ACADEMIC REGULATIONS & CURRICULUM

Applicable to the students admitted from the Academic Year 2023-2024

INFORMATION TECHNOLOGY
(B.Tech. Programme)

MAHARAJ VIJAYARAM GAJAPATHI RAJ COLLEGE OF ENGINEERING
(Autonomous)

(Approved by AICTE, New Delhi, and permanently affiliated to JNTUGV, Vizianagaram) Listed u/s 2(f) & 12(B) of UGC Act 1956.

Vijayaram Nagar Campus, Chintalavalasa,Vizianagaram-535005, Andhra Pradesh

The visionaries

Late Dr. P V G Raju
Raja Saheb of Vizianagaram
Founder Chairman-MANSAS
Ex-Minister for Education and Health, Govt. of AP
Ex Member of Parliament

Late Dr. P. Anand Gajapathi Raju
Ex-Chairman-MANSAS
Ex-Minister for Education and Health
Govt. of AP
Ex Member of Parliament

P. Ashok Gajapathi Raju
Chairman-MANSAS
Ex-Union Minister for Civil Aviation,
Govt. of India
Ex-Minister for Finance, Govt. of AP

Academic Regulations (R23) for B. Tech (Regular-Full time)
(Effective for the students admitted into I year from the Academic Year **2023-24** onwards)

1. Award of the Degree

(a) **Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfills the following:**

(i) Pursues a course of study for not less than four academic years and not more than eight academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Eight years).

(ii) Registers for 160 credits and secures all 160 credits.

(b) **Award of B.Tech. degree with Honors**

A student will be declared eligible for the award of the B.Tech. with Honors if he/she fulfills the following:

(i) Student secures additional 18 credits fulfilling all the requisites of B.Tech. program i.e., 160 credits.
(ii) Registering for Honors is optional.
(iii) Honors is to be completed simultaneously with B.Tech. programme.

Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech. course and their admission stands cancelled. This clause shall be read along with clause 1 a) i).

2. Admissions

Admission to the B. Tech Program shall be made subject to the eligibility, qualifications and specialization prescribed by the A.P. State Government/University from time to time. Admissions shall be made either based on the merit rank obtained by the student in the common entrance examination conducted by the A.P. Government/University or any other order of merit approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

3. Program related terms

Credit: A unit by which the course work is measured. It determines the number of hours of instruction required per week. One credit is equivalent to one hour of teaching (Lecture/Tutorial) or two hours of practical work/field work per week.

Credit definition:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credit
2 Hrs. Practical (Lab) per	1 credit

a) ***Academic Year***: Two consecutive (one odd + one even) semesters constitute one academic year.
b) ***Choice Based Credit System (CBCS):*** The CBCS provides a choice for students to select from the prescribed courses.

4. Semester/Credits:

i. A semester comprises 90 working days and an academic year is divided into two semesters.
ii. The summer term is for eight weeks during summer vacation. Internship/ apprenticeship / work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study.
iii. Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.
iv. The Universities/HEIs can decide on the courses to be offered in the summer term depending on the availability of faculty and the number of students.

5. Structure of the Undergraduate Programme

All courses offered for the undergraduate program (B. Tech.) are broadly classified as follows:

S.No.	Category	Breakup of Credits (Total 160)	Percentage of total credits	AICTE Recommendation (%)
1.	Humanities and Social Science	13	8 %	8 – 9%
2.	Basic Sciences (BS)	20	13 %	12 - 16%
3.	Engineering Sciences (ES)	23.5	14%	10 – 18%
4.	Professional Core (PC)	54.5	34 %	30 – 36%
5.	Electives – Professional (PE) & Open (OE); Domain Specific Skill Enhancement Courses (SEC)	33	21 %	19 - 23%
6.	Internships & Project work	16	10 %	8 – 11%
7.	Mandatory Courses (MC)	Non-credit	Non-credit	-

6. Course Classification:

All subjects/ courses offered for the undergraduate programme in Engineering & Technology (B.Tech. degree programs) are broadly classified as follows:

S.No.	Broad Course Classification	Course Category	Description
1.	Foundation Core Courses	Foundation courses	Includes Mathematics, Physics and Chemistry; fundamental engineering courses; humanities, social sciences and
2.	Core Courses	Professional Core Courses (PC)	Includes subjects related to the parent discipline /department / branch of Engineering
3.	Elective Courses	Professional Elective	Includes elective subjects related to the parent
		Open Elective Courses (OE)	Elective subjects which include interdisciplinary subjects or subjects in an area outside the
		Domain specific skill enhancement	interdisciplinary/job-oriented/domain courses which are relevant to the industry
4.	Project & Internships	Project	B.Tech. Project or Major Project
		Internships	Summer Internships – Community based and Industry Internships; Industry oriented Full Semester
5.	Audit Courses	Mandatory non-	Covering subjects of developing desired attitude

7. Programme Pattern

i. Total duration of the B. Tech (Regular) Programme is four academic years.
ii. Each academic year of study is divided into two semesters.
iii. Minimum number of instruction days in each semester is 90 days.
iv. There shall be mandatory student induction program for fresher's, with three-week duration before the commencement of first semester. Physical activity, Creative Arts, Universal Human Values, Literary, Proficiency Modules, Lectures by Eminent People, Visits to local Areas, Familiarization to Dept./Branch & Innovations etc., are included as per the guidelines issued by AICTE.
v. Health/wellness/yoga/sports and NSS /NSS /Scouts & Guides / Community service activities are made mandatory as credit courses for all the undergraduate students.
vi. Courses like Environmental Studies, Ethics and Human values are offered as non-credit mandatory courses for all the undergraduate students.
vii. Increased flexibility for students through an increase in the elective component of the curriculum, with 05 Professional Elective courses and 08 Open Elective courses.
viii. Professional Elective Courses, include the elective courses relevant to the chosen specialization/branch. Proper choice of professional elective courses can lead to students specializing in emerging areas within the chosen field of study.
ix. A total of 29 credits are offered in the curriculum as Extended Open Elective Cluster (EOEC). A student can complete the requirement for B.Tech. Degree with a Minor within the 160 credits by opting for the

courses offered through various verticals/tracks under Extended Open Elective Cluster (EOEC).

x. While choosing the electives, students shall ensure that they do not opt for the courses with syllabus contents similar to courses already pursued.
xi. A pool of interdisciplinary/job-oriented/domain skill courses which are relevant to the industry are integrated into the curriculum of all disciplines.
xii. Students shall undergo summer internships, for a period of four week's duration at the end of second and third year of the programme. The internship at the end of second year shall be community oriented and industry internship at the end of third year.
xiii. There will be Project work in the final semester of the programme.
xiv. Undergraduate degree with Honors is introduced by the University for the students having good academic record.

8. Evaluation Process

The performance of a student in each semester shall be evaluated subject wise with a Maximum of 100 marks for theory and 100 marks for practical subject. Summer Internships shall be evaluated for 50 marks, Project work in final semester shall be evaluated for 200 marks, and mandatory courses with no credits shall be evaluated for 30 mid semester marks.

A student has to secure not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester and end examination marks taken together for the theory, practical, design, drawing subject or project etc. In case of a mandatory course, he/she should secure 40% of the total marks.

THEORY COUSES

Assessment Method	Marks
Continuous Internal	30
Semester End Examination	70
Total	100

i. For theory subject, the distribution shall be 30 marks for Continuous Internal Assessment and 70 marks for the End-Examination.
ii. For practical subject, the distribution shall be 30 marks for Internal Evaluation and 70 marks for Semester End Examination.
iii. If any course contains two different branch subjects, the syllabus shall be written in two parts with 3 units each (Part-A and Part-B) and external examination question paper shall be set with two parts each for 35 marks.

a) Continuous Internal Evaluation

i. For theory subjects, during the semester, there shall be two midterm examinations. Each midterm examination shall be evaluated for 30 marks of which 10 marks for objective paper (20 minute's duration), 15 marks for subjective paper (90 minutes duration) and 5 marks for assignment.
ii. Objective paper shall contain for 05 short answer questions with 2 marks each. Subjective paper shall contain 3 either or type questions (totally six questions from 1 to 6) of which student has to answer one from each either-or type of questions. Each question carries 10 marks. The marks obtained in the subjective paper are condensed to 15 marks.

iii. First midterm examination shall be conducted for I, II units of syllabus with one either or type question from each unit and third either or type question from both the units. The second midterm examination shall be conducted for III, IV and V units with one either or type question from each unit.
iv. Final mid semester marks shall be arrived at by considering the marks secured by the student in both the mid examinations with 80% weightage given to the better mid exam and 20% to the other.

For Example:
Marks obtained in first mid: 25
Marks obtained in second mid: 20
Final mid semester Marks: (25x0.8) + (20x0.2) = 24

If the student is absent for any one midterm examination, the final mid semester marks shall be arrived at by considering 80% weightage to the marks secured by the student in the appeared examination and zero to the other. For Example:

Marks obtained in first mid: Absent
Marks obtained in second mid: 25
Final mid semester Marks: (25x0.8) + (0x0.2) =20

b) End Examination Evaluation:

End examination of theory subjects shall have the following pattern: There shall be 6 questions and all questions are compulsory.

i. Question I shall contain 10 compulsory short answer questions for a total of 20 marks such that each question carries 2 marks.
ii. There shall be 2 short answer questions from each unit.
iii. In each of the questions from 2 to 6, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv. The questions from 2 to 6 shall be set by covering one unit of the syllabus for each question.

End examination of theory subjects consisting of two parts of different subjects, *for example*: Basic Electrical &Electronics Engineering shall have the following pattern:

i. Question paper shall be in two parts viz., Part A and Part B with equal weightage of 35 marks each.
ii. In each part, question 1 shall contain 5 compulsory short answer questions for a total of 5 marks such that each question carries 1mark.
iii. In each part, questions from 2 to 4, there shall be either/or type questions of 10 marks each. Student shall answer any one of them.
iv. The questions from 2 to 4 shall be set by covering one unit of the syllabus for each question.

PRACTICAL COURSES

Assessment Method	Marks
Continuous Internal	30
Semester End Examination	70
Total	100

a) For practical courses, there shall be a continuous evaluation during the semester for 30 sessional marks and end examination shall be for 70 marks.
b) Day-to-day work in the laboratory shall be evaluated for 15 marks by the concerned laboratory teacher based on the regularity/record/viva and 15 marks for the internal test.
c) The end examination shall be evaluated for 70 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same department.

Procedure	: 20 Marks
Experimental work & Results	: 30 marks
Viva voce	: 20 marks.

d) In a practical subject consisting of two parts (Eg: Basic Electrical &Electronics Engineering Lab), the end examination shall be conducted for 70 marks as a single laboratory in 3 hours.

e) Engineering Graphics evaluation

For the subject having design and/or drawing, such as Engineering Drawing, the distribution of marks shall be 30 for mid semester evaluation and 70 for end examination.

Assessment Method	Marks
Continuous Internal	30
Semester End	70
Total	100

Day-to-day work shall be evaluated for 15 marks by the concerned subject teacher based on the reports/submissions prepared in the class and 15 marks for the internal test.

The end examination pattern for Engineering Graphics, shall consist of 5 questions, either/or type, of 14 marks each. There shall be no objective type questions in the end examination.

9. a) NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totaling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

b) HEALTH AND WELLNESS, YOGA AND SPORTS

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

There shall be no external examination for mandatory courses with zero credits. However, attendance shall be considered while calculating aggregate attendance and student shall be declared to have passed the mandatory course only when he/she secures 40% or more in the internal examinations. In case, the student fails, a re-examination shall be conducted for failed candidates for 30 marks satisfying the conditions mentioned in item 1 & 2 of the regulations.

The laboratory records and mid semester test papers shall be preserved for a minimum of 1 year in the respective institutions and shall be produced to the Committees of the University as and when the same are asked for.

10. Community Project:

There will be a summer break of 4 to 6 weeks at the end of each academic year to provide opportunity to students to engage in internships with industry/government agencies/NGO etc. These internships are intended to give exposure to the students through Community Projects and Mini Projects.

- A student shall identify and provide a solution to the problem relevant to society.
- A student shall engage at least 30 hours on community project. Community project shall be evaluated internally for 50 marks by Project Review Committee (PRC). PRC comprising of HoD, Two senior faculty and guide shall review the progress.
- There shall be no Continuous Assessment marks for these projects.
- A student shall secure minimum 40% of marks for successful completion.

In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the Institution.

11. Mini Project:

- A student shall undergo internship (Physical/Virtual) for a period of 4 weeks and provide solution to the problem relevant to Industry/ Modern tool during the vacation after VI semester and submit comprehensive report/certificate (For virtual internship) issued by external agencies.

- The recommended Virtual Internships offered by external agencies/regulating bodies like AICTE/APSCHE etc, conversions and appropriate grades/marks are to be approved by the BoS at the beginning of the semester.
- Mini project shall be evaluated internally for 50 marks by Project Review Committee (PRC). PRC shall prepare rubrics for assessment.

12. Skill Enhancement Course:

Skill Enhancement Course is assessed for 100 marks, of which, 30 marks for internal assessment and 70 marks for semester end examination.

Assessment Method	Marks
Continuous Internal	30
Semester End Examination	70
Total	100

Continuous Internal Assessment : (30 Marks)
Continuous assessment : 15 Marks
Internal test : 15 Marks

The end examination shall be evaluated for 70 marks, conducted by the concerned course teacher and a senior expert in the subject from the same department.

Procedure : 20 Marks
Experimental work & Results : 30 marks
Viva voce : 20 marks.

The student shall be given an option to choose either the skill courses being offered by the college or to choose a certificate course (Minimum 30 hours) being offered by industries / Professional bodies or any other accredited bodies. If a student chooses to take a Certificate Course offered by external agencies, the credits shall be awarded to the student upon producing the Course Completion Certificate from the agency. A committee shall be formed at the level of the college to evaluate the grades/marks given for a course by external agencies and convert to the equivalent marks/grades.

The recommended courses offered by external agencies, conversions and appropriate grades/marks are to be approved by the BoS at the beginning of the semester.
If a student prefers to take a certificate course offered by external agency and approved by BoS, the department shall mark attendance of the student for the remaining courses in that semester excluding the skill course in all the calculations of mandatory attendance requirements upon producing a valid certificate as approved by the BoS.

Evaluation pattern for Quantitative Problem Solving Techniques :

The Course is assessed for 100 marks, of which, 30 marks for internal assessment and 70 marks for semester end examination.

Assessment Method	Marks
Continuous Internal	30
Semester End Examination	70
Total	100

Continuous Internal Assessment : (30 Marks)
Continuous assessment : 15 Marks
Internal test : 15 Marks

The end examination shall be evaluated for 70 marks, conducted by the concerned course teacher and a senior expert in the subject from the same department.

Objective Test (MCQs, 50 Questions Each one mark) : 50 Marks
Viva voce : 20 marks.

13. Main Project Work:

The 4th Year of study comprises only self-study courses giving opportunity to students to spend one full year as an intern at various organizations (government/private) in pursuance of his/her career aspiration. The student is also expected to complete the Main Project during this period. At the end of the year, the candidate shall submit the main project report.

The project report shall be evaluated with an external examiner. The total marks for project work is **200 marks** and the distribution shall be **60 marks** for continuous assessment and **140 marks** for summative assessment. The supervisor assesses the student for 30 marks (Report: 20 marks, Seminar: 10 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

The college shall facilitate and monitor the student main project/internship programs. Completion of the main project is mandatory. If any student fails to complete the main project, he/she will not be eligible for the award of degree. In such cases, the student shall repeat and complete the main project.

14. Massive Open Online Courses (MOOCs):

- It is recommended to register and complete minimum two courses through MOOCs approved by the BoS. A student can pursue courses other than core through MOOCs. A student is not permitted to register and pursue core courses through MOOCs.

- The student shall register for the (Minimum of 12 weeks) courses offered by SWAYAM/NPTEL as Program elective/Open elective with the approval of the BoS. The Head of the Department shall appoint one mentor for each MOOC. The student has to submit the pass certificate issued by SWAYAM/NPTEL after completion of the course.

- Students who have qualified in the proctored examinations conducted through MOOCs platform can apply for credit transfer as specified and are exempted from appearing internal as well as external examination (for the specified equivalent credit course only) conducted by the Institution.

  Necessary amendments in rules and regulations regarding adoption of MOOC courses would be proposed from time to time.

15. Academic Bank of Credits (ABC)

The Institution is part of the Academic Bank of Credits (ABC) initiative to promote increased opportunity of mobility for a student (as per NEP 2020). As such,

i. A student, upon joining the institution, will become part of the ABC.

ii. All credits earned by the students in the institution as well as through MOOCs will be reflected in his/her account in the ABC

iii. The student will be able to avail transfer of credits earned from other institutions to his account as per the regulations of UGC/AICTE/JNTUGV declared from time to time.

16. Guidelines for offering Honors

The objective of introducing B.Tech.(Honors) is to facilitate the students to choose additionally the specialized courses of their choice and build their competence in a specialized area in the UG level. The program is a best choice for academically excellent students having good academic record and interest towards higher studies and research.

i. Honors is introduced in the curriculum of all B. Tech. programs offering a major degree and is applicable to all B.Tech (Regular and Lateral Entry) students admitted in Engineering & Technology.
ii. A student shall earn additional 18 credits for award of B.Tech.(Honors) degree from same branch/department/discipline registered for major degree. This is in addition to the credits essential for obtaining the Undergraduate degree in Major Discipline.
iii. A student is permitted to register for Honors and is allowed to take maximum of two subjects per semester pertaining to the Honors.
iv. Separate class work and timetable of the courses offered under Honors program shall be arranged.
v. Courses that are used to fulfill the student's primary major may not be double counted towards the Honors. Courses with content substantially equivalent to courses in the student's primary Major may not be counted towards the Honors.
vi. Students can complete the courses offered under Honors either in the college or in online platforms like SWAYAM with a minimum duration of 12 weeks for a 3-credit course satisfying the criteria for credit mobility. If the courses under Honors are offered in conventional mode, then the teaching and evaluation procedure shall be similar to regular B. Tech courses.
vii. A student registered for Honors shall pass in all subjects that constitute the

requirement for the Honors degree program. No class/division (i.e., second class, first class and distinction, etc.) shall be awarded for Honors degree program.

viii. If a student drops or is terminated from the Honors program, the additional credits so far earned cannot be converted into open or core electives; they will remain extra. However, such students will receive a separate grade sheet mentioning the additional courses completed by them.

ix. The Honors will be mentioned in the degree certificate as Bachelor of Technology (Honors) in XYZ. For example, B.Tech. (Honors) in Mechanical Engineering.

Enrolment into Honors:

i. Students of a Department/Discipline are eligible to opt for Honors program offered by the same Department/Discipline.

ii. The enrolment of student into Honors is based on the CGPA obtained in the major degree program. CGPA shall be taken up to IV semester in case of regular and Lateral entry students. Students having 7 CGPA without any backlog subjects will be permitted to register for Honors.

iii. Transfer of credits from Honors to regular B. Tech degree and vice-versa shall not be permitted.

iv. Honors is to be completed simultaneously with a Major degree program.

Registration for Honors:

i. The eligible and interested students shall apply through the HOD of his/her parent department. The whole process should be completed within one week before the start of every semester. Selected students shall be permitted to register the courses under Honors.

ii. The selected students shall submit their willingness to the principal through his/her parent department offering Honors. The parent department shall maintain the record of student pursuing the Honors.

iii. The students enrolled in the Honors courses will be monitored continuously. An advisor/mentor from parent department shall be assigned to a group of students to monitor the progress.

iv. There is no fee for registration of subjects for Honors program offered in offline at the respective institutions.

17. Attendance Requirements:

i. A student shall be eligible to appear for the University external examinations if he/she acquires a minimum 75% of attendance in aggregate of all the subjects.

ii. Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester may be granted by the College Academic Committee.

iii. Shortage of Attendance below 65% in aggregate shall in NO CASE be condoned.

iv. Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examination of that class and their registration shall stand cancelled.

v. A student will not be promoted to the next semester unless he satisfies the attendance requirements of the present semester. They may seek readmission for that semester from the date of commencement of class work.

vi. If the learning is carried out in blended mode (both offline & online), then the total attendance of the student shall be calculated considering the offline and online attendance of the student.

vii. For induction programme attendance shall be maintained as per AICTE norms.

18. Promotion Rules:

A student shall be promoted from IV semester to V semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits (any decimal fraction should be rounded off to lower digit) up to either III semester or IV semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Two regular and Two supplementary examinations of I semester
- Two regular and One supplementary examinations of II semester
- One regular examination and One supplementary examination of III semester
- One regular examination of IV semester.

A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits (any decimal fraction should be rounded off to lower digit) up to either V Semester or VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Three regular and Three supplementary examinations of I semester
- Three regular and Two supplementary examinations of II semester
- Two regular and Two supplementary examinations of III semester
- Two regular and One supplementary examinations of IV semester
- One regular and One supplementary examination of V semester
- One regular examination of VI semester.

19. Grading:

As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed:

After each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Range in which the marks in the subject fall	Grade	Grade points Assigned
90 & above	S (Superior)	10
80 - 89	A (Excellent)	9
70 - 79	B (Very Good)	8
60 - 69	C (Good)	7

50 - 59	D (Average)	6
40 - 49	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

i. A student obtaining Grade "F" or Grade "Ab" in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii. For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA/Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.,

$$SGPA = \Sigma (Ci \times Gi)/\Sigma Ci$$

where, Ci is the number of credits of the ith subject and Gi is the grade point scored by the student in the ith course.

The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \Sigma (Ci \times Si)/ \Sigma Ci$$

where "Si" is the SGPA of the ith semester and Ci is the total number of credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

While computing the SGPA the subjects in which the student is awarded Zero grade points will also be included.

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

20. Award of Class:

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of B. Tech. Degree, he/she shall be placed in one of the following four classes:

Class Awarded	CGPA Secured
First Class with Distinction	≥ 7.5 (Without any supplementary
First Class	≥ 6.5 < 7.5
Second Class	≥ 5.5 < 6.5
Pass Class	≥ 5.0 < 5.5

Note: * Students who have written supplementary examinations to fulfil the credit requirement will not be awarded First Class with Distinction. For such students the highest degree that is awarded will be First Class Only.

CGPA to Percentage conversion Formula – (CGPA – 0.5) x 10

21. With–holding of Results

If the candidate has any dues not paid to the university or if any case of indiscipline or malpractice is pending against him/her, the result of the candidate shall be withheld in such cases.

22. Multiple Entry / Exit option

With NEP setting in, the theme is we will need to give different entry-exit options for students and a possibility to tailor a 4-year course or even a 3-year exit degree to suit their interests and requirements.

- Exit-Entry at each year of study through the entire 4-year duration.
- Possible multiple Degree Options with different Credit requirements that provide an option to a student to pick an option that best suits his/her interests and requirements.

Note: Four Year undergraduate program (FYUP) with or without Honors is the most recommended exit. But if for some unavoidable reasons, a student needs to exit at the end of Year I, Year II, Year III, the following would be the respective exit requirements with a tentative certificate/ diploma/ degree defined.

Year of Exit	Degree	Credits Required to be Earned During Course Work	Exit Extra Credits (Crash Course & Exam)	Total Credits
End of Year I	Office Tools Certificate (Or something equivalent as determined by Affiliating University)	40	6	46
End of Year II	Diploma in Discipline 1 (Or something equivalent as determined by Affiliating University)	88	8	96
End of Year III	Bachelor in Vocational Sciences in **Discipline1** (Or something equivalent as determined by Affiliating University)	136	0	136
End of Year IV (Without Honors)	Bachelor of Technology in **Discipline 1**) (Or something equivalent as determined by Affiliating University)	160	0	160

Year of Exit	Degree	Credits Required to be Earned During Course Work	Exit Extra Credits (Crash Course & Exam)	Total Credits
End of Year IV (With Honors)	Bachelor of Technology with Honors in **Discipline 1**) (Or something equivalent as determined by Affiliating University)	176	0	176

Note: The exit extra credits at Year II and Year III would essentially come from critical courses as determined by BoS from the following semester.

(a) Exit Policy:

The students can choose to exit the four-year program at the end of first/second/third year.

i) **UG Certificate in (Field of study/discipline)** - Program duration:
First Year (first two semesters) of the undergraduate program, 40 credits followed by an additional exit 6 credit bridge course. The 6 extra credits would be to make the certificate self-sufficient, with one 3-Credit Course on Taxation and one 3-Credit Course on Accounting that would help the candidates acquire job-ready competencies required to enter the workforce.

ii) **UG Diploma (in Field of study/discipline)** - Program duration: First two years (first four semesters) of the undergraduate program, 88 credits followed by an additional exit of 8-credit bridge course with 2 Integrated 4 Credit courses in Major with 3+1 Theory and Lab distribution administrated as a Crash course in 1 month which would help the candidates acquire job-ready competencies required to enter the workforce.

iii) **Bachelor of Science (in Field of study/discipline) i.e., B.Sc. Engineering in (Field of study/discipline)-** Program duration: First three years (first six semesters) of the undergraduate program, 120 credits.

(b) Entry Policy:

Modalities on multiple-entry by the student into the B.Tech. program will be provided in due course of time.

Note: The institution shall resolve any issues that may arise in the implementation of Multiple Entry and Exit policies from time to time and shall review the policies in the light of periodic changes brought by UGC, AICTE, State government and the affiliating univeristy.

23. Gap Year Concept:

Gap year concept for Student Entrepreneur in Residence is introduced and outstanding students who wish to pursue entrepreneurship / become entrepreneur are allowed to take a break of one year at any time after II year to pursue full-time entrepreneurship programme/to establish startups. This period may be extended to two years at the most and these two years would not be counted for the time for the maximum time for graduation. The principal of the respective college shall forward such proposals submitted by the students to the University. An evaluation committee constituted by the University shall evaluate the proposal submitted by the student and the committee shall decide whether to permit the student(s) to avail the Gap Year or not

24. Transitory Regulations

Discontinued, detained, or failed candidates are eligible for readmission as and when the semester is offered after fulfillment of academic regulations. Candidates who have been detained for want of attendance or not fulfilled academic requirements or who have failed after having undergone the course in earlier regulations or have discontinued and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

Candidates who are permitted to avail Gap Year shall be eligible for re-joining into the succeeding year of their B. Tech from the date of commencement of class work, subject to Section 2 and they will follow the academic regulations into which they are readmitted.

25. Minimum Instruction Days for a Semester:

The minimum instruction days including exams for each semester shall be 90 days.

26. Medium of Instruction:

The medium of instruction of the entire B.Tech undergraduate programme in Engineering &Technology (including examinations and project reports) will be in English only.

27. Student Transfers:

Student transfers shall be as per the guidelines issued by the Government of Andhra Pradesh and the Universities from time to time.

28. General Instructions:

a. The academic regulations should be read as a whole for purpose of any interpretation.
b. Malpractices rules-nature and punishments are appended.
c. Where the words "he", "him", "his", occur in the regulations, they also include "she", "her", "hers", respectively.
d. In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
e. The Universities may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on rolls with effect from the dates notified by the Universities.
f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the Vice-Chancellor / Head of the institution is final.

Regulations for MALPRACTICES during the conduct of examinations

	Nature of Malpractices/Improper conduct	Punishment
1.a	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) - **FIRST TIME** (whether copied or not)	Expulsion from the examination hall and cancellation of the performance in that subject only. • To keep the CC footage of the act as an evidence. • To obtain a statement from student and get it authorized by observer and Chief superintendent.
1.b	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) - **SECOND TIME**(whether copied or not)	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations, project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. • To keep the CC footage of the act as an evidence. • To obtain a statement from student and get it authorized by observer and Chief superintendent.
1.c	If the candidate possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) - **REPITITION OF THE ABOVE ACT** (After second time and whether copied or not)	Nature of punishment to be given for the improper conduct shall be as per the recommendations of the committee. • The committee comprising of Principal, Vice principal, Chief superintendent, Controller of Examinations and HoD to discuss and initiate the action to be taken and recommend. • To keep the CC footage of the act as evidence. • To obtain a statement from student and invigilator and authorized by Chief superintendent.
2.a.	If the candidate gives assistance or guidance or receives it from any other candidate orally or by any	Expulsion from the examination hall and cancellation of the performance in that subject only

	other body language methods.	of all the candidates involved. • To keep the CC footage of the act as an evidence.
2.b	If the candidate communicates through cell phones / through any other means with any candidate or persons in or outside the exam hall in respect of any matter.	Confiscation of the mobile or electronic gadgets involved and Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations, project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. • To obtain all relevant proofs of evidence from the Mobile/ gadgets and handing over of the same to the candidate. • To keep the CC footage of the act as evidence. • To obtain a statement from student and invigilator and authorized by observer and Chief superintendent.
	(i) If the communication is with the person(s) who belongs to our college.	Confiscation of the mobile or electronic gadgets involved and Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations, project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.
	(ii) If the communication is with the person(s) outside the campus or people who are not related to our college.	To obtain all relevant proofs of evidence from the Mobile/ gadgets and handing over of the same to the candidate. To keep the CC footage of the act as evidence. To obtain a statement from student and invigilator and authorized by observer and Chief superintendent. The person(s) involved should be handed over to the police and a case is registered against him.
3.	If the candidate impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not

		be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider/candidate not on rolls, he will be handed over to the police and a case is registered against him. • To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action with documented proofs. • To keep the CC footage of the act as an evidence. • To obtain a statement from student, invigilator, subject expert and authorized by observer and Chief superintendent.
4	If the candidate mishandles the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination. Also,if the answer script is mutilated / damaged disturbing the shape, of the script, answers, the bar code intentionally.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. In addition to the above punishment, a committee shall be constituted and recommends appropriate punishment for the improper conduct. • To keep the CC footage of the act as an evidence. • To Obtain a statement from student and invigilator and authorized by observer and Chief superintendent.
5.	Uses objectionable, abusive or offensive language in the Examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject only. • To Obtain a statement from student and invigilator and get it authorized by Observer and Chief superintendent.

6.	Refuses to obey the orders of the Chief Superintendent/ACE/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them. • To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action with documented proofs • To keep the CC footage of the act as an evidence. • To Obtain a statement from student and invigilator and authorized by observer and Chief superintendent.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. • To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action. • To keep the CC footage of the act as an evidence. • To Obtain a statement from

		student and invigilator and authorized by observer and Chief superintendent.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. • To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action with documented proofs • To keep the CC footage of the act as an evidence. • To obtain a statement from student and invigilator and authorized by observer and Chief superintendent. • The candidate shall be handed over to Police and register a case.
9.	If a student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	If the student belongs to our college: Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them. • To constitute a committee comprising of Principal, Vice principal, Chief superintendent, Observer, Controller of Examinations and HoD to discuss and initiate the above action. • To keep the CC footage of

		the act as an evidence. • To Obtain a statement from student and invigilator and authorized by observer and Chief Superintendent.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester. • To keep the CC footage of the act as an evidence(If any). • To obtain a statement from invigilator and any others as witness authorized by observer and Chief superintendent.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations. • To Obtain a statement from Valuer / Chief Valuer authorized by Spot Coordinator and Controller of Examinations.

General :

- Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".
- The academic regulation should be read as a whole for the purpose of any interpretation.
- In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.
- The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

* * *

LET US MAKE MVGR A RAGGING FREE CAMPUS

ABSOLUTELY NO TO RAGGING

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1. Ragging is prohibited as per Act 26 of A.P. Legislative Assembly, 1997.
2. Ragging entails heavy fines and/or imprisonment.
3. Ragging invokes suspension and dismissal from the College.
4. Outsiders are prohibited from entering the College and Hostel without permission.
5. Girl students must be in their hostel rooms by 7.00 p.m.
6. All the students must carry their Identity Cards and show them when demanded
7. The Principal and the Wardens may visit the Hostels and inspect the rooms any time.

ACADEMIC REGULATIONS (R23)
FOR B.TECH. (LATERAL ENTRY SCHEME)

*(Effective for the students getting admitted into II year through Lateral Entry Scheme from the Academic Year **2024-2025** onwards)*

1. Award of the Degree

Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils the following:

i. Pursues a course of study for not less than three academic years and not more than six academic years. However, for the students availing Gap year facility this period shall be extended by two years at the most and these two years would in addition to the maximum period permitted for graduation (Six years).

ii. Registers for 120 credits and secures all 120 credits.

2. Award of B.Tech. degree with Honors

A student will be declared eligible for the award of the B.Tech with Honors if he/she fulfils the following:

i. Student secures additional 18 credits fulfilling all the requisites of a B.Tech. program i.e., 120 credits. (ii)Registering for Honors is optional.

ii. Honors is to be completed simultaneously with B.Tech. programme.

Students, who fail to fulfil the requirement for the award of the degree within six consecutive academic years from the year of admission, shall forfeit their seat.

3. Minimum Academic Requirements

The following academic requirements have to be satisfied in addition to the requirements mentioned in item no.2

i. A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory, practical, design, drawing subject or project if he secures not less than 35% of marks in the end examination and a minimum of 40% of marks in the sum total of the mid semester evaluation and end examination taken together.

ii. A student shall be promoted from VI semester to VII semester if he fulfills the minimum attendance requirement (75%) and academic requirement of 40% of credits (any decimal fraction should be rounded off to lower digit) up to either V Semester or VI semester from the following examinations irrespective of whether the candidate takes the examination or not.

- Three regular and Three supplementary examinations of I semester
- Three regular and Two supplementary examinations of II semester
- Two regular and Two supplementary examinations of III semester
- Two regular and One supplementary examinations of IV semester
- One regular and One supplementary examination of V semester
- One regular examination of VI semester.

iii. And in case if student is already detained for want of credits for particular academic year, the student may make up the credits through supplementary exams of the above exams before the commencement of IV year I semester class work of next year.

4. Course Pattern

i. The entire course of study is three academic years on semester pattern.
ii. A student eligible to appear for the end examination in a subject but absent at it or has failed in the end examination may appear for that subject at the next supplementary examination offered.
iii. When a student is detained due to lack of credits/shortage of attendance the student may be re-admitted when the semester is offered after fulfilment of academic regulations, the student shall be in the academic regulations into which he/she is readmitted.

5. All other regulations as applicable for B. Tech. Four-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme).

R23-MVGR
COURSE STRUCTURE
B. Tech. (Regular/Honors)-Information Technology
(Applicable from the academic year 2023-24 onwards)

I SEMESTER						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23HSST001	Communicative English	2	0	0	2
2	R23MATT101	Linear Algebra & Calculus	3	0	0	3
3	R23PHYT101	Engineering Physics	3	0	0	3
4	R23CMET201	Basic Civil & Mechanical Engineering	3	0	0	3
5	R23CSET201	Introduction to Programming	3	0	0	3
6	R23HSSL001	Communicative English Lab	0	0	2	1
7	R23PHYL101	Engineering Physics Lab	0	0	2	1
8	R23CSEL201	Computer Programming Lab	0	0	3	1.5
9	R23MECW201	Engineering Workshop	0	0	3	1.5
10	R23CSEW201	IT Workshop	0	0	2	1
11	R23HSSM801	Health and wellness, Yoga and Sports	0	0	1	0.5
	Total Credits					**20.5**

II SEMESTER						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MATT102	Differential Equations and Vector calculus	3	0	0	3
2	R23CHYT102	Chemistry	3	0	0	3
3	R23EEET201	Basic Electrical &Electronics Engineering	3	0	0	3
4	R23CSET301	Data Structures	3	0	0	3
5	R23MECD201	Engineering Graphics	1	0	4	3
6	R23CHYL102	Chemistry Lab	0	0	2	1
7	R23EEEL201	Electrical & Electronics Engineering Lab	0	0	3	1.5
8	R23CSEL301	Data Structures Lab	0	0	3	1.5
9	R23HSSM802	NSS/NCC/Scouts & Guides/Community Service	0	0	1	0.5
	Total Credits					**19.5**

III Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MSCST003	Discrete Mathematical Structures	3	0	0	3
2	R23MSCST004	OOP with C++	3	0	0	3
3	R23MSCST005	Digital Logic Design	3	0	0	3
4	R23MSCST006	Principles of Programming Languages	3	0	0	3
5	R23MBMCT001	Financial Management	3	0	0	3
6	R23MMECT013	Leadership and Team Management	3	0	0	3
7	R23MSCSL003	Unix & Shell Programming Lab	0	0	3	2
8	R23MSCSL004	OOP with C++ Lab	0	0	3	2
9	R23MMECL001	Computer Aided Geometric Design and Assembly Lab	0	0	3	2
	Total Credits					**24**

IV Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MSCST007	Python Programming	3	0	0	3
2	R23MSCST008	Design and Analysis of Algorithms	3	0	0	3
3	R23MSCST009	Computer Architecture	3	0	0	3
4	R23MSCST010	Database Management Systems	3	0	0	3
5	R23MMECT020	Product Lifecycle Management	3	0	0	3
6	R23MBMCT002	Quality Management	3	0	0	3
7	R23MSCSL005	Python Programming Lab	0	0	3	2
8	R23MSCSL006	Database Management Systems Lab	0	0	3	2
9	R23MBMCL001	Financial Accounting Lab	0	0	3	2
10	R23MENGAT01	Ethics & Human Values	2	0	0	-
Total Credits						**24**

V Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MSCST011	Operating Systems	3	0	0	3
2	R23MSCST012	Advanced Java Programming	3	0	0	3
3	R23MSCST013	Automata and Compiler Design	3	0	0	3
4	R23MSCST014	Computer Networks	3	0	0	3
5	R23MSCSTXXX	DSC-E1	3	0	0	3
6	R23MBMCT005	Entrepreneurship	3	0	0	3
7	R23MSCSL007	Advanced Java Programming Lab	0	0	3	2
8	R23MBMCL003	Digital Engineering Lab	0	0	3	2
9	R23MSCSP001	Community Project	0	0	2	2
10	R23MMATT007	Quantitative Problem Solving Techniques	2	0	0	2
Total Credits						**26**

VI Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MSCST015	Web Technologies	3	0	0	3
2	R23MSCST016	OOAD and Design Patterns	3	0	0	3
3	R23MSCST017	Microprocessors and Interfacing	3	0	0	3
4	R23MBMCT006	Business Analysis	3	0	0	3
5	R23MSCSTXXX	DSC E2	3	0	0	3
6	R23MSCSTXXX	DSC E3	3	0	0	3
7	R23MSCSL008	Web Technologies Lab	0	0	3	2
8	R23MBMCL004	Business Analytics Lab	0	0	3	2
9	R23MCIVAT02	Environmental Studies	2	0	0	-
Total Credits						**22**

VII Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MSCST018	Software Engineering (Self-Study/MOOCS)	3	0	0	3
2	R23MSCSTXXX	DSC E4 (Self-Study/MOOCS)	3	0	0	3
3	R23MSCSTXXX	DSC E5 (Self-Study/MOOCS)	3	0	0	3
4	R23MSCSP002	Mini Project	0	0	2	2
5	R23MSCSL009	Android Development/ Mean Stack/Robotic Process automation using UI path/ Data Protection Officers/ Data visualization Tools/ UIX	0	0	3	2
Total Credits						**13**

VIII Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R23MBMCT007	Strategic Management	3	0	0	3
	R23MBMCT008	Digital Marketing	3	0	0	
	R23MMECT009	Logistic and Supply Chain Management	3	0	0	
2	R23MSCSP003	Major-Dissertation/Academic Project-Major	0	0	16	8
Total Credits						**11**

INFORMATION TECHNOLOGY
PROFESSIONAL ELECTIVE AND HONOR COURSES

Elective Thread (Artificial Intelligence) : CS-AI&ML					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Regular**
1	DSC-E1	V	R23MSCST019	Data Warehousing and Data Mining	R
2	DSC-E2	VI	R23MSCST020	Statistical and Predictive Analytics	R
3	DSC-E3	VI	R23MSCST021	Machine Learning	R
4	DSC-E4	VII	R23MSCST022	Deep Learning	R
5	DSC-E5	VII	R23MSCST023	Natural Language Processing	R
Honors Thread (Artificial Intelligence) : CS-AI&ML					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R23MSCSHT01	Computing for AI-ML	H
2	HON-2	VI	R23MSCSHT02	Open Databases	H
3	HON-3	VII	R23MSCSHT03	Process Automation using UI Path	H
4	HON-4	VII	R23MSCSHT04	Decision Support Mechanisms	H
5	HON-5	VIII		MOOCS/Self-Study	H
6	HON-6	VIII		MOOCS/Self-Study	H

Elective Thread (Business Intelligence) : CS-Business Intelligence					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Regular**
1	DSC-E1	V	R23MSCST019	Data Warehousing and Data Mining	R
2	DSC-E2	VI	R23MSCST024	Data Analytics and Tools	R
3	DSC-E3	VI	R23MSCST021	Machine Learning	R
4	DSC-E4	VII	R23MSCST022	Deep learning	R
5	DSC-E5	VII	R23MSCST025	Mean Stack Web Development	R
Honors Thread (Business Intelligence) : CS-Business Intelligence					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R23MSCSHT02	Open Databases	H
2	HON-2	VI	R23MSCSHT01	Computing for AI-ML	H
3	HON-3	VII	R23MSCSHT05	Cloud Services	H
4	HON-4	VII	R23MSCSHT06	Big Data Visualization	H
5	HON-5	VIII		MOOCS/Self-Study	H
6	HON-6	VIII		MOOCS/Self-Study	H

Elective Thread (Data Science) : CS-DS					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Regular**
1	DSC-E1	V	R23MSCST026	Statistical and Mathematical Foundations of Data Analytics	R
2	DSC-E2	VI	R23MSCST019	Data Warehousing and Data Mining	R
3	DSC-E3	VI	R23MSCST020	Statistical and Predictive Analytics	R
4	DSC-E4	VII	R23MSCST024	Data Analytics and Tools	R
5	DSC-E5	VII	R23MSCST027	Time Series Analysis in Data Science	R
Honors Thread (Data Science) : CS-DS					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R23MSCSHT01	Computing for AI-ML	H
2	HON-2	VI	R23MSCSHT02	Open Databases	H
3	HON-3	VII	R23MSCSHT06	Big Data Visualization	H
4	HON-4	VII	R23MSCST033	Block Chain Essentials	H
5	HON-5	VIII		MOOCS/Self-Study	H
6	HON-6	VIII		MOOCS/Self-Study	H

Elective Thread (IOT & Cyber Security including Block chain Technology): CS-ICB					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Regular**
1	DSC-E1	V	R23MSCST032	Cryptography and Information Security	R
2	DSC-E2	VI	R23MSCST033	Block Chain Essentials	R
3	DSC-E3	VI	R23MSCST034	Principles of IoT	R
4	DSC-E4	VII	R23MSCST035	IoT Development Boards and its Interfacing	R
5	DSC-E5	VII	R23MSCST036	Ad Hoc Networks	R
Honors Thread (IOT & Cyber Security including Block chain Technology): CS-ICB					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R23MSCSHT09/ R23MSCSHT10	Information Security and Forensics/ Routing and Switching Applications	H
2	HON-2	VI	R23MSCSHT11/ R23MSCSHT12	Penetration Testing/ Network Security, Firewalls and VPNs	H
3	HON-3	VII	R23MSCSHT13/ R23MSCSHT14	Information Security Governance and Complaince	H

				Standards/ Protocol Stacks	
4	HON-4	VII	R23MSCSHT15	Block chain Technology and its Applications	H
5	HON-5	VIII		MOOCS/Self-Study	H
6	HON-6	VIII		MOOCS/Self-Study	H

Elective Thread (Computer Networks) : CS-Networks					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Regular**
1	DSC-E1	V	R23MSCST037	Information Security Management Standards	R
2	DSC-E2	VI	R23MSCST036	Ad Hoc Networks	R
3	DSC-E3	VI	R23MSCST038	Routing and Switching Concepts	R
4	DSC-E4	VII	R23MSCST039	Enterprise Networking, Security and Automation	R
5	DSC-E5	VII	R23MSCST040	Firewalls and VPN	R
Honors Thread (Computer Networks) : CS-Networks					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R23MSCSHT05	Cloud Services	H
2	HON-2	VI	R23MSCSHT14	Protocol Stacks	H
3	HON-3	VII	R23MSCSHT16	Cyber and Digital Forensics	H
4	HON-4	VII	R23MSCST033	Block Chain Essentials	H
5	HON-5	VIII		MOOCS/Self-Study	H
6	HON-6	VIII		MOOCS/Self-Study	H

EXTENDED OPEN ELECTIVE CLUSTER

Business Management Cluster(BMC) (for CSE/IT/CSIT/AIML/DS/ICB)							
Type of Course	**Course code**	**Course Title**	**Sem**	**Type of Course**	**Course Code**	**Course Title**	**Sem**
EOEC - T1	R23MBMCT001	Financial Management	III	EOEC-L1	R23MMECL001	Computer Aided Geometric Design and Assembly Lab	III
EOEC - T2	R23MMECT013	Leadership and Team Management	III	EOEC-L2	R23MBMCL001	Financial Accounting Lab	IV
EOEC - T3	R23MMECT020	Product Lifecycle Management	IV	EOEC-L3	R23MBMCL003	Digital Engineering Lab	V
EOEC - T4	R23MBMCT002	Quality Management	IV	EOEC-L4	R23MBMCL004	Business Analytics Lab	VI
EOEC – T5	R23MBMCT005	Entrepreneurship	V				
EOEC – T6	R23MBMCT006	Business Analysis	VI				
EOEC - E1 (Self-Study/ MOOCs)	R23MBMCT007	Strategic Management	VIII				
	R23MBMCT008	Digital Marketing					
	R23MBMCT009	Logistics and Supply Chain Management					

Computer Science Cluster(CSC) (for MEC, ECE, EEE, CIV and CHE) (Not for CSE/IT/CSIT/AIML/DS/ICB)							
Type of Course	**Course code**	**Course Title**	**Sem**	**Type of Course**	**Course Code**	**Course Title**	**Sem**
EOEC-T1	R23MCSCT001	Data Structures & Algorithms	III	EOEC-L1	R23MCSCL001	Data Structures & Algorithms Lab	III
EOEC-T2	R23MSCST011	Operating Systems	III	EOEC-L2	R23MSCSL005	Python Programming Lab	IV
EOEC-T3	R23MSCST007	Python Programming	IV	EOEC-L3	R23MSCSL003	Database Management Systems Lab	V
EOEC-T4	R23MSCST010	Database Management Systems	IV	EOEC-L4	R23MCSCL004	OOP with JAVA Lab	VI
EOEC-T5	R23MCSCT005	Software Engineering	V				
EOEC-T6	R23MCSCT006	OOP with JAVA	VI				
EOEC-E1 Selfstudy /Moocs	R23MCSCT007	Computer Networks	VIII				
	R23MCSCT008	Artificial Intelligence: Principles and Techniques					
	R23MCSCT009	OOAD and Design Patterns					

R23-MVGR

B. Tech. (Regular/Honors)-Computer Science and Engineering

(Applicable from the academic year 2023-24 onwards)

I SEMESTER

<table>
<tr><td rowspan="3">R23HSST001</td><td colspan="6">COMMUNICATIVE ENGLISH
(Common to All Branches of Engineering)</td></tr>
<tr><td>Total Contact Hours</td><td>30 (L)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>Nil</td><td>2</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">The student will be able to apply the concepts of comprehension, Interpretation and structured presentation in varied contexts and demonstrate skilled communication.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Developing the ability to comprehend, analyze and elicit information.(BL6)</td></tr>
<tr><td>2</td><td colspan="6">Demonstrating the skill of Structured thinking. (BL3)</td></tr>
<tr><td>3</td><td colspan="6">Developing Competency to summarize and paraphrase content in different materials.(BL6)</td></tr>
<tr><td>4</td><td colspan="6">Demonstrating the skill of constructive presentation.(BL3)</td></tr>
<tr><td>5</td><td colspan="6">Building communicative competence.(BL6)</td></tr>
<tr><td colspan="7">SYLLABUS</td></tr>
<tr><td>Unit I</td><td colspan="5">THEME: HUMAN VALUES
Sample Text: The Power of a Plate of Rice (short story) by Ifeoma Okoye
Supplementary Text: The Lament by Anton Chekov
Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions.
Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others.
Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.
Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences. (Remedial learning with additional resources.)
Grammar: Parts of Speech, Basic Sentence Structures-forming questions. (Remedial learning with additional resources.)
Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words</td><td>6 hr</td></tr>
<tr><td>Unit II</td><td colspan="5">Theme: NATURE
Sample Text: Night of the Scorpion (poem) by Nissim Ezekiel
Supplementary Text: ‘IF’ by Rudyard Kipling
Listening: Answering a series of questions after listening to audio texts.
Speaking: Discussion in pairs/small groups on specific topics.
Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.
Writing: Structure of a paragraph - Paragraph writing (specific topics)
Grammar: Cohesive devices - linkers, use of articles and zero article prepositions.
Vocabulary: Homonyms, Homophones, Homographs.</td><td>6 hr</td></tr>
</table>

Unit III	**Lesson: BIOGRAPHY of Steve Jobs** Supplementary Text: Biography of Tenzing Norgay **Listening**: Listening for global comprehension and summarizing. **Speaking**: Discussing specific topics in pairs or small groups and reporting what is discussed. **Reading:** Reading a text in detail by making basic inferences-recognizing and interpreting specific context clues; strategies to use text clues for comprehension. **Writing:** Summarizing, Note-making, paraphrasing **Grammar**: Verbs - tenses; subject-verb agreement **Vocabulary**: Compound words, Collocations	**6 hr**
Unit IV	**Lesson: INSPIRATION: *The Toys of Peace* by Saki** Supplementary Text: *The Man Who Planted Trees* by Jean Giono **Listening**: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for the practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading**: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing**: Letter Writing: Official Letters, Resumes. **Grammar:** Reporting verbs, Direct & Indirect speech, Active & Passive Voice. **Vocabulary**: Words often confused, Jargon.	**6 hr**
Unit V	**Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)** **Listening**: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. **Speaking**: Formal oral presentations **Reading**: Reading comprehension. **Writing**: Writing structured essays on specific topics. **Grammar**: Editing short texts –identifying and correcting common errors in grammar (articles, prepositions, tenses, subject-verb agreement) **Vocabulary:** Technical Jargon.	**6 hr**

LEARNING RESOURCES

TEXT BOOKS:

1	Pathfinder: *Communicative English for Undergraduate Students*, 1st Edition, Orient Black Swan, 2023.
2	*Empowering English* by Cengage Publications, 2023.

