the system, prove the relation's properties, and list the resulting student groups.

Unit III | **Combinatorics and Probability** | **(08 Hours)**

- **Combinatorics:** Rules of Sum and Product, Factorial, Permutations, Combinations, Inclusion–exclusion principle, Pigeonhole principle
- **Probability:** Basics of Probability (Sample Space, Events), Probability Theorems, Conditional Probability, Bayes' theorem, Discrete Probability Distributions (Binomial, Poisson Distribution)
- **Case study:** Design a password system where:
  - Passwords are **8 characters long.**
  - The password must contain **exactly**: **2 uppercase letters, 3 digits, 3 lowercase letters**

Unit IV | **Graphs** | **(08 Hours)**

- **Graphs:** Basic Terminology, Multi-Graphs, Weighted Graphs, Sub Graphs, Isomorphic graphs, Complete Graphs, Regular Graphs, Bipartite Graphs, Paths, Cycles, Circuits, Eulerian paths and circuits, Hamilton paths and circuits, Traveling Salesman Problem, Single source shortest path- Dijkstra's Algorithm
- **Case study:** Network Routing Using Graphs
  Design a **network routing system** where routers are represented as **nodes** and communication

links between routers as **edges** with associated **weights** (representing cost, distance, or transmission delay). Use **Dijkstra's Algorithm** to find the **shortest path** between two routers, ensuring the most **efficient data transmission** across the network.

Unit V	Trees	(07 Hours)

- **Trees:** Terminologies, Binary Trees, Prefix Codes, Huffman Tree, Decision Trees and their Applications in Machine Learning, Applications of Trees in File Systems, Fundamental Cut Sets and Circuits, Max flow –Min Cut Theorem (Transport Network).

Unit VI	Algebraic Systems	(07 Hours)

- **Algebraic structures:** Semigroups, Monoids, Groups, Homomorphism and Isomorphism, Normal Subgroups, Congruence relations, Rings, Integral Domains and Fields.
- **Case study:** Consider the set of all strings over the alphabet Σ = {a, b} with the operation of concatenation. The task is to analyze whether this structure forms a semigroup or a monoid.

Learning Resources

Text Books:

1. J. Tremblay and R. Manohar, Discrete Mathematical Structures with Application to Computer Science, Tata McGraw-Hill, 2002, ISBN: 0070651426.
2. C. L. Liu and D. P. Mohapatra, Elements of Discrete Mathematics, 4th Edition, McGraw-Hill, 2017, ISBN-13: 978-1259006395.
3. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 8th Edition, McGraw-Hill Education, 2019, ISBN-13: 978-9390727353.

Reference Books:

1. G. Shanker Rao, Discrete Mathematical Structures, 2nd Edition, 2009, New Age International, ISBN-10: 8122426697, ISBN-13: 9788122426694.
2. Seymour Lipschutz and Marc Lipson, Discrete Mathematics, 2nd Edition, 1999, Tata McGraw-Hill, ISBN: 007463710X.
3. V. K. Balakrishnan, Graph Theory, 1st Edition, 2004, Tata McGraw-Hill, ISBN-10: 0070587183, ISBN-13: 9780070587182.

E-resources:

- **NPTEL - Discrete Mathematical Structures**
  https://nptel.ac.in/courses/106106094

- **Coursera – Discrete Mathematics Courses & Certificates (UC San Diego, others)**
  https://www.coursera.org/courses?query=discrete%20mathematics

E-Resources for Each Unit

Unit I – Mathematical Logic and Sets

- Discrete Mathematics Tutorial (Logic, Proofs, CNF/DNF, Induction)
  https://www.geeksforgeeks.org/engineering-mathematics/discrete-mathematics-tutorial/
- Sets in Discrete Mathematics
  https://www.tutorialspoint.com/discrete_mathematics/discrete_mathematics_sets.htm

Unit II – Relations and Functions

- Sets, Relations, and Functions Notes
  https://math4cs.university/notes/01-sets_relations_functions/

Unit III – Combinatorics and Probability

- Combinatorics and Probability
  https://www.coursera.org/learn/combinatorics

Unit IV – Graphs

- Graph Theory Tutorial
  https://www.geeksforgeeks.org/dsa/graph-theory-tutorial/
- D3 Graph Theory – Interactive Visual Tutorials
  https://d3gt.com/

Unit V – Trees

- Trees
  https://discrete.openmathbooks.org/dmoi3/sec_trees.html

Unit VI – Algebraic Systems

- AllTheMath – Free Discrete Math Course (functions, recurrence, algebraic structures)
  https://allthemath.org/

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** III
Course Code: PCC-202-ITT	**Name of Course:** Object Oriented Programming					
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:

Programming in C (ESC-101- ASH), Fundamentals of Computer Engineering (PCC-101-ITT), Python Programming (ESC-151-ASH)

Course Objective:

1. To introduce the fundamentals of object-oriented programming and the Java programming language.
2. To explain the creation and usage of classes and objects in OOP.
3. To explain inheritance and polymorphism concepts of OOP.
4. To introduce exception handling and multi-threading in Java.
5. To understand advanced OOP concepts such as file handling, collections, and design patterns in Java.

Course Outcome: On completion of course, student will be able to	
PCC-202-ITT.1	Understand and demonstrate the core Object-Oriented Programming (OOP) concepts and the structure of basic Java programs.
PCC-202-ITT.2	Design and implement classes, objects, constructors, and methods in Java, applying OOP principles.
PCC-202-ITT.3	Apply inheritance and polymorphism to enhance program functionality and code reusability in Java
PCC-202-ITT.4	Implement exception handling and multi-threading to manage runtime errors and improve program efficiency.
PCC-202-ITT.5	Apply advanced OOP techniques such as file handling, collections, and design patterns to solve programming problems in Java.

Course Content		
Unit I	**Introduction to Object-Oriented Programming**	**(06 Hours)**

- Introduction to Programming Paradigms - Evolution of programming language, Programming paradigms (procedural & object-oriented), Need of Object Oriented Programming
- Comparison between Procedural and Object-Oriented Programming
- Features of OOP: Core Concepts of OOP (Classes and Objects), Four Pillars of OOP (Encapsulation, Abstraction, Inheritance, Polymorphism)
- Benefits of OOP, Applications of OOP
- Comparison between OOP languages like Java, C++, Python
- Overview of Java Language: simple java program structure (JDE, JRE & JVM, package statement, import statements, class definition, main method class. Implementing Java Program, Data types, operators and expressions, Java Class Libraries)

Unit II	**Classes and Objects**	**(06 Hours)**

- Class: Definition, Syntax.
- Object Creation and destruction: Creation and initialization of objects, Finalize method
- Instance Variables and Methods: Member variables, creation & access of methods, method overloading, this keyword.
- Access Modifiers: Visibility (default, public, private, protected) and their usage.
- Constructors: Definition, rules, types, constructor overloading.
- Static Members: Static variables, static methods (with example).

Unit III	**Inheritance and Polymorphism**	**(06 Hours)**

- Inheritance: Introduction, Need of Inheritance, protected members, Types of Inheritance, Benefits of Inheritance, Constructors in derived classes, super keyword, instanceof keyword, Interfaces, Constructor Chaining
- Polymorphism: introduction, types (compile time & run time), @override, final method
- Abstract Classes: Definition, abstract class, abstract methods
- Package : Definition, types, Access Modifiers and Packages

Unit IV	**Exception Handling & Threading**	**(06 Hours)**

- Exception handling: fundamentals, Exception Types, Using try-catch, Multiple try-catch clauses, Nested try statements, throw, throws, finally, Built-in Exceptions
- Multi Threading: Java Thread Model, Main Thread, Creating a Thread , Creating Multiple Threads, Using isAlive() and join().

Unit V	**Advanced OOP Concepts**	**(06 Hours)**

- File Handling: Introduction to File Handling, File Class, Streams in Java, FileReader and FileWriter, BufferedReader and BufferedWriter
- Generics, Templates: Introduction, Collection Interfaces: List Interface and Set Interface, Collection Classes: ArrayList Class and LinkedList Class.
- Design Patterns: Introduction, Example of Design Patterns : Adapter, Singleton, Iterator.

Learning Resources

Text Books:

1. Schildt, H. Java: The Complete Reference, 9th Edition, McGraw-Hill Education, 2018, ISBN: 978-1259589314.
2. Balagurusamy, E. Programming with Java - A Primer, 4th Edition, Tata McGraw-Hill, 2011, ISBN: 978-0070636763.

3. Sierra, K., Bates, B. Head First Java, 2nd Edition, O'Reilly Media, 2005, ISBN: 978-0596009205.

Reference Books:

1. Bloch, J. Effective Java, 3rd Edition, Addison-Wesley, 2018, ISBN: 978-0134685991.
2. Deitel, P., Deitel, H. Java How to Program, 10th Edition, Pearson Education, 2015, ISBN: 978-0134177304.
3. Johnson, R. Object-Oriented Programming in Java, 3rd Edition, McGraw-Hill, 2000, ISBN: 978-0071154059.

E-resources:

- **NPTEL - Programming in JAVA**
  - https://nptel.ac.in/courses/106105191
- **Coursera – Java Programming Fundamentals Specialization**
  https://www.coursera.org/specializations/java-programming-fundamentals

E-Resources for Each Unit

Unit 1: Introduction to Object-Oriented Programming

- https://www.geeksforgeeks.org/system-design/introduction-of-programming-paradigms/
- https://www.geeksforgeeks.org/java/four-main-object-oriented-programming-concepts-of-java/
- https://www.ibm.com/think/topics/jvm-vs-jre-vs-jdk

Unit 2: Classes and Objects

- https://www.geeksforgeeks.org/java/classes-objects-java/
- https://www.geeksforgeeks.org/java/object-oriented-programming-oops-concept-in-java/
- https://www.geeksforgeeks.org/java/access-modifiers-java/
- https://www.geeksforgeeks.org/java/static-keyword-java/

Unit 3: Inheritance and Polymorphism

- https://www.geeksforgeeks.org/java/inheritance-in-java/
- https://www.geeksforgeeks.org/java/inheritance-and-constructors-in-java/
- https://www.geeksforgeeks.org/java/polymorphism-in-java/
- https://www.geeksforgeeks.org/java/abstract-classes-in-java/

Unit 4: Exception Handling & Threading

- https://www.geeksforgeeks.org/java/exceptions-in-java/
- https://www.w3schools.com/java/java_try_catch.asp
- https://www.tutorialspoint.com/java/java_exceptions.htm
- https://www.baeldung.com/java-exceptions
- https://www.geeksforgeeks.org/java/java-threads/

Unit 5: Advanced OOP Concepts

- https://www.geeksforgeeks.org/java/file-handling-in-java/
- https://www.w3schools.com/java/java_files.asp
- https://www.geeksforgeeks.org/java/generics-in-java/
- https://www.geeksforgeeks.org/java/collections-in-java-2/

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** III
Course Code: PCC-203-ITT		**Name of Course:** Object Oriented Programming Laboratory				
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	2		-	-	1
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	50	-	-		50

Prerequisite:

Programming in C Laboratory (ESC-102- ASH), Python Programming Laboratory (ESC-152-ASH)

Course Objective:

1. To enable students to apply Object-Oriented Programming (OOP) concepts such as classes, inheritance, polymorphism, and interfaces to solve problems by designing and implementing Java programs.
2. To provide students with the skills to implement exception handling, static variables and methods, and abstract classes and interfaces to build Java programs.
3. To equip students with the ability to evaluate and apply advanced Java features such as file handling, multithreading, and package creation.
4. To enable students to develop Java programs that effectively utilize collections (e.g., ArrayList, LinkedList, Set, and generics) and iterators.

Course Outcome: On completion of course, student will be able to

PCC-203-ITT.1	Apply Object-Oriented Programming (OOP) concepts such as classes, inheritance, polymorphism, and interfaces to design and implement Java programs.
PCC-203-ITT.2	Implement exception handling, static variables/methods, abstract classes and interfaces to create Java applications.
PCC-203-ITT.3	Implement advanced Java features, including file handling, multithreading, and package creation.
PCC-203-ITT.4	Develop Java programs that effectively utilize collections (e.g., ArrayList, LinkedList, Set, and generics) and iterators for managing and processing complex data structures.

Guidelines for Student's Lab Journal

1. Students are required to submit a handwritten laboratory journal prepared strictly according to the prescribed list of assignments.
2. The Practical Examination shall be conducted only if the lab journal is complete in all respects and duly verified and certified by the course instructor.

Guidelines for Laboratory Conduction

1. All assignments must be performed and executed on 64-bit open-source software platforms.
2. The completion and execution of all lab assignments must be carried out using the Linux Terminal.

Guidelines for Practical Examination

1. The Practical Examination will assess all laboratory assignments completed throughout the course.
2. Students will be evaluated based on their practical execution and their ability to respond to questions regarding the implementation and concepts behind the experiments.
3. The evaluation will be conducted by both external and internal examiners, who will jointly assess the student's practical performance and understanding.

List of Assignments

Group A

1. Basic Calculator Using Object-Oriented Principles

Design and implement a Complex Number Calculator using Java that performs the following operations on two complex numbers: Addition, Subtraction, Multiplication and Division. The calculator should be able to handle input from the user, process the operations, and display the results. Additionally, the calculator should allow the user to perform multiple operations until they choose to exit.

2. Constructor Implementation in Java

Create a Student class with attributes for name, age, rollNo, and marks. Implement a default constructor that initializes these attributes with default values, and a parameterized constructor to set these values when creating a student object. Use "this" keyword to refer to instance variables in the constructor. Add methods to display the student's details and update the marks. In the main() method, create two student objects using both constructors, display their details, and update the marks of one student.

3. Static member and static method

Create a class Employee with a static variable employeeCount to track the total number of Employee objects created. Each time an object is instantiated, increment employeeCount. Implement a static method getEmployeeCount() to access this count without creating an object. The program should create multiple Employee objects and display the count using both an instance method and the static method, demonstrating how static variables and methods are shared across all instances of the class.

4. Inheritance

Create a class Employee with attributes empId, name, and salary. Then, create a subclass Manager that extends the Employee class and adds an additional attribute department. Implement constructor chaining by using the super() keyword to call the parent class constructor from the subclass constructor, ensuring proper initialization of the inherited attributes. Add a method displayDetails() in both the Employee and Manager classes to print the details of an employee and a manager, respectively (calling displayDetails() of parent class using super in child class) . In the main() method, create objects of both classes and demonstrate inheritance by calling the displayDetails() method for both the Employee and Manager objects to display their details.

5. Polymorphism

Create an abstract class Animal with an abstract method makeSound(), which will be implemented by its subclasses. The makeSound() method should be abstract because it will be defined differently in each subclass. Next, create two subclasses, Dog and Cat, that extend the Animal class and provide their specific implementations of the makeSound() method, simulating the sounds of a dog (e.g., "Bark") and a cat (e.g., "Meow"). To demonstrate polymorphism, create an array of Animal objects, where you store both Dog and Cat objects. Then, iterate through the array and call the makeSound() method on each object.

6. Abstract Classes and Interfaces

Create an interface FuelEfficient with methods fuelEfficiency() and maintenanceCost(). Implement this interface in two classes, Car and Motorcycle, where each class provides its specific implementation for calculating fuel efficiency and maintenance cost. For instance, a Car might have a fuel efficiency of "15 km per liter" and a Motorcycle might have "30 km per liter."

