Shivaji University
Vidya Nagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Second Year B.Tech (Computer Science and Technology) Detailed Curriculum
2024-25 onwards

A. Definition of Credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hr. Practical(Lab) per week	1 Credit

B. Credits for award of Degrees

a. A total of **176 credits** are required for all the students to get entitled for **Under Graduate Degree in Engineering (Major) with a Multidisciplinary Minor (MDM).** This feature is the **fourth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech in Major Degree Title with Multidisciplinary Minor. The routine fees will be charged for award of the degree with multidisciplinary minor**.** There will be a pool of multidisciplinary minors for each major UG Program.

b. A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree** with **Honors,** if the candidate earns an **additional 17 credits.** Out of these 17 credits, 15 credits will be against 5 different theory courses (3 credits each) pertaining to the Major Discipline while 2 credits will be against an advance laboratory practice in the respective discipline of studies. These theory credits could be acquired preferably through MOOCs the title of which will be well declared to the aspirants. This particular feature is the **fifth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech Honors in Major Degree and Multidisciplinary Minor. For this option of Honors, the interested candidates have to pay the separate fees as decided by the institute.

c. A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree having an option of Honors with Research**. For the same, the candidate, in addition to those **17** credits allotted to the Honors, has to earn an **additional of 3 credits against an extra research project.** (As regards this extra project work, it is mandatory to be successful in publishing at least one research paper based on the research topic.) This feature is the **sixth vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech Honors with Research in Major Degree and Multidisciplinary Minor. The interested candidates for this option will have to pay the separate fees as decided by the institute.

d. A student will be entitled to acquire this 'MDM featured' **Under Graduate Degree** with **additional Specialization Minor,** if the candidate earns an **additional 14 credits against one more minor from the specialization.** These will be a separate pool of the specialization minors for choice. (The courses under minors could be through MOOCs also). This is the case of double minors and it is the **seventh vertical (Level 6.0)** from the National Credit Framework. For such a candidate the degree offered would be: B.Tech in Major Degree with double minors. (Multidisciplinary Minor and Specialization minor.) For this option of additional specialization minor, the interested candidates will have to pay the separate fees as decided by the institute.

C. Component wise distribution of credits

(Expected range of credits as per AICTE & NEP2020 guidelines is 160-176)

Sr. No.	Category Suggested	Course	No. of	Components

		Code	Credits	%
1.	Indian Knowledge System	IKS	05	2.84
2.	Ability Enhancement Course	AEC	03	1.70
3.	Value Education Courses	VEC	02	1.13
4.	Basic Science Courses	BSC	22	12.5
5.	Engineering Science Courses including workshop, drawing, basics of civil/electrical/mechanical/computer etc.	ESC	24	13.63
6.	Professional Core Courses	PCC	75	42.61
7.	Professional Elective Courses relevant to chosen specialization/branch	PEC	12	6.81
8.	Open subjects – Electives from other technical and /or emerging subjects	OEC	06	3.40
9.	Project , Seminar and Internship	PSI	11	6.25
10.	Project Based Learning	PBL	02	1.13
11.	Multidisciplinary Minor	MDM	14	7.95
12.	Vocational and Skill Enhancement Courses	VSEC	Audit Courses	-
13.	Humanities and Social Sciences including Management & Environment Courses	HSMEC		
14	Mandatory Audit Courses [Some other courses Decided at the Institute level but that do not get fit in the credits]	MAC		
	Total		**176**	**100**

D. Course code and Definition

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
MDM	Multidisciplinary Minor
SPM	Specialization Minor
ISE	In Semester Examination
ESE	End Semester Examination
IE	Internal Evaluation
EE	External Evaluation

BSC	Basic Science Course
ESC	Engineering Science Course
HSMEC	Humanities and Social Sciences including Management , Environmental Course
PCC	Professional Core Course
PEC	Professional Elective Course
OEC	Open Elective Courses
VSEC	Vocational and Skill Enhancement Courses
IKS	Indian Knowledge System
AEC	Ability Enhancement Course
VEC	Value Education Courses
MAC	Mandatory Audit Course
PSI	Project, Seminar, Internship
PBL	Project Based Learning
PBL, PBI	Project Based Learning Program Based Internship
MN , HN, HNR	Minor , Honors, Honors with Research
CC, DC	Certificate Course, Diploma Course
CHE, CE,CST	Chemical Engineering, Civil Engineering, Computer Science and Technology
ETC, FT, ME	Electronics and Telecommunication Engineering, Mechanical Engineering, Food Technology

Mandatory Induction Program at FY B. Tech First Term Commencement
(3 Weeks Duration)

a) Physical activity
b) Creative Arts
c) Universal Human Values
d) Literary
e) Proficiency Modules
f) Lectures by Eminent People
g) Visits to local Areas
h) Familiarization to Dept./Branch & Innovations

Note: On the campus, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC is available for the interested & selected students while National Service Scheme i.e. NSS unit is for all the volunteer students who will contribute as and when necessarily called for the services.

E. Four-year B. Tech. Program Academic Rules and Regulations

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Glossary

B. Tech.: Bachelor of Technology, an Under Graduate Degree awarded from the Shivaji University, Kolhapur

Director: Director, Department of Technology, Shivaji University, Kolhapur

Program: The specialization in B.Tech (Particular Major Branch)

Program Head: The Head of the Specialized Branch of B.Tech studies

DC: Department Committee

DEC: Departmental Examination Coordinator

Semester: The academic year will be divided into two regular semesters of approximately 20 weeks' duration each. Typically, the odd semester will be from the first week of July to last week of November while the even semester will be from the first week of January to the last week of May.

This will include the period of academic delivery (14 to 15 weeks), Internal Evaluation (CIE) i.e. In Semester Examination and Assignments, End Semester Examination (ESE) assessment and declaration of results.

R.B.T.: Rule B.Tech

Course: Subject

Course Coordinator: Subject teacher

Course Credit: Weighted sum of the number of Lecture hours (L), Tutorial hours (T), and Practical hours (P) associated with the course.

Credits Earned: The sum of course credits for credit courses in which a student has passed.

Grade: Assessment of the student's performance in a course indicated by the letters, "AA", "AB", "BB", "BC", "CC", "CD", "DD", "FF", "XX", "ABSENT", "PP", "NP".

Grade Point: Number equivalent of the letter grades given by 10, 9, 8, 7, 6, 5, 4 corresponding to grades "AA", "AB", "BB", "BC", "CC", "CD", "DD" respectively. "FF" and "XX" carry zero grade points.

Instructor: Member of faculty who will be assigned to teach a specific course.

Semester Grade Points: The sum of the products of credits and Grade Points for each course registered by a student in a semester.

SGPA: Semester Grade Point Average

CGPA: Cumulative Grade Point Average

ATKT: Allowed to Keep Terms.

R.B.T. 1 Admission:

At the Department of Technology, Shivaji University, candidates are admitted to all the available specialized B.Tech Programs according to norms and conditions prescribed as per AICTE, New Delhi and DTE, Mumbai, Maharashtra.

R.B.T. 2 Award of Degree:

Following rules prevail for the award of degree:

1. B.Tech Degree will be awarded to the student, who has registered and earned all the credits of prescribed courses under the general departmental requirements.
2. In addition to the credit requirement prescribed above for the Degree award, each student will have to complete the requirements of Audit Course (AC) during the programme. All the students will receive certification as PP *(for Passed),* and NP *(for not passed)* in AC, in the mark sheet. While obtaining certification as PP is a mandatory requirement for the Degree award of a student, this will not be taken into account for computing the final Cumulative Grade Point Average.
3. A student has obtained CGPA ≥ 4.5.

4. A student has paid all the institute dues and satisfied all the requirements prescribed.
5. A student has no case of indiscipline pending against him/her.
6. University authorities will recommend the award of B. Tech. Degree to a student who is declared to be eligible and satisfies the said norms.

R.B.T. 3 Attendance Rule:

All students must attend every lecture, tutorial and practical class. However, to account for late registration, sickness or other such contingencies, the attendance requirement will be a minimum of 75% of the classes actually held. A student with less than 75% attendance in a course during the semester, in lectures, tutorials and laboratories taken together (as applicable), will be awarded an 'XX' grade in that course irrespective of his/her performance in the tests.

Attendance record will be maintained based upon roll calls (or any equivalent operation) in every scheduled lecture, tutorial and practical class. The course coordinator will maintain and consolidate attendance record for the course (lectures, tutorials and laboratories together, as applicable).

R.B.T. 4 Academic Progress Rules (ATKT Rules)

1. If a candidate fails in any number of courses (subject heads) of Semester I, will be allowed to proceed to Semester II.

2. A candidate, who earns 50% of total credits of Level 4.5 (FY B.Tech), will be allowed to keep terms in Level 5.0 (SY B.Tech).

3. If a candidate fails in any number of courses (subject heads) of Semester III, will be allowed to proceed to Semester IV.

4. A candidate, who earns 50% of total credits of Level 5.0 (SY B.Tech), will be allowed to keep terms in Level 5.5 (TY B.Tech).

5. No candidate will be allowed to proceed to Semester V (TY B.Tech), unless candidate has passed in all courses of Level 4.5 (FY B.Tech).

6. If a candidate fails in any number of courses (subject heads) of Semester V, will be allowed to proceed to Semester VI.

7. A candidate, who earns 50% of total credits of Level 5.5 (TY B.Tech), will be allowed to keep terms in Level 6.0 (Final Year B.Tech).

8. No candidate will be allowed to proceed to Semester VII (Final Year B.Tech), unless candidate has passed in all courses of Level 5.0 (SY B.Tech).

9. If a candidate fails in any number of courses (subject heads) of Semester VII, shall be allowed to proceed to Semester VIII.

10. In case, if the rules of any Apex body differ from these rules, then the rules of that apex body will be applicable. However under the National Education Policy, the rules extended by University from time to time regarding ATKT will be applicable.

11. While considering the passing heads, for a year (both the semesters), 45 % aggregate score is mandatory failing to which the same will be considered as one more passing head. Any such student needs to improve the score in either of the courses to maintain 45 % aggregate for the year through appearing in re-examination or repeated examination. In such cases, the award of grade for calculation of SGPA and CGPA will be as per the table no.3 from clause R.B.T 12 with the consideration of one grade penalty as mentioned under the clause R.B.T 15, f.

12. A student who has obtained 'FF' grade in ESE of a regular semester and has obtained 'FF' grade in 2nd attempt of ESE will be eligible to choose one of the two options below to clear the backlog:

i. Re-registration for the next regular semester course whenever that course is offered.

ii. Application for Repeated Examination.

13. A student who has been detained in a regular semester and obtained 'XX' grade can Re-register for the next regular semester whenever it is offered.

14. The maximum duration for getting B. Tech. degree for students admitted in the first semester of U.G. program will be 16 semesters (eight academic years) while for lateral entry students admitted in the third semester will be 14 semesters (seven academic years) from their date of admission. The maximum duration of the program includes the period of withdrawal, absence and different kinds of leaves permissible to a student but excludes the period of rustication of a student from the department.

15. If a student is unable to gain all credits of first year in three years from the date of the admission, then the candidate will be declared as "Not Fit for Engineering" leading to discontinuation of candidate's registration with the department.

16. Depending upon the academic progress of a student, department may take a decision regarding continuation or discontinuation of candidate's registration with the institute.

R.B.T. 5 Academic Flexibility

1. Flexibility in deciding curriculum structure and contents of curriculum with reasonable frequency for changes in the same.
2. Continuous assessment of student's performance with newly adopted NEP 2020 Credit system based on Award of Grade.
3. Credits are quite simply a means of attaching relative values to courses different components. These are a currency of learning, and in general regarded as a measure of the time typically required to achieve a given curricular outcome.
4. All courses (year-wise) under each program/discipline are unitized

R.B.T. 6 Credit system:

Education at the Institute is organized around the semester-based credit system of study. The prominent features of the credit system are a process of continuous evaluation of a student's performance/progress and flexibility to allow a student to progress at an optimum pace suited to candidate's ability or convenience, subject to fulfilling minimum requirements for continuation.

A student's performance/progress is measured by the number of credits that the candidate has earned, i.e. completed satisfactorily. Based on the course credits and grades obtained by the student, grade point average is calculated. A minimum grade point average is required to be maintained for satisfactory progress and continuation in the program. Also a minimum number of earned credits and a minimum grade point average should be acquired in order to qualify for the degree. All programs are defined by the total credit requirement and a pattern of credit distribution over courses of different categories.

R.B.T. 7 Features of Credit System at Department of Technology, Shivaji University, Kolhapur:
Every course is allotted credits based on its academic importance/weightage.

1. All courses may not have same credits.
2. 21 credits / semester for First Year B.Tech while 20 credits /semester for remaining 6 semesters. Thus there are 162 credits against the B.Tech Major plus additional 14 credits against the chosen Multidisciplinary Minor. So the total credits of this Multidisciplinary Minor (MDM) Featured B.Tech Degree are 176. The particular Degree falls under the **fourth vertical** (Level 6.0) as per the National Credit Framework.
3. Absolute grading System with 7 passing Grades viz. AA, AB, BB, BC, CC, CD, DD and FF for failure.
4. Standardization of courses; with few exceptional cases, each course is of 6 units.
5. In Semester Examination (ISE) and End Semester Examination (ESE), both having (30:70) weightage in the student's performance in course work/laboratory work and other activities. A student's performance in a subject will be judged by taking into account the results of In Semester Examination and End Semester Examination together. Students must score 40% marks in ESE irrespective of the ISE marks.

   (Note: The ISE will be conducted as In Semester Exam and assignments throughout the semester on dates announced in advance by the department and its results to be made known to the students from time to time. However, the dates for the ESE will be fixed at the University level.)
6. Continuous internal evaluation consists of 'In Semester Examination' of 20 marks and assignment of 10 marks handled by Department of Technology and setting of question papers should be done by course coordinator. Assignments may be of varied nature for each course based on the need of the course coordinator.
7. End Semester Examination (ESE) to be conducted by the Department of Technology however setting of question papers will be as per University Rules. The ESE will include a written examination for

theory courses and practical/design/drawing examination with built-in oral part for laboratory/ design/drawing courses.