REFERENCE BOOKS:

1	Dubey, Sham Ji & Co. *English for Engineers*, Vikas Publishers, 2020.
2	Bailey, Stephen. *Academic writing: A Handbook for International Students*. Routledge, 2014.
3	Murphy, Raymond. *English Grammar in Use*, Fourth Edition, Cambridge University Press, 2019.
4	Lewis, Norman. Word Power Made Easy- *The Complete Handbook for Building Superior Vocabulary*. Anchor, 2014.

WEB RESOURCES:

1. www.bbc.co.uk/learningenglish
2. https://dictionary.cambridge.org/grammar/british-grammar/
3. www.eslpod.com/index.html

4. https://www.learngrammar.net/32
5. https://english4today.com/english-grammar-online-with-quizzes/
6. https://www.talkenglish.com/grammar/grammar.aspx

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL6	X	X	X	X	X
CO2	BL3		X			
CO3	BL6			X		
CO4	BL3	X	X	X	X	X
CO5	BL6	X	X	X	X	X

R23MATT101	LINEAR ALGEBRA & CALCULUS (Common to All Branches of Engineering)					
	Total Contact Hours	45 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Calculus and Matrices	**3**	**0**	**0**	**3**

Course Objective

To equip the students with standard concepts and tools of mathematics to handle various real-world problems and their applications.

Course Outcomes

1	Solve system of equation by Direct and Indirect methods.(**BL3**)
2	Make use of Linear Algebra techniques to find higher powers and inverse of Matrices.(**BL3**)
3	Make use of Mean value theorems to deduce Mathematical identities.(**BL3**)
4	Use the concept of multivariable calculus to determine the maxima and minima of a multivariable function.(**BL3**)
5	Estimate areas and volumes with help of Multiple integrals.(**BL3**)
6	Formulate Mathematical models and estimate appropriate physical quantities.(**BL6**)

SYLLABUS

Unit I	**MATRICES**	**9 hr**

Rank of a matrix by echelon form, normal form. Cauchy –Binet formulae (without proof). Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Gauss Seidel Iteration Method.

Unit II	**LINEAR TRANSFORMATION AND ORTHOGONAL TRANSFORMATION**	**9 hr**

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

Unit III	**CALCULUS**	**9 hr**

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems.

Unit IV	**PARTIAL DIFFERENTIATION AND APPLICATIONS (MULTI VARIABLE CALCULUS)**	**9 hr**

Partial derivatives, total derivatives, chain rule, change of variables, Taylor's and Maclaurin's series expansion of functions of two variables, Jacobians, maxima and minima of functions of two variables, method of Lagrange multipliers.

Unit V	**MULTIPLE INTEGRALS (MULTI VARIABLE CALCULUS)**	**9 hr**

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

LEARNING RESOURCES

TEXT BOOKS:

1	B.S. Grewal, *Higher Engineering Mathematics*, 44/e, Khanna Publishers, 2017.
2	Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2018.

REFERENCE BOOKS:	
1	R.K. Jain and S.R.K. Iyengar, *Advanced Engineering Mathematics*, 5/e, Alpha Science International Ltd.,2021 (9th reprint).
2	George B.Thomas, Maurice D. Weir and Joel Hass, *Thomas Calculus*, 14/e, Pearson Publishers, 2018.
3	Glyn James, *Advanced Modern Engineering Mathematics*, 5/e, Pearson publishers, 2018.
4	Michael Green berg, *Advanced Engineering Mathematics*, 9th edition, Pearson edn.
5	K Das, Er. Rajnish Verma, *Higher Engineering Mathematics*, S. Chand, 2021.

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL 3	X				
CO2	BL 3		X			
CO3	BL 3			X		
CO4	BL 3				X	
CO5	BL 3					X
CO6	BL 6	X	X	X	X	X

R23PHYT101	ENGINEERING PHYSICS (Common to All Branches of Engineering)					
	Total Contact Hours	45 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Higher Secondary School Physics	**3**	**0**	**0**	**3**

Course Objective

To bridge the gap between the Physics in school at 10+2 level and UG level engineering courses by identifying the importance of the optical phenomenon like interference, diffraction etc. Enlightening the periodic arrangement of atoms in crystalline solids and concepts of quantum mechanics, introduce novel concepts of dielectric and magnetic materials, physics of semiconductors.

Course Outcomes

1	Student will be able to **analyze** the intensity variation of light due to interference, diffraction and polarization. (**BL4**)
2	Student will be able to **investigate** the crystallographic phase of the unknown specimen by using the X-ray diffraction method. (**BL5**)
3	Student will be able to **interpret** the various polarization mechanisms and their frequency dependence in dielectrics; and **choose** a magnetic material for a given application based on the domain model.(**BL5**)
4	Student will be able to **deduce** the quantized facets for a free electron in a potential box, and extend the same to **explain** the electrical conductivity and Fermi energy of metals. (**BL4**)
5	Student will be able to **classify** the solids, **analyze** the semiconductor charge carrier concentrations, and **identify** the semiconductor type by using the Hall effect. (**BL4**)
6	Student will be able to **elaborate** the optical phenomena, crystallographic phase, magneto-dielectric physiognomies, quantum confinement effects, and the rudiments of semiconductor band model.(**BL6**)

SYLLABUS

Unit I	**WAVE OPTICS**	**9 hr**

Interference: Introduction **-** Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colors in thin films- Newton's Rings- Determination of wavelength and refractive index. **Diffraction:** Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative). **Polarization:** Introduction -Types of polarization - Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

Unit II	**CRYSTALLOGRAPHY AND X-RAY DIFFRACTION**	**9 hr**

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC - Miller indices – separation between successive (hkl) planes. **X-ray diffraction:** Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods.

Unit III	**DIELECTRIC AND MAGNETIC MATERIALS**	**9 hr**

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector –Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative) - Lorentz internal field - Clausius- Mossotti equation - complex dilectric constant – Frequency dependence of polarization – dielectric loss. **Magnetic Materials:** Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro,

anti-ferro& Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.		
Unit IV	**QUANTUM MECHANICS AND FREE ELECTRON THEORY**	**9 hr**
Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well. **Free Electron Theory:** Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory –electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy.		
Unit V	**SEMICONDUCTORS**	**9 hr**
Semiconductors: Formation of energy bands – classification of crystalline solids - Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation - Hall effect and its applications.		

LEARNING RESOURCES

TEXT BOOKS:	
1	M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy, *A Text book of Engineering Physics*, 11th Edition, S.Chand Publications, 2019.
2	D.K.Bhattacharya and Poonam Tandon, *Engineering Physics*, 1st Edition, Oxford press, 2015.
REFERENCE BOOKS:	
1	B.K. Pandey and S. Chaturvedi, *Engineering Physics*, 2nd Edition, Cengage Learning, 2021.
2	Shatendra Sharma, Jyotsna Sharma, *Engineering Physics*, 1st Edition, Pearson Education, 2018.
3	Sanjay D. Jain, D. Sahasrabudhe and Girish, *Engineering Physics*, 1st Edition, University Press, 2010.
4	M.R. Srinivasan, *Engineering Physics*, 1st Edition, New Age international publishers, 2009
ONLINE COURSES:	
1	https://archive.nptel.ac.in/courses/122/107/122107035/
2	https://www.youtube.com/watch?v=GQ5XpeS3e3U&list=PLLy_2iUCG87B_Tmfs0y2tR8GNIkyRIKpW
3	https://archive.nptel.ac.in/courses/112/106/112106227/
4	https://archive.nptel.ac.in/courses/115/101/115101107/
5	https://archive.nptel.ac.in/courses/108/108/108108122/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL5		X			
CO3	BL5			X		
CO4	BL4				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23CMET201	BASIC CIVIL & MECHANICAL ENGINEERING (Common to All branches of Engineering)					
	Total Contact Hours	48	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objectives

- Get familiarized with the scope and importance of Civil and Mechanical Engineering in different sectors and industries.
- Introduce the preliminary concepts of Building Planning, Building Construction, Materials and the related tests.
- Provide preliminary knowledge of surveying and understand the importance of transportation and the water resources in terms of quantity and quality.
- Explain different engineering materials and manufacturing processes.
- Provide an overview of different thermal and mechanical systems; introduce basics of robotics and its applications.

Course Outcomes

1	Compile the role of a Civil Engineer in his multifaceted tasks and Discuss the principles of building planning and various construction aspects including materials. (**BL6**)
2	Solve for areas of irregular boundaries by means of lengths and bearings and for reduced level of an object. (**BL6**)
3	Elaborate the importance of Transportation in Nation's economy and the engineering measures related to highways in terms of geometrics and water resources and storage structures to appreciate the social responsibility of water conservation in terms of quality and quantity.(**BL6**)
4	Adapt and integrate the mechanical engineering technologies in various Industrial sectors, and choose appropriate engineering materials for engineering applications.(**BL6**)
5	Express the working of different manufacturing processes, refrigeration and air-conditioning cycles, IC engines, electric and hybrid vehicles.(**BL6**)
6	Express and write the working of power plants, mechanical power transmission systems, and different robotic configurations.(**BL6**)

SYLLABUS

PART A: BASIC CIVIL ENGINEERING

Unit I	**BASICS OF CIVIL ENGINEERING**	**8 hr**

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-Technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering- Scope of each discipline - Building Construction and Planning- Construction Materials- Cement - Aggregate - Bricks- Cement concrete- Steel-Tests on these materials.

Factors to be considered in Building Planning- Nature of Buildings- Typical Layouts of a Residential Building- Industrial Building- Commercial Building like a Supermarket / Hotel / Theatre.

Unit II	**SURVEYING**	**8 hr**

Surveying: Objectives of Surveying- Horizontal Measurements- Vertical Measurements- Angular Measurements- Levelling instruments used for levelling- Introduction to Bearings-Simple problems on levelling and bearings-Contour mapping.

Unit III	**TRANSPORTATION ENGINEERING, WATER RESOURCES AND ENVIRONMENTAL ENGINEERING**	**8 hr**

Transportation Engineering, Water Resources and Environmental Engineering: Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences - Basic geometric design elements of a highway- Camber- Stopping Sight Distance- Super elevation-Introduction.

Water Resources and Environmental Engineering: Sources of water- Quality of water- Specifications and Tests- Introduction to Hydrology- Hydrograph –Rain water Harvesting- Rain water runoff- Water Storage Structures (Simple introduction to Dams and Reservoirs).		
PART B: BASICMECHANICAL ENGINEERING		
Unit IV	**INTRODUCTION TO MECHANICAL ENGINEERING AND ENGINEERING MATERIALS**	**8 hr**
Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors. **Engineering Materials -** Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.		
Unit V	**MANUFACTURING PROCESSES AND THERMAL ENGINEERING**	**8 hr**
Manufacturing Processes: Principles of Casting**,** Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing. **Thermal Engineering**– working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air-conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.		
Unit VI	**POWER PLANTS, MECHANICAL POWER TRANSMISSION AND INTRODUCTION TO ROBOTICS**	**8 hr**
Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants. **Mechanical Power Transmission -** Belt Drives, Chain, Rope drives, Gear Drives and their applications. **Introduction to Robotics -** Joints & links, configurations, and applications of robotics.		
<u>LEARNING RESOURCES</u>		
TEXT BOOKS:		
1	M.S.Palanisamy, *Basic Civil Engineering*, Fourth Edition, Tata Mcgraw Hill publications (India) Pvt. Ltd, 2017.	
2	S.S. Bhavikatti, *Introduction to Civil Engineering*, First Edition, New Age International Publishers, 2022.	
3	Satheesh gopi, *Basic Civil Engineering*, First Edition, Pearson publications,2009.	
4	V.Ganesan, *Internal Combustion Engines*, 4th edition, Tata McGraw Hill publications Pvt. Ltd, 2017.	
5	S.S. Rattan, *Theory of Machines*, Fourth edition, McGraw Hill Education; 2017	
6	Jonathan Wicker and Kemper Lewis, *An introduction to Mechanical Engineering*, 3rd edition, Cengage learning India Pvt. Ltd, 2012.	
REFERENCE BOOKS:		
1	S.K. Duggal, *Surveying, Vol- I and Vol-II*, 4th Edition, Tata McGraw Hill Publishers, 2017.	
2	Santhosh Kumar Garg, *Hydrology and Water Resources Engineering*, 23rd Edition, Kahnna publishers, Delhi, 2016.	
3	Santhosh Kumar Garg, *Irrigation Engineering and Hydraulic Structures*, 38th Edition, Kahnna publishers, Delhi, 2023.	
4	S K Khanna and C E G Justo and Veeraraghavan, *Highway Engineering*,10th Edition Nemchand Brothers Publications, 2019	
5	Indian Standard Drinking water Specifications – IS 10500-2012	
6	Appuu Kuttan KK, *Robotics, I.K. Volume-I*, International Publishing House Pvt. Ltd, 2013.	
7	L. Jyothish Kumar, Pulak M Pandey, *3D printing & Additive Manufacturing Technology*, Springer publications, 2017.	
8	Mahesh M Rathore, *Thermal Engineering*, Tata McGraw Hill publications (India) Pvt. Ltd, 2010.	

ADDITIONAL REFERENCE MATERIAL:	
1	Subramanian KP, *Highway, Railway, Airport and Harbour Engineering*, First Edition, Scitech Publications (India) Pvt. Limited, 2010.
2	M S Shetty, *Concrete Technology (Theory & Practice)*, Revised Edition, S Chand Publishers, 2006.
3	Dr. S.C. Rangwala, *Engineering Materials*, 3rd edition, Charotor Publishing House, 2018.
4	P. K. Nag, *Power Plant Engineering*, 4th edition, McGraw Hill Education, 2017.
5	James D. Halderman, Curt Ward, *Electric and Hybrid Electric Vehicles*, Pearson Education, 2023.
ONLINE COURSES:	
1	https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ce40/
2	https://www.udemy.com/course/surveying/
3	https://archive.nptel.ac.in/courses/112/103/112103316/
4	https://nptel.ac.in/courses/112107291

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Unit VI
CO1	BL6	X					
CO2	BL6		X				
CO3	BL6			X			
CO4	BL6				X		
CO5	BL6					X	
CO6	BL6						X

R23CSET201	INTRODUCTION TO PROGRAMMING (Common to All branches of Engineering)					
	Total Contact Hours	45 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective

- The course aims to equip students with advanced proficiency in C programming, fostering problem-solving skills and algorithmic design, while ensuring mastery in data manipulation, function implementation, and file handling techniques.

Course Outcomes

1	Students will develop essential problem-solving skills and ability to design efficient algorithms to address a wide range of challenges effectively.
2	Students will formulate solutions by constructing well-organized and efficient C programs, effectively using data types, program flow, and loop structures with appropriate utilization of keywords, operators and identifiers.
3	Students will have the ability to experiment on arrays, pointers, and dynamic memory allocation, effectively to develop strategies for manipulates data with precision and efficiency.
4	Students will construct solutions by utilizing functions, string handling, applying variable scope and storage classes effectively, and implementing recursion through C programming principles.
5	Students will create and develop skills in handling structures, unions, and self-referential structures, and demonstrate proficiency in file handling techniques for input and output operations in C.
6	Students will develop and author comprehensive programming expertise in C, encompassing computer problem-solving skills, array and pointer manipulation, function implementation, string handling, and data structure utilization through file operations.

SYLLABUS

Unit I	**INTRODUCTION TO COMPUTER PROBLEM SOLVING**	**9 hr**

Programs and Algorithms, Computer Problem Solving Requirements, Phases of Problem Solving, Problem. Solving Strategies, Top-Down Approach, Algorithm Designing, Program Verification, Improving Efficiency, Algorithm Analysis and Notations.

Unit II	**INTRODUCTION TO C PROGRAMMING**	**9 hr**

Introduction, Structure of a C Program. Comments, Keywords, Identifiers, Data Types, Variables, Constants, Input/output Statements. Operators, Type Conversion. Control Flow, Relational Expressions: Conditional Branching Statements: if, if-else, if-else—if, switch. Basic Loop Structures: while, do-while loops, for loop, nested loops, The Break and Continue Statements, goto statement.

Unit III	**ARRAYS & POINTERS**	**9 hr**

Introduction, Operations on Arrays, Arrays as Function Arguments, Two Dimensional Arrays, Multidimensional Arrays. Pointers: Concept of a Pointer, Declaring and Initializing Pointer Variables, Pointer Expressions and Address Arithmetic, Null Pointers, Generic Pointers, Pointers as Function Arguments, Pointers and Arrays, Pointer to Pointer, Dynamic Memory Allocation, Dangling Pointer, Command Line Arguments.

Unit IV	**FUNCTIONS & STRINGS**	**9 hr**

Introduction Function: Declaration, Function Definition, Function Call, Categories of Functions, Passing Parameters to Functions, Scope of Variables, Variable Storage Classes. Recursion. Strings: String Fundamentals, String Processing with and

without Library Functions, Pointers and Strings.		
Unit V	**STRUCTURES & FILE HANDLING**	**9 hr**
Structures, Unions, Bit Fields: Introduction, Nested Structures, Arrays of Structures, Structures and Functions, Self-Referential Structures, Unions, Enumerated Data Type —Enum variables, Using Typedef keyword, Bit Fields. Data Files: Introduction to Files, Using Files in C, Reading from Text Files, Writing to Text Files, Random File Access.		
LEARNING RESOURCES		
TEXT BOOKS:		
1	B. A. Forouzan, *Computer science: a structured programming approach using C*, 3rd ed. India edition. New Delhi: Cengage Learning India Private Ltd., 2012	
2	R. G. Dromey, *How to solve it by computer*. Delhi: Pearson education, 2008.	
3	A. Mittal, *Programming in C: a practical approach.* New Delhi, India: Pearson Education, 2010.	
REFERENCE BOOKS:		
1	Byron Gottfried, *Schaum's Outline of Programming with C*, McGraw-Hill.	
2	Reema Thareja, *Computer Programming*, Oxford University Press	
3	Dennis Richie and Brian Kernighan, *The C Programming Language*, Pearson Education.	
4	Ashok Kamthane, *Programming In C*, Second Edition, Pearson Publication.	
5	Kanetkar, *Let us C*, Yaswanth, 16th Edition, BPB Publication.	
6	Balagurusamy, E., *Computing fundamentals and C Programming*, McGraw-Hill Education, 2008	
WEB REFERENCES:		
1	http://www.c4learn.com/	
2	http://www.geeksforgeeks.org/c/	
3	http://nptel.ac.in/courses/122104019/	
4	http://www.learn-c.org/	
5	https://www.tutorialspoint.com/cprogramming/	
ONLINE COURSES:		
1	https://mvgrce.codetantra.com	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL6		X			
CO3	BL3			X		
CO4	BL6				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23HSSL001	**COMMUNICATIVE ENGLISH LAB** (Common to All Branches of Engineering)					
	Total Contact Hours	30 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**0**	**0**	**2**	**1**

Course Objective

The main objective of the course is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills to become industry ready.

Course Outcomes

1	Demonstrate understanding of the different aspects of English language proficiency with emphasis on LSRW skills.
2	Develop communication skills by exposing the student to various language learning activities.
3	Analyse and apply techniques to comprehend information in audio/video material.
4	Develop professionalism by facilitating debates and group discussions.
5	Demonstrate effective presentation skills.

List of Topics

1	Communication Skills & JAM
2	Articulation of sounds & Listening to comprehend information
3	Role Play or Conversational Practice
4	E-mail Writing
5	Resume Writing, Cover letter writing
6	Group Discussions-methods & practice
7	Debates - Methods & Practice
8	PPT Presentations/ Poster Presentation
9	Interview skills

LEARNING RESOURCES

REFERENCE BOOKS:

1	Raman Meenakshi, Sangeeta-Sharma, *Technical Communication*, Oxford Press, 2018.
2	Taylor Grant, *English Conversation Practice*, Tata McGraw-Hill Education India, 2016.
3	Hewing's, Martin, *Cambridge Academic English (B2)*, CUP, 2012.
4	J. Sethi & P.V. Dhamija, *A Course in Phonetics and Spoken English*, (2nd Ed), Kindle, 2013.

WEB RESOURCES:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com/

R23PHYL101	ENGINEERING PHYSICS LAB (Common to All Branches of Engineering)					
	Total Contact Hours	30 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Higher Secondary School Physics	**0**	**0**	**2**	**1**

Course Objective

To complement classroom learning with laboratory experiments. Calibration of instruments like travelling-microscope, spectrometer, etc. and to make precise measurements. Understand the physical principles involved in the conduct of experiment and measure the relevant experimental variables. Apply the analytical techniques and graphical analysis to experimental data and draw necessary conclusions. Prepare a concise and clear technical report to communicate his/her experimental understanding.

Course Outcomes

1	Student will be able to **conduct** experiments to reconnoitre the interference and diffraction patterns of light.
2	Student will be able to **find** the signature variation of magnetic field due to current; and the hysteresis energy loss in a magnetic material.
3	Student will be able to **measure** the physiognomies of the semiconductor devices like the energy band gap (E_g) and the temperature coefficient of resistance (α).
4	Student will be able to **observe** the pendulum oscillations and **determine** the impelling parameters like rigidity modulus (η), acceleration due to gravity (g), etc.
5	Student will be able to **verify** the laws of vibrations and **determine** the unknown fork frequency by forming standing waves on stretched strings.

List of Experiments

1	Determination of radius of curvature of a given plano-convex lens by Newton's rings.
2	Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
3	Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
4	Determination of wavelength of Laser light using diffraction grating
5	Determination of energy gap of a semiconductor using p-n junction diode
6	Magnetic field along the axis of a current carrying circular coil by Stewart and Gee's Method
7	Determination of temperature coefficients of a thermistor
8	Determination of rigidity modulus of the material of the given wire using Torsional pendulum
9	Determination of frequency of the electrically maintained tuning fork by Melde's experiment
10	Sonometer: Verification of the laws of stretched string

Additional Experiments

1	Determination of acceleration due to gravity and radius of Gyration by using a compound pendulum

LEARNING RESOURCES

TEXT BOOKS:

1	S. Balasubramanian, M.N. Srinivasan, *A Textbook of Practical Physics*, S. Chand Publishers, 2017.

REFERENCE BOOKS:	
1	C.S. Robinson and Dr. Ruby Das, *A Textbook of Engineering Physics Practical*,1st Edition Laxmi Publications Pvt. Ltd., 2016.
ADDITIONAL REFERENCE MATERIAL:	
1	www.vlab.co.in

<table>
<tr><td rowspan="3">R23CSEL201</td><td colspan="6">COMPUTER PROGRAMMING LAB
(Common to all branches of Engineering)</td></tr>
<tr><td>Total Contact Hours</td><td>45 (P)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>-</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">● The course aims to give students hands – on experience and train them on the concepts of the C- programming language.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Read, understand, and trace the execution of programs written in C language.</td></tr>
<tr><td>2</td><td colspan="6">Select the right control structure for solving the problem.</td></tr>
<tr><td>3</td><td colspan="6">Develop C programs which utilize memory efficiently using programming constructs like pointers.</td></tr>
<tr><td>4</td><td colspan="6">Develop, Debug and Execute programs to demonstrate the applications of arrays, functions, basic concepts of pointers in C.</td></tr>
<tr><td colspan="7">LIST OF EXPERIMENTS</td></tr>
<tr><td>1</td><td colspan="6">WEEK 1:
Familiarization with programming environment.
i Basic Linux environment and its editors like Vi, Vim & Emacs, gedit etc.
ii Exposure to Turbo C, gcc
iii Writing simple programs using printf(), scanf()</td></tr>
<tr><td>2</td><td colspan="6">WEEK 2
Developing the algorithms/flowcharts for the following sample programs
i Sum and average of 3 numbers
ii Conversion of Fahrenheit to Celsius and vice versa
iii Simple interest calculation</td></tr>
<tr><td>3</td><td colspan="6">WEEK 3
Simple computational problems using arithmetic expressions.
i Finding the square root of a given number
ii Finding compound interest
iii Area of a triangle using heron’s formulae
iv Distance travelled by an object</td></tr>
<tr><td>4</td><td colspan="6">WEEK 4:
Simple computational problems using the operator’ precedence and associativity
i Evaluate the following expressions.
a. A+B*C+(D*E) + F*G
b. A/B*C-B+A*D/3
c. A+++B---A
d. J= (i++) + (++i)
ii Find the maximum of three numbers using conditional operator
iii Take marks of 5 subjects in integers, and find the total, average in float</td></tr>
<tr><td>5</td><td colspan="6">WEEK 5:
Problems involving if-then-else structures.:
i Write a C program to find the max and min of four numbers using if-else.
ii Write a C program to generate electricity bill.
iii Find the roots of the quadratic equation.
iv Write a C program to simulate a calculator using switch case.
v Write a C program to find the given year is a leap year or not.</td></tr>
</table>

6	**WEEK 6:** Iterative problems: i Find the factorial of given number using any loop. ii Find the given number is a prime or not. iii Compute sine and cos series iv Checking a number palindrome v Construct a pyramid of numbers.
7	**WEEK 7:** Array manipulation, linear search i Find the min and max of a 1-D integer array. ii Perform linear search on1D array. iii The reverse of a 1D integer array iv Find 2's complement of the given binary number. v Eliminate duplicate elements in an array
8	**WEEK 8:** Matrix problems, String operations, Bubble sort i Addition of two matrices ii Multiplication two matrices iii Sort array elements using bubble sort iv Concatenate two strings without built-in functions v Reverse a string using built-in and without built-in string functions
9	**WEEK 9:** Pointers and structures, memory dereference. i Write a C program to find the sum of a 1D array using malloc() ii Write a C program to find the total, average of n students using structures iii Enter n students data using calloc() and display failed students list iv Read student name and marks from the command line and display the student details along with the total. v Write a C program to implement realloc()
10	**WEEK 10:** i Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields ii Create and display a singly linked list using self-referential structure. iii Demonstrate the differences between structures and unions using a C program. iv Write a C program to shift/rotate using bitfields. iv) Write a C program to copy one structure variable to another structure of the same type.
11	**WEEK 11:** Simple functions using call by value, solving differential equations using Eulers theorem. i Write a C function to calculate NCR value. ii Write a C function to find the length of a string. iii Write a C function to transpose of a matrix. iv Write a C function to demonstrate numerical integration of differential equations using Euler's method
12	**WEEK 12:** Recursive functions: i Write a recursive function to generate Fibonacci series. ii Write a recursive function to find the lcm of two numbers. iii Write a recursive function to find the factorial of a number. iv Write a C Program to implement Ackermann function using recursion. v Write a recursive function to find the sum of series.

13	**WEEK 13:** Simple functions using Call by reference, Dangling pointers. i Write a C program to swap two numbers using call by reference. ii Demonstrate Dangling pointer problem using a C program. iii Write a C program to copy one string into another using pointer. iv Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.
14	**WEEK 14:** File operations i Write a C program to write and read text into a file. ii Write a C program to write and read text into a binary file using fread() and fwrite() iii Copy the contents of one file to another file. iv Write a C program to merge two files into the third file using command-line arguments. v Find no. of lines, words and characters in a file vi) Write a C program to print last n characters of a given file.
LEARNING RESOURCES	
TEXT BOOKS:	
1	Ajay Mittal, *Programming in C: A practical approach*, Pearson.
2	Byron Gottfried, *Schaum' s Outline of Programming with C*, McGraw Hill
REFERENCE BOOKS:	
1	Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, Prentice- Hall of India,1988.
2	Forouzan, Gilberg, Prasad, *C Programming, A Problem-Solving Approach*, CENGAGE, 2011.
ONLINE COURSES:	
1	https://mvgrce.codetantra.com

R23MECW201	ENGINEERING WORKSHOP (Common to All Branches of Engineering)					
	Total Contact Hours	45 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**0**	**0**	**3**	**1.5**
Course Objective						
Students will understand various engineering trades such as carpentry, tin smithy, foundry, fabrication, fitting and electrical house wiring skills and required safety practice required and address common trouble shooting in day- today practice.						
Course Outcomes						
1	Identify workshop tools and their operational capabilities.					
2	Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.					
3	Apply concept of fitting and sheet metal understanding in various applications.					
4	Apply basic electrical engineering knowledge for House Wiring Practice.					
Syllabus						
1	**Demonstration**: Safety practices and precautions to be observed in workshop.					
2	**Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints. a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint					
3	**Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets. a)Tapered tray b)Conical funnel c)Elbow pipe d)Brazing					
4	**Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises. a) V-fit b)Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre					
5	**Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections. a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light e) Three phase motor f) Soldering of wires					
6	**Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.					
7	**Welding Shop**: Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.					
8	**Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.					
Additional Experiments						
1	Making of study lamp using combination of carpentry and house wiring trades.					
2	Frame making of dissemination using carpentry and welding.					
3	Electric Load calculation in a living room.					
4	Demonstration of connection in street lights using single control.					
LEARNING RESOURCES						
TEXT BOOKS:						
1	W. Felix, Basic *Workshop Technology: Manufacturing Process*,					

	Independently Published, 2019.
2	Bruce J. Black, *Workshop Processes, Practices and Materials*, Routledge publishers, 5th Edn. 2015.
3	B.S. Raghuwanshi, Dhanpath Rai & Co., *A Course in Workshop Technology Vol I. & II*, Dhanpat Rai& Co. 2015 & 2017.
REFERENCE BOOKS:	
1	S. K. Hajra Choudhury, *Elements of Workshop Technology, Vol. I.* 14th edition, Media Promoters and Publishers, Mumbai, 2007.
2	H. S. Bawa,Workshop Practice,Tata-McGraw Hill, 2004.
3	P.M.Soni & P.A.Upadhyay, Wiring Estimating, Costing and Contracting, Atul Prakashan, 2021-22.
ADDITIONAL REFERENCE MATERIAL:	
1	https://mrcet.com/downloads/hs/EWS-ITWS%20%20LAB%20MANUAL.pdf
2	https://sjce.ac.in/wp-content/uploads/2018/04/Workshop-Laboratory-Manual.pdf
3	https://manavrachna.edu.in/latest/virtual-lab-workshop-for-first-year-engineering-students-mru/

<table>
<tr><td rowspan="3">R23CSEW201</td><td colspan="6">IT WORKSHOP
(Common to all branches of Engineering)</td></tr>
<tr><td>Total Contact Hours</td><td>30 (P)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">● To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables, operating systems, Compression, Multimedia, Antivirus tools and Office Tools such as Word processors, spreadsheets, and Presentation tools.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Students will be able to analyze Hardware troubleshooting.</td></tr>
<tr><td>2</td><td colspan="6">Students will be able to identify Hardware components and inter dependencies.</td></tr>
<tr><td>3</td><td colspan="6">Students will be able to choose safeguard computer systems from viruses/worms.</td></tr>
<tr><td>4</td><td colspan="6">Students will be able to Create document and power point presentation.</td></tr>
<tr><td>5</td><td colspan="6">Students will be able to develop calculations using spreadsheets.</td></tr>
<tr><td colspan="7">List of Experiments</td></tr>
<tr><td>1</td><td colspan="6">Week-1: PC Hardware & Software Installation
1) Identify the peripherals of a computer, components in a CPU, and functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.
2) Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students must go through the video showing the PC assembling process. A video would be given as part of the course content.</td></tr>
<tr><td>2</td><td colspan="6">Week-2:
1) Students should install MS windows on their personal computer. The lab instructor should verify the installation and follow it with a Viva.</td></tr>
<tr><td>3</td><td colspan="6">Week-3:
1) Every student should install Linux on the computer. This computer should have Windows installed. The system should be configured as dual boot (VMWare) with Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva.
2) Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva.</td></tr>
<tr><td>4</td><td colspan="6">Week-4: Internet & World Wide Web
1) Orientation & Connectivity Boot Camp: Students should connect to their Local Area Network and access the Internet. In the process, they configure the TCP/IP setting. Finally, students should demonstrate to the instructor how to access the websites and email. Without internet connectivity, instructors must simulate the WWW on the LAN.
2) Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search</td></tr>
</table>

	toolbars, and pop-up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
5	Week-5: 1) Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student. 2) Cyber Hygiene: Students would be exposed to the various threats on the internet and asked to configure their computers to be safe on the internet. They need to customize their browsers to block pop-ups, and block active X downloads to avoid viruses and worms.
6	Week-6: LaTeX and WORD 1) Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) Office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent(FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word. 2) Using LaTeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in Word, Drop Cap in Word, Applying Text effects, Using Character Spacing, Borders, and Colors, Inserting Header and Footer, Using Date and Time options in LaTeX and Word.
7	Week-7: 1) Creating project abstract Features to be covered: Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes. 2) Creating a Newsletter: Features to be covered:- Table of Contents, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs, and Mail Merge in word.
8	Week-8: EXCEL Excel Orientation: The mentor needs to tell the importance of the MS Office or equivalent (FOSS)tool Excel as a Spreadsheet tool give the details of the four tasks and features that would be covered in each. Using Excel – Accessing an overview oftool bars, saving Excel files, Using help and resources. 1) Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto-fill, Formatting Text. 2) Calculating GPA -. Features to be covered:- Cell Referencing, Formulae in Excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyperlinking, Count function.
9	Week-9: 1) LOOKUP/LOOKUP : Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting.
10	Week-10: POWERPOINT 1) Students will be working on essential PowerPoint utilities and tools which help them create introductory PowerPoint

	presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint. 2) Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.
11	Week-11: 1) Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes, etc.), and Inserting – Background, textures, Design Templates, Hidden slides.
12	Week-12: AI TOOLS – Chat GPT 1) Prompt Engineering: Experiment with different prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them. 2) Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a scene description, and let the model generate the rest of the content. This can be a funway to brainstorm creative ideas. 3) Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

LEARNING RESOURCES

TEXT BOOKS:

1	Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream Tech, 2003
2	Introduction to Information Technology, ITL Education Solutions Limited, Pearson Education, 2012, 2nd edition

REFERENCE BOOKS:

1	The Complete Computer Upgrade and Repair Book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
2	PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
3	LaTeX Companion, Leslie Lamport, PHI/Pearson

R23HSSM801	HEALTH AND WELLNESS, YOGA AND SPORTS (Common to All Branches of Engineering)					
	Total Contact Hours	15 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**0**	**0**	**1**	**0.5**

Course Objective

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes

1	Demonstrate the importance of yoga and sports for Physical fitness and sound health.
2	Demonstrate an understanding of health-related fitness components.
3	Compare and contrast various activities that help enhance their health.
4	Assess current personal fitness levels.
5	Develop Positive Personality

SYLLABUS

Unit I	Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups. **Activities:** Organizing health awareness programmes in community ii) Preparation of health profile iii) Preparation of chart for balance diet for all age groups	**5 hr**
Unit II	Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice. **Activities:** Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar	**5 hr**
Unit III	Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and 49 Modern Olympics, Asian games and Commonwealth games. **Activities:** i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.	**5 hr**

LEARNING RESOURCES

REFERENCE BOOKS:

1	Gordon Edlin, Eric Golanty, *Health and Wellness*, 14th Edn. Jones & Bartlett Learning, 2022.
2	T.K.V.Desikachar, *The Heart of Yoga: Developing a Personal Practice*, Inner Traditions,1999.
3	Archie J.Bahm, *Yoga Sutras of Patanjali*, Jain Publishing Company, 1993.
4	Wiseman, John Lofty, *SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere*, Third Edition, William Morrow Paperbacks, 2014.
5	Thomas Hanlon, *The Sports Rules Book/ Human Kinetics*, 3rd ed. Human Kinetics, Inc.2014.

***

II SEMESTER

R23MATT102	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS (Common to All Branches of Engineering)					
	Total Contact Hours	45 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Calculus	**3**	**0**	**0**	**3**

Course Objective

- To enlighten the learners in the concept of differential equations and multivariable calculus.
- To furnish the learners with basic concepts and techniques at plus two level to lead them in to advanced level by handling various real-world applications.

Course Outcomes

1	Solve first order differential equations and make use of them to deal with real word problems like law of cooling, growth, decay and electrical circuits.(**BL3**)
2	Solve the higher order differential equations to make use of them to deal with real word problems like LCR circuits and simple harmonic motion.(**BL3**)
3	Solve the partial differential equations by various methods.(**BL3**)
4	Interpret the physical meaning of different operators such as gradient, curl and divergence.(**BL3**)
5	Estimate the work done against a field, circulation and flux using vector calculus.(**BL5**)
6	Formulate Mathematical models and estimate appropriate physical quantities.(**BL6**)

SYLLABUS

Unit I	**DIFFERENTIAL EQUATIONS OF FIRST ORDER AND FIRST DEGREE**	**9 hr**

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

Unit II	**LINEAR DIFFERENTIAL EQUATIONS OF HIGHER ORDER (CONSTANT COEFFICIENTS)**	**9 hr**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskean, method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

Unit III	**PARTIAL DIFFERENTIAL EQUATIONS**	**9 hr**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

Unit IV	**VECTOR DIFFERENTIATION**	**9 hr**

Scalar and vector point functions, vector operator del, del applies to scalar point functions -Gradient, del applied to vector point functions - Divergence and Curl, vector identities.

Unit V	**VECTOR INTEGRATION**	**9 hr**

Line integral – circulation - work done, surface integral - flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and applications of these theorems.

LEARNING RESOURCES

TEXT BOOKS:

1	Erwin Kreyszig, *Advanced Engineering Mathematics*, 10/e, John Wiley & Sons, 2018.
2	B.S.Grewal, *Higher Engineering Mathematics*, 44/e, Khanna Publishers, 2017.

REFERENCE BOOKS:	
1	Dennis G.Zill and Warren S.Wright, *Advanced Engineering Mathematics*, Jones and Bartlett, 2018.
2	Michael Green Berg, *Advanced Engineering Mathematics*, 9th edition, Pearson edn
3	George B.Thomas, Maurice D. Weir and Joel Hass, *Thomas Calculus*,14/e, Pearson Publishers, 2018.
4	R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 5/e, Alpha Science International Ltd., 2021 (9th reprint).
5	B.V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education, 2017.

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL3			X		
CO4	BL3				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23CHYT102	CHEMISTRY (Common to EEE, ECE, CSE, IT & allied Branches)					
	Total Contact Hours	45 (L)	L	T	P	C
	Pre-requisite	Chemistry at 10 + 2 level education	3	0	0	3

Course Objective

- Students will get exposure to familiarize engineering chemistry and its applications
- Students will get exposure to train the students on the principles and applications of electrochemistry and polymers
- Students will get exposure to introduce instrumental methods, molecular machines and switches.

Course Outcomes

1	The student will be able to analyze the structure of various homo and hetero atomic molecules and also estimate the energies of the molecules using principles of Quantum mechanics and molecular orbital theory.
2	The student will be able to apply the knowledge of modern engineering materials to solve real world problems and adapt to new developments in the field of material science, electronics and energy technology.
3	The student will be able to analyze, compare, make use of and design the batteries, sensors, fuel cells and various electro analytical techniques.
4	The student will be able to select, distinguish and appraise the diversity and versatility of polymers, elastomers, plastics, conducting and biodegradable polymers, their widespread applications in various industries, and their environmental implications
5	The student will be able to have strong foundation in various analytical and spectroscopic techniques enabling him to apply and evaluate in quality control, scientific exploration and in various industries.
6	Demonstrate the ability to identify, synthesize, interpret, categorize, and characterize different materials and their significance to be used as suitable and appropriate engineering materials using the concepts of quantum mechanics, principles of storage devices, electrochemistry, polymer chemistry, and analytical instrumental methods of analysis to propose innovative solutions to engineering problems/ challenges of simple to complex nature.

SYLLABUS

Unit I	STRUCTURE AND BONDING MODELS	9 hr

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box

Molecular orbital theory – Bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O_2 and CO, etc. π-molecular orbitals of butadiene and benzene, calculation of bond order.

Unit II	MODERN ENGINEERING MATERIALS	9 hr

Semiconductors - Introduction, basic concept, application

Super conductors - Introduction basic concept, applications.

Supercapacitors - Introduction, Basic Concept-Classification – Applications.

Nano materials - Introduction, classification, properties and applications of fullerenes, carbon nanotubes and Graphines nanoparticles

Unit III	ELECTROCHEMISTRY AND APPLICATIONS	9 hr
Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations). **Electrochemical sensors –** potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).		
Unit IV	**POLYMER CHEMISTRY**	**9 hr**
Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation. **Plastics –**Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC,Teflon, Bakelite, Nylon-6,6, carbon fibers. **Elastomers–**Buna-S, Buna-N–preparation, properties and applications. **Conducting polymers –** polyacetylene, polyaniline, – mechanism of conduction and applications. **Bio-Degradable polymers -** Poly Glycolic Acid (PGA), Poly Lactic Acid (PLA).		
Unit V	**INSTRUMENTAL METHODS AND APPLICATIONS**	**9 hr**
Electromagnetic spectrum - Absorption of radiation: Beer-Lambert's law. **UV-Visible Spectroscopy -** electronic transition, Instrumentation, **IR spectroscopy -** fundamental modes and selection rules, Instrumentation. **Chromatography-**Basic Principle, Classification-HPLC: Principle, Instrumentation and Application		

LEARNING RESOURCES

TEXT BOOKS:

1	Jain and Jain, *Engineering Chemistry*, 16/e, DhanpatRai, 2013.
2	Peter Atkins, Julio de Paula and James Keeler, Atkins' *Physical Chemistry*, 10/e, Oxford University Press, 2010.

REFERENCE BOOKS:

1	Skoog and West, *Principles of Instrumental Analysis*, 6/e, Thomson, 2007.
2	J.D. Lee, Concise *Inorganic Chemistry*, 5th Edition, Wiley Publications, Feb.2008.
3	Fred W. Billmayer Jr, *Polymer Science*, 3rd Edition

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL3		X			
CO3	BL4			X		
CO4	BL4				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23EEET201	BASIC ELECTRICAL & ELECTRONICS ENGINEERING (Common to All Branches of Engineering)					
	Total Contact Hours	48 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Fundamental Physics and Maths	**3**	**0**	**0**	**3**

Course Objective

Students will gain understanding of laws and principles of electrical and electronics engineering and able to apply this knowledge to build simple circuits in relevant fields.

Course Outcomes: Student

1	Will be able to apply the basic principles of electrical and circuits to solve DC and AC circuits.(**BL3**)
2	Will be able to analyze the construction and operation of various electrical machines and measuring instruments also select a machine for an application.(**BL3**)
3	Will be able to analyze power generation, electric safety measures and examine electrical power consumption and tariff.(**BL4**)
4	Will be able to appraiser a profound comprehension of semiconductor devices, basic electronic circuits, and instrumentation by examining the principles, characteristics, & application and analyze the block diagrams and interactions within electronic instrumentation systems.(**BL4**)
5	Will be able to design simple combinational and sequential circuits of digital electronics.(**BL6**)
6	Will be able to combine the fundamental principles of electrical and electronics engineering to design & solve simple circuits and discuss power generation, control and safety.(**BL6**)

SYLLABUS

Unit I	**DC & AC CIRCUITS**	**8 hr**

Electrical circuit elements (R), Ohm's Law and its limitations; KCL; KVL; Electrical circuit elements (L, C);
Superposition theorem; A.C. Fundamentals; Voltage and current relationship with phasor diagrams in R, L, and C circuits; Concept of Impedance, Active power, reactive power, apparent power and power factor;

Unit II	**MACHINES AND MEASURING INSTRUMENTS**	**8 hr**

Construction, principle and operation of & Applications - DC Motor; DC Generator; Single Phase Transformer; Three Phase Induction Motor;
Construction, principle and operation of & Applications – Alternator; Construction and working principle of PMMC Instruments; MI Instruments; Wheatstone bridge;

Unit III	**ENERGY RESOURCES, ELECTRICITY BILL & SAFETY MEASURES**	**8 hr**

Conventional and non-conventional energy resources, Layout and operation of various Power Generation systems - Hydel generation; Nuclear generation; Solar power generation.; Wind power generation.
Power rating of household appliances, Definition of "unit" used for consumption of electrical energy; Two-part electricity tariff, calculation of electricity bill for domestic consumers; Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits; Earthing and types of earthing, Safety Precautions to avoid shock;

Unit IV	**SEMICONDUCTOR DEVICES**	**8 hr**

Evolution of Electronics and Classification of Materials; PN Junction Diode and Characteristics; Zener Diode and Characteristics; Transistor (NPN and PNP) Operation;
Transistor CB configuration; Transistor CE Configuration; Transistor CC Configuration; Small signal Transistor CE amplifier;

Unit V	**BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION**	**8 hr**

Half Wave Rectifier; Full Wave Bridge Rectifier; Rectifiers with filters; Zener regulator;
DC Power supply (RPS); Public Address System; Frequency response of CE amplifier; Electronic Instrumentation System;

Unit VI	**DIGITAL ELECTRONICS**	**8 hr**
Number Systems; Binary Codes; Logic gates; Boolean Algebra; Half and Full adder; Flip Flops; Registers; Counters		
LEARNING RESOURCES		
TEXT BOOKS:		
1	D. C. Kulshreshtha, *Basic Electrical Engineering*, Tata McGraw Hill, 2019.	
2	P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, *Power System Engineering*, Dhanpat Rai & Co, 2013.	
3	R. S. Sedha, *A Textbook of Electronic Devices and Circuits*, S. Chand & Co, 2010.	
REFERENCE BOOKS:		
1	V.K. Mehtha, *Principles of Electrical and Electronics Engineering*, S.Chand Technical Publishers, 2020.	
2	S. K. Bhatacharya, *Basic Electrical and Electronics Engineering*, Person Publications, 2018.	
3	R. P. Jain, *Modern Digital Electronics*, Tata Mc Graw Hill, 2009.	
ONLINE COURSES:		
1	https://nptel.ac.in/courses/108105053	
2	https://nptel.ac.in/courses/108108076	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V	Unit VI
CO1	BL3	X	X				
CO2	BL3		X				
CO3	BL4			X			
CO4	BL4				X	X	
CO5	BL6						X
CO6	BL6	X	X	X	X	X	X

R23CSET301	DATA STRUCTURES (Common to CSE, IT and Allied Branches)					
	Total Contact Hours	45 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Programming	**3**	**0**	**0**	**3**

Course Objective

- Students will get exposure to use data structures such as arrays, linked lists, stacks,queues, trees and will be able to select and implement the appropriate data

structures to solve the given problem

Course Outcomes:

1	Students will be able to apply various searching and sorting techniques and analyze their time complexities.
2	Students will be able to apply Linked Lists and its variants and utilize them for various applications.
3	Students will be able to compare arrays and Linked Lists and conclude which storage structure is appropriate for the given problem/data structure.
4	Students will be able to develop novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees
5	Students will be able to recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.
6	Students will be able to collaborate in teams to design and implement innovative solutions by choosing and combining the appropriate data structure(s).

SYLLABUS

Unit I	**INTRODUCTION TO LINEAR DATA STRUCTURES**	**9 hr**

Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. **Searching Techniques**: Linear & Binary Search, **Sorting Techniques**: Bubble sort,
Selection sort, Insertion Sort

Unit II	**LINKED LISTS**	**9 hr**

Linked Lists: Singly linked lists, representation and operations, doubly linked lists and
circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

Unit III	**STACKS**	**9 hr**

Stacks: Introduction to stacks: properties and operations, implementing stacks using
arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

Unit IV	**QUEUES**	**9 hr**

Queues: Introduction to queues: properties and operations, implementing queues using arrays andlinked lists, Applications of queues in breadth-first search, scheduling, etc.
Deques: Introduction to deques (double-ended queues), Operations on deques andtheir applications.

Unit V	**TREES AND HASHING**	**9 hr**

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversals

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc

LEARNING RESOURCES	
TEXT BOOKS:	
1	Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2	Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008.
3	Data Structures, 2/e, Richard F, Gilberg , Forouzan, Cengage.
REFERENCE BOOKS:	
1	Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders.
2	C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3	Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4	Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
5	Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick
ONLINE COURSES:	
1	https://www.javatpoint.com/data-structure-tutorial
2	https://www.programiz.com/dsa
3	https://www.cs.bham.ac.uk/~jxb/DSA/dsa.pdf

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL4	X	X	X	X	
CO4	BL6			X	X	X
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23MECD201	ENGINEERING GRAPHICS (Common to All Branches of Engineering)					
	Total Contact Hours	75(15L+60P)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic mathematics, imagination skills	**1**	**0**	**4**	**3**

Course Objective: To enable the students with various concepts like dimensioning, conventions and standards related to Engineering Drawing

Course Outcomes: On completion of the course, the student should be able to

1	Apply the principles of curves, scales, orthographic and isometric projections. in engineering drawing.(**BL3**)
2	Interpret orthographic projections like front, top and side views related to points, lines, planes and solids.(**BL5**)
3	Demonstrate the projection of solids in various positions in the first quadrant. (**BL3**)
4	Examine the principles behind development of surfaces. (**BL4**)
5	Develop orthographic and isometric projections of solids. (**BL6**)

SYLLABUS

Unit I	**CURVES, SCALES AND POLYGONS**	**15 hr**

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods.

Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involutes, Normal and tangent to Curves.

Scales: Plain scales, diagonal scales and vernier scales.

Unit II	**ORTHOGRAPHIC PROJECTIONS**	**15 hr**

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

Unit III	**PROJECTIONS OF SOLIDS**	**15 hr**

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

Unit IV	**SECTIONS OF SOLIDS AND DEVELOPMENT OF SURFACES**	**15 hr**

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

Unit V	**CONVERSIONS OF VIEWS**	**15 hr**

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using AutoCAD

LEARNING RESOURCES	
TEXT BOOKS:	
1	N. D. Bhatt, *Engineering Drawing*, Charotar Publishing House, 2016.
REFERENCE BOOKS:	
1	K.L. Narayana and P. Kannaiah, *Engineering Drawing*, Tata McGraw Hill, Third Edition, 2013.
2	M.B.Shah and B.C. Rana, *Engineering Drawing*, Pearson Education Inc,2009.
3	Dhananjay Jolhe, *Engineering Drawing with an Introduction to AutoCAD*, Tata McGraw Hill, 2017.
ADDITIONAL REFERENCE MATERIAL:	
1	https://nitc.ac.in/imgserver/uploads/attachments/Ed__5c3343c5-c3f9-468a-b114-8f33556810b4_.pdf
ONLINE COURSES:	
1	https://www.mygreatlearning.com/academy/learn-for-free/courses/engineering-graphics-drawing
2	https://onlinecourses.nptel.ac.in/noc21_me128/preview
3	https://www.udemy.com/course/engineering-drawing-graphics/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X	X	X		
CO2	BL5	X	X	X		
CO3	BL3			X	X	X
CO4	BL4				X	X
CO5	BL6	X	X	X	X	X

R23CHYL102	CHEMISTRY LAB (Common to EEE, ECE, CSE, IT & allied Branches)					
	Total Contact Hours	30 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Chemistry at 10 + 2 level education	**0**	**0**	**2**	**1**

Course Objective

- Verify the fundamental concepts with experiments

Course Outcomes: At the end of the course, the student will be able to

1	Determine the cell constant and conductance of solutions.
2	Prepare advanced polymers and nanomaterials.
3	Measure the strength of an acid present in secondary batteries.
4	Understand, analyze and apply the principles of UV - Visible and IR spectroscopic Techniques.
5	Understand and determine the potentials using Potentiometry.

List of Experiments

1	Measurement of 10Dq by spectrophotometric method.
2	Conductometric titration of strong acid vs. strong base.
3	Conductometric titration of weak acid vs. strong base.
4	Determination of cell constant and conductance of solutions.
5	Potentiometry - determination of redox potentials and emfs.
6	Determination of Strength of an acid in Pb-Acid battery.
7	Preparation of a Bakelite.
8	Verify Lambert-Beer's law.
9	Wavelength measurement of sample through UV-Visible Spectroscopy.
10	Identification of simple organic compounds by IR.
11	Preparation of nanomaterials by precipitation method.
12	Estimation of Ferrous Iron by Dichrometry.

LEARNING RESOURCES

TEXT BOOKS:

1	Chemistry lab Manual. Prepared by Department of Chemistry, MVGR College of Engineering (A)

REFERENCE BOOKS:

1	J. Mendham, R. C. Denney, J. D. Barnes, and B. Sivasankar, *Vogel's textbook of quantitative chemical analysis*. New Delhi: Pearson, 2009.

ADDITIONAL REFERENCE MATERIAL:

1	https://www.youtube.com/@spardhayavardhatheyvidya3470

R23EEEL201	ELECTRICAL & ELECTRONICS ENGINEERING LAB (Common to All Branches of Engineering)					
	Total Contact Hours	45 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	BEEE	**0**	**0**	**3**	**1.5**

Course Objective

To impart knowledge on design and practical verification basic electrical and electronic circuits and simple energy calculation.

Course Outcomes: Student will be able to

1	Design and analyze simple circuits to verify basic electrical laws and theorems.
2	Design and analyze electrical circuits to measure resistance, power and energy consumption.
3	Understand the voltage build up procedure in DC shunt generator.
4	Design simple electronic circuits to analyze the behavior of electronic components and verify their applications.
5	Explain the operation of digital circuits.

List of Experiments

1	Verification of KCL and KVL
2	Verification of Superposition theorem
3	Measurement of Resistance using Wheat stone bridge
4	Magnetization Characteristics of DC shunt Generator
5	Measurement of Power and Power factor using Single-phase wattmeter
6	Calculation of Electrical Energy for Domestic Premises
7	Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
8	Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
9	Implementation of half wave and full wave rectifiers
10	Plot Input & Output characteristics of BJT in CE and CB configurations
11	Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
12	Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Additional experiments

1	Measurement of Earth Resistance using Megger
2	Frequency response of CE amplifier
3	Simulation of RC coupled amplifier with the design supplied

LEARNING RESOURCES

TEXT BOOKS:

1	D. C. Kulshreshtha, *Basic Electrical Engineering*, Tata McGraw Hill, 2019.
2	P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, *Power System Engineering*, Dhanpat Rai & Co, 2013.
3	R. S. Sedha, *A Textbook of Electronic Devices and Circuits*, S. Chand & Co, 2010.

REFERENCE BOOKS:

1	V.K. Mehtha, *Principles of Electrical and Electronics Engineering*, S.Chand Technical Publishers, 2020.
2	S. K. Bhatacharya, *Basic Electrical and Electronics Engineering*, Person Publications, 2018.
3	R. P. Jain, *Modern Digital Electronics*, Tata Mc Graw Hill, 2009

ADDITIONAL REFERENCE MATERIAL:

1	https://www.udemy.com/course/complete-course-on-electronic-devices-and-circuits/
2	http://nptel.iitm.ac.in/
3	http://www.learningware.in/

R23CSEL301	DATA STRUCTURES LAB (Common to CSE, IT & Allied Branches)					
	Total Contact Hours	45 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**0**	**0**	**3**	**1.5**

Course Objective

- Students will be able to develop programs for solving real time problems by choosing appropriate data structure concepts.

Course Outcomes:

1	Students will be able to explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
2	Students will be able to design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
3	Students will be able to develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
4	Students will be able to apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
5	Students will be able to devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees

List of Experiments

1	**Exercise 1: Array Manipulation** i) Write a program to reverse an array. i) C Programs to implement the Searching Techniques – Linear &Binary Search ii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort
2	**Exercise 2: Linked List Implementation** i) Implement a singly linked list and perform insertion and deletion operations. ii) Develop a program to reverse a linked list iteratively and recursively. iii) Solve problems involving linked list traversal and manipulation.
3	**Exercise 3: Linked List Applications** i) Create a program to detect and remove duplicates from a linked list. ii) Implement a linked list to represent polynomials and perform addition. iii) Implement a double-ended queue (deque) with essential operations.
4	**Exercise 4: Double Linked List Implementation** i) Implement a doubly linked list and perform various operations to understand its properties and applications. ii) Implement a circular linked list and perform insertion, deletion, and traversal.
5	**Exercise 5: Stack Operations** i) Implement a stack using arrays and linked lists. ii) Write a program to evaluate a postfix expression using a stack. iii) Implement a program to check for balanced parentheses using a stack.
6	**Exercise 6: Queue Operations** i) Implement a queue using arrays and linked lists. ii) Develop a program to simulate a simple printer queue system. iii) Solve problems involving circular queues.

7	**Exercise 7: Stack and Queue Applications** i) Develop a program to simulate a simple printer queue system. ii) Use a stack to evaluate an infix expression and convert it to postfix. iii) Create a program to determine whether a given string is a palindrome or not.
	iv) Implement a stack or queue to perform comparison and check for symmetry
8	**Exercise 8: Binary Search Tree** i) Implementing a BST using Linked List. ii) Traversing of BST.
9	**Exercise 9: Hashing** i) Implement a hash table with collision resolution techniques. ii) Write a program to implement a simple cache using hashing.
LEARNING RESOURCES	
TEXT BOOKS:	
1	Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2	Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, SiliconPress, 2008
REFERENCE BOOKS:	
1	Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2	C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3	Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4	Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, andClifford Stein
5	Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and GraphAlgorithms by Robert Sedgewick.
ADDITIONAL REFERENCE MATERIAL:	
1	https://www.udemy.com/course/complete-course-on-electronic-devices-and-circuits/
2	http://nptel.iitm.ac.in/
3	http://www.learningware.in/

R23HSSM802	NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE (Common to All Branches of Engineering)					
	Total Contact Hours	15 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**0**	**0**	**1**	**0.5**

Course Objective

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Outcomes

1	Demonstrate the importance of discipline, character and service motto.
2	Solve some societal issues by applying acquired knowledge, facts, and techniques.
3	Explore human relationships by analyzing social problems.
4	Develop service-oriented approach to extend their help for the fellow beings and downtrodden people.
5	Develop leadership skills and civic responsibilities.

SYLLABUS

Unit I	General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance. **Activities:** i) Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills ii) Conducting orientations programs for the students –future plans-activities-releasing road map etc. iii) Displaying success stories-motivational biopics- award winning movies on societal issues etc. iv) Conducting talent show in singing patriotic songs-paintings- any other contribution.	**5 hr**
Unit II	**NATURE & CARE** **Activities:** i) Nature & Care Best out of waste competition. ii) Poster and signs making competition to spread environmental awareness. iii) Recycling and environmental pollution article writing competition. iv) Organizing Zero-waste day. v) Digital Environmental awareness activity via various social media platforms. vi) Virtual demonstration of different eco-friendly approaches for sustainable living. vii) Write a summary on any book related to environmental issues.	**5 hr**
Unit III	**COMMUNITY SERVICE** **Activities:** i) Community Service Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media-authorities- experts-etc. 24 JNTUGV B. Tech. R23 Regulations ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS, iii) Conducting consumer Awareness. Explaining various legal provisions etc. iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education. v) Any other programmes in collaboration with local charities, NGOs etc.	**5 hr**

LEARNING RESOURCES	
REFERENCE BOOKS:	
1	Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme Vol;.I*, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2	Red Book - *National Cadet Corps – Standing Instructions Vol I & II*, Directorate General of NCC, Ministry of Defence, New Delhi
3	Davis M. L. and Cornwell D. A., *Introduction to Environmental Engineering*, McGraw Hill, New York 4/e 2008
4	Masters G. M., Joseph K. and Nagendran R. *Introduction to Environmental Engineering and Science*‖, Pearson Education, New Delhi. 2/e 2007.
5	Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

III SEMESTER

R23MSCST003	DISCRETE MATHEMATICAL STRUCTURES					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**0**	**0**	**3**

Course Objective

Acquaintance with the basic mathematical implication for computer science, applications of mathematics in computer science.

- To understand mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic, and truth tables.
- To understand about elementary of combinatorics, the principle of inclusion and exclusion and the pigeonhole principle.
- To expose the students to Binary relations, posets, Hasse diagram, lattice, and discuss various properties of relations.
- To understand Algebraic structures like groups, semigroups, monoids.
- To introduce generating functions and recurrence relations.

Course Outcomes

After completing this course, the students will be able to

1	Apply mathematical logic to solve problems.
2	Apply the concepts related to primality, divisibility, and Greatest common divisors.
3	Evaluate the problems using set theory and Apply basic counting techniques to solve combinatorial problems.
4	Gain the conceptual background needed and analyze the structures of algebraic nature
5	Formulate problems and solve recurrence relations.
6	Design the problems by using the concepts of discrete mathematical structures to computer science and engineering. (**BL6**)

SYLLABUS

Unit I	**MATHEMATICAL LOGIC & STATEMENT CALCULUS**	**8 hr**

Statements : Simple and Compound statements, Truth Tables, Well Formed Formulas; Tautologies, Equivalence of formulas; Converse, Contrapositive & inverse of an implication, Duality Law, tautological implications; Normal Forms: Principal Disjunctive Normal Forms, Principal Conjunctive Normal Forms; Inference Theory of Statement Calculus: Validity of argument using Truth Tables; Validity of argument using rules of inference; Consistency of premises; Indirect Method of Proof

Unit II	**PREDICATE CALCULUS & NUMBER THEORY**	**8 hr**

Predicate Calculus: Predicate calculus: Predicates, statement of functions, variables and quantifiers, predicate formulas; free and bound variables, universe of discourse, valid formulas and equivalences involving quantifiers; rules of inference; theory of inference for predicate calculus;

Number Theory:

Properties of integers, Division Theorem; Euclidian Algorithm: finding GCD, testing for prime numbers; Fundamental Theorem of Arithmetic, Prime factorization; Modular Arithmetic, Fermats Theorem

Unit III	**COMBINATORICS, SET THEORY, POSETS AND LATTICES**	**8 hr**

Combinatorics: Principles of counting (product and sum rules); Pigeon hole principle and its applications; Principle of Inclusion-Exclusion and its applications; Relations: Binary relation, properties; equivalence relation, composition of relations; partition of a set, equivalence classes; Partial ordering: Partial order relation, partially ordered set (poset), chain; Hasse diagrams, Lattices.

Unit IV	**ALGEBRAIC STRUCTURES**	**8 hr**

Algebraic Systems (Structures): Binary operation, algebraic structures such as Semi

group, Monoid; Group, commutative group with suitable examples; properties satisfied by the algebraic structures and the elements; Special group structures: Sub group and its criteria; Cyclic Groups; Homomorphisim of a Groups; Cosets, properties of cosets; order of a group, Lagrange's theorem		
Unit V	**RECURRENCE RELATIONS & GENERATING FUNCTIONS**	**8 hr**
Recurrence Relations: Formation, iterative method of solving recurrence relations; solving homogeneous and non-homogeneous recurrence relations by characteristic roots method; Generating Functions: Generating functions of sequences; calculation of coefficients of expansions; Closed form expression; solving homogeneous and non-homogeneous recurrence relations by generating functions.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	J. P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to C Sc, Tata McGraw Hill, 1997	
2	S. Santha and E V Prasad, Mathematical Foundations for Computer Science, CENGAGE Publishers	
REFERENCE BOOKS:		
1	Kenneth. H. Rosen, Discrete Mathematics and its Applications, 6/e, Tata McGraw-Hill, 2009.	
2	Dr. D S Chandrasekharaiah, Mathematical Foundations of Computer Science, Prism Book Pvt Ltd.	
3	Swapan Kumar Sarkar, Mathematical Foundation of Computer Science, 9th Edition, S Chand Publishers.	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X	X			
CO2	BL3		X			
CO3	BL3			X		
CO4	BL4				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST004	OOP with C++ (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	C Programming	**3**	**0**	**0**	**3**

Course Objective

To get exposure to the style of object oriented programming over procedure oriented programming that makes modeling complicated solutions more manageable & structured and explore the same using C++ programming constructs.

Course Outcomes	
1	Students will be able to compare the differences between procedure oriented programming and object oriented programming. **(BL5)**
2	Students will be able to analyze the class object model and apprise constructors, destructors, static variables and methods. **(BL4)**
3	Students will be able to apply the concept of operator and function overloading and also evaluate friend functions and classes. **(BL3)**
4	Students will be able to examine the features of inheritance to enhance code Reusability. **(BL4)**
5	Students will be able to experiment with template functions and classes and could also identify the exception handling, vector classes. **(BL3)**
6	Students will be able to design and develop applications using oop Model confidently and also distinguish between oop technique and Procedural oriented methodology. **(BL6)**

SYLLABUS

Unit I	**Incremental Changes to C: C++**	**8 hr**

Deficiencies with Structured Programming in C, Grouping of Data and related functions; Enhancements to built-in data types from C; Identifying a logical group – Abstraction, create a capsule with Data and related functions – Encapsulation; Class – a construct to support Abstraction & Encapsulation, Control Visibility of parts inside capsule – Data Hiding; Macros to avoid duplicate User Defined Data Type definitions, Enhancements to built-in operators from C in C++; Streams, Stream Classes, pre-defined Streams, Input and Output from Standard streams; Manipulators: pre-built & user-defined, Formatted and Unformatted input and output; Concepts of Scope & Extent/life-time, Concepts of static and dynamic memory allocation for member variables;

Unit II	**CLASSES, OBJECTS, MEMBER FUNCTIONS & VARIABLES**	**8 hr**

Constructors-Types and Destructors; Static Object creation : static memory allocation, initialization with Constructor, invoking public member functions, Dynamic object creation and destruction; Public and private members of a class and their usage through an object – Protected members; Static member variables, static member functions; This pointer & self- reference, Namespace & inline functions; Class Functions/Variables distinct from Instance Functions/Variables; Const Functions and Const parameters to Functions; Parameter passing mechanisms in C++

Unit III	**OVERLOADING, FRIEND FUNCTIONS AND CLASSES**	**8 hr**

Overloading Definition, Constructor Over-loading, Function Over-loading, drawbacks of functions overloading; Unary Operators Overloading using public member functions; Binary Operators Overloading using public member functions; Copy Constructor, Assignment Operator Overloading for a Class ; Friend Functions, Friend Classes; Unary Operators Overloading using Friend Functions; Binary Operators Overloading Using Friend Functions; "<<" overloading using Friend Function

Unit IV	**INHERITANCE & POLYMORPHISM**	**8 hr**
Inheritance & Types of Inheritance, Type-Substitutability; Multiple Inheritances, Issues with Multiple Inheritance; Composition versus Inheritance, Virtual Base Class; Static Polymorphism using Inheritance; Functions Overriding; Constructors in inheritance & Destructors inheritance; Pointers in Inheritance, Virtual Functions; Pure virtual functions and Abstract classes		
Unit V	**TEMPLATES, EXCEPTIONS HANDLING & COLLECTIONS**	**8 hr**
Templates functions, Sorting using Templates; Templates Classes, Overloading of Templates Functions; Exception handling, keywords using, Types of Exceptions; Multiple Catch statements, User-defined Exceptions; Lists collections; Iterators collections; Vectors collections; Maps collections		
LEARNING RESOURCES		
TEXTBOOKS:		
1	C++ Primer, fifth edition, Stanley B. Lippman, Josee Lajoie.	
2	C++ The Complete Reference : HERBERT SCHILDT, 4th Edition	
REFERENCE BOOKS:		
1	Object-Oriented Programming with C++ 8th Edition by Balagurusamy	
2	Object-Oriented Programming with C++ 4th Edition by Robert Lafore	
3	Object-Oriented Programming with C++ by A.K. Sharma	
ADDITIONAL REFERENCE MATERIAL		
1	Programming: Principles and Practice Using C++ by Bjarne Stroustrup, 2014	
2	The C Programming Language by Brian W. Kernighan and Dennis M. Ritchie, 2015	
ONLINE COURSES		
1	https://www.geeksforgeeks.org/the-c-standard-template-library-stl	
2	https://onlinecourses.nptel.ac.in/noc21_cs02	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL4		X			
CO3	BL3			X		
CO4	BL4				X	
CO5	BL3					X
CO6	BL6	X	X	X	X	X

R23MSCST005	DIGITAL LOGIC DESIGN (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Discrete Mathematical Structures	**3**	**0**	**0**	**3**

Course Objectives	
1	Students will gain and understanding of various number systems, fixed and floating-point representation.
2	Students will get exposure to Boolean algebra, various representations of Boolean expressions and simplification of Boolean functions.
3	Students will learn designing and analyzing combinational logic circuits using various logic gate configurations.
4	Students will understand the principles of sequential logic, including flip-flops, registers, and state machines and learn to design sequential circuits.

Course Outcomes	
1	Students will be able to make use of the number systems, radix complement and diminished radix complements in representing numbers and in implementing binary and decimal integer arithmetic operations. **(BL3)**
2	Students will be able to apply Boolean algebra principles to minimize the number of logic gates required to design a circuit by simplifying the Boolean expressions using Boolean algebra and Karnaugh maps. **(BL3)**
3	Students will be able to design combination and sequential logics using Programmable Logic Devices such as Programmable Logic Array (PLAs) and Programmable Array Logic (PALs). **(BL6)**
4	Students will be able to analyze and build common sequential circuits like registers and counters and also compare and contrast various registers and counters. **(BL4)**
5	Students will be able to distinguish among various flipflops and their triggering mechanisms. **(BL4)**
6	Students will be able to design combinational and sequential circuits as required using logic gates and flip-flops and other hardware components. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO DIGITAL SYSTEMS**	**8 hr**

Whole numbers: Non-decimal to decimal; Whole numbers: Decimal to non-decimal; Fractional Numbers: Non-decimal to decimal; Fractional Numbers: Decimal to non-decimal; r's complement and r-1's complement, Signed number representations; Unsigned addition with overflow check, Un-signed subtraction; Signed addition/subtraction with overflow; Weighted and Non-weighted codes, Floating Point Representation

Unit II	**BOOLEAN ALGEBRA**	**8 hr**

Huntington's postulates, Duality and Complement; Boolean Theorems; POS and SOP Canonical and Standard forms, NAND and NOR gates (AND and OR using NAND and NOR) – universal gates; Minimization (3 and 4 variables) given min terms or max-terms to Sum of Products, implement using universal gates; Minimization (3 and 4 variables) given min terms or max-terms to Product of sums, implement using universal gates; Minimization (3 and 4 variables) given min-terms and don't cares to SOP or POS.; Minimization (3 and 4 variables) given max-terms and don't cares to SOP or POS.; Q-M Method of Minimization (prime implicates method)

Unit III	**COMBINATIONAL LOGIC CIRCUITS**	**8 hr**

Half & Full Adders, Half & Full Subtractors; Ripple Adders, Adder/Subtractor using

complement method; Decoders & implementing Boolean functions using decoders; Encoders & Priority Encoders; Multiplexers & implementing Boolean functions using multiplexers; De-Multiplexers, Multiplexer using decoder and tri-state buffers; Magnitude Comparator, carry look-ahead adder; Code Converters.		
Unit IV	**SYNCHRONOUS SEQUENTIAL LOGIC & PLD'S**	**8 hr**
Definition and classification of sequential circuits, Latches: SR latch, S'R' Latch; Latches: S'R' latch with enable, D Latch, Difference between Level Triggering and Edge-Triggering, Positive-edge and Negative-edge, Asynchronous Inputs, Master Slave Flip Flop Design; SR and D Flip-Flop; JK and T Flip Flop; Implement SR in any other Flip Flop**;** Conversion of D to JK and T Flip Flop**;** PROM and realization, PAL and realization**;** PLA and realization, Comparison between PROM, PLA, PAL		
Unit V	**REGISTERS, COUNTERS AND VARIABLE COUNTERS**	**8 hr**
Control Buffer Registers**;** Bi-directional Shift register, Universal Shift Register**;** Serial Transfer, Serial Addition with and without full adder**;** Binary synchronous up-counter with control, down-counter with control**;** Binary synchronous up-counter with parallel load, BCD Ripple counter; BCD synchronous counter or any Mod-n synchronous counter; Ripple binary up-counter and Ripple binary down-counter; Ring Counter& Johnson Counter, handling unused states		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Digital Design, 4th edition by M. Moris Mano, Michael D.Ciletti	
2	Fundamentals of Logic Design, 5th edition, Charles H.Roth, Cengage	
REFERENCE BOOKS:		
1	Switching and Finite Automata Theory- Zvi Kohavi & Niraj K. Jha, 3rd	
2	Switching Theory and Logic Design by A. Anand Kumar, PHI, 2nd	
ADDITIONAL REFERENCE MATERIAL		
1	Switching Theory and Logic Design-A. Anand Kumar, PHI, 2nd Edition	
ONLINE COURSES		
1	https://www.geeksforgeeks.org/digital-electronics-logic-design-	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL6				X	
CO4	BL4					X
CO5	BL4				X	
CO6	BL6	X	X	X	X	X

R23MSCST006	PRINCIPLES OF PROGRAMMING LANGUAGES (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic computer knowledge and programming languages like C.	**3**	**0**	**0**	**3**

Course Objective

- To understand and describe syntax and semantics of programming languages
- Understand the significance and implementation of programming languages in a compiler or interpreter.
- To implement programs in an Imperative, functional, logical, scripting and object-oriented programming languages.
- Learning principles to design modern programming languages.
- Increase capacity to express programming concepts alternative ways

Course Outcomes

1	Students will be able to analyze syntax and semantic of programming languages and design parsers for the grammars. **(BL4)**
2	Students will be able to design and implement the concepts of data types, arrays, pointers and control structures in various programming languages. **(BL6)**
3	Students will be able to create and implement basic concepts of sub-programs in various programming languages. **(BL6)**
4	Students will be able to design and implement basic concepts of OOPs, Multithreading and Exception handling in various programming languages. **(BL6)**
5	Students will be able to implement and adapt to Functional Programming Languages and Logic Programming Languages. **(BL6)**
6	Students will be able to adapt to various programming language principles and develop programs using them. **(BL6)**

SYLLABUS

Unit 1	**PRELIMINARY CONCEPT, SYNTAX AND SEMANTICS**	**8 hr**

Reasons for studying concepts of programming languages, programming domains; Language evaluation criteria, influences on language design; Language categories, Language design trade-offs; implementation methods, programming environments; General problem of describing syntax; Formal methods of describing syntax; Attribute grammars; Describing the meanings of programs.

Unit II	**NAMES, BINDINGS, AND SCOPES & DATA TYPES , EXPRESSIONS AND STATEMENTS**	**8 hr**

Introduction, names, variables, concept of binding, Scope, scope and lifetime; referencing environments, named constants , primitive, character, string types, user defined ordinal types; Array, associative arrays, record, tuple types, list types, union types; Pointer and reference types, type checking, strong typing, type equivalence; Arithmetic expressions, overloaded operators, type conversions, relational and Boolean expressions; short- circuit evaluation, assignment statements, mixed-mode assignment; Control Structures – introduction, selection statements, iterative statements; Unconditional branching guarded commands.

Unit III	**SUBPROGRAMS, IMPLEMENTING SUBPROGRAMS & ABSTRACT DATA TYPES**	**8 hr**

Fundamentals of subprograms, design issues for subprograms, local referencing environments; Parameter passing methods, parameters that are subprograms, calling subprograms indirectly; Overloaded subprograms, generic subprograms,

design issues for functions; User defined overloaded operators, closures, co routines, General semantics of calls and returns; implementing simple subprograms, Implementing subprograms with stack-dynamic local variables; Nested subprograms, blocks, implementing dynamic scoping; The concept of abstraction, introductions to data abstraction, design issues, language examples; Parameterized ADT, encapsulation constructs, naming encapsulations		
Unit IV	**OBJECT ORIENTED PROGRAMMING, CONCURRENCY**	**8 hr**
Design issues for OOP, OOP in Smalltalk, C++, Java, Ada 95, Ruby; Implementation of Object-Oriented constructs; introduction to subprogram level concurrency; Semaphores, monitors, Message passing, Ada support for concurrency; Java threads; Concurrency in functional languages, statement level concurrency; Exception Handling: Introduction, exception handling in Ada, C++, Java; Introduction to event handling, event handling with Java and C#.		
Unit V	**FUNCTIONAL PROGRAMMING LANGUAGES, LOGIC PROGRAMMING LANGUAGES**	**8 hr**
Introduction, mathematical functions, fundamentals of functional programming language; LISP, LISP Functions, LISP Schema; ML, Haskell; support for functional programming in primarily imperative languages, comparison of functional and imperative languages; Brief Introduction to predicate Calculus & proving theorems; An overview of logic programming, the origins of prolog; Basic elements of prolog; Deficiencies of prolog, applications of logic programming.		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Concepts of Programming Languages, Robert. W. Sebesta 10th edition, Pearson Education.	
2	Programming Language Design Concepts, D. A. Watt, Wiley India Edition.	
REFERENCE BOOKS:		
1	Programming Languages, A.B. Tucker, R.E. Noonan, TMH.	
2	Programming Languages, K. C. Louden and K A Lambert., 3rd edition, Cengage Learning.	
3	Programming Language Concepts, C Ghezzi and M Jazayeri, Wiley India.	
4	Programming Languages 2nd Edition Ravi Sethi Pearson.	
5	Introduction to Programming Languages Arvind Kumar Bansal CRC Press.	
ADDITIONAL REFERENCE MATERIAL		
ONLINE COURSES		

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL6		X			
CO3	BL6			X		
CO4	BL6				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23MBMCT001	FINANCIAL MANAGEMENT (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40(L)+Introduction(2)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**0**	**0**	**3**

Course Objective

This course will help students understand the foundations of managerial economics and demand, investigate market structures, pricing policies, and business forms, basic financial accounting concepts, financial statements and ratio analysis, to understand the time value of Money.

Course Outcomes

After completing this course, the students will be able to

1	Infer demand analysis to optimize strategic decision- making and resource allocation (**BL4**)
2	Formulate competitive pricing strategies and analyze business environment (**BL6**)
3	Adapt fundamental accounting principles to maintain records and thereby financial transparency (**BL6**)
4	Prepare and analyze financial statements to effectively evaluate financial data of a firm. (**BL5**)
5	Evaluate different savings, investments, and loan options by estimating the interest rates and time value of money. (**BL5**)

SYLLABUS

Unit I	**MANAGERIAL ECONOMICS & DEMAND ANALYSIS**	**8 hr**

Definition and Nature of Managerial Economics; Scope of Managerial Economics; Demand Determinants; Law of Demand and its exceptions; Elasticity of Demand: Types; Demand Forecasting types; Factors governing demand forecasting; Methods of demand forecasting.

Unit II	**MARKET STRUCTURES & PRICING POLICIES**	**8 hr**

Market structures; Types of competition; Features of Perfect and Imperfect Competitions; Pricing Methods; Pricing Strategies; Forms of Business Organizations; Sources of capital; Cost concepts.

Unit III	**FUNDAMENTALS OF FINANCIAL ACCOUNTING**	**8 hr**

Introduction to accounting; Types of accounting; Classification of Accounts, Accounting Cycle; Double-Entry Book Keeping and GAAP; Role of technology in accounting; Evolution and Importance of Green accounting; Journal; Ledger.

Unit IV	**FINANCIAL STATEMENTS PREPARATION AND ANALYSIS**	**8 hr**

Preparation of Trial Balance; Trading Account ; Profit and Loss Account; Balance Sheet (Simple problems) ; Introduction to Ratio Analysis, Liquidity Ratios; Solvency Ratios ; Turnover Ratios; Profitability Ratios.

Unit V	**INTRODUCTION TO PERSONAL FINANCE AND TIME VALUE OF MONEY**	**8 hr**

Six step Financial Planning; Concept of Present Value and Future Value; Real and Nominal Interest rates ;Simple Interest Calculation; Compound Interest Calculation; Applications of TVM in Real Life; Inflation and its Impact on TVM; Introduction to Fintech-Digital Payment Gateways.

LEARNING RESOURCES

TEXTBOOKS:

1	Varshney, R. L., & Maheswari, K. L. (2003). *Managerial economics*. Sultan Chand.
2	Narayanaswamy, R. (2022). *Financial Accounting—A Managerial Perspective* (7th ed.). PHI Learning

3	Dean, J. (2010). *Managerial Economics* (7th ed.). PHI Learning
REFERENCE BOOKS:	
1	Maheswari, S. N., & Maheswari, S. K. (2018). *Financial accounting*. Vikas Publications
2	Seth, M. L. (2020). *Microeconomics*. Lakshmi Narain Agarwal publications
ADDITIONAL REFERENCE MATERIAL	
1	https://web.mei.edu/IDtrack?pdfid=S38x726&FilesData=Managerial+Economics+Lecture+Notes+Mba.pdf
2	https://r13csevignanlara.files.wordpress.com/2015/09/managerial-economics-and-financial-analysis-aryasri.pdf
3	https://www.bput.ac.in/lecture-notes-download.php?file=lecture_note_302311150242400.pdf
ONLINE COURSES	
1	https://www.edx.org/learn/economics/stanford-university-principles-of-economics
2	https://www.coursera.org/learn/principles-of-economics-intro
3	https://www.udemy.com/course/basics-of-accounting-indian/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL6	X	X			
CO3	BL6			X		
CO4	BL5			X	X	
CO5	BL5					X

R23MMECT013	LEADERSHIP AND TEAM MANAGEMENT (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40 (L) + 2 (Introduction) + 6 (Case Discussion)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective:

This course is aimed at helping students:

- To understand ***what leadership is*** and the ***various perspectives*** put forward by the scientific community
- To understand the ***intrinsic challenges*** faced by the individual in his/her development of leadership abilities
- To understand the ***extrinsic challenges*** faced by the individual in discharging his/her role as a leader

Course Outcomes:

At the end of the course, the student will be able to:

1	Assess the current world leadership scenario and critique different approaches taken **(BL5)**
2	Evaluate leadership styles and determine applicability to various societal contexts **(BL5)**
3	Evaluate ability for self-awareness and perception, mental and emotional ability, courage and morality and followership **(BL5)**
4	Evaluate ability to motivate and empower others, communicate better, lead teams, handle diversity, influence others and provide direction **(BL5)**
5	Evaluate organisational ecosystem and develop a leadership style to meet current challenges **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION**	**8 hr**

Need for leadership, Goal of an Organisation- Forces of Change- New Realities and Learning Organisations- Prime Task of Leadership- Management and Leadership- Great Man Theory and Leadership Evolution- Leader Fatal Flaws- Systemic Leadership

Unit II	**PERSPECTIVES ON LEADERSHIP**	**8 hr**

Trait Theory-Behaviour Approaches: Autocratic v/s Democratic, Ohio State Studies - University of Michigan Studies, Leadership Grid- Individualised Leadership-Contingency Approach: Hersey Blanchard Theory-Fiedler's Contingency Model-Path-Goal Theory-Vroom-Jago Model

Unit III	**PERSONAL SIDE OF LEADERSHIP**	**8 hr**

Personality and Leadership (Values/Attitudes, Social Perception, Cognitive Difference)-Mental Models, Developing Leader's Mind- Emotional Intelligence- Leading with Love Versus Leading With Fear- Moral Leadership- Leading with Courage-Art of Followership-Strategies for Managing Up

Unit IV	**LEADERSHIP AND RELATIONSHIP**	**8 hr**

Leadership and Motivation, Theories of Motivation- Empowering People to Meet Higher Needs-Leadership and Communication, Channels of Communication- Leading Teams-Handling Diversity- Inclusive Leadership-Influential Leadership-Hard and Soft Power, Increasing Power

Unit V	**LEADER AS A SOCIAL ARCHITECT**	**8 hr**

Vision and Strategic Leadership-Themes of Vision, Mission-Strategic Direction-Organisational Culture- Competing Values Approach-Value-Based Leadership-Leading Change: Appreciative Inquiry- Implementing Change

LEARNING RESOURCES	
TEXT BOOKS:	
1	Richard L. Daft, "*The Leadership Experience*", 6TH Edition, Cengage Learning, 2015.
2	Annabel Beerel, "*Leadership and Change Management*", Sage Publication, 2009.
REFERENCE BOOKS:	
1	Gary Yukl, "*Leadership in Organizations*", Eighth edition, Pearson, 2017.
ONLINE COURSES	
1	https://hbsp.harvard.edu
2	https://www.coursera.org/learn/leading-diverse-teams-and-organizations
3	https://www.coursera.org/learn/leadershipskills
4	https://www.coursera.org/specializations/inspired-leadership

Bloom's level - Units Catchment Articulation Matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL5	X	X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL6			X	X	X

<table>
<tr><td rowspan="3">R23MSCSL003</td><td colspan="6">UNIX & SHELL PROGRAMMING LAB
(CSE,IT,CSIT,AIML,DS,ICB)</td></tr>
<tr><td>Total Contact Hours</td><td>42 (P)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>C Programming</td><td>0</td><td>0</td><td>3</td><td>2</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">To get exposure to a comprehensive set of Unix and shell programming skills, including fundamental command execution, advanced text manipulation, system and user information management, networking and process control, and the development of automated scripts for various practical applications.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">To demonstrate the ability to use Unix commands for directory navigation, file manipulation, and basic system operations.</td></tr>
<tr><td>2</td><td colspan="6">To execute advanced text processing tasks, including sorting, searching, and modifying file contents using command-line tools.</td></tr>
<tr><td>3</td><td colspan="6">To efficiently gather system and user information, manage user permissions, and perform security operations through Unix commands.</td></tr>
<tr><td>4</td><td colspan="6">To apply networking commands to check connectivity, configure network settings, and use process management commands to monitor and control system processes.</td></tr>
<tr><td>5</td><td colspan="6">To develop and implement shell scripts for automating tasks, including text manipulation, system monitoring, and user-defined operations, showcasing an understanding of scripting logic and syntax.</td></tr>
<tr><td colspan="7">List of Experiments</td></tr>
<tr><td>1</td><td colspan="6">Week-1:
1. Directory and File Handling Utilities:
▪ Display the current working directory using the pwd command.
▪ Create a directory named lab1 using the mkdir command.
▪ Navigate into the lab1 directory using the cd command.
▪ Create three subdirectories named dir1, dir2, and dir3 inside lab1 using the mkdir command.
▪ List the contents of the lab1 directory using the ls command.
2. Basic File Operations:
▪ Create three files named file1.txt, file2.txt, and file3.txt inside dir1 using the touch command.
▪ Copy file1.txt to dir2 and rename it to file1_copy.txt using the cp command.
▪ Move file2.txt from dir1 to dir3 using the mv command.
▪ Remove file3.txt from dir1 using the rm command.
3. Viewing and Editing Files:
▪ Use the cat command to concatenate file1.txt and file1_copy.txt and display the result.
▪ Use the more command to view the contents of file1.txt.
▪ Use the less command to view the contents of file1_copy.txt.
▪ Use the head command to display the first 10 lines of file1.txt.
▪ Use the tail command to display the last 10 lines of file1.txt.
4. Text Manipulation and Sorting:
▪ Use the echo command to append "Hello, World!" to file1.txt.
▪ Use the printf command to add formatted text to file1.txt.
▪ Use the sort command to sort the contents of file1.txt and save the sorted output to sorted_file1.txt.
▪ Use the uniq command to remove duplicate lines from sorted_file1.txt.
5. Cut, Paste, and Split Commands:
▪ Use the cut command to extract the first column from sorted_file1.txt</td></tr>
</table>

	and save it to column1.txt. ▪ Use the paste command to combine column1.txt and sorted_file1.txt into a new file pasted_file.txt. ▪ Use the split command to split file1.txt into pieces of 5 lines each. **6. User and System Information:** ▪ Display the username of the current user using the whoami command. ▪ Display the system information using the uname -a command. ▪ Display the current date and time using the date command. ▪ Display the users currently logged in using the who command. ▪ Display detailed information about a user using the finger command. **7. Security by File Permissions:** ▪ Create a file named permissions_test.txt using the touch command. ▪ Change its permissions to read-only for the owner and no permissions for others using the chmod command. ▪ Display the permissions of permissions_test.txt using the ls -l command. ▪ Change the ownership of permissions_test.txt to a different user (requires superuser permissions) using the chown command. ▪ Change the group of permissions_test.txt to a different group using the chgrp command.
2	**Week-2:** **1. Disk Usage and File System Management:** ▪ Use the du command to display the disk usage of the lab1 directory. ▪ Use the df command to display the available disk space on all mounted file systems. ▪ Mount a temporary file system to the /mnt directory using the mount command. ▪ Unmount the temporary file system using the umount command. **2. Networking Commands:** ▪ Display the hostname of the machine using the hostname command. ▪ Use the ping command to check the connectivity to google.com. ▪ Display the network interface configuration using the ifconfig or ip command. ▪ Use the nslookup command to find the IP address of a given domain name. ▪ Use the netstat command to display all active network connections. **3. Process Management:** ▪ List all currently running processes using the ps command. ▪ Kill a process by its PID using the kill command. ▪ Display the current system's uptime using the uptime command. ▪ Display the current user's scheduled tasks using the at command. ▪ Set a process to run with a lower priority using the nice command.
	Week-3: **1. Standard Streams and Redirection:** ▪ Write a command to redirect the output of the ls command to a file named ls_output.txt. ▪ Append the output of the date command to the same ls_output.txt file. ▪ Redirect the standard error of a non-existent command ls non_existing_file to a file named error_output.txt. **2. Pipes and Filters:** ▪ Use a pipe to count the number of lines in the /etc/passwd file. ▪ Combine the cat and sort commands using a pipe to display the sorted contents of a file named data.txt. ▪ Use the tee command to simultaneously display the output of the who

3	command on the terminal and save it to a file named who_output.txt. **3. Sorting and Counting:** ▪ Sort the contents of unsorted.txt and save the sorted output to sorted.txt. ▪ Use the uniq command to remove duplicate lines from sorted.txt and save the output to unique_sorted.txt. ▪ Count the number of lines, words, and characters in unique_sorted.txt using the wc command. **4. Command Substitution and Quotes:** ▪ Use command substitution to store the output of the date command in a variable and then display that variable. ▪ Demonstrate the difference between single quotes (') and double quotes (") by creating a variable that contains a wildcard character (*) and displaying its value using both types of quotes. **5. Job Control:** ▪ Start a long-running process (e.g., sleep 1000) in the background and list all background jobs. ▪ Bring the background job to the foreground and then stop it using ctrl+z. ▪ Resume the stopped job in the background using the bg command and then terminate it using the kill command. **6. Aliases and Shell Customization:** ▪ Create an alias named ll for the command ls -la and demonstrate its use. ▪ Remove the alias ll and verify it has been removed. ▪ Customize the shell prompt to display the current directory followed by a $ sign. **7. Variables and Environment Customization:** ▪ Create a local variable named LOCAL_VAR and assign it a value. Display its value. ▪ Export an environment variable named GLOBAL_VAR and assign it a value. Display its value. ▪ Demonstrate the use of predefined environment variables like PATH, HOME, and USER by displaying their values.
4	**Week-4:** **1. Basic Grep Usage:** Write a program that creates a file named `sample.txt` and fills it with random text. Use the `grep` command to search for lines containing the word "example" and print those lines. **2. Counting Lines:** Create a file named lines.txt with random lines of text. Write a program using `grep` options to: ▪ Display the count of blank lines. ▪ Display the count of non-blank lines. **3. Regular Expression Search:** Write a program that searches for a pattern that starts with any character followed by "test" and ends with any character in a file named `regex_test.txt`. Use `grep` to find and display matching lines. **4. Case Insensitive Search:** Create a file named `case.txt` with various lines of text in mixed case. Write a program using `grep` to search for the word "linux" ignoring case sensitivity and display the matching lines. **5. Display Line Numbers:** Write a program that creates a file named `numbered.txt` and fills it with

	random text. Use `grep` to search for lines containing the word "data" and display those lines along with their line numbers. **6. Search and Invert Match:** Write a program that creates a file named `invert.txt' with random lines of text. Use `grep` with the `-v` option to display all lines that do not contain the word "error".
5	**Week-5:** **1. Extended Grep (egrep):** Write a program that creates a file named `extended.txt` with random lines of text. Use `egrep` to search for lines containing the pattern "abc|def" and display those lines. **2. Character Set Matching:** Create a file named `char_set.txt` with various lines of text. Write a program using `grep` to search for lines that start with any lowercase letter and contain the word "pattern". Display the matching lines. **3. Fixed String Search (fgrep):** Write a program that creates a file named `fixed.txt` with random lines of text. Use `fgrep` to search for the literal string "[ABC]123" and display the matching lines. **4. Pattern Matching with Line Anchors:** Create a file named anchors.txt with lines starting and ending with different words. Write a program using `grep` to: ▪ Search for lines that start with the word "start". ▪ Search for lines that end with the word "end". **5. Search for Multiple Patterns:** Write a program that creates a file named multi_pattern.txt with various lines of text. Use `grep` to search for lines containing either "foo" or "bar" and display the matching lines. **6. Piping Commands:** Write a program that lists all files in the current directory and pipes the output to `grep` to display only the files with names starting with "log".
6	**Week-6:** **1. Basic Sed Operations:** Write a script that creates a file named input.txt with lines of text. Use `sed` to replace the first occurrence of the word "Hello" with "Hi" in the file and display the modified content. **2. Multiple Substitutions**: Create a file named `multi_sub.txt` with several lines of text. Write a `sed` script to: ▪ Replace "apple" with "orange". ▪ Replace "banana" with "grape". ▪ Perform these substitutions on specific lines as well as globally in the file. **3. Address Ranges:** Write a script that creates a file named `range.txt` with random lines of text. Use `sed` to print lines between the 3rd and the 7th line inclusive. **4. Conditional and Unconditional Branching:** ▪ Create a file named branch.txt with multiple lines. Write a `sed` script to: ▪ Replace the first occurrence of "Admin" with "Supervisor". ▪ Use an unconditional branch to loop through and print remaining lines. ▪ Use a conditional branch to handle specific patterns. **5. Line Numbering:** Write a script that creates a file named `numbered_lines.txt` with random

	lines of text. Use `sed` to display the file content with line numbers prefixed to each line. **6. Using Hold Space:** ▪ Create a file named `hold_space.txt` with lines of text. Write a `sed` script to: ▪ Copy the first line to the hold space. ▪ Append the contents of the hold space to the end of the file.
7	**Week-7:** **1. Inserting and Appending Text:** Write a script that creates a file named insert_append.txt with lines of text. Use sed to: ▪ Insert "Start" before the second line. ▪ Append "End" after the fourth line. **2. Substitution with Flags:** Create a file named `sub_flags.txt` with lines of text. Write a `sed` script to: ▪ Replace all occurrences of "cat" with "dog" globally. ▪ Replace the first occurrence of "mouse" with "rat" in each line. ▪ Print the lines where substitutions have occurred. **3. Reading and Writing Files:** Write a script that creates two files: `file1.txt` and `file2.txt` with random lines of text. Use `sed` to: ▪ Read the contents of `file2.txt` and insert it into `file1.txt` after the first line. ▪ Write specific lines from `file1.txt` to a new file `output.txt`. **4. Transform Command:** Create a file named `transform.txt` with text containing vowels. Write a `sed` script to transform all lowercase vowels to uppercase vowels in the file and display the result. **5. Branching with Labels:** Write a script that creates a file named branch_labels.txt with multiple lines. Use sed to: ▪ Replace the word "old" with "new" only if it is not at the beginning of a line. ▪ Implement branching with labels to handle specific patterns and conditions. **6. Delete and Substitute Commands:** Create a file named delete_substitute.txt with lines of text. Write a sed script to: ▪ Delete the first character of each line. ▪ Delete the last but one character of each line. ▪ Swap the first and second words in each line.
8	**Week-8:** **1. Basic AWK Usage:** Write a script to create a file named `data.txt` with random lines of text. Use an AWK command to print all lines containing the word "example". **2. Field Separator:** Create a file named `fields.txt` where fields are separated by commas. Write an AWK script to print the second and fourth fields of each line. **3. Pattern Matching:** Write a script that creates a file named `match.txt` with lines of text. Use an AWK command to print lines where the third field matches the regular expression `[A-Za-z]+`. **4. Using Variables:** Create a file named variables.txt with numerical data in each line. Write an

	AWK script to calculate and print the sum and average of the numbers in the second field. **5. BEGIN and END Blocks:** Write a script that creates a file named `begin_end.txt` with random data. Use an AWK script with BEGIN and END blocks to print a header before processing the file and a footer after processing the file. **6. String Functions:** Create a file named `strings.txt` with various strings. Write an AWK script to use the length, substr, and toupper functions to process and print the strings.
9	**Week-9:** **1. Arithmetic Operations:** Write a script to create a file named `arithmetic.txt` with numerical data. Use an AWK script to perform arithmetic operations on the fields and print the results. **2. Conditional Statements:** Create a file named `conditions.txt` with student names and their scores in three subjects. Write an AWK script to print "Pass" if the average score is 50 or above, otherwise print "Fail". **3. Loops:** Write a script that creates a file named loops.txt with multiple lines of data. Use an AWK script to iterate over each field of the file and print each field value. **4. Associative Arrays:** Create a file named `words.txt` with lines of text. Write an AWK script to count the frequency of each word and print the word along with its count. **5. Formatted Output:** Write a script that creates a file named `formatted.txt` with numerical data. Use an AWK script with the printf function to print the data in a formatted table. **6. Using System Commands:** Create a file named `system.txt` with user information. Write an AWK script that pipes the contents of the file to another command (e.g., sort) and processes the sorted data.
10	**Week-10:** **1. Directory or File Check:** Write a shell script that takes a command line argument and reports whether it is a directory or a file. **2. Uppercase Conversion:** Write a shell script that accepts one or more file names as arguments and converts all of them to uppercase, provided they exist in the current directory. **3. Gross Salary Calculation:** Write a shell script that computes the gross salary of an employee according to the following rules: ▪ If the basic salary is less than 1500, then HRA = 10% of the basic and DA = 90% of the basic. ▪ If the basic salary is 1500 or more, then HRA = Rs.1500 and DA = 98% of the basic. **4**. String Operations: Write a shell script to perform the following string operations: ▪ Extract a substring from a given string. ▪ Find the length of a given string. **5. Login Notification:** Write a shell script that takes a login name as a command-line argument and reports when that person logs in.

11	**Week-11:** 1. Greeting Based on Time: Write a shell script which will greet you "Good Morning," "Good Afternoon," "Good Evening," and "Good Night" according to the current time. **2. Binary Search:** Write a shell script to search for a given number using a binary search. **3. Terminal Lock:** Write a shell script to lock the terminal. The script should prompt for a password to unlock the terminal. **4. String Analysis:** Write a shell script to find the number of vowels, consonants, digits, whitespaces, and special characters in a given string. **5. Mathematical Tables:** Write a shell script to generate the multiplication table of a given number.
12	**Week-12:** **1. Reverse Numbers:** Write a shell script to display the reverse of a given number. **2. File Handling Menu:** Write an interactive shell program that offers the user a choice of copying, removing, renaming, or linking files. The program should prompt the user for the necessary information, such as file names and new names. **3. Fibonacci Series:** Write a shell script which will display the Fibonacci series up to a given number of terms. **4. Palindrome Check:** Write a shell script to display if a given string is a palindrome from the command-line arguments. **5. Factorial Calculation:** Write a shell script to find the factorial of a given number.