Additionally, create an abstract class Vehicle with an abstract method move(), which will be implemented by the subclasses to describe how the vehicle moves. The Vehicle class will also have a concrete method startEngine() that displays a message like "Engine started" (common to all vehicles).

Implement the Car and Motorcycle classes by extending the Vehicle class, and implement the FuelEfficient interface in both. In these classes, provide specific implementations of the abstract move() method, such as "Car moves on four wheels" for the Car class and "Motorcycle moves on two wheels" for the Motorcycle class.

7. Handling Built-in & User-Defined Exceptions

Develop a Java program that demonstrates both built-in and user-defined exception handling. The program should take two integers as input and perform basic arithmetic operations such as addition, subtraction, multiplication, and division. Implement multiple catch blocks to handle exceptions like NumberFormatException, ArithmeticException, and ArrayIndexOutOfBoundsException, along with a general catch-all block for unexpected errors.

Additionally, create a user-defined exception class InvalidAgeException to handle invalid age input (less than 0). Prompt the user to enter their age and throw this exception when necessary, using throw and throws. Ensure all logic is enclosed within try-catch blocks and include a finally block to display an end-of-operation message.

8. Thread Creation

Create a program that extends the Thread class and overrides the run() method to display a message. Create multiple threads and use isAlive() to check if they are running, and join() to make the main thread wait until all threads complete. Implement a multi-threaded program that prints numbers from 1 to 5, with each number printed by a different thread.

9. File Handling

Create a program that reads student names and marks from a file student_info.txt using BufferedReader or FileReader. Calculate and display the average marks of the students, while handling IOException during file operations. Ensure proper resource management and file closure.

10. Generics with List and Set Interfaces

Create a generic class Box to store any type of object. Use ArrayList and LinkedList to store different types of objects (e.g., Integer, String). Demonstrate the usage of List for storing duplicates and Set for storing unique objects. Use an Iterator to iterate through the collections and display the contents.

Learning Resources

Text Books:

1. Schildt, H. Java: The Complete Reference, 9th Edition, McGraw-Hill Education, 2018, ISBN: 978-1259589314.
2. Balagurusamy, E. Programming with Java - A Primer, 4th Edition, Tata McGraw-Hill, 2011, ISBN: 978-0070636763.
3. Sierra, K., Bates, B. Head First Java, 2nd Edition, O'Reilly Media, 2005, ISBN: 978-0596009205.

Reference Books:

1. Bloch, J. Effective Java, 3rd Edition, Addison-Wesley, 2018, ISBN: 978-0134685991.
2. Deitel, P., Deitel, H. Java How to Program, 10th Edition, Pearson Education, 2015, ISBN: 978-

0134177304.
3. Johnson, R. Object-Oriented Programming in Java, 3rd Edition, McGraw-Hill, 2000, ISBN: 978-0071154059.

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** III
Course Code: PCC-204-ITT		**Name of Course:** Data Structures and Algorithms				
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:

Programming in C (ESC-101-ASH)

Course Objective:

1. To understand basic concepts of data structures, ADTs, algorithm design strategies, and performance analysis using asymptotic notations.
2. To implement and analyze arrays and linked lists, and apply searching and sorting techniques for efficient data processing.
3. To design and implement stack and queue data structures and apply them to solve computational problems.
4. To understand and implement tree-based data structures and heaps for hierarchical data organization.
5. To represent graphs and apply traversal, spanning tree, and shortest path algorithms.
6. To apply greedy algorithm, dynamic programming, and backtracking techniques to solve optimization problems.

Course Outcome: On completion of course, student will be able to	
PCC-204-ITT.1	Understand data structures, ADTs, and analyze algorithms using time and space complexity.
PCC-204-ITT.2	Apply linear data structures to solve the searching and sorting problems.
PCC-204-ITT.3	Apply stack and queue for expression evaluation and to solve scheduling problems.
PCC-204-ITT.4	Understand nonlinear data structures, like binary trees, binary search trees, and heaps.
PCC-204-ITT.5	Apply graph algorithms such as DFS, BFS, MST, and shortest path techniques.
PCC-204-ITT.6	Apply greedy approach, dynamic programming, and backtracking to solve optimization problems.

Course Content		
Unit I	**Introduction to Data Structures & Algorithms**	**(07 Hours)**

- **Introduction**: Data, Data Objects, Data Types, Data Structure, Abstract Data Types (ADT)
- **Classification**: Primitive vs Non-Primitive, Linear vs Non-Linear, Static vs Dynamic
- **Algorithms Design Strategies**: Brute force, Divide & Conquer, Greedy, Dynamic Programming, Backtracking.
- **Performance Analysis**: Time and Space Complexity, Asymptotic Notations (Big-O, Θ, Ω)

Unit II	Linear Data Structures- I	(08 Hours)

- **Overview of Arrays, Linked List:** Linked List as an ADT, Linked List Vs. Arrays, Dynamic Memory Allocation & De-allocation, Types of Linked List: Circular & Doubly Linked List.
- **Searching**: Linear search, Binary search
- **Sorting**: Introduction, Types - Stable & Unstable, Insertion Sort, Selection sort, Bubble sort, Merge Sort, Quick Sort

Unit III	Linear Data Structures-II	(07Hours)

- **Stack**s: ADT, Implementation of stack using Arrays & Linked List, Applications of Stack: Recursion, Infix to Postfix and Prefix Expression Conversion, Evaluating Postfix and Prefix Expression.
- **Queues**: ADT, Implementation of Queues using Arrays & Linked List, Circular Queue, Priority Queue, Operations on Queues : Enque and Deque

Unit IV	Non-Linear Data Structures-I	(08 Hours)

- **Trees**: Introduction, Binary tree, Types of Binary Tree, Representation of Binary tree using Arrays & Linked List, Binary Tree Traversal : Inorder, Postorder, Preorder
- **Binary Search Tree**: Introduction, Operations : Creation, Insertion, Deletion & Searching an element
- **Height balanced Tree**: AVL, B-Tree, B+Tree, Threaded Binary Tree
- **Heap**: Min/Max heap, Operations on Heap : Creation, Insertion & Deletion, Heap Sort

Unit V	Non-Linear Data Structures-II	(07 Hours)

- **Graph**: Introduction, Graph Representations: Adjacency Matrix, Incidence matrix, Adjacency List
- **Graph Traversal Techniques:** Depth First Search (DFS), Breadth First Search (BFS).
- **Spanning Tree**: Introduction, Minimum Spanning Tree, Kruskal's and Prim's Algorithms.
- **Shortest Path Algorithms**: Dijkstra's Algorithm, Bellman-Ford Algorithm

Unit VI	Algorithm Design Strategies	(08 Hours)

- **Greedy Algorithms**: Fractional Knapsack Problem, Job Scheduling with deadlines
- **Dynamic Programming:** 0/1 Knapsack Problem, Floyd-Warshall Algorithm, Matrix Chain Multiplication, TSP
- **Backtracking**: 4 Queens problem, N Queen's Problem

Learning Resources

Text Books:

1. Horowitz, E.; Sahni, S.; Anderson-Freed, S. Fundamentals of Data Structures in C. University Press, 2014. ISBN: 978-8173716058
2. Gilberg, R.; Forouzan, B. Data Structures: A Pseudocode Approach with C. Cengage Learning, 2011. ISBN: 978-8131503056
3. Tenenbaum, Aaron M.; Langsam, Yedidyah; Augenstein, Moshe J. Data Structures Using C. Pearson Education, 2016. ISBN: 978-9332575262

Reference Books:

1. Aho, Alfred V.; Hopcroft, John E.; Ullman, Jeffrey D. Data Structures and Algorithms. Pearson Education, 2001. ISBN: 978-0201000238

2. Lipschutz, Seymour. Data Structures with C (Schaum's Outline Series). McGraw-Hill, 2014. ISBN: 978-0071829863
3. Cormen, Thomas H.; Leiserson, Charles E.; Rivest, Ronald L.; Stein, Clifford. Introduction to Algorithms (CLRS). MIT Press, 2009. ISBN: 978-0262033848

E-resources:

- https://nptel.ac.in/courses/106106130
- https://nptel.ac.in/courses/106102064
- https://nptel.ac.in/courses/106106127

Class: Second Year B. Tech. (2025 Pattern)						**Sem: III**
Course Code: PCC-205-ITT	**Name of Course:** Data Structures and Algorithms Lab					
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	4		-	-	2
Examination Scheme:						
FA	SA	PR	OR	TW		Total
-	-	50	-	25		75

Prerequisite:

Principles of Programming Languages (ESC-101-BSH)

Course Objective:

1. To implement searching, sorting, and traversal techniques
2. To understand Linear data structure and implement their application
3. To understand Non-Linear data structure and implement their application
4. To apply data structures to solve real-world problems.

Course Outcome: On completion of course, student will be able to

PCC-205-ITT.1	Implement searching and sorting algorithms using recursive and iterative approaches.
PCC-205-ITT.2	Implement linear data structures such as stacks, queues and linked lists.
PCC-205-ITT.3	Implement non-linear data structures such as tree, graph
PCC-205-ITT.4	Apply a suitable data structure to solve a real-world problem

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Problem statement, Theory- Concept in brief, conclusion).
2. The program codes along with their outputs for all performed experiments may be submitted in the softcopy.
3. Students are expected to have a clear understanding of the theoretical concepts involved in each experiment.
4. The practical examination will be conducted only if the journal is complete in all respects and duly certified by the instructor.

Guidelines for Lab /TW Assessment
1. The instructor will assess the term work based on the overall performance of the student, considering parameters such as: ● Timely conduction of practical experiments ● Timely submission of the handwritten journal with proper results ● Attendance and regularity in laboratory sessions 2. The instructor will evaluate the student's understanding of the practical work by asking questions related to theory, data structure concepts, and implementation details of the experiments carried out.
Guidelines for Laboratory Conduction
1. All the assignments should be conducted on open-source software using 'C' Programming Language.
Guidelines for Practical Examination
1. During the practical assessment, weightage shall be given to the correct and satisfactory implementation of the given problem statement. 2. Supplementary and relevant questions may be asked at the time of evaluation to assess the student's performance. 3. The evaluation shall be carried out jointly by both internal and external examiners.
Guidelines for Mini Project
1. A group of 3-4 Students can form a Team for the Mini project. 2. The project should integrate at least two data structures from the syllabus. 3. Each student in the group must work collaboratively and contribute significantly to the design and development of the Project.
List of Assignments
1. Write a program that uses both recursive and non-recursive functions to perform the following search operations for a Key value in a given list of integers: a. Linear search b. Binary search.
2. Consider a student database of a Second-Year class (at least 15 records). Database should contain different fields like Roll No, Name and SGPA. a. Design a roll call list, arrange list of students according to roll numbers in ascending order using Bubble Sort b. Arrange list of students alphabetically using Insertion Sort c. Arrange list of students to find out first ten toppers from a class using Selection Sort
3. Consider the playlist in a music player. Implement a playlist feature in music player application using singly linked list. Each song title in the playlist is represented as a node in the linked list. Each node contains information about the song title and duration. The playlist should allow users to: a. Add songs b. Remove songs c. Display the entire playlist d. Play specific songs
4. Write a program to convert infix expression to postfix expression using stack.

5. Write a menu driven Program for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
   a. Insert an Element
   b. Delete an Element
   c. Demonstrate Overflow and Underflow situations
   d. Display the status of Circular QUEUE
   e. Exit
   Support the program with appropriate functions for each of the above operations
6. Write a program to perform the following operations on Binary Search Tree:
   a. Inserting an element.
   b. Deleting an element.
   c. Searching for a key element.
7. Write a program to perform the following operations on a graph representing a network of cities:
   a. Create a Graph of N Cities using an Adjacency Matrix, where cities are nodes, and edges (direct connections) are represented by 1 (connected) or 0 (not connected).
   b. Implement Depth First Search (DFS) and Breadth First Search (BFS) to print all cities reachable from a given starting city.
8. A city is planning to lay down fiber-optic cables to connect different offices. Each office is represented as a node, and possible cable connections between offices are represented as edges with associated costs. Write a program to:
   a. Represent the network as a weighted undirected graph.
   b. Apply Kruskal's algorithm to determine the Minimum Spanning Tree (MST), which gives the least-cost way to connect all offices.
   c. Display the selected edges and the total cost of laying cables.
9. Implement Dijkstra's Algorithm to find the shortest path from a given source node to all other nodes. Display the paths and their total costs.
10. Mini-Project: Design a real-world application (e.g., Library Management, Inventory System, or Student Attendance System) integrating at least two data structures.

Learning Resources

Reference Books:

1. Horowitz, Ellis; Sahni, Sartaj; Anderson-Freed, Susan. Fundamentals of Data Structures in C.
2. Aho, Alfred V.; Hopcroft, John E.; Ullman, Jeffrey D. Data Structures and Algorithms. Pearson Education.
3. Lipschutz, Seymour. Data Structures with C (Schaum's Outline Series).
4. Cormen, Thomas H.; Leiserson, Charles E.; Rivest, Ronald L.; Stein, Clifford. Introduction to Algorithms (CLRS).

E-resources:

- NPTEL: Data Structures and Algorithms
- NPTEL: Advanced Data Structures and Algorithms
- https://www.geeksforgeeks.org/data-structures/

Virtual Laboratory

- https://www.programiz.com/c-programming/online-compiler/
- https://ds1-iiith.vlabs.ac.in
- https://visualgo.net/en

Class: Second Year B. Tech. (2025 Pattern)						**SEM : III**
Course Code: MDM-206-ITT		**Name of Course:** Digital Electronics and 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:

Basic Electrical and Electronics Engineering (ESC-105-ASH)

Course Objective:

1. To provide foundational knowledge of number systems, binary codes, Boolean algebra, and logic minimization techniques for digital system design.
2. To develop the ability to design and analyze combinational logic circuits using SSI and MSI devices.
3. To enable students to design and analyze sequential logic circuits using flip-flops, counters, and registers.
4. To introduce the fundamental concepts of computer organization, CPU architecture, instruction set architecture, and processor operations.
5. To impart understanding of memory hierarchy, cache organization, and various semiconductor memory technologies used in computer systems.

Course Outcome: On completion of course, student will be able to	
MDM-206-ITT.1	Apply number systems, binary codes, Boolean algebra, and Karnaugh map techniques to simplify and solve digital logic problems.
MDM-206-ITT.2	Design combinational logic circuits using SSI and MSI devices for specified functional requirements.
MDM-206-ITT.3	Design sequential logic circuits using flip-flops, counters, and registers for digital system applications.
MDM-206-ITT.4	Explain computer organization concepts including CPU architecture, instruction formats, addressing modes, and instruction.
MDM-206-ITT.5	Analyze memory hierarchy, cache mapping techniques, and semiconductor memory technologies for performance evaluation.

Course Content		
UNIT I	**Number Systems and Boolean Algebra**	**(06 Hours)**

- **Number System:** Overview, Interconversion.
- BCD numbers (8421-2421), gray code, excess–3 code, cyclic code, code conversion,
- ASCII, EBCDIC codes.
- Binary addition and subtraction, signed and unsigned binary numbers, 1's and 2's complement representation.
- **Logic minimization:** Representation of logic functions: logic statement, truth table, SOP form, POS form.
- Simplification of logical functions using K-Maps up to 4 variables.