7.1 End Semester Examination (ESE) of the courses offered for the MOOCs will be conducted by MOOC offering Institute. The credits earned by the students will be communicated to the University and to be converted as per the weightage of the said course in the structure. Student may get failure in the said MOOC or the examination may get delayed by the MOOC offering institute, in either cases, ESE of the said course will be conducted as per the University rules.

8. In case the candidate is absent on the scheduled ISE, request for separate In Semester Examination for the students representing in co-curricular, extracurricular activities or on medical grounds will only be considered. On receipt of application from the student, the DC will take decision for the conduct of the In Semester Examination.
9. Care will be taken to ensure that the total numbers of days for academic work are ≥180 per year.
10. Academic schedule prescribed will be strictly adhered and applicable to all the UG Programs.

R.B.T. 8 Course credits assignment:

Each course, except a few special courses, has a certain number of credits assigned to it depending upon its lecture, tutorial and laboratory contact hours in a week. This weightage is also indicative of the academic expectation that includes in-class contact and self-study outside of class hours.

Lectures and Tutorials: One lecture or tutorial hour per week per semester is assigned one credit.

Practical/Laboratory: One laboratory hour per week per semester is assigned half credit.

Example: Course: Heat Transfer Operations: 05 credits (3-1-2)

The credits indicated for this course are computed as follows:

3 hours/week lectures = 3 credits

1 hours/week tutorial = 1 credit

2 hours/week practical = 2 × 0.5 = 1 credit

Also, (3-1-2) **5** credit course = (**3** h Lectures + **1** h Tutorial + **2** h Practical) per week

= **6** contact hours per week = **5** credits

R.B.T. 9 Detailed Evaluation Scheme:

1. Out of total 100% theory weightage, 30% weightage is allotted for In Semester Examination (ISE). Appearing for ISE is must and student must submit the assignments to become eligible for End Semester Examination (ESE) of respective course.

   ISE (30% weightage) includes:

   a. In Semester Examination of 20 Marks of one Hour
   b. Assignments of 10 Marks during entire semester

2. For the End Semester Examination (ESE), 70 marks question paper will be set in which student must secure 40% (28 Marks out of 70) as university examination pass head and candidate must be appeared for ISE to become eligible for ESE of respective course.
3. Final theory marks (out of 100) will be the addition of ISE (30 Marks) and ESE (70Marks).
4. Final laboratory letter grade will be awarded (100%) will be the addition of IE (50%) and EE (50%) as applicable to the course.
5. End Semester Examination (ESE) for laboratory consists of internal evaluation (IE) and External Evaluation (EE). Nature of the evaluation as viva-voce or practical will be as application to the course which will be well mentioned in the course description.
6. There will be no EE for laboratory courses of the First Year. The entire assessment of a student will be based on IE 100% weightage and a minimum performance of 40% in IE will be required to obtain the passing grade. IE of laboratory work will be based on turn-by-turn supervision of the student's work and the quality of the candidate's work as prescribed through laboratory journals and the candidate's performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IE of the concerned course. Non submission of the term work and the IE score below 40% marks will lead to term not grant (TNG). The TNG cases must be promptly communicated by the course teacher to the examination cell of the Department of Technology. The Departmental Examination Coordinator (DEC) will communicate the same to the office of the Director, Board of Examinations and Evaluation,, Shivaji University, Kolhapur for further actions.
7. The assessment of laboratory courses from the 3rd semester onwards will be carried out in two parts.
   i. ISE of laboratory will be based on turn-by-turn supervision of the student's work and the quality of candidate's work as prescribed through laboratory journals and the performance in oral or Practical/Oral examinations uniformly distributed throughout the semester. Student must submit and secure 40% marks in the IE of the concerned course. Non submission of IE will lead to term not grant (TNG).
   ii. ESE of laboratory will be based on performing an experiment followed by an oral examination or a written examination.
   iii. The relative weightage for IE and EE for assessment of laboratory courses will be 50% and 50% respectively from second year onwards and a minimum performance of 40% in both IE and EE separately will be required to get the passing grade.
   iv. EE for laboratory course will normally be held one week before the ESE for theory courses and will be conducted by a panel of examiners consisting of external and internal examiner. This activity will be coordinated by Department Examination Coordinator (DEC) in consultation with Coordinator of the respective Program.
8. A student failed in EE of a laboratory course in a regular semester will be eligible to appear for examination conducted along with ESE of laboratory courses of the subsequent semester. Such

examination will be fairly comprehensive (generally of 3 hours similar to EE i.e. External Examinations) to properly judge candidate's practical skill and theoretical knowledge for that laboratory course. The candidate will suffer a grade penalty as per Table 3.

9. Assessment of Seminar, Mini-project, Major Project, internship etc.:

i. The Seminar/Project report must be submitted by the prescribed date usually two weeks before the end of academic session of the semester.

ii. It is desirable that the topics for seminar/project be assigned by the end of previous semester.

iii. The seminar report and the presentation of seminar will be evaluated by panel of three departmental faculty members (decided by Branch Coordinator).

iv. The mini-project will be evaluated jointly by a panel of three Internal Examiners.

v. The report on field training will be evaluated by a panel of three Internal Examiners.

vi. The assessment of B. Tech major project work will be carried out in two phases as follows:
For IE, there will be

a) Departmental Committee (To approve synopsis submission based on seminar)

b) Project work assessment by Guide

(Departmental Committee constitution will be as follow:

(1) Director- Chairman

(2) Branch Coordinator from respective branch – member

(3) Senior faculty from respective branch – member

(4) Guide/Course Coordinator- member)

EE consists of progress seminar and presentation to be evaluated by panel of internal and external examiners. The process will be as below:

a) Project work assessment by Guide

b) Report submission based on seminar which will be evaluated by Departmental Committee

c) EE (Viva-voce and presentations): Evaluation by panel of external and internal examiners.

vii. The evaluation of industrial internship: Students will undergo industrial internship for one semester (8^{th} Semester). Students have to prepare a report related to the work carried out during this internship. This may include study of the new science/technology, applications of the technology/development of the technology and its implementation /designing/obtaining practical or numerical solution etc. By the Program, there will random and surprise visits to the place of internship so as to record the attendance and performance of the interns. The evaluation will be as per the university examination similar to the project evaluation.

10. The duration of End Semester Examination will be 2.5 hrs however there might be few courses having duration of End Semester Examination as 3 hrs.

11. In respect of IE and Laboratory work, a target date will be fixed for the completion of each sheet, job, Project, experiment or assignment and the same either complete or incomplete will be collected on the target date and assessed immediately at the respective departments by the concerned teachers and %

marks (or grades) will be submitted to the Co-ordinator. The Co-ordinator of the Department of Technology will communicate this % of marks (or grades) to the University.

12. In respect of IE of the audit (Non Credit) courses, the respective course in charge will organise and plan activities for the conduct of the evaluation. Preferably, the teacher will announce 5 assignments each one carrying 10 marks. So based on the assignments submitted by the candidate, there will be evaluation out of 50 marks. The passing is for 20 marks. The passing is mandatory for every student. However, the course in charge will communicate to the examination section whether the student has passed the audit course or not. As mentioned earlier, in case of audit courses, the result will appear over the mark sheet and certificate as either PP for passed and NP for not passed.

R.B.T. 10 Earning credits:

At the end of every course, a letter grade is awarded in each course for which a student had registered. On obtaining a pass grade (≥40% minimum grade DD), the student accumulates the course credits as earned credits. A student's performance is measured by the number of credits that the candidate has earned and by the weighted grade point average.

The credit system enables continuous evaluation of a student's performance, and allows the students to progress at an optimum pace suited to individual ability and convenience, subject to fulfilling minimum requirement for continuation.

As regards earning credits against certificate or Diploma award (exit after the first year and the second respectively) also through Honors, Minors, Honors with Research, all these are the optional for the interested ones. The earning of credits for certificate and diploma is mandatory to take place immediately within 45 days from the last day of respective even End Semester Examination. In case of the credits against the Honors, Minors, Honors with Research, the interested candidates to plan for the same from SY B.Tech to Final Year B.Tech completion. As per the list of interested students to opt for these features, the Department of Technology will plan the activities regarding conduct/mentoring of the course by such students. Further from time to time, the Department will communicate the details of such students to the University Examination section. The students will have their respective End Semester Examination in continuation to the End Semester Examination of the Majors.

The details regarding credits assigned against all these features are elaborated in R.B.T. 19.

R.B.T. 11 CGPA Improvement Policy for award of degree:

A student getting CGPA ≤ 4.50 with grade 'DD' in any course or grade 'FF' in any course will have the possibility to repeat one or more 'DD' graded courses along with the failed courses, /are being offered in a semester.

An opportunity will be given to a student who has earned all the credits required by the respective program with CGPA greater than or equal to 4.00 but less than 4.50, to improve his/her grade by allowing him/her to

appear for SEE of maximum two theory courses of seventh and eighth semester.

R.B.T. 12 Evaluation System:

1. **Semester Grade Point Average (SGPA)**

$$= \frac{\sum(\textbf{Course credits in passed courses} \times \textbf{Earned Credits})}{\sum(\textbf{Course credits in registered courses})}$$

2. **Cumulative Grade Point Average (CGPA)**

$$= \frac{\sum(\textbf{Course credits in passed courses} \times \textbf{Earned Credits})\textbf{of all Semesters}}{\sum(\textbf{Course credits in registered courses})}$$

   i. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. I to Sem. VIII for regular students.

   ii. Cumulative Grade Point Average (CGPA) will be calculated cumulatively for Sem. III to Sem. VIII for lateral entry students.

3. At the end of B. Tech Program, student will be placed in any one of the divisions as detailed below:

   Ist Division with distinction : CGPA $\geq$ 7.5 and above

   Ist Division : CGPA $\geq$ 6.0 and < 7.5

   IInd Division : CGPA $\geq$ 5.5 and < 6.0

New gradation suggested as follows.

Table 1

Grade Points	Equivalent Range
5.5	55%
6.0	60%
6.5	65%
7.0	70%
7.5	75%

Conversion of CGPA to percentage marks for CGPA **≥ 4.5** can be obtained using equation.

Percentage marks = (CGPA x 10)

An example of these calculations is given below:

Typical academic performance calculations - I semester

Table 2

Course no.	Course credits	Grade awarded	Earned credits	Grade points	Points secured
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6 (col4 *col5)
MALXXX	5	CC	5	6	30
CSLXXX	4	CD	4	5	20

PHLXXX	4	AA	4	10	40
PHPXXX	2	BB	2	8	16
MELXXX	4	FF	0	0	00
TTNXXX	2	AB	2	9	18
Total	21		17	38	124

1. Total Points earned for this semester = 124

$$\textbf{Semester Grade Point Average (SGPA)} = \frac{124}{21} = 5.90$$

2. Cumulative Grade Point Average (CGPA) =

Cumulative points earned in all passed courses = 124 (past semesters) + 124 (this semester)

= 248

Cumulative earned credits = 23 (past semesters) + 21 (this sem.) = 44

$$\textbf{Cumulative Grade Point Average (CGPA)} = \frac{\Sigma(124+124)}{\Sigma(23+21)} = 5.63$$

Table 3: System of Evaluation

Grade	Grade Points	Marks obtained (%)			Description of Performance
		Regular Semester	Re-examination	Repeated Examination	
AA	10	90-100	--	--	Outstanding
AB	09	80-89	90-100	--	Excellent
BB	08	70-79	80-89	90-100	Very Good
BC	07	60-69	70-79	80-89	Good
CC	06	50-59	60-69	70-79	Fair
CD	05	45-49	50-59	60-69	Average
DD	04	40-44	40-49	40-59	Poor
DD$	04	Below 40	Below 40	Below 40	Poor (Subject to Application of Ordinance 96)
FF	00	Below 40	Below 40	Below 40	Fail
XX	--	--	--	--	Detained
ABSENT	--	--	--	--	Absent
PP	--	--	--	--	Passed (Audit Course)
NP	--	--	--	--	Not Passed (Audit Course)

Note: An equivalent certificate of CGPA to percentage of marks will be provided to student on candidate's demand after remitting prescribed fees by Shivaji University.

R.B.T. 13 Entry of Students from previous credit to new Credit Pattern

A student of Department of Technology, Shivaji University, Kolhapur admitted before academic year 2023-24 and having backlogs such student will clear back log subjects as per the equivalence given by the respective program.

R.B.T. 14 Audit Courses:

Additional courses are included as audit courses in each semester. While the performance of the student in audit courses will be included in the Grade Card, these grades do not contribute to SGPA or CGPA of the concerned student. However the passing in Audit Courses is mandatory for every student.

R.B.T. 15 Awards of Grades for Re-Examination:

a) A student who has obtained grade 'FF' in regular semester will be eligible to appear for re-examination conducted before the commencement of the next regular semester.
b) In such cases In Semester Examination performance of a student will not be wiped out.
c) A student will apply for re-examination before the last date of such application and will appear for re-examination.
d) 70% weightage similar to ESE will be given to re-examination.
e) A student who is eligible for re-examination but remains absent for re-examination will be given grade 'Absent'.
f) A student will be awarded a grade between 'AB' to 'DD', or 'FF' or 'XX' as given in Table 3 depending upon the cumulative marks obtained by him/her in IE and Re-examination of ESE. Here a student has to suffer a grade penalty by accepting one grade lower as compared with the regular grades.

R.B.T. 16 Showing Evaluated Semester End Examination Answer Papers, Re-evaluation, and applying for revaluation:

The evaluated answer book will be shown to the student immediately as per the timetable prepared by the exam cell of Department of Technology before the declaration of result. The grievances regarding the incorrect total and assessment of the not assed questions will be done by the respective faculty. A student having doubt regarding the grade declared in a course can apply for the photocopy of the answer book by remitting the prescribed fee as specified; a student can also apply for rechecking of his/her SEE answer book as per Shivaji University rules. There is no provision for showing of evaluated answer book, photocopy, rechecking and revaluation of the re-examination.

