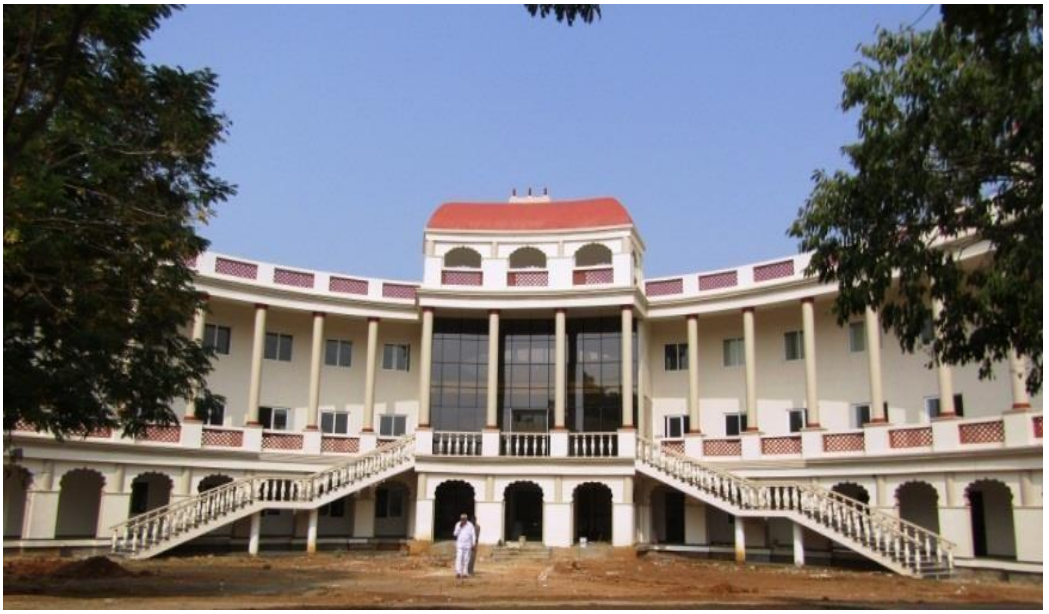
ACADEMIC REGULATIONS
&
CURRICULUM

Applicable to the students admitted from the Academic Year 2024-25 Onwards



INFORMATION TECHNOLOGY
B. Tech. Program

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 (R24M) for B. Tech (Regular-Full time)
(Effective for the students admitted into I year from the Academic Year **2024-25** onwards)

1. Award of the Degree

Award of the B.Tech. Degree if he/she fulfils 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.

2. Award of B.Tech. degree with Honors

1. A student will be declared eligible for the award of the B.Tech degree with Honors if he/she fulfills the following:
   (i) Student secures additional **18** credits fulfilling all the requisites of B.Tech program i.e., **178** credits.
   (ii) Registering for Honors is optional.
   (iii) Honors is to be completed simultaneously with B.Tech. program.

2. 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, forfeit their seat in B.Tech. course and their admission stands cancelled.
   This clause shall be read along with clause 1 (a) (i).

3. 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 approved by the A.P. Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. 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 clock hour of teaching (Lecture/Tutorial) or two clock 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 week	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.

5. Semester/Credits:

i. A semester comprises 90 working days and an academic year is divided into two semesters.

ii. The summer break term is for Six /eight weeks during which a student has the opportunity to pursue Internship/ apprenticeship/work-based vocational education and training. This is intended to meet the mandatory requirement of a student to carry out 2-credit Community Project and Mini Project modules. This is especially helpful for 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. The student will have the option to repeat the course inclusive of continuous assessment.

iv. The institution can decide on the courses to be offered in the summer term depending on the availability of faculty and the number of students.