UNIT II	Combinational Logic Design	(06Hours)

- Introduction to Combinational Logic Design
- **Design using SSI chips:** Code converters, Half- Adder, Full Adder, Half Subtractor, Full Subtractor, n-bit Binary adder.
- **Introduction to MSI chips:** Multiplexer (IC 74153), Demultiplexer (IC 74138), Decoder (74238), Encoder (IC 74147), Binary adder (IC 7483)
- **Design using MSI chips:** BCD adder & subtractor using IC 7483, Implementation of logic functions using IC 74153 & 74138.

UNIT III	Sequential Logic Design	(06 Hours)

- Introduction to sequential circuits. Difference between combinational circuits and sequential circuits, memory element – latch.
- **Flip- flop:** SR, JK, D, T; Preset & Clear, Master and Slave Flip Flops, Truth Tables and Excitation tables and their conversion.
- **Counters:** asynchronous, synchronous and modulo counters, study of modulus-n counter ICs-7490 & their applications to implement mod counters.
- **Registers:** shift register types (SISO, SIPO, PISO & PIPO)
- Applications of sequential circuits.

UNIT IV	Computer Organization & Processor	(07 Hours)

- **Introduction to Computer Organization**: Functional units of a computer system, Von Neumann and Harvard Architecture (concept, block diagram, working advantages and limitations).
- **Register Organization**: General purpose registers, Special purpose registers, Role of registers in instruction execution.
- **Instruction Set Architecture (ISA):** Instruction Types (Data manipulation, Control instructions), Types of Operands (Register operands, Memory operands, immediate operands). Types of operations **(**data transfer, arithmetic operations, logical operations, control flow operations and shift/rotate operations.
- **Instruction Formats:** Concept. Types of instruction formats – zero address, one address, two address and three address instructions. Fields of an instruction.
- **Addressing modes:** Immediate, direct, indirect, register, register indirect, indexed and relative addressing
- **Instruction cycle**: Fetch, decode, execute and interrupt cycle.

UNIT V	Computer Memory System	(05 Hours)

- **Memory System Overview**: Role of memory in computer organization; memory performance parameters – access time, cycle time, and transfer rate; memory hierarchy; locality of reference.
- **Main Memory Organization**: Semiconductor memories; RAM – SRAM and DRAM; ROM – PROM, EPROM, EEPROM, Flash memory
- **Cache Memory:** Cache memory concept and organization; cache mapping techniques – direct mapping, associative mapping, and set-associative mapping; cache replacement policies – LRU

and FIFO; write policies – write-through and write-back; cache performance – hit ratio.

- **Secondary Storage Overview**: Magnetic disks , Optical storage, Hard Disk Drive (HDD), Solid-State Drive (SSD)

Learning Resources

Text Books:

1. Jain, R.P. Modern Digital Electronics. Tata McGraw-Hill, Third Edition.
2. Stallings, William. Computer Organization and Architecture: Designing for Performance. 8th Edition, Prentice Hall of India, 2010. ISBN: 978-0-13-607373-4

Reference Books:

1. Mano, M. Morris. Digital Design. Prentice Hall, Third Edition.
2. Hamacher, Carl; Zaky, Zvonko. Computer Organization. Fifth Edition.
3. Tanenbaum, Andrew S. Structured Computer Organization. 4th Edition, Prentice Hall of India, 1991. ISBN: 81–203–1553–7

E-resources:

- https://bcrti.co.in/digitallibrary/includeFolder/noticeFolder/21102611512388.pdf

Links to online SWAYAM/NPTEL Courses

- https://onlinecourses.nptel.ac.in/noc24_ee17/preview
- https://onlinecourses.nptel.ac.in/noc25_ee20/preview

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** III
Course Code: MDM-207-ITT		**Name of Course:** Digital Electronics and Computer Organization Lab				
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	2		-	-	1
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	-	-	25		25

Prerequisite:

Basic Electrical and Electronics Engineering Lab (ESC-106-ASH)

Course Objective:

1. To enable students to design, implement, and test fundamental digital logic circuits by applying Boolean algebra and minimization techniques.
2. To develop hands-on proficiency in building and analyzing sequential circuits, including asynchronous and synchronous counters and shift registers.
3. To introduce and illustrate the foundational organization of a computer system by designing and simulating the core functional units.
4. To simulate the function of computer memory systems.

Course Outcome: On completion of course, student will be able to

MDM-207-ITT.1	Use logic function representation for simplification with K-Maps and design combinational logic circuits using SSI & MSI chips.
MDM-207-ITT.2	Design sequential logic circuits.
MDM-207-ITT.3	Understand the basics of simulator tool and simulate basic blocks such as ALU
MDM-207-ITT.4	Simulate the basic storage elements of a computer system to understand memory organization.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to Students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration concept, objectives, outcomes, algorithms, sample test cases, data sheets of various elements of computer system, ICs, tools and references.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Problem statement, Theory- Concept in brief, conclusion).

2. The program codes along with their outputs for all performed experiments may be submitted in the softcopy.
3. Students are expected to have a clear understanding of the theoretical concepts involved in each experiment.

Guidelines for Lab /TW Assessment

1. The instructor will assess the term work based on the overall performance of the student, considering parameters such as:
   - Timely conduction of practical experiments
   - Timely submission of the handwritten journal with proper results
   - Attendance and regularity in laboratory sessions
2. The instructor will evaluate the student's understanding of the practical work by asking questions related to theory and implementation details of the experiments carried out.
3. Appropriate knowledge of usage of necessary tools, software and hardware such as ICs, memory elements, digital trainer kits, IC testers should be checked by the faculty member.

Guidelines for Laboratory Conduction

1. All the assignments should be conducted on open-source software.

List of Assignments

1. Design and implement 4-bit BCD to Excess-3 code.
2. Design and implement 1 digit BCD adder using IC7483
3. Design and implement following using multiplexer IC 74153 1) full adder 2) Three variable
4. Design and implement full subtractor using decoder IC 74138
5. Design and implement 3-bit Up and 3- bit Down Asynchronous Counters using master slave JK flipflop (IC 7476)
6. Design and implement 3-bit Up and 3-bit Down Synchronous Counters using master slave JK flipflop (IC 7476)
7. Design and implement 4-bit Shift Register of any one type (e.g., SISO, SIPO or PIPO) and demonstrate its operation using JK flip-flops (IC 7476).
8. Design and implement Modulo 'N' counter using IC7490. (N<=99)
9. Design & simulate single bit RAM cell
10. Design& simulate single bit ALU with four functions (AND, OR, XOR, ADD)
11. Design & simulate single instruction CPU.

Learning Resources

Text Books:

1. Jain, R.P. Modern Digital Electronics. 3rd Edition, Tata McGraw-Hill. ISBN: 0-07-049492-4.
2. Floyd, Thomas L. Digital Fundamentals. Pearson Education.
3. Stallings, William. Computer Organization and Architecture: Designing for Performance. Pearson Education.

Reference Books:

1. Horowitz, Paul; Hill, Winfield. The Art of Electronics.
2. Roth, Charles H. Jr.; Kinney, Larry L. Fundamentals of Logic Design.
3. Harris, David; Harris, Sarah. Digital Design and Computer Architecture.

E-resources:

- https://youtu.be/QzgGqIT5M0U?si=9vSfZG3QkvlcyJop

- https://youtu.be/ZlGe9eByCEM?si=nZn500J_Seh_wtfH

Virtual Laboratory

- http://vlabs.iitkgp.ac.in/coa/
- https://www.vlab.co.in/lab_ready_for_use.php

Class: Second Year B. Tech. (2025 Pattern)	**Sem:** III
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

Class: Second Year B. Tech. (2025 Pattern)						**Sem: III**
Course Code: EEM-208-ITT	**Name of Course:** Engineering Economics					
Teaching Scheme (Hrs/week):				**Credits:2**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
1	1	-		1	1	-
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	-	-	25		25

Prerequisite:

Basic Mathematics and Logical Reasoning

Course Objective:

1. To Understand basic economic terms and different types of costs in engineering projects.
2. To Understand the time value of money, interest concepts, present and future worth, annuities, and economic comparison of alternatives for engineering and IT project decision-making.
3. To Understand depreciation, break-even analysis, cost–benefit analysis, and project evaluation techniques for effective financial decision-making.

Course Outcome: On completion of course, student will be able to	
EEM-208-ITT.1	Understand basic economic terms and classify different types of costs in engineering projects.
EEM-208-ITT.2	Apply the concepts of time value of money, calculate simple and compound interest, evaluate present and future worth, analyze annuities, and compare economic alternatives in engineering and projects.
EEM-208-ITT.3	Apply depreciation methods, calculate break-even points, perform cost–benefit analysis, and evaluate alternatives economically.

Course Content

Unit I	**Introduction to Engineering Economics & Cost Estimation**	**(05 Hours)**

- **Introduction**: Meaning, Importance, and scope of engineering economics.
- **Basic Economic Terms**: Goods, Services, Needs, Utility, Demand and Supply.
- **Market Analysis**: Overview of markets and classification of different types of markets.
- **Types of Cost: Analysis of** fixed and variable costs; direct and indirect costs; opportunity cost and sunk cost; total cost, average cost, and marginal cost. Case study on simple cost estimation techniques for engineering economics.

Unit II	Fundamentals of Financial Analysis	(05Hours)

- **Time Value of Money**: Importance, Application in Engineering Economics.
- **Interest**: Introduction, Types of Interest, formulae, and simple numerical examples.
- **Present worth:** Concept & significance of Present Worth in financial analysis**,** Value of cash flow - future cash inflows and outflows**,** Methods of calculation: single payment, uniform series, Application.
- **Future worth**: Introduction, Techniques for calculating FW.
- **Annuities**: Introduction, Types annuities, Fixed and Variable.

Unit III	Depreciation, Break-Even Analysis, and Project Evaluation	(05 Hours)

- **Depreciation:** Meaning and need; Methods – Straight Line Method (SLM) and Declining Balance Method (DBM)
- **Break-Even Point (BEP):** Concept, BEP graph, and simple numerical problems.
- **Cost–Benefit Analysis (CBA):** Payback period method (simple), feasibility
- **Case Studies (Application-Based):**
- Hardware/Software buy vs. build decision
- Cloud storage cost comparison

Learning Resources

Text Books:

1. Panneerselvam, R. Engineering Economics. 2nd Edition, PHI, ISBN-13: 9788120348370
2. Blank, Leland; Tarquin, Anthony. Engineering Economy (Basics of Engineering Economy). McGraw-Hill Higher Education, ISBN: 9780073401294
3. Riggs, James L.; Bedworth, David; Randhawa, Sabah. Engineering Economics. 4th Edition, McGraw-Hill, ISBN-13: 9780079122483

Reference Books:

1. Sullivan, W. G.; Wickham, C.; Luxhoj, J. Engineering Economy.
2. Mankiw, N. Gregory. Principles of Economics.
3. Brigham, Eugene F.; Houston, Joel F. Fundamentals of Financial Management.

E-resources:

1. **NPTEL — "Engineering Economic Analysis" course**
https://nptel.ac.in/courses/112107209 NPTEL

2. **NPTEL — "Introduction to Microeconomics" (fundamentals of demand/supply, markets etc.)**
https://onlinecourses.nptel.ac.in/noc21_hs52/preview

Guidelines for Student's Lab Journal

- The term work for this course shall be submitted in the form of a journal.
- The journal shall contain systematically organized theoretical and analytical work related to the assigned topics.
- Each student shall maintain an individual journal, duly certified by the subject teacher.

Guidelines for Assessment of Term Work

1. The instructor will assess the term work based on the overall performance of the student, considering parameters such as:
    - Timely conduction of practical experiments
    - Timely submission of the handwritten journal with proper results
    - Attendance and regularity in laboratory sessions

2. The instructor will evaluate the student's understanding of the assignment by asking questions related to theory and economic concepts.

Engineering Economics

List of Assignments

Assignment No.	Content
01	An organization plans to introduce a new service offering for customers in a competitive market. Before implementation, the organization wants to study the demand and supply conditions to determine pricing and capacity planning. Students are required to: • Analyze the demand and supply situation for the service. • Identify key factors affecting demand and supply. • Explain how changes in market conditions influence price and service availability.
02	An organization is undertaking a project that involves expenses related to manpower, resources, facilities, utilities, and administration. Students are required to: • Classify the costs into fixed costs, variable costs, and semi-variable costs. • Explain why cost classification is important for planning, budgeting, and control
03	A project requires planning, execution, and post-completion support. The project involves costs such as resource utilization, materials/tools, operational expenses, and maintenance. Students are required to: • Estimate the total cost of executing the project. • Calculate the annual maintenance or operating cost. • Suggest two methods to reduce variable costs without compromising quality.
04	Time Value of Money – Software Subscription
05	Simple & Compound Interest – Hardware Investment: An IT startup invests ₹1,00,000 in computer hardware. Case A: Simple interest @ 10% for 3 years Case B: Compound interest @ 10% for 3 years Tasks: 1. Calculate total amount in Case A and Case B. 2. Identify which is more beneficial and why. Explain the importance of money–time relation for long-term investments
06	Depreciation of Computer System: A server costing ₹80,000 has a life of 4 years. Tasks: 1. Calculate annual depreciation using Straight-Line Method. 2. Calculate book value at the end of each year. 3. Explain why IT equipment depreciates faster than furniture.
07	Break-Even Analysis – New Mobile App (Unit 4) A startup builds a subscription-based app. Given: • Fixed cost: ₹2,00,000 • Variable cost per user: ₹20 • Subscription price per user: ₹50

	Tasks: 1. Calculate Break-Even Point in number of users. 2. Draw BEP graph (simple). Suggest two ways to reduce BEP
08	Make or Buy Decision – Cloud vs. Local ServerA company must choose between: Option A: Buy Server • Cost: ₹1,50,000 • Maintenance per year: ₹20,000 Option B: Cloud Rental • ₹8,000 per month Tasks: 1. Calculate 3-year total cost for both options. 2. Recommend the best option with justification. 3. Explain how cost–benefit analysis helps in IT decision-making.

Class: Second Year B. Tech. (2025 Pattern)						**Sem: III**
Course Code: VEC-209-ITT	**Name of Course:** Environmental Science Studies					
Teaching Scheme (Hrs/week):				**Credits:2**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
2	-	-		2	-	-
Examination Scheme:						
FA	SA	PR	OR	TW		Total
25	25	-	-	-		50

Course Objective:

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

Course Outcome: On completion of course, student will be able to	
VEC-209-ITT.1	Explain environmental systems, ecosystem interactions, and sustainability concepts in relation to human and engineering activities.
VEC-209-ITT.2	Analyze natural resource utilization, biodiversity concerns, and conservation strategies for sustainable environmental management.
VEC-209-ITT.3	Evaluate environmental impacts, climate change issues, and associated risks arising from industrial and developmental activities.
VEC-209-ITT.4	Apply basic principles of waste management and pollution control to address real-world environmental challenges.
VEC-209-ITT.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)

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.