R.B.T. 17 Change of Branch:

Students will be eligible to apply for Change of Branch after completing the first two semesters. The change of branch will be permitted strictly on merit basis subject to the rules and regulations prescribed by Directorate of Technical Education, Maharashtra State/Admission Regulatory authority, Maharashtra State time to time.

R.B.T. 18 Disciplines and Conduct:

i. Every student will be required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity which will tend to bring down the prestige of the Department.
ii. Any act of indiscipline of a student reported to the Department will be referred as per Shivaji University norms.
iii. If a student while studying in the institute is found indulging in anti-national activities contrary to the provisions of acts and laws enforced by Government, the candidate will be liable to be expelled from the Department without any notice.
iv. If a student is involved in any kind of ragging, the student will be liable for strict action as per Maharashtra anti-ragging act 1999, which is in effect from 15th May 1999.

v. If any statement/information supplied by the student in connection with his/her admission is found to be false/ incorrect at any time, his/ her admission will be cancelled and the candidate will be expelled from the institute and fees paid will be forfeited.

vi. Student once admitted in the Department of Technology will follow instructions issued from time to time.

vii. If a student is found guilty of malpractice in examinations then the candidate will be punished as per the recommendations of the Shivaji University, Kolhapur.

viii. Every admitted student will be issued photo identification (ID) card which must be retained by the student while the candidate is registered at Department of Technology. The student must have valid ID card with him/her while in the Department of Technology.

ix. Any student who alters or intentionally mutilates an ID card or who uses the ID card of another student or allows his/her ID card to be used by another student will be subjected to disciplinary action.

x. The valid ID card must be presented for identification purpose as and when demanded by authorities. Any student refusing to provide an ID card will be subjected to disciplinary action.

R.B.T. 19 Details regarding B.Tech Major, Minor, Honors, Honors with Research, Multiple entry, multiple exit features:

(Major means the respective 6 UG Programs available on the Campus at the Department of Technology)

I. **B. Tech Major:** The B. Tech Major requires earning the routine no of credits i.e. 162 (First Two semesters, 21 credits each plus remaining 6 semesters @ 20 Credits=120 credits.), thus the total credits against the Major will be 42+ 120 = 162. Along with that, there will be mandatory audit courses in each semester.

II. **B. Tech Multidisciplinary Minor (MDM):** There will be at least one Multidisciplinary Minor Program for each UG Major. For that sake, extra 14 Credits are mandatory to be earned. The credit split up is as follows: 3 Courses each of 3 credits plus 3 credits against MDM based internship plus 2 credits against MDM based Mini Project.

III. With the aforesaid I & II, every enrollee under a particular UG Degree program, after the successful completion of the same will be the awardees of B.Tech in Major Degree Title with Multidisciplinary Minor (Minor Title Mention*). As per the National Credit Framework's mention of verticals, this particular Degree falls under the* ***fourth level (Level 6.0)***. Routine fees as decided by the institute will be applicable to all the enrolled students. As usual if these graduates want to pursue PG, it will be of 2 years duration for them.

IV. The credits distribution for the MDM featured B.Tech Degree in a particular Major Program is as follows: 21+21+20+23+23+23+23+22=176. The SGPA and CGPA calculation will be as per this distribution.

V. **B. Tech (Honors):** This is purely an option to all the students. There will be additional **17** credits out of which **15** credits will be earned through successful completion of 05 courses 3 Credits each **plus 2** credits will be against a course in advanced laboratory practice from the major. (These courses could be

preferably through the MOOCs. If so, these MOOCs need to be other than MOOCs of Semester VIII). The courses to be completed throughout four years starting from second year. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***fifth level (Level 6.0)***. As per NEP 2020 guidelines, such successful candidates will be eligible to enter at the Second Year of PG in the respective specialization.

VI. **B. Tech (Honors with Research):** This is also purely an option to all the students. There will be **17 credits** earned as in case of Honors **plus** there will be **3 more credits** earned against an additional Project Work with success in publishing at least one research paper based on the research topic. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***sixth level(Level 6.0)***. As per NEP 2020 guidelines, such successful candidates will be eligible to pursue PhD studies **provided the candidate's entire CGPA is 7.5 and above.**

VII. **B. Tech Double Minor:** This is also purely an option to all the students. As mentioned in I & II, the candidate in addition to Multidisciplinary Minor (MDM) along with the Major Degree, may choose to opt for one more minor from the Pool of Specialization Minors (SPM) and earns 14 extra credits against this minor. The successful candidates will be the awardees of B.Tech in Major Degree with Double Minors. (Mention of the Multidisciplinary and Specialization Minors). The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under the* ***seventh level (Level 6.0)***.

VIII. **Multiple entry and multiple exit feature:**

i. **After First year**, any candidate desiring exit from first year with a claim to be an awardee of certificate course in respective specialization, the enrolee has to complete (in addition to the First Year Credits 42 in number), two, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 08 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under* ***the first vertical (Level 4.5).***

ii. **After Second Year**, any candidate desiring to exit from second year with a claim to be an awardee of Diploma in respective specialization, the enrolee must have completed the courses against the Certificate. Moreover, the enrolee has to complete (in addition to the First Year and Second Year Credits 85 in number), three, '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). These additional 10 credits to be earned by such aspirants. The details of these courses to be defined by the respective specialization and designed and well narrated to the aspirants. The interested students have to pay separate fees for the same. *As per the National Credit Framework's mention of verticals, this particular case falls under* ***the second vertical (Level 5.0).***

iii. **After Third Year**, any candidate desiring to exit from third year will be an awardee of Bachelor's Degree in Vocation (B.Voc.) in respective specialization, provided the enrolee must have completed all the courses till T.Y B.Tech (Credits 131 in number). However, such a candidate needs to earn an

additional 8 credits that include any two '2 credits theory courses' and a skill based 4 credits course (i.e. 1 Month Industrial Training). The choice of these two theory courses could be from the two courses which are listed against the exit after first year for certificate and three courses which are listed against the exit after S.Y.B.Tech with a claim for Diploma in respective specialization. *As per the National Credit Framework's mention of verticals, this particular case falls under* ***the third vertical (Level 5.5)***.

iv. In case of multiple entry-multiple exit features, to undergo the one-month internship against the certificate and diploma, also in case of all other internships, the selection of skill imparting industry or organization will be preferably from the **AICTE approved SKPs (Skill knowledge Providers)** list.

IX. **About the courses through MOOCs:** In case of the non-availability of the MOOCs, the students will prepare for the course in a self-study mode under the mentorship of a teacher assigned by the respective Program Coordinator and the Director of the Department of Technology. The students also will have option to choose to appear for the End Semester Examination either by the MOOCs organizers or that by the Shivaji University.

N.B.: All the students will be mandatorily enrolled under the academic bank of credits. As regards, multiple entries, any student from same specialization who desires to join at second, third or Final Year has to have accumulation of those minimum numbers credits in the ABC account till the candidate's last year to that of the entry year.

Note: Also one more feature of this revision is that, besides the curriculum structure, as co-curricular activities, National Cadet Corps (India) i.e. NCC and National Service Scheme i.e. NSS units are available for the interested ones the selections of whom will be as per the respective norms.

Note: All other rules and regulations will be applicable as per Shivaji University, Kolhapur.

F. Engineering Graduate Attributes

1. Domain specific Engineering Knowledge
2. Problem Analysis Ability
3. Acquiring Skills that enable them to Design & Develop Solutions to the Problems
4. Capacity to investigate Complex Problems
5. Familiarity of using Modern Tools
6. Understanding Engineer's role and connectivity towards Society
7. Awareness about Environment & Sustainability
8. Practicing ethics and values
9. Ability to work as an Individual & in a Team also
10. Acquiring Communication skills
11. Becoming well verse with task of Project management & Finance aspects
12. Developing Lifelong Learning attitude

Note: For every program, there are its own Program Educational Objectives (PEOs) while there are 12 Program Outcomes (POs) which are aligned with these graduate attributes for the engineers.

G. B. Tech (Computer Science and Technology) Program: Vision, Mission, PEOs and POs.

VISION:

To be a centre of academic excellence and research in the field of Computer Science and Technology by imparting knowledge to students and facilitating research activities that cater the needs of industries and society.

MISSION:

1. To provide a learning environment that help students to enhance problem solving skills, be successful in their professional career and to prepare students to be lifelong learners by offering theoretical foundation in Computer Science and Technology.
2. To prepare students in developing research, design, entrepreneur skills and employability capabilities.
3. To establish Industry Institute Interaction to make students ready for industrial environment.
4. To educate students about their professional and ethical responsibilities.

Program Educational Objectives (PEOs):	
PEO1	To create graduates with sound learning of basics of Computer Science and Technology who can contribute towards propelling Science and Technology.
PEO2	To create graduates with adequate abilities in Computer Science and Technology who can progress towards becoming developers, researchers and designers to fulfill the necessities of Computer Industries.
PEO3	To develop among students capacity to figure, formulate, analyze and solve real life problems confronted in Software Enterprises.
PEO4	Graduate will exhibit professionalism, ethical attitude, communication ability, collaboration in their profession and adapt to current trends by engaging in lifelong learning.
Program Outcomes (POs)	
PO1	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design solutions for complex engineering problems and design system components or

	processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and Leader in a team, to manage projects and in multidisciplinary environments.
PO12	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

H. Fees structure for Multiple Entry/Exit, Minor, Honors, Honors with Research

Sr. No.	Component	Total additional Credits	Fees to be charged* INR
1.	Exit After FY B.Tech claiming Certification in respective specialization	08	8000/-
2.	Exit After SY B.Tech claiming Diploma in respective specialization	10	10000/-
3.	Exit After TY B.Tech claiming Bachelor's Degree in Vocation (B.Voc.) in respective specialization.	08	8000/-
4.	B.Tech Double minor (Only for Specialization Minor)	14	14000/-

5.	B.Tech (Honors)	17	17000/-
6.	B.Tech (Honor with Research)	20	20000/-

* For these optional features, the fees calculation is based on INR1000 per Credit. These fees against the additional optional features are applicable to the batch enrolled in the year 2023-24. All these fees will be in addition to the management approved total tuition fees per year for the MDM featured B.Tech Majors plus the admissible and payable other fees.

Shivaji University, Kolhapur

Department of Technology

Second Year B. Tech (Computer Science and Technology), Semester- III

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Course	BSC 211	Applied Mathematics- I	03	-	00	03	03	30:70	50:00
2.	Professional Core Courses	PCC211	Discrete Mathematical Structure	03	-	00	03	03	30:70	00:00
3.	Professional Core Courses	PCC212	Digital System and Microprocessor	03	-	02	05	04	30:70	50:00
4.	Professional Core Courses	PCC213	Data Structures	03	-	04	07	05	30:70	50:50
5.	Professional Core Courses	PCC214	Data Communication and Networking	03	-	02	05	04	30:70	00:50
6.	Ability Enhancement Courses	AEC211	Soft Skills Development	01	-	-	01	01	-	50:00
				-	**-**	**-**	**-**	**20**	**500**	**300**
7.	Project Based Learning	PBL211	Mini Project I	-	01	-	01	IE at Course in charge end		
8.	Humanities, Social Sciences, Management, Environment	HSMEC 211	Environmental Studies	02	-	-	02	University Exam at year end		
			Total Hours	**18**	**01**	**08**	**27**	**-**	**-**	**-**

Shivaji University, Kolhapur

Department of Technology

Second Year B. Tech (All Programs), Semester- IV

Teaching and Evaluation Scheme

S.N.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Basic Science Courses	BSC 221	Applied Mathematics- II	03	-	-	03	03	30:70	00:00
2.	Professional Core Courses	PCC221	Theory of Computation	03	-	-	03	03	30:70	00:00
3.	Professional Core Course	PCC 222	Advanced Microprocessor	03	-	02	05	04	30:70	50:50
4.	Professional Core Course	PCC 223	Computer Organization	03	-	-	03	03	30:70	00:00
5.	Professional Core Course	PCC 224	Software Engineering	03	-	-	03	03	30:70	00:00
6.	Professional Core Course	PCC 225	Linux and Shell Programming Lab	-	-	02	02	01	00:00	50:00
7.	Professional Core Course	PCC 226	Object Oriented Programming Lab	-	-	04	04	02	00:00	50:50
8.	MDM Course	MDM 221	Multidisciplinary Minor Course I*	03	-	-	03	03	30:70	00:00
9.	Indian Knowledge Systems	IKS221	Introduction to Performing Arts	01	-	-	01	01	-	50:00
				-	-	-	-	**23**	**600**	**300**
10.	Mandatory Audit Course	MAC 221	Aptitude Enhancement Course I	-	01	-	01	IE at Course in charge end		
11.	Project Based Learning	PBL221	Mini Project II	-	01	-	01	IE at Course in charge end		
12.	Humanities, Social Sciences, Management Environment	HSMEC 221	Environmental Studies	02	-	-	02	University Exam at year end		
			Total Hours	**21**	**02**	**08**	**31**	-	-	-

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	BCS211					
Course Category	Basic Sciences Courses					
Course title	**Applied Mathematics – I (Advanced Calculus)**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	**-**	**-**	**03**		**03**
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	30	**70**	**50**	**00**	**150**	
Pre-requisites(if any)	Basic knowledge of Mathematics					
Course Objectives	The Course is aimed at- 1. Introducing linear differential equations and partial differential equations 2. Explaining Laplace Transform, Inverse Laplace Transform and applications to electric circuit problems 3. Demonstrating Fourier transform and their applications. 4. Explaining mathematical programming and assignment problems. 5. Demonstrating applications to computer engineering.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Solve linear differential equations and apply them on simple electric circuit 2. Solve the problems on partial differential equations. 3. Gain the basic knowledge of Laplace transform and their applicability in solving initial value problems. 4. Understands the new notion of Fourier transform and their usability **5.** Solve engineering problems using Mathematical Programming 6. Analyze and solve engineering problems using Assignment problems.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3													
CO 2	3	3													
CO 3	3	1													
CO 4	3	2													
CO 5	3	3		2											
CO6	3	3	3												

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Linear Differential Equations** Linear Differential Equations with constant coefficients, Homogeneous Linear differential equations, Applications of LDE with constant coefficients to Electrical systems.	7

II	**Partial Differential Equations** First order partial differential equations, solutions of first order linear and non-linear PDEs-Four	6
III	**Laplace Transform** Definitions, Laplace transform of standard functions, Properties & theorems of Laplace transform Inverse Laplace transform and application to solutions of linear differential equations (electric circuit problems).	7
IV	**Fourier Transform** Definition, Properties & theorem, Fourier sine & cosine transform, Inverse Fourier transform, Discrete Fourier transform & its properties, Applications of Fourier transform	7
V	**Mathematical Programming** Linear Optimization problems, Standard and Canonical forms, Basic solutions and feasible solutions, Optimal solutions by simplex method, Big M-method, Relation between Primal and Dual L.P.P., Dual simplex method, Solution of Primal L. P. P. using Dual L. P. P	6
VI	**Assignment Problems** Definition, Balanced and Unbalanced assignment problems, Hungarian method of solving assignment problems. Travelling salesmen problem.	6

Suggested list of Assignments:

1. To find solution of LDE with constant coefficients
2. Examples of Homogeneous LDE
3. Problems on Partial differential equations
4. Examples on Properties of Laplace transform
5. Examples on Inverse Laplace transform
6. Examples on Fourier transform
7. Examples on Simplex and Dual Simplex method
8. Examples on Big M-method
9. Assignment Problems

General Instructions:

1. Students must be encouraged to solve engineering mathematics problems using different software's
2. Each Student has to write at least 6 assignments on entire syllabus.