LEARNING RESOURCES

TEXT BOOKS:

1	UNIX and shell Programming Behrouz A. Forouzan, Richard F. Gilberg, Thomson
2	Your UNIX the ultimate guide, Sumitabha Das, TMH. 2nd Edition
3	UNIX programming environment, Kernighan and Pike, PHI. / Pearson Education

R23MSCSL004	OOP WITH C++ LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	C Programming	**0**	**0**	**3**	**2**

Course Objective

To get practical exposure to the style of Object Oriented Programming with hands-on experience in laboratory for solving real world problems using C++

Course Outcomes

After completing this course, the students will be able to

1	Students will be able to demonstrate the Object-Oriented Concepts
2	Students will be able to develop C++ programs on constructors, inline, static and friend concepts
3	Students will be able to experiment on polymorphism, inheritance and abstract classes
4	Students will be able to develop C++ programs on generic programming using templates
5	Students will be able to develop C++ programs on exception handling and Standard template library collections

List of Experiments

1	**Week-1:** 1) Write a program to read inputs from keyboard and print outputs on toconsole screen using C++. 2) Write a program to work with different data types using C++. 3) Write a program to do typecasting in C++.
2	**Week-2:** 1) Write a program to create classes and objects using C++. 2) Write a program to implement constructors in C++. 3) Write a program to implement destructors in C++.
3	**Week-3:** 1) Write a program to implement inline functions in C++. 2) Write a program to implement static concept in C++. 3) Write a program to implement arrays concept in C++.
4	**Week-4:** 1) Write a program to implement function overloading in C++. 2) Write a program to implement friend functions,frined classes in C++.
5	**Week-5:** 1) Write programs to implement different types of inheritances in CPP
6	**Week-6:** 1) Write a program to implement function overriding in C++. 2) Write a program to implement virtual functions in C++.
7	**Week-7:** 1) Write a program to implement to pure virtual functions in C++. 2) Write a program to create abstract class in C++.
8	**Week-8:** 1) Write a program to implement composition in C++. 2) Write a program to implement Virtual base classes in C++.

9	**Week-9:** 1) Write a program to implement bubble sort using templates in C++. 2) Write a program to implement template classes in C++.
10	**Week-10:** 1) Write a program to work with Exception handling keywords: try, throw,catch in C++. 2) Write a program to implement user-defined exceptions
11	**Week-11:** 1) Write a program to implement Lists in C++. 2) Write a program to implement iterators in C++.
12	**Week-12:** 1) Write a program to implement vectors in C++. 2) Write a program to implement maps in C++.
LEARNING RESOURCES	
TEXTBOOKS:	
1	C++ Primer, fifth edition, Stanley B. Lippman, Josee Lajoie.
2	C++ The Complete Reference : HERBERT SCHILDT, 4th Edition
REFERENCE BOOKS:	
1	Object-Oriented Programming with C++ 8th Edition by Balagurusamy
2	Object-Oriented Programming with C++ 4th Edition by Robert Lafore
3	Object-Oriented Programming with C++ by A.K. Sharma
ADDITIONAL REFERENCE MATERIAL	
1	https://www.geeksforgeeks.org/the-c-standard-template-library-stl

R23MMECL001	COMPUTER AIDED GEOMETRIC DESIGN AND ASSEMBLY LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Aided Engineering Graphics	**0**	**0**	**3**	**2**

Course Objective

To equip students with the knowledge and skills to proficiently utilize computer-aided design (CAD) software, specifically focusing on geometric design and assembly, enabling them to create, modify, and analyze complex geometric models and assemblies for applications in various industries.

Course Outcomes: At the end of this course, the student will be able to

1	Prepare 2-D drawings of different components
2	Model 3-D geometries of components used for different engineering applications
3	Explain the importance of assembly drawings and prepare the assembly drawings.
4	Convert the assembly drawings into 2-D drawings by using different draughting tools

List of Exercises

1	Basic Sketching: Creating 2D sketches, applying constraints and dimensions.
2	Advanced Sketching: Complex sketch constraints, relations
3	Basic Modeling Techniques: Extrusions, revolve, Hole and basic solid modeling operations.
4	Boolean operations (Union, Subtract, Intersect), Creation of Datum coordinate system, axis and planes
5	Solid Modified Features: Editing and modifying features such as Move, Delete, Replace, Offset etc
6	Solid Modified Features: Edge Blend, Chamfer, shell, patterns, mirror.
7	Basic Assembly Constraints: Applying constraints (Touch, Align, Parallel and Perpendicular) for defining relationships.
8	Basic Assembly Constraints: Applying constraints (Bond, Distance, Concentric) for defining relationships.
9	Creating and managing sub-assemblies.
10	Creating detailed engineering drawings, annotations, and part lists.

Additional Exercises

1	Surface Modeling: Creating and editing surfaces
2	Sheet Metal Design: Creating sheet metal parts, Bending, flanging, and forming tools, Flattening and exporting sheet metal parts

LEARNING RESOURCES

TEXT BOOKS:

1	Sham Tickoo, *CATIA V5R14 for Designers*, Cadcim Technologies, 2005.
2	Louis Gary Lamit, *Creo Parametric 2.0*, CL Engineering, 2013.
3	NX Basic Design with Teamcenter Integration Student Guide October 2011 MT10053_TC_S — NX 8.
4	Solid Works User's Manual.

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IV SEMESTER

R23MSCST007	PYTHON PROGRAMMING (Common to all branches)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic C Programming	**3**	**0**	**0**	**3**

Course Objective

Students will gain knowledge on the basic programming constructs of python language to develop both desktop and Graphical user applications.

Course Outcomes

1	Students will be able to apply the basic building blocks of python language. **(BL3)**
2	Students will be able to distinguish between various conditional control statements and simplify the problems using functions. **(BL4)**
3	Students will be able to experiment with various non-scalar data types. **(BL3)**
4	Students will be able to examine the data using file operations and pandas library. **(BL4)**
5	Students will be able to decide suitable widgets to implement Graphical User applications. **(BL5)**
6	Students will be able to design and develop real time applications using Python Programming constructs and GUI tkinter module. **(BL6)**

SYLLABUS

Unit I	**BASICS – DATA TYPES, OPERATORS, BUILT-IN MODULES**	**8 hr**

Data Types, Escape Sequences, Variables and Basic Input/Output; Assignment Statements, Operators; Arithmetic Expressions, Operator precedence, Type Casting, Program Comments and Docstrings; Program Format and Structure, REPL, IDLE, Running a Script from a Terminal Command Prompt;
Built-In Functions and Modules; NumPy – Functions on 1D arrays, Functions on 2D arrays; Math Module and Pandas Module (DataFrame Creation); User Defined modules creation and importing a user defined module;

Unit II	**DECISION-MAKING STATEMENTS, LOOPS AND USER-DEFINED FUNCTIONS**	**8 hr**

Conditional Statements; While loop, for loop; range () function, nested loops; While-else, For- else, break, continue, pass, examples;
Functions: Syntax and basics of function and usage; Passing Parameters, arguments in a function – Default, keyword, fixed and Variable - length arguments; local and global scope of variable; return statement, recursive function;

Unit III	**STRINGS, LISTS, TUPLES AND DICTIONARIES**	**8 hr**

Strings- A String is a sequence, Strings are immutable, String slice, String methods; Membership and Identity operators, String search; List- Lists are mutable, List operations; Map filter and reduce, deleting elements, Lists and Strings;
Tuples- Tuples are immutable, Variable - length argument tuples; Tuple as return values, Comparison of Lists and tuples; Dictionaries – Dictionary Creation, Looping and dictionaries; Dictionary as a collection of counters, Reverse Lookup;

Unit IV	**FILES**	**8 hr**
Introduction to Files, modes, types of files; File handling functions: open(), close(), read(), readline(), readlines(); write(), writeline(), append(); seek(), tell(), flush(); file copy using shutil (), delete a file (os.remove ()); Importing data from CSV to DataFrame (Pandas); Inspecting data in DataFrame (head (), tail ()), Statistical summary (describe ()); Sorting and slicing records and filtering data; Create a DataFrame by passing Dict of Series (Column Selection, Addition, Deletion), Triggers;		
Unit V	**TKINTER GUI, EVENT DRIVEN PROGRAMMING, WIDGETS**	**8 hr**
The Behavior of Terminal-Based Programs and GUI-Based Programs, Label, Entry and Button widget; Tkinter Geometry methods (pack(), grid(), place()); Event-Driven Programming, Command Buttons and Responding to Events; CheckButton and Radiobutton widgets; Menu and Menu button widgets; Listbox and Scrollbar widgets; Messagebox and Toplevel widget; File Dialog widget;		

LEARNING RESOURCES

TEXTBOOKS:

1	Kenneth A. Lambert. - Fundamentals of Python: First Programs‖, 2nd Edition, Publisher: Cengage Learning
2	Reema Thareja.-Python Programming using Problem Solving Approach
3	R. Nageswara Rao, -Core Python Programming‖

REFERENCE BOOKS:

1	Wesley J. Chun. -Core Python Programming - Second Edition‖, Prentice Hall
2	John V Guttag. -Introduction to Computation and Programming Using Python‖, Prentice Hall of India

ADDITIONAL REFERENCE MATERIAL

ONLINE COURSES

1	https://www.w3schools.com/python/
2	https://www.tutorialspoint.com/python/index.htm
3	https://docs.python.org/3/tutorial/
4	https://www.pythontutorial.net/tkinter
5	https://www.python-course.eu/python3_course.php
6	https://www.geeksforgeeks.org/python-tkinter-tutorial/
7	https://www.tutorialspoint.com/python/python_gui_programming.htm
8	https://www.programiz.com/python-programming

Bloom's level – Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X			
CO3	BL3			X		
CO4	BL4				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST008	DESIGN AND ANALYSIS OF ALGORITHMS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Data Structures	**3**	**0**	**0**	**3**

Course Objective

Students will have the ability to understand, analyze and design algorithms using various design techniques, apply and synthesize efficient algorithms in common Engineering design situations

Course Outcomes

1	Students will be able to analyze the time and space complexity of simple recursive and non-recursive algorithms and express those using asymptotic notations. **(BL4)**
2	Students will be able to apply Divide and Conquer algorithms, Pattern matching techniques in real world problems. **(BL4)**
3	Students will be able to apply Greedy programming techniques for cost optimization to real world problems. **(BL4)**
4	Students will be able to solve several problems using Dynamic programming and understand its benefits over other techniques. **(BL3)**
5	Students will be able to apply the Backtracking and Branch and Bound techniques to solve real world problems. **(BL4)**
6	Students will be able design various problems using the appropriate algorithmic strategy and estimate the time complexity of the algorithm used to find the solution. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO ALGORITHMS, DISJOINT SETS**	**8 hr**

Algorithm, Algorithm specification - Pseudo code conventions; Recursive and Non-Recursive Algorithms; Performance Analysis – Space complexity, Performance Analysis – Time complexity; Asymptotic Notations (O, Ω, Θ); Amortized Complexity; Disjoint sets, Representation of disjoint sets; Disjoint operations – union and find algorithms; Collapsing find and Weighted Union;

Unit II	**PATTERN MATCHING, DIVIDE AND CONQUER**	**8 hr**

Pattern Matching, Applications, Naive String-Matching Algorithm, Boyer-Moore Algorithm; Knuth-Morris-Pratt Algorithm; Divide and Conquer general method; Binary Search; Finding the Maximum and Minimum; Merge sort; Quick sort; Strassen‘s Matrix Multiplication;

Unit III	**GREEDY METHOD**	**8 hr**

Greedy Technique general method; Knapsack Problem; Job Sequencing with Deadlines; Optimal storage on tapes; Minimum Cost Spanning Trees – Prim’s Algorithm; Minimum Cost Spanning Trees – Kruskal’s Algorithm; Single Source Shortest Path; Huffman Coding;

Unit IV	**DYNAMIC PROGRAMMING**	**8 hr**

Dynamic Programming general method; Matrix Chain Multiplication; All-pairs Shortest path problem; Optimal Binary Search Trees; Single source shortest path: Bellman and Ford algorithm; 0/1 Knapsack Problem; Travelling Sales Person Problem; Reliability Design;

Unit V	BACKTRACKING, BRANCH AND BOUND	8 hr
Backtracking general method, N-Queens Problem; Sum of subsets problem; Graph Coloring; Hamiltonian cycles; Branch and Bound general method, Control abstraction of LC-Search; 0/1 Knapsack Problem using FIFO Branch and Bound; 0/1 Knapsack Problem using LC Branch and Bound; Travelling salesperson problem;		

LEARNING RESOURCES

TEXTBOOKS:	
1	Ellis Horowitz, Satraj Sahni and Sanguthevar Rajasekharam, -Fundamentals of Computer Algorithms‖, 2nd Edition, Universities Press.
2	Fundamentals of DATA STRUCTURES in C: 2nd Edition., Horowitz, Sahni, Anderson –freed, Universities Press.
REFERENCE BOOKS:	
1	Data Structures, A Pseudocode Approach, Richard F Gilberg, Behrouz A Forouzan, Cengage.
2	Introduction to The Design and Analysis of Algorithms, Anany Levetin, 3rd Edition, Pearson.
ADDITIONAL REFERENCE MATERIAL	
1	https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
2	https://www.tutorialspoint.com/design_and_analysis_of_algorithms/index.htm
3	https://www.geektonight.com/design-and-analysis-of-algorithm-notes/
ONLINE COURSES	
1	https://nptel.ac.in/courses/106106131
2	https://www.coursera.org/specializations/algorithms

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL4		X			
CO3	BL4			X		
CO4	BL3				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23MSCST009	COMPUTER ARCHITECTURE (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Digital Logic and Design	**3**	**0**	**0**	**3**

Course Objectives

- Students will get exposure to basic structure of a computer, different functional sub-systems of the computer and different architectural models of computer design.
- Students will study and analyze the different ways of designing arithmetic logic unit, instruction sets, control units that control the computer, memory subsystems and Input Output subsystems of a computer;
- Students will study and analyze design of computers with parallel processing capabilities and having multi-processors.

Course Outcomes

1	Students will be able to construct a combined ALU circuit by designing and assembling arithmetic, logic, and shift operations. **(BL6)**
2	Students will be able to judge the effectiveness of addressing modes in optimizing program control, supporting efficient data access and instruction flow. **(BL5)**
3	Students will be able to formulate floating-point arithmetic circuits by designing and assembling components based on IEEE standards. **(BL6)**
4	Students will be able to judge the selection of I/O transfer methods such as handshaking, strobe, and DMA, evaluating their effectiveness for specific system requirements. **(BL5)**
5	Students will be able to defend the use of RISC pipelining for particular applications, evaluating its efficiency in specific computing environments. **(BL5)**
6	Students will be able to create an integrated computer architecture model encompassing memory, processing, I/O, and parallel systems to improve computational efficiency and support complex operations. **(BL6)**

SYLLABUS

Unit I	**BASIC COMPUTER STRUCTURE AND MICRO-OPERATIONS**	**8 hr**

Computer Types and Functional Units; Stored Program Computer and Basic operational Concepts; Error detection codes – Parity bit error detection, RTL and notations; BUS and memory transfers; Arithmetic micro-operations circuit; Logic Micro-operations, circuit, applications of logical micro-operations; Shift micro-operations and circuit; Micro-operation completeness and combined ALU circuit;

Unit II	**COMPUTER INSTRUCTION AND CONTROL UNIT**	**8 hr**

Timing & Control, Special Purpose Registers and sizes; Instruction Cycle, Fetch & Decode; Memory Reference Instructions; Register Reference Instructions, Input-Output Organization; Input-Output Instructions, Interrupt Cycle; Different Organizations of Computer, Stack Organization, Instruction Formats; Addressing Modes; Program Control Instructions and Flags;

Unit III	**COMPUTER ARITHMETIC**	**8 hr**

Signed binary addition/subtraction with negative numbers in signed magnitude

form, Signed binary addition/subtraction with negative numbers in 2`s complement form; Binary multiplication with negative numbers in signed magnitude form; Binary multiplication with negative numbers in 2`s complement form (Booth's Algorithm); Division with negative numbers in signed magnitude form (restoring & nonrestoring); Floating point representation, IEEE floating point representations; Floating point addition/subtraction with mantissa in signed magnitude form; Floating point multiplication with mantissa in signed magnitude form; Floating point division with mantissa in signed magnitude form;		
Unit IV	**MEMORY AND I/O ORGANIZATION**	**8 hr**
Memory Hierarchy and criteria for building hierarchy, RAM and ROM, Main Memory; Associative Memory; Cache Memory –Introduction, Locality of Reference, Mapping Techniques; Input / Output Interface, Isolated I/O and memory mapped I/O; Asynchronous data transfer-Strobe Control, Handshaking mode of transfer; Program Controlled I/O, Interrupt Driven I/O; Priority Interrupts, Types of Interrupts, Interrupt – Initial and Final Operations, Cycle; Direct Memory Access;		
Unit V	**PIPELINING & MULTIPROCESSORS**	**8 hr**
Parallel processing basics, Flynn's classification; Pipelining, parameters and Performance Measurement; Arithmetic Pipeline, Instruction Pipeline; RISC and RISC Instruction Pipeline; Characteristics of Multiprocessors, Interconnection Structures-Time Shared common bus, Multiport Memory; Interconnection Structures-Crossbar Switch, Multistage switching Network, Hyper Cube System; Cache Coherence and solutions; Interprocessor Arbitration, interprocessor synchronization;		
LEARNING RESOURCES:		
TEXT BOOKS:		
1	Computer System Architecture, M. Morris Mano, 3rd Edition, Pearson/PHI	
2	Computer Architecture, A quantitative Approach, John L. Hennessy and David A. Patterson, 4thEdition , Elsevier	
REFERENCE BOOKS:		
1	Computer Organization, Carl Hamacher, ZvonksVranesic, SafeaZaky, 5th Edition, McGraw Hill	

Bloom's Level- Units Catchment Articulation Matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL6	X				
CO2	BL5		X			
CO3	BL6			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST010	DATABASE MANAGEMENT SYSTEMS (Common to all branches)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**0**	**0**	**3**

Course Objective

Students will get Exposure on basics of designing relational Database without having any redundancy and also gain the knowledge on handling transaction data in concurrent way and recovering from the failures.

Course Outcomes

1	Students will be able to ***choose*** and appreciate the RDBMS over file system and also be able to ***apply*** the knowledge of ER Modeling design the database from the client requirements. **(BL3)**
2	Students Will be able to ***analyze*** the SQL query pattern and classify the query patterns based on the client requirements. **(BL4)**
3	Students will be able to ***Examine*** the database design and classify the different levels of dependencies using Normal Forms and students will be able to identify how triggers are useful in data auditing purpose. **(BL4)**
4	Students will be able to ***compare and choose*** different indexing mechanisms to store data in secondary storage devices as per the requirements. **(BL6)**
5	Students will be able to ***justify*** the importance of concurrency and recovery Management. **(BL6)**
6	Students will be able to ***design*** the complete database without redundant storage and able to solve the user queries. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO DATABASE MANAGEMENT SYSTEM, ER MODELING**	**8 hr**

Need for DBMS, Advantages of DBMS over File Systems, Database applications; Database Users, Different Data Models; 3 Levels of Abstraction in DBMS (External, Conceptual & Physical Schema) and data independence, Database Management System Structure.; Introduction to ER Model, Entity, Entity Set, Attribute – Entity Vs Attribute;

Relationship & Relationship Set – Entity Vs Relationship – Binary Relationship, Ternary Relationship; Introduction to Keys (Candidate Key, Primary Key, Super Key, Unique Key, Not Null Key) – Modeling Key Constraints; Modeling Weak Entities – Mapping concept of Weak Entities to Composite, Primary Key Concept, Referential Integrity Constraint (include cascaded operations of Delete & Update) ; Modeling Participation Constraints – Cardinality, Full participation & Partial, Modeling Class Hierarchies – Mapping concept of class Hierarchies to covering constraints, Modeling Aggregation – Ternary Vs Aggregation

Unit II	**RELATIONAL ALGEBRA & RELATIONAL CALCULUS**	**8 hr**

Introduction to Relational Model (Translating Entity Set & Relationship set into Tables) ; Introducing Basic operations on Relations: Selection and Projection , Cartesian product, examples; Introducing Basic operations on Relations : Joins, Set Operations and examples ; Introducing Basic operations on relations: Division & Renaming and example;

Syntax & Semantics of Tuple Relational Calculus (notations used to represent a query using DRC); Syntax & Semantics of Domain Relational Calculus (notations used to represent a query using DRC); TRC, DRC Query representations using AND, OR, NOT OPERATORS; IMPLIES operator , Comparison between TRC and DRC		
Unit III	**SQL (STRUCTURED QUERY LANGUAGE)**	**8 hr**
Basic Structure of SQL queries(Basic format of select query, DDL,DML commands) ; Integrity and Referential constraints (Includes syntax for all key constraints, Translating Constraints associated with ER into Tables); Additional Basic Operations(Arithmetic, logical, relational, pattern matching); Functions(String, Date, Numeric); Aggregate Functions, Clauses and Set Operations**;** Join Expressions; Nested Queries, Correlated Queries; Introduction to Views, Destroying/Altering/Updating of views, Handling Null values		
Unit IV	**NORMALIZATION**	**8 hr**
FDs and Decomposition: Problems caused by redundancy, FD (definition), Armstrong 's axioms; FD identification from relations, Equivalence of two FD sets; Dependency preserving Decomposition, examples; Lossless join, verification, examples; **Normal Forms:** First normal form, partial dependency, Second normal Form; Transitive dependency, third normal form, Motivation for BCNF; BCNF, Multivalued dependency, Fourth normal form.; Triggers		
Unit V	**INDEXING, TRANSACTION MANAGEMENT, CONCURRENCY CONTROL & RECOVERY MANAGEMENT**	**8 hr**
Types of indexes (Clustered index, un clustered index primary index, secondary index), Tree based index versus and Hash based index; ISAM, B+ Tree construction (Insertion and Deletion of nodes); Transaction concept, Transaction states, ACID properties of transaction; Transactions and Schedules, Concurrent executions of transactions (anomalies); Serializability, Testing for serializability,2PL; Strict 2PL, Deadlocks, timestamp based protocols; Recoverability, Introduction to Log based recovery, check pointing and shadow paging; ARIES algorithm		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth Edition. McGrawHill.	
2	Data base Management Systems, Raghurama Krishnan, Johannes Gehrke	
REFERENCE BOOKS:		
1	Fundamentals of Database Systems, Elmasri Navathe Pearson Education.	
2	An Introduction to Database systems, C.J. Date, A.Kannan, S.Swami Nadhan, Pearson, Eight Edition for UNIT III.	
ADDITIONAL REFERENCE MATERIAL		
1	https://docs.oracle.com/cd/B19306_01/server.102/b14200/toc.htm	
2	https://dev.mysql.com/doc/refman/8.0/en/select.html	

Bloom's level – Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X	X		
CO3	BL4				X	
CO4	BL6					X
CO5	BL6					X
CO6	BL6	X	X	X	X	

R23MMECT020	PRODUCT LIFECYCLE MANAGEMENT (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40 (L) + 2 (Introduction) + 6 (Case Discussion)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective:

This course is aimed at helping students:

- To understand the philosophy and methodology of product design
- To understand the concept of lifecycle and its management
- To build an insight into the real world and the challenges related to product data management

Course Outcomes:

At the end of the course, the student will be able to:

1	Verify the efficacy of a good engineering design **(BL 5)**
2	Create a suitable development process for an engineering product **(BL 6)**
3	Develop a PLM implementation strategy for a product company **(BL 6)**
4	Assess a physical product in terms of product data management requirements **(BL 5)**
5	Recommend suitable PLM process requirements for a product **(BL 5)**

SYLLABUS

Unit I	**ENGINEERING DESIGN**	**8 hr**

4 C's of Engineering Design; Importance of the Engineering Design Process and Types of Design; Modelling Design Thought; Design as a Problem-solving Methodology; Considerations of a Good Design; The Design Process; Codes/Standards and Review; Societal Considerations in Engineering Design.

Unit II	**PRODUCT DEVELOPMENT**	**8 hr**

The Product Development Process; Factors for Success, Static/Dynamic Products, Variations on the Generic Process; Product and Process Cycles; Organisation for Product Development; Markets and Marketing; Identifying Customer's Needs; Kano Model, Quality Function Deployment; Design Specification and Product Architecture.

Unit III	**PRODUCT LIFECYCLE MANAGEMENT**	**8 hr**

Challenges and Emergence of PLM, Definition of PLM; PLM Model, Characteristics of PLM; Environment Driving PLM; PLM Elements; Developing PLM Strategy; Implementing PLM Strategy; PLM Readiness Assessment; Capability Maturity Model.

Unit IV	**PRODUCT IN PLM**	**8 hr**

Collaborative Product Development: Part 1; Collaborative Product Development: Part 2; Product Structure and Specifications; Bill of Material; Product Range, Instance, Identifier; Product Data and Metadata, Product Data Models; Types of Product Data in PLM; Product Data Issues.

Unit V	**PROCESS IN PLM**	**8 hr**
Overall Business Process Architecture, Managing BoM; Engineering Change Process; Workflow; Process Mapping and Modelling; Change Management; Variant and Version Management; Configuration Management; PLM Integration with Other Applications.		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Dieter, George. E. and Schmidt, Linda. C., "Engineering Design", 4th Edition, McGraw-Hill, 2009	
2	Grieves, Michael, "Product Lifecycle Management", McGraw-Hill, 2006	
3	Antti Saaksvuori, Anselmi Immonen, "Product Lifecycle Management", 1st Edition, Springer-Verlag	
4	Sark, John, "Product Lifecycle Management: 21st Century Paradigm for Product Realisation", 2nd Edition, Springer-Verlag, 2011	
REFERENCE BOOKS:		
1	https://books.google.co.in/books?id=q9AdtdDeuPsC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false	
2	https://books.google.co.in/books?id=CiHbLm6twJMC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false	
ONLINE RESOURCES		
1	https://www.slideshare.net/anandsubramaniam/product-life-cycle-management	
2	http://productlifecyclestages.com/	
3	https://nxrev.com/2018/02/windchill-vs-enovia/	
4	https://www.cimdata.com/en/education/plm-basics-e-learning-course	
5	https://www.cimdata.com/en/education/plm-certificate-program	

Bloom's level - Units Catchment Articulation Matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL6		X			
CO3	BL6			X		
CO4	BL5				X	
CO5	BL5					X

R23MBMCT002	QUALITY MANAGEMENT (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40 (L) + 2 (Introduction) + 6 (Case Discussion)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective:

This course is aimed at helping students:

- To understand the philosophy of quality management
- To understand Lean philosophy and its implementation tools/techniques
- To understand the Six Sigma methodology

Course Outcomes:

At the end of the course, the student will be able to:

1	Assess an organisation from a quality management perspective **(BL5)**
2	Assess how lean philosophy can be implemented in a traditional organisation **(BL5)**
3	Evaluate a factory for JIT and TPM practices **(BL5)**
4	Decide upon a Six Sigma project and carry out suitable measurements **(BL5)**
5	Evaluate hypothesis and present control charts to ensure quality **(BL5)**
6	Develop an action plan for quality management **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO QUALITY MANAGEMENT**	**8 hr**

Organising for Quality; Planning for Quality; Staffing and Motivating; Pioneers of Quality; Total Quality Management; Customer and Quality; The Juran Trilogy; Benchmarking.

Unit II	**THE LEAN PHILOSOPHY**	**8 hr**

The Emergence of Lean; House of Lean, Muda, Mura, Muri; 5S, Value Stream Mapping; Standardised Work; SMED, Jidoka, Poka-yoke; Kaizen; Hoshin Kanri; Lean Culture

Unit III	**JIT AND TPM**	**8 hr**

JIT Production System; Flow Production; Kanban; Visual Control, Heijunka; Total Productive Maintenance: Introduction; Overall Equipment Efficiency; Autonomous Maintenance; Fault Analysis

Unit IV	**SIX SIGMA METHODOLOGY: PART 1**	**8 hr**

Six Sigma Methodology; Define Phase: Project Identification, Voice of Customer; Define Phase: Project Management; Define Phase: Management and Planning Tools; Measure Phase: Data Collection; Measure Phase: Graphical Methods; Measure Phase: Measurement System Analysis; Measure Phase: Process and Performance Capability

Unit V	**SIX SIGMA METHODOLOGY: PART 2**	**8 hr**

Analyse Phase: Exploratory Data Analysis, Analyse Phase: Hypothesis Testing Basics, Analyse Phase: Tests for Means, Variances and Proportions, Analyse Phase:

Paired Comparison Test, ANOVA, Chi-Square Test; Improve Phase: Design of Experiments; Improve Phase: Root Cause Analysis; Control Phase: Statistical Process Control; Control Phase: Control Charts.	
LEARNING RESOURCES	
TEXT BOOKS:	
1	Mouch, Peter. D., "Quality Management: Theory and Application", CRC Press, Taylor and Francis Group, 2010
2	Besterfield, Dale. H., Besterfield-Michna, Carol, Besterfield, Glen. H., Besterfield-Sacre, Mary., Urdhwareshe, Hemant., Urdhwareshe, Rashmi., "Total Quality Management", Revised Third Edition, Pearson, 2012
3	Dennis, Pascal., "Lean Production Simplified", Third Edition, CRC Press, Taylor and Francis Group, 2015
4	Hirano, Hiroyuki., "JIT Implementation Manual: A Complete Guide to Just-in-Time Manufacturing", Second Edition, CRC Press, Taylor and Francis Group, 2009
5	Borris, Steven., "Total Productive Maintenance", McGraw-Hill, 2006
6	Munro, Roderick. A., Govindarajan Ramu and Zrymiak, Daniel. J., "The Certified Six Sigma Green Belt Handbook", Second Edition, ASQ Quality Press, 2015

Bloom's level - Units Catchment Articulation Matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL5		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6		X	X	X	X

<table>
<tr><td rowspan="3">R23MSCSL005</td><td colspan="6">PYTHON PROGRAMMING LAB
(Common to all branches)</td></tr>
<tr><td>Total Contact Hours</td><td>42 (P)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>-</td><td>0</td><td>0</td><td>3</td><td>2</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">Students will implement python programming constructs which are used to develop both desktop and graphical user applications.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Students will be able to apply the basic building blocks of python language like variables, operators and modules.</td></tr>
<tr><td>2</td><td colspan="6">Students will be able to apply conditional control statements and functions.</td></tr>
<tr><td>3</td><td colspan="6">Students will be able to apply various file operations and analyze the data using pandas library.</td></tr>
<tr><td>4</td><td colspan="6">Students will be able to choose and decide the suitable widgets to design and develop Graphical User Interface (GUI) applications.</td></tr>
<tr><td colspan="7">List of Experiments</td></tr>
<tr><td>1</td><td colspan="6">Week – 1: DATA TYPES, OPERATORS, BUILT-IN FUNCTIONS
1. Write a python script to illustrate data types (int, char, float, string).
2. Write a python program to perform the following expressions using operator precedence
(1) 5+3*2
(2) 2*3**2
(3) 2**3**2
(4) (2**3)**2
3. Write a python program to illustrate type conversion functions
4. Write a python program to illustrate pi, sqrt, cos, sin functions of math module</td></tr>
<tr><td>2</td><td colspan="6">Week – 2: PROGRAMS WITHOUT CONTROL STATEMENTS
1. Write a program to calculate simple interest
2. Write a python program to calculate compound interest
3. Write a python program to print ASCII value of a character
4. Write a python program to find the area of a circle
5. Write a python program to find the area of a triangle
6. Write a program to perform string concatenation</td></tr>
<tr><td>3</td><td colspan="6">Week – 3: PROGRAMS ON NUMPY MODULE
1 Write a program to work with 1D array operations including indexing and slicing.
2 Write a program to work with 2D array operations</td></tr>
<tr><td>4</td><td colspan="6">Week – 4: PROGRAMS ON CONTROL STATEMENTS
1. Write a python program find the power of a number without built-in functions.
2. Write a python program to count the number of even and odd numbers upto the given range.</td></tr>
</table>

	3. Write a python program to print the multiplication table for a given number. 4. Write a python program to display minimum and maximum among three numbers.
5	**Week – 5: PROGRAMS ON FUNCTIONS** 1. Write a python program to find if a number is prime or not with and without recursion. 2. Write a python program to display Fibonacci series using iteration and recursion. 3. Write a python program to find the factorial of a number with and without recursion.
6	**Week – 6: PROGRAMS ON STRINGS** 1. Write a program to work with string built-in functions 2. Write a python program to determine number of times a given letter occurs in a string 3. Write a python program to check if a string is a palindrome or not. 4. Illustrate in operator and write a python program to count number of lowercase characters in a string. 5. Write a program to replace all the occurrences of letter 'a' with letter 'x' in a string.
7	**Week – 7: PROGRAMS ON LISTS** 1. Write a program to implement the following list functions a)len() b)extend() c)sort() d) append() e)insert() f)remove() 2. Write a program to pass list as an argument to a function 3. Write a python program to find the largest and smallest number in a list. 4. Write a python program to merge two lists and sort it. 5. Write a python program to remove the duplicate items from a list. 6. Write a python program to find sum of elements in a list
8	**Week – 8: PROGRAMS ON TUPLES , DICTIONARIES** 1. Write a program to create a list of tuples with the first element as the number and the second element as the square of the first element. 2. Write a python program that takes the list of tuples and sorts the list of tuples in increasing order by the last element in each tuple. 3. Write a program to implement the following dictionary methods a) keys() b) values() c)items() d) pop() e)delete() 4. Write a python program to add a key value pair to a dictionary and update the dictionary based on the key. 5. Write a Program to do a reverse dictionary lookup in python.
9	**Week – 9: PROGRAMS ON FILES** 1. Write a program to implement read(), readline(), readlines(),

	write(), writelines() methods on files. 2. Write a program to implement seek(), tell() and flush() methods with different arguments in a file. 3. Write a program to generate 20 random numbers in the range of 1 to100 and write to a file.
10	**Week – 10: PROGRAMS ON PANDAS MODULE** 1. Write a program to import data from CSV to DataFrame in pandas. 2. Write a program to inspect data in DataFrame using head(), tail () and describe() functions in pandas. 3. Write a program to perform sorting and slicing operations in pandas.
11	**Week – 11: PROGRAMS ON GUI** 1. Design and develop a GUI application to display -Hello World. 2. Design and develop a GUI application using Label, Entry and Button widgets. 3. Design and develop a GUI application using Tkinter Geometry methods pack(),grid(), place(). 4. Design and develop a GUI application using CheckButton and Radiobutton widgets.
12	**Week – 12: PROGRAM ON GUI CONTI…** 1. Design and develop a GUI application using Menu and Menubutton widgets. 2. Design and develop a GUI application using Listbox and Scrollbar widgets. 3. Design and develop a GUI application using Messagebox and File Dialog widget

Demonstration experiments	
1	Demonstration of Python IDLE to implement solutions.
2	Demonstration on Colab notebook to read, access and display data from google drive.
3	Demonstration on jupyter notebook to link and access data.
LEARNING RESOURCES	
TEXTBOOKS:	
1	Kenneth A. Lambert. - Fundamentals of Python: First Programs‖, 2nd Edition, Publisher: Cengage Learning
2	Reema Thareja.-Python Programming using Problem Solving Approach
3	R. Nageswara Rao, -Core Python Programming‖
REFERENCE BOOKS:	
1	Wesley J. Chun. -Core Python Programming - Second Edition‖, Prentice Hall
2	John V Guttag. -Introduction to Computation and Programming Using Python‖, Prentice Hall of India.
3	Python Practice Book Release 2014, Anand Chitipothu.

ADDITIONAL REFERENCE MATERIAL	
1	https://www.w3schools.com/python/
2	https://www.tutorialspoint.com/python/index.htm
3	https://docs.python.org/3/tutorial/
4	https://www.pythontutorial.net/tkinter
5	https://www.python-course.eu/python3_course.php
6	https://www.geeksforgeeks.org/python-tkinter-tutorial/
7	https://www.tutorialspoint.com/python/python_gui_programming.htm
8	https://www.programiz.com/python-programming

R23MSCSL006	DATABASE MANAGEMENT SYSTEMS LAB (Common to all branches)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**0**	**0**	**3**	**2**

Course Objective

Students will gain exposure on ER model, R- Model to design the database, Data Retrieval using SQL and Procedural SQL. Students will be able to explore view level ofdata abstraction levels.

Course Outcomes

After completing this course, the students will be able to

1	Students will be able to design the database for the given client requirements using ER- Model and also be able to convert the ER design to R model by covering all sorts of constraints
2	Students will be able to retrieve the data for any given user constraints using SQL features group by, nested Queries and joins
3	Students will be able to design the different views and also able to identify the execution differences between a query and query as a view.
4	Students will be able to identify the importance of data and auditing.
List of Experiments	
1,2	Designing of ER model for the given constraints
3	Conversion of entities to relational tables with constraints using DDL statements (CREATE, ALTER, DROP)
4	Conversion of relations to relational tables with referential integrity constraint (using ON DELETE CASCADE and ON UPDATE CASCADE) and DML operations (INSERT, DELETE, UPDATE)
5	Querying the data using SELECT, WHERE, AND, BETWEEN, LIKE
6	Applying string, number and date functions while querying the data
7	Querying the data using set operations(UNION, UNION ALL, INRESECT, MINUS/EXCEPT) and GROUPBY, HAVING clauses
8	Querying the data using Nested Queries (Correlated Queries- EXISTS, NOT EXISTS, independent queries- IN, NOT IN, ANY, ALL, =, > and <).
9	Querying the data using JOINS and Handling NULL values using JOINS
10	Designing views for different user perspectives (updatable views and non-updatable views),
11	Designing of procedures and functions in PL/SQL
12	Design of Triggers
Additional experiments	
1	Sequence generation and its usage as primary key
2	Verifying DCL-grant, revoke
3	Verifying TCL commands- commit, roll back and save point.
Demonstration experiments	
1	Case study - Library Management system
2	Case study- E-commerce store management
3	Case Study**-** Hospital management
LEARNING RESOURCES	
TEXTBOOKS:	
1	Data base System Concepts, Silberschatz, Korth, McGraw hill, Sixth

	Edition. McGrawHill.
2	Data base Management Systems, Raghurama Krishnan, Johannes Gehrke
3	Learning SQL, Alan Beaulieu, O'Reilly Media, Inc., 3rd Edition,
ADDITIONAL REFERENCE MATERIAL	
1	https://docs.oracle.com/cd/B19306_01/server.102/b14200/toc.htm
2	https://dev.mysql.com/doc/refman/8.0/en/select.html

R23MBMCL001	FINANCIAL ACCOUNTING LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**0**	**0**	**3**	**2**

Course Objective

The course on Personal Finance Fundamentals aims to equip students with the skills to analyze, interpret, and manage financial data using Excel, encompassing budgeting, financial statements, investment strategies, capital budgeting, and tax planning.

Course Outcomes

After completing this course, the students will be able to

1	**Create** and **apply** financial goals and budgets using Excel, and **analyze** financial statements.
2	**Calculate** financial ratios and **evaluate** performance metrics, and **construct** and **interpret** financial charts.
3	**Describe** stocks and bonds, **compare** investment types, and **develop** and **assess** basic investment strategies.
4	**Calculate** NPV, IRR, and Payback Period using Excel, and **evaluate** and **select** projects based on financial analysis.
5	**Compute** income taxes using Excel, and **design** and **implement** financial planning and retirement strategies.

List of Experiments

1	**Week 1: Personal Finance Fundamentals** **Financial goal-setting and budgeting using Excel** Experiment 1: Creating a Personal Budget in Excel Experiment 2: Building and Analyzing a Balance Sheet
2	**Week 2: Personal Finance Fundamentals** **Understanding financial statements (balance sheet, income statement**) Experiment 1: Constructing and Analyzing an Income Statement Experiment 2: Creating a Cash Flow Statement
3	**Week 3: Financial Analysis using Excel** **Ratio analysis and financial performance metrics** Experiment 1: Calculating Liquidity Ratios Experiment 2: Analyzing Profitability Ratios
4	**Week 4: Financial Analysis using Excel** **Ratio analysis and financial performance metrics** Experiment 1: Assessing Solvency Ratios Experiment 2: Visualizing Financial Ratios
5	**Week 5: Financial Analysis using Excel** **Charting and graphing financial data using Excel** Experiment 1: Creating Bar Charts for Financial Ratios Experiment 2: Constructing Line Graphs for Trend Analysis
6	**Week 6: Financial Analysis using Excel** **Charting and graphing financial data using Excel** Experiment 1: Using Pie Charts to Illustrate Financial Composition Experiment 2: Building a Financial Dashboard

7	**Week 7: Investment Basics** **Understanding stocks and bonds** Experiment 1: Analyzing Stock Performance Experiment 2: Evaluating Bond Prices and Yields Experiment 3: Comparing Stocks and Bonds
8	**Week 8: Investment Basics** **Basic investment strategies and risk management** Experiment 1: Understanding Risk and Return Experiment 2: Diversification Strategies
9	**Week 9: Capital Budgeting Basics** **Understanding capital budgeting decisions using Excel (NPV, IRR, Payback Period)** Experiment 1: Calculating Net Present Value (NPV) Experiment 2: Determining Internal Rate of Return (IRR) Experiment 3: Analyzing Payback Period
10	**Week 10: Capital Budgeting Basics** **Project evaluation and selection using Excel formulas** Experiment 1: Evaluating Investment Projects Experiment 2: Decision Criteria and Project Selection
11	**Week 11: Taxation and Financial Planning** **Income tax calculations using Excel (personal and business)** **Basic financial planning and retirement savings strategies** Experiment 1: Personal Income Tax Calculations Experiment 2: Business Income Tax Calculations
12	**Week 12: Taxation and Financial Planning** **Basic financial planning and retirement savings strategies** Experiment 1: Personal Financial Planning Experiment 2: Retirement Savings Strategies
LEARNING RESOURCES	
TEXTBOOKS:	
1	Gitman, L. J., Juchau, R., & Flanagan, J. (2015). *Principles of managerial finance* (7th ed.). Pearson Education Australia.
2	Brigham, E. F., & Houston, J. F. (2016). *Fundamentals of financial management* (14th ed.). Cengage Learning.
REFERENCEBOOKS:	
1	Ross, S. A., Westerfield, R. W., & Jordan, B. D. (2019). *Fundamentals of corporate finance* (12th ed.). McGraw-Hill Education.
2	Brealey, R. A., Myers, S. C., Allen, F., & Mohanty, P. (2017). *Principles of corporate finance* (13th ed.). McGraw-Hill Education.
3	Brigham, E. F., & Ehrhardt, M. C. (2016). *Financial management: Theory & practice* (15th ed.). Cengage Learning.
ADDITIONAL REFERENCE MATERIAL	
1	https://www.investopedia.com/financial-planning-beginners
2	https://www.financialplanning.org/retirement-tips
3	https://openstax.org/books/intro-financial-markets

R23MENGAT01	ETHICS & HUMAN VALUES (Common to All branches of Engineering)					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**2**	**0**	**0**	**0**

Course Objective

The course creates awareness regarding the need for the development of a holistic perspective in understanding the nuances of personal, professional and social life. It enables the student to grasp the ethical principles that govern human existence.

Course Outcomes

After completing this course, the students will be able to

1	Identify the relevance of the concepts of Self -Exploration and Natural Acceptance in day-to-day life to achieve continuous happiness and prosperity. (**BL 3**)
2	Discuss the impact of trust and respect as foundational values in human relationships to achieve comprehensive human goals. (**BL 3)**
3	Understand the relevance of ethical theories and their applications in societal living. (**BL3**)
4	Understand the concept of ethics in engineering practice **(BL 3)**
5	Discuss the purview of ethics in understanding global issues pertaining to different fields. (**BL 3)**

SYLLABUS

Unit I	**UNDERSTANDING THE SELF**	**5 hr**

Characteristics of Universal Human Values; Self-Exploration– Meaning and Process; Basic Human Aspirations – Meaning and Basic Requirements for fulfilment; Concept of Human Existence – Conscious and Material Entities; Difference between the Conscious and the Material Entities of Human Existence.

Unit II	**UNDERSTANDING THE FAMILY AND SOCIETY**	**5 hr**

Understanding the importance of harmony in a family; Exploring value of feelings in relationships; Measures to ensure Harmony in the family. Understanding conflict (meaning, types); Dimensions of Human order for harmony in society – Physical, mental, social and spiritual; Universal values of justice, democracy, respect and gratitude.

Unit III	**ETHICAL THEORIES**	**5 hr**

Professionalism and ethics; Ethical Theories: Golden mean theory, Rights-based theory, Duty-based theory, Utilitarian theory, Kohlberg's Theory. Moral issues; Moral Dilemmas; Types of Inquiries – Normative, Conceptual, factual/descriptive.

Unit IV	**ETHICS AND ENGINEERING**	**5 hr**

Engineering ethics - Social Experimentation; Safety Responsibility and Rights: Engineers as responsible Experimenters, Concept of Safety and Risk: Engineer's Responsibility for Safety, Risk – Benefit Analysis.

Case Studies: The challenger disaster, The Three Mile Island, Fukushima Nuclear Disaster, Bhopal Gas Tragedy, The Titan submersible disaster.

Unit V	**ETHICS AND GLOBAL ISSUES**	**5 hr**

Ethics and Global Issues: Environmental ethics; computer ethics; Business Ethics; Corporate Social responsibility; Code of ethics.

LEARNING RESOURCES	
TEXTBOOKS:	
1	R R Gaur, R Sangal, G P Bagaria, "*A Foundation Course in Human Values and Professional Ethics*" Excel Books, New Delhi, 2010.
REFERENCE BOOKS:	
1	A.N. Tripathi, "*Human Values*", 2nd Edition, New Age International Publishers, 2004.
2	Charles D. Fleddermann, "*Engineering Ethics*", Pearson Education / Prentice Hall, New Jersey, 2004.

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL3			X		
CO4	BL3				X	
CO5	BL3					X

***

V SEMESTER

R23MSCST011	OPERATING SYSTEMS (Common to all Branches)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**0**	**0**	**3**

Course Objective

Students will gain a comprehensive understanding of operating systems, covering topics such as system architecture, functionalities, structures, processes, file systems, storage management, and advanced concepts like inter-process communication, multithreading, disk scheduling, and RAID, enabling them to grasp the fundamental principles and practical aspects of managing computer systems effectively.