Unit II	**Natural Resources, Biodiversity & Conservation**	**(06 Hours)**

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.

Unit III	**Climate Change, Environmental Impacts and Risk Assessment**	**(06 Hours)**

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.

Waste Management	**(06 Hours)**

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.

Pollution Control and Environmental Regulations	**(06 Hours)**

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.

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

Class: Second Year B. Tech. (2025 Pattern)				**Sem: III**		
Course Code: ELC-210-ITT	**Name of Course:** Community Engagement Project					
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	4		-	-	2
Examination Scheme:						
FA	SA	PR	OR	TW		Total
-	-	25	-	50		75

Prerequisite:

Programming in C (ESC-101-ASH), Python Programming (ESC-151-ASH), Life Skill II (CCC-151-ASH)

Course Objective:

1. To develop understanding of local community needs, challenges, and socio-economic conditions through direct field engagement and interaction.
2. To apply engineering and interdisciplinary knowledge to design feasible, community-oriented solutions.
3. To promote teamwork, leadership, ethical responsibility, and effective communication while working with community stakeholders.
4. To encourage reflective learning, documentation, and evaluation of project impact for sustainable community development.

Course Outcome: On completion of course, student will be able to	
ELC-210-ITT.1	Analyze real-world community problems using field visits, surveys, and stakeholder interactions.
ELC-210-ITT.2	Design context appropriate solutions to address the identified community needs.
ELC-210-ITT.3	Demonstrate teamwork, leadership, ethical practices, and effective communication during project execution and community interaction.
ELC-210-ITT.4	Evaluate the effectiveness of student's interventions and articulate lessons learned through reports and presentations.

Course Guidelines for Implementation

- A Group of 3-4 students can form a team.
- The project coordinator assigns project to the project guides based on expertise of the guides match with domain of project title where they provide guidance and support to the teams throughout the project. Each group is allotted to a faculty member of the department as a mentor.

- Students should work at least 4 hours per week and shall meet their project guide regularly (at least twice a week) and report the progress of the project work.
- Field visits are encouraged to identify the problem statements.
- Each student in the group must work collaboratively and contribute significantly to the design and development of solutions for registered problem statements, focusing on environmental challenges faced by the community.
- **The Project Diary** has to be maintained by each of the student group to record the activities undertaken/ involved and will be countersigned by the concerned mentor and HoD.
- Project report shall be submitted by each group.
- An internal evaluation shall also be conducted by a committee constituted by the HoD. Evaluation to be done based on the active participation of the student and marks could be awarded by the committee.
- Oral Examination shall consist of presentation and demonstration of the project work carried out by the project groups.

Documentation

Each group must maintain:

- Project Diary (meetings, progress, remarks).
- Project Report
- A3 Poster, Presentation.
- Plagiarism and AI check report.

Suggestive list of topics under Community Engagement Project

- Community & Social.
- Health and hygiene awareness.
- Women empowerment & education.
- Career guidance for youth.
- Cell phone addiction & digital safety.
- Traditional vs modern healthcare practices.
- Environmental & Sustainability.
- Waste management and recycling.
- Water scarcity, quality assessment.
- Air/noise/water pollution mitigation.
- Renewable energy awareness.
- Organic farming & soil protection.
- E-waste management.
- Climate change adaptation practices.
- Health & Wellbeing.
- Nutrition & lifestyle diseases.
- Diabetes incidence and awareness.
- Yoga and wellness programs.
- Technology based Interventions.
- Simple mobile apps for community use.
- Data logging or monitoring devices.
- Digital literacy modules.
- IoT-based solutions.

Synopsis Submission

Contents can be as follow

- Title of the project
- Aim, Objective and expected outcome
- Plan of execution (timeline and activities).
- Required resources

Evaluation Scheme

Review-I (Mid-Semester) – 50% Weightage

- Students must identify a specific problem statement related to community engineering projects.
- The problem statement should be relevant to environmental science/ societal needs/ real-world issues etc.
- A brief presentation should be prepared outlining the identified problem. The presentation should include the background of the problem, literature review, proposed solution approach, and initial findings or developments.
- The project will be assessed regarding its technical feasibility, economic viability, societal impact, and environmental sustainability.

Review-II (End-Semester) – 50% Weightage

- Project will be evaluated based on the effectiveness of the solution designed and developed using coding, modeling, product design, process design, or other relevant processes for identified problem statement.
- A project report should be submitted in prescribed format.
- Groups must prepare the Project report, uploaded along with a plagiarism and AI check report, detailing their project work and findings.

Learning Resources

Reference Books:

1. Sally. Service-Learning: Planning, Implementing & Assessing Student Projects. Corwin Press, 2006. ISBN: 9781412936736 / 141293673X
2. Beckman, M.; Long, J. F. Community-Based Research: Teaching for Community Impact. Stylus Publishing, LLC, 2016. ISBN: 9781620363553 / 9781620363560
3. IDEO. Design Thinking for Social Innovation. IDEO Press.
4. Dostilio, L. D.; et al. The Community Engagement Professional's Guidebook: A Companion to The Community Engagement Professional in Higher Education. Campus Compact, Stylus Publishing, LLC, 2019. ISBN-10: 1945459182

E-resources:

https://nptel.ac.in/courses/109103123

Web Links:

1. UNESCO: Education for Sustainable Development https://www.unesco.org
2. EPICS (Engineering Projects in Community Service) https://engineering.purdue.edu/EPICS
3. Ashoka: Innovators for the Public https://www.ashoka.org
4. Design for Change https://www.dfcworld.com

SEMESTER – IV

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: PCC-251-ITT	**Name of Course:** Software Engineering and Project Management					
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:

Fundamentals of Computer Engineering (PCC-101-IT), Communication Skills (AEC-101-ASH)

Course Objective:

1. Understand Software Myths, engineering practices, process models, and agile frameworks for effective software project development.
2. Understand agile philosophy, Agile Manifesto, and apply agile frameworks such as Extreme Programming (XP) and Scrum in software projects.
3. Develop the ability to elicit, analyze, document, and validate software requirements and to design software systems using architectural styles and UML modeling techniques.
4. To provide knowledge of software project planning, estimation, scheduling, measurement metrics, and the role of project managers using standard project management tools.
5. To impart understanding of project execution, monitoring, control techniques, earned value analysis, and risk management for successful software project delivery.

Course Outcome: On completion of course, student will be able to

PCC-251-ITT.1	Understand software engineering concepts, software myths, and different software process models.
PCC-251-ITT.2	Apply agile principles, Agile Manifesto values, and frameworks like XP and Scrum to plan and analyze software development activities.
PCC-251-ITT.3	Analyze functional and non-functional requirements and prepare a complete Software Requirement Specification (SRS) and UML-based design models.
PCC-251-ITT.4	Apply project planning, estimation, scheduling, and measurement techniques using tools such as Gantt charts, PERT/CPM, and project management software.
PCC-251-ITT.5	Understand project performance using execution and control techniques, earned value management, and apply risk management strategies to minimize project uncertainties.

Course Content

Unit I	Introduction to Software Engineering	(05 Hours)

- **Introduction**: Nature of Software, The software Process, Software Engineering Practice and Software Myths.
- **Software Process Models**: A Generic Process Model, **Prescriptive Process Models:** Waterfall Model, Iterative Process Model, Incremental Process Model, Evolutionary Process Models.
- **Case Study:** Software Process Models on Online Shopping System

Unit II	Agile Software Development	(06 Hours)

- **Agile Software Development**: Introduction, Agility and the cost of change. What is an agile Process? Comparison between Non-Agile and Agile Project Principles & Agile Manifesto
- **Extreme Programming (XP):** XP values, Process, industrial XP, **SCRUM Framework**: Scrum Roles, Scrum Events, Product Backlog and Sprint Backlog, Burn-down Chart.
- **Agile Practices:** test driven development, pair programming
- **Case Study:** Analyze the Online Shopping System using Agile. Create the three stages of the project

Unit III	Requirements Engineering & Design	(07 Hours)

- **Requirements Engineering:** functional and non-functional requirements, user requirements, system requirements, software requirements Specification document (SRS), Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management
- **Requirements Design**: Software Design Fundamentals, Architectural styles, Creating an architectural design- software architecture, data design. UML models: Use case diagram, State Diagram, Class Diagram, Sequence Diagram, Activity Diagram, and Component Diagram & Deployment Diagram.
- **Case Study:** Writing SRS for online shopping

Unit IV	Project Planning & Management	(06 Hours)

- **Project Planning:** Introduction to project planning, Project planning process, Agile project management, Gantt Chart, PERT chart, CPM, Microsoft Projects, and Primavera Project Management Software.
- **Project Management:** Role of Project Manager, Sequencing and Scheduling, The Management Spectrum, The W5HH Principle, Software Measurement: size & function-oriented metrics (FP & LOC), Metrics for Project
- **Case study:** Develop the Software project plan using Microsoft Projects or any open source tool like Jira, Kanban, extreme programming.

Unit V	Project Execution and Control	(06 Hours)

- **Project execution:** task assignment, tracking, and monitoring - Project control: schedule control, budget control, and quality control - Earned value management (EVM) and project performance measurement - Project reporting and communication
- **Risk management principles and concepts**: Risk identification, analysis, and prioritization – Risk response planning and implementation - Risk monitoring and review

Learning Resources

Text Books:

1. Pressman, Roger S.; Maxim, Bruce R. Software Engineering: A Practitioner's Approach. McGraw-Hill Education. ISBN-13: 9781259872976, ISBN-10: 1259872971
2. Jalote, Pankaj. Software Engineering: A Precise Approach. Wiley India. ISBN-13: 9788126523115, ISBN-10: 8126523115
3. Hughes, Bob; Cotterell, Mike. Software Project Management. McGraw-Hill Education. ISBN-13: 9780077122799, ISBN-10: 0077122798.

Reference Books:

1. Sommerville, Ian. Software Engineering. Addison-Wesley, Pearson. ISBN-13: 9780133943030
2. Royce, Walker. Software Project Management: A Unified Framework. Addison-Wesley. ISBN-13: 9780201309584
3. Booch, Grady; Rumbaugh, James; Jacobson, Ivar. The Unified Modeling Language User Guide. Addison-Wesley. ISBN-13: 9780321267979

E-resources:

https://nptel.ac.in/courses/106105218
https://nptel.ac.in/courses/106101061
https://nptel.ac.in/courses/106105087
https://nptel.ac.in/courses/106105182

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: PCC-252-ITT	**Name of Course:** Database Management System					
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:

Data Structures & Algorithms (PCC-204-ITT)

Course Objective:

1. To understand the fundamental concepts of Database management systems.
2. To develop skills in relational algebra and SQL for querying and manipulating data.
3. To understand schema design, ER modeling, functional dependencies, and normalization techniques.
4. To explain transaction concepts, concurrency control, and recovery mechanisms.
5. To learn procedural extensions of SQL using PL/SQL programming.
6. To explore distributed databases and advanced database technologies.

Course Outcome: On completion of course, Student will be able to	
PCC-252-ITT.1	Understand database concepts, architecture, and data models.
PCC-252-ITT.2	Apply relational algebra and SQL to query and manipulate data.
PCC-252-ITT.3	Design normalized relational schemas.
PCC-252-ITT.4	Understand transaction processing, concurrency, and recovery mechanisms.
PCC-252-ITT.5	Apply PL/SQL concepts including procedures, functions, cursors, triggers, and exception handling.
PCC-252-ITT.6	Understand distributed databases and advanced database technologies.

Course Content

Unit I	**Introduction to DBMS**	**(07 Hours)**

- DBMS: Introduction, Advantages of DBMS over file processing systems
- View of Data: Data abstraction (Physical or Internal Level, Logical or Conceptual Level, View or External Level) and Data independence (Physical Data Independence, Logical Data Independence)
- DBMS Architecture 1-level, 2-Level, 3-Level**,** structure of DBMS
- Database Users and Administrators: naïve users, application programmers, sophisticated users, specialized users, role of database administrator.
- Keys: Introduction, Primary Key, Foreign Key, Super Key, Candidate Key, Secondary

Key/Alternate Key, Unique Key, Composite Key

- Data Models: Introduction, Conceptual, Representational, Physical, Characteristics of each model, Advantages and Disadvantages.
- ER Model: Introduction, entities, attributes, relationships, Degree and Cardinality, components of ER diagram.

Unit II	Relational Model & SQL	(08 Hours)

- Relational Model: Concepts (Attribute, Tables, Tuple, Column, Relational Schema, Degree, Cardinality), CODD's Rules
- Relational Integrity constraints: Domain Constraints, Key Constraints, Entity Integrity Constraints, Referential Integrity Constraints,
- Relational algebra operations: selection, projection, union, intersection.
- SQL languages: Introduction, SQL datatypes, DDL (create alter, drop, truncate, rename), DML (Insert, Update Delete,), DCL (grant and revoke), TCL (commit, rollback, checkpoint), DQL (SELECT), clauses of SELECT (FROM, WHERE, GROUP BY, HAVING, ORDER BY, DISTINCT, Pattern Matching with LIKE and LIMIT)
- SQL Joins (Inner, Left, Right and Full Join)
- Views: Introduction, create, update, drop

Unit III	Database Design & Normalization	(07 Hours)

- Database Design: Introduction, Features of good database design in DBMS,
- Functional Dependencies (FDs): Rules of Functional dependency, Types of FDs (Trivial, Non-trivial, Transitive, Multivalued)
- Normalization: Needs for Normalization, Anomalies in database (insertion, deletion and update), 1NF, 2NF, 3NF, BCNF, 4NF.
- Converting ERD to a relational schema, Convert ER Diagrams to Tables in DBMS,
- EER Model: Introduction, components, converting into tables.

Unit IV	Transaction Management and Concurrency Control	(08 Hours)

- Transaction: introduction, ACID properties, Transaction Management, Commit Protocols: (One-Phase, two-phase, three-phase Commit)
- Scheduling (Serial, Concurrent), Serializability (conflict, view)
- Concurrency Control Protocols: Lock-Based, Timestamp-Based, Validation-Based
- Deadlocks: introduction, Necessary Conditions of Deadlock (Mutual Exclusion, Hold and Wait, No Preemption, Circular Wait) , Types of Deadlock (Resource Deadlocks, Communication Deadlocks),
- Deadlock Handling in DBMS: Detection, Prevention, Recovery, Avoidance
- Deadlock. Recovery Techniques: Shadow-Paging, Log-based, Recovery, Check Point.