Text Books

i)	Erwin Kreyszig, "Advanced Engineering Mathematics", Fifth Edition, John Wiley & Sons
ii)	B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, Delhi
iii)	S. D. Sharma, "Operations Research", 11th Edition.

Reference Books

i)	C. R. Wylie, "Advanced Engineering Mathematics", 6th Edition , McGraw Hill Publication, New Delhi
ii)	H. A. Taha, "Operations Research", 8 th Edition, Pearson
iii)	S. S. Sastry, "Engineering Mathematics (Volume-I)", 4 th Edition, Prentice Hall Publication, New Delhi
iv)	H. K. Dass, "Advanced Engineering Mathematics", 2014, S. Chand Publishing.
v)	N. P. Bali, Iyengar "A text book of Engineering Mathematics by", Laxmi Publications (P)Ltd., New Delhi
vi)	M. D. Greenberg, "Advanced Engineering Mathematics", 2nd Edition, Pearson Education

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	PCC211					
Course Category	Professional Core Courses					
Course title	**Discrete Mathematical Structure**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	30		70	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed at- 1. Introducing most of the basic terminologies used in computer science courses and application of ideas to solve practical problems 2. Explaining basic mathematical logic and Set theory 3. Demonstrating relations and functions 4. Extending student's Logical and Mathematical ability to deal with abstraction 5. Exposing to concepts and properties of algebraic structures such as semi groups, monoids and groups 6. Demonstrating core ideas in graph theory					
Course Outcomes	Upon completion of this course, student should be able to – 1. Apply mathematical thinking, mathematical proofs, and algorithmic thinking, and be able to apply them in problem solving 2. Demonstrate the fundamental concepts related to set theory, relations and functions which are frequently required in advanced courses such as analysis of algorithms. 3. Compare algebraic structures like monoid, semi groups and groups. 4. Learn and summarize the group theory and group codes with applications in communication model. 5. Develop the ability to solve the problems related to algebra, POSETs, lattices, Boolean algebra and their application in computer science. 6. Solve the practical problems using graphs and related discrete structures					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3														
CO 2	2	3													
CO 3				2											
CO 4			2												
CO 5	2	2													
CO6		2				2									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Mathematical Logic :** Introduction, statements and Notation, Connectives, statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives, Normal & Principle normal forms.	8
II	**Set Theory:** Basic concepts of set theory, types of operations on sets, ordered pairs, Cartesian product, representation of discrete structures, relation, properties of binary relations, matrix and graph representation, partition and covering of set, equivalence relation, composition, POSET and Hasse diagram, Function – types, composition of functions, Inverse function.	9
III	**Algebraic Systems:** Semigroups and Monoids, properties and examples.	3
IV	**Groups:** Definition and examples, subgroups and homomorphism, Group codes, communication model, Generation of codes using checksum, error recovery in group codes.	4
V	**Lattices and Boolean Algebra:** Lattice as POSETs, definition, examples and properties, Lattice as algebraic systems, Special lattices, Boolean algebra definition and examples, Boolean functions, representation and minimization of Boolean functions.	7
VI	**Graph Theory:** Basic concepts of graph theory, Storage representation and manipulation of graphs, Fault detection in combinational switching circuits – Faults in combinational circuits, Notions of Fault detection, Algorithm for fault matrix, PERT and related techniques.	8

Text Books

i)	Discrete mathematical structures with applications to computer science", J. P. Tremblay& R. Manohar, Tata McGraw-Hill Edition, 35th Reprint
ii)	"Elements of Discrete Mathematics", C. L. LIU, Tata McGraw-Hill, 2nd Edition, 2002, ISBN 0- 07-043476-X.

Reference Books

i)	Discrete Mathematics and Its Applications", Kenneth H. Rosen, Tata McGraw-Hill, 5th Edition, 2003, ISBN 0-07-053047-5.
ii)	"Theory and problems in Abstract algebra",Schaums outline series, MGH.
iii)	Discrete Mathematics",Lipschutz, Lipson, Tata McGraw-Hill, 2nd Edition, 1999, ISBN 0-07- 463710--X.
iv)	Graph Theory", V. K. Balakrishnan, TMH (Recommended for Graph) ISBN 0-07-058718-3
v)	"Discrete Mathematical Structures", B. Kolman, R. Busby and S. Ross, Pearson Education, 4th Edition, 2002, ISBN 81-7808-556-9

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	PCC212					
Course Category	Professional Core Courses					
Course title	**Digital system and Microprocessor**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	02	05		04
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		50	---	150
Pre-requisites(if any)	Basic knowledge of digital logic and computer hardware basics.					
Course Objectives	The Course is aimed at- 1. Introducing the analysis and design of digital systems and microprocessors. 2. Understanding combinatorial analysis and design. 3. Explaining Computer aided design and programming of digital electronic circuits through the application of several modern software packages. 4. Explaining features and architectures of 8085. 5. Introducing 8085 Instruction set. 6. Studying types of Main memory.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Understand the logical behavior of digital circuits 2. Design combinatorial logic using K maps 3. Design sequential logic using ASM charts 4. Analyze combinatorial and sequential digital circuits 5. Explain the architecture, pin configuration of various microprocessors 6. Perform various microprocessor-based programs and apply the concepts of 8085 programming, interrupts, stacks & subroutines					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1		2								2				
CO 2			2	2	2										
CO 3			1		2										
CO 4		3					2								
CO 5		1									1				
CO6					1						3				

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Fundamentals Concepts:** Logic Families, TTL, TTL sub families, Characteristics of TTL gates, Axioms and laws of Boolean algebra, Practical examples with logic gates IC's.	3
II	**Combinatorial Logic Design:** Boolean algebra, min and max terms, K-maps and quine –McClusky methods, Solution using Kmaps, SOP & POS representation of digital logic and their reduction using K-map, BCD to 7- segment converter, Multiplexer and demultiplexer, encoder, decoder, Half and Full adder design	8
III	**Sequential Logic Design:** Various flip flops (R-S, D, J-K, T) using gates, counter using J-K flip-flops, shift Register using flip-flops, study of different ICs (7490, 7495, 74LS138, 7447) Timer IC (555), IEEE / ANSI symbols Analog Electronics: OP-AMP (741), Basics of OP-AMP, Characteristics, Adder, Substractor, Integrator, Differentiator, Comparator using OP-amp	8
IV	**8085 Microprocessor:** Introduction: Introduction to Microprocessor, Features of 8085, 8085-CPU architecture, Demultiplexing of address and data bus, Instruction fetching and execution operation of microprocessor.	4
V	**8085 Instruction Set:** Instruction formats, addressing modes, Op-code formats, Classification of Instruction set, Programming technique, Instruction timings, WAIT state, Single step and single cycle execution.	8
VI	**Interrupt and DMA Transfer:** Types of Memory, Memory organizations Mapping of I/O 8085 Interrupts RST5.5, RST6.5, RST7.5, TRAP & INTR. Designing hardware for INTR, Interrupt priorities, SIM and RIM instruction, DMA transfer, HOLD and HLDA pins for DMA transfer. I/O Operation and interfacing: Devices, IN & OUT Instruction with timing diagrams study of 8255 PPI, Interfacing Keyboards, Interfacing Thumbwheel switches, 8253.	8
Text Books		
i)	"Modern Digital Electronics" 4thEdition,By R.P.Jain	
ii)	Microprocessor Architecture Programming & Application", Ramesh Gaonkar, Willey Estern.5 th Edition	
iii)	Digital Systems-Principals and Application", Tocci, Widmer, Moss, (Pearson Education) 11th Edition	
iv)	Design with operational amplifier", Sergio Franko and book by RamakantGaiekwad4 th Edition	
Reference Books		
i)	"Fundamentals of digital circuits", B.Anandkumar 4th Edition	
ii)	Digital Systems & Microprocessor", Douglas Hall MGH3 rd Edition	
iii)	Digital Logic and Computer Design",Book by M. Morris Mano 5th Edition	

Experiment No.	Experiment Title/Objective	Hours
1.	Study of Basic gates.	02
2.	Study of Universal gates	02
3.	Study of Boolean algebra & De Morgan's theorem using gates.	02
4.	Study of MUX/DEMUX.	02
5.	Study of 74138	02
6.	Study of R-S and J-K flip-flops	02
7.	Study of counters	02
8.	Interfacing of counters to seven segment display.	02
9.	Realization of 4/5 variable K-maps	02
10.	Study of 8085.	02
11.	Assembly language programming for 8085 (Arithmetic, Logical and data transfer- Minimum 8 programs).	02
12.	Writing subroutine to perform delay operation of 10 ms	02
13.	Designing & implementing hardware for INTR	02
14.	Study of 8255. Interfacing using 8255	02
15.	Study of 8253 interfacing.	02

General Instructions: Students have to perform 8-10 practical's from the list

Reference Books

1	"Digital Logic and Computer Design "Book by M. Morris Mano5 th Edition
2	Fundamentals of logic design "Book by Charles H Roth7 th edition
3	Microprocessor Architecture , Programming and Applications with the 8085 written by Ramesh .
4	Fundamentals of digital circuits", B.Anandkumar 4th edition

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester III</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC213</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Data Structures</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>04</td><td colspan="2">07</td><td>05</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>50</td><td>50</td><td>200</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basic understanding of C programming language and basic mathematics.</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Provide the knowledge of basic data structures and their implementations.
2. Demonstrating data structures such as arrays, stacks, queues, hash tables and linked list etc.
3. Understanding searching and sorting techniques.
4. Introducing the concepts of trees and graphs.
5. Understanding the hashing technique.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Implement abstract data types using arrays and linked list.
2. Apply the different linear data structures like stack and queue to various computing problems.
3. Implement different types of trees and apply them to problem solutions.
4. Discuss graph structure and understand various operations on graphs and their applicability
5. Analyze the various sorting and searching algorithms.
6. Understand the hashing technique and hash functions.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3														
CO 2				3	1										
CO 3	2	2		2	1								2		
CO 4	3	2		3	1								2		
CO 5	2	2	1	2	1										
CO6	1	2													

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Stacks and Queue** Fundamentals stack and queue as ADT, Representation and Implementation of stack and queue using sequential and linked organization, circular queue: representation and implementation, Application of stack for expression evaluation and for expression conversion, Recursion, Priority queue, Doubly Ended Queue	7
II	**Searching and sorting Search:** Importance of searching, Sequential, Binary, Fibonacci search algorithms Sorting: Quick sort, two-way merge sort, heap sort, shell sort, Radix sort.	7
III	**Linked list** Concept of linked organization, Singly linked list, doubly linked list and dynamic storage management, circular linked list, Operations such as Insertion, deletion, inversion, concatenation, Computation of length, traversal on linked list, Representation & manipulations of polynomials using linked lists.	7
IV	**Hashing** Definition, Hash functions, Overflow, Collision, Open Hashing, closed hashing, Rehashing Techniques.	5
V	**Tree** Basic Technology, Binary Tree, Traversal methods, Binary search tree, B tree, B+ tree, Heaps-operations and their applications.	6
VI	**Graph** Basic concepts of graph theory, storage representation and manipulation of graphs, Introduction to Sparse matrix, representation of sparse matrix using linked list.	7
Text Books		
i)	Data Structure using C -- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI). 2nd Edition	
ii)	Data Structures using C – ISRD Group, TMH publication 2nd Edition	
Reference Books		
i)	Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (AddisionWesely Series)	
ii)	Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines. 4th Edition	
iii)	Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education). 2nd Edition	
iv)	Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2nd Edition	

Experiment No.	Experiment Title/Objective	Hours
1.	Write a program for matrix Manipulation using array.	02
2.	Implement Tower of Hanoi problem using recursion.	02
3.	Implement different operations on string without using library function.	02
4.	Implementation of palindrome string.	02
5.	Implement different operation on file.	02
6.	Implement stack as an ADT. Perform push() and pop() operations on it.	02
7.	Implementation of queue using array.	02
8.	Implement circular queue and double ended queue using arrays.	02
9.	Write a program for sequential search and linear search.	02
10.	Apply following searching techniques on list or array: Binary ii) Fibonacci	02
11.	Implement following sorting techniques on list or array: i) Quick sort ii) Merge sort.	02
12.	Write a program to create linked list and perform operation such as insert, delete, update, reverse	02
13.	To implement of binary tree traversal.	02
14.	To study hashing techniques.	02
15.	To study graph traversal method.	02
General Instructions: Practical Journal Assessment, Internal practical Examination and External Practical Examination		