Course Outcomes

1	Students will be able to analyze the diverse structures and functionalities of operating systems. **(BL4)**
2	Students will be able to design and make use of efficient process management strategies, employing system calls and various threading models to improve overall system responsiveness. **(BL6)**
3	Students will be able to analyze the system's performance and effectiveness by comparing different strategies for deadlock resolution and memory management. **(BL3)**
4	Students will be able to analyze the performance of virtual memory management techniques, including TLB, different page table structures, and page replacement algorithms. Examine system behavior to identify and understand the causes of thrashing and evaluate the effectiveness of various file management methods and directory structures. **(BL5)**
5	Students will be able to analyze the effectiveness of various file system structures and management techniques. Evaluate the efficiency of free space management techniques and disk scheduling algorithms. Examine RAID levels to assess their impact on disk and swap space management. **(BL5)**
6	Students will be able to adapt to build basic internals of operating system framework that integrates diverse OS concepts (process management strategies, efficient file system structures, and virtual memory management techniques), choose different approaches for inter-process communication to enhance system responsiveness and collaboration, and discuss various solutions for ensuring improved performance and reliability in storage systems. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO OS AND CONCEPTS OF PROCESS AND THREADING**	**8 hr**

What Operating Systems do? Computer System architecture; OS Functionalities: Process Management, Memory Management, Storage Management, Protection and Security; Computing Environment: Traditional Computing, Client Server computing, Peer to Peer computing, web based computing, OS Services; System calls, Types of System calls; Operating System Structure: Simple, Layered, Microkernels, Modules; Introduction to Processes: Process, Process States, Process Control Block. Threads.; Operations On Processes: Process Creation, Process

Termination (fork(),exec(),exit() system calls); Inter-Process communication: Shared memory, Message Passing;		
Unit II	**PROCESS SCHEDULING AND SYNCHRONIZATION**	**8 hr**
Multithreading Models: Overview, Benefits, Many to One, One to One, Many to Many. Process Scheduling: Scheduling queues, Schedulers, Context switch; Process Scheduling: Basic Concepts, CPU Scheduler, Preemptive Scheduling, Dispatcher, Scheduling Criteria; Scheduling Algorithms (Non-pre-emptive): FCFS, SJF; Scheduling Algorithms II(pre-emptive): Priority Scheduling, Round Robin; Multilevel Queue, Multilevel Queue feedback, Process Synchronization: Introduction to process synchronization. Producer Consumer Problem; Critical Section Problem, Peterson's Solution, Synchronization Hardware; Semaphore, Classical problems of synchronization: Bounded-buffer Problem, Readers Writers Problem; Dining Philosophers Problem, Monitors: Introduction, Usage;		
Unit III	**DEADLOCKS AND MEMORY MANAGEMENT**	**8 hr**
Deadlocks: Introduction, System Model, Deadlock Characterization; Methods for Handling Deadlocks Deadlock Prevention; Deadlock Avoidance (Part -1) Safe state, resource allocation graph algorithm; Deadlock Avoidance (Part -2) Banker's algorithm, Deadlock Detection single instance of each resource type; Deadlock Detection several instances of resource type and Recovery from Deadlocks; Memory Management, Address Binding, Logical vs Physical Address space; Swapping, Contiguous Memory; Paging (Basic Method);		
Unit IV	**PAGING TECHNIQUES, PAGE REPLACEMENT AND ACCESSING FILES TECHNIQUES**	**8 hr**
Hardware, TLB, Protection, Shared Pages,; Structure of the Page table, hierarchy, hashed,; Inverted page table, Segmentation; Virtual memory management, Demand paging; Page Replacement Algorithms: FIFO, Optimal page replacement; LRU Page replacement, Thrashing: causes of thrashing,; File concept, File Attributes, File operations, File types, File Structure; Access methods: Sequential Access, Direct Access, Directory Structure: Single level directory, Two level directory;		
Unit V	**FILE ORGANIZATION AND DISK SCHEDULING TECHNIQUES**	**8 hr**
Tree structured directories, Acyclic graph directories, File System Mounting File Sharing; File Protection: types of access, Access control, File allocation methods: Contiguous allocation,; File allocation methods: Linked allocation, Indexed allocation, Free space management: Bit vector, Linked list, Grouping,; Overview of Mass Storage Structure: Magnetic disks, Magnetic Tapes, Disk Structure; Disk Scheduling: FCFS,SSTF,SCAN,; CSCAN,LOOK,CLOOK; Disk Management, Swap Space Management; Raid Structure: Levels: 0-6, RAID levels 0+1;		
LEARNING RESOURCES		
TEXT BOOKS:		
1	"Operating System Concepts" by Abraham Silberschatz, Peter B. Galvin, and Greg Gagne.	
2	"Modern Operating Systems" by Andrew S. Tanenbaum.	
REFERENCE BOOKS:		
1	"Operating Systems: Internals and Design Principles" by William Stallings.	
ADDITIONAL REFERENCE MATERIAL		
1	"Operating Systems: Three Easy Pieces" by Remzi H. Arpaci-Dusseau and	

	Andrea C. ArpaciDusseau (Free online book available at: http://pages.cs.wisc.edu/~remzi/OSTEP/)
2	"Linux Kernel Development" by Robert Love.
3	"File System Forensic Analysis" by Brian Carrier.
ONLINE COURSES	
1	**Coursera: "Operating Systems and System Programming"** ● Offered by Stanford University, this course covers fundamental concepts and principles of operating systems. ● https://www.coursera.org/specializations/codio-introduction-operating-systems
2	**edX: "Introduction toss Operating Systems"** ● Provided by Georgia Institute of Technology, this course explores the design and implementation of modern operating systems. ● **Link:** https://www.udacity.com/course/introduction-to-operating-systems--ud923
3	**MIT OpenCourseWare: "Operating System Engineering"** ● A free online course from MIT, offering in-depth coverage of operating system design and implementation. **Link:** https://ocw.mit.edu/courses/6-828-operating-system-engineering-fall-2012/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL6		X			
CO3	BL3			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST012	ADVANCED JAVA PROGRAMMING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	OOP with C++	**3**	**0**	**0**	**3**

Course Objective

Students will have the ability to understand, design, integrate, and evaluate complex Java systems by combining object-oriented principles, exception handling, multithreading, networking, GUIs, and collections to create efficient, scalable, and robust applications

Course Outcomes

1	Students will be able to create and manipulate classes and objects in Java by apply constructors, methods, and access modifiers and string functions. **(BL3)**
2	Students will be able to analyze a Java program that identifies the purpose of the Inheritance, abstract classes, interfaces and evaluate how the built-in packages can be leveraged to enhance application development and reduce code redundancy. **(BL4)**
3	Students will be able to use Reflection API, collections, packages and generics to provide type-safe solution to a given problem. **(BL3)**
4	Students will be able to analyze various exception handling mechanisms and principles of multithreading. **(BL4)**
5	Students will be able to demonstrate to handle data transmission and reception using client-server application and also design and develop a Graphical User Interface (GUI) application. **(BL5)**
6	Students will be able to critically evaluate the implementation and appropriateness of various java concepts (Inheritance, packages, collections and Reflection API) in their applications that integrate GUI components. **(BL6)**

SYLLABUS

Unit I	**JAVA FUNDAMENTALS, CLASSES, ARRAYS AND STRINGS**	**8 hr**

Java Features, Comparison between C++ & JAVA (platform independence, pure object orientation, garbage collection, single object hierarchy, reference passing);A First Simple Java Program, Compilation execution, CLASS PATH, jdk, jvm, jre, byte code; Transition of C++ to java in language fundamentals; Command lines, Scanner class, Iteration statements; Class Fundamentals, Declaring Objects, Constructors and Method overloading; Java Arrays, this keyword; Access modifiers, passing object as parameter example comparing objects; Introduction to Strings: immutability, String Methods, String Buffer methods;

Unit II	**INHERITANCE, ABSTRACT CLASSES, INTERFACES AND BUILT-IN PACKAGES**	**8 hr**

Static variable, static method, static block, final Keyword; Inheritance, Member access, Types of Inheritance, Forms of inheritance; Super key word, Methods overriding; Dynamic method dispatch, Final with inheritance; Abstract Classes,

Object Class , Problems with Multiple inheritances; Interfaces, Creation, Extending and Implementing interfaces, multiple inheritance using interfaces; interface inheritance, Exploring java.util Package (Random, String Tokenizer); Exploring java.io package (Byte and Character streams, File class), Serialization;		
Unit III	**COLLECTIONS, USER-DEFINED PACKAGES, GENERICS AND REFLECTION API**	**8 hr**
Collections: Array List Class, and Iterator interface; java wrapper classes: boxing and unboxing; Packages, Defining a Package, Finding Package with CLASSPATH, importing packages, Access Protection; Introduction to Generics: Generic classes, Generic Methods; Generic Constructors, Generic Interfaces; Introducing the Reflection API: Retrieving Classes; Reflection of fields, Invoking Methods; Invoking Constructors, obtaining the Parameters of a Constructor;		
Unit IV	**EXCEPTION HANDLING AND MULTITHREADED PROGRAMMING**	**8 hr**
Exception Handling: try and catch, nested try Statements and multiple catch clauses; Throw, Throws, Finally and Built-in exceptions; User Defined Exception handling, types of exceptions; The Java Thread Model, Thread Life Cycle, Comparison of Thread and Process, The Main Thread; Creating a Thread: Implementing Runnable Interface, Extending Thread class; Creating Multiple Threads, is Alive () and join (), Thread Priorities; Daemon Thread and Thread group; Synchronization, Producer-Consumer Problem, Inter thread Communication;		
Unit V	**NETWORKING, EVENT HANDLING, AWT & SWING COMPONENTS**	**8 hr**
Networking Basics, Networking Classes and Interfaces, TCP/IP Client & Server Sockets; Datagrams, Datagram Socket, Datagram Packet; Delegation event model: events, event Classes, event listeners; Window Fundamentals, AWT Controls (Label, Text Field, Lists, Checkbox); Frame and Panel, Window and Button events; Key and Mouse event handling. Adapter classes; Layout Managers , Swing Components; Containers usage and J Table, MVC;		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Java The Complete Reference ninth edition, Herbert Schildt, Oracle Press.	
2	Paul Deitel and Harvey Deitel, "Java How to Program", 11th Edition, Pearson.	
REFERENCE BOOKS:		
1	Core Java : An Integrated Approach New includes All Versions Up To Java 8, R Nageshwara Rao, Dreamtech Press.	
2	Herbert Schildt, "Java: A Beginner's Guide", 9th Edition, McGraw Hill, 2022	
3	Bruce Eckel, "Thinking in Java", 9th Edition, Mind View, 2022.	
ADDITIONAL REFERENCE MATERIAL		
1	https://www.geeksforgeeks.org/reflection-in-java/	
2	https://www.javatpoint.com/daemon-thread	
3	https://dev.java/learn/reflection/	
ONLINE COURSES		
1	https://onlinecourses.nptel.ac.in/noc22_cs47/preview	

2	https://www.udemy.com/courses/search/?q=java
3	https://www.coursera.org/specializations/java-programming

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X			
CO3	BL3			X		
CO4	BL4				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST013	AUTOMATA AND COMPILER DESIGN (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Discrete Mathematics	**3**	**0**	**0**	**3**

Course Objective

- Students will be instructed in the fundamental principles of formal languages and automata theory, including deterministic finite automata (DFA) and non-deterministic finite automata (NFA), along with regular and context-free grammars and languages.
- The student will acquire knowledge of the process entailed in compiler design, and the phases of a compiler, including the principles of lexical and syntactic analysis and different parsers.
- Students will explore several types of intermediate representations, delve into intermediate code generation, and examine the process of syntax-directed translation.
- Students will explore a range of code optimization techniques including code generation.

Course Outcomes

1	Students will be able to build the different kinds of finite automata and use techniques for conversion and minimization. **(BL3)**
2	Students will be able to determine regular expressions for given regular languages, explore context-free grammar's and its importance in compilers. **(BL5)**
3	Students will be able to analyze the role of parsers, and the phases of compilers, and build the parse tree using top-down parsing methods. **(BL4)**
4	Students will be able to construct a parser for a given grammar using bottom-up parsing techniques and study the compiler's semantics. **(BL6)**
5	Students will be able to apply code optimization techniques to enhance a program's efficiency and build intermediate code for a given program. **(BL3)**
6	Students will be able to design compilers for programming language using the principles of automata theory, compiler tools & techniques. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO THEORY OF COMPUTATION**	**8 hr**

Central Concepts of Automata Theory:

Alphabet, Strings and Languages, Operations on Languages, Finite Automaton Model; Deterministic Finite Automaton – Definition and various representations; Designing DFAs, String Acceptance of DFA; Non-deterministic finite automaton - Definition and various representations, Designing NFAs, String Acceptance of NFA;

Finite Automata with Epsilon-transitions:

NFA to DFA Conversion (Equivalence between DFA and NFA); NFA with Epsilon transitions; Equivalence between NFA without and with Epsilon transitions (NFA -€ to NFA conversion); Minimization of Finite Automaton

Unit II	REGULAR EXPRESSIONS AND CONTEXT-FREE LANGUAGES	8 hr

Regular Expressions and Languages:

Regular Expressions and Operators, Algebraic Laws of Regular Expressions, Closure properties of Regular Languages; Conversion from Regular expression to DFA; Conversion from DFA to regular expression; Chomsky Hierarchy of Grammars-Languages and Recognizers;

Context-Free Grammars and Languages:

Context-Free Languages Definition, Left most and Right most derivations, Sentential forms, Derivation trees; Ambiguity in context-free grammars and eliminating ambiguity; Left recursion, Elimination of left recursion; Left factoring a grammar, Closure Properties and Applications of CFL

Unit III	INTRODUCTION TO COMPILER; LEXICAL ANALYSIS AND SYNTAX ANALYSIS (TOP-DOWN PARSING)	8 hr

Compilers-Lexical and Syntax Analysis:

Compiler, Structure of compiler – Lexical analysis, Syntax Analysis and semantic analysis; Intermediate code generation, Intermediate code optimization, Target code generation, target code optimization; Role of Lexical Analysis, Tokens, patterns and lexemes, Attributes for tokens, Input Buffering; Lex tool & Sample Lex programs;

Compilers - Syntax Analysis:

Parsing, role of parser, top-down parsing, Recursive descent parser; Computing first and follows; Construction of predictive parsing table; Predictive parsing program, LL (1) parser & LL (1) Grammar

Unit IV	BOTTOM-UP PARSING, SEMANTIC ANALYSIS	8 hr

Bottom-up parsing – LR Parsers:

Bottom-up parsing - Shift reduce parser; SLR Parser – LR (0) item, Closure & goto for LR (0) items, canonical LR (0) collection; SLR parser – SLR parsing table construction and parsing using SLR parser; LR (1) item, Closure & goto for LR(1) items, canonical LR(1) collection;

Advanced LR parser's & **Syntax Directed Translation:**

CLR parser – CLR parsing table construction and parsing using CLR parser, LALR Parser; Yacc-Automatic Parser Generator; Role of semantic analyzer, Syntax directed definitions; Attributed grammars- (S –attribute, L-attribute), Syntax directed translation

Unit V	INTERMEDIATE CODE GENERATION & FUNDAMENTALS OF CODE GENERATION, CODE OPTIMIZATION AND CODE GENERATION	8 hr

Intermediate Code Generation & Fundamentals of Code Generation:

Intermediate representation – Three address code, Types of three address statements, Implementations of three address code; Translation of popular programming language constructs into three address code – assignment statements, if, if-else statements, loops; Translation of popular programming

language constructs into three address code – switch statement, procedure calls and array references; Basic blocks and flow graphs; **Code Optimization & Code Generation:** Machine-independent optimization techniques; Code generation issues, The Target Program; Machine-dependent code optimization techniques (peephole optimization), DAG representation; Generic code generation algorithm;	
LEARNING RESOURCES	
TEXTBOOKS:	
1	Introduction to Automata Theory, Languages, and Computation,2e– John E. Hopcroft, Rajeev Motwani, Jefrey D Ullman.
2	Compilers, Principles Techniques and Tools,2e- Alfred V Aho, Ravi Sethi, Jeffrey D. Ullman.
REFERENCE BOOKS:	
1	Theory of Computer Science – Automata languages and computation,3e - Mishra and Chandrashekaran.
2	Principles of Compiler Design 2e-ALFRED V.AHO, RAVI SETHI, J.D.ULLMAN
3	Bruce Eckel, "Thinking in Java", 9th Edition, Mind View, 2022.
ADDITIONAL REFERENCE MATERIAL	
1	https://www.geeksforgeeks.org/reflection-in-java/
2	https://www.javatpoint.com/daemon-thread
3	https://dev.java/learn/reflection/
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2	https://www.udemy.com/courses/search/?q=java
3	https://www.coursera.org/specializations/java-programming

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL5		X			
CO3	BL4			X		
CO4	BL6				X	
CO5	BL3					X
CO6	BL6	X	X	X	X	X

R23MSCST014	COMPUTER NETWORKS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	**42 (L)**	**L**	**T**	**P**	**C**
	Pre-requisites	**DLD, CAO**	**3**	**0**	**0**	**3**

Course Objective

Students will gain an ability to identify and design network architecture and apply the essence of various protocols.

Course Outcomes

1	Students will be able to analyse and **apply** key concepts of data communication, including network topologies, layering, and protocols; the OSI and TCP/IP reference models in order to design and evaluate efficient communication systems. **(BL3)**
2	Students will be able to **describe**, **demonstrate**, and **analyse** various data link layer techniques and apply this knowledge to design and evaluate reliable data communication systems. **(BL4)**
3	Students will be able to **identify**, **explain**, and **apply** random access methods and assess their impact on the performance and evolution of network communication systems. **(BL3)**
4	Students will be able to **describe**, **compare**, and **apply** the roles of connecting devices (switches, hubs, routers, bridges, gateways), **analyze** and **evaluate** various routing algorithms and **assess** the effectiveness of flooding in network communication. **(BL5)**
5	Students will be able to **compare**, and **apply** the TCP and UDP datagram formats, congestion control techniques and flow control methods and their roles in Internet communication. **(BL4)**
6	Students will be able to design and evaluate efficient, reliable and effective network communication systems. **(BL6)**

SYLLABUS

Unit I	**OVERVIEW OF DATACOMMUNICATION AND NETWORKING**	**8 hr**

Introduction to Data Communications**;** Network Topologies, Layering and Protocols; Reference-Model: OSI Model, TCP/IP Reference Model, Addressing; Physical Layer-Different types of Transmission Media-Guided; Different types of Transmission Media-Unguided; Multiplexing-TDM, FDM, WDM; Line Encoding (NRZ, NRZI, Manchester, AMI, 4B/5B); Switching and Taxonomy: Circuit Switched, Packet Switched.

Unit II	**DATALINK LAYER : ERROR CONTROL & FLOW CONTROL**	**8 hr**

Error Detection: CRC, Checksum; Error Correction: Hamming Distance, Linear Block Codes ; Framing: Bit and Byte Stuffing; Flow Control: Noiseless-Simplest, Stop and Wait; Noisy: Stop and wait ARQ; Go Back N, Selective repeat; PPP, HDLC; Random Access: Aloha: Pure and Slotted.

Unit III	**DATALINK LAYER**	**8 hr**

Random Access: CSMA, CSMA/CD; Random Access: CSMA/CA; Controlled Access-Reservation, Polling and Token passing; Channelization-FDMA, TDMA and CDMA; Standard Ethernet-MAC; Standard Ethernet-Physical Layer; Changes in the

Standard- Fast Ethernet; Gigabit Ethernet,10 Gigabit Ethernet.		
Unit IV	**NETWORK LAYER**	**8 hr**
Connecting Devices- Switches, Hubs, Routers, Bridges, Gateways; IPv4addressing-Classful,Classless; IPv4 Datagram Format; IPv6 Datagram Format; Address Mapping: ARP; RARP,BOOTP, DHCP; Routing: Routing table, Optimization, Distance Vector Routing ; Link State Routing, Path Vector Routing.		
Unit V	**TRANSPORT LAYER AND APPLICATION LAYER**	**8 hr**
TRANSPORT LAYER: TCP Datagram Format; UDP Datagram Format; Congestion Control: Data Traffic, Open Loop, Closed Loop; Quality of Service: Flow characteristics, Scheduling ; Flow Control: Leaky Bucket and Token Bucket; **REMOTE LOGIN & APPLICATION LAYER:** Telnet, Electronic Mail; DNS, Distribution of Name Space, DNS in the Internet; WWW and HTTP.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Data Communications and Networking, Behrouz Forouzan ,4th Edition,McGrawHill.	
REFERENCE BOOKS:		
1	Computer Networks –Andrew S Tanenbaum,4th Edition, Pearson Education/PHI.	
2	Computer Networking: *A Top Down Approach-James F Kurose and Keith W Ross,* 6th Edition, Pearson Education.	
ADDITIONAL REFERENCE MATERIAL		
1	https://www.geeksforgeeks.org/computer-network-tutorials	
2	https://www.javatpoint.com/computer-network-tutorial	
3	https://www.tutorialspoint.com/data_communication_computer_network	
ONLINE COURSES		
1	https://onlinecourses.nptel.ac.in/noc22_cs19	
2	https://www.coursera.org/learn/illinois-tech-computer-networking	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X			
CO3	BL3			X		
CO4	BL5				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23MSCST019 (DSC-E1)	DATA WAREHOUSING AND DATA MINING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisites	Basic Mathematics, Database Management Systems	**3**	**0**	**0**	**3**

Course Objective

Students will gain knowledge on the concepts of data warehousing and data mining, which gives a complete description about the principles, architectures, applications, design, and implementation.

Course Outcomes

1	Students will be able to recognize the significance of data mining and choose appropriate data mining functionalities for extracting knowledge from real-world data. **(BL3)**
2	Students will be able to classify various types of data and apply data preprocessing techniques to prepare it for further analysis. **(BL3)**
3	Students will be able to develop models, select appropriate data cube computation operations and methods for building a data warehouse, and assess association rules to uncover relationships within the data. **(BL5)**
4	Students will be able to construct models to classify data objects, identify class labels, and evaluate classifier accuracies. **(BL5)**
5	Students will be able to generate clusters by optimizing proximity measures between data attributes and critically evaluate the clustering process. **(BL5)**
6	Students will be able to develop methods for extracting knowledge from data warehouses in a specific domain to support management decision-making by mastering the principles and techniques of data warehousing and data mining. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO DATA MINING, DATA MINING QUERY LANGUAGES**	**8 hr**

Introduction to Data Mining- Technologies used and Applications; Knowledge Discovery in databases; Architecture of Data Mining Systems, Coupling; Kinds of data can be mined; Patterns that can be mined-Characterization, Discrimination, Association; Patterns that can be mined-Classification, Clustering, Outlier Analysis; Are all patterns interesting?, Major issues in Data Mining; Syntax of Data mining query language.

Unit II	**DATA ATTRIBUTES, DATA PREPROCESSING**	**8 hr**

Attribute Types, Basic Statistical Description of Data-Measuring the Central Tendency; Measuring the Dispersion of Data, Graphic Display of Basic Statistical Description of Data (Q-Q Plots, Histograms, Scatter Plots); Data Matrix and Dissimilarity Matrix, Minkowski Distance, Proximity Measures for Nominal and Binary attributes,; Proximity Measures for Ordinal attributes, Dissimilarity for attributes of Mixed Types, Cosine similarity; Data Preprocessing – Why Preprocessing, Major tasks in Data Preprocessing, Data Cleaning techniques; Data Integration- Redundancy, Correlation Analysis for Nominal Data and Numeric Data; Data Reduction-Attribute Subset Selection, Sampling, Data compression; Data Transformation –Normalization, Data Discretization and Concept Hierarchies.

Unit III	DATA WAREHOUSING-MODEL, DESIGN, IMPLEMENTATION AND ASSOCIATION ANALYSIS	8 hr
Introduction to Data Warehouse, 3-tier Architecture, Differences between OLAP and OLTP; Multidimensional data model-Data cubes introduction, Role of Concept hierarchy, Star-net Query model, Schemas, OLAP Operations; Data Warehouse Design Process, Indexing OLAP data, Data Warehouse Implementation-Data cubes computation preliminary concepts, Cube Materialization; Data cube Computation Methods- Multiway Array Aggregation, Bottom-Up Construction-iceberg cubes, Star cubing; Market Basket Analysis, Frequent Item set Mining - Apriori Algorithm; Association Rules generation, FP growth Algorithm; Pattern Mining in Multilevel, Multidimensional Space, Colossal Patterns; Constraint based pattern mining, Pattern Evaluation Methods.		
Unit IV	**CLASSIFICATION**	**8 hr**
Introduction to Classification, Classification by Decision Tree Induction; Bayesian Classification, Bayesian Belief Networks; Basics of Support Vector Machines, Rule Based Classification; Classification by Back Propagation; Other classification methods- K-nearest Neighbor Classifier, Genetic Algorithms; Other classification methods-Rough Set, Fuzzy set approach; Metrics for Evaluating Classifier Performance-Confusion Matrix; Common techniques for assessing and improving classifier Accuracy.		
Unit V	**CLUSTERING**	**8 hr**
Cluster Analysis & its requirements, Categorization of clustering methods; Partitioning Methods(K-means); Partitioning Methods(K-Medoids); Hierarchical Methods (Agglomerative, Divisive), Distance Measures in Algorithmic Methods; Hierarchical clustering using single and complete linkages; Density Based Methods (DBSCAN, OPTICS); Grid Based Methods(STING, CLIQUE); Evaluation of Clustering.		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Data Mining, Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei.	
REFERENCE BOOKS:		
1	Data Mining Concepts and Techniques, Han, Morgan Kaufmann Publishers.	
2	Introduction to Data Mining by Pang-Ning Tan, Vipin Kumar, Michael Steinbach	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL5				X	
CO6	BL6	X	X	X	X	X

<table>
<tr><td rowspan="3">R23MSCST026
(DSC-E1)</td><td colspan="6">STATISTICAL AND MATHEMATICAL FOUNDATION OF DATA ANALYSIS
(CSE,IT,CSIT,AIML,DS,ICB)</td></tr>
<tr><td>Total Contact Hours</td><td>42 (L)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>Mathematical Methods, calculus and probability & statistics</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="7">Course Objective
1. Students will get exposure to learn about the concepts of random vectors, distributions, to get expertise in analyzing the random phenomenon through statistical averages data analysis.
2. Students will gain understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
3. Students to be acquire the basic knowledge to assess different sampling methods theoretical as well as practical knowledge and construct mathematical models by applying different sampling techniques to the data in real life situations.
4. Students will get exposure to a good estimator, depth knowledge of theoretical foundation of point estimation and Interval estimation and identify appropriate estimation techniques and statistical designs to perform correct statistical analysis in data</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Students will be able to acquire the basic knowledge to the concepts of random vectors, distributions, to get expertise in analysing the random phenomenon through statistical averages, statistical designs in data analysis of real world problems. (BL3)</td></tr>
<tr><td>2</td><td colspan="6">Students will be able to analyze the basic knowledge to the concepts of random vectors, probability distributions distributions, to get expertise in analysing the random phenomenon through statistical averages, statistical designs in data analysis of real world problems. (BL3)</td></tr>
<tr><td>3</td><td colspan="6">Students will be able to develop different sampling methods theoretical as well as practical knowledge and construct mathematical models by applying different sampling techniques to the data in real life situations. (BL4)</td></tr>
<tr><td>4</td><td colspan="6">Students understanding to the concepts of random vectors, distributions, to get expertise in analysing the random phenomenon through statistical averages, statistical designs in data analysis of real world problems. (BL4)</td></tr>
<tr><td>5</td><td colspan="6">Students understand different sampling methods theoretical as well as practical knowledge and construct mathematical models by applying different sampling techniques to the data in real life situations. (BL5)</td></tr>
<tr><td>6</td><td colspan="6">Students will be able to summarize and understood the estimation of the parameters and sampling distribution of an estimator by the random sampling procedures samples and test the hypothesis by the statistical tools and drawn the conclusions. (BL6)</td></tr>
</table>

SYLLABUS		
Unit I	**BI – VARIATE DATA ANALYSIS**	**8 hr**
Two Dimensional Random Vectors; Types-discrete and continuous of random variable; Joint Probability distribution; Marginal distributions ; Conditional distributions; cumulative distributions; Functions of random variables; transformation of random variables;		
Unit II	**STATISTICAL AVERAGES AND CONVERGENCE**	**8 hr**
Mathematical expectation bi- variable; conditional expectation; Co- Variance and properties; generating function- MGF and characteristic function; Uniqueness theorem; (without proof) along with applications; Basic Markov's and Chebyshev's inequalities; Law of large numbers.		
Unit III	**DISTRIBUTIONS IN DATA ANALYSIS**	**8 hr**
Discrete distributions: Bernoulli trails; Binomial process; Poison Process; Geometric distributions definitions, properties – moments, operating characteristics, additive properties.**Continuous distributions** - Uniform; Exponential; Gaussian distribution; standard normal distribution; symmetric curve and area property; applications, definitions, properties – moments, operating characteristics; additive properties.		
Unit IV	**STATISTICAL INFERENCE – SAMPLING, ESTIMATION AND TESTING**	**8 hr**
Methods of sampling-Simple random sampling**;** stratified and systematic Sampling; sampling error and sample size; Parameter estimation-Method of estimation – Likelihood function, Maximum likelihoods; properties of good estimator; Point estimation; interval estimation of parameters - mean and variance; Statistical hypothesis, types of error, level of significance, power of the test.		
Unit V	**STATISTICAL DESIGNS FOR DATA ANALYTICS**	**8 hr**
Principles of designs; analysis of variance and analysis of co-variance; Test for Normality; Test for equality of means; Test for equality of Variances; Bartlett test; Designs- complete randomized design; Randomized Block Design; classification and Comparison of their efficiencies.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	E Walpole, SL Mayeres & K May, Probability and Statistics for Engineers & Scientists, 3/e, Pearson Publishers	
2	K.Trivedi.Probability and Statistics with Reliability, Queuing,and ComputerScience Applications. Wiley sons.	
3	S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.	
REFERENCE BOOKS:		
1	S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.	
2	John Vince, Foundation Mathematics for Computer Science, Springer.	
3	Murugesan and Gurusamy, Probability, Statistics and Random Process, Anuradha Publicatons.	
ADDITIONAL REFERENCE MATERIAL		
1	MOOCS: https://www.edx.org/course/introduction-probability-science-mitx-6-041x-2	

2	E books: https://www.khanacademy.org
3	https://www.stat.ipb.ac.id/en/uploads/KS/S2%20-%20ADW/3%20Montgomery%20-%20Introduction%20to%20Time%20Series%20Analysis%20and%20Forecasting.pdf
ONLINE COURSES	
1	http:// nptel.ac.in/courses/ IIT-MADRAS/ Principles_of_Communication1/ Pdfs/ 1_5.pdf
2	https://www.edx.org/course/big-data-analytics-2
3	http://nptel.ac.in/courses/110106072/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X		X		
CO2	BL3		X		X	
CO3	BL3				X	X
CO4	BL4	X		X		
CO5	BL5		X			X
CO6	BL6		X		X	X

R23MSCST032 (DSC-E1)	CRYPTOGRAPHY AND INFORMATION SECURITY (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Networks Basics	**3**	**0**	**0**	**3**

Course Objective

To gain expertise in cryptography, network security, and cybersecurity, enabling students to analyze threats, apply encryption, and implement secure communication. They will learn symmetric & public-key encryption (DES, AES, RSA, D-H), authentication (PGP, S/MIME, SSL, IPsec, Kerberos), and intrusion detection. Skills include mitigating cyber-attacks (session hijacking, phishing, DDoS, malware), configuring firewalls, and securing digital transactions across email, e-commerce, and web applications.

Course Outcomes
Students should be able to

1	**Construct** network security models with mechanisms to counter threats like TCP hijacking, ARP spoofing, MITM, SQL injection, and phishing, while identifying vulnerabilities like buffer overflows to boost resilience.
2	**Evaluate** symmetric encryption using algorithms like DES, 3DES, AES, and RC4, along with techniques like cipher modes, cryptanalysis, and MACs. Assess effectiveness against attacks and explore real-world uses in securing communications.
3	**Develop** public key cryptography using RSA and Diffie-Hellman, analyze vulnerabilities like MITM in key exchange, and propose solutions with DSS, X.509, and Kerberos. Implement secure communication with PGP, S/MIME, and SET for email and e-commerce.
4	**Analyze** and implement secure communication using IPsec (AH, ESP), ISAKMP, and SSL. Configure web security, examine SSL connection phases, and integrate IPsec to ensure confidentiality, integrity, and authentication in digital transactions.
5	**Develop** intrusion detection and prevention strategies, covering intrusion techniques, audit logs, IDS types, and honeypots. Design password security, malware defenses, and firewall solutions to protect against unauthorized access and cyber threats.
6	**Construct** a comprehensive understanding of cryptography and security, enabling analysis of threats, design encryption-based defenses, and implementation of secure protocols. Develop expertise in symmetric and public-key cryptography (DES, AES, RSA), authentication (PGP, Kerberos, SSL, IPsec), and intrusion detection. Address threats like session hijacking, SQL injection, phishing, and DDoS, applying firewall security and risk mitigation for robust digital protection.

SYLLABUS

Unit I	**INTRODUCTION TO CRYPTOGRAPHY & SECURITY**	**8 hr**

Definitions of Threat, attack, security attacks; Security Services and Security mechanisms; A model for network security, Internet Standards; Buffer Overflow and Format String Vulnerabilities; TCP Session Hijacking; ARP Attacks; Man-in-the-Middle attacks; SQL injection, Phishing attacks;

Unit II	**SYMMETRIC CRYPTOGRAPHY**	**8 hr**
Symmetric Encryption Principles, Cryptography, Cryptanalysis**; T**ypes of Attacks on Encryption Messages, Feistel's Cipher Structure**;** Cipher Block Modes of Operation**;** DES; AES, RC4 Algorithm; Applications of Symmetric Cryptography and Hash Functions, Location of Encryption Devices; Key Distribution, Message Authentication, MAC, And HMAC; Secure Hash, SHA-1, MD5;		
Unit III	**PUBLIC KEY CRYPTOGRAPHY & EMAIL SECURITY AND E-COMMERCE SECURITY**	**8 hr**
Public Key Cryptography & Encryption Structure; RSA & Diffie-Hellman (D-H) Algorithms with Examples; Man-in-the-Middle Attack on D-H Key Exchange; Digital Signatures & DSS; Public Key Certificates & X.509 Authentication Service; Kerberos Authentication System (V4 & V5); PGP (Pretty Good Privacy) & S/MIME; Secured Electronic Transaction (SET) & Payment Process;		
Unit IV	**IPSEC AND WEB SECURITY**	**8 hr**
IP Sec Overview, IP Sec Architecture; AH and ESP formats; Combining Security Associations; ISAKMP; Web Security considerations; SSL architecture; Different protocols of SSL; Four phases of connection establishment;		
Unit V	**MISCELLANEOUS SECURITY ISSUES**	**8 hr**
Intrusion techniques Intrusion detection, IDS types; Audit records, Honey pots; Password protection, Password Selection Strategies; Malicious Programs, Types of viruses; worms, Trojan horses; DDOS attacks and countermeasures; Firewalls, Firewall Types, Characteristics, and Design Principles; Firewall Configuration, Advantages, and Limitations;		

LEARNING RESOURCES

TEXTBOOKS:	
1	William Stallings - *Network security Essentials, Applications, and standards,* 3e, Pearson Education
2	Ryan Russell, Dan Kandinsky, Rain Forest Pippy et. Al. Wiley Dreamtech.- *Hack Proofing your network*
REFERENCE BOOKS:	
1	William Stallings - *Cryptography and network security*, 3e, PHI/Pearson
ADDITIONAL REFERENCE MATERIAL	
1	https://www.geeksforgeeks.org/cryptography-and-network-security-principles/
2	https://www.tutorialspoint.com/cryptography/
ONLINE COURSES	
1	https://www.udemy.com/topic/cryptography/
2	https://www.coursera.org/courses?query=cryptography
3	https://www.scaler.com/topics/computer-network/cryptography-and-network-security/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL5		X			
CO3	BL3			X		
CO4	BL4				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23MSCST037 (DSC-E1)	INFORMATION SECURITY & MANAGEMENT STANDARDS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisites	-	**3**	**0**	**0**	**3**

Course Objective

To provide students with a comprehensive understanding of the principles, practices, and implementation strategies of information security management, risk management, contingency planning, security policies, and compliance with the PCI Data Security Standard, equipping them with the knowledge and skills necessary for effective information security governance and implementation in various organizational contexts.

Course Outcomes
Students should be able to

1	**Identify** security concepts, essential security principles, and management basics to compose and design comprehensive information security policies and procedures. **(BL3)**
2	**Evaluate** the ability to create and design effective contingency plans, combining knowledge of contingency planning basics and components, to minimize potential risks and respond efficiently to unforeseen events, thereby ensuring the continuity of critical business operations. **(BL5)**
3	**Develop** a comprehensive security program, combining roles, training, and models to maximize security within a holistic framework, addressing diverse cybersecurity challenges. **(BL3)**
4	**Evaluate** a comprehensive risk management framework, combining risk fundamentals with evaluation and implementation. This equips them to minimize risks effectively and maximize benefits in diverse contexts. **(BL5)**
5	**Develop** a thorough PCI DSS compliance strategy, covering fundamentals, testing methods, and document components for enhanced security and regulatory adherence. **(BL6)**
6	**Formulate** a comprehensive understanding of security fundamentals, policy development, risk management, and PCI DSS compliance, enabling them to design, develop, and implement effective security programs, policies, and risk mitigation strategies in diverse organizational contexts. **(BL6)**

SYLLABUS

Unit I	**FOUNDATIONS OF SECURITY & SECURITY PLANNING AND GOVERNANCE**	**8 hr**

What is security? CNSS Security Model, Key concepts of information security; Management in Information Security-Roles & Characteristics; Principles of information security management; Project management; Role of planning, Categories of Information Security Planning, Precursors to planning; Organizational Planning & sub categories; Planning for information security implementation, Introduction to the Security Systems Development Life Cycle; Information security governance;

Unit II	**CONTINGENCY PLANNING AND INFORMATION SECURITY POLICIES**	**8 hr**

Understanding Contingency Planning; Components of Contingency Planning; Roles

and Responsibilities in Contingency Planning; Implementation and Maintenance of Contingency Plans; Overview of Information Security Policies; Enterprise Information Security Policy (EISP); Issue-Specific Security Policy (ISSP); System-Specific Security Policy (SysSP);		
Unit III	**INFORMATION SECURITY MANAGEMENT: ROLES, RESPONSIBILITIES, FRAMEWORKS, MODELS, AND STANDARDS**	**8 hr**
Leadership Roles in Information Security; Operational Roles in Security Management; Specialized and Supportive Roles; Education and Awareness for Security; Security Frameworks and Blueprints; Access Control Models and Principles; Security Architecture Models; ISO 27000 Series and Its Applications;		
Unit IV	**RISK MANAGEMENT AND RISK EVALUATION IMPLEMENTATION**	**8 hr**
Introduction to Risk Management; Risk Identification; Threats-Vulnerabilities-Assets (TVA) Worksheet; Organizational Assets; Risk Assessment Components and Methods; Risk Control Strategies; Feasibility Analysis; Cost-Benefit Analysis;		
Unit V	**PCI DSS: COMPONENTS, STRATEGIES, AND IMPLEMENTATION**	**8 hr**
Introduction to PCI DSS, Scoping of PCI DSS; Components that Comprise Account Data, System Components in PCI DSS Compliance; Advantages of Segmenting or Isolating the Cardholder Data Environment (CDE); PCI DSS Sampling Considerations; Incorporating PCI DSS into Business-As-Usual (BAU); Testing Methods for PCI DSS Requirements; PCI DSS Compliance; Parts of a Typical PCI DSS Requirements Document: Purpose and Functions;		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Michael E. Whitman and Herbert J. Mattord - *Management of Information Security*, Fourth Edition, Cengage Learning.	
REFERENCE BOOKS:		
1	International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC). (2013). ISO/IEC 27001:2013 Information technology — Security techniques — Information security management systems — Requirements.	
2	International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC). (2013). ISO/IEC 27002:2013 Information technology — Security techniques — Code of practice for information security controls.	
3	National Institute of Standards and Technology (NIST). (n.d.). NIST Standard Publication 800-30r1.	
4	ISACA. (2021). CISA® Review Manual 27th Edition.	
5	Payment Card Industry Security Standards Council. (2020). PCI DSS v4.0 Self-Assessment Questionnaire A (SAQ A). [Online PDF] Available at: https://listings.pcisecuritystandards.org/documents/PCI-DSS-v4-0-SAQ-A.pdf.	
ONLINE COURSES		
1	https://www.isaca.org/credentialing/cism#1	
2	https://www.coursera.org/learn/cybersecurity-management-and-compliance	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL5		X			
CO3	BL3			X		
CO4	BL5				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23MBMCT005	ENTREPRENEURSHIP (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40 (L) + 2	**L**	**T**	**P**	**C**
	Prerequisite	NIL	**3**	**0**	**0**	**3**

Course Objective

The purpose of this course is to provide guidance for students aiming to launch ventures or innovate in business. It targets aspiring entrepreneurs, managers in family-owned businesses, and corporate teams developing new business units. Additionally, it offers insights into India's government policies, institutions, and resources supporting start-ups.

Course Outcomes

After completing this course, the students will be able to

1	Analyze the economic, societal, and personal ecosystems that influence entrepreneurial ventures and identify critical success factors for entrepreneurs. **(BL5)**
2	Evaluate innovative business ideas and assess their market feasibility, customer value, and alignment with entrepreneurial opportunities. **(BL5)**
3	Assess different sources of capital available to startups, including government initiatives, and choose appropriate financing methods for given business scenarios. **(BL5)**
4	Critically analyze marketing strategies, including the 4 Ps and consumer behavior, to develop a comprehensive product marketing plan that aligns with market realities. **(BL5)**
5	Evaluate the role of government policies, educational reforms, and support systems in fostering entrepreneurship and innovation in India. **(BL5)**
6	Design a comprehensive business model and strategic plan for a startup, incorporating elements of innovation, marketing, funding, and government policy compliance. **(BL6)**

SYLLABUS

Unit I	**THE SPIRIT OF ENTREPRENEURSHIP**	**8 hr**

Entrepreneurship Today & Terms; The Process of Entrepreneurship; The Economic Relevance of Entrepreneurship; Societal Entrepreneurial Ecosystem, Personal Entrepreneurial Ecosystem;

Critical Success Factors to be an Entrepreneur, Components of an Entrepreneurial Mindset; Possibility of Teaching an Entrepreneurial Mind; Invention, Innovation and Imitation, Entrepreneurs in the Innovation Process; The Entrepreneur and the Commercialization of Innovations.

Unit II	**BUILDING A NEW VENTURE**	**8 hr**

Generation of a New Business Idea, Pre-Field Assessment of the Business Idea; Turn the Innovative Idea into a Concept, Innovative Market Offering meets Customer; Customer Value, Seizing the Entrepreneurial Opportunity; Development of a Sales Process, Customer Understanding as a Critical Part of the Sales Process; Addressing the Business Initiatives of the Customer, Business Opportunity Analysis; Sales Strategy to Win the Contract, Monitoring the Execution; Value Proposition as Key Concept, Concept of the Business Model; Outcomes of the Business Model

Analysis, Reflection of the Business Model with Innovations.		
Unit III	**SOURCES OF CAPITAL FOR ENTERPRENEURS**	**8 hr**
Financing Staircase, Indian Start-up Funding; Investment Trends, Some Areas of Start-up Investor Interest; Types of Enterprises, Financing Options available for Start-ups in India; Personal Savings, Family and Friends, Angel Funding, Some Angel Networks in India; Debt Financing, Bootstrapping as a Source of Finance; Incubator Support, Atal Incubator Centers in India; Venture Capital firms, Private Equity Funding; Corporations as Investors; Start-up IPOs, Crowdfunding of Start-ups.		
Unit IV	**VENTURE MARKETING & IPR**	**8 hr**
Marketing Strategy, Marketed Entities; Diversity and Hierarchies of Needs, 4 Ps of Marketing in a Digital Era; Granularity of Sales, Product- Market Grid, The New Marketing Realities, Consumer Behaviour, Product Marketing Plan; Perception filter and Product purchasing decision; Building Brand Equity, Customer Relationship Management; Retailing Options, Packaging, wholesaling, Dealership, Market Segmentation; Patents, Copyrights, Trademarks, Securing a Patent: Basic Rules.		
Unit V	**GOVERNMENT POLICY FRAMEWORK**	**8 hr**
India's development pathway, India's Performance and potential; India as a Start-up Funding Destination; Start-up India, Indian Commercial Banks and Start-ups under StartupIndia; Microfinance Corporation Support for Startups; MUDRA Enterprise Legal Constitution; Some ongoing positive changes in the Indian educational system, The bodies that can support Startups in Higher Educational Institutes, Student Entrepreneurship; National Education System as a Transformer for Startups; National Innovation and Startup Policy 2019 for students.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Prof. Dr. Helmut Kohlert, Prof. Dr.-Ing. Dawud Fadai, Prof. Hans-Ulrich Sachs, *Entrepreneurship for Engineers*, 2nd Edition, Oldenbourg Wissenschaftsverlag GmbH, 2013.	
2	Donald F. Kuratko, *Entrepreneurship: Theory, Process, Practice*, 12th Edition, Cengage Learning, Inc., 2024.	
3	Steven Rogers, *Entrepreneurial Finance: Finance and Business Strategies for the Serious Entrepreneur*, 2nd Edition, The McGraw-Hill Companies, Inc., 2009.	
REFERENCE BOOKS:		
1	Donald F. Kuratko, *Entrepreneurship: Theory, Process, Practice*, 12th Edition, Cengage Learning, Inc., 2024.	
ADDITIONAL REFERENCE MATERIAL		
1	Zero to One: Notes on Startups, or How to Build the Future, by Peter Thiel with Blake Masters	
2	S. Jerrold Kaplan - Startup_ A Silicon Valley Adventure-Houghton Mifflin Harcourt (2014)	
3	https://nptel.ac.in/courses/110106141	
4	https://nptel.ac.in/courses/127105007	
ONLINE COURSES		
1	https://www.edx.org/learn/entrepreneurship/massachusetts-institute-	

	of-technology-becoming-an-entrepreneur
2	https://www.coursera.org/specializations/business-entrepreneurship

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL5		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6		X	X	X	X

<table>
<tr><td rowspan="3">R23MSCSL007</td><td colspan="6">ADVANCED JAVA PROGRAMMING LAB</td></tr>
<tr><td>Total Contact Hours</td><td colspan="2">42 (P)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td colspan="2">-</td><td>0</td><td>0</td><td>3</td><td>2</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">Students will have the ability to apply object-oriented programming concepts in Java to develop and implement modular and reusable software solutions.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Students will be able to apply object-oriented concepts, Java programming constructs, and control structures.</td></tr>
<tr><td>2</td><td colspan="6">Students will be able to analyze real-world problems and design efficient object-oriented solutions using Java features like encapsulation, inheritance, and polymorphism</td></tr>
<tr><td>3</td><td colspan="6">Students will be able to evaluate the design of Java programs utilizing packages, exception handling and Reflection API for scalability and reliability.</td></tr>
<tr><td>4</td><td colspan="6">Students will be able to create a fully functional desktop application integrating OOP concepts, collections, multithreading, and GUI frameworks.</td></tr>
<tr><td colspan="7">List of Experiments</td></tr>
<tr><td>1</td><td colspan="6">Week 1: Introduction to Java Basics and Class Fundamentals
1. Write a simple JAVA program that prints "Hello, World!" to the console.
2. i. Write a JAVA program to perform addition of two numbers using command line arguments.
ii. Write a JAVA program to perform addition of two numbers using Scanner Class.
3. Write a JAVA program to display default value of all primitive data types of JAVA.
4. Write a JAVA program that displays the roots of a quadratic equation $ax^2+bx+c=0$. Calculate the discriminant D and basing on the value of D, describe the nature of roots.
5. Write a JAVA program to illustrate increment/decrement and bitwise operators.</td></tr>
<tr><td>2</td><td colspan="6">Week 2: Control and Iteration Statements, Classes and Methods
1. Write a JAVA program to illustrate definition of class and creation of object with example.
2. Write a JAVA program to illustrate selection statements.
3. Write a JAVA program to illustrate looping statements.
4. Write a JAVA program to display the Fibonacci sequence.
5. Write a JAVA program to illustrate Methods Overloading.
6. Write a JAVA program to illustrate Parameter Passing Techniques (call by value and call by reference).
7. Write a JAVA program to illustrate default and parameterized Constructors.</td></tr>
</table>

3	**Week 3: Arrays and Strings** 1. Write a JAVA program to read and display array of integers using 1D and 2D. 2. Write a JAVA program to sort given list of numbers. 3. Write a JAVA program to search for an element using linear search. 4. Write a JAVA program to determine the addition of two matrices. Write a JAVA program to determine the multiplication of two matrices. 5. Write a JAVA program to illustrate passing Arrays as parameters to methods. 6. Write a JAVA program to check string palindrome property 7. Write a JAVA program to illustrate String handling methods (charAt(), compareTo(), equals(), indexOf(), join(), replace(), substring(), toUpperCase(), toLowerCase()).
4	**Week 4: Static Members, String Buffer and Inheritance** 1. Write a JAVA program to illustrate Static Variable, Static Method, and Static Block. 2. Write a JAVA program to sort an array of strings. 3. Write a JAVA program to illustrate five String Buffer handling methods. 4. Write a JAVA program to illustrate Inheritance, Member access, Types of Inheritance, Forms of inheritance 5. Write a JAVA program to illustrate the uses of Super key word. 6. Write a JAVA program to illustrate Methods overriding.
5	**Week 5: This and Final keyword and Files** 1. Write a JAVA program to illustrate This Key word and Final keyword. 2. Write a Java program to make frequency count of words in a given text. 3. Write a Java program that reads a file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes. 4. Write a Java program that reads a file and displays the file on the screen, with a line number before each line. 5. Write a Java program that displays the number of characters, lines and words in a text file. 6. Write a Java Program that reads a line of integers, and then displays each integer, and the sum of all the integers (Use StringTokenizer).
6	**Week – 6: User defined Packages, Abstract classes and**

	interfaces 1. Write a JAVA program to create package named p1 and import this package in other classes to get access of members of classes of p1package. 2. Write a JAVA program to create package named mypack and import it in circle class. 3. Write a JAVA program to illustrate Random class. 4. Write a JAVA program to give simple example for abstract class. 5. Write a JAVA program illustrating multiple inheritance using interfaces.
7	**Week 7: Generic Classes, Reflection API and Collections** 1. Write a JAVA program to illustrate Generic classes. 2. Write a JAVA program to illustrate Reflection API to retrieving the classes; 3. i. Write a JAVA program to illustrate Reflection of fields and Invoking Methods 4. Write a JAVA program to illustrate Reflection API to invoking Constructors and obtaining the parameters of a Constructor; 5. Write a JAVA program to demonstrate ArrayList.
8	**Week 8: Exception Handling, Multithreading and Synchronization** 1. i. Write a JAVA program for describing exception handling mechanism. ii. Write a JAVA program for creation of user defined exception. 2. Write a JAVA program to illustrate creation of thread using Runnable interface and extending Thread class. 3. Write a JAVA program that creates three threads. First thread displays "Good Morning" every one second, the second thread displays "Hello" every two seconds and the third thread displays "Welcome" every three seconds. 4. Write a JAVA program that correctly implements producer consumer problem using the concept of inter-thread communication.
9	**Week 9: Networking and AWT** 1. Write a JAVA program that implements a simple client/server application. The client sends data to a server. The server receives the data, uses it to produce a result, and then sends the result back to the client. The client displays the result on the console. For ex: The data sent from the client is the radius of a circle, and the result produced by the server is the area of the circle. (Use java.net) 2. Write a JAVA program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result.
10	**Week 10: Event handling**

	1. Write a JAVA program for handling keyboard events. 2. Write a JAVA program for handling Mouse events. 3. Write a JAVA program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an ArithmeticException. Display the exception in a message dialog box.
11	**Week 11: GUI Development** 1. Write a JAVA program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green. When a radio button is selected, the light is turned on, and only one light can be onat a time No light is on when the program starts. 2. Write a Java program that allows the user to draw lines, rectangles and ovals.
12	**Week 12: Swings** 1. Create a simple Swing application with JLabel, JTextField, and JButton. When the user clicks the button, display the text entered in the JTextField in a JLabel. 2. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas. Write a JAVA program to display the table using JTable component.
LEARNING RESOURCES	
TEXTBOOKS:	
1	Herbert Schildt, "Java The Complete Reference" 9th Edition, Oracle Press
2	Paul Deitel and Harvey Deitel, "Java How to Program", 11th Edition, Pearson.
REFERENCE BOOKS:	
1	Herbert Schildt, "Java: A Beginner's Guide", 9th Edition, McGraw Hill, 2022
2	Bruce Eckel, "Thinking in Java", 9th Edition, Mind View, 2022.
ADDITIONAL REFERENCE MATERIAL	
1	https://www.w3schools.com/java
2	https://docs.oracle.com/javase/tutorial/
3	https://www.geeksforgeeks.org/java/
4	https://www.javatpoint.com/java-tutorial
5	https://www.udemy.com/courses/search/?q=java
6	https://www.coursera.org/specializations/java-programming
7	https://www.freecodecamp.org/news/tag/java/
8	https://www.tutorialspoint.com/java/index.htm

R23MBMCL003	DIGITAL ENGINEERING LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Prerequisite	Product lifecycle management	**0**	**0**	**3**	**2**

Course Objective

This hands-on lab course is designed to equip learners with essential skills in **UI/UX design**. By focusing on **engineering design**, **product development processes**, and **product lifecycle management**, the course offers a comprehensive understanding of how to conceptualize, design, and iterate on real-world products. Learners will work through a series of practical experiments aimed at building functional products, such as a **travel booking app**, a **food delivery platform**, and a **learning management system**. The course provides a deep dive into wireframing, high-fidelity prototyping, responsive design, component creation, usability testing, accessibility, and design system management. Through these experiments, students will develop a strong grasp of both the technical and creative aspects of designing and developing products with a focus on user experience and efficiency

Course Outcomes

1	Demonstrate proficiency in using UI/UX tool to design wireframes, prototypes, and high-fidelity interactive designs, while creating responsive and adaptive layouts for seamless user experiences across various devices.
2	Apply a solid understanding of the product development lifecycle, from wireframing and user flow design to testing, prototyping, and iterative updates, to build scalable, usable products with a focus on accessibility, usability, and design consistency.
3	Develop and manage design systems using real-time collaboration tools, ensuring consistency and iterating designs

List of Experiments

Module 1: Engineering Design (Example for practice: Building a Travel Booking App, etc)	
1	Basic Wireframing for Core Pages
2	User Flow Design for Travel Booking
3	Typography and Color Systems Selection
4	UI Component Design for Travel Features
Module 2: Product Development Process (Example for practice: Building a Food Delivery App, etc)	
5	High-Fidelity Prototyping of Core Pages
6	Designing for Responsive Layouts
7	Usability Testing with Interactive Prototypes
8	Accessibility Design for Inclusive Experience
Module 3: Product Lifecycle Management (Example for practice: Building a Learning Management System)	
9	Creating a Comprehensive Design System
10	Animation and Micro-Interactions for User Engagement
11	Collaboration and Real-Time Design

12	Iteration and Lifecycle Maintenance through Data Insights
Additional experiments	
1	**Module 1 (Engineering Design):** Focuses on wireframing, user flows, and basic prototyping for a Task Management App.
2	**Module 2 (Product Development Process):** Enhances the fitness tracker app with high-fidelity design, responsive design, and user feedback.
3	**Module 3: Product Lifecycle Management (Product: SaaS Dashboard):** full lifecycle of a SaaS dashboard, from creation to maintenance, ensuring scalability, accessibility, and long-term usability.
Demonstration experiments	
1	**Module 1: Engineering Design (Product: E-Commerce Website)**
2	**Module 2: Product Development Process (Product: Mobile Banking App)**
3	**Module 3: (Product Lifecycle Management)** Finalizes an e-commerce shopping cart with a design system, animations, and real-time collaboration for long-term product management.
LEARNING RESOURCES	
ONLINE:	
1	UDEMY COURSE titled 'Learn Figma - UI/UX Design Essential Training'
2	COURSERA course titled 'Google UX Design Professional Certificate'
REFERENCE BOOKS:	
1	Dieter, George. E. and Schmidt, Linda. C., "Engineering Design", 4th Edition, McGraw-Hill, 2009
2	Grieves, Michael, "Product Lifecycle Management", McGraw-Hill, 2006
ADDITIONAL REFERENCE MATERIAL	
1	UX for Dummies, by Donald Chesnut (Author), Kevin P. Nichols (Author), Wiley publications, ISBN-10: 9788126552252
2	More reference books available at: 'https://www.untitledui.com/blog/ui-design-books'

R23MMAT007	QUANTITATIVE PROBLEM SOLVING TECHNIQUES (Common to All branches of Engineering)					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**2**	**0**	**0**	**2**

Course Objective

The course aims to equip the students with standard concepts and techniques of arithmetic and logical thinking to handle various real-world problems and their applications.