Unit V	PL/SQL Programming	(07 Hours)

- Introduction to PL/SQL: block structure, advantages
- Variables, constants, data types, operators
- Control structures: IF, CASE, LOOP, WHILE, FOR
- Procedures and Functions
- Triggers: Introduction, create, remove
    - trigger event predicates: UPDATING, DELETING, and INSERTING
- Cursors: Introduction, implicit and explicit
- Exception: Introduction, Types - User defined, System defined (Named, unnamed)

Unit VI	Advanced Database Systems	(08 Hours)

- Introduction to NoSQL: Features, Challenges, SQL vs. NoSQL,
- Types of NoSQL databases: Document-oriented (MongoDB, Couchbase), Key-value databases (DynamoDB, Redis), Wide-column stores (Cassandra, HBase), Graph databases (Neo4J), Multi-model databases (ArangoDB and Orient DB)
- MongoDB: Queries (create, insert, update, delete)
- Distributed database: Introduction, architecture
- Hadoop and HDFS: Introduction, Architecture & components, Advantages

Learning Resources

Text Books:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, 7th Edition, McGraw-Hill Education, 2019, ISBN-13: 9780078022159
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2017, ISBN-13: 9789332582705
3. C. J. Date, An Introduction to Database Systems, 7th Edition, Addison-Wesley, 2000, ISBN-13: 9780201385908

Reference Books:

1. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, Fourth Edition, Pearson Education, 2003, ISBN-13: 9780321122260
2. G. K. Gupta, Database Management Systems, Tata McGraw-Hill Education, 2006, ISBN-13: 9780070493421
3. Pramod J. Sadalage and Martin Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Addison-Wesley, 2012, ISBN-13: 9780321826625

E-resources:

- Introduction to Database Systems - Course Introduction - https://www.youtube.com/watch?v=vf5HAEQwD5g
- Fundamentals of Database Systems, IIT Kanpur Prof. Arnab Bhattacharya https://nptel.ac.in/courses/106104135
- Introduction to Database Systems, IIT Madras Prof. Sreenivasa Kumar https://nptel.ac.in/courses/106106220
- NOSQL https://www.mongodb.com/resources/basics/databases/nosql-explained#types-of-nosql-databases
- Hadoop https://www.databricks.com/glossary/hadoop-distributed-file-system-hdfs

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: PCC-253-ITT	**Name of Course:** Database Management System Lab					
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	4		-	-	2
Examination Scheme:						
FA	SA	PR	OR	TW		Total
-	-	50	-	50		100

Course Objective:

1. To understand database concepts, architectures, and to design ER/EER diagrams.
2. To implement procedures, functions, triggers, and cursors using PL/SQL.
3. To implement joins, views, aggregate functions, indexing by using SQL and MongoDB for effective data manipulation.
4. To develop and connect database-driven applications with Python/Java.

Course Outcome: On completion of the course, student will be able to	
PCC-253-ITT.1	Implement CRUD operations, constraints, by using MySQL/MongoDB and design ER/EER diagrams.
PCC-253-ITT.2	Design and implement procedures, functions, triggers, and cursors using PL/SQL.
PCC-253-ITT.3	Apply SQL and MongoDB operations, including joins, nested queries, aggregate functions, views to manipulate data.
PCC-253-ITT.4	Build and integrate database applications with Python/Java.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Problem statement, Theory- Concept in brief, conclusion.).
2. The program codes along with their outputs for all performed experiments may be submitted in the softcopy.
3. Students are expected to have a clear understanding of the theoretical concepts involved in each experiment.
4. The practical examination will be conducted only if the journal is complete in all respects and duly certified by the instructor.

Guidelines for Lab /TW Assessment

1. The instructor will assess the term work based on the overall performance of the student, considering parameters such as:
   - Timely conduction of practical experiments

- Timely submission of the handwritten journal with proper results
- Attendance and regularity in laboratory sessions

2. The instructor will evaluate the student's understanding of the practical work by asking questions related to theory, database concepts, and implementation details of the experiments carried out.

Guidelines for Laboratory Conduction

1. All the assignments should be conducted on open-source DBMS software, such as: MySQL / PostgreSQL or equivalent.

Guidelines for Practical Examination

1. During the practical assessment, weightage shall be given to the correct and satisfactory implementation of the given problem statement.
2. Supplementary and relevant questions may be asked at the time of evaluation to assess the student's performance.
3. The evaluation shall be carried out jointly by both internal and external examiners.

List of Assignments

Group A

1. **MySQL Installation:**
Install MySQL and execute basic SQL commands such as USE, SHOW DATABASES, and SHOW TABLES.

2. **ER and EER Model:**
Design an ER and EER diagram for an application (eg. student database system) using tools like ERD plus, ER Win etc.
(Note: Identify entities, relationships, attributes, keys, cardinalities, generalization, specialization etc. for given application)

Group B

3. **SQL Queries:**

a. Execute SQL DDL statements which demonstrate the use of SQL objects such as Tables by applying constraints (PRIMARY KEY, FOREIGN KEY, UNIQUE, NOT NULL, CHECK, DEFAULT).
- Create a new database object - table (CREATE Command).
- Modify the structure of an existing table (ALTER Command).
- Delete a database object permanently (DROP Command).
- Removes all rows from a table but keeps the structure intact (TRUNCATE Command).
- Rename a table or column (RENAME Command).

b. Write SQL queries on the suitable database application using SQL DML statements.
- Insert record
- Insert data into selected columns
- Update record
- Delete record
- Delete Multiple Records

c. Write SQL queries on the suitable database application using SQL DQL statements.
- Display all records
- Display specific columns
- Select with Sorting (ascending & descending order by using ORDER BY clause).
- Use aggregate function: count, sum, avg, min, max, having clause, group by clause

4. **SQL Queries:** Perform following SQL queries on a suitable database.

- Boolean operators - AND, OR, NOT
- Pattern matching

  (Eg. 1. Find employees whose names start with 'A'.

  2. Find employees whose city contains “pur”)
- Arithmetic operations (Addition, Subtraction, Multiplication, Division, Modulus) and built in functions (ROUND, CEIL, FLOOR, MOD, UPPER, LOWER, LENGTH, CONCAT, SUBSTR)
- Processing Date and Time functions (YEAR, MONTH, DAY, SYSDATE, DATEDIFF)
- Nested queries and set operators (UNION, UNION ALL, INTERSECT, EXCEPT / MINUS)

5. **SQL Queries -**

a. Combine data from multiple tables using all types of joins. (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL OUTER JOIN, CROSS JOIN)

b. Create and use **views**. (CREATE, SELECT, UPDATE)

c. Create and use **indexes** to improve query performance. (CREATE, SELECT, DROP)

6. PL/SQL: Create a procedure named employee_bonus that:

- Accepts emp_name and emp_salary as input.
- If emp_salary > 40000, add a 10% bonus and display final salary.
- Otherwise, display “No bonus applicable”.

7. **PL/SQL:** Write a function that returns the factorial of a number.

- Function name: factorial
- Input: n NUMBER
- Output: Factorial of n

8. **Cursors:** Write a PL/SQL program that performs the following tasks using a single parameterized explicit cursor:

- Accept a department ID as input.
- Fetch all employees from the given department.
- Display the employee name, salary, and department ID.
- If the salary < 40,000, give a 5% bonus.
- Display total number of employees processed using %ROWCOUNT.
- Display a message if no employees exist using %NOTFOUND.
- Ensure cursor status is displayed using %ISOPEN.
- Handle exceptions if salary is NULL or any unexpected error occurs.

9. **Database Trigger:** A Student table stores student details. The university wants to track all changes (insertions, updates, deletions) for auditing purposes.

- Row-level triggers track each individual record.
- Statement-level triggers track the operation as a whole.
- Before triggers allow checking or modifying data before changes.
- After triggers allow logging or auditing after the operation is completed.

1. Create the Student and Student_Audit tables.
2. Create all triggers as described above.
3. Perform the following operations to observe triggers:

a. Insert a student without marks → Before Insert sets default.
b. Insert multiple students → After Insert Statement-level trigger logs the action.
c. Update marks below 35 → Before Update prevents invalid data.
d. Update marks normally → After Update Row-level logs old values.
e. Delete a student → After Delete Row-level logs deleted record.

4. Verify the Student_Audit table for all logs.

10. **Database Connectivity:**

Establish a connection between a MySQL database and a programming language (Python / Java) and perform basic database operations such as data retrieval.

1. Create a database and table in MySQL.
2. Install and configure the required database connector.
3. Write a Python or Java program to establish a connection with MySQL.
4. Execute SQL queries using the program.
5. Display the retrieved records.

11. **MongoDB: Basic CRUD Operations**

Implement a MongoDB database by creating collections, inserting documents, and performing queries using CRUD operations:

1. Show and create database
2. Show Current Database
3. Show and create collection
4. Insert Documents (insertOne, insertMany)
5. Retrieve Documents (find)
6. Update Document (updateOne, updateMany)
7. Delete Document (deleteOne, deleteMany)
8. Sort documents (ascending, descending)
9. Drop collection & database

12. **MongoDB: Indexing & Aggregation**

a) Implement indexing with suitable examples in MongoDB.
   1. Create an Index
   2. Create a Descending Index
   3. Create a Compound Index
   4. View All Indexes
   5. Drop a Specific Index
   6. Drop All Indexes (Except _id)
   7. Check Index Usage

b) Implement aggregation with suitable examples in MongoDB.
   1. Basic Aggregation Structure
   2. Filter Documents ($match)
   3. Group Documents ($group)
   4. Calculate Average ($avg)
   5. Sum Values ($sum)
   6. Sort Aggregated Results ($sort)
   7. Limit Output ($limit)

8. Count Documents ($count)

Group C

13. **Mini Project - Develop a mini project for any one of the following statements:**

1. **Student Information Management System**
   Problem Statement: Design and implement a database system to manage student academic information such as personal details, department, courses, marks, and attendance. The system should support data storage, retrieval, updates, and deletion while ensuring data integrity and security.
2. **Online Course Registration System**
   Problem Statement: Design a database system that allows students to register for courses, view course availability, and manage enrollment. The system must enforce constraints such as seat limits and prerequisite validation.
3. **Inventory Management System**
   Problem Statement: Create a database system to manage product inventory, suppliers, purchases, and sales. The system should support stock monitoring, automated updates, and analytical reporting.
4. **E-Commerce Order Management System**
   Problem Statement: Design and implement a database system to manage products, customers, orders, and payments for an e-commerce platform. The system should support efficient order processing and customer analytics.
5. **Banking Management System**
   Problem Statement: Develop a secure database application to manage customer accounts, transactions, loans, and balances. The system should ensure data consistency, transactional integrity, and auditability.

Prepare and submit report to include: Title of the Project, Abstract, List the hardware and software requirements at the backend and at the front end, Source Code, Conclusion.

Learning Resources

Text Books:

1. Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, Database System Concepts, 7th Edition, McGraw-Hill Education, 2019, ISBN-13: 9780078022159
2. Ramez Elmasri and Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson Education, 2017, ISBN-13: 9789332582705
3. C. J. Date, An Introduction to Database Systems, 7th Edition, Addison-Wesley, 2000, ISBN-13: 9780201385908

Reference Books:

1. Thomas M. Connolly and Carolyn E. Begg, Database Systems: A Practical Approach to Design, Implementation and Management, 6th Edition, Pearson Education, 2020 (global editions around 2014–2015), ISBN-13: 9789353438913
2. Jeffrey D. Ullman, Principles of Database Systems, Computer Science Press, circa 1980, ISBN-13: 9780273084761
3. Serge Abiteboul, Richard Hull, and Victor Vianu, Foundations of Databases, Addison-Wesley, 1995, ISBN-13: 9780201537710

E-resources:

- MySQL Tutorial

https://www.w3schools.com/MySQL/default.asp

- MongoDBTutorial
  https://www.w3schools.com/mongodb/
- PL/SQL Tutorial
  https://www.geeksforgeeks.org/plsql/plsql-introduction/
- Oracle PL/SQL Tutorial
  https://docs.oracle.com/en/database/oracle/oracle-database/19/
- Database Connectivity
  https://www.w3schools.com/python/python_mysql_getstarted.asp
- Database Connectivity
  https://www.geeksforgeeks.org/python/connect-mysql-database-using-mysql-connector-python/

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: PCC-254-ITT		**Name of Course:** Computer Network				
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:

Fundamentals of Computer Engineering (PCC-101-ITT)

Course Objective:

1. To learn the fundamentals of data communication systems, network topologies, transmission media, and network reference models.
2. To introduce Data Link Layer functions, including framing, flow control, error detection and correction techniques, and data transmission protocols for noiseless and noisy channels.
3. To understand channel access mechanisms and collision avoidance methods in shared communication environments.
4. To introduce subnetting and supernetting concepts used in network design.
5. To provide knowledge about functionality of transport layer services & application layer protocols.

Course Outcome: On completion of course, student will be able to

PCC-254-ITT.1	Explain and Apply basic concepts of communication systems, signal conversion, modulation techniques, computer networks, transmission media, and OSI/TCP-IP models
PCC-254-ITT.2	Analyze and Implement Data Link Layer mechanisms such as framing, flow control, error detection and correction codes, and ARQ protocols for reliable data transmission.
PCC-254-ITT.3	Apply channel access mechanisms and collision avoidance methods in shared communication environments
PCC-254-ITT.4	Understand network layer services and apply subnetting, supernetting, and routing mechanisms.
PCC-254-ITT.5	Explain services and protocols used at Transport layer & Application Layer

Course Content

Unit I	**Introduction to Network Architecture**	**(06 Hours)**

- **Communication Systems:** Overview of communication systems, Types of Signals.
- **Signal Conversion Methods:** A/D, D/A, A/A, D/D.
- **Modulation Techniques:** Frequency, Amplitude and Phase Modulation.
- **Network topologies:** Bus Topology, Star Topology, Ring Topology, Mesh Topology and Hybrid Topology.
- **Types of network:** LAN, WAN and MAN.

- **Transmission Media:** Guided Media: Twisted-Pair Cable, Coaxial Cable and Fiber-Optic Cable, Unguided Media: Radio waves, microwaves, and infrared.
- **Network Reference Models:** ISO OSI Model, TCP/IP Protocol Suite.

Unit II	Data Link Layer	(06 Hours)

- **Data Link Layer:** Data Link Layer Services.
- **Error Detection and Correction:** Introduction, Types of Error.
- **Linear Block Codes:** Parity Bits, Hamming code, Hamming distance, Parity check code. **Cyclic Codes:** CRC (Polynomials), Other Cyclic Codes (Examples: CHECKSUM: One's Complement, Internet Checksum).
- **Framing:** fixed-size framing, variable size framing.
- **Flow control**: flow control protocols. Noiseless channels: simplest protocol, stop-and-wait protocol. Noisy channels: stop-and-wait Automatic Repeat Request (ARQ), go-back-n ARQ, Selective repeat ARQ, piggybacking.

Unit III	Medium Access Control Layer	(06 Hours)

- **Random Access Techniques:** Pure and Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA
- **Controlled Access Techniques**: Reservation, Polling, Token Passing and Channelization: FDMA, TDMA, CDMA, Ethernet: IEEE Standard 802.3, 802.4, 802.5, 802.6.
- **Comparison of Ethernet Standards:** Standard Ethernet, Fast Ethernet, Gigabit Ethernet with reference to MAC layer and Physical Layer.

Unit IV	Network Layer: Services and Addressing	(06 Hours)

- **Network Layer:** Network Layer Services.
- **IPv4 Addresses**: Static and Dynamic Configuration, Classful and Classless Addressing, Special Addresses, NAT, Subnetting, Supernetting
- **IPv6 Addressing :** Need & Header
- **Address Resolution and Configuration Protocols:** Address Mapping, ARP, RARP, DHCP.
- **Routing Fundamentals**: distance vector routing and link state routing.
- **Unicast Routing Protocols**: RIP, BGP

Unit V	Transport Layer and Application Layer Protocols	(06 Hours)

- **Transport Layer:** Transport Layer Services.
- **TCP:** Header, Services, Segments, Connection Establishment, Connection Termination, Flow Control, Congestion Control.
- **UDP:** Header, Datagram, Services, Applications
- **Socket:** Primitives, Types (Raw, TCP, UDP)
- **Application Layer:** Application Layer Services & Protocols: DNS, FTP, HTTP, SMTP, POP.