Reference Books	
i)	Data Structure using C -- A. M. Tanenbaum, Y. Langsam, M. J. Augenstein (PHI).
ii)	Data Structures- A Pseudo code Approach with C – Richard F. Gilberg and Behrouz A. Forouzon 2ndEdition
iii)	Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines.
iv)	Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series)

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	PCC214					
Course Category	Professional Core Course					
Course title	**Data Communication and Networking**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	02	05		04
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**	
	30	70	--	50	150	
Pre-requisites(if any)	Basics of Communication and Computers					
Course Objectives	The Course is aimed at - 1. Providing knowledge about basics of Data Communication and computer network 2. Providing knowledge about the Functions of Physical Layer. 3. Providing details of different data link layer functions including error detection and error corrections. 4. Providing knowledge about different framing techniques and network layer protocols for data communication 5. Providing detail knowledge of Transport Layer and protocols. 6. Providing knowledge about protocols from application layer.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Explain Data Communications System, its components and Articulate the networking Basics. 2. Explain and examine wired and wireless communication with medium access control layer. Differentiate and analyze various multiplexing techniques. 3. Apply error control techniques and study different protocols used at Data Link Layer. 4. Examine IPv4 and IPv6 structure. Solve sub-netting problems and analyze various routing mechanism, Identify and compare congestion control mechanisms 5. Examine the services provided by transport layer and have a hands-on experience of socket programming 6. Inspect the networking applications used in everyday tasks such as reading email or surfing the web and analyze its architecture					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3														
CO 2	2	1	1												
CO 3	2	1	1		1								1		
CO 4	2	2	2	1	2								1		
CO 5	2	2	2	1	2								1		
CO6	1	2	2	1	2								1		

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Communication Fundamentals, Protocols and Models :** Introduction to data communications, data and signals, transmission impairment, Network Representations and Topologies, Common Types of Networks, Internet Connections, Layered network model: OSI, TCP/IP	06
II	**Physical Layer Characterization:** Purpose of the Physical Layer, transmission media: - Guided and Unguided media, Network Hardware components, Introduction to packet switching: Circuit switching vs. packet switching, Types of services: - Connection oriented services, Connectionless services, Multiplexing	05
III	**Data Link Layer:** Purpose of the Data Link Layer, Error detection & correction: cyclic codes, hamming code, Data Link Control: - Farming, Flow & error control, Protocol basics- stop & wait protocol, sliding window protocol, MAC protocols, ALHOA, CSMA, CSMA/CD, CSMA/CA	09
IV	**Network Layer:** Network Layer Services, Network Layer Performance: Delay, throughput, congestion control, IPv4 Addresses: Address space, Classful addressing, classless addressing, IP datagram format, IPv6 Address Representation, IPv6 Address Types, Introduction to Network Routing Algorithm- Link State routing, Distance Vector Routing etc	09
V	**Transport Layer:** Transportation of Data, TCP Overview, UDP Overview, Port Numbers, TCP Communication Process, Reliability and Flow Control, UDP Communication	05
VI	**Application Layer:** Application, Presentation, and Session, Peer-to-Peer, NAME SPACE, DOMAIN NAME SPACE, Web and Email Protocols, File Sharing Services, Security Threats and Vulnerabilities, Network Attacks	05
Text Books		
i)	B. A. Forouzan, "Data Communications and Networking", 4th Edition, Tata McGraw-Hill, 2013, ISBN-10: 1-25-906475-1	
ii)	Computer Networks – Andrew S. Tanenbaum (Pearson Education) 4th Edition	
Reference Books		
i)	William Stallings, "Data and computer Communication", 7th Edition, Pearson Education, 2003, ISBN-13: 978-0131006812, ISBN-10: 0131006819.	
ii)	Larry L. Peterson and Bruce S. Davie, "Computer Networks a systems approach", 5th Edition, Morgan Kaufmann an imprint of Elsevier, 2014, ISBN: 978-93-80501-93-2	

Experiment No.	Experiment Title/Objective	Hours
1.	Study and demo of LAN, WAN and various connecting devices and components.	02
2.	Study of Different Networking Command	02
3.	Implementation of Framing Method By Character Count	02
4.	Implementation of Error Detecting Code (CRC)	02
5.	Implementation of Error Correcting Code (Hamming Code).	02
6.	Implementation of Simplex Stop and Wait Protocol.	02
7.	File transfer using Go back n / Selective Repeat Protocol	02
8.	Implementation of Shortest Path algorithm	02
9.	Implementation of connection oriented (TCP) client-server socket program.	02
10.	Implementation of connectionless (UDP) client-server socket program.	02
11.	Study of network protocol analyzer (Wire-Shark) / (Packet sniffer) and understanding packet formats for UDP, TCP, ARP, ICMP protocols	02
12.	DNS client utilities with Nslookup and Dig	02
13.	Implement simple web page design	02
14.	Case study of campus-wide network	02

General Instructions: Students have to perform 8-10 practicals from the list

Reference Books

i)	Richard Steven, "Unix network programming", for Socket Programming, Prentice Hall 3rd edition, 2015
ii)	James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education,5th /6th edition, 2012/2013
iii)	Jeffery S. Beasley, "Networking", New Riders Press, 2nd edition, 2008.

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III					
Course Code	AEC211					
Course Category	Ability Enhancement Courses					
Course title	**Soft skills Development**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	01	-	-	01		01
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	-	50
Pre-requisites(if any)	H. S. C. Level English language competency					
Course Rationale:	In today's competitive professional landscape, technical skills alone are insufficient. Soft skills such as communication, teamwork, problem-solving, and adaptability are essential for engineering graduates to thrive in their careers. This course aims to equip students with the necessary soft skills to complement their technical expertise and enhance their employability and success in the workplace.					
Course Objectives	The Course aimed at - 1. Enhancing communication, teamwork, problem-solving skills. 2. Fostering adaptability and resilience in engineering contexts.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Proficient in oral and written communication. 2. Effective as regards teamwork and collaboration skills. 3. Able to apply critical thinking to industrial problems. 4. Able to demonstrate adaptability and resilience in profession.					

Course Outcome and Program Outcome Mapping

	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1									3	3	-				
CO2									3	-	-				
CO3		3													
CO4												2			

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Written communication** • Email Writing • Technical Report	03
II	**Oral Communication** • Presentation Skills	02
III	**Soft Skills** • Importance of Soft Skills • Overview of Various Soft Skills	02
IV	**Team Spirit & Leadership Ability** • Understanding team dynamics and roles • Building trust and rapport within team	02
V	**Assessment** • Discussion on incorporating soft skills development into daily practice • Case Studies or Role-Play	05
Text Books		
i)	1. Soft Skills, 2015, Career Development Centre, Green Pearl Publications.	
Reference Books		
i)	Sharma R. & Krishna Mohan (2017), *Business Correspondence and Report Writing*, McGraw Hill Education	
ii)	P. D. Chaturvedi & Mukesh Chaturvedi (2013), *Business Communication: Skills, Concepts & Applications*, Pearson Publications, New Delhi, 3rd Edition, Seventh Impression	
iii)	K. K. Sinha (2006), *Business Communication*, 2nd Edition (Reprint), Galgotia Publishing, New Delhi	
iv)	Khera, S. (1998). "You Can Win: A Step by Step Tool for Top Achievers." New Delhi: Macmillan Publishers India.	
v)	Covey, S. R. (2004). "The 7 Habits of Highly Effective People." New York: Free Press.	
vi)	Carnegie, D. (2009). "How to Win Friends and Influence People." New York: Pocket Books.	
vii)	Bradberry, T., & Greaves, J. (2009). "Emotional Intelligence 2.0." San Diego, CA: TalentSmart.	
viii)	Dweck,C.S.(2006). "Mindset: The New Psychology of Success." New York: Ballantine Books.	
Assessment		

	For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested: **1. Quizzes/Tests (10 marks)** Periodic quizzes or tests to evaluate students' understanding of key concepts and their ability to apply them. **2. Activity 1 (10 marks)** Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance 3. **Activity 2 (20 marks)** Group activity focusing application of creative thinking and teamwork; designed to assess both individual and group performance **4. Classroom Participation and Engagement (10 marks)** Demonstrating engagement with course material and Active participation in class discussions, group activities and question-answer sessions. .

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III			
Course Code	PBL211			
Course Category	Project Based Learning			
Course title	**Mini Project I**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	01	-	01
Evaluation Scheme	IE at Course in charge end			
Pre-requisites(if any)	Basics of Computers			
Course Objectives	The Course is aimed to- 1. Create awareness among the students to express technical ideas, strategies and methodologies in written form. 2. Enable students to work as a responsible member and possibly a leader of a team in developing software solutions. 3. Motivate students to self-learn new tools, algorithms, and/or techniques that contribute to the software solution of the project 4. Create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 5. Improve the team building, communication and management skills of the students 6. Enable students to develop a design solution for a set of requirements			
Course Outcomes	Upon completion of this course, student should be able to – 1. Acquire practical knowledge within the chosen area of technology for project development 2. Identify, analyze and handle programming projects with a comprehensive and systematic approach 3. Contribute as an individual or in a team in development of technical projects 4. Develop effective communication skills for presentation of project related activities 5. Formulate and propose a plan for creating a solution for the problem identified 6. Report and present the findings of the study conducted in the preferred domain			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		2	2												
CO2		2	2	2											
CO3									2	2					
CO4							2								
CO5						2									
CO6											2	2			

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Mini Project I is a dynamic course designed to bridge the gap between classroom learning and real-world application. Throughout the semester, all students will engage themselves in a series of mini projects that challenge them to apply theoretical concepts learned in previous courses to solve practical problems. These projects, conducted in small groups, will cover a range of topics relevant to their field of study, allowing students to explore different facets of their discipline and develop versatile skill sets.

The course structure is carefully crafted to align with NEP 2020 and Outcome Based Education principles, emphasizing experiential learning, competency development, and holistic skill enhancement. Through active participation in mini project, students will not only deepen their understanding of academic concepts but also cultivate essential soft skills such as teamwork, problem-solving, and effective communication.

Each week, students will dedicate one hour to course activities, including project discussions, progress updates etc. Faculty guidance and mentorship will be provided to support students throughout their project work, ensuring they maximize their learning outcomes and derive meaningful insights from their engagements.

By the end of the semester, students will emerge with a comprehensive understanding of how theoretical knowledge translates into practical applications, equipping them with the competencies and confidence to thrive in their future careers.

The mini-project should be undertaken preferably by a group of 3 students who will jointly work and implement the mini-project. The group will select a project with the approval of the guide. A batch of practical / Tutorial will be divided into mini project groups. Mini project topics and the work for these groups in the batch will be guided by a teacher for the batch, preferably on one of the topics like Compiler Construction, Database Engineering, Operating System, Computer Graphics and Multimedia, Advanced Programming and latest developments and trends in Computer Science and Technology. The teacher will periodically assess the performance of individual student in the mini project, jointly with a teacher of another batch. Project group will submit hardcopy project report along with project demonstration software in CD and/or project hardware gadget at the term end. The IOE of mini project will be jointly conducted by appointed examiners. Note: Use of Open source tools should be preferred.

Course Assessment Process

The course evaluation will be at the course teacher end. The teachers will follow the instructions as below:

- Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:
    - Rubric-based assessment for mini project.
    - Peer evaluation for team-based projects.
    - Written exams or quizzes to assess theoretical knowledge.
    - Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
    - Overall course grading based on a weighted average of individual assessments and participation.

Year, Program, Semester	S.Y. B. Tech (Computer Science and Technology) , Part II, Semester III				
Course Code	HSMEC211				
Course Category	Humanities, Social Science, Management, Environment				
Course title	**Environmental Studies**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	02	-	-	02	00
Evaluation Scheme	**IE at the course in charge end, University Exam at year end**				
Pre-requisites(if any)	-				
Course Objectives	The Course is aimed to- 1. Introduce the basic concepts and principles of environmental science and its significance. 2. Explain various types of natural resources and their significance. 3. Describe the role of ecosystems in supporting life and maintaining ecological balance. 4. Define biodiversity and its significance				
Course Outcomes	Upon completion of this course, student should be able to – 1. Understand terms and principles related to environmental studies. 2. Classify different types of natural resources and their uses. 3. Analyze energy flow and nutrient cycling within ecosystems. 4. Identify different levels of biodiversity and their importance.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	2	-	-	-	-	-	3	3	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	3	3	2	-	-	-	-	-	-
CO3	-	-	3	-	-	-	3	3	2	-	-	-	-	-	-
CO4	-	-	-	-	-	-	3	3	-	-	-	-	-	-	-