Course Outcomes: After completing this course, the students will be able to

1	Enhance the aptitude and reasoning round clearing ability.
2	Solve real-time problems for performing job functions easily.
3	Improve individual decision–making abilities, how to think critically, and logically and analyze information as corporate company-based decisions.
4	Acquire satisfactory competency in the use of VERBAL REASONING as well as LOGICAL REASONING.
5	Develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others.

SYLLABUS

Unit I	**ARITHMETIC ABILITY**	**5 hr**
Number System and LCM & HCF; Ratio & Proportion; Percentages; Profit & Loss; Mixture and Allegation.		
Unit II	**ALGEBRAIC ANALYSIS**	**5 hr**
Quadratic & Linear eq's; Inequalities; Speed, Time and Distance; Time and Work; Simple Interest & Compound Interest.		
Unit III	**ADVANCED MATHS**	**5 hr**
Circles, lines, angles & Co-ordinate geometry; Triangles, quadrilaterals & polygons; Areas & perimeter-2D; Surface area & volumes-3D; Trigonometry.		
Unit IV	**MODERN MATHS**	**5 hr**
Probability; Permutation and Combination; Surds, indices& set theory; Functions; Logarithms.		
Unit V	**DATA INTERPRETATION & ELEMENTARY STATISTICS**	**5 hr**
Tables, charts & pie-diagrams; Venn diagrams; Data sufficiency; Mean, median & mode; Standard deviation ,variance& Case studies.		

LEARNING RESOURCES

TEXTBOOKS:

1	Arihant Publications - Rajesh Verma, Fast Track Objective Arithmetic (Revised Edition)
2	MC GRAW HILL Education- ABHIJIT GUHA, Quantitative Aptitude (6th Edition)
3	ARIHANT Publications - B.S. SIJWALI & INDU SIJWALI, Verbal, Non-Verbal & Analytical Reasoning
4	ARIHANT SERIES - JAI KISHAN & PREM KISHAN, Verbal, Non-Verbal & Analytical Reasoning
5	R. S. Aggarwal - S. Chand Publications, Quantitative Aptitude For Competitive Examinations

REFERENCE BOOKS:	
1	A Sure Shot Guide To Crack Ssb: Yes, You Have It In You(Maj Gen Vps Bhakuni (Author), Vsm (Author), Kavita Modi (Author)) https://amzn.in/d/9QFY0oF
2	Excel in Quantitative Aptitude: Chapter-wise Maths 10 Years Previous Solved Papers (PYQ) of SSC CGL, IBPS PO & Clerk, SBI PO, & RRB NTPC Tier I & II | Mathematics for SSC, Banking, Railways Exams 2024 (Arun Sharma (Author)) https://amzn.in/d/3OTZ5uI
3	Ace Reasoning Ability for Banking and Insurance Book 2024 (Third English Edition) (Adda247 Publications (Author) https://amzn.in/d/4aMMHvq
4	Ultimate Guide to SSC CGL - Combined Graduate Level - Tier I & Tier II Exam with Previous Year Questions & 5 Online Practice Sets 9th Edition | Combined Graduate Level Prelims & Mains| PYQs https://amzn.in/d/9IEwmYc (Disha Experts (Author))
5	Excel in Quantitative Aptitude: Chapter-wise Maths 10 Years Previous Solved Papers (PYQ) of SSC CGL, IBPS PO & Clerk, SBI PO, & RRB NTPC Tier I & II | Mathematics for SSC, Banking, Railways Exams 2024 (Arun Sharma (Author)) https://amzn.in/d/3OTZ5uI
6	Quantitative Aptitude for CAT 2025 | 11th Edition (Latest) | Quant | CAT Preparation Exam Book with Solved Previous Years Papers (PYQ) | McGraw Hill edge Access: Mock Tests, Expert Sessions & Strategies (Arun Sharma (Author)) https://amzn.in/d/9OQMQBX
7	Ace Reasoning Ability for Banking and Insurance Book 2024 (Third English Edition) (Adda247 Publications (Author)) https://amzn.in/d/4aMMHvq

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VI SEMESTER

<table>
<tr><td rowspan="3">R23MSCST015</td><td colspan="6">WEB TECHNOLOGIES
(CSE,IT,CSIT,AIML,DS,ICB)</td></tr>
<tr><td>Total Contact Hours</td><td>42 (L)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td>Object-Oriented Programming (OOP) using Java, Database Management Systems</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="7">Course Objective</td></tr>
<tr><td colspan="7">Students will get exposure to basic web designing features like HTML5, CSS and validate the data using scripts get adequate idea about web development and deployment using servlet ,JSP JDBC.</td></tr>
<tr><td colspan="7">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="6">Students will be able to analyze requirements and design effective web pages using HTML and CSS. (BL4)</td></tr>
<tr><td>2</td><td colspan="6">Students will be able to design dynamic web pages and validate them using scripts, interpret the structure and applications of XML, and compare features such as DTD and XML Schema. (BL4)</td></tr>
<tr><td>3</td><td colspan="6">Students will be able to interpret the applications of JavaBeans and analyze web application development using Servlets. (BL4)</td></tr>
<tr><td>4</td><td colspan="6">Students will be able to compare JSP and Servlets, and evaluate their usage by compiling and deploying them for effective web application development. (BL5)</td></tr>
<tr><td>5</td><td colspan="6">Students will be able to develop complete web applications and integrate them with a database using JDBC for efficient data management. (BL5)</td></tr>
<tr><td>6</td><td colspan="6">Students will be able to design and develop fast, rich, and robust web applications by creatively integrating web development technologies such as HTML, CSS, JavaScript, JavaBeans, Servlets, and JSP. (BL6)</td></tr>
<tr><td colspan="7">SYLLABUS</td></tr>
<tr><td colspan="2">Unit I</td><td colspan="4">INTRODUCTION TO WEB TECHNOLOGIES, HTML & CSS</td><td>8 hr</td></tr>
<tr><td colspan="7">Basics of Internet, WWW, web servers, HTTP; HTML Common tags; List, Tables; Images, HTML5 Blogging Tags; Forms- HTML 5 supported input fields; Cascading Style sheets, Types of CSS, CSS Selectors; CSS properties (background, text, image, font); CSS properties (lists, div, border);</td></tr>
<tr><td colspan="2">Unit II</td><td colspan="4">JAVASCRIPT & XML</td><td>8 hr</td></tr>
<tr><td colspan="7">Introduction to Scripting. JavaScript- Language Basics; Control Structures, functions; Arrays, Strings, Methods on strings and Arrays; form Validations using JS; Object in JS (window, navigator) , HTML DOM ;Introduction to XML& Purpose, Naming Rules, Well-formed ness; Validations DTD, XML Schema Features Benefits PART-1(Elements, Attributes) ; XML Schema PART-2(Indicators), XSLT, XML Parsers;</td></tr>
<tr><td colspan="2">Unit III</td><td colspan="4">JAVABEANS, WEBSERVERS & SERVLETS</td><td>8 hr</td></tr>
<tr><td colspan="7">Introduction to JavaBeans, Bean Features, and advantages ; Introspection using Bean Info interface, Bean Properties, Persistence ; Bean Deployment Using</td></tr>
</table>

Netbeans, API, Fact Bean; Color Bean, Rect Bean, Rect Bean with Get, Set methods ; Color Bean Example with oval and rectangle shape and mouse events, Customization; Tomcat web server , The Servlet API, The javax.servlet Package; Generic Servlet, Reading request parameters, reading Initialization and context parameters ; The Handling Http Request & Responses using request dispatch and sendRedirect(), Session Tracking , Cookies;		
Unit IV	**SERVER-SIDE SCRIPTING JSP**	**8 hr**
Problems with Servlets, Advantages of JSP, life cycle of JSP; Anatomy of JSP, JSP Processing; Language Basics Control Structures Directives, Scriptlets; JSP implicit Objects; Form Processing using JSP, errors and Exception handling using isErrorPage; MVC using JSP and servlet;		
Unit V	**JAVA DATABASE CONNECTIVITY**	**8 hr**
JDBC Drivers, Studying Java.sql; Javax.sql.* package ; Database Programming using JDBC; Resultset and Resultset metadata; accessing database using JDBC Prepared Statements; Accessing a Database into a JSP Page(CRUD) ; Accessing Database objects by Bean ; JNDI, Connection Pooling;		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Web Technologies Black Book Kogent Publications.	
2	WebTechnolgies Uttham K Roy.	
3	Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech.	
ADDITIONAL REFERENCE MATERIAL		
1	https://www.geeksforgeeks.org/web-technology/	
2	https://www.geeksforgeeks.org/javascript/?ref=shm	
3	https://www.tutorialspoint.com/html/index.htm	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL4		X			
CO3	BL4			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST016	OOAD & DESIGN PATTERNS (Common to all Branches)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Object Oriented Programming	**3**	**0**	**0**	**3**

Course Objectives

1. Understand the importance and basic concepts of object oriented modeling,
2. Specify, analyze and design the requirements for a system and model the state of the set of objects and their implementation specifications.
3. Identify, Analyze the subsystems, various components and collaborate them interchangeably.
4. Describe the design patterns that are common in software applications
5. Design a module structure to solve a problem, and evaluate alternatives

Course Outcomes

On the successful completion of this course, Students will be able to

1	Examine the Object Oriented Models required for Software development through use case driven approach (**BL4**)
2	Categorize and model the structural and behavioural concepts of the software system. (**BL4**)
3	Develop and explore the transformation of conceptual models into various scenarios and real time applications. (**BL4**)
4	Construct a design consisting of a collection of modules using creational and structural design patterns.(**BL5**)
5	Identify appropriate behavioral patterns to demonstrate the dynamic aspects of a given software model during execution.(**BL5**)
6	Design a Small-Scale Application with Unified Models and Integrated Design Patterns.(**BL6**)

SYLLABUS

Unit I	**INTRODUCTION TO UNIFIED MODELING LANGUAGE**	**8 hr**

Introduction to UML, Importance of Modeling; Principles of Modeling; Object oriented modeling; Conceptual model of UML: Basic building blocks; Conceptual model of UML: Rules; Conceptual model of UML: Common Mechanisms; Architecture; Software Development life cycle

Unit II	**STRUCTURAL MODELING**	**8 hr**

Basic Structural Modeling: Classes ; Relationships; Common Mechanisms; Diagrams; Advanced Structural Modeling: Advanced classes; Advanced Relationships; Interfaces, Types and Roles**;** Packages & Instances**;**

Unit III	**ARCHITECTURAL MODELING & UML 2.0**	**8 hr**

Usecase Diagrams**;** Interactions : Sequence & Collaboration Diagrams**;** Activity Diagrams**;** State Diagrams; Component Diagrams; Deployment Diagrams; Updations in UML 2.0: Interaction overview diagram and Timing diagrams; Unified Process Models in Software Engineering;

Unit IV	**DESIGN PATTERNS-1**	**8 hr**

Introduction to Design patterns; Creational Design Patterns : Factory Method & Abstract Factory; Builder; Prototype; Singleton; Case study on Creational Design Patterns ; Structural Patterns: Adapter ; Bridge;

Unit V	DESIGN PATTERNS-2	8 hr
Composite; FlyWeight; Case study on Structural Patterns; Behavioral Patterns: Chain of Responsibility; Iterator; Memento ; Observer ; Case study on Behavioral Patterns		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modeling Language User Guide, Pearson Education.	
2	Design Patterns By Erich Gamma, Pearson Education.	
3	Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: UML 2 Toolkit, WILEY-Dreamtech India Pvt. Ltd.	
REFERENCE BOOKS:		
1	https://www.ibm.com/developerworks/rational/library/769.html	
2	https://www.visual-paradigm.com/tutorials/uml-class-diagram-in-diff-programming-languages.jsp	
3	https://www.uml-diagrams.org/index-examples.html	
4	https://www.tutorialspoint.com/design_pattern/	
5	http://www.oodesign.com/	
6	https://praveenthomasln.wordpress.com/2012/03/03/interfaces-types-and-roles-s8-cs/	
7	https://www.uml-diagrams.org/uml-25-diagrams.html	
8	https://www.tutorialspoint.com/uml/uml_2_overview.htm#:~:text=UML%202.0%20offers%20four%20interaction,of%20interactions%20as%20interaction%20occurrences.	
ONLINE COURSES		
1	NPTEL :: Computer Science and Engineering - NOC:Object-Oriented Analysis and Design	
2	https://onlinecourses.nptel.ac.in/noc22_cs99/preview	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL4		X			
CO3	BL4			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST017	MICROPROCESSORS AND INTERFACING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Digital Logic Design	**3**	**0**	**0**	**3**

Course Objective

To develop a comprehensive understanding of 8086 microprocessor and 8051 microcontroller systems, enabling students to design, program, and interface hardware effectively to address complex hardware and software challenges.

Course Outcomes

1	Students will be able to analyze the architecture, pin configurations, and timing diagrams of the 8086 microprocessors. **(BL4)**
2	Students will be able to apply the addressing modes and instruction set of the 8086 microprocessors to develop and debug 8086 assembly language programs. **(BL3)**
3	Students will be able to make use of interrupt facility, Assembler directives in developing effective assembly language programs. **(BL6)**
4	Students will be able to analyze the functionality of basic peripherals and illustrate their interfacing with the 8086 microprocessors. **(BL4)**
5	Students will be able to analyze the architecture, features, and applications of the 8051 microcontrollers. **(BL4)**
6	Students will be able to design and implement microprocessor and microcontroller-based systems integrating 8086 and 8051 features to address complex hardware and software challenges. **(BL6)**

SYLLABUS

Unit I	**MICROPROCESSOR: 8086- ARCHITECTURE, PIN DIAGRAMS AND TIMING DIAGRAMS**	**8 hr**

Features of 8086, Architecture of 8086; Register Organization; Memory segmentation; 8086 Signal description (Pin diagram); General 8086 bus operation and timing diagram; Minimum mode 8086 system and timings; Maximum mode 8086 system and timings; Physical memory organization, I/O addressing capability.

Unit II	**8086 INSTRUCTION SET**	**8 hr**

Addressing Modes of 8086; Instruction set, data transfer instructions part-1(MOV, PUSH, PUSHF, POP, POPF, XCHG); Data transfer instructions part-2 (IN, OUT, XLAT, LEA, LDS/LES, LAHF, SAHF); Logical instructions, Shift and rotate instructions; Arithmetic instructions part-1 (ADD, DAA, ADC, AAA, SUB, SBB, AAS, NEG, CMP); Arithmetic instructions part-2 (DAS, INC, DEC, MUL, IMUL, AAM, DIV, IDIV, AAD, CBW, CWD); Processor Control & String Manipulation instructions, Flag Manipulation Processor; Unconditional and Conditional Branch Instructions, Sample Programs.

Unit III	**SPECIAL ARCHITECTURAL FEATURES AND RELATED PROGRAMMING**	**8 hr**

Assembler Directives; Programming with an assembler (Assembling, linking, debugging process); Procedures, Macros; Data conversions: Binary to ASCII; ASCII to Binary & Read Hexadecimal data, Display hexadecimal data; Timing and Delay, Lookup tables for data conversion; Interrupts and Interrupt Service Routine, Interrupt Cycle of 8086; Interrupt Types (Maskable, Non-Maskable), Structure of Interrupt Vector Table of 8086; DOS BIOS Operations.		
Unit IV	**BASIC PERIPHERALS AND THEIR INTERFACING WITH 8086**	**8 hr**
Static RAM Interfacing; 8255 PPI Architecture; 8255 Pin Configuration; Modes of operations of 8255; DMA Controller 8257; Signal Descriptions of 8257; USART 8251 Architecture; USART 8251 Signal Description.		
Unit V	**AN INTRODUCTION TO 8051 MICROCONTROLLE**	**8 hr**
Introduction to microcontroller (Differences, features, Applications, Types, Advantages and Disadvantages); Architecture of 8051; Signal Descriptions of 8051; Register set of 8051; Timers and Counters of 8051; Important Operational Features (TCON register, TMOD, SCON); Operational Modes of 8051 Serial Port; Interrupts of 8051.		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Advanced Microprocessors and Peripherals 2nd edition by A K Ray, K.M Bhurchandi	
2	The 8086 Microprocessor Programming & Interfacing the PC 3rd edition by Kenneth J Ayala	
3	The 8051 Microcontroller and Embedded Systems 2nd edition by Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay.	
REFERENCE BOOKS:		
1	Microprocessors and Interfacing by A.P. Godse	
2	Microprocessors and Interfacing 3rd edition by Douglas V Hall.	
3	The 8088 and 8086 microprocessors 4th edition by Walter A.Triebel, Avtar Singh	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL3		X			
CO3	BL6			X		
CO4	BL4				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23MBMCT006	BUSINESS ANALYSIS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40 (L) + 2 (Introduction) + 6 (Case Discussion)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**0**	**0**	**3**

Course Objective

This course is aimed at helping students:

- To understand the need for business analysis and the challenges faced
- To understand the key concepts in Business Analysis and their applications
- To understand the major techniques that are adopted in the field of Business Analysis

Course Outcomes

At the end of the course, the student will be able to

1	Assess the scenario of a business establishment and evaluate the competencies required to handle it **(BL5)**
2	Plan the requirements for a business in terms of approach, stakeholder engagement and governance **(BL5)**
3	Evaluate the strategy, requirements and performance of a business scenario **(BL5)**
4	Evaluate a business scenario and define the scope of the project **(BL5)**
5	Develop a detailed business analysis plan adopting the techniques involved **(BL6)**

SYLLABUS

UNIT I	**INTRODUCTION**	**8 hr**

Business Analysis and Scope; Key Concepts and Competencies; Role of Techniques and Perspectives; The Agile Perspective; The Business Intelligence Perspective; The Information Technology Perspective; The Business Architecture Perspective; The Business Process Management Perspective.

UNIT II	**BUSINESS ANALYSIS: PLANNING, COLLABORATION AND LIFE CYCLE MANAGEMENT**	**8 hr**

Planning Business Analysis Approach; Planning Stakeholder Engagement; Planning Business Analysis Governance; Information Management and Performance Improvement; Elicitation in Business Analysis; Collaboration in Business Analysis; Tracing and Prioritising Requirements; Assess and Approve Requirement Changes.

UNIT III	**STRATEGY AND REQUIREMENTS ANALYSIS, DESIGN DEFINITION AND SOLUTION EVALUATION**	**8 hr**

Analyse Current State; Define Future State; Assess Risks; Define Change Strategy; Specify, Verify and Validate Requirements; Design Definition; Measure Solution Performance; Assess and Recommends Actions to Increase Solution Value.

UNIT IV	**BUSINESS ANALYSIS COMPETENCIES AND TECHNIQUES - I**	**8 hr**

Analytical Thinking and Problem Solving; Behavioral Characteristics; Business Knowledge; Communication Skills, Interaction Skills, Tools and Technology; Technique Set: Understand 1 (Brainstorming, Collaborative Games, Concept Modelling, Data Flow Diagrams); Technique Set: Understand 2 (Data Modelling, Focus Groups, Interviews, Observation); Technique Set: Understand 3

(Prioritization, Process Modelling, Scope Modelling, Sequence Diagrams); Technique Set: Understand 4 (State Modelling, Survey or Questionnaire, SWOT Analysis, Use Cases and Scenarios).		
UNIT V	**BUSINESS ANALYSIS COMPETENCIES AND TECHNIQUES - II**	**8 hr**
Technique Set: Define 1 (Acceptance and Evaluation Criteria, Business Capability Analysis, Business Cases, Business Model Canvas); Technique Set: Define 2 (Business Rules Analysis, Decision Analysis, Glossary, Mind mapping); Technique Set: Define 3 (Non-functional Requirements Analysis, Organizational Modelling, Roles and Permissions Matrix, User Stories); Technique Set: Manage (Backlog Management, Balanced Scorecard, Functional Decomposition, Item Tracking, Workshops); Technique Set: Analyze 1 (Benchmarking and Market Analysis, Data Mining, Decision Modelling, Document Analysis); Technique Set: Analyze 2 (Estimation, Financial Analysis, Interface Analysis, Process Analysis); Technique Set: Analyze 3 (Risk Analysis and Management, Root Cause Analysis, Stakeholder List, Map or Personas, Vendor Assessment); Technique Set: Validate (Data Dictionary, Lessons Learned, Metrics and Key Performance Indicators (KPIs), Prototyping, Reviews)		
LEARNING RESOURCES		
TEXT BOOKS:		
1	*BABOK: A Guide to the Business Analysis Body of Knowledge*, Version 3, International Institute of Business Analysis, 2015.	
REFERENCE BOOKS:		
1	Debra Paul, James Cadle, and Donald Yeates, *Business Analysis*, 3rd Edition, BCS, The Chartered Institute for IT, 2014.	
2	James Cadle, Debra Paul, and Paul Turner, *Business Analysis Techniques: 99 Essential Tools for Success*, 3rd Edition, BCS, The Chartered Institute for IT, 2014.	
3	Business Analysis: Solving Business Problems by Visualizing Effective Processes and IT Solutions" by Pradeep Hari Pendse	
4	Dr. N. Sasikala Devi, *Business Analysis: Concepts and Practice*, 2nd Edition, Prentice Hall India Learning Private Limited, 2015.	

Bloom's level - Units Catchment Articulation Matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL5		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL6		X	X	X	X

R23MSCST020 (DSC-E2)	STATISTICAL AND PREDICTIVE ANALYTICS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42(L)	**L**	**T**	**P**	**C**
	Pre-requisite	Probability & Statistics, Linear Algebra, Calculus, Python programming	**3**	**0**	**0**	**3**

Course Objective

1. Students will get exposure to basic knowledge, understand and analyze the components of data with different structures and to perform predictive analysis.
2. Students will understand data to learn and construct, design skills and knowledge in communicating statistical techniques for mathematical and computer models for data and to perform analysis of any phenomenon.
3. Students will get exposure to acquire the basic required knowledge to smooth the data and apply various smoothing methods for data analysis and acquire construct predictive methods to analyze, forecast with different scientific methods and be trained to get Cutting edge of knowledge in data analysis and applications.

Course Outcomes

1	Students will be able to acquire basic knowledge of the data with different structures and perform correlation analysis for random components. **(BL3)**
2	Students will be able to apply and construct, design skills and knowledge in communicating statistical techniques Regression and computer models for conducting analysis of any phenomenon in scientific data analysis. **(BL4)**
3	Students will be able to develop the knowledge to smooth the data and apply various smoothing methods for data analysis. **(BL4)**
4	Students will be able to analyze of the components of time series with different structures and to perform trend or predictive analysis with testing. **(BL5)**
5	Students will be able to develop and construct, design skills and knowledge in communicating statistical techniques for mathematical and computer models for conducting analysis of any phenomenon in scientific data analysis. **(BL5)**
6	To be able to understand and interpret the results to data and various forecasting methods for data in real world problems. **(BL6)**

SYLLABUS

Unit I	**EXPLORATORY DATA ANALYSIS (EDA)**	**8 hr**

Data collection strategies, Elements of Structured; data cleaning, data integration and transformation; data classification, Clustering, outliers; Frequency tables and Histograms, frequency curves; Measures of central tendency; Measures of Variability; measures of symmetry and Coefficient of variation; Normalization and Z- Score;

Unit II	**CORRELATION ANALYTICS**	**8 hr**

Introduction to correlation, correlation for Variables; auto-correlation; Bi-variate data, Scatter plot; covariance and properties; correlation coefficient, limits of

correlation coefficient; rank correlation; coefficient of determination R^2; Multiple correlation and partial correlation;		
Unit III	**STATISTICAL DISTRIBUTIONS**	**8 hr**
Introduction to random variables, types; discrete distributions–recurrence relations and expected frequencies: uniform; Binomial; Poisson; Continuous distributions - rectangular; Exponential; Gaussian distribution; standard normal distribution related properties;		
Unit IV	**DATA SAMPLING AND HYPOTHESIS TESTING**	**8 hr**
Data sampling, Simple Random sampling, cluster Sampling; Sampling error, Bootstrapping, max. error; sampling distributions, central limit theorem; confidence intervals; Hypothesis – Simple and composite, A/B testing; types of error, p-value, one tailed, two tailed; F-statistic: One way ANOVA; two way ANOVA;		
Unit V	**STATISTICAL REGRESSION AND PREDICTION**	**8 hr**
Introduction to regression, simple linear regression; regression coefficients and properties; multiple regression; Prediction of new Observations - Model Adequacy Checking; Decision Tree based methods for classification; Naive Bayes; Logistic Regression; t- testing of correlation coefficient, regression coefficient;		

LEARNING RESOURCES

TEXTBOOKS:

1	S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.
2	Peter Bruce and Andrew Bruce "Practical Statistics for Data Scientists" – 50 Essential Concepts. Published by O'Reilly Media, Inc.,1005 Gravenstein Highway North, Sebastopol, CA 95472.
3	Montgomery, D.C. and Johnson, L.A. (1977): Forecasting and Time Series Analysis, McGraw Hill
4	Fundamentals of applied Statistics: VK Kapoor, SP Gupta; S Chand Publishers
5	Fuller, W.A. (1976): Introduction to Statistical Time Series, John Wiley
6	Mark Gardener (2012), Beginning R - The Statistical Programming Language, Wiley India Pvt Ltd.

REFERENCE BOOKS:

1	Anderson, T.W. (1971): The Statistical Analysis of Time Series, Wiley, New York.
2	Anany Levetin - *Introduction to The Design and Analysis of Algorithms*, 3rd Edition, Pearson Education.
3	K.Trivedi.ProbabilityandStatisticswithReliability, Queuing,and ComputerScience Applications. Wiley sons.
4	Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis –Forecasting and Control. Holden Day, San Francisco.
5	Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).

ADDITIONAL REFERENCE MATERIAL

1	Chris Eaton, Dirk Deroos, Tom Deutsch et al., "Understanding Big Data",

	McGrawHIll, 2012. 2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.
2	https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling- maxkuhn-kjell-johnson_1518.pdf
3	https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodolo gy
4	https://ru.b-ok2.org/terms/?q=forecasting
5	https://otexts.com/fpp2/
6	http://home.iitj.ac.in/~parmod/document/introduction%20time%20series.pdf
ONLINE COURSES	
1	https://www.coursera.org/learn/predictive-modeling-analytics
2	https://www.edx.org/course/predictive-analytics
3	https://www.udemy.com/course/machinelearningandlogisticregression/
4	https://www.coursera.org/learn/practical-time-series-analysis
5	https://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/downloadcourse- materials/
6	https://swayam.gov.in/nd1_noc19_mg46/preview

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X		X		
CO2	BL4		X		X	X
CO3	BL4			X	X	
CO4	BL5		X			X
CO5	BL5	X		X	X	
CO6	BL6	X	X	X	X	X

R23MSCST024 (DSC-E2)	DATA ANALYTICS AND TOOLS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Database, Operating Systems	**3**	**0**	**0**	**3**

Course Objective

This course aims to provide students with a comprehensive understanding of Big Data concepts, frameworks and tools. It focuses on the principles of handling, processing, and analyzing large-scale datasets using modern technologies. By exploring tools such as Hadoop, NoSQL databases, Spark for handling data streams learners will be able to derive actionable insights from Big Data.

Course Outcomes

After completing this course, the students will be able to

1	Apply the concepts of Big Data to identify and solve real-world data processing problems. **(BL3)**
2	Can interpret and summarize unstructured data with No SQL. **(BL3)**
3	Analyze Hadoop and Map Reduce framework associated with big data in a distributed environment. **(BL4)**
4	Process and Analyze large datasets with PIG and retrieve from a data warehouse using Hive. **(BL4)**
5	Handle streaming data from various sources using spark and transformations on RDD for efficient storage. **(BL4)**
6	Fully appreciate big data handling techniques using the latest open source tools for data analytics. **(BL6)**

SYLLABUS

Unit I	**BIG DATA AND REAL TIME APPLICATIONS**	**8 hr**

What is Big Data, Convergence of Key trends; Variety of Data, Unstructured Data; Industry examples of Big Data; Big Data and Marketing; Fraud and Big Data, Risk and Big Data; Credit risk management, Big Data and Algorithmic trading; Big Data and healthcare & medicine; Cloud and Big Data. **(BL2)**

Unit II	**NO SQL - UNSTRUCTURED DATABASES**	**8 hr**

Introduction to No SQL; Aggregate data models & relationships; Key-value and Document data models; Graph Databases and Schema less Databases; Distribution models; Sharding & Replication; CAP theorem; Version stamps

Unit III	**HADOOP DISTRIBUTED FILE SYSTEM**	**8 hr**

Introduction to Hadoop, Open Source Technologies; Data storage and Analysis; Comparison with Other Systems; Architecture of Hardtop distributed file system (HDFS); HDFS Concepts; Map Reduce Architecture; Case study of Weather Dataset; JAVA Interface & Data Flow

Unit IV	**PIG and HIVE**	**8 hr**

Big Data Applications Using PIG; Anatomy of PIG; Data processing operations in PIG; Tuple, Maps and UDFs; Big Data Applications using Hive; Hive Architecture; Hive QL – DDL, DML; Tables, Partitioning & Bucketing

Unit V	**SPARK STREAMING**	**8 hr**

Apache Spark- Advantages over Hadoop, Spark Features; DAG; Spark Context & Spark Session; RDD, Transformations & Actions; Working with Timestamps, Nulls,

Complex Types; Spark Functions; Spark Streaming; Sliding & Tumbling Windows	
LEARNING RESOURCES	
TEXTBOOKS:	
1	Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj
2	SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018Edition
3	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
4	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012
REFERENCE BOOKS:	
1	"Hadoop Operations", O'Reilley, Eric Sammer, 2012
2	"Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3	"Programming Pig", O'Reilley, Alan Gates, 2011
4	Big Data And Analytics, Seema Acharya, Subhashini Chellappan, Wiley

R23MSCST019 (DSC-E2)	DATA WAREHOUSING AND DATA MINING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisites	Basic Mathematics, Database Management Systems	**3**	**0**	**0**	**3**

Course Objective

Students will gain knowledge on the concepts of data warehousing and data mining, which gives a complete description about the principles, architectures, applications, design, and implementation.

Course Outcomes

1	Students will be able to recognize the significance of data mining and choose appropriate data mining functionalities for extracting knowledge from real-world data. **(BL3)**
2	Students will be able to classify various types of data and apply data preprocessing techniques to prepare it for further analysis. **(BL3)**
3	Students will be able to develop models, select appropriate data cube computation operations and methods for building a data warehouse, and assess association rules to uncover relationships within the data. **(BL5)**
4	Students will be able to construct models to classify data objects, identify class labels, and evaluate classifier accuracies. **(BL5)**
5	Students will be able to generate clusters by optimizing proximity measures between data attributes and critically evaluate the clustering process. **(BL5)**
6	Students will be able to develop methods for extracting knowledge from data warehouses in a specific domain to support management decision-making by mastering the principles and techniques of data warehousing and data mining. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO DATA MINING, DATA MINING QUERY LANGUAGES**	**8 hr**

Introduction to Data Mining- Technologies used and Applications; Knowledge Discovery in databases; Architecture of Data Mining Systems, Coupling; Kinds of data can be mined; Patterns that can be mined-Characterization, Discrimination, Association; Patterns that can be mined-Classification, Clustering, Outlier Analysis; Are all patterns interesting?, Major issues in Data Mining; Syntax of Data mining query language.

Unit II	**DATA ATTRIBUTES, DATA PREPROCESSING**	**8 hr**

Attribute Types, Basic Statistical Description of Data-Measuring the Central Tendency; Measuring the Dispersion of Data, Graphic Display of Basic Statistical Description of Data (Q-Q Plots, Histograms, Scatter Plots); Data Matrix and Dissimilarity Matrix, Minkowski Distance, Proximity Measures for Nominal and Binary attributes,; Proximity Measures for Ordinal attributes, Dissimilarity for attributes of Mixed Types, Cosine similarity; Data Preprocessing – Why Preprocessing, Major tasks in Data Preprocessing, Data Cleaning techniques; Data Integration- Redundancy, Correlation Analysis for Nominal Data and Numeric Data; Data Reduction-Attribute Subset Selection, Sampling, Data compression; Data Transformation –Normalization, Data Discretization and Concept Hierarchies.

Unit III	DATA WAREHOUSING-MODEL, DESIGN, IMPLEMENTATION AND ASSOCIATION ANALYSIS	8 hr
Introduction to Data Warehouse, 3-tier Architecture, Differences between OLAP and OLTP; Multidimensional data model-Data cubes introduction, Role of Concept hierarchy, Star-net Query model, Schemas, OLAP Operations; Data Warehouse Design Process, Indexing OLAP data, Data Warehouse Implementation-Data cubes computation preliminary concepts, Cube Materialization; Data cube Computation Methods- Multiway Array Aggregation, Bottom-Up Construction-iceberg cubes, Star cubing; Market Basket Analysis, Frequent Item set Mining - Apriori Algorithm; Association Rules generation, FP growth Algorithm; Pattern Mining in Multilevel, Multidimensional Space, Colossal Patterns; Constraint based pattern mining, Pattern Evaluation Methods.		
Unit IV	**CLASSIFICATION**	**8 hr**
Introduction to Classification; Classification by Decision Tree Induction; Bayesian Classification, Bayesian Belief Networks; Basics of Support Vector Machines, Rule Based Classification; Classification by Back Propagation; Other classification methods- K-nearest Neighbor Classifier, Genetic Algorithms; Other classification methods-Rough Set, Fuzzy set approach; Metrics for Evaluating Classifier Performance-Confusion Matrix; Common techniques for assessing and improving classifier Accuracy.		
Unit V	**CLUSTERING**	**8 hr**
Cluster Analysis & its requirements, Categorization of clustering methods; Partitioning Methods(K-means); Partitioning Methods(K-Medoids); Hierarchical Methods (Agglomerative, Divisive), Distance Measures in Algorithmic Methods; Hierarchical clustering using single and complete linkages; Density Based Methods (DBSCAN, OPTICS); Grid Based Methods(STING, CLIQUE); Evaluation of Clustering.		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Data Mining, Concepts and Techniques, Third Edition, Jiawei Han, Micheline Kamber, Jian Pei.	
REFERENCE BOOKS:		
1	Data Mining Concepts and Techniques, Han, Morgan Kaufmann Publishers.	
2	Introduction to Data Mining by Pang-Ning Tan, Vipin Kumar, Michael Steinbach	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL5				X	
CO6	BL6	X	X	X	X	X

R23MSCST033 (DSC-E2)	BLOCK CHAIN ESSENTIALS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Programming Skills, Computer Science Fundamentals (Data structures,algorithms and data bases), Cryptography Basics, Networking Concepts, Problem-Solving Skills	**3**	**0**	**0**	**3**

Course Objective

To equip students with the knowledge and skills to design, develop, and deploy secure, scalable blockchain-based applications by integrating foundational concepts, consensus mechanisms, smart contract programming, and Ethereum ecosystem tools.

Course Outcomes

After completing this course, the students will be able to

1	Apply foundational blockchain principles to identify the evolution of computer applications and distinguish between centralized, decentralized, and distributed models. (**BL3**)
2	Analyze core blockchain components such as block chaining, consensus algorithms, and token mechanisms to explain how they ensure data integrity and trust in decentralized environments. (**BL4**)
3	Examine various blockchain applications and architectures to evaluate their suitability for different enterprise and security use cases.(**BL4**)
4	Evaluate Ethereum-based tools and Solidity programming constructs to determine their role in smart contract development and deployment. (**BL5**)
5	Assess smart contract lifecycles and development environments to build and test secure decentralized applications (DApps). (**BL5**)
6	Design and develop a comprehensive decentralized application by integrating blockchain architecture, smart contract logic, and Ethereum deployment tools..(**BL6**)

SYLLABUS

Unit I	**Foundations and Evolution of Blockchain Technology**	**8 hr**

Introduction to Blockchain, Scenarios and Challenges Articulated, What is Blockchain?; Blockchain Characteristics; Opportunities Using Blockchain, History of Blockchain, Skillsets Requirements; Evolution of Computer Applications, Centralized Applications, Decentralized Applications; Stages in Blockchain Evolution; Consortia, Restrictions on Sharing Ledgers; Forks, Public Blockchain Environments; Types of Players in Blockchain Ecosystem, Players in the market.

Unit II	**Core Blockchain Concepts and Mechanisms**	**8 hr**

Blockchain Concepts: Chaining of blocks, Hashing; Merkle tree, consensus Concept; Consensus algorithms: Proof of work, proof of stake; Delegated proof of stake, Byzantine fault-tolerant mechanisms; DAG, Proof of capacity; Mining and Finalizing Blocks, Currency Aka Tokens; Security on Blockchain; Data Storage on Blockchain.

Unit III	**Blockchain Application Architecture and Evaluation**	**8 hr**
Wallets, Coding on Blockchain: Smart Contracts, Peer-to-Peer Network; Types of Blockchain Nodes, Risk Associated with blockchain solutions; Life Cycle of Blockchain Transaction, Obstacles for the Use of Blockchain; Blockchain Relevance Evaluation Framework; Blockchain solutions reference architecture; Types of Blockchain Applications, Cryptographic tokens; Typical solution Architecture for enterprise use cases, Types of Blockchain solutions; Architectural considerations: Performance, Storage Management, Distributed Computing, Privacy, User Experience		
Unit IV	**Ethereum Ecosystem and Smart Contract Development with Solidity**	**8 hr**
Architectural considerations: Integration with Other Systems, Compliance, Standardization, Costing,security; Ethereum ecosystem, Ethereum development; Ethereum Tool stack, Ethereum Virtual Machine; Smart contract Programming: Layout of a solidity source file, Data Types in Solidity; Expressions and control structures; Contract Instance, function calls and parameters; Layout of storage; Modifiers, calling contracts from contracts, Handling events,		
Unit V	**Smart Contract Lifecycle and Decentralized Application Deployment**	**8 hrs**
Smart contract design; user specific contracts, handling persistent contract addresses, halting a contract; Smart contract life cycle: Migration; Integrated Development Environment: Remix; VS Code, Truffle frame work; Ganache, Unit testing, Ethereum accounts; Myether wallet, Ethereum networks/environments, Infura; Etherscan, ethereum clients, Decentralized application, Metamask		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Ambadas, Arshad Sarfarz Ariff, Sham "Block chain for Enterprise Application Developers", Wiley	
2	Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions by Joseph Bambara, Paul Allen	
REFERENCE BOOKS:		
1	Block chain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.	
2	Block chain: Blueprint for a New Economy, Melanie Swan, O'Reilly	
3	Andreas M. Antonpoulos, "Mastering Bitcoin: Programming the Open Block chain" , O'Reilly	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X			
CO3	BL4			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST036 (DSC-E2)	AD HOC NETWORKS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Networks	**3**	**0**	**0**	**3**

Course Objective

Students will have the ability to Categorize and compare various protocols in Ad-hoc networks, Wireless Sensor Networks and choose appropriate protocols in order to plan and build a sensor network suitable for particular applications

Course Outcomes

1	Students will be able to compare Cellular and Ad-hoc networks, categorize and compare MAC protocols for MANETs. **(BL4)**
2	Students will be able to categorize and compare various Routing and Transport protocols for MANETs. **(BL4)**
3	Students will be able to appraise the importance of addressing the security and challenges in Ad Hoc wireless networks. **(BL5)**
4	Students will be able to use a variety MAC and Routing protocols for energy efficiency to suit particular applications. **(BL3)**
5	Students will learn to appraise the Quality of Service of Wireless Sensor Networks and use TinyOS for WSNs. **(BL5)**
6	Students will be able to develop a Wireless Sensor Network for different applications using the principles, protocols and tools. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO AD-HOC NETWORKS, MAC PROTOCOLS**	**8 hr**

Ad hoc wireless networks: Introduction to MANETs, Characteristics of MANETs; Cellular and Ad hoc networks, Types of Wireless Networks; Applications of MANETs; Issues and Challenges of MANETs; MAC protocols for Ad hoc Wireless Networks- Issues; Design Goals and Classifications of the MAC Protocols; Contention based - MACAW protocol; Contention based protocols with reservation mechanisms-D-PRMA protocol, Hop Reservation Multiple Access Protocol (HRMA);

Unit II	**ROUTING PROTOCOLS FOR AD-HOC NETWORKS**	**8 hr**

Issues in Designing a Routing Protocol, Classifications of Routing Protocols; Table-Driven Routing protocols-DSDV, WRP, CGSR protocols; On-Demand Routing protocols-DSR, AODV, TORA, LAR protocols; Hybrid Routing protocols-CEDAR, ZRP, ZHLS protocols; Issues and design goals of a Transport layer protocol; TCP over Ad-hoc Wireless Networks-Why Does TCP Not Perform Well in Ad Hoc Wireless Networks; Solutions for TCP over Ad Hoc Wireless Networks-End to End approach: Feedback-Based TCP(TCP-F); Split approach: Split TCP;

Unit III	**SECURITY PROTOCOLS FOR AD-HOC WIRELESS NETWORKS**	**8 hr**

Security in Ad Hoc network-Requirements; Challenges; Network Security Attacks; Key Management- Diffie- Hellman Key Agreement, N-party Diffie- Hellman Key Agreement; The Burmester and Desmedt Protocol, The Ingemarsson Protocol; Security-Aware Ad Hoc routing protocol; Secure Efficient Ad Hoc Distance Vector Routing; Authenticated Routing for Ad Hoc Networks (ARAN);

Unit IV	**WIRELESS SENSORS AND DATA DISSEMINATION**	**8 hr**

The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption; Clustering of Sensors-Regularly placed sensors, Randomly placed

sensors; Applications; Classification of WSNs, MAC layer-Design issues; MAC protocols: S-MAC, EAR, STEM protocols; Routing layer-Routing schemes classification; Routing protocols- Directed diffusion, Minimum cost forwarding algorithm; Energy aware routing, CBRP, LEACH, PEGASIS;		
Unit V	**SECURITY IN WSNS AND WIRELESS NETWORK SIMULATORS**	**8 hr**
WSN security; Intrusion Detection Systems-Overview, An IDS Architecture for Ad Hoc networks; Quality of Service in Ad Hoc Wireless Networks :Introduction-An example; QoS parameters, issues and challenges in providing QoS in Ad Hoc wireless networks; Classification of QoS solutions; Sensor Network Operating Systems– TinyOS, Imperative Language-nesC; Tiny OS concepts embodied by nesC-Tasks, Events and Commands; Examples, A Blink application implementation in TinyOS;		

LEARNING RESOURCES

TEXTBOOKS:	
1	Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2	Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal
REFERENCE BOOKS:	
1	Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2	Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3	Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001
ONLINE COURSES	
1	http://www.cs.utsa.edu/~korkmaz/teaching/cn-resources/tinyos/tinyosnesc_pres.pdf
2	Microsoft PowerPoint - NS2-tutorial [Compatibility Mode] https://cs.ucf.edu/~czou/CDA6530-11/NS2-tutorial.pdf
3	A Tutorial on the Implementation of Ad-hoc On Demand Distance Vector (AODV) Protocol in Network Simulator (NS-2) https://ar5iv.labs.arxiv.org/html/1007.4065
4	The ns-3 Network Simulator — An Introduction to Computer Networks, desktop edition 2.0.11 https://intronetworks.cs.luc.edu/current/html/ns3.html

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL4		X			
CO3	BL5			X		
CO4	BL3				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST021 (DSC-E3)	MACHINE LEARNING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Data Mining	**3**	**0**	**0**	**3**

Course Objective

Students will gain understanding to comprehend the foundational principles, algorithms, and theoretical frameworks underlying machine learning, covering topics such as concept learning, decision tree learning, artificial neural networks, computational learning theory, instance-based learning, and analytical learning.