Learning Resources

Text Books:

1. Tanenbaum, Andrew S.; Wetherall, David J. Computer Networks. Pearson Education. ISBN-13: 9780132126953
2. Forouzan, Behrouz A. Data Communication and Networking. 5th Edition, McGraw Hill Education. ISBN-13: 9781259064753

Reference Books:

1. Forouzan, Behrouz A. TCP/IP Protocol Suite. 4th Edition, McGraw Hill Education. ISBN: 9780070706521
2. Kurose, James F.; Ross, Keith W. Computer Networking: A Top-Down Approach Featuring the

Internet. Pearson Education. ISBN: 9788177588781

E-resources:

- **NPTEL Computer Network**

https://nptel.ac.in/courses/106105081

- **Cisco Networking Academy**

https://www.netacad.com/courses/packet-tracer

Class: Second Year B. Tech. (2025 Pattern)						**Sem: IV**
Course Code: MDM-255-ITT	**Name of Course:** Microprocessor					
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:

Basics of Electrical and Electronics Engineering. (ESC-103-BSH), Digital Electronics & Computer Organization (MDM-206-ITT)

Course Objective:

1. To introduce the fundamental concepts, applications, and evolution of microprocessors.
2. To develop assembly language programming skills using the 8086 microprocessor for arithmetic, logical, control, and string operations.
3. To understand the system bus organization, operating modes, and timing diagrams of the 8086 microprocessor.
4. To implement basic memory and I/O interfacing schemes using standard peripheral devices.
5. To understand microcontroller concepts and the architecture of the 8051 microcontroller.

Course Outcome: On completion of course, Learner will be able to

MDM-255-ITT.1	Explain the fundamental concepts, terminology, applications, and evolution of microprocessors.
MDM-255-ITT.2	Develop, execute, and debug assembly language programs using the 8086 microprocessor.
MDM-255-ITT.3	Explain the 8086 system bus organization, operating modes, timing diagrams, and the role of supporting system components.
MDM-255-ITT.4	Design and implement basic memory and I/O interfacing using standard peripheral devices.
MDM-255-ITT.5	Explain the architecture, functional blocks, timers, serial communication, I/O ports, and interrupt mechanisms of the 8051 microcontroller.

Course Content

Unit I	**Introduction of Microprocessor**	**(06Hours)**

- Introduction to microprocessors: definition, applications, and evolution.
- Overview of microprocessors, microcontrollers, and embedded systems.

- 8086 microprocessor: architecture and functional block diagram, register organization, pin configuration, Addressing modes of 8086, Instruction set overview.

Unit II	Assembly Language Programming	(06 Hours)

- Assembly language programming model.
- Assembler directives and program development tools.
- 8086 assembly language programming: arithmetic and logical operations, looping and branching instructions, stack operations, Procedures and macros, Interrupts and interrupt service routines: basic concepts. Byte and string manipulation instructions.

Unit III	Bus Structure	(06 Hours)

- 8086 signals and system bus organization, Minimum mode and maximum mode operation.
- System bus and timing diagrams, System design using 8086.
- Introduction to multiprocessor systems: closely coupled and loosely coupled systems.
- Role and functions of supporting system components such as clock generator, bus controller, and bus transceivers

Unit IV	Memory and I/O Interfacing	(06Hours)

- Memory organization of 8086.Memory interfacing techniques.
- Overview of interfacing standard peripheral devices such as programmable peripheral interface, programmable interrupt controller, and programmable interval timer.
- I/O addressing modes, I/O interfacing techniques.
- Basic I/O programming, Introduction to DMA and coprocessors.

Unit V	Microcontrollers	(06Hours)

- Introduction to microcontrollers, Comparison of microprocessors and microcontrollers.
- 8051 microcontroller: architecture and block diagram, special function registers, instruction set overview, addressing modes.
- Timers and counters: Types of Timers, Modes and registers
- Serial communication: overview, Simple I/O port programming, ISR

Learning Resources

Text Books:

1. A.Ray, K.Bhurchandi, Advanced Microprocessors and peripherals: Arch, Programming & Interfacing, Tata McGraw Hill,2004 ISBN 0-07-463841-6
2. R. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085, Prentice Hall, 2014.
3. M.A. Mazidi, R.D. McKinlay, J.G. Mazidi, The 8051 Microcontroller: A Systems Approach, Pearson, 2013.

Reference Books:

1. Douglas Hall, Microprocessors & Interfacing, McGraw Hill, Revised 2 Edition, 2006 ISBN 0-07-100462-9
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

E-resources:

- **NPTEL – Microprocessor**
  https://nptel.ac.in/courses/108103157

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

E-Resources for Each Unit

- **Unit I – Introduction of Microprocessor**
  https://nptel.ac.in/courses/Microprocessor
  https://www.geeksforgeeks.org/microprocessor-tutorials
- **Unit II – Assembly Language Programming**
  https://www.geeksforgeeks.org/computer-organization-architecture/architecture-of-8086/
  https://www.nptelprep.in/courses/108103157/videos
- **Unit III — Bus Structure & System Design**
  https://nptel.ac.in/courses/
  https://www.vssut.ac.in/lecture_notes/lecture1423813120.pdf
- **Unit IV — Memory & I/O Interfacing**
  https://mrcet.com/downloads/digital_notes/EEE/Microprocessors%20and%20Microcontrollers.pdf
- **Unit V — Microcontrollers**
  https://nptel.ac.in/courses/108105102/
  https://www.rmkcet.ac.in/eee/Notes/Micro_Processor_Based_System_Design_EE6502/UNIT%20III%20Introduction%20to%20Microcontroller.pdf

Class: Second Year B. Tech. (2025 Pattern)				**Sem:** IV		
Course Code: MDM-256 -ITT	**Name of Course:** Microprocessor Lab					
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	2		-	-	1
Examination Scheme:						
FA	SA	PR	OR	TW		Total
-	-	-	25	-		25

Prerequisite:

Basics of Electrical and Electronics Engineering (ESC-103-BSH), Digital Electronics & Computer Organization (MDM-206-ITT)

Course Objective:

1. To develop and debug 8086 assembly language programs using various addressing modes and control instructions.
2. To understand modular programming using procedures, macros and stack operations.
3. To implement interrupt and I/O interfacing concepts through programs.
4. To gain introductory hands-on experience with the 8051 microcontroller.

Course Outcome: On completion of course, student will be able to	
MDM-256-ITT.1	Develop and debug assembly language programs using different addressing modes and control instructions.
MDM-256-ITT.2	Implement modular programming using procedures, macros and stack operations.
MDM-256-ITT.3	Develop assembly language programs using interrupts and basic I/O interfacing concepts.
MDM-256-ITT.4	Develop basic programs for 8051 microcontroller I/O operations.

Guidelines for Student's Lab Journal

1. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Problem statement, Theory- Concept in brief, conclusion).
2. The program codes along with their outputs for all performed experiments may be submitted in the softcopy.
3. Students are expected to have a clear understanding of the theoretical concepts involved in each experiment.

Guidelines for Lab /TW Assessment

1. The instructor will assess the term work based on the overall performance of the student, considering

parameters such as:

- Timely conduction of practical experiments
- Timely submission of the handwritten journal with proper results
- Attendance and regularity in laboratory sessions

2. The instructor will evaluate the student's understanding of the practical work by asking questions related to theory and implementation details of the experiments carried out.

Guidelines for Laboratory Conduction

1. All the assignments should be conducted on open-source software.
2. Use Turbo Assembler (TASM) or Microsoft Macro Assembler (MASM) for 8086 programming.
3. Emulator / Simulator: 8086 Emulator (such as EMU8086 or equivalent).
4. Use Keil µVision or any equivalent 8051 development environment for microcontroller programming.
5. Hardware Tools: 8051 Microcontroller Trainer Kit (for microcontroller experiments). LEDs, connecting wires, and basic interfacing components (for I/O experiments with 8051).

Guidelines for Oral Examination

1. During assessment, the examiners should give the maximum weightage to the satisfactory answer of the problem statement in question.
2. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation**.**
3. The evaluation shall be carried out jointly by both internal and external examiners.

List of Laboratory Assignments

1. **16-bit Arithmetic Operations**
   Write and execute an 8086 ALP to perform addition and subtraction of 16-bit numbers with and without carry/borrow.

2. **Multiplication and Division**
   Write an 8086 ALP to perform multiplication and division using loop and conditional branching instructions.
3. **Data Transfer and Addressing Modes**
   Write and execute 8086 ALPs demonstrating immediate, register, direct, indirect, indexed, and based addressing modes.
4. **Macros and Modular Programming**
   Write 8086 ALPs using macros for repetitive arithmetic or data processing operations.

5. **Stack Operations and Procedures**
   Write an 8086 ALP using stack operations, CALL and RET instructions, and parameter passing through stack.

6. **Interrupt Programming**
   Write an 8086 ALP using software interrupts and demonstrate a simple interrupt service routine.

7. **Delay Generation Using 8086**
   Write an 8086 ALP to generate a programmable delay using nested loops.

8. **8051 I/O Port Programming**

Write and execute an 8051 program to control LEDs connected to I/O ports.

9. **8051 Delay and Pattern Generation**
   write an 8051 program to generate delays and display LED patterns using timers.

Learning Resources

Text Books:

1. Ayala, Kenneth. The 8086 Microprocessor: Programming & Interfacing the PC.
2. Kumar, Senthil; Saravanan; Jeevananthan. Microprocessors and Interfacing. Oxford University Press (OUP).

Reference Books:

1. John Uffenbeck, "8086/8088 family: Design Programming and Interfacing", PHI
2. Hall, Dauglas V. Microprocessor and Interfacing (Programming and Hardware))

E-resources:

- www.intel.com
- www.pcguide.com/ref/CPU
- www.CPU-world.com/Arch/
- https://onlinecourses.nptel.ac.in/noc24_ee40/preview?utm_source=chatgpt.com

Class: Second Year B. Tech. (2025 Pattern)	**Sem:** IV
Name of Course: Open Elective Course-II	

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

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: VSE-257-ITT		**Name of Course:** Java Programming Lab				
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
-	-	4		-	-	2
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	50	-	-		50

Prerequisite:

Object Oriented Programming (PCC-202-ITT)

Course Objective:

1. To learn the basics of Java programming, including collections, threads, GUI, database, and web tools.
2. To apply Java programming constructs to develop desktop, web, and network applications
3. To understand and solve problems related to concurrency, synchronization, and client–server communication.
4. To build integrated applications using Servlets, JSP, JDBC, and REST APIs.

Course Outcome: On completion of course, student will be able to	
VSE-257-ITT.1	Use Java collections, multithreading, and concurrency utilities to solve programming problems.
VSE-257-ITT.2	Design desktop, web, and network applications.
VSE-257-ITT.3	Implement solutions for concurrency, synchronization, and client–server communication problems.
VSE-257-ITT.4	Build web applications that use Servlets, JSP and REST APIs.

Guidelines for Student's Lab Journal

1. Students should submit a handwritten journal based on the specified list of assignments.
2. The laboratory assignments are to be submitted by students in the form of a journal. Journal consists of Certificate, table of contents, and handwritten write-up of each assignment (Title, Problem

statement, Theory- Concept in brief, conclusion).

3. The program codes along with their outputs for all performed experiments may be submitted in the softcopy.
4. Students are expected to have a clear understanding of the theoretical concepts involved in each experiment.
5. The practical examination will be conducted only if the journal is complete in all respects and duly certified by the instructor.

Guidelines for Laboratory Conduction

1. All assignments from **Group A** are compulsory and must be performed individually by each student.
2. The Mini Project from **Group B** is a group activity to be carried out in teams of 2–4 students, with a detailed project document prepared and submitted as part of the lab journal.
3. A study assignment on REST API Consumer from **Group C** is recommended for self-study. It is optional, but completing it will provide extra learning and deeper understanding.
4. All assignments must be conducted and executed on **open-source software platforms** (e.g., VS Code/Eclipse/NetBeans, MySQL).

Guidelines for Practical Examination

1. The Practical Examination will be conducted on all laboratory assignments specified under Group A.
2. Examiners will judge the students based on practical performed in the examination and by asking some questions related to implementation of experiments, which he/she has carried out.
3. The evaluation should be done by both external and internal examiners.

List of Laboratory Assignments

Group-A

1. **Student Record Management**
   Write a Java program to store student records (roll number, name, marks) using an ArrayList. Provide menu-driven options to add a new student, update, delete a student, search by roll number, and display all records. Also, implement sorting by marks using both Comparable and Comparator.
2. **Employee Directory with HashMap**
   Write a Java program to maintain an employee directory where employee IDs are mapped to employee names using a HashMap. Implement operations to add, update, delete, search employees by ID and sort employees by name.
3. **Concurrent Task Runner**
   Write a Java program that creates two threads: one thread prints numbers from 1 to 20, and the other thread prints alphabets from A to Z. Implement this using the Runnable interface and the Thread class.
4. **Bank Transaction with Concurrency Utilities**
   Write a Java program to simulate a bank account with deposit and withdrawal operations. Create two threads: one performs deposits and the other performs withdrawals at the same time. Use java.util.concurrent.locks to synchronize access to the account and ensure the balance is updated correctly.

5. **Desktop Calculator using Swing**
   Build a calculator GUI application in Java using Swing. The calculator should have buttons for digits (0–9) and operations (+, –, ×, ÷), along with a display area to show input and results. Implement event handling so that when a button is clicked, the corresponding value or operation is processed. Include a clear button and handle invalid inputs (e.g., e.g., when the divisor is zero).
6. **Student Admission Form with Validation**
   Create a swing form in Java to capture student details. The form should include text fields, radio buttons, and combo boxes to capture student details (name, age, gender & course). Validate the inputs (e.g., age must be numeric). When the form is submitted, display the entered data in a table view.
7. **CRUD Operations with JDBC + JSON Output**
   Write a Java program that connects to a MySQL database and performs Create, Read, Update, and Delete (CRUD) operations on a student table. Display the results in JSON format.
8. **TCP Chat Application with Multi-Client Support**
   Develop a client–server chat application using TCP sockets. The server should handle multiple clients concurrently, and clients should be able to send and receive messages.
9. **Servlet Lifecycle Demonstration**
   Write a servlet that responds with "Hello, World!" in JSON format. Demonstrate the servlet lifecycle methods (init, service, destroy).
10. **JSP**
    Create a JSP page that greets the user based on the current time (Good Morning/ Afternoon/ Evening).

Group-B

Mini Project

Student Registration Portal

Build a web application where students register via a form. A servlet should process the form data and store it in a database. Use JSP to display the list of registered students. Extend the application by adding a REST endpoint that returns the student data in JSON format.

Group-C

Study Assignment:

REST API Consumer

Design a Java program that connects to a public REST API (for example, a weather or currency API). The program should send an HTTP request, receive the JSON response, parse the data, and display it in a user-friendly format.