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Nature of Environmental Studies:** Definition, scope and importance, Significance of environmental studies, Multidisciplinary nature of environmental studies. Its need for public awareness.	**05**
II	**Natural resources and associated problems:** a) Forest resources: Use and over- exploitation, deforestation, Timber extraction, mining, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Usage and exploitation, environmental effects of extracting and using mineral resources. d) Food resources: World food problem, changes caused by agriculture effects of modern agriculture, fertilizer-pesticide problems. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. g) Role of an individual in conservation of	**08**

	natural resources. h) Equitable use of resources for sustainable lifestyle.	
III	**Ecosystems:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristics features, structure and function of the following Ecosystem: a) Forest ecosystem b) Grassland ecosystem c) Desert ecosystem d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	**08**
IV	**Biodiversity and its conservation:** Introduction – Definition: genetic, species and ecosystem diversity, Bio geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.; Biodiversity at global, National and local levels.; India as a mega-diversity nation; Western Ghats as a bio-diversity region; Hot-spots of biodiversity; Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; Endangered and endemic species of India; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	**09**
Text Books		
i)	Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.	
ii)	BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India	
iii)	Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p	
Reference Books		
i)	Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6	
ii)	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B. Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">BSC221</td></tr>
<tr><td>Course Category</td><td colspan="6">Basic Science Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Applied Mathematics – II
(Numerical Methods and Statistics)</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td colspan="2">ISE</td><td>ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td colspan="2">30</td><td>70</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basic knowledge of Mathematics-I</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at –
1. Elaborating numerical methods and statistics.
2. Analyzing engineering problems based on probability
3. Familiarizing with correlation and regression
4. Providing knowledge of the Test of Hypotheses and Significance.
5. Discussing and solve Transportation Problem.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Understand the difficulty of solving problems analytically and the need to use numerical approximations for their resolution
2. Apply numerical methods for solving problems in different areas of engineering
3. Gain the basic knowledge of correlation and regression.
4. Formulate and solve different problems in the field computer engineering using probability and test of Significance
5. Analyze and solve engineering problems using transportation problem.
6. Formulate a mathematical model for engineering problem, solve and interpret the solution in real world.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	1			1									
CO2	3	2	1			1									
CO3	3	2			2										
CO4	3	2			2										
CO5	3	2													
CO6	3	2	2			1									

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**Numerical solution of algebraic and transcendental equations** Zeroes of polynomial and transcendental equation using Bisection method, Iterative method, Secant method, Regula-falsi method and Newton-Raphson method, Newton-Raphson method for system of equations, Mullers method, Rate of convergence of above methods.	7
II	**Interpolation, Numerical Differentiation and Numerical Integration** Lagrange's interpolation formula, Newton's forward and backward difference interpolation formula, Newton's divided difference interpolation formula, Numerical differentiation based on interpolation, Numerical Integration: Trapezoidal Rule, Simpson's 1/3 rd rule, Simpson's 3/8 th rule.	6
III	**Curve Fitting** Fitting of Curves by method of Least-squares for linear, parabolic, and exponential, Coefficient of correlation, Spearman's rank correlation, coefficient and lines of regression of bivariate data.	7
IV	**Probability** Random variable, Mean, median, mode and standard deviation. Binomial, Poisson, and Normal distributions.	6
V	**Test of Significance** Sampling distribution of mean and standard error, Large sample tests: Test for an assumed mean and equality of two population means. Small sample tests: t-test for an assumed mean and equality of means of two populations, Paired t-test. Test by using Chi – square distribution. Goodness of fit test. Test for independence of attributes Yates's Correction.	7
VI	**Transportation Problem** Introduction, Mathematical formulation, Method for obtaining initial basic feasible solution, North –West corner method, Low cost entry method, Vogel′s approximation method, Method to obtain optimal solution (MODI Method).	6
	Text Books	
i)	M. K. Jain, S. R. K. Iyengar, R. K. Jain, "Numerical methods for scientific and Engineering Computation" , 2012, New Age International Limited Publishers.	
ii)	S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", 2020.	
iii)	B. S. Grewal, "Higher Engineering Mathematics", 43rd Edition , Khanna Publishers, Delhi.	
iv)	S. D. Sharma, "Operations Research ", 11th Edition	
	Reference Books	
i)	S.C. Chapra, R.P. Canale, "Numerical method for Engineers", 2015, Tata McGraw Hill Publications	
ii)	James L. Johnon, "Probability and Statistics for Computer science", 2011.	
iii)	H. K. Dass, "Advanced Engineering Mathematics", 2014, S. Chand Publishing.	
iv)	Erwin Kreyszig, "Advanced Engineering Mathematics", Fifth Edition , John Wiley & Sons.	
v)	M. D. Greenberg, "Advanced Engineering Mathematics", 2nd Edition , Pearson Education.	
vi)	C. R. Wylie, "Advanced Engineering Mathematics", 6th Edition , McGraw Hill Publication, New Delhi.	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC221</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Courses</td></tr>
<tr><td>Course title</td><td colspan="6">Theory of Computation</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>30</td><td colspan="2">70</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Discrete Mathematical Structure</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at –
1. Helping students to develop ability to understand and conduct mathematical proofs for computation and algorithms
2. Introducing students to the mathematical foundations of computation including automata theory.
3. Demonstrating students to design DFA and NFA for solution to engineering problems.
4. Explaining the theory of formal languages and grammars.
5. Demonstrating the PDA and normal forms of grammar.
6. Explaining different types of Turing Machines</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –
1. Analyze problem solving situations in related areas of theory in computer science.
2. Enhance ability to understand and conduct mathematical proofs for computation and algorithms.
3. Design deterministic and nondeterministic automata to recognize specified regular languages
4. Analyze and design finite automata, pushdown automata, formal languages, and grammars.
5. Convert among equivalently powerful notations for a language, including among DFAs, NFAs, and regular expressions, and between PDAs and CFGs.
6. Design and analyze Turing Machine</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	2	3	3	2											
CO2	3	2	2												
CO3	3	2	3												
CO4	1		3												
CO5	2		2												
CO6	1		3	2											

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Proofs and Regular Languages: Types of Proofs, Mathematical Induction and Recursive definitions with examples. Regular expressions & corresponding regular languages, examples and applications, unions, intersection & complements of regular languages.	6
II	Finite State Machines: Deterministic finite automata definition and representation, Non-deterministic F.A., NFA with ^ transitions, Equivalence of DFAs, NFAs and NFA-^s. Kleene's theorem - part I & II statements & proofs, minimum state FA for a regular language, minimizing number of states in an FA.	10
III	Grammars & Languages: Definition and types of grammars and languages, derivation trees and ambiguity, CFL's & Non CFL's., Union, Concatenation and Kleene's operations, Intersection and complements of CFLs, Pumping Lemma & examples.	6
IV	Chomsky Normal Form: BNF and CNF notations, Eliminating ^ production and unit productions from a CFG, Eliminating useless variables from a Context Free Grammar.	3
V	Push Down Automata: Definition, deterministic PDA, types of acceptance and conversions to each other, CFGs & PDAs., Top-Down, & Bottom-up parsing.	6
VI	Turing Machines: Models of computation, definition of TM as Language Acceptors, Combining Turing machines, computing a function with a TM. Variations in TM, TMs with doubly-infinite tapes, more than one tape, Non-deterministic TM and Universal TM.	8
Text Books		
i)	Introduction to Languages & Theory of Computation", John C. Martin, TMH, 3rd Edition.	
ii)	"Discrete Mathematical Structures with Applications to Computer Science", J. P. Tremblay & R. Manohar, Tata McGraw-Hill Edition, 35th Reprint.	
Reference Books		
i)	"Introduction to Automata Theory, Languages and Computations", John E. Hopcraft, Rajeev Motwani, Jeffrey D. Ullman (Pearson Edition).	
ii)	"Introduction to Theory of Computations", Michael Sipser, Thomson Brooks/Cole.	

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV					
Course Code	PCC222					
Course Category	Program Core Course					
Course title	**Advanced Microprocessor**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	02	05		04
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		50	50	200
Pre-requisites(if any)	Basic knowledge of microprocessor					
Course Objectives	The Course is aimed at – 1. Analyzing the architecture, instruction set and operations of microprocessors 8086 and contemporary peripherals. 2. Elaborating the single and multiprocessor mode of 8086 processor. 3. Discussing to develop assembly level programs for microprocessor and microcontroller. 4. Describing and analyze 80386 microprocessor and PIC microcontroller. 5. Illustrating and analyze I/O Interfacing and Interrupt handling concept and to implement these concepts with Intel 8086 Assembly Language. 6. Elaborating the operation of microprocessors and microcontrollers, machine language programming and interfacing techniques.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Get complete knowledge of architecture, instruction sets and operations of microprocessors 8086. 2. Understand 8086 microprocessor, multiprocessor addressing modes. 3. Develop various assembly language programs and understands the various addressing modes required for assembly language programming. 4. Develop enough confidence to take up the challenges in building useful microprocessor based applications. **5.** Analyze instruction sets, applying programming and gain hands-on experience of 8086 & 80386 microprocessor and microcontroller. 6. Outline the architecture of ARM processor and PIC microcontroller.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	1	2		2											
CO2		2													
CO3	1	2													
CO4					1										
CO5		2			1										
CO6	1	2													

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	**8086 Architecture** 8086 CPU Architecture, EU & BIU activities, Segmentation and address transition, 8086 pin description, 8284 clock generation 8286, 8282, configuration of 8086. Accessing even and add address memory with byte/ word. Software and Hardware interrupts.	8
II	**8086 Addressing modes and instruction sets** Addressing modes, data Transfer, arithmetic logical string, i/o instruction, control group of instruction, writing programs using assembler directive and in different module and linking, BIOS /DOS interrupts for Printer, VDU, serial, FDC, Add on cards interface.	8
III	**Minimum & Maximum mode of 8086** Multifunction pins of 8086, 8088-Bus controller, IOB mode of 8288, Minimum & Maximum mode Configuration diagram. Study of 8087 NDP	3
IV	**Modular Programming** Linking and relocation, Stacks, procedures, interrupt and interrupt routines, macros, program design, program design examples.	4
V	**80386, 32~bit processor** Salient features of 80386DX, Architecture and signal description, Register organization, addressing modes, data types, Real address mode, protected mode, Segmentation, Paging.	5
VI	**Embedded System and other Microcontrollers** PIC Microcontroller 8 bit Microcontroller, architecture, Addressing Modes, Timers, Counters, Interrupts, Serial Communication, Programming Concepts, design of embedded systems with microcontrollers.	11
Text Books		
i)	"8086/8088 Family design programming and interfacing", John Uffenbeck, PHI.8 th Edition.	
ii)	"Design with PIC Microcontrollers", John B. Peatman, Pearson Education.4 th Edition	
Reference Books		
i)	"The INTEL Microprocessor".	
ii)	"An introduction to 8086/8088 assembly language programming for beginners", N. M. Morris.	
iii)	"Microcomputer Systems: The 8086 / 8088Family Architecture, Programming and Design", Yn - cheng Liu and Gibson, G.A. Prentice Hall of India, 2nd Edition, 2006.	

Experiment No.	Experiment Title/Objective	Hours
1.	8086 Architecture: To understand 8086 Architecture in details.	02
2.	Implement 8086 program for addition and subtraction of two 16 bit numbers.	02
3.	Implement 8086 program for signed and unsigned multiplication.	02
4.	Implement 8086 program for signed and unsigned division	02
5.	Implement 8086 program to check number is even or odd.	02
6.	Implement 8086 program for check number is positive or negative.	02
7.	Implement a program: a)To find largest number from array. b)To find smallest number from array.	02
8.	Implement program for password matching.	02
9.	Implement a program to display a string and to do case conversion.	02
10.	Implement a program to string reverse and string copy.	02
11.	Implement a program: a)To sort numbers in ascending order. b)To sort numbers in descending order.	02
12.	Implement a program for counting 1's and 0's.	02
13.	Write NDP architecture in detail with diagram.	02
General Instructions: Practical Journal Assessment, Internal Oral Examination and External Practical Examination		
Reference Books		
i)	"8086/8088 Family design programming and interfacing", John Uffenbeck, PHI.2nd Edition	
ii)	"An introduction to 8086/8088 assembly language programming for beginners", N. M. Morris	

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV					
Course Code	PCC223					
Course Category	Professional Core Course					
Course title	**Computer Organization**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**	
	03	-	-	03	03	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	30	70		--	--	100
Pre-requisites(if any)	Basic knowledge of digital logic and computer hardware basics					
Course Objectives	The Course is aimed at- 1. Conceptualizing the basics of organizational and architectural issues of computer 2. Helping to analyze performance issues in processor and memory design of a computer. 3. Discussing various data transfer techniques in computer. 4. Explaining to analyze processor performance improvement using instruction level parallelism. 5. Providing the knowledge on Instruction Level Parallelism. 6. Providing the knowledge and Analyze Memory Organization.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Understand basic structure of computer. 2. Perform computer arithmetic operations. 3. Understand control unit operations. 4. Design memory organization that uses banks for different word size operations. **5.** Understand the concept of cache mapping techniques. Ability to understand the concept of I/O organization 6. Conceptualize instruction level parallelism					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	2														
CO2	1		2												
CO3	1														
CO4			2												
CO5	1	1													
CO6		2													

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Basic Computer Organization:** Evolution of computers - Mechanical era, Electronic computers, Generations, VLSI era, CPU organization , communications, user and supervisor modes, accumulator based CPU, System bus, instruction cycle, types of instruction(zero, one, two and three address machines), IO interface, RISC & CISC, definition, comparison and examples.	3
II	**CPU design:** Specifications, (memory, speed, frequency etc.) with example, Instruction fetching, decoding, executing, Case Study (architecture, block diagram, instruction sets etc.), Pentium 4 processor, AMD processor.	8
III	**Computer Arithmetic:** Data Representation, basic formats, storage order, fixed point numbers, binary, signed, decimal, hexadecimal, Floating point numbers, basic formats, normalization, biasing, IEEE754 format, Fixed point arithmetic - Addition and subtraction, overflow, high speed adders, adder expansion, Fixed point multiplication - Two's complement multiplier, Booth's algorithm, Combinational array multiplier, Fixed point division - Restoring, Non restoring algorithm, Combinational array divider, Division by repeated multiplication, Floating point arithmetic - Basic operations, Difficulties, Floating point units, Addition, subtraction, multiplication, division.	8
IV	**Control Design:** Introduction, multi cycle operation, implementation methods, Hardwired control, design methods, state tables, GCD processor, Classical method, one hot method, Design example- twos complement multiplier control, CPU control unit design.	4
V	**Micro programmed control:** Basic concepts, control unit organization, parallelism in microinstructions, Microinstruction addressing, timing, Control unit organization, Design example- twos complement, multiplier control, Control field encoding, encoding by function, multiple microinstruction formats.	8
VI	**Memory Organization:** Types of memory, Memory systems, multilevel, address translation, memory allocation, Caches, Associative memory, direct mapping, set associative addressing.	8
Text Books		
i)	Computer Architecture and Organization - John P Hayes (MGH) 3rd Edition.	
ii)	Computer Systems Organization & Architecture – John D. Carpinelli (Pearson Education)	
Reference Books		
i)	Computer Organization - HamacherZaky (MGH).	
ii)	http://cse.stanford.edu/class/sophomore-college/projects-00/risc/risccisc/ (RISC vs CISC)	
iii)	http://www.cpu-world.com/sspec/	
iv)	http://www.intel.com/technology/itj/q12001/pdf/art_2.pdf (The Micro architecture of the Pentium 4 Processor).	
v)	http://www.amd.com/usen/assets/content_type/white_papers_and_tech_docs/30579_AMD_Processor_ Evaluation_Guide3.1.pdf (AMD Processor Performance Evaluation Guide)	