Course Outcomes

1	Students will be able to apply the concepts of Artificial Intelligence, knowledge representation, Concept Learning and make use of General-to-specific Ordering of Hypothesis. **(BL3)**
2	Students will be able to classify training examples using Decision Tree Learning and evaluate the accuracy of the model. **(BL4)**
3	Students will be able to analyze complex real-time data using Artificial Neural Networks and Bayesians belief networks. **(BL5)**
4	Students will be able to determine and evaluate the error on training data using computational and Instance-based Learning. **(BL5)**
5	Students will be able to evaluate the training set examples using learning set of rules and able to explain various examples using reinforcement learning. **(BL5)**
6	Students will be able to construct models on training datasets and minimize the error using artificial neural networks, machine learning algorithms and learning theories. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO ARTIFICIAL INTELLIGENCE, LEARNING, CONCEPT LEARNING AND THE GENERAL-TO-SPECIFIC ORDERING**	**8 hr**

Introduction to AI: Basics of AI, Types of AI, Advantages and Disadvantages of AI, Applications; Agents and Environments, Types of agents; Knowledge representation and reasoning; Un-certainty and probabilistic reasoning; Well posed learning problems, Designing a learning system, Perspectives and issues in Machine learning; Introduction to Concept Learning, A Concept learning task, Concept learning as search; Find-S: Finding a Maximally Specific Hypothesis, Inductive Bias-A Biased Hypothesis Space, Version spaces representation and Candidate elimination algorithm- representation; The List-Then-Eliminate Algorithm Compact representation for version spaces, Candidate elimination algorithm and example;

Unit II	**DECISION TREE LEARNING and ARTIFICIAL NEURAL NETWORKS (Part 1)**	**8 hr**

Introduction, Decision Tree representation, appropriate problems for decision tree learning, Basic Decision Tree Algorithm – ID3 Algorithm; Which attribute is the best classifier?, An Illustrative Example; Issues in Decision Tree Learning: Avoiding Over fitting the Data; Incorporating Continuous-Valued attributes, Alternative measures for selecting attributes, Handling training examples with Missing Attribute Values, Handling attributes with Different Costs;

Biological motivation, Neural Network representation, Appropriate problems for

neural network learning; Perceptrons - Representational power of Perceptrons, The Perceptron Training Rule; Gradient Descent and the Delta Rule; Stochastic Approximation to Gradient Descent, Remarks;		
Unit III	**ARTIFICIAL NEURAL NETWORKS (Part 2) and BAYESIAN BELIEF NETWORKS**	**8 hr**
Multilayer networks and the back propagation algorithm - A Differentiable Threshold Unit, The Back propagation Algorithm; Derivation of the Backpropagation Rule; Remarks on the Backpropagation Algorithm: Convergence and local minima, Representational power of feed forward networks, Hypothesis space search, inductive bias; Hidden layer representations, Generalizations, Overfitting, and Stopping criterion; Bayesian Belief Networks: Conditional Independence, Representation, Inference; Learning Bayesian Belief Networks, Gradient Ascent Training of Bayesian Networks, Learning the structure of Bayesian Networks; The EM Algorithm: Estimating means of k Gaussians; General Statement of EM Algorithm, Derivation of the k-means algorithm;		
Unit IV	**COMPUTATIONAL LEARNING THEORY, INSTANCE BASED LEARNING**	**8 hr**
Computational Learning Theory: Introduction, Probability Learning an Approximately Correct Hypothesis: The problem setting, Error of a Hypothesis, PAC Learnability; Sample Complexity for Finite Hypothesis Spaces: Agnostic Learning and Inconsistent Hypotheses; Conjunctions of Boolean Literals are PAC-Learnable; PAC-Learnability of other Concept Classes; Sample Complexity for Infinite Hypothesis Space: Shattering a set of Instances, The VC Dimension, Illustrative example; Sample complexity and the VC Dimension, VC Dimension for Neural Networks; Instance Based Learning: Introduction, k-Nearest Neighbor learning: Distance-Weighted Nearest Neighbor Algorithm; Locally Weighted Regression: Locally Weighted Linear Regression; Radial Basis functions, Case based reasoning;		
Unit V	**LEARNING SETS OF RULES, REINFORCEMENT LEARNING**	**8 hr**
Learning Sets of Rules: Introduction, Sequential Covering Algorithms: General to Specific Beam Search, Variations; Learning rule sets: Learning First-order rules – First-Order Horn Clauses; Learning Sets of First-order rules: The Basic FOIL Algorithm; Reinforcement Learning – Introduction, The Learning Task; Q Learning- The Q Function, An Algorithm for Learning Q; Q Learning – An Illustrative Example, Convergence, Experimentation Strategies; Nondeterministic rewards and actions, Temporal Difference Learning;		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Tom M. Mitchell, "Machine Learning" First Edition by Tata McGraw- Hill Education.	
2	Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 2nd Edition, Pearson Education, 2010. (UNIT I)	
3	Rich E & Knight K, "Artificial Intelligence", 4th Edition, Tata McGraw hill, 2010. (UNIT I)	
REFERENCE BOOKS:		
1	Christopher M. Bishop, "Pattern recognition and machine learning", Springer,2007.	

2	Ethem Alpaydin, "Introduction to Machine Learning", PHI, Third edition, 2015.
ADDITIONAL REFERENCE MATERIAL	
1	https://www.geeksforgeeks.org/machine-learning/
2	https://cs229.stanford.edu/lectures-spring2022/main_notes.pdf
ONLINE COURSES	
1	https://nptel.ac.in/courses/106106139
2	https://www.youtube.com/watch?v=PPLop4L2eGk

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X			
CO3	BL5		X	X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST020 (DSC-E3)	STATISTICAL AND PREDICTIVE ANALYTICS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42(L)	**L**	**T**	**P**	**C**
	Pre-requisite	Probability & Statistics, Linear Algebra, Calculus, Python programming	**3**	**0**	**0**	**3**

Course Objective

1. Students will get exposure to basic knowledge, understand and analyze the components of data with different structures and to perform predictive analysis.
2. Students will understand data to learn and construct, design skills and knowledge in communicating statistical techniques for mathematical and computer models for data and to perform analysis of any phenomenon.
3. Students will get exposure to acquire the basic required knowledge to smooth the data and apply various smoothing methods for data analysis and acquire construct predictive methods to analyze, forecast with different scientific methods and be trained to get Cutting edge of knowledge in data analysis and applications.

Course Outcomes

1	Students will be able to acquire basic knowledge of the data with different structures and perform correlation analysis for random components. **(BL3)**
2	Students will be able to apply and construct, design skills and knowledge in communicating statistical techniques Regression and computer models for conducting analysis of any phenomenon in scientific data analysis. **(BL4)**
3	Students will be able to develop the knowledge to smooth the data and apply various smoothing methods for data analysis. **(BL4)**
4	Students will be able to analyze of the components of time series with different structures and to perform trend or predictive analysis with testing. **(BL5)**
5	Students will be able to develop and construct, design skills and knowledge in communicating statistical techniques for mathematical and computer models for conducting analysis of any phenomenon in scientific data analysis. **(BL5)**
6	To be able to understand and interpret the results to data and various forecasting methods for data in real world problems. **(BL6)**

SYLLABUS

Unit I	**EXPLORATORY DATA ANALYSIS (EDA)**	**8 hr**

Data collection strategies, Elements of Structured; data cleaning, data integration and transformation; data classification, Clustering, outliers; Frequency tables and Histograms, frequency curves; Measures of central tendency; Measures of Variability; measures of symmetry and Coefficient of variation; Normalization and Z- Score;

Unit II	**CORRELATION ANALYTICS**	**8 hr**

Introduction to correlation, correlation for Variables; auto-correlation; Bi-variate data, Scatter plot; covariance and properties; correlation coefficient, limits of

correlation coefficient; rank correlation; coefficient of determination R^2; Multiple correlation and partial correlation;		
Unit III	**STATISTICAL DISTRIBUTIONS**	**8 hr**
Introduction to random variables, types; discrete distributions–recurrence relations and expected frequencies: uniform; Binomial; Poisson; Continuous distributions - rectangular; Exponential; Gaussian distribution; standard normal distribution related properties;		
Unit IV	**DATA SAMPLING AND HYPOTHESIS TESTING**	**8 hr**
Data sampling, Simple Random sampling, cluster Sampling; Sampling error, Bootstrapping, max. error; sampling distributions, central limit theorem; confidence intervals; Hypothesis – Simple and composite, A/B testing; types of error, p-value, one tailed, two tailed; F-statistic: One way ANOVA; two way ANOVA;		
Unit V	**STATISTICAL REGRESSION AND PREDICTION**	**8 hr**
Introduction to regression, simple linear regression; regression coefficients and properties; multiple regression; Prediction of new Observations - Model Adequacy Checking; Decision Tree based methods for classification; Naive Bayes; Logistic Regression; t- testing of correlation coefficient, regression coefficient;		
LEARNING RESOURCES		
TEXTBOOKS:		
1	S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.	
2	Peter Bruce and Andrew Bruce "Practical Statistics for Data Scientists" – 50 Essential Concepts. Published by O'Reilly Media, Inc.,1005 Gravenstein Highway North, Sebastopol, CA 95472.	
3	Montgomery, D.C. and Johnson, L.A. (1977): Forecasting and Time Series Analysis, McGraw Hill	
4	Fundamentals of applied Statistics: VK Kapoor, SP Gupta; S Chand Publishers	
5	Fuller, W.A. (1976): Introduction to Statistical Time Series, John Wiley	
6	Mark Gardener (2012), Beginning R - The Statistical Programming Language, Wiley India Pvt Ltd.	
REFERENCE BOOKS:		
1	Anderson, T.W. (1971): The Statistical Analysis of Time Series, Wiley, New York.	
2	Anany Levetin - *Introduction to The Design and Analysis of Algorithms*, 3rd Edition, Pearson Education.	
3	K.Trivedi.ProbabilityandStatisticswithReliability, Queuing,and ComputerScience Applications. Wiley sons.	
4	Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis –Forecasting and Control. Holden Day, San Francisco.	
5	Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).	
ADDITIONAL REFERENCE MATERIAL		
1	Chris Eaton, Dirk Deroos, Tom Deutsch et al., "Understanding Big Data", McGrawHIll, 2012. 2. Alberto Cordoba, "Understanding the Predictive	

	Analytics Lifecycle", Wiley, 2014.
2	https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling- maxkuhn-kjell-johnson_1518.pdf
3	https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodolo gy
4	https://ru.b-ok2.org/terms/?q=forecasting
5	https://otexts.com/fpp2/
6	http://home.iitj.ac.in/~parmod/document/introduction%20time%20series.pdf
ONLINE COURSES	
1	https://www.coursera.org/learn/predictive-modeling-analytics
2	https://www.edx.org/course/predictive-analytics
3	https://www.udemy.com/course/machinelearningandlogisticregression/
4	https://www.coursera.org/learn/practical-time-series-analysis
5	https://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/downloadcourse- materials/
6	https://swayam.gov.in/nd1_noc19_mg46/preview

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X		X		
CO2	BL4		X		X	X
CO3	BL4			X	X	
CO4	BL5		X			X
CO5	BL5	X		X	X	
CO6	BL6	X	X	X	X	X

<table>
<tr><td rowspan="3">R23MSCST034
(DSC-E3)</td><td colspan="6">Principles of IoT
(CSE,IT,CSIT,AIML,DS,ICB)</td></tr>
<tr><td>Total Contact Hours</td><td>42 (L)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Prerequisite</td><td>Python, Computer Networks and Communication Protocols</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td colspan="7">Course Objectives
1. To understand the fundamental concepts of IoT, including its definition, characteristics, enabling technologies, architecture, and domain-specific applications.
2. To analyze various IoT communication models, protocol suites, and networking technologies such as MQTT, CoAP, AMQP, and NB-IoT to evaluate their suitability for different IoT applications.
3. To apply cloud computing principles in IoT, including cloud storage models, edge and fog computing, and IoT cloud platforms like AWS, Microsoft Azure, and IBM Watson to implement IoT solutions.
4. To evaluate IoT data analytics techniques, including big data tools, machine learning, predictive analytics, and network analytics, to process and interpret IoT-generated data effectively.
5. To design and develop secure IoT systems by addressing security challenges, implementing authentication, encryption, intrusion detection systems, and adopting Zero Trust Security principles.</td></tr>
<tr><td colspan="7">Course Outcomes
On the successful completion of this course, Students will be able to</td></tr>
<tr><td>1</td><td colspan="6">Analyze IoT's architecture, enabling technologies, and deployment models to understand its role in various domains such as smart cities, healthcare, and agriculture. (BL4)</td></tr>
<tr><td>2</td><td colspan="6">Examine IoT communication models, protocols, and message structures to differentiate between IoT networking technologies like MQTT, CoAP, and Zigbee. (BL4)</td></tr>
<tr><td>3</td><td colspan="6">Evaluate different IoT cloud platforms, storage models, and computing paradigms (Edge, Fog, and Cloud) to select appropriate solutions for real-world IoT applications. (BL4)</td></tr>
<tr><td>4</td><td colspan="6">Assess IoT data analytics techniques, including predictive analytics, machine learning, and distributed analytics, to optimize decision-making in IoT-based applications. (BL5)</td></tr>
<tr><td>5</td><td colspan="6">Critically evaluate IoT security risks, authentication mechanisms, and encryption techniques to enhance the resilience of IoT networks against cyber threats. (BL5)</td></tr>
<tr><td>6</td><td colspan="6">Design and develop a secure and scalable IoT system by integrating cloud computing, analytics, and security protocols to address real-world challenges effectively. (BL6)</td></tr>
<tr><td colspan="7">SYLLABUS</td></tr>
<tr><td colspan="2">Unit I</td><td colspan="4">INTRODUCTION TO IOT</td><td>8 hr</td></tr>
<tr><td colspan="7">Definition of IoT, Advantages and disadvantages of IoT, History/Evolution of IoT; Characteristics of IoT, Enabling Technologies of IoT; Physical Design of IoT-Things</td></tr>
</table>

in IoT & Protocol suite in IoT network, Logical Design of IoT**-** Functional Blocks of IoT; Communication models of IoT, Communication API's; IoT Levels & Deployment templates; Architecture of IoT – Layered architectures; Domain-specific applications-Home Automation, Smart Cities, Agriculture, Industry, Environment, Energy systems, Retail, Logistics; IoT Components and implementation, IoT interdependencies and challenges for IoT.		
Unit II	**IOT PROTOCOL SUITE-I**	**8 hr**
M2M - Architecture, Characteristics, M2M Vs IoT; Software Defined Networking and Network Function Virtualization; **SNMP-** Architecture, Components, Messages/keywords; **CoAP-** Architecture, Key features, Types of messages, Messaging models and Header format; **MQTT-**Architecture, Terminology & Advantages; MQTT control packet structure – Fixed and variable header; **MQTT Control Packets-** CONNECT, PUBLISH, SUBSCRIBE, and UNSUBSCRIBE; **MQTT Control Packets-** CONNACK, PUBACK, SUBACK, UNSUBACK, and DISCONNECT.		
Unit III	**IOT PROTOCOL SUITE-II**	**8 hr**
AMQP- Introduction, Architecture, Types of Message Exchanges; **XMPP-** Introduction, Evaluation, Architecture & specification & steps to establish communication; **DDS-** Architecture & Global data space in DDS; **Tunneling Protocol-**Various types of tunneling protocols; **Zigbee-**Types of networks, Nodes of Zigbee; **LoRA-** LoraWAN Network, Types of End devices, Advantages; **NB-IoT-** Characteristics/Features, Design & Deployment of NB-IoT; NB-IoT- Architecture, Versions (CAT-NB1, CAT-NB2) & Applications.		
Unit IV	**IOT CLOUD PLATFORMS**	**8 hr**
Cloud storage models and Web Application Messaging Protocol(WAMP); Computing in IoT- Edge, Fog and Cloud computing; IoT Cloud platforms, advantages & key features; Application domain and selection criteria for IoT cloud platforms; **Cloud Storage –** Types of cloud storage models, Advantages and Challenges; **Thingspeak-**Key features, Applications & ThingWorx, Advantages and Disadvantages; **Microsoft Azure-**Key Features, Applications & IBM Watson, Advantages and Disadvantages; **AWS IoT core**-Key Features, Application.		
Unit V	**ANALYTICS AND SECURITY IN IOT**	**8 hr**
Introduction to data analytics for IoT, IoT Data analytics- overview, Challenges; Machine Learning in IoT, Predictive Analysis; Big data analytics tools and technology; Edge streaming Analytics, Distributed Analytics system, Network Analytics; IoT Security - IoT Security Challenges, Authentication and Authorization, Data Privacy and Encryption; Threats and Vulnerabilities in IoT, IoT Network Security, Intrusion Detection and Prevention Systems (IDPS) for IoT; IoT Device Identity Management, Security for IoT Protocols; IoT Security Testing and Penetration Testing, Zero Trust Security for IoT.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	"Internet of Things: A Hands-On Approach" by Arshdeep Bahga and Vijay Madisetti.	
2	"Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz.	

3	"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes and Gonzalo Salgueiro.
REFERENCE BOOKS:	
1	"Interconnecting Cisco Network Devices, Part 1 (ICND1): CCNA Exam 640-802 and ICND1 Exam 640-822" by Wendell Odom.
2	"Internet of Things: Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi, and editors.
3	"Practical IoT Projects with LoRa, NodeMCU and ESP8266" by Agus Kurniawan.
4	"Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini.
ONLINE COURSES	
1	Cisco Networking Academy:Offers free courses on networking fundamentals and Cisco technologies.
2	IoT For All (https://www.iotforall.com/): Provides articles, guides, and case studies on IoT applications and technologies.
3	IEEE Internet of Things Journal (https://iot.ieee.org/): Publishes research papers and articles on IoT advancements and applications
4	Coursera and edX: Platforms offering courses on IoT, networking, and related topics from universities and institutions worldwide.

R23MSCST034 (DSC-E3)	ROUTING AND SWITCHING CONCEPTS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Networks	**3**	**0**	**0**	**3**

Course Objectives

This course equips students with the knowledge and practical skills necessary to design, configure, and troubleshoot switching and routing protocols to support secure and efficient network infrastructures.

Course Outcomes

1	Students will be able to **apply** switching concepts to configure and secure switches for efficient network connectivity. **(BL3)**
2	Students will be able to **design** VLAN configurations and inter-VLAN routing strategies to optimize network segmentation. **(BL6)**
3	Students will be able to **analyze** and implement STP and EtherChannel solutions to prevent loops and aggregate network links effectively. **(BL4)**
4	Students will be able to **evaluate** LAN security vulnerabilities and deploy first-hop redundancy protocols to enhance network reliability and security. **(BL5)**
5	Students will be able to **construct** and maintain static and dynamic routing configurations to build efficient routing tables. **(BL3)**
6	Students will be able to **design** and **develop** advanced network infrastructures that integrate switching, VLANs, routing, and security protocols to achieve secure, scalable, and resilient networks. **(BL6)**

SYLLABUS

Unit I	**SWITCHING CONCEPTS**	**8hr**

Configuring a switch with initial settings

Switch boot sequence, Switch LEDs, recover from system crash, Switch management access, Switch SVI configuration example; Configuring a switch with initial settings: Duplex communication, configure switchport at physical layer, AUTO-MDIX, Switch verification commands; Network access layer issues, Interface input output errors, troubleshooting network access layer issues.; Secure remote access: Telnet operation, SSH operation, configure SSH, verify SSH.

Basic router configuration, Frame Forwarding

Configure basic router settings, Dual stack topology, configure router interfaces, IPv4 loopback interfaces.; Verify directly connected networks: interface verification commands, verify interface status, verify IPv6 link local and multicast addresses, verify interface configuration, verify routes, filtering show command output, command history.; Frame forwarding methods: Store and forward, cut-through switching, Differences; Switching Domains: collision domains, broad cast domains, Features of the switch that alleviate congestion.;

Unit II	**VLANS & INTER VLAN ROUTING**	**8hr**

VLANs: Overview, definitions, benefits, types.; VLANs in a Multi-Switched Environment: Defining VLAN trunks, Networks without and with VLANs, VLAN

identification with a Tag., Native VLANs and 802.1Q tagging, Voice VLAN tagging, Voice VLAN verification,; VLAN: Configuration, VLAN ranges in Catalyst Switch, VLAN creation commands with example, VLAN port assignment commands.; Data and Voice VLAN example, verify VLAN information, change VLAN port membership, Delete VLANs.

VLAN trunks & Inter VLAN Routing

VLAN Trunks: Trunk configuration commands, Trunk configuration example, verify trunk configuration, reset the trunk to default.; Dynamic Trunking Protocol (DTP): Introduction to DTP, Negotiated Interface Modes, Results of a DTP configuration, verify DTP mode.; Inter VLAN routing: Definitions, Legacy inter-VLAN routing, 'router-on-a-stick' inter-VLAN routing.; Inter-VLAN Routing on a Layer 3 Switch, Router-on-a-Stick Scenario (configurations)

Unit III	**STP, ETHERCHANEL AND DHCP**	**8hr**

STP, Ether Channel

Purpose of STP, STP operations: Steps to a Loop-Free Topology, Elect the root bridge, Elect the root ports, Elect designated ports, Elect alternate (blocked) ports.; Elect a Root Port from Multiple Equal-Cost Paths, STP Timers and Port States, Operational Details of Each Port State, Per-VLAN Spanning Tree, Different Versions of STP.; Ether Channel: Link aggregation, Ether Channel technology, Advantages of Ether Channel.; Ether Channel implementation restrictions, Auto Negotiation Protocols, PAgP operation,

DHCP

LACP Operation, Configure Ether Channel, verify Ether Channel; DHCPv4: Server and Client, DHCPv4 operation, configure a Cisco IOS DHCPv4 Server.; Verify DHCPv4 is Operational, Disable the Cisco IOS DHCPv4 Server, DHCPv4 Relay; Other Service Broadcasts Relayed, Configure a DHCPv4 Client.

Unit IV	**FHRP, LAN SECURITY**	**8 hr**

FHRP

First Hop Redundancy Protocols (FHRP): Default Gateway Limitations, Router Redundancy, Steps for Router Failover, FHRP Options; HSRP Overview, HSRP Priority and Preemption, HSRP States and Times.; LAN Security: Endpoint security: Network attacks today, Network security devices, Endpoint protection.; Cisco ESA, Cisco WSA, Access Control: Authentication with a Local Password, AAA components;

Vulnerabilities and Attacks

802.1X, Layer 2 Vulnerabilities, Switch attack categories, Switch attack mitigation techniques.; MAC address table attack, mitigation, VLAN hopping attack.; VLAN Double-Tagging attack, DHCP attacks.; ARP Attacks, STP Attacks, and CDP Reconnaissance.

Unit V	**ROUTING CONCEPTS, STATIC AND DYNAMIC ROUTING**	**8hr**

Routing concepts:

Functions of router, example, longest match for IPv4 and IPv6, Build the routing table.; Packet forwarding decision process, Packet forwarding mechanism; IP

routing table: Route source, routing table principles, routing table entries, directly connected networks, static routes.; Dynamic routing protocols, Dynamic Routes in the Routing Table, Default route, structure of IPv4 routing table, structure of IPv6 routing table, Administrative distance. **Static and Dynamic Routing** Static Vs Dynamic routing, Dynamic routing evolution, Dynamic routing protocol concepts, best path, load balancing.; IP Static routing: Types, next hop options, ip route command, ipv6 route command, Configuring static routing.; Default static route, floating static routes.; Configuring Dynamic Routing with RIP;.

LEARNING RESOURCES	
TEXTBOOKS:	
1	Companion Guide - *Switching, Routing, and Wireless Essentials*, v7.0 Cisco Press.
2	Todd Lammle, *CCNA Routing and Switching Study Guide*, Publisher: Sybex, Wiley
ONLINE COURSES	
1	www.netacad.com

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL4		X			
CO3	BL4			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

<table>
<tr><td rowspan="3">R23MSCSL008</td><td colspan="6">WEB TECHNOLOGIES LAB
(CSE,IT,CSIT,AIML,DS,ICB)</td></tr>
<tr><td>Total Contact Hours</td><td colspan="2">42 (P)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>Pre-requisite</td><td colspan="2">Object-Oriented Programming (OOP) using Java, Database Management Systems</td><td>0</td><td>0</td><td>3</td><td>2</td></tr>
<tr><td colspan="8">Course Objective</td></tr>
<tr><td colspan="8">Students will gain an understanding of design and implement a comprehensive web development project using HTML, CSS, JavaScript, and Java technologies.</td></tr>
<tr><td colspan="8">Course Outcomes</td></tr>
<tr><td>1</td><td colspan="7">Students will be able to create a dynamic and responsive website with proper HTML structure and utilize CSS for effective styling, ensuring a visually appealing user interface.</td></tr>
<tr><td>2</td><td colspan="7">Students will be able to implement JavaScript programs for user interaction, including pop-up boxes, number validation, and search algorithms, showcasing problem-solving skills and logical reasoning.</td></tr>
<tr><td>3</td><td colspan="7">Students will be able to utilize XML and DTD/XSD to define structured data formats, ensuring proper validation and adherence to schema constraints.</td></tr>
<tr><td>4</td><td colspan="7">Students will be able to develop Java servlets and JSP to handle user requests, demonstrate and understand life cycle methods, and create dynamic web pages to enhance the user experience.</td></tr>
<tr><td colspan="8">List of Experiments</td></tr>
<tr><td>1</td><td colspan="7">1. Write a program to demonstrate the usage of heading tags in HTML
2. Write a program to demonstrate the usage of marquee tag in HTML
3. Write a program to demonstrate the usage of anchor and image tag in HTML</td></tr>
<tr><td>2</td><td colspan="7">1. Write an HTML Program to demonstrate lists and nested lists
2. Write an HTML Program to display the Time Table using table tag.
3. Write an HTML Program to create a form for collecting personal details using all input types and its attributes.
4. 4. Write an HTML Program to Explore HTML5 Blogging Tags</td></tr>
<tr><td>3</td><td colspan="7">1. Develop and demonstrate inline CSS which include the following properties.
a) Properties related to anchor tag.
b) Properties related to background.
2. Develop and demonstrate the usage of internal CSS which include the following properties.
a) Properties related to anchor tag.
b) Properties related to background.
3. Develop and demonstrate the usage of external CSS which include the following properties.
a) Properties related to anchor tag.
b) Properties related to background.
4. Develop and demonstrate the usage of different selectors in CSS which includes the following properties:
a) CSS properties related to font tag.
b) CSS properties related to border tag.</td></tr>
<tr><td>4</td><td colspan="7">1. Write a JavaScript program to demonstrate pop-up boxes. (Alert, Prompt, Confirm).
2. Write a JavaScript program to check whether a given number is prime or not.</td></tr>
</table>

	3. Write a JavaScript program to check whether a given number is Armstrong or not 4. Write a JavaScript program to demonstrate linear search.
5	1. Write JavaScript to validate the following fields of the Registration page. a) First Name (Name should contains alphabets and the length should not be less than 6 characters). b) Password (Password should not be less than 6 character's length). c) E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com) d) Mobile Number (Phone number should contain 10 digits only). e) Last Name and Address (should not be Empty).
6	1. Write an XML file which will display the Book information which includes the following: a) Title of the book b) Author Name c) ISBN number d) Publisher name e) Edition f) Price 2. Write an internal Document Type Definition (DTD) document to validate the above XML file. 3. Write an XML file which will display the student information containing the elements (all types), as well as their attributes (attribute specifiers and data types), as well as the interrelationships among the elements. 4. Write an external Document Type Definition (DTD) document to validate the above XML file.
7	1. Create a schema for ship order where orderperson, shipto and itemdetails as elements? OrderID is a compulsory attribute, shipto can have colony, city, pin. Itemdetails can have description(as optional), quantity and cost? One person can order many items. 2. Create an XML document for Bookstore example with elements Book name, Genre, Author name, Date of publishing, price. 3. Write an XML Schema Document (XSD) / Schema to validate the above XML file.
8	1. Create a JavaBean to display a red color rectangle 2. Write a JavaBean program to change the color of bean based on the mouse press. 3. Write a JavaBean program to introspect a Bean
9	1. Create a servlet program (by implementing Servlet Interface) to demonstrate servlet life cycle methods. 2. Write a servlet program that displays "MVGR College of Engineering" message on a web page using GenericServlet/HttpServlet class. 3. Implement a servlet to read User Parameters (Week-5) using Registration Form
10	1. Implement a servlet program to demonstrate the following a) how to read Initialization parameters. b) how to read Context parameters. 2. Write a JAVA Servlet Program to implement sessions using HTTP Session Interface. 3. Write a JAVA Servlet Program to implement sessions using Cookies.
11	1. Write a JSP Program to generate multiplication table of a given number 2. Write a JSP Program to check if a number is Armstrong or not. 4. Write a JSP Program to find the salary of an employee whose basic salary has to be taken as an input from the user. Use the following rules to

	compute the gross salary a. DA-DMS allowances= 90% of basic b. HRA=10% of basic c. Gross salary= basic +DA+HRA
12	Create a MySQL database named labdb and a table student with fields: id, name, email, and course. 1. Design a JSP form (insert.jsp) to accept student details and insert them into the students table using JDBC. 2. Create a JSP page (view.jsp) that fetches and displays all records from the students table in an HTML table format. 3. Design a JSP page that loads the details of a student (based on id) into a form, allows editing, and updates the record in the database (update.jsp). 4. 4. Create a JSP page (delete.jsp) where you can enter a student ID and delete that student from the table.
Additional experiments	
1	1. Upload and store files (e.g., profile photos) using JSP and servlet. 2. Download files from server using a download link.
2	1. Display 5 student records per page using pagination logic. 2. Implement a servlet program that connects to a database, retrieves data, and dynamically displays it on a web page.
3	1. Design a secure user authentication system using Java Server Pages (JSP), incorporating sessions and cookies for user management.
Demonstration experiments	
1	Develop static pages (using only HTML) of an online Book store. I. The website should consist of the following pages. II. Home page, Registration and user Login, User profile page, Books catalog, Shopping cart, Payment By credit card, order confirmation.
2	I. Install a database (MySQL) II. Create a table which should contain at least the following fields: name, password, email-id, phone number (these should hold the data from the registration form).
LEARNING RESOURCES	
TEXT BOOKS:	
1	Web Technologies, Black Book, Kogent Publications.
2	WebTechnologies, Uttham K Roy.
3	Internet & World Wide Web: How to Program, 4e, Deitel & Deitel Publication.
REFERENCE BOOKS:	
1	Web Programming, building internet applications, Chris Bates 2nd edition, WILEY Dreamtech
ADDITIONAL REFERENCE MATERIAL	
1	https://www.w3schools.com/html/default.asp
2	https://www.w3schools.com/css/default.asp
3	https://www.javatpoint.com/jsp-tutorial
4	https://www.javatpoint.com/servlet-tutorial
5	https://www.w3schools.com/js/default.asp

R23MBMCL004	BUSINESS ANALYTICS LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42(P)	**L**	**T**	**P**	**C**
	Prerequisite	Basic Programming Concepts, Probability	**0**	**0**	**3**	**2**

Course Objective

This course aims to equip students with the skills to apply statistical and machine learning techniques to real-world problems, develop and evaluate models, and understand various model architectures for practical applications.

Course Outcomes

After completing this course, the students will be able to

1	Implement statistical analysis techniques for solving real world problems.
2	Apply machine learning techniques for various applications.
3	Develop machine learning models using mathematical and statistical tools.
4	Identify different model architectures.
5	Demonstrate scaling up of machine learning techniques.

LIST OF EXPERIMNETS

1. Predict the housing prices of a new house using regression. (Dataset Link: https://www.kaggle.com/puxama/bostoncsv)
2. Build a predictive model for determining height or weight of a person. (DatasetLink: http://wiki.stat.ucla.edu/socr/index.php/SOCR_Data_Dinov_020108_HeightsWeights)
3. Implement a machine learning classification algorithm on image to recognize handwritten digits from a paper. (Dataset Link: http://yann.lecun.com/exdb/mnist/)
4. Segment the customers based on the age, gender, interest. Customer segmentation is an important practise of dividing customers base into individual groups that are similar. It is useful in customised marketing. (Dataset Link: https://www.kaggle.com/shwetabh123/mall-customers)
5. Build a model can be used to differentiate healthy people from people having Parkinson's disease. The algorithm that is useful for this purpose is XGboost which stands for extreme gradient boosting, it is based on decision trees. (Dataset Link: https://archive.ics.uci.edu/ml/datasets/parkinsons)
6. Perform various different machine learning algorithms like regression, decision tree, random forests, etc and differentiate between the models and analyse their performances on wine quality dataset. (Dataset Link: https://archive.ics.uci.edu/ml/datasets/wine+quality)
7. Build a model that can identify your emails as spam or non-spam. (Dataset Link: https://archive.ics.uci.edu/ml/datasets/Spambase)
8. Use k-means clustering to build a model to detect fraudulent activities. (Dataset Link: https://www.cs.cmu.edu/~enron/)
9. Build an SVM model which can detect whether a restaurant's review is fake or real. (Dataset Link: https://www.yelp.com/dataset)
10. Build a Reinforcement Learning-Based Path Optimization Using Q-Learning in a Gridworld Environment
11. Build a product recommendation system. (Dataset Link: https://cseweb.ucsd.edu/~jmcauley/datasets.html)
12. Perform Sentiment analysis on the data to see the statistics of what type of movie do users like. (Dataset Link: http://ai.stanford.edu/~amaas/data/sentiment/)

LEARNING RESOURCES

TEXTBOOKS:

1	https://towardsdatascience.com/tagged/projects
2	https://www.analyticsvidhya.com
3	https://www.kaggle.com

R23MCIVAT02	ENVIRONMENTAL STUDIES					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	NIL	**2**	**0**	**0**	**0**

Course Objective

This course aims to impart a deep understanding of environmental processes, climate change, biodiversity, ecosystem functionality, and lifestyle impacts. Equipped with this knowledge, students will advocate for climate mitigation and combat climate change effectively.

Course Outcomes: After completing this course, the students will be able to

1	Develop comprehensive environmental management and conservation plans (**BL6**)
2	Create programs for energy, water conservation, and waste reduction. (**BL6**)
3	Formulate proposals for combating climate change (**BL6**)
4	Develop models to study climate dynamics and impacts (**BL6**)
5	Develop strategies to mitigate climate change impacts (**BL6**)

SYLLABUS

Unit I	**INTRODUCTION TO ENVIRONMENTAL STUDIES**	**5 hr**

Biodiversity and ecosystem functionality; Natural resources; Environmental pollution; Environmental episodes; Environmental legislation.

Unit II	**LIFE STYLE FOR ENVIRONMENT**	**5 hr**

Sustainability Challenges; Save Energy; Save Water; Reduce waste; Healthy Lifestyles.

Unit III	**INTRODUCTION TO CLIMATE CHANGE**	**5 hr**

Carbon cycle; Earth's Climate System; Weather and Climate; Understanding Microclimate; Policy initiatives to Combat Climate Change.

Unit IV	**SCIENCE BEHIND THE CLIMATE CHANGE – 1**	**5 hr**

Greenhouse gas effect; Paleoclimate; Energy Balance; Water Cycle; Atmospheric motion.

Unit V	**SCIENCE BEHIND THE CLIMATE CHANGE – 2**	**5 hr**

Ocean changes; Cryosphere dynamics; Volcanoes; Biosphere and climate regulation; Mitigation strategies.

LEARNING RESOURCES

TEXTBOOKS:

1	E. Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, 2nd ed. Hyderabad, India: Universities Press, 2012.
2	J.K. Arora, B.K. Tyagi, K.S. Bath, R. Bal, and S.S. Ladhar, *Activity Book on Climate Change*. Punjab State Council for Science & Technology, 2022.

REFERENCE BOOKS:

1	R. T. Wright and D. F. Boorse, *Environmental Science: Toward a Sustainable Future*, 13th ed. Boston, MA: Pearson, 2017.
2	United Nations Development Programme, *Climate Box. An interactive learning toolkit on climate change*. New York, NY, 2018.

ADDITIONAL REFERENCE MATERIAL

1	https://missionlife-moefcc.nic.in/Download-Creatives-Save-Energy.php?id=MTE=

ONLINE COURSES

1	https://enterprise.edx.org/APSCHE/program/df4909e1-a837-4c49-b575-a909c3990bf8 /progress

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL6	X				
CO2	BL6		X			
CO3	BL6			X		
CO4	BL6				X	
CO5	BL6					X

VII SEMESTER

R23MSCST018	SOFTWARE ENGINEERING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Nil	**3**	**0**	**0**	**3**

Course Objective

This course introduces students to fundamental Software Engineering principles, including software processes, requirements engineering, design, testing, quality assurance, and risk management.

Course Outcomes

After completing this course, the students will be able to

1	Students will have the ability to apply the core concepts of software engineering, including the nature of software, layered technology, and common software myths, to analyze real-world software development scenarios. **(BL3)**
2	Students will have the ability to analyze various software process models to determine their suitability for different types of projects. **(BL4)**
3	Students will have the ability to apply requirements engineering techniques to elicit, document, and validate software requirements and utilize software design models. **(BL3)**
4	Students will evaluate various software testing strategies, assess the effectiveness of black box and white box testing methods, and recommend improvements in testing strategies based on product metrics and testing outcomes to optimize software quality. **(BL5)**
5	Students will have the ability to analyze software project risks and develop strategies for risk mitigation and management. **(BL6)**
6	Students will write the entire software engineering process, assess the effectiveness of each phase from requirements gathering to deployment, and recommend improvements for optimizing the overall workflow and activities involved in software engineering. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO SOFTWARE ENGINEERING**	**8 hr**

The Nature Of Software; Software Engineering - A Layered Technology; Software Engineering Practice; Software Myths; A Generic Process Model, Software Process Framework; Process flow, Identifying Task set, Process pattern; Process Assessment and Improvement (SCAMPI, CMM-IPI,SPICE, ISO 9001:2000); The Capability Maturity Model Integration (CMMI);

Unit II	**PROCESS MODELS & SOFTWARE REQUIREMENTS**	**8 hr**

The Waterfall Model, Incremental Process Models; Evolutionary Process Models: The Prototype Model, Spiral Model; Unified Process, Personal And Team Process Models; Agile Process Model; Feasibility Studies, User Requirements and System Requirements; Functional and Non - Functional Requirements; The software requirements document; Requirements engineering processes;

Unit III	**REQUIREMENTS ENGINEERING & DESIGN ENGINEERING**	**8 hr**

Establishing The Groundwork, Requirements Elicitation; Requirement Analysis - DFD, Data Dictionaries; Developing Use Cases, Use Case Diagrams; Requirements Negotiation and Validation; Requirements Management; Preparation of SRS; Design Concepts - Abstraction, Architecture, Patterns, Separation of concerns and Modularity ;The Design Model - Data Design Elements, Architectural Elements-Interface, Component and Deployment design elements;

Unit IV	**TESTING STRATEGIES & METRICS**	**8 hr**

A Strategic Approach to Software Testing, Test Strategies for Conventional Software -

Unit and Integration Testing; Testing Strategies - Validation Testing, System Testing; Black Box Testing - Graph-Based Testing Methods; White box testing - Basis path testing;A Framework for Product Metrics - Measures, Metrics, and Indicators; Metrics for the Requirements Model - Function-Based Metrics; Metrics for the Design Model-Architectural Design Metrics and Metrics for Source Code; Metrics for Testing;		
Unit V	**QUALITY MANAGEMENT & RISK MANAGEMENT**	**8 hr**
Quality Management - Software Quality (McCall's software quality factors) ; Review Techniques - Informal and Formal Review Techniques; Software Quality Assurance - Elements of SQA, SQA Tasks, Goals and Metrics; Statistical SQA, ISO 9000 Quality Standards; Reactive vs. Proactive Risk Strategies; Software Risks; Risk Identification; Risk Projection, Risk Refinement; RMMM Plan;		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th Edition, McGrawHill International Edition.	
2	Software Engineering- Sommerville, 7th edition, Pearson education.	
REFERENCE BOOKS:		
1	Software Engineering- K.K. Agarwal & Yogesh Singh, New Age International Publishers	
2		
ADDITIONAL REFERENCE MATERIAL		
1	https://ocw.mit.edu/courses/16-355j-software-engineering-concepts-fall-2005/pages/lecture-notes/	
2		
ONLINE COURSES		
1	https://nptel.ac.in/courses/106101061	
2		

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X	X			
CO2	BL4		X			
CO3	BL3			X		
CO4	BL5				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23MSCST022 (DSC-E4)	DEEP LEARNING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Machine Learning	**3**	**0**	**0**	**3**

Course Objective

Students will have the ability to understand neural network architectures, including mathematical foundations, deep learning models, convolutional and recurrent networks, and object detection techniques, equipping learners with the skills to design and apply advanced solutions to real-world problems.

Course Outcomes

1	Students will be able to **apply** different active functions and solve various problems using feed forward and multi-layer feed forward neural networks. **(BL3)**
2	Students will be able to **analyze** the structure and dimensionality of tensors and **examine** the effectiveness of optimization methods like AdaGrad, RMSProp, and Adam in improving training performance. **(BL4)**
3	**Students will be able to evaluate** the architectural differences and strengths of AlexNet, VGG16, and GoogLeNet in addressing real-world challenges. **(BL5)**
4	Students will be able to **apply** modern RNN architectures like GRU, LSTM, and Bidirectional RNNs to model complex sequential data effectively. **(BL3)**
5	Students will be able to **examine** the role of anchor boxes in improving object detection across different scales and aspect ratios.**(BL4)**
6	Students will be able to **build** various deep learning models real-world applications. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO ARTIFICIAL NEURAL NETWORKS AND FUNCTIONAL UNITS**	**8 hr**

Introduction to Biological and Artificial Neural Networks; Models of Neuron, Topology; Basic Learning Laws; Learning methods: Hebbian, Competitive and Error-correction Learning; Basic Functional Units: Pattern recognition task; Pattern Classification Network: perceptron; Perceptron representation problem: Linear inseparability; Generalized Delta Rule: Back propagation Algorithm.

Unit II	**MATHEMATICAL BLOCKS OF NEURAL NETWORKS, DEEP NEURAL NETWORKS**	**8 hr**

Data representation of neural networks: Scalars (0D tensors),Vectors (1D tensors), Matrices (2D tensors), 3D tensors and higher-dimensional tensors, Tensor Attributes; Real-world examples of data tensors (Vector data, Time series data, Image data, Video data); Tensor operations: Element-wise operations, Broadcasting, Tensor dot, Tensor reshaping; The engine of neural networks: Gradient-based optimization; Introduction to Deep Learning : Advances in network architecture, layer type, neuron types and Hybrid Structures and From feature engineering to automated feature learning; Tensorflow, keras, Google collaborators exploration, tensor operations; Optimization methods for neural networks (AdaGrad, RMSProp, Adam); Model Build and compile with built-in MNIST dataset for classification.

Unit III	**CONVOLUTIONAL NEURAL NETWORKS**	**8 hr**

From Fully-Connected Layers to Convolutions; Convolutions for Images; Padding and Stride; Multiple Inputs and Outputs Channels; Pooling (Max, Average); Deep Convolutional Neural Network Architectures – AlexNet; Deep Convolutional Neural Network Architectures – VGG16 Architecture with Application; Networks with Parallel Concatenations: GoogLe Net.

Unit IV	**RECURRENT NEURAL NETWORKS**	**8 hr**

Batch Normalization; Residual Networks (ResNet18); Sequence Models; Text Pre-processing; Recurrent Neural Networks; Modern Recurrent Neural Network: Gated Recurrent Unit (GRU); Long Short-Term Memory (LSTM); Bidirectional Recurrent Neural Networks.		
Unit V	**OBJECT DETECTION**	**8 hr**
Encoder-Decoder Architecture; Sequence to Sequence Learning; Object Detection – Bounding Boxes; Anchor boxes; Multi Scale Object Detection; Object Detection Dataset with application; Single Shot Multibox Detection; Region-based CNNs (Fast and Faster R-CNNs).		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Yegnanarayana, B., "Artificial Neural Networks" PHI Learning Pvt. Ltd, 2009 (UNIT-I)	
2	Goodfellow, I., Bengio,Y., and Courville, A., "Deep Learning", MIT Press, 2016. (UNIT II)	
3	Franchois Chollet, Deep Learning with Python (UNIT II)	
4	Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, "Dive into Deep Learning", 2021 (UNIT-III, UNIT-IV, UNIT-V)	
REFERENCE BOOKS:		
1	Deep Learning: A Practitioner's Approach by Adam Gibson and Josh Patterson Shroff/O'Reilly; First edition (2017)	
2	Python Deep Learning by Daniel Slater and Gianmario Spacagna, Packt Publishing; 2/e (January 16, 2020)	
ADDITIONAL REFERENCE MATERIAL		
1	https://www.geeksforgeeks.org/deep-learning-tutorial/	
2		
ONLINE COURSES		
1	https://onlinecourses.nptel.ac.in/noc25_cs21/preview	
2	https://onlinecourses.nptel.ac.in/noc25_ee16/preview	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL4		X			
CO3	BL5			X		
CO4	BL3				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23MSCST024 (DSC-E4)	DATA ANALYTICS AND TOOLS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Database, Operating Systems	**3**	**0**	**0**	**3**

Course Objective

This course aims to provide students with a comprehensive understanding of Big Data concepts, frameworks and tools. It focuses on the principles of handling, processing, and analyzing large-scale datasets using modern technologies. By exploring tools such as Hadoop, NoSQL databases, Spark for handling data streams learners will be able to derive actionable insights from Big Data.

Course Outcomes

After completing this course, the students will be able to

1	Apply the concepts of Big Data to identify and solve real-world data processing problems. **(BL3)**
2	Can interpret and summarize unstructured data with No SQL. **(BL3)**
3	Analyze Hadoop and Map Reduce framework associated with big data in a distributed environment. **(BL4)**
4	Process and Analyze large datasets with PIG and retrieve from a data warehouse using Hive. **(BL4)**
5	Handle streaming data from various sources using spark and transformations on RDD for efficient storage. **(BL4)**
6	Fully appreciate big data handling techniques using the latest open source tools for data analytics. **(BL6)**

SYLLABUS

Unit I	**BIG DATA AND REAL TIME APPLICATIONS**	**8 hr**

What is Big Data, Convergence of Key trends; Variety of Data, Unstructured Data; Industry examples of Big Data; Big Data and Marketing; Fraud and Big Data, Risk and Big Data; Credit risk management, Big Data and Algorithmic trading; Big Data and healthcare & medicine; Cloud and Big Data. **(BL2)**

Unit II	**NO SQL - UNSTRUCTURED DATABASES**	**8 hr**

Introduction to No SQL; Aggregate data models & relationships; Key-value and Document data models; Graph Databases and Schema less Databases; Distribution models; Sharding & Replication; CAP theorem; Version stamps

Unit III	**HADOOP DISTRIBUTED FILE SYSTEM**	**8 hr**

Introduction to Hadoop, Open Source Technologies; Data storage and Analysis; Comparison with Other Systems; Architecture of Hardtop distributed file system (HDFS); HDFS Concepts; Map Reduce Architecture; Case study of Weather Dataset; JAVA Interface & Data Flow

Unit IV	**PIG and HIVE**	**8 hr**

Big Data Applications Using PIG; Anatomy of PIG; Data processing operations in PIG; Tuple, Maps and UDFs; Big Data Applications using Hive; Hive Architecture; Hive QL – DDL, DML; Tables, Partitioning & Bucketing

Unit V	**SPARK STREAMING**	**8 hrs**

Apache Spark- Advantages over Hadoop, Spark Features; DAG; Spark Context & Spark Session; RDD, Transformations & Actions; Working with Timestamps, Nulls, Complex Types; Spark Functions; Spark Streaming; Sliding & Tumbling Windows

LEARNING RESOURCES

TEXTBOOKS:

1	Big Data, Big Analytics: Emerging, Michael Minnelli, Michelle Chambers, and Ambiga Dhiraj
2	SPARK: The Definitive Guide, Bill Chambers & Matei Zaharia, O'Reilley, 2018Edition

3	P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World Polyglot Persistence", Addison-Wesley Professional, 2012
4	Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012
REFERENCE BOOKS:	
1	"Hadoop Operations", O'Reilley, Eric Sammer, 2012
2	"Programming Hive", O'Reilley, E. Capriolo, D. Wampler, and J. Rutherglen, 2012
3	"Programming Pig", O'Reilley, Alan Gates, 2011
4	Big Data And Analytics, Seema Acharya, Subhashini Chellappan, Wiley

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL4			X		
CO4	BL4				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23MSCST035 (DSC-E4)	IoT DEVELOPMENT BOARDS AND ITS INTERFACING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Principles of IoT	**3**	**0**	**0**	**3**

Course Objective:

Upon completing this course, students will be able to design, develop, and implement innovative IoT projects using Arduino and Raspberry Pi platforms, integrating various sensors, actuators, and I/O devices. They will learn to program and interface with Arduino Uno R3, ESP8266, ESP32, and Raspberry Pi, and develop skills in Python programming, Linux command line, and IoT protocols. Students will also analyze data from sensors and design control systems for real-world applications.

Course Outcomes: Students will be able to

1	Apply the fundamental concepts of Arduino Uno R3, ESP8266, and ESP32 for interfacing digital, analog, and communication peripherals using Arduino IDE and alternative development platforms. **(BL3)**
2	Analyse and implement structured programs using Arduino programming constructs, libraries, and functions to control digital and analog devices in embedded applications. **(BL4)**
3	Apply knowledge of various sensors, actuators, and I/O devices to develop embedded applications for data acquisition, motion control, and environmental monitoring. **(BL3)**
4	Examine and configure Raspberry Pi for IoT applications by setting up the operating system, programming GPIOs, and interfacing basic sensors and actuators. **(BL4)**
5	Evaluate different interfacing techniques for Arduino Uno R3, ESP8266, ESP32, and Raspberry Pi to implement real-time embedded applications. **(BL5)**
6	Design and develop IoT-based embedded systems by integrating Arduino, ESP8266, ESP32, and Raspberry Pi with various sensors, actuators, and communication modules to address real-world challenges. **(BL6)**

SYLLABUS

Unit I	**ARDUINO UNO R3, ESP8266, ESP32 AND ARDUINO IDE**	**8 hr**

Introduction to Arduino, Arduino Uno R3 board, Digital GPIOs, PWM and Analog pins in Arduino Uno R3; Power pins, Serial communication and I2C in Arduino Uno R3; NodeMCU ESP8266 – MCU, GPIOs, ADC, PWM, I2C, SPI; NodeMCU ESP32 – MCU, GPIOs, ADC, PWM, I2C, SPI; Introduction to Arduino IDE, setting up the Arduino board, ESP8266, and ESP32; Creating sketches, using Libraries – built-in and external, using example codes; Debugging and monitoring using the Serial monitor – Data logging and monitoring; Additional Tools and Software for Development-Introduction to PlatformIO (Alternative to Arduino IDE), MicroPython for ESP8266 and ESP32 (Alternative to Arduino C).