Learning Resources

Text Books:

1. Balagurusamy, E. Programming with Java. 7th Edition, McGraw Hill Education India, 2023.
2. Sierra, Kathy; Bates, Bert; Gee, Trisha. Head First Java. 3rd Edition, O'Reilly Media, 2022.

3. Schildt, Herbert. Java: A Beginner's Guide. 9th Edition, McGraw Hill Professional, 2022 (10th Edition, 2024).

Reference Books:

1. Schildt, Herbert; Coward, Danny. Java: The Complete Reference. 13th Edition, McGraw Hill Education, 2023.
2. Sierra, Kathy; Bates, Bert; Basham, Bryan. Head First Servlets and JSP. 2nd Edition, O'Reilly Media, 2008.
3. Burke, Bill. RESTful Java with JAX-RS 2.0. 2nd Edition, O'Reilly Media, 2014.

E-resources:

E-Learning Platforms & Tutorials

- **NPTEL - Programming in Java**
  https://onlinecourses.nptel.ac.in/noc24_cs105/
- **Oracle University Java SE Programming I MOOC**
  https://education.oracle.com/java-se-programming-i-mooc
- **Oracle University Java SE Programming II MOOC**
  https://education.oracle.com/ansans
- **Oracle Java Tutorials – Official documentation and tutorials from Oracle.**
  https://docs.oracle.com/javase/tutorial/
- **Codecademy – Learn Java – Interactive beginner-friendly Java course.**
  https://www.codecademy.com/learn/learn-java
- **Coursera – Java Programming and Software Engineering Fundamentals (Duke University)**
  https://www.coursera.org/specializations/java-programming
- **Udemy – Complete Java Masterclass – Paid but comprehensive, covers basics to advanced.**
  https://www.udemy.com/course/java-the-complete-java-developer-course/

Practice & Coding Challenges

- **CodeGym – Java Coding Practice – Hands-on tasks with instant feedback.**
  https://codegym.cc/java-coding-practice
- **CodeChef – Practice Java – 180+ coding problems for Java learners.**
  https://www.codechef.com/practice/java
- **HackerRank – Java Practice Problems – Industry-style coding challenges.**
  https://www.hackerrank.com/domains/tutorials/10-days-of-java
- **W3Schools – Java Tutorial – Beginner-friendly explanations with examples.**
  https://www.w3schools.com/java/

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: AEC-258-ITT	**Name of Course:** Modern Indian Language					
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
1	1	-		1	1	-
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	-	-	25		25

Course Objective:

- 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 course, student will be able to	
AEC-258-ITT.1	विविध प्रकारचे व्यावसायिक लेखन.
AEC-258-ITT.2	प्रभावी सादरीकरण आणि सूत्रसंचालन.
AEC-258-ITT.3	डिजिटल आशय निर्मिती .

Course Content

घटक १	**मराठी भाषेची मूलभूत क्षमता व संवाद कौशल्ये**	**(05 Hours)**

- **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.

घटक २	श्राव्य-दृश्य माध्यमे आणि कार्यालयीन व्यवहार	(05 Hours)

- **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	(05 Hours)

- **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:

1. डॉ. केतकी मोडक, डॉ. सुहासकुमार बोबडे, डॉ. संजय विठ्ठल, उपयोजित मराठी
2. डॉ. ल. रा. नसिराबादकर,फडके प्रकाशन, व्यावहारिक मराठी
3. डॉ. नागनाथ कोत्तापल्ले, मराठी भाषा : संवादाचे स्वरूप आणि माध्यमे

Reference Books:

1. डॉ. संदीप सांगळे, व्यावहारिक उपयोजित मराठी आणि प्रसारमाध्यमांची कार्यशैली
2. डॉ. रमेश वरखेडे, सायबर संस्कृती
3. कल्याण काळे आणि अंजली सोमण, भाषांतर मीमांसा

List of Assignments

1	**बातमी लेखन आणि मुद्रितशोधन (News Writing & Proofreading)**

	● **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)** ● **कार्य:** एखाद्या कंपनीत 'मराठी कंटेंट रायटर' या पदासाठी नोकरीचा अर्ज (Resume सह) आणि त्यासोबत पाठवण्यायोग्य एक औपचारिक ई-मेल मसुदा तयार करा.	
3	**भाषांतर कौशल्य (Translation Skills)** ● **कार्य:** इंग्रजी किंवा हिंदीतील एका प्रसिद्ध तांत्रिक लेखाचा किंवा बातमीचा (किमान ३०० शब्द) ओघवत्या मराठी भाषेत अनुवाद करा.	
4	**ब्लॉग लेखन (Blog Writing)** ● **कार्य:** 'आधुनिक शेती आणि तंत्रज्ञान' किंवा 'माझी आवडती साहित्यकृती' या विषयावर मराठीत एक माहितीपूर्ण ब्लॉग पोस्ट तयार करा (किमान ५०० शब्द).	
5	**सोशल मीडिया आशय निर्मिती (Social Media Content Creation)** ● **कार्य:** एका शैक्षणिक संस्थेच्या जाहिरातीसाठी फेसबुक पोस्ट, इंस्टाग्राम कॅप्शन आणि ट्विटर (X) साठी ३ प्रभावी 'थ्रेड्स' मराठीत तयार करा.	
6	**मुलाखत प्रश्नावली तयार करणे (Interview Questionnaire)** ● **कार्य:** एखाद्या यशस्वी उद्योजकाची किंवा लेखकाची दूरचित्रवाणीसाठी मुलाखत घ्यायची आहे असे मानून, १० प्रश्नांची एक सुनियोजित प्रश्नावली तयार करा.	
7	**सूत्रसंचालन संहिता (Anchoring Script)** ● **कार्य:** महाविद्यालयाच्या वार्षिक स्नेहसंमेलनाच्या (Gathering) उद्घाटन सोहळ्यासाठी एक प्रभावी आणि रंजक सूत्रसंचालन संहिता लिहा.	
8	**सॉफ्टवेअर लोकलायझेशन प्रकल्प (Software Localization Project)**	

	● **कार्य:** एखाद्या मोबाइल ॲप्लिकेशनमधील (उदा. ई-कॉमर्स किंवा बँकिंग ॲप) १० महत्त्वाच्या कमांड्स किंवा संज्ञांचे (उदा. Settings, Add to Cart, Proceed) चपखल मराठीत रूपांतर करा.
9.	**प्रकल्प अहवाल/रिपोर्ट लेखन (Technical Report Writing)** ● **कार्य:** 'तुमच्या गावातील/शहरातील कचरा व्यवस्थापन' या तांत्रिक विषयावर एक औपचारिक अहवाल किंवा प्रस्ताव (Proposal) तयार करा.
10.	**डिजिटल साक्षरता आणि सायबर सुरक्षा जाणीव (Cyber Security Awareness)** ● **कार्य:** 'ऑनलाइन आर्थिक फसवणूक कशी टाळावी?' या विषयावर सामान्य लोकांसाठी एक माहितीपत्रक (Brochure) किंवा पीपीटी (PPT) सादरीकरण तयार करा.

Class: Second Year B. Tech. (2025 Pattern)						**Sem: IV**
Course Code: EEM-259-ITT	**Name of Course:** Business and Entrepreneurship					
Teaching Scheme (Hrs/week):				**Credits:2**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
1	1	-		1	1	-
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	-	-	50		50

Prerequisite:

Economics Engineering (EEM-208-ITT), Open Elective Course-I (Financial Literacy and Digital Finance) (OEC-223-ITT)

Course Objective:

1. To analyze business opportunities by identifying problems, customer needs, market size, and competitive alternatives.
2. To analyze business models, value propositions, and risky assumptions to achieve problem–solution and solution–market fit.
3. To design execution, branding, digital marketing, and growth strategies for sustainable entrepreneurial ventures.

Course Outcome: On completion of course, student will be able to

EEM-259-ITT.1	Analyze customer problems, market opportunities, and value creation potential.
EEM-259-ITT.2	Apply entrepreneurial tools such as Value Proposition Canvas, Lean Canvas, MVP, and validation techniques.
EEM-259-ITT.3	Design business execution plans including financial projections, branding, digital marketing, and pitch decks.

Course Content

Unit I	**Entrepreneurial Foundations and Opportunity Analysis**	**(05 Hours)**

- Entrepreneurship: Introduction, scope of entrepreneurship, Role of entrepreneurs in the economy, Types of business opportunities (problem-driven vs innovation-driven)
- Opportunity Identification: Identifying real-world problems, Problem identification vs problem validation, Understanding customer pains and unmet needs, Existing alternatives and substitutes.

- Market Understanding: Market size analysis (TAM, SAM, SOM – basic level),Market potential and demand estimation, Customer segments and target customers.
- Customer & Value Perspective: Customer psychology and buying behavior, Willingness to pay, Value perception from the customer's point of view.
- Value Creation & Competition: Value Proposition Canvas (overview + example),Problem–solution fit, Basic competition analysis

Unit II	Business Models, Validation & Product–Market Fit	(05 Hours)

- Business Models: Introduction, Common types of business models (B2B, B2C, marketplace, subscription, etc.)
- Lean Canvas: Overview, Components of Lean Canvas, Comparison of Lean Canvas with a traditional business plan in terms of structure and purpose
- Risky Assumptions: Identifying risky assumptions related to:
  - Product
  - Market
  - Business model
  - Execution capability

  Why early validation is critical
- **Minimum Viable Product (MVP):** Concept and importance of MVP, Types of MVPs (prototype, landing page, demo, etc.), Creating and iterating MVP
- Validation & Market Fit: Testing MVP with customers ,Collecting customer feedback, Learning and iteration ,Problem–solution fit vs solution–market fit

Unit III	Business Execution, Branding & Digital Growth	(05Hours)

- Business Execution Basics: Manpower planning, Roles and responsibilities, Operational planning overview
- Financial Planning: Revenue streams and sales planning , Cost structure and expense management , Profitability projections, Reality check and feasibility analysis
- Funding & Pitching: Funding requirements ,Sources of funding (bootstrapping, angel, VC, loans), Pitch deck structure and key elements
- Branding & Marketing Strategy: Importance of branding, Brand positioning, Market penetration strategies, Growth planning basics
- Digital Marketing & Technology: Introduction to digital marketing, Digital marketing channels , Social media for business growth, Customer acquisition strategies, Role of technology in scalability and growth

Learning Resources

Text Books:

1. Khanka, S. S. Entrepreneurship Development. 4th Edition, S. Chand, ISBN-10: 8121918015.
2. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. 1st Edition, Crown Business, ISBN-10: 0307887898.

3. Neck, Heidi M.; Neck, Christopher P.; Murray, Emma L. Entrepreneurship: The Practice and Mindset. 3rd Edition, SAGE Publications, ISBN-10: 1544375028.

Reference Books:

1. Osterwalder, Alexander; Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. 1st Edition, John Wiley & Sons, ISBN-10: 0470876417.
2. Aulet, Bill. Disciplined Entrepreneurship: 24 Steps to a Successful Startup. 1st Edition, John Wiley & Sons, ISBN-10: 1118692284.
3. Moore, Geoffrey A. Crossing the Chasm: Marketing and Selling High-Tech Products to Mainstream Customers. 3rd Edition, Harper Business, ISBN-10: 0062292986.

E-resources:

- **NPTEL: Business Fundamentals for Entrepreneurs**
  https://onlinecourses.nptel.ac.in/noc24_mg121
- **Entrepreneurship (IIT Madras)**

  https://elearn.nptel.ac.in/shop/nptel/entrepreneurship
- **Innovation, Business Models and Entrepreneurship**
  https://onlinecourses.nptel.ac.in/noc24_mg128

Guidelines for Student's Lab Journal

- The Term Work assignments shall be submitted by the student in the form of a Journal.
- The journal shall consist of systematically documented theoretical, analytical, and practical work related to Startup and Entrepreneurship, including idea generation, business models, innovation, and entrepreneurial processes.
- Each student shall maintain an individual journal, duly certified by the subject teacher.

Guidelines for Assessment of Term Work

1. The instructor will assess the term work based on the overall performance of the student, considering parameters such as:
   - Timely conduction of practical experiments
   - Timely submission of the handwritten journal with proper results
   - Attendance and regularity in laboratory sessions

2. Continuous assessment of Startup and Entrepreneurship term work shall be based on the overall performance of the student across all assigned activities**,** aligned with the learning outcomes of entrepreneurial mindset, startup ecosystem, innovation, business planning, customer discovery, and ethics in entrepreneurship.

Business and Entrepreneurship

List of Assignment:

Assignment No.	Content
01	**Business Opportunity Identification**

	Problem Statement: Identify a real-life problem faced by individuals or businesses around you. Analyze the problem and justify why it represents a viable business opportunity. **Tasks:** ● Describe the problem ● Identify affected customers ● Explain why existing solutions are insufficient
02	**Market Size and Customer Pain Analysis** **Problem Statement:** Select a business idea and estimate its potential market size while identifying major customer pain points. **Tasks:** ● Define target market ● Estimate market size (local/national/global) ● List customer pains and unmet needs
03	**Customer Segmentation and Psychology** **Problem Statement:** For a chosen product or service, analyze different customer segments and their buying behavior. **Tasks:** ● Identify customer segments ● Understand customer psychology ● Analyze willingness to pay
04	**Value Proposition Canvas** **Problem Statement:** Design a Value Proposition Canvas for your selected business idea to clearly match customer needs with your solution. **Tasks:** ● Customer profile (jobs, pains, gains) ● Value map (products, pain relievers, gain creators) ● Explain problem–solution fit
05	**Idea Brainstorming and Competition Analysis** **Problem Statement:** Analyze competitors for your business idea and propose ways to differentiate your offering. **Tasks:** ● Identify key competitors ● Compare features, pricing, and value ● Propose competitive advantage and differentiation
06	**Business Model and Lean Canvas**

	Problem Statement: Develop a Lean Canvas model for your startup idea to understand key business components. **Tasks:** ● Fill all sections of Lean Canvas ● Explain revenue streams and cost structure ● Identify key partners and resources
07	**Identification of Risky Assumptions** **Problem Statement:** Identify and evaluate risky assumptions related to your business idea. **Tasks:** ● Product-related risks ● Market-related risks ● Business and execution risks ● Prioritize assumptions based on risk level
08	**Minimum Viable Product (MVP) Design** **Problem Statement:** Design a Minimum Viable Product (MVP) for your business idea to test customer acceptance. **Tasks:** ● Define MVP features ● Explain how MVP solves the core problem ● Describe testing approach
09	**Customer Feedback and Validation** **Problem Statement:** Collect and analyze customer feedback for your MVP to validate assumptions. **Tasks:** ● Design feedback questions ● Analyze responses ● Validate or reject assumptions ● Suggest improvements
10	**Financial Planning and Profitability** **Problem Statement:** Prepare a basic financial plan for your startup idea to assess feasibility. **Tasks:** ● Manpower planning ● Estimated expenses ● Sales and revenue projections ● Profitability analysis
11	**Branding and Digital Marketing Strategy**

	Problem Statement: Develop a branding and digital marketing strategy to acquire customers for your business. **Tasks:** ● Brand name, logo idea, positioning ● Target audience ● Introduction to digital marketing channels ● Social media strategy for customer acquisition
12	**Funding Plan and Pitch Deck** **Problem Statement:** Prepare a startup pitch deck to present your business idea to potential investors. **Tasks:** ● Funding requirement and usage ● Business model summary ● Market opportunity ● Competitive advantage ● Growth and scalability plan

Class: Second Year B. Tech. (2025 Pattern)						**Sem:** IV
Course Code: VEC-260-ITT		**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:

Life Skills-I (CCC-101-ASH), Life Skills-II (CCC-151-ASH)

Course Objective:

1. To understand the concept of value education and enable students to understand its importance in achieving harmony within the self, family, society, and nature.
2. To understand and practice harmony in family, society, nature, and existence by recognizing the values of trust, respect, justice, and interconnectedness, leading to a holistic and sustainable way of living.
3. To apply human values and professional ethics in real-life and workplace decision-making.