<table>
<tr><td>Year, Program, Semester</td><td colspan="6">S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV</td></tr>
<tr><td>Course Code</td><td colspan="6">PCC224</td></tr>
<tr><td>Course Category</td><td colspan="6">Professional Core Course</td></tr>
<tr><td>Course title</td><td colspan="6">Software Engineering</td></tr>
<tr><td rowspan="2">Teaching Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td colspan="2">Total Contact Hours</td><td>Total Credits</td></tr>
<tr><td>03</td><td>-</td><td>-</td><td colspan="2">03</td><td>03</td></tr>
<tr><td rowspan="2">Evaluation Scheme</td><td>ISE</td><td colspan="2">ESE</td><td>IE</td><td>EE</td><td>Total</td></tr>
<tr><td>30</td><td colspan="2">70</td><td>--</td><td>--</td><td>100</td></tr>
<tr><td>Pre-requisites(if any)</td><td colspan="6">Basics of Computers</td></tr>
<tr><td>Course Objectives</td><td colspan="6">The Course is aimed at-
1. Providing knowledge of basic Software engineering methods and practices, and their appropriate applications.
2. Giving a general understanding of software process models such as the waterfall and evolutionary models and an understanding of software requirements and the SRS document.
3. Elaborating to know role of project management in planning, scheduling, risk management, different software architectural styles, implementation issues such as modularity and coding standards.
4. Providing knowledge of software testing approaches such as unit testing and integration testing and understanding of software evolution and related issues such as version management.
5. Illustrating quality control and how to ensure good quality software.
6. Explaining some ethical and professional issues that are important for software engineers and development of significant teamwork and project based experience.</td></tr>
<tr><td>Course Outcomes</td><td colspan="6">Upon completion of this course, student should be able to –

1. Apply the project management and analysis principles to Software project development
2. Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
3. Identify and solve engineering problems and to gain Knowledge about software development life cycle.
4. Communicate effectively and the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
5. Apply the design & testing principles to software project development to maintain software systems.
6. Identify and Apply methods for software quality and its control.</td></tr>
</table>

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		2	2								3				
CO2			3			2	2	2							
CO3		2	2												
CO4			3			3	2			2					
CO5			2		2										
CO6		1			2										

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Introduction to Software Engineering:** The Problem Domain, Software Engineering Challenges, Software Engineering approaches, Software Processes, Software Development Process Models, Extreme programming and agile software development, Other Software Processes	6
II	**Software Requirement Engineering:** Requirement Engineering Processes, Requirement elicitation and analysis, Software Requirement Specification, Requirement Validations	7
III	**Software Architecture:** Role of software architecture, Architecture View, Component and Connector View, Architecture styles for Component and Connector View, Evaluating Architectures.	6
IV	**Software Design:** **Function Oriented Design :** Design Principles, Module Level Concepts, Design Notation and Specifications, Structure Design Methodology, Metrics **Object Oriented Design:** OO Analysis and OO Design, OO Concepts, Design Concepts, Design Methodology, Metrics.	8
V	**Coding and Testing:** Programming Principles and Guidelines, Coding Process, Refactoring, Testing, Black Box Testing, White Box Testing, Program Analysis Tools, Unit Testing, Integration Testing, System Testing	7
VI	**Software Quality and Management:** Software quality, Software standards, CMM, Reviews and inspections, Software measurement and metrics. **Case Study:** Complete a case study related to requirements gathering and analysis, designing, coding and testing phase of software development by forming a group of 3-4 students.	5
	Text Books	
i)	An Integrated Approach to software engineering by Pankaj Jalote, Narosa Publication, 3rd Edition (Unit I,III,IV)	
ii)	Software Engineering by Ian Sommerville, Pearson Publication, 9th Edition	
iii)	Fundamentals of Software Engineering by Rajib Mall, PHI, 3rd Edition. (Unit V)	
iv)	Software Engineering by Roger Pressman, McGraw-Hill Publication, 9th Edition (Unit II,VI)	
v)	The Unified Modeling Language User Guide by Grady Booch, James Rumbaugh, Ivar Jacobson (Unit IV)	

Reference Books	
i)	.Software Engineering - Concepts & Practices by UgrasenSuman (Cenage Learning)
ii)	Software Engineering Fundamentals -- Behforooz& Hudson (Oxford : Indian Edition 1st)

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV					
Course Code	PCC225					
Course Category	Professional Core Course					
Course title	**Linux and Shell Programming Lab**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	-	-	02	02		01
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	-	50
Pre-requisites(if any)	Basics of Operating System					
Course Objectives	The Course is aimed at - 1. Familiarizing students with the Linux environment 2. Teaching the Vi editor at an introductory level of proficiency 3. Familiarizing students the fundamentals of shell scripting/programming 4. Helping to perform simple concurrent programs **5.** Explaining to write and use moderately complex regular expressions 6. Familiarizing students with basic Linux administration.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Use and execute basic Linux commands and understand features of Linux 2. Use Vi editor 3. Use and write Shell Programming using Linux 4. Write and use moderately complex regular expressions. 5. Perform basic Linux administration					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	-	-	-	-								2		
CO2	2	-	-	-	-								2		
CO3	2	-	-	-	1								2		
CO4	2	1	-	-	1								2		
CO5	2	-	-	-	1								2		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Introduction to Linux and Linux utilities – A brief history of Linux Architecture , Features of Linux , Linux commands- PATH, man, echo, printf, script, passwd, uname, who, date, sty, pwd, cd, mkdir, rmdir etc	3
II	The File System: Basic File Attributes, the vi Editor	4
III	The Shell, The Process, Customizing the environment	5
IV	More file attributes, Simple filters	4

V	Filters using regular expressions	5
VI	Essential Shell Programming, awk – An Advanced Filter	5

Experiment No.	Experiment Titles	Hours
1.	Introduction Linux Operating System- Linux Architecture, features of Linux, Versions of Linux	02
2.	Study basic Linux Commands	02
3.	Study File System commands and basic File Attributes	02
4.	Vi Editor: Hands-on	02
5.	Shell Script: Basic Commands	02
6.	Shell Script: Control Statements (Fibonacci Program)	02
7.	Shell Script: Function arrays- string operation and addition	02
8.	Shell Script: Head, tell, wc, sort, eval	02
9.	Shell Script: Regular expression, cut and grep command	02
10.	Shell Script: awk	02
11.	Essential system Administration concepts and commands	02
12.	Design a calculator using different commands	02

General Instructions: Students have to perform minimum 8 to 10 practical's

Text Books	
i)	Unix Concepts and Applications, 4thedititon , Sumitabha Das , MGH
ii)	Linux system programming, Robert Love, O` Reilly, SPD
Reference Books	
i)	Beginning Linux Programming, 4th edition, N . Mathew, R.stone, Wrox Willey India Edition
ii)	Linux, The Complete Reference , 6th edition, Richard Petersen, MGH

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV					
Course Code	PCC226					
Course Category	Professional Core					
Course title	**Object Oriented Programming Lab**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	-	-	04	04		02
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**
	-	-		50	50	100
Pre-requisites(if any)	Knowledge of Programming Methodology, 'C' language					
Course Objectives	The Course is aimed to- 1. Introduce students to the principals and concepts of object oriented programming paradigm 2. Familiarize students with the basics of C++ language and its features 3. Impart knowledge about inheritance and polymorphism and their implementation in C++ 4. Provide an understanding of file handling and streams for input/output operations. 5. Explore advanced features of C++ including templates, standard template library and exception handling 6. Enhance problem solving skills through practical implementation of concepts learned in C++ programming.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Demonstrate solid understanding of fundamental principal of object oriented programming and its significance in software development. 2. Proficient in C++ Programming language. 3. Implement OO features like inheritance and polymorphism 4. Implement function overloading, operator overloading and virtual functions. 5. Proficient in file handling operations. 6. Utilize C++ features of exception handling.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	3														
CO2			3												
CO3		2	3												
CO4			2												
CO5					2										
CO6			3												3

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Introduction to Object Oriented Programming:** Introduction object-oriented programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, features of OOP.	2
II	**Basics of C++ programming:** Variable declarations, global scope, const variables, reference variables, functions with default arguments, call by value, call by reference, returning by reference, call by pointer, Classes and Objects defining Class, data members, member functions, Access specifies – public, private, protected, constructor, destructor.	2
III	**Inheritance:** Need of Inheritance, Concept, public, private, protected inheritance, inheritance type, Virtual base class, method overriding, static variable, static function, friend function, friend class	2
IV	**Polymorphism:** Pointers basics of memory management, New and delete operators, Pointer to object, Pointer to data members, this pointer. Need of Polymorphism, concept, Compile time polymorphism or early binding: function over loading and operator overloading, overloading - unary, binary, arithmetic operators, relational operators, Run time polymorphism or late binding using Virtual function, pure virtual function, Abstract class, Type conversion	3
V	**Files and Streams:** Concept of Streams, concept of File, opening and closing a file, detecting end-of-file, file modes, file pointer, reading and writing characters, strings and objects to the file, operations to move file pointers i.e seekg, seekp, tellg, tellp	2
VI	**Advanced C++ features:** Introduction to Generic Programming using Templates: Function template and class template, Introduction to Standard Template Library (STL), containers, iterators and algorithms, study of container template classes for vectors and stacks and related algorithms Exception handling: Introduction, syntax for exception handling code: try- catch-throw, Multiple Exceptions, Exceptions with arguments	2
Reference Books		
i)	C++: The Complete Reference Fourth Edition - Herbert Schildt (McGraw-Hill) , 4th edition	
ii)	C++ programming: From Problem Analysis to Program Design Fifth Edition -D.S. Malik (Cengage Learning)	
iii)	C++ Programming with language –Bjarne Stroustrup (AT & T), 4th edition	
iv)	Object Oriented Programming with C++ Fourth Edition-E Balguruswamy (McGraw-Hill), 4th edition	
v)	Object oriented Programming in C++ 3rd Edition-R.Lafore (Galgotia Publications), 3rd Edition	
vi)	C++ programming –John Thomas Berry(PHI), 2nd Edition	
vii)	Object –Oriented Analysis & Design: Understanding System Development with UML 2.0 , Docherty, Wiley India Ltd.	
viii)	http://www.spoken-tutorial.org/ NMEICT Project of Govt. Of India.	

Experiment No.	Experiment Title/Objective	Hours
1.	Write a program to demonstrate concept of class. For example: create class matrix, class string, class car, class date, class time, class person etc.	02
2.	Write a program to demonstrate following Function concepts a. Function overloading b. Constructors of all types c. Default parameters, returning by reference id. Demonstration of friend function e. Demonstration of static function	02
3.	Write a program to demonstrate a. Operator overloading –for unary as well as binary operation. b. Apply above concept on matrix and string classes created above	02
4.	Write a program to demonstrate C++ s capability of all types of inheritance a. Single, multiple, multivalued b. Virtual function. c. Abstract class d. Runtime polymorphism	02
5.	Write a program for new and delete operators, pointers to objects.	02
6.	Write a program for pointers to pointers, this pointer.	02
7.	Write a program for Templates, Exception handling.	02
8.	Write a program for Stack and Queue.	02
9.	Write a program for the linked list,	02
10.	Write a program for Binary tree, Traversal of a Binary tree.	02

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV						
Course Code	IKS221						
Course Category	Indian Knowledge Systems						
Course title	**Introduction to Performing Arts**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	01	-	-	01		01	
Evaluation Scheme	**ISE**	**ESE**		**IE**	**EE**	**Total**	
	-	-		50	-	50	
Course Rationale:	The course "Introduction to Performing Arts" seeks to broaden the horizons of engineering students by integrating the rich and diverse realm of performing arts into their curriculum. By exploring various performing arts forms, students will not only develop a deeper understanding of human expression but also enhance their creativity, communication skills, and cultural awareness. This interdisciplinary approach aligns with NEP 2020's vision of holistic education and fosters the development of well-rounded individuals equipped to thrive in a rapidly evolving world.						
Course Objectives	The Course is aimed to- 1. Introduce fundamental concepts, history, and theoretical frameworks of various performing arts forms. 2. Cultivate appreciation for cultural, social, and aesthetic dimensions of performing arts. 3. Develop critical thinking and analytical skills through performance analysis. 4. Enhance communication and presentation skills through practical exercises. 5. Foster creativity and imagination through exploration of diverse performing arts mediums.						
Course Outcomes	Upon completion of this course, student should be able to – 1. Identify and analyze key elements and techniques across theater, dance, music, and visual arts. 2. Demonstrate understanding of historical, cultural, and social contexts in performing arts. 3. Critically evaluate performances using appropriate terminology. 4. Apply performance principles to effectively communicate ideas and emotions. 5. Engage in creative expression through original performances.						