Unit II	**PROGRAMMING OF ARDUINO**	**8 hr**

Structure- Sketch, Control structure, additional syntax, and various operators; Variables- Constants, data types and conversions; Basic Functions- Digital and Analog I/O, advanced I/O; Mathematical and Trigonometric, Random numbers, Characters; Bits and Bytes, Serial and Stream, Keyboard and USB; Libraries and Functions – Liquid crystal, Servo, Stepper; Libraries and Functions – Software Serial, Wi-Fi, Wire and SPI; Programming examples- Basic, digital, analog, communication, control, sensors and display.

Unit III	**SENSORS, ACTUATORS, AND I/O DEVICES**	**8 hr**

LEDs, Switch, Push buttons, LCD and Seven segment display; DC motor, Stepper motor, Servo motor; Temperature sensor LM35, DHT11, Soil moisture sensor; IR

sensor, PIR sensor, Ultrasonic sensor; Gas sensors- MQ-2, MQ-3 and MQ-135, Rain detection sensor; Motor drivers- L293D, L298N, ULN2003A, Relay, Analog Joystick; Bluetooth module HC-05, ESP8266-01 (WiFi module); GPS & GSM Module, MPU6050 Accelerometer and Gyroscope sensor.		
Unit IV	**EXPLORING RASPBERRY PI FOR IOT**	**8 hr**
Overview of Raspberry Pi – Evolution, board variants, GPIO pins, applications; Setting Up Raspberry Pi – OS installation, initial configurations, SSH, VNC; Linux Command Line for IoT – Basic shell commands and file management; Python Programming for Raspberry Pi – GPIO programming and basic Python libraries; Understanding GPIO and Interfacing Basics – Digital I/O, PWM and serial communication; Interfacing LEDs, Buzzers, and Buttons – Basic control applications; Using Sensors with Raspberry Pi – DHT11 (temperature) and LDR (light sensing); Basic GPIO-based prototype – Fading an LED using PWM, reading the state of the button, and reading values from the LDR.		
Unit V	**INTERFACING WITH ARDUINO UNO R3, ESP8266, ESP32 & RASPBERRY PI**	**8 hr**
LCD 16x2 and 7-Segment display interfacing With Arduino Uno; LM35 and DHT11 interfacing with Arduino UNO; PIR and Ultrasonic sensor interfacing with Arduino Uno; Soil moisture and rain detection sensor interfacing with Arduino Uno; DC motor and servo motor interfacing with Arduino UNO; Stepper Motor Interfacing with Raspberry Pi; GPS Module Interfacing with Raspberry Pi; MPU6050 (Accelerometer + Gyroscope) Interfacing with Raspberry Pi; MQ2 and MQ135 interfacing with Raspberry Pi; Pi Camera module interface with Raspberry Pi.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	"Arduino Cookbook" by Michael Margolis	
2	"Programming Arduino: Getting Started with Sketches" by Simon Monk	
3	"Raspberry Pi Cookbook: Software and Hardware Problems and Solutions" by Simon Monk	
4	"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things" by David Hanes and Gonzalo Salgueiro	
REFERENCE BOOKS:		
1	"Internet of Things: Principles and Paradigms" by Rajkumar Buyya, Amir Vahid Dastjerdi, and editors	
2	"Practical Electronics for Inventors" by Paul Scherz and Simon Monk	

Bloom's level - Unit's catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X	X	X		
CO2	BL4		X			
CO3	BL3	X	X	X		
CO4	BL4			X	X	
CO5	BL5	X			X	X
CO6	BL6	X	X	X	X	X

R23MSCST039 (DSC-E4)	ENTERPRISE NETWORKING, SECURITY AND AUTOMATION (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Routing and switching concepts	**3**	**0**	**0**	**3**

Course Objective

To enable students to design, implement, troubleshoot, and secure Enterprise networks using advanced technologies and protocols.

Course Outcomes

1	Students will be able to **Analyze** and configure single-area OSPF networks and implement appropriate Access Control Lists (ACLs) to manage network traffic securely. **(BL4)**
2	Students will be able to **evaluate** NAT techniques and WAN options to determine the most effective solutions for network scalability. **(BL5)**
3	Students will be able to **Analyze** VPN types and QoS models to optimize secure and efficient data transmission. **(BL4)**
4	Students will be able to **Design** scalable network architectures, troubleshoot network issues effectively, and deploy virtualization technologies to enhance network efficiency. **(BL6)**
5	Students will be able to **Develop** automated network configurations using modern tools and secure network infrastructures against common cyber security threats. **(BL6)**
6	Students will be able to **Design and implement,** and secure advanced network solutions incorporating OSPF, ACLs, NAT, WAN technologies, VPNs, QoS mechanisms, virtualization, automation, and security practices to address real-world networking challenges. **(BL6)**

SYLLABUS

Unit I	**OSPF AND ACLs**	**8 hr**

OSPF Features, Characteristics and OSPF Packets; OSPF Operation, Router ID; Point-to-Point OSPF Networks, Multiaccess OSPF Networks; Modify Single-Area OSPFv2, Default Route Propagation; ACLs, Purpose of ACL, ACL operation; Wildcard mask in ACL, Guidelines for creating ACLs; Standard ACLs; Extended ACLs;

Unit II	**NAT AND WAN**	**8 hr**

What is NAT, How NAT works, NAT terminology; Types of NAT, Advantages and Disadvantages of NAT; Static NAT, Dynamic NAT; PAT, NAT64; Purpose of WANs, WAN Operations; Traditional WAN Connectivity; Modern WAN Connectivity; Internet-Based Connectivity;

Unit III	**VPN AND QOS**	**8 hr**

VPN Technology; Types of VPNs; IPsec; Introduction to QOS Concepts: Network Transmission Quality; Traffic Characteristics, Queuing Algorithm: FIFO; Queuing Algorithms: WFQ, CBWFQ, LLQ; QoS Models; QoS Implementation Techniques;

Unit IV	**NETWORK DESIGN, NETWORK TROUBLESHOOTING AND NETWORK VIRTUALIZATION**	**8 hr**

Hierarchical Networks; Scalable Networks; Switch Hardware; Network Documentation, Troubleshooting Process ; Cloud Computing; Virtualization; Virtual Network Infrastructure; Software-Defined Networking;

Unit V	**NETWORK AUTOMATION, NETWORK SECURITY CONCEPTS**	**8 hr**

Automation Overview, Data Formats; APIs, REST; Configuration Management; IBN and Cisco DNA Center; Current State of Cybersecurity, Threat Actors, Threat Actor Tools; Malware, Common Network Attacks; IP Vulnerabilities and Threats; TCP and UDP Vulnerabilities, IP Services.

LEARNING RESOURCES	
TEXTBOOKS:	
1	Enterprise Networking, Security, and Automation Companion Guide CCNAv7, Cisco Press
REFERENCE BOOKS:	
1	CCNA 200-301 Official Cert Guide Library, Authors: Wendell, Odom
2	Computer Networking: Principles, Protocols, and Practice, Author: Olivier Bonaventure
ONLINE COURSES	
1	www.netacad,com

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL5		X			
CO3	BL4			X		
CO4	BL6				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R23MSCST023 (DSC-E5)	NATURAL LANGUAGE PROCESSING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	**Finite Automata, Basic Neural Networks**	**3**	**0**	**0**	**3**

Course Objective

Students will gain understanding of natural language processing techniques, gain exposure to neural network language models and information extraction applications.

Course Outcomes

1	Will be able to **identify** various applications of NLP models, the phases of NLP model and steps to build NLP mode for text data. **(BL3)**
2	Will be able to **explain** N-gram model and classifiers like Naïve Bayes text processing techniques and **evaluate** them. **(BL5)**
3	Will be able to **explain** vector semantics and transformer architecture and **asses** the model and **justify** the use of the model. **(BL5)**
4	Will be able to **elaborate** large language models and masked language models and **adopt** them for advanced technologies. **(BL5)**
5	Will be able to **choose** the required NLP technique and **evaluate** them in the real-world application and asses the ethical issues in NLP. **(BL5)**
6	Will be able to **choose** the apt models and **combine** the NLP techniques to find **solutions** for real-world problems that involve text data. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO NATURAL LANGUAGE PROCESSING**	**8 hr**

Introduction to Natural Language Processing, Brief History of NLP; Applications of NLP; Phases of NLP; Basic steps to build an NLP Pipeline; Regular Expressions - Basic Regular Expression Patterns, A Simple Example, Lookahead Assertions; Word, Corpora, Word and sub-word Tokenization; Word Normalization, Lemmatization and Stemming, Sentence Segmentation; Minimum Edit Distance;

Unit II	**N-GRAM LANGUAGE MODELS, NAÏVE BAYES AND SENTIMENT CLASSIFICATION**	**8 hr**

N-Grams- Introduction, The Markov assumption; How to estimate probabilities, Dealing with scale in large n-gram models; Evaluating Language Model- Training and Test Sets, Perplexity; Smoothing-Laplace Smoothing, Add-k smoothing; Naive Bayes Classifiers-Introduction; Worked Example, Optimizing for Sentiment Analysis; Naive Bayes for other text classification tasks, Naive Bayes as a Language Model; Evaluation: Precision, Recall, F-measure; Test sets and Cross-validation;

Unit III	**VECTOR SEMANTICS AND EMBEDDINGS, THE TRANSFORMER**	**8 hr**

Vector Semantics and Embeddings- Lexical Semantics, Vector Semantics; Words and Vectors, Cosine for measuring similarity; TF-IDF: Weighing terms in the vector; Word2vec, Evaluating Vector Models;

The Transformer-Introduction to Transformer, Transformer Model; Attention – simplified version of attention; Single headed attention and multi-headed attention; Transformer Blocks;

Unit IV	**LARGE LANGUAGE MODELS, MASKED LANGUAGE MODELS**	**8 hr**

Large Language Models-Introduction to Large Language Models, Large Language Models with Transformers; Sampling for LLM Generation - Top-k sampling; Pretraining Large Language Models - Self-supervised training algorithm; Pretraining Large Language Models-Training corpora for large language models, Evaluating Large Language Models;

Masked Language Models-Bidirectional Transformer Encoders- The architecture for

bidirectional masked models; Fine-Tuning for Classification; Fine-Tuning for Sequence Labelling: Named Entity Recognition- Named Entities, BIO Tagging; Sequence Labelling, Evaluating Named Entity Recognition;		
Unit V	**APPLICATIONS OF NLP, CASE STUDY, ETHICAL ISSUES IN NLP**	**8 hr**
Introduction to Chatbots; Building Chatbot with BOT Press; WordNet-Introduction, WordNet Hierarchy; WordNet- Lexical Relations, Semantic Similarity; Sequence Labelling for Parts of Speech and Named Entities Part-of-Speech Tagging, Named Entities and Named Entity Tagging; Hidden Markov Model (HMM), HMM Part-of-Speech Tagging; Case Study- ChatGPT; Ethical issues in NLP: Bias, Fairness, and Data Privacy		

LEARNING RESOURCES

TEXT BOOKS:	
1	"Speech and Language Processing, An Introduction to Natural language processing, Computational Linguistics and Speech Recognition"-Daniel Jurafsky, James H Martin,3rd Edition.
2	"Natural Language Processing with Python"-Steven Bird, Ewan Klein, and Edward Loper, O'REILLY Publications.
REFERENCE BOOKS:	
1	"Handbook Of Natural Language Processing", - Nitin Indurkhya Fred J. Damerau, CRC PRESS, Second Edition 2010.
2	"Foundations of Statistical Natural Language Processing."- Manning, Christopher D., and Hinrich Schütze, Cambridge, MA: MIT Press, 1999. ISBN: 0262133601.
ADDITIONAL REFERENCE MATERIAL	
1	https://www.geeksforgeeks.org/natural-language-processing-nlp-tutorial/
2	https://www.javatpoint.com/nlp
3	https://www.ibm.com/topics/natural-language-processing
4	https://www.geeksforgeeks.org/phases-of-natural-language-processing-nlp/
5	https://botpress.com/blog/how-to-build-your-own-ai-chatbot
ONLINE COURSES	
1	https://www.coursera.org/specializations/natural-language-processing
2	https://onlinecourses.nptel.ac.in/noc21_cs102/preview
3	Data Science: Natural Language Processing (NLP) in Python | Udemy

Bloom's level - Units catchment articulation matrix.

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				X
CO2	BL5		X			X
CO3	BL5			X		X
CO4	BL5				X	X
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST025 (DSC-E5)	MEAN STACK WEB DEVELOPMENT (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Object Oriented Programming	**3**	**0**	**0**	**3**

Course Objective

Students will get exposure jquery and DOM manipulation and get adequate idea about asynchronous web development using NODE, Angular, Express Framework and Mongo

Course Outcomes

1	Students Will be able to able to build front end webpages by using jQuery on existing HTML and CSS and be able to learn document traversal and event handling.
2	Students Will be able to Design web pages using Bootstrapping, and able to develop Rich interfaces and dynamic web applications using Angular JS.
3	Students Will be able to examine the web applications on server side and appraise light weight asynchronous event driven node applications using NODE JS.
4	Students Will be able to experiment and deploy the web applications using frameworks like Express.
5	Students Will be able to distinguish sql and nosql, and use mongo to fetch and filter the data and compare the scalability and performances.
6	Students Will be able to develop and design fast, rich and robust web applications using MEAN STACK technologies.

SYLLABUS

Unit I	**JQUERY**	**8 hr**

JQUERY introduction: what is jquery, advantages, features; Environment setup, start using JQUERY; jquery selectors; jquery methods

Jquery DOM manipulation: DOM manipulation; Traversing elements; CSS manipulation; Events.

Unit II	**BOOTSTRAP & ANGULAR JS**	**8 hr**

Introduction to Bootstrap, Bootstrap features and benefits, Buttons, cards; Bootstrap Tables, alerts, Carousel, alerts, Forms;Introduction to angular, Angular features, MVC, installation; Expressions, directives, data binding; Controllers, Modules, scope; Filters, Tables;Angular Forms, Services;Routing, AngularJS Login application;

Unit III	**NODE JS**	**8 hr**

Node JS Basics: Introduction to Node Js, Architecture of Node JS Application, Applications; Environment set up, NPM, REPL; Node JS modules, export; Node JS first application, Node JS important functions and execution steps; Blocking & Non-Blocking, call back concept

Node JS advanced: Node JS promises,Node js events; event loop and event emitter; buffers and streams; Node JS web server, handling HTTP request, sending json response.

Unit IV	**EXPRESS JS WEB FRAMEWORK**	**8 hr**

Express: Express introduction, Environment setup, Hello world; Exploring folder structure, Running Express application; Express routing; Http Methods; URL Building

Express advanced: Express middleware; template Engines; Express static files handling, Express form data and database connectivity (post and retrieve);

Unit V	**MONGO DB,NO SQL**	**8 hr**

Mongo DB Introduction, Basic queries: Introduction to MongoDB (No-sql), installation and environment set up, sql Vs mongo; features and benefits of mongo; Mongo db datatypes, object id; Database collection document; Mongo CRUD operations; insert

and types, and filtering; logical operators, comparison operators; Aggregations, validations; indexing.	
LEARNING RESOURCES	
TEXTBOOKS:	
1	Mean Web development , Amos Q & Haviv (PACKT publications)
2	Write Modern Web apps with Mean Stack Jef Dickey
REFERENCE BOOKS:	
1	JavaScript and jQuery: Interactive Front-End Web Development" by Jon Duckett
2	Beginning Web Development using MEAN by Greg Lim
ADDITIONAL REFERENCE MATERIAL	
1	https://www.tutorialspoint.com/bootstrap/index.htm
2	Pro Mean Web development By Elad Elrom.
3	"Head First jQuery" by Ryan Benedetti and Ronan Cranley
ONLINE COURSES	
1	https://www.coursera.org/specializations/mean-stack-developer-mongodb-expressjs-angularjs-nodejs
2	https://www.edx.org/learn/mean-stack

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X			
CO3	BL4			X		
CO4	BL3				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R23MSCST027 (DSC-E5)	TIME SERIES ANALYSIS IN DATA SCIENCE (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Probability & Statistics, Statistical predictive analytics, Python programming	**3**	**0**	**0**	**3**

Course Objective

1. To be acquire basic require knowledge, understand and analyse the components of time series with different structures in time series analysis.
2. To learn to perform trend analysis, seasonal indices analysis, cyclical variations and random components.
3. To acquire the basic require knowledge to smooth the data and apply various smoothing methods for data analysis.
4. To learn and construct, design skills and knowledge in communicating statistical techniques for mathematical and computer models for conducting time series analysis of any phenomenon in scientific data analysis.
5. To be acquire construct time series models and analyse, forecast with different scientific methods and trained to get cutting edge of knowledge in time series analysis and applications.

Course Outcomes

1	To acquire basic require knowledge of the components of time series with different structures in time series analysis and perform trend analysis, seasonal indices analysis, cyclical variations and random components. **(BL3)**
2	To learn and construct, design skills and knowledge in communicating statistical techniques for mathematical and computer models for conducting time series analysis of any phenomenon in scientific data analysis. **(BL4)**
3	To acquire the basic require knowledge to smooth the data and apply various smoothing methods for data analysis. **(BL4)**
4	To understand of the components of time series with different structures in time series analysis and perform trend analysis, seasonal indices analysis, cyclical variations and random components. **(BL5)**
5	To able to understand and construct, design skills and knowledge in stochastic processes in time series data and Monrovian process, transition probabilities. **(BL5)**
6	To able to understand the smooth of data and various smoothing methods for time series data in real world problems. **(BL6)**

SYLLABUS

Unit I	**TIME SERIES ANALYSIS - COMPONENTS**	**8 hr**

Introduction to Time Series and Forecasting; Different types of Data-Internal structures of time Series-Models for time series analysis; Graphical Displays Time Series Plots and plotting Smoothed Data; Numerical Description of Time Series Data; Use of Data Transformations and Adjustments; Components of time series- secular trend and seasonal; cyclic and random variations; Nature and uses of forecasting-Forecasting Process-Data for forecasting.

Unit II	**LEAST SQUARES ESTIMATES, FORECASTING AND TESTING**	**8 hr**

Linear trend – graphical method; semi averages-moving averages; least squares method; General model of time Series Data- Least Squares Estimation in Linear supervised Models; Generalized and Weighted Least Squares; Discounted Least Squares; Estimating the Parameters in Time Series Regression Models; Confidence Intervals on the Mean Response; Prediction of New Observations.

Unit III	TIME SERIES- SEASONAL VARIATIONS AND MODEL	8 hr
General Approach to Time Series Modeling and Forecasting; Monitoring- Evaluating-Forecasting – Performance of seasonal variations; Spectral densities their properties; Exponential Smoothing for Seasonal Data; Methods of seasonal variations in time series - simple average method; ratio to trend method; ratio to moving averages method; principle of link relatives.		
Unit IV	**STOCHASTIC PROCESSES FOR TIME SERIES DATA**	**8 hr**
Introduction to Stochastic processes, classification of Stochastic processes according to state space and time domain; Mean functions - properties; Covariance functions-properties; Morkov's principle - Countable state Markov chains (MC's); Chapman Kolmogorov equations; calculation of n-step transition probability and its limit; Classification of states and period of a state; Stationary distribution of Markov Chain.		
Unit V	**EXPONENTIAL SMOOTHING OF TIME SERIES DATA**	**8 hrs**
Introduction to discrete parameter stochastic process; Stationary Time Series- Auto covariance and Autocorrelation Functions; The Durbin–Watson Test : Detecting Autocorrelation ; Additive Seasonal Model and Multiplicative Seasonal Model; Exponential Smoothing of Bio surveillance Data; Exponential Smoothers Models- The First-Order Moving Average Process MA(1); Finite Order Autoregressive Processes- First-Order Autoregressive Process, AR(1); Autoregressive Integrated Moving Average (ARIMA) Models.		

LEARNING RESOURCES

TEXTBOOKS:

1	Montgomery, D.C. and Johnson, L.A. (1977): Forecasting and Time Series Analysis, McGraw Hill.
2	Peter Bruce and Andrew Bruce "Practical Statistics for Data Scientists" – 50 Essential Concepts. Published by O'Reilly Media, Inc.,1005 Gravenstein Highway North, Sebastopol, CA 95472.
3	Box, G.E.P. and Jenkins, G.M. (1976): Time Series Analysis –Forecasting and Control. Holden Day, San Francisco.
4	Fundamentals of applied Statistics: VK Kapoor, SP Gupta; S Chand Publishers
5	Fuller, W.A. (1976): Introduction to Statistical Time Series, John Wiley
6	Mark Gardener (2012), Beginning R - The Statistical Programming Language, Wiley India Pvt Ltd.

REFERENCE BOOKS:

1	Anderson, T.W. (1971): The Statistical Analysis of Time Series, Wiley, New York.
2	Anany Levetin - *Introduction to The Design and Analysis of Algorithms*, 3rd Edition, Pearson Education.
3	K.Trivedi.ProbabilityandStatisticswithReliability, Queuing,and ComputerScience Applications. Wiley sons.
4	S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.
5	Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).

ADDITIONAL REFERENCE MATERIAL

1	Chris Eaton, Dirk Deroos, Tom Deutsch et al., "Understanding Big Data", McGrawHIll, 2012. 2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.
2	https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling- maxkuhn-kjell-johnson_1518.pdf
3	https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodolo gy
4	https://ru.b-ok2.org/terms/?q=forecasting

5	https://otexts.com/fpp2/
6	http://home.iitj.ac.in/~parmod/document/introduction%20time%20series.pdf
ONLINE COURSES	
1	https://www.coursera.org/learn/predictive-modeling-analytics
2	https://www.edx.org/course/predictive-analytics
3	https://www.udemy.com/course/machinelearningandlogisticregression/
4	https://www.coursera.org/learn/practical-time-series-analysis
5	https://ocw.mit.edu/courses/economics/14-384-time-series-analysis-fall-2013/downloadcourse- materials/
6	https://swayam.gov.in/nd1_noc19_mg46/preview

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3		X	X		
CO2	BL4	X			X	X
CO3	BL4		X	X		
CO4	BL5			X	X	X
CO5	BL5	X				
CO6	BL6		X	X	X	X

R23MSCST036 (DSC-E5)	AD HOC NETWORKS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Networks	**3**	**0**	**0**	**3**

Course Objective

Students will have the ability to Categorize and compare various protocols in Ad-hoc networks, Wireless Sensor Networks and choose appropriate protocols in order to plan and build a sensor network suitable for particular applications

Course Outcomes

1	Students will be able to compare Cellular and Ad-hoc networks, categorize and compare MAC protocols for MANETs. **(BL4)**
2	Students will be able to categorize and compare various Routing and Transport protocols for MANETs. **(BL4)**
3	Students will be able to appraise the importance of addressing the security and challenges in Ad Hoc wireless networks. **(BL5)**
4	Students will be able to use a variety MAC and Routing protocols for energy efficiency to suit particular applications. **(BL3)**
5	Students will learn to appraise the Quality of Service of Wireless Sensor Networks and use TinyOS for WSNs. **(BL5)**
6	Students will be able to develop a Wireless Sensor Network for different applications using the principles, protocols and tools. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO AD-HOC NETWORKS, MAC PROTOCOLS**	**8 hr**

Ad hoc wireless networks: Introduction to MANETs, Characteristics of MANETs; Cellular and Ad hoc networks, Types of Wireless Networks; Applications of MANETs; Issues and Challenges of MANETs; MAC protocols for Ad hoc Wireless Networks- Issues; Design Goals and Classifications of the MAC Protocols; Contention based - MACAW protocol; Contention based protocols with reservation mechanisms-D-PRMA protocol, Hop Reservation Multiple Access Protocol (HRMA);

Unit II	**ROUTING PROTOCOLS FOR AD-HOC NETWORKS**	**8 hr**

Issues in Designing a Routing Protocol, Classifications of Routing Protocols; Table-Driven Routing protocols-DSDV, WRP, CGSR protocols; On-Demand Routing protocols-DSR, AODV, TORA, LAR protocols; Hybrid Routing protocols-CEDAR, ZRP, ZHLS protocols; Issues and design goals of a Transport layer protocol; TCP over Ad-hoc Wireless Networks-Why Does TCP Not Perform Well in Ad Hoc Wireless Networks; Solutions for TCP over Ad Hoc Wireless Networks-End to End approach: Feedback-Based TCP(TCP-F); Split approach: Split TCP;

Unit III	**SECURITY PROTOCOLS FOR AD-HOC WIRELESS NETWORKS**	**8 hr**

Security in Ad Hoc network-Requirements; Challenges; Network Security Attacks; Key Management- Diffie- Hellman Key Agreement, N-party Diffie- Hellman Key Agreement; The Burmester and Desmedt Protocol, The Ingemarsson Protocol; Security-Aware Ad Hoc routing protocol; Secure Efficient Ad Hoc Distance Vector Routing; Authenticated Routing for Ad Hoc Networks (ARAN);

Unit IV	**WIRELESS SENSORS AND DATA DISSEMINATION**	**8 hr**

The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption; Clustering of Sensors-Regularly placed sensors, Randomly placed sensors; Applications; Classification of WSNs, MAC layer-Design issues; MAC protocols: S-MAC, EAR, STEM protocols; Routing layer-Routing schemes classification; Routing protocols- Directed diffusion, Minimum cost forwarding algorithm; Energy aware routing, CBRP, LEACH, PEGASIS;

Unit V	**SECURITY IN WSNS AND WIRELESS NETWORK SIMULATORS**	**8 hr**

WSN security; Intrusion Detection Systems-Overview, An IDS Architecture for Ad Hoc networks; Quality of Service in Ad Hoc Wireless Networks :Introduction-An example; QoS parameters, issues and challenges in providing QoS in Ad Hoc wireless networks; Classification of QoS solutions; Sensor Network Operating Systems– TinyOS, Imperative Language-nesC; Tiny OS concepts embodied by nesC-Tasks, Events and Commands; Examples, A Blink application implementation in TinyOS;	
LEARNING RESOURCES	
TEXTBOOKS:	
1	Ad Hoc Wireless Networks – Architectures and Protocols, C. Siva Ram Murthy, B. S. Murthy, Pearson Education, 2004
2	Ad Hoc and Sensor Networks – Theory and Applications, Carlos Corderio Dharma P.Aggarwal
REFERENCE BOOKS:	
1	Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp2009
2	Wireless Ad hoc Mobile Wireless Networks – Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008
3	Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001
ONLINE COURSES	
1	http://www.cs.utsa.edu/~korkmaz/teaching/cn-resources/tinyos/tinyosnesc_pres.pdf
2	Microsoft PowerPoint - NS2-tutorial [Compatibility Mode] https://cs.ucf.edu/~czou/CDA6530-11/NS2-tutorial.pdf
3	A Tutorial on the Implementation of Ad-hoc On Demand Distance Vector (AODV) Protocol in Network Simulator (NS-2) https://ar5iv.labs.arxiv.org/html/1007.4065
4	The ns-3 Network Simulator — An Introduction to Computer Networks, desktop edition 2.0.11 https://intronetworks.cs.luc.edu/current/html/ns3.html

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL4		X			
CO3	BL5			X		
CO4	BL3				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MSCST040 (DSC-E5)	FIREWALLS AND VPN (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Networks	**3**	**0**	**0**	**3**

Course Objective

Upon completion of this course, Students will be able to design, implement, and manage Firewall and Virtual Private Network (VPN) solutions to secure network infrastructure and protect against unauthorized access, while ensuring compliance with organizational security policies and industry best practices.

Course Outcomes

1	Students will be able to apply firewall principles and types to configure and implement effective network security solutions.. **(BL3)**
2	Students will be able to Implement firewalls with robust security measures. **(BL3)**
3	Students will be able to Implement, configure, and troubleshoot firewall systems using Smooth-wall, ensuring effective network security. **(BL4)**
4	Students will be able to analyze organizational security requirements and design appropriate VPN solutions, considering factors such as encryption protocols, tunneling methods, and access controls. **(BL4)**
5	Students will be able to Implement Virtual Private Networks using various protocols, technologies. **(BL3)**
6	Students will be able to design and develop innovative firewall and Virtual Private Network (VPN) solutions, integrating various protocols, technologies, and architectures to meet complex security requirements and ensure secure, stable, and optimized connectivity in diverse network environments. **(BL6)**

SYLLABUS

Unit I	**FIREWALL FUNDAMENTALS**	**8 hr**

Introduction to firewall, Need of a Firewall, Zones of Risk; Types of Firewalls, Types of Filtering; Comparison between Firewalls, Placement of Firewalls; Firewall Rules; Authentication, authorization, and accounting (AAA); Monitoring and logging; Limitations of Firewalls, Improving Performance; Downside of encryption with Firewalls, Firewall Enhancement;

Unit II	**FIREWALL DEPLOYMENT AND MANAGEMENT**	**8 hr**

Firewall deployment security strategies; Elements of firewall policy, Software and Hardware Options for firewall; Reverse proxy and port forwarding; Best Practices for Firewall Management, Additional Security Measures; Firewall selection, Buying and Building; Mitigating Threats and Exploits; Tunnelling through a Firewall; Tools for Firewall Management;

Unit III	**FIREWALL IMPLEMENTATION**	**8 hr**

Firewall Implementation Procedure, Incident Response; Troubleshooting common Firewalls; Constructing, configuring and managing a Firewall, Smooth wall; Network Examining and Security needs; Hardware requirements of Smooth wall , Firewall Implementation with Smooth wall; Installing and Configuring a firewall with smooth wall; Elements of Firewall deployment, Performance Testing with Smooth wall; Troubleshooting Smooth wall, Additional Features;

Unit IV	**VPN MANAGEMENT**	**8 hr**

Introduction to Virtual Private Network (VPN); Benefits and Limitation of VPN, Effective VPN policy; VPN deployment Models and architecture; Relation between Encryption and VPNs; VPN authentication and Authorization; Best Practices for VPN management, VPN Policy Development; VPN deployment Plan; VPN threats and Exploits;

Unit V	**VPN TECHNOLOGIES**	**8 hr**

VPN troubleshooting; Software and Hardware VPNs, Layer 2 and 3 VPNs; IPsec, L2TP;

Secure socket layer (SSL, Secure shell (SSH); Establishing Performance and Stability for VPNS; VPNS with NAT; Types of Virtualization; IPV4 vs IPV6;	
LEARNING RESOURCES	
TEXTBOOKS:	
1	J. Michael Stewart, Network security, Firewalls, VPNs,Jones and Bartlett Learning, 3rd edition, 2020
2	J. Michael Stewart, Network security, Firewalls, VPNs,Jones and Bartlett Learning, 2nd edition, 2014.
REFERENCE BOOKS:	
1	Guide to Firewalls & VPNs by Whitman,Michael E.; Mattord,Herbert J.; Green,Andrew,3rd Edition,2011.
2	Basics of Network Security, Firewalls And VPNs, **N**IIT, Publisher , Prentice Hall of India.

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL3		X	X		
CO3	BL4			X		
CO4	BL4				X	
CO5	BL3					X
CO6	BL6	X	X	X	X	X

R23MSCSL009	ANDROID DEVELOPER (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	36	**L**	**T**	**P**	**C**
	Pre-requisite	JAVA Programming	**0**	**0**	**3**	**2**
Course Objective						
Acquire Mobile Application Development skills to develop apps with aesthetic UI and responsive UX.						
Course Outcomes						
1	Design UI with components for user interaction.					
2	Connect the UI components with Backend for data persistence.					
3	Deploy developed apps on Play Store.					
List of Experiments						
1	Introduction to Kotlin Environment					
2	Hands on with Android studio					
3	Build App UI					
4	Use various UI elements and event handling					
5	Display lists using material design					
6	Navigation					
7	Using Jetpack Compose					
8	Loading images from Internet					
9	Data persistence using SQLite/Firebase					
10	Data Access using keys					
11	Work Manager					
12	Views and Compose					
Additional experiments						
1	Develop app using Augmented Reality					
2	Deploy app in Playstore and share					
LEARNING RESOURCES						
LMS for Certification Courses: https://developer.android.com/						
1	Android Basics with Compose					
2	Earn badges for Kotlin, Android Studio, Jetpack Compose, Android s					
ONLINE REFERENCES:						
1	https://developer.android.com/studio					
2	https://developer.android.com/community					

R23MSCSL009	ROBOTIC PROCESS AUTOMATION USING UiPath (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	36	**L**	**T**	**P**	**C**
	Pre-requisite	Flowcharts and Web Crawling	**0**	**0**	**3**	**2**

Course Objective	
Acquire the Robotic Process Automation skills which increase efficiency in an organization with fixed and repetitive workflow.	
Course Outcomes	
1	Create RPA bots and design solutions for repetitive tasks.
2	Automate data migration across multiple applications.
3	Utilize Process automation work flow to complete job with
List of Experiments	
1	Usage of different data types and variables
2	Design of Workflow and passing Arguments
3	Selection using Switch Case and If-Else
4	Iteration using For-each Loop
5	Using Arrays & Generic Values
6	UI Automation using Notepad
7	UI Automation using Word Document
8	Data Migration to and from Spread Sheet
9	Using Regular Expression for Pattern Matching
10	Exception Handling
11	Reading PDF File
12	Web Crawling
Additional experiments	
1	UI Automation, Information Extraction from E-Commerce Website
2	UI Automation, Information Extraction from Travel Website (Ex:
LEARNING RESOURCES	
LMS for Certification Courses:	
1	https://academy.uipath.com/
2	https://academy.uipath.com/learning-plans/rpa-developer-foundation
3	https://academy.uipath.com/learning-plans/rpa-developer-advanced-
ONLINE REFERENCES:	
1	https://docs.uipath.com
2	https://forum.uipath.com

R23MSCSL009	MEANSTACK DEVELOPMENT LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	36	**L**	**T**	**P**	**C**
	Pre-requisite	Java	**0**	**0**	**3**	**2**

Course Objective

1. Understand the architecture and components of the MEAN stack (MongoDB, Express, AngularJS, and Node.js).
2. Learn to create RESTful web services using Node.js and Express.
3. Gain hands-on experience in using MongoDB for data storage and retrieval.
4. Develop dynamic web applications using AngularJS for the frontend.
5. Integrate all components to build full-stack web applications.

Course Outcomes

Upon completion of this lab, students will be able to:

1	Set up and configure a MEAN stack development environment.
2	Design and develop server-side applications using Node.js and Express.
3	Model and interact with MongoDB databases using Mongoose.
4	Create responsive frontend interfaces using AngularJS.
5	Develop and deploy complete MEAN stack web applications.

List of Experiments

1	Setup Lab: Environment setup - Install Node.js, npm, MongoDB, and AngularJS - Create MEAN project structure - Test sample routes and MongoDB connection
2	Basic Node.js Server - Create a simple Node.js server - Handle different routes ("/", "/about", "/contact") - Return plain text or HTML response
3	Express.js API Setup - Set up Express.js server - Create routes: GET /students, POST /students, DELETE /students/:id - Use in-memory array to simulate database
4	MongoDB Integration - Connect Express with MongoDB using Mongoose - Define Student schema and model - Perform CRUD operations with Postman
5	AngularJS Frontend - Basic Setup - Create an AngularJS app with routes and views - Add header, footer, home components - Create a form using AngularJS bindings
6	AngularJS-Express Integration - Use $http service to call Express APIs - Display student list in view - Add form to create new students
7	Update & Delete Operations - Add update and delete functionality - Use AngularJS controllers and services for interaction - Improve UI with Bootstrap (optional)

8	Authentication with JWT - Create login/register APIs in Node.js - Implement JWT-based authentication - Protect Express routes and AngularJS views
9	File Upload (Optional) - Upload and store files using Multer (Node.js) and AngularJS file input - Display uploaded files
10	Deployment - Deploy backend using Render or Heroku - Deploy frontend using GitHub Pages or Firebase Hosting - Use MongoDB Atlas for cloud database
Additional experiments	
1	Capstone Mini Project: Develop a full-stack application such as: - Student Management System - Task Tracker - Blog CMS - Inventory Manager
LEARNING RESOURCES	
LMS for Certification Courses:	
1	
2	
ONLINE REFERENCES:	
1	https://www.geeksforgeeks.org/introduction-to-mean-stack/
2	https://www.tutorialspoint.com/meanjs/index.htm

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VIII SEMESTER

EOEC-E1(Self-Study/MOOCs)

R23MBMCT007	**STRATEGIC MANAGEMENT (CSE,IT,CSIT,AIML,DS,ICB)**					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective

Equip students with the knowledge and skills required to analyze, formulate, and implement strategies that help organizations achieve a competitive advantage and long-term success. The course aims to develop strategic thinking, problem-solving abilities, and decision-making skills necessary for handling complex business challenges.

Course Outcomes

After completing this course, the students will be able to

1	**Design** strategic frameworks that align vision, mission, and objectives with organizational success, considering leadership, stakeholder interests, and overcoming strategic challenges **(BL5)**
2	**Develop** strategies by combining PESTLE, Porter's Five Forces, SWOT, and RBV analysis to leverage external opportunities and internal strengths for competitive advantage. (**BL5)**
3	**Create** innovative strategies at the corporate and business levels, integrating diversification, innovation, global expansion, and sustainability for long-term competitive advantage. (**BL5)**
4	**Design** action plans that align leadership, structure, resources, and performance systems to effectively implement strategies and manage risks. (**BL5)**
5	**Formulate** evaluation systems using tools like Balanced Scorecard and benchmarking to monitor performance, adjust strategies, and ensure long-term success. (**BL5)**
6	**Evaluate** and **synthesize** strategic management concepts to design aligned, adaptive strategies for achieving long-term competitive advantage and assess and strategies based on environmental analysis, implementation, and performance outcomes. (**BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO STRATEGIC MANAGEMENT**	**8 hr**
Definition and Importance of Strategic Management; Levels of Strategy; Strategic Vision and Mission; Strategic Objectives and Goals; Types of Strategies; The Role of Leadership in Strategy; Stakeholder Analysis; Strategic Management Challenges;		
Unit II	**ENVIRONMENTAL AND INDUSTRY ANALYSIS**	**8 hr**
External Environment Analysis; Industry Analysis and Porter's Five Force; Competitive Advantage ; Resource-Based View (RBV); SWOT Analysis; Strategic Group Mapping; Environmental Scanning and Forecasting; Global Environment and Competitive Strategy;		
Unit III	**STRATEGY FORMULATION**	**8 hr**
Corporate Strategy Formulation; Business Level Strategy; Innovation and Strategic Change; Strategic Alliances and Partnerships; Global Strategy Formulation; Diversification Strategies; Value Chain Analysis; Sustainability and Strategic Planning;		
Unit IV	**STRATEGY IMPLEMENTATION**	**8 hr**
Strategic Leadership and Execution; Organizational Structure and Design; Culture and Strategy; Change Management in Strategy Execution ; Resource Allocation and Budgeting; Performance Management and Control; Strategic Communication; Risk Management in Strategy Implementation;		

Unit V	STRATEGY EVALUATION AND CONTROL	8 hr
Strategy Evaluation Process; Strategic Control Systems; Balanced Scorecard; Benchmarking and Best Practices; Corrective Actions and Strategy Adjustment; Strategic Risk and Crisis Management; Sustainability and Long; Term Strategy Evaluation; Emerging Trends in Strategic Management;		
LEARNING RESOURCES		
TEXT BOOKS:		
1	Fred R. David, Strategic Management: Concepts and Cases, 16th Edition Pearson, 2015.	
2	John A. Pearce II, Richard B. Robinson Jr Strategic Management: Theory and Practice.,10th Edition McGraw-Hill Education, 2017.	
REFERENCE BOOKS:		
1	James A. Thompson, Strategic Management: Strategy Formulation and Implementation, 10th Edition Pearson, 2019.	
2.	Charles W. L. Hill, Gareth R. Jones, Strategic Management: An Integrated Approach, 12th Edition Cengage Learning, 2012.	
3	Michael E. Porter, Competitive Strategy: Techniques for Analyzing Industries and Competitors, 1st Edition Free Press, ISBN: 978-0029253609, (1980).	
4	Jay B. Barney, William S. Hesterly, Strategic Management and Competitive Advantage: Concepts and Cases, 6th Edition Pearson, 2019.	
ADDITIONAL REFERENCE MATERIAL		
1.	John E. Gamble, Arthur A. Thompson Jr., A. J. Strickland III, Essentials of Strategic Management, 4th Edition McGraw-Hill Education, 2015.	
2	David A. Aaker, Business Strategy: A Guide to Competitive Advantage, 1st Edition Wiley, 2015.	
3	David J. Collis, Cynthia A. Montgomery Corporate Strategy: A Resource-Based Approach, ,1st Edition McGraw-Hill Education, 2008.	
ONLINE COURSES		
1	**Strategic Management** IIT Kharagpur (Indian Institute of Technology, Strategic Management – NPTEL , Prof. K. K. Awasthi (IIT Kharagpur), **NPTEL website**: www.nptel.ac.in.	
2	https://onlinecourses.nptel.ac.in/noc24_mg112/preview	

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL5		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R23MBMCT008	DIGITAL MARKETING (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective

This course aims to equip students with a comprehensive understanding of digital marketing strategies and tools, enabling them to effectively navigate the online marketplace, optimize digital campaigns, and leverage various digital channels for brand development and customer engagement.

Course Outcomes

After completing this course, the students will be able to

1	Analyze digital marketing strategies to determine their effectiveness in various business contexts. (**BL4**)
2	Evaluate the impact of SEO techniques on website visibility and traffic generation. (**BL5**)
3	Design an integrated email marketing campaign that utilizes automation and social media integration. (**BL6**)
4	Implement social media marketing strategies that foster customer engagement and brand loyalty. (**BL4**)
5	Assess the role of digital transformation in shaping modern marketing practices and strategies. (**BL5**)

SYLLABUS

Unit I	**INTRODUCTION TO ONLINE MARKET**	**8 hr**

Online Market space; Digital Marketing Strategy - Components; Opportunities for building Brand Website; Steps for Planning Brand Website; Planning and Creation; Content Marketing; Types of Content; Metrics for Measuring Content effectiveness.

Unit II	**SEARCH ENGINE OPTIMIZATION**	**8 hr**

Search Engine optimization; Keyword Strategy; SEO Strategy; SEO success factors - On-Page Techniques and Off-Page Techniques; Search Engine Marketing; How Search Engine works; SEM components; PPC advertising and Display Advertisement.

Unit III	**E-MAIL MARKETING**	**8 hr**

E- Mail Marketing; Types of E- Mail Marketing; Email Automation – Lead Generation – Integrating Email with Social Media and Mobile - Measuring and maximizing email campaign effectiveness; Mobile Marketing; Mobile Inventory/channels - Location based and Context based; Coupons and offers; Mobile Apps and Mobile Commerce; SMS Campaigns-Profiling and targeting.

Unit IV	**SOCIAL MEDIA MARKETING**	**8 hr**

Social Media Marketing; Social Media Channels; Leveraging Social media for brand conversations and buzz; Successful / benchmark Social media campaigns; Engagement Marketing; Building Customer relationships; Creating Loyalty drivers; Influencer Marketing.

Unit V	**DIGITAL TRANSFORMATION**	**8 hr**

Digital Transformation; Channel Attribution - Analytics; Ad-words and Email; Mobile; Social Media; Web Analytics; Changing your strategy based on analysis; Recent trends in Digital marketing.

LEARNING RESOURCES

TEXTBOOKS:

1	P. S. Bhatia, *Fundamentals of Digital Marketing*, 1st ed. Pearson Education, 2017.
2	V. Ahuja, *Digital Marketing*. Oxford University Press, 2015.

REFERENCE BOOKS:

1	P. Kotler, *Marketing 4.0: Moving from Traditional to Digital*, 1st ed. Wiley, 2017.

2	D. Ryan, *Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation*. Kogan Page Limited, 2014.
3	D. Barker, S. Bormann, and A. Neher, *Social Media Marketing: A Strategic Approach*, 2nd ed. South-Western, Cengage Learning, 2017
ONLINE COURSES	
1	Swayam :: Digital Marketing
2	Swayam :: Basics of Digital Marketing

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL4	X				
CO2	BL5		X			
CO3	BL6			X		
CO4	BL4				X	
CO5	BL5					X

R23MBMCT009	LOGISTICS AND SUPPLY CHAIN MANAGEMENT (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Nil	**3**	**0**	**0**	**3**

Course Objective

- To understand the role of logistics in the supply chain and its impact on overall operations.
- To identify and analyze key issues in logistics, operations, marketing, procurement, and warehousing.
- To explore the integration of information technology in optimizing logistics and supply chain management.

Course Outcomes

1	Evaluate and integrate advanced SCM concepts to design strategies that improve coordination with suppliers and customers, driving corporate success through sustainable and innovative solutions. (**BL5)**
2	Develop and propose SCM strategies that align with organizational goals, critically assessing procurement, production planning, logistics, and sales to ensure smooth execution across the supply chain. (**BL5)**
3	Design and justify strategies for vendor selection, network optimization, layout design, and process re-engineering, evaluating their impact on supply chain performance and organizational goals. (**BL5)**
4	Adequately skilled in selecting the right model for vehicle routing and scheduling to rise up to the expectations of firms. (**BL5)**
5	Differentiate, comprehend and leverage the type of organizational structures and implement process frame work. (**BL5)**
6	Develop an understanding of the practices, Operational activities, Re-Design, Optimize, Transportation and Organisational structure in SCM. (**BL6)**

SYLLABUS

Unit I	**INTRODUCTION**	**8 hr**

Business Logistics; Supply Chain Overview; Objectives of Business Logistics; Drivers of Supply Chain Management, Strategic Planning; Performance Measurement in Logistics; Role of Information Technology (IT) in Logistics; Supply Chain Risk Management; Ethical Considerations in Supply Chain

Unit II	**MANAGING FLOWS**	**8 hr**

Network Planning and Decision Making; Distribution Network Design and Design Tree; Inventory Management Objectives; Probabilistic Inventory Model, Multi-Echelon Inventory Management; Supply chain network optimisation models; Logistics information system; Role of IT in Supply chain; Framework for IT adoption

Unit III	**INVENTORY AND WAREHOUSING**	**8 hr**

Inventory Objectives and Control; Bullwhip Effect in Supply Chains; Probabilistic Inventory Models; Risk Pooling Strategies, Vendor-Managed Inventory (VMI); Multi-Echelon Inventory Management; Warehousing Functions and Types; Site Selection for Warehousing; Warehouse Decision Model, Layout, and Costing, Virtual Warehouse

Unit IV	**TRANSPORTATION AND PACKAGING**	**8 hr**

Organizational Structure in Logistics; Organizational Choices and Positioning; Interfunctional Management; Inter-organisational Management, Control Processes in Logistics; Continuous Improvement in Logistics; Supply Chain Visibility and Collaboration; Strategic Alignment of Logistics and Business Goals; Adapting to Changing Business Environments

Unit V	**ORGANISATION AND CONTROL**	**8 hr**

Organizational Structure: Need and Development; Organizational Choices; Orientation and Positioning in Organizations; Inter functional Management in Logistics, Inter

organisational Management: Alliances and Partnerships; Control Processes in Logistics; Process Framework for Control; System Details in Control; Information, Measurement, and Interpretation in Control.	
LEARNING RESOURCES	
TEXT BOOKS:	
1	S. Chopra and P. Meindl, *Supply Chain Management – Strategy, Planning, and Operation*, 4th ed. New Delhi, India: PHI, 2010.
2	J. D. Wisner, K.-C. Leong, and K.-C. Tan, *Principles of Supply Chain Management: A Balanced Approach*. Mason, OH, USA: Thomson Press, 2005.
3	Coyle, Bardi, Longley, THE MANAGEMENT OF BUSINESS LOGISTICS – A SUPPLY CHAIN PERSPECTIVE, Thomson Press, 2006.J. J. Coyle, E. J. Bardi, and C. J. Langley Jr., *The Management of Business Logistics: A Supply Chain Perspective*. Mason, OH, USA: Thomson Press, 2006.
REFERENCE BOOKS:	
1	R. Monczka, R. Handfield, L. Giunipero, and J. Patterson, *Purchasing and Supply Chain Management*. Boston, MA, USA: Cengage Learning, 2020.
2.	J. F. Shapiro, *Modeling the Supply Chain*. Belmont, CA, USA: Thomson Duxbury, 2002.
3	A. Harrison and R. Van Hoek, *Logistics Management and Strategy: Competing through the Supply Chain*. 4th ed. Harlow, England: Pearson Education, 2014.
4	F. R. Jacobs, W. Berry, D. C. Whybark, and T. Vollmann, *Manufacturing Planning and Control for Supply Chain Management*. 6th ed. New York: McGraw-Hill, 2011.
ADDITIONAL REFERENCE MATERIAL	
1	Purchasing and Supply Chain Management: Analysis, Strategy, Planning and Practice by Arjan J. Van WA. J. Van Weele, *Purchasing and Supply Chain Management: Analysis, Strategy, Planning and Practice*. 6th ed. Andover, UK: Cengage Learning, 2010.
2	S. Cohen and J. Roussel, *Strategic Supply Chain Management: The Five Core Disciplines for Top Performance*. New York: McGraw-Hill, 2005.
3	D. Bowersox, D. Closs, and M. Bixby Cooper, *Supply Chain Logistics Management*. 4th ed. New York: McGraw-Hill, 2013.
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc21_mg79/preview
2	https://www.careers360.co m/courses-certifications/swayam-logistics-and-supply-chain-management-courses
3	https://onlinecourses.swayam2.ac.in/ugc19_hs51/previeiw

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL5	X				
CO2	BL5		X			
CO3	BL5			X		
CO4	BL5				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

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