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

VEC-260-ITT.1	Understand value education and human aspirations.
VEC-260-ITT.2	Demonstrate the ability to practice harmonious relationships by applying values such as trust, respect, justice, and interconnectedness in family, social, and environmental contexts.
VEC-260-ITT.3	Apply ethical principles in professional decision-making.

Course Content

Unit I	**Introduction to Value Education & harmony in the Human Being**	**(05 Hours)**

- **Understanding Value Education:** Need for value education, Self-exploration as the process for value education.

- **Human aspirations:** Need, purpose, and relevance of human values in modern life, Continuous happiness and prosperity, Basic requirements for fulfillment of human aspirations.
- **Right understanding, Relationship and Physical Facility:** Development of human consciousness.
- **Happiness and prosperity:** Current scenario, Method to fulfill the basic human aspirations.
- **Harmony in the Human Being :** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to Ensure self-regulation and Health

Unit II	Harmony in the Family/Society and Nature/Existence	(06 Hours)

- **Harmony in the Family:** The basic unit of human interaction, 'Trust' — the foundational value in Relationship, 'Respect' — as the right evaluation, Other feelings, Justice in human-to-human relationship.
- **Harmony in the Society:** Understanding harmony in the society, Vision for the universal human order.
- **Harmony in Nature:** Understanding harmony in nature, Interconnectedness, Self-regulation and mutual fulfillment among the four orders of nature.
- **Harmony in Existence:** Realizing existence as coexistence at all levels, The holistic perception of harmony in existence.

Unit III	Professional Ethics and Application of Values	(04 Hours)

- Competence in Professional Ethics: Ability to Utilize Values in Decision-Making
- Ethical Human Conduct – The Foundation of Universal Human Order
- Vision for a Value-Based Society
- Case Studies: Ethical Dilemmas in the IT Sector
- Integration of Human Values with Technical Education

Tutorial

Guidelines for Tutorial:

Students should carry out the following activities during the tutorial

SR. NO	List of Tutorial
1	**Activity: Reflect, Realize, and Align: A simple path to know myself and live with values.** Students reflect on the following prompts in writing: ● What makes me happy? ● What do I want to achieve in life? ● What are my strengths and limitations?

<table>
<tr><td></td><td>
What values do I naturally accept as right?
Reflection Questions:
What did I learn about myself today?
How can self-exploration guide my daily choices?
</td></tr>
<tr><td>2</td><td>
Activity: Differentiate between temporary pleasure and continuous happiness.
Students list:
Activities that give short term pleasure
Activities that give long term happiness
Material needs vs. non material needs
Reflection Questions:
What are my basic aspirations?
How can I achieve continuous happiness?
</td></tr>
<tr><td>3</td><td>
Group discussion: “What makes a fulfilling life?”
Reflection Questions:
How do I personally define a fulfilling life?
What habits or choices in my life take me away from fulfillment?
How do my values influence the way I think about a meaningful life?
</td></tr>
<tr><td>4</td><td>
Activity: Understand the three key components needed for a fulfilling life.
Students create a three-column table:
<table>
<tr><th>Right Understanding</th><th>Relationship</th><th>Physical Facility</th></tr>
<tr><td>What I need</td><td>What I give/receive</td><td>What I use</td></tr>
</table>
Reflection Questions:
Which of the three areas do I focus on most?
How can I improve harmony among them?
</td></tr>
<tr><td>5</td><td>
Activity: Understand trust as the basic expectation in relationships.
Students reflect on:
A moment when someone trusted them
A moment when trust was broken
How trust affects relationships
Pair Activity: Role-play a situation where trust is restored through communication.
Reflection Questions:
Why is trust unconditional?
How can I build trust in my relationships?
</td></tr>
<tr><td>6</td><td>
Activity: Understand respect as recognizing the other person’s innate qualities.
Students list:
Qualities they respect in others
Qualities they want others to respect in them
</td></tr>
</table>

<table>
<tr><td></td><td>Reflection Questions:
Do I respect people for what they have or who they are?
How can I practice right evaluation?</td></tr>
<tr><td>7</td><td>Activity: Students analyze real life examples of justice and injustice in relationships.
Create a flowchart showing the process of justice.

Reflection Questions:
How can I contribute to justice in my relationships?</td></tr>
<tr><td>8</td><td>Activity: Campus Sustainability Audit
Walk around your campus and note observations in each category.
<table>
<tr><th>Category</th><th>What You Observed</th><th>Improvements You Suggest</th></tr>
<tr><td>Energy Use</td><td></td><td></td></tr>
<tr><td>Water Use</td><td></td><td></td></tr>
<tr><td>Waste Management</td><td></td><td></td></tr>
<tr><td>Green Spaces</td><td></td><td></td></tr>
<tr><td>Student Awareness</td><td></td><td></td></tr>
</table>
Reflection Questions
Which area needs the most improvement?
How can engineering solutions help?</td></tr>
<tr><td>9</td><td>Activity: Understand the interconnectedness of nature.
Students observe campus surroundings and classify items into:
Material order
Plant/bio order
Animal order
Human order
Reflection Questions:
How does nature demonstrate mutual fulfillment?</td></tr>
<tr><td>10</td><td>Case study: Technology vs. Environment</td></tr>
<tr><td>11</td><td>PPT Presentation: Values in Decision-Making – Choosing with Integrity
Students reflect on the following prompts in PPT:
Recall a situation where you had to make a tough decision.
Which values guided your choice?
Did your decision align with fairness, honesty, or responsibility?
How did the outcome affect you and others?
Reflection Questions:
How do values influence my decisions?
What happens when I ignore values in decision-making?
How can I strengthen my ability to make ethical choices?</td></tr>
<tr><td>12</td><td>Debate: Integration of Human Values with Technical Education
Discussion prompt: “Technical education without human values is incomplete.”
For: Values ensure responsible use of knowledge.
Against: Technical education should focus on skills; values can be learned</td></tr>
</table>

	elsewhere. **Reflection Questions:** ● How can values be practically integrated into technical curricula? ● What examples show this integration working well?

Learning Resources

Text Books:

1. R. R. Gaw, R Asthma, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 3rd Revised Edition, Excel Books, New Delhi, 2019, ISBN: 978-93-87034-47-1.
2. M.G. Velasquez, Business Ethics: Concepts and Cases, 5th Edition, Pearson Education, 2023, ISBN-13: 9780130938213
3. Dr. Ritu Soryan, Universal Human Values and Professional Ethics, 2nd Edition,S.K. Kataria & Sons, 2022, ISBN-13: 978-93-5014-746-7

Reference Books:

1. Mr. Brij M. Upreti, Basics of Human Values and Ethics, Woman University Press, Jaipur, ISBN 978-93-90892-54-9.
2. A. N. Tripathi, Human Values, 3rd Edition, New Age International Publishers, ISBN: 978-8122425895.
3. M.K. Gandhi, "The Story of My Experiments with Truth", Fingerprint Publishing, ISBN: 978- 8172343118.

E-resources:

E-Resources for Each Unit

Unit 1: Introduction to Value Education & Harmony in the Human Being

1. Exploring Human Values: Visions of Happiness and Perfect Society https://nptel.ac.in/courses/109104068
2. An introduction to values and ethics – https://youtu.be/XiN8iqJGb48?si=WyHWS0rL_GtYXlPC

Unit 2: Harmony in the Family/Society and Nature/Existence

1. Harmony in the Family and Society – https://youtu.be/K17NiRJBv3E?si=MF4Df29nvQyHubPL
2. Harmony in the Family – https://uhv.org.in/UHV-II%20Course%20Material%202024/L%2013%20Harmony%20in%20the%20Family%20v7.pdf
3. Understanding harmony in the nature and existence – https://youtu.be/XuHFT3JYKnc?si=hbavJEZ0uI1QTp1z
4. Understanding the Harmony in Nature – https://youtu.be/m7LIb6E9uEU?si=IAZy1JoK3I6fRlsh

Unit 3: Professional Ethics and Application of Values

1. Four Orders in Nature – https://youtu.be/stHnGNOxlMs?si=0ewIp7iUgJK7lzFp
2. Humanistic Education Humanistic Constitution – https://youtu.be/y9ovK_AdveA?si=Y6xc4B20hTv7q5j4

Class: Second Year B. Tech. (2025 Pattern)						**Sem: IV**
Course Code: AC-261-ITT	**Name of Course:** Aptitude Skills-I					
Teaching Scheme (Hrs/week):				**Credits:**		
Lecture	Tutorial	Practical		Lecture	Tutorial	Practical
1	-	-		-	-	-
Examination Scheme :						
FA	SA	PR	OR	TW		Total
-	-	-	-	-		-

Prerequisite:

Engineering Mathematics-I (BSC-101-BSH)

Course Objective:

1. To recall and apply core mathematical formulas and concepts in quantitative aptitude.
2. To solve quantitative aptitude problems with accuracy and efficiency.
3. To use shortcut methods and approximation techniques to optimize time during exams.
4. To analyze and evaluate quantitative problems in placement-style scenarios.

Course Outcome: On completion of course, Students will be able to

AC-261-ITT.1	Build strong fundamentals and apply them in real-world aptitude tests.
AC-261-ITT.2	Develop analytical thinking required in competitive exams.
AC-261-ITT.3	Strengthen decision-making and accuracy for company-specific test patterns.
AC-261-ITT.4	Encourage self-directed learning and strategy creation for long-term placement readiness.

Course Content

Unit I	**Number Systems & Basic Arithmetic**	**(05 Hours)**

- Develop problems that test the ability to classify integers as even, odd, prime, or composite.
- Frame scenarios requiring application of divisibility rules (e.g., check divisibility by 2, 3, 5, 9, 11).
- Construct problems where students prove or disprove statements about integer properties (e.g., "If a number is divisible by 6, it must be divisible by both 2 and 3").

- Two machines beep at intervals of 42 seconds and 56 seconds. If they beep together at 10:00 AM, when will they beep together again?
- Find the HCF and LCM of 144 and 180, and verify the relation HCF·LCM=Product.
- Simplify: (256)1/4·(81)1/2(64)1/3.
- If 5 workers can complete a task in 12 days, how many days will 8 workers take (assuming direct proportion)?
- A car travels 120 km in 3 hours at a constant speed. How long will it take to travel 200 km at the same speed?
- The cost of electricity varies jointly with power consumed and time. If 5 kW used for 2 hours costs ₹100, find the cost of 8 kW used for 3 hours.
- A student has 84 pencils and 108 pens. He wants to distribute them equally among students without any remainder. Find the maximum number of students possible.

Unit II	Percentages, Averages & Interest	(05Hours)

- A population increases by 12% in the first year and decreases by 8% in the second year. Find the overall percentage change.
- The salary of an employee is increased by 15% and then again by 10%. Find the effective percentage increase.
- A batsman scores runs in 10 innings with an average of 40. Find his new average if he scores 80 runs in the 11th inning.
- A student scored 80 marks in Physics (weight 3), 70 in Chemistry (weight 2), and 90 in Mathematics (weight 5). Find the weighted average.
- A trader buys 3 articles for ₹1,200. He sells one at 20% gain, another at 10% loss, and the third at cost price. Find overall profit/loss percentage.
- A shopkeeper marks goods 40% above cost and allows a discount of 25%. Find the profit percentage.
- A population of a town increases at 5% per annum. If the present population is 20,000, find the population after 3 years.
- A sum of ₹20,000 is borrowed at 10% CI compounded annually. Find the amount after 4 years.
- A person borrows ₹10,000 at 12% per annum CI and repays in 2 equal annual installments. Find installment amount.
- A person borrows ₹1,00,000 at 10% CI compounded annually and repays in 4 equal annual installments. Find installment amount.

Unit III	Time, Work & Distance	(05Hours)

- A can do a job in 20 days, B in 30 days, C in 60 days. If they work together, how long will it take?
- A and B together can finish a work in 12 days. A alone can finish it in 18 days. After working together for 6 days, A leaves. How long will B take to finish the remaining work?
- A can do a piece of work in 10 days, B in 20 days, C in 40 days. They start together, but C leaves after 2 days. Find total time taken.
- A tank can be filled by two pipes in 20 and 30 hours. A third pipe can empty it in 40 hours. If all three are opened together, how long will it take to fill the tank?
- A cistern has two inlet pipes and one outlet pipe. The first fills in 12 hours, the second in 15 hours, and the outlet empties in 10 hours. If all are opened together, find time to fill the cistern.
- A man covers half the distance at 40 km/h and the other half at 60 km/h. Find average speed.
- A train travels 300 km at 60 km/h and 200 km at 80 km/h. Find average speed.
- A boat goes 36 km downstream in 3 hours and returns upstream in 6 hours. Find speed of boat and stream.
- A boat travels 48 km downstream in 4 hours and 24 km upstream in 6 hours. Find speed of boat in still water and stream.
- Two trains of lengths 200 m and 300 m run at speeds of 60 km/h and 80 km/h respectively. Find time taken to cross each other when running in opposite directions.

Unit IV	**Algebra, Equations &Probability**	**(05Hours)**

- If the sum of first n terms of an AP is 3n2+5n, find the 20th term.
- The harmonic mean between two numbers is 12 and their geometric mean is 16. Find the numbers.
- In how many ways can 5 boys and 5 girls be seated in a row such that all boys sit together?
- How many arrangements of the word “BANANA” are possible?
- In how many ways can 10 students be divided into two groups of 5 each?
- Find number of ways to select 4 cards from a deck of 52 cards.
- Find coefficient of xn in expansion of (1+x)2n.
- A bag contains 3 red and 5 blue balls. Two balls are drawn without replacement. Find probability both are red.
- A coin is tossed twice. Find probability of getting at least one head.
- Events A and B are independent with P(A)=0.4, P(B)=0.5. Find P(A∩B).

Learning Resources

Text Books:

1. R.S. Aggarwal, Quantitative Aptitude for Competitive Examinations
2. Abhijit Guha, Quantitative Aptitude for Competitive Examinations
3. GKP, A Complete Manual for Campus Placements

Reference Books:

1. Uma Maheswari, General Aptitude for Campus Placements
2. Oswaal Books, Objective Quantitative Aptitude for Competitive Examinations
3. EduGorilla, Wipro Elite NTH Placement Papers Book

E-resources:

1. https://www.indiabix.com/aptitude/questions-and-answers/
2. https://www.careerride.com/Quantitative-Aptitude.aspx
3. https://www.freshersworld.com/aptitude-questions-and-answers