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1	3	2	2		2		2								
CO2						3	2								
CO3							2		3	3					
CO4						2		2	3	3					
CO5											3				

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	**Foundations of Performing Arts** • Introduction to Performing Arts: Definition, scope, and significance. • Historical overview: Evolution of performing arts across cultures and civilizations.	2
II	**Theatrical Arts** • Introduction to theater: Origins, elements, and dramatic conventions. • Major theatrical movements and styles: Realism, surrealism, absurdism, etc. • Analysis of selected plays and playwrights.	3
III	**Dance Forms** • Introduction to dance: Styles, techniques, and cultural contexts. • Exploration of classical, folk, and contemporary dance forms. • Practical exercises and choreography workshops.	3
IV	**Musical Expressions** • Introduction to music: Basic principles, genres, and traditions. • Appreciation of classical, folk, and popular music styles. • Analysis of musical compositions and performances.	2
V	**Visual Performing Arts** • Introduction to visual arts in performance: Set design, costume, and makeup. • Role of visual elements in enhancing the theatrical experience. • Case studies and practical demonstrations.	2
VI	**Performance and Presentation** • Practical application of performing arts principles: Group performances and presentations. • Rehearsal techniques, stage presence, and audience engagement. • Reflection and feedback on individual and group performances.	2
	Reference Books	
i)	Bharata Muni, *Natyashastra*, An ancient Indian treatise on performing arts covering various aspects of classical dance, music, and drama, composed between 200 BCE and 200 CE, influencing the theory and practice of Indian performing arts for centuries.	
ii)	Girish Karnad. (2005). Collected Plays: Volume 1. Oxford University Press.	
iii)	Mohan Khokar. (2000). Traditions of Indian Classical Dance. Clarion Books	
iv)	Sunil Kothari. (2001). Kathak, Indian Classical Dance Art. Abhinav Publications.	

v)	Sangeet Natak Akademi. (2005). Indian Music: Tradition and Trends. Sangeet Natak Akademi.
vi)	P. Sambamurthy. (2010). South Indian Music, Vol. 1. The Indian Music Publishing House.
vii)	Kapila Vatsyayan. (2007). Indian Classical Dance: Tradition in Transition. Publications Division, Ministry of Information and Broadcasting, Government of India.
viii)	Vijay Tendulkar. (2010). Collected Plays in Translation. Oxford University Press.
Useful Links	
i)	https://www.youtube.com/watch?v=W7bEzgZrN7s
ii)	https://www.youtube.com/watch?v=DQbNpx_CfJY
iii)	https://www.youtube.com/watch?v=eGiz50aVYWQ
Assessment	

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. Following Evaluation Components are suggested:

- Written Assignments: 20 Marks
- Practical Assessments: 20 Marks
- Class Participation and Engagement: 10 Marks

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV			
Course Code	MAC 221			
Course Category	Mandatory Audit Course			
Course title	**Aptitude Enhancement Course I**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	01	-	01
Evaluation Scheme	IE at Course in charge end			
Course Rationale	This Aptitude Enhancement Course I aims to nurture holistic development among second-year B. Tech. Engineering students by focusing on enhancing their critical thinking, problem-solving skills, creativity, and emotional intelligence. Aligned with the NEP 2020 and Outcome-Based Education (OBE) philosophy, the course seeks to empower students with essential aptitudes required for success in both academic and professional domains.			
Course Objectives	The Course is aimed to- 1. Equip students with critical thinking skills through analytical exercises and problem-solving tasks. 2. Foster creativity and innovation by engaging students in structured workshops and practical projects. 3. Develop students' emotional intelligence through self-awareness activities and stress management techniques. 4. Enhance collaborative skills and effective communication through group discussions and team-based projects.			
Course Outcomes	Upon completion of this course, student should be able to – 1. Demonstrate proficiency in critical thinking by analysing complex problems and proposing effective solutions. 2. Exhibit creativity through the development of innovative projects and solutions. 3. Display heightened emotional intelligence by managing stress, communicating empathetically, and resolving conflicts constructively. 4. Showcase collaborative skills by actively participating in group activities, contributing to team goals, and communicating ideas effectively.			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		3		3						2					
CO2		2			2	1									
CO3						3	2	3							
CO4									3	3	2	1			

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Inter-Personal & Inter-Organisational Communication	2
II	Creative & Critical Thinking	2
III	Group Dynamics & Decision-Making Techniques	2
IV	Emotional Intelligence & Stress Management	3
V	Assessment	5

Reference Books

i)	Chakravarthi T. Kalyana and Chakravarthi T. Latha, *Soft Skills for Managers* (Biztantra Publications, 2014 (ISBN: 978-81-7722-568-6))
ii)	Kumar Sanjay and Pushp Lata (2015), *Communication Skills*, 2nd Edition, Oxford University Press, (ISBN: 9780199457069)
iii)	P. D. Chaturvedi and Mukesh Chaturvedi (2017), *The Art and Science of Business Communication-Skills, Concepts, Cases and Applications*, 4th Edition, Pearson India Education Services Pvt. Ltd., (ISBN 978-93-325-8728-1)
iv)	Wright, L. (2001). Critical Thinking: An Introduction to Analytical Reading and Reasoning. Oxford University Press.
v)	Kallet, M. (2014). Think Smarter: Critical Thinking to Improve Problem-Solving and Decision-Making Skills. Wiley.
vi)	Bradberry, T., & Greaves, J. (2009). Emotional Intelligence 2.0. TalentSmart.
vii)	Dweck, C. S. (2007). Mindset: The New Psychology of Success. Ballantine Books.

Assessment

For the internal assessment of the course, with a total evaluation is of 50 marks. Combination of different evaluation methods can be utilized to ensure comprehensive assessment of the students' performance. The assessment will focus real-world scenarios that require the application of critical thinking, problem-solving, creativity, emotional intelligence, and teamwork. Following Evaluation Components are suggested:

1. Activity 1- Group Presentation (20 marks)
2. Activity 2- Group Discussion (20 marks)
3. Classroom Participation and Engagement (10 marks)
   Active participation in class discussions, group activities and question-answer sessions.

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV			
Course Code	PBL221			
Course Category	Project Based Learning			
Course title	**Mini Project II**			
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**
	-	01	-	01
Evaluation Scheme	IE at Course in charge end			
Pre-requisites(if any)	Basics of Programming Language and Computers			
Course Objectives	The Course is aimed to- 1. Create awareness among the students to express technical ideas, strategies and methodologies in written form. 2. Enable students to work as a responsible member and possibly a leader of a team in developing software solutions. 3. Motivate students to self-learn new tools, algorithms, and/or techniques that contribute to the software solution of the project 4. . Create awareness among the students of the characteristics of several domain areas where IT can be effectively used. 5. Improve the team building, communication and management skills of the students 6. Enable students to develop a design solution for a set of requirements			
Course Outcomes	Upon completion of this course, student should be able to – 1. Acquire practical knowledge within the chosen area of technology for project development 2. Identify, analyze and handle programming projects with a comprehensive and systematic approach 3. Contribute as an individual or in a team in development of technical projects 4. Develop effective communication skills for presentation of project related activities 5. Formulate and propose a plan for creating a solution for the problem identified 6. Report and present the findings of the study conducted in the preferred domain			

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1		2	2												
CO2		2	2	2											
CO3									2	2					
CO4							2								
CO5						2									
CO6											2	2			

Level of Mapping as: Low 1, Moderate 2, High

Course Content
Mini Project II is a continuation of the experiential learning journey initiated in Semester III. Building upon the foundations laid in Mini Project I , students will delve deeper into project activities related to their chosen area of interest within Computer Science and Technology. The course encompasses following component: 1. Mini Project II: Students will continue their project activities from the preceding semester, further refining their research objectives, conducting experiments, analyzing data, and presenting findings. Emphasis will be placed on applying advanced concepts and techniques to address specific challenges or opportunities identified in the chosen project area. The course will be conducted over the duration of one tutorial hour per week, with additional time allocated for project work as necessary. Assessment will be based on project presentations, reports, evaluating students' understanding, application, and integration of theoretical and practical knowledge. The mini-project should be undertaken preferably by a group of 3 students who will jointly work and implement the mini-project. The group will select a project with the approval of the guide. A batch of practical / Tutorial will be divided into mini project groups. Mini project topics and the work for these groups in the batch will be guided by a teacher for the batch, preferably on one of the topics like Compiler Construction, Database Engineering, Operating System, Computer Graphics and Multimedia, Advanced Programming and latest developments and trends in Computer Science and Technology. The teacher will periodically assess the performance of individual student in the mini project, jointly with a teacher of another batch. Project group will submit hardcopy project report along with project demonstration software in CD and/or project hardware gadget at the term end. The IOE of mini project will be jointly conducted by appointed examiners. Note: Use of Open source tools should be preferred.
Course Assessment Process
The course assessment process will be similar to that mentioned under Mini Project I.

Year, Program, Semester	S.Y. B.Tech (Computer Science and Technology) , Part II, Semester IV				
Course Code	HSMEC221				
Course Category	Humanities, Social Science, Management Environment				
Course title	**Environmental Studies**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	02	-	-	02	00
Evaluation Scheme	University exam at year end				
Pre-requisites(if any)	-				
Course Objectives	The Course is aimed at- 1. Explaining the types of environmental pollution. 2 Helping to make the students recognize social issues and the environment connectivity with the same. 3. Discussing various environmental Protection Acts reveal the students the importance of the same. 4. Explaining the students to adapt to various environmental technologies.				
Course Outcomes	Upon completion of this course, student should be able to – 1. Identify the pollutants and respond to the pollution problem 2. Acquire knowledge of ecological threats and choose for sustainable developments. 3. Anticipate all these laws and follow the same for the care of the environment. 4. Apply their knowledge to implement pollution prevention measure through some practical work				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO12	PSO 1	PSO 2	PSO3
CO1							3		2	1	2				
CO2							3		2	1					
CO3							3	1							
CO4			1				3		2		3				

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
V	**Environmental pollution:** Definition: Causes, effects and control measures of: a) Air pollution, b) Water pollution, c) Soil pollution, d) Marine pollution, e) Noise pollution, f) Thermal pollution, g) Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies Disaster management: Floods, earthquake, cyclone and landslides. Tsunami 06	6
VI	**Social issues and the environment :** From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Resettlement and rehabilitation	8

	of people; its problems and concerns; Environmental ethics: Issue and possible solutions; Climate change, Global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust; Wasteland reclamation; Consumerism and waste products.	
VII	**Environmental protection :** Environment Protection Act.; Air (Prevention and Control of Pollution) Act.; Water (Prevention and control of Pollution) Act; Wildlife Protection Act; Forest Conservation Act; Population Growth and Human Health, Human Rights. ;Field Work-Visit to a local area to document environmental assets river/forest/grassland/hill/mountain or Visit to a local polluted siteurban/rural/Industrial/Agricultural or Study of common plants, insects, birds or Study of simple ecosystems-ponds, river, hill slopes, etc.	6
VIII	**Project / Field work:**	10
Reference Books		
i)	Agarwal, K. C. 2001, Environmental Biology, Nidi Publ. Ltd., Bikaner.	
ii)	BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad, 380013, India	
iii)	Brunner R. C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p	
iv)	Clark R. S., Marine Pollution, Clanderson Press Oxford (TB) Pg No. 6	
v)	Cunningham, W. P. Cooper, T. H. Gorhani, E. & Hepworth, M. T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p	
vi)	De A. K., Environmental Chemistry, Wiley Eastern Ltd.	
vii)	Down to Earth, Centre for Science and Environment (R)	

Equivalence for the curriculum revision at B. Tech Computer Science and Technology

The above syllabus structure is a revised version of the Second Year B. Tech (Computer Science and Technology) Program being conducted by Shivaji University at its Technology Department. A special mention rather feature of this revision is, ***it is in line with New National Education Policy 2020 guidelines.*** This syllabus is to be implemented from June 2024, (Academic year 2024-25).

The Equivalence for the Courses of Computer Science and Technology at Second Year B Tech Semester III and IV pre-revised Program under the faculty of Science and Technology is as follows.

Semester III

Sr. No.	Second Year B. Tech Semester III Pre-revised syllabus	Second Year B. Tech Semester III Revised syllabus	Remark
1	Applied Mathematics-I	Applied Mathematics- I	Content is revised
2	Discrete Mathematical Structure	Discrete Mathematical Structure	No change in the subject content
3	Digital System and Microprocessor	Digital System and Microprocessor	No change in the subject content
4	Data Structures	Data Structures	No change in the subject content
5	Data Communication and Networking	Data Communication and Networking	No change in the subject content
6	Digital System and Microprocessor Lab	Digital System and Microprocessor Lab	No change in the subject content
7	Data Structures Lab	Data Structures Lab	No change in the subject content
8	Data Communication and Networking Lab	Data Communication and Networking Lab	No change in the subject content
9	Environmental Studies	Environmental Studies	No change as it is centrally offered by the University.
10	Soft Skills Development	Soft Skills Development	Content is revised and made it as a Credit course
11	------	Mini Project I	Newly introduced audit course.
12	Introduction to Performing Arts	------	Shifted to Sem IV

Semester IV

Sr. No.	Second Year B. Tech Semester IV Pre-revised syllabus	Second Year B. Tech Semester IV Revised syllabus	Remark
1	Theory of Computation	Theory of Computation	No change in the subject content
2	Advanced Microprocessor	Advanced Microprocessor	No change in the subject content
3	Computer Organization	Computer Organization	No change in the subject content
4	Software Engineering	Software Engineering	No change in the subject content
5	Applied Mathematics-II	Applied Mathematics-II	No change in the subject content
6	Advanced Microprocessor Lab	Advanced Microprocessor Lab	No change in the subject content
7	Linux and Shell Programming Lab	Linux and Shell Programming Lab	No change in the subject content
8	Object Oriented Programming Lab	Object Oriented Programming Lab	No change in the subject content
9	Environmental Studies Project Work	Environmental Studies	No change in the subject content. Only change in Title.
10	Soft Skills Development	------	Shifted to Sem III
11	-	Multidisciplinary Minor Course I	As per NEP feature, MDM is introduced.
12	------	Aptitude Enhancement Course -I	Newly introduced
13	------	Mini Project II	Newly introduced
14	------	Introduction to Performing Arts	Made it as a Credit course with content revision.