6. Structure of the Undergraduate Program:

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
1.	Engineering Major	81	50.625
2.	Extended Open Elective Cluster (EOEC)	29	18.125
3.	Generic Engineering Stream	20	12.5
4.	Ability Enhancement Courses (AEC)	6	3.75
5.	Value Added Courses (VAC)	6	3.75
6.	Skill Enhancement Courses (SEC)	8	5
7.	Projects	10	6.25
	Total	**160**	**100**

7. Course Classification:

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

Course Category	Course Modules	Total Credits
Professional Core	• 16 Professional Core Theory Mandatory of 3 credits each **16 * 3 credits = 48 credits** • 5 Professional Core Elective Theory of 3 credits each **5 * 3 credits = 15 credits** • 6 Professional Core Lab of 2 credits each **6 * 2 credits = 12 credits** • Projects (Mini & Major) **(2 + 8) credits = 10 credits** • Department specific module (SEC) = **2 credits**	**87**
Basic Sciences	• M-I and M-II **2 * 3 credits = 6 credits** • Physics + Lab **(3 + 1) credits = 4 credits** • Chemistry + Lab **(3 + 1)credits = 4 credits** • Department Specific Math oriented courses **2 * 3 credits = 6 credits**	**20**
Humanities	• **AEC** (Language Proficiency = 2 credits; Env. Studies = 2 credits; Community Project = 2 credits) • **VAC** (E & HV = 2 credits; Constitutional values/ Rights = 2 credits; Health & Wellness =2 credits) • **SEC** (Quantitative Problem Solving = 2 credits)	**14**
Engineering Sciences/Professional Sciences	**EOEC-Extended Open Elective Cluster** • 6 Theory Mandatory modules. **6 * 3 credits = 18** credits • 1 Theory Elective module. **1 * 3 credits = 3** credits • 4 Lab/practice modules. **4 * 2 credits = 8** credits, which is an elective cluster where students can choose from multiple clusters which they can opt for as secondary skill with total of **29 credits**. • Procedural Programming + Lab **(3 +1) credits = 4** credits • Computer Aided Engineering Drawing **= 2** credits • Engineering Workshop **= 2** credits • Office tools & Social Media Etiquette **= 2** credits	**39**
		160
Honors	Optional For Honors (In Professional Core Area as a deep dive into Professional Elective Cluster) **4 Modules * 4 credits = 16 credits**	**16**
	4 Year Honors Degree	**176**

8. Programme Pattern

i. Total duration of the B. Tech (Regular) Program is four academic years of 8 semesters.
ii. A semester comprises 90 working days and an academic year is divided into two semesters.
iii. There will be an Induction Program before the commencement of the First Semester for the newly admitted students in order to provide orientation and acclimatization to the college campus and professional learning environment. Several activities such as physical activity, creative arts, universal human values, literary, proficiency modules, lectures by eminent people, visits to local areas, familiarization to the departments, innovation activities etc., form part of the Induction Program.
v. Value Added Courses (VAC) like Health & Wellness, Constitutional Rights/Values, Ethics and Human Values are mandatory credit courses for all the undergraduate students.
vi. Ability Enhancement Courses (AEC) like Language Proficiency, Environmental Studies and Community Project are mandatory credit courses for all the undergraduate students.
vii. Skill Enhancement Courses (SEC) like Office Tools & Social Media Etiquette, Engineering Workshop, Quantitative Problem Solving Techniques and Departmental Specific Module are mandatory credit courses for all the undergraduate students.
viii. Undergraduate degree with Honors is offered as an option for the students having good academic record.
xvi. College shall assign a faculty advisor/mentor after admission to a group of students from same department to provide guidance in courses registration/ career growth / placements / opportunities for higher studies/ GATE/ other competitive exams etc.

9. Evaluation Process

- The performance of a student in each semester shall be evaluated subject wise with a maximum of 100 marks for 3 credit theory subjects, 50 Marks for 2 credit theory courses and 100 marks for practical subjects. Community Project and Mini Project shall be evaluated for 50 marks while Main Project work shall be evaluated for 200 marks.
- A student has to secure not less than 35% of marks in the semester end examination and a minimum of 40% of marks in the sum total of the Continuous Assessment (CA) and Summative Assessment (SA) marks taken together for the theory, practical, design, drawing subject or project etc.

THEORY COUSES

Assessment Method	Marks
Continuous Assessment (CA)	40
Summative Assessment (SA)	60
Total	**100**

i. For theory subject, the distribution shall be 40 marks for Continuous Assessment and 60 marks for the Summative Assessment.

ii. For practical subject, the distribution shall be 40 marks for Continuous Assessment and 60 marks for the Summative Assessment.

a) Continuous Assessment (5- unit/3 Credit courses)

i. Continuous Assessment, which is evaluated for 40 Marks is divided into 2 parts: Periodic Assessment (PA) examinations for 25 Marks and Teacher Assessment (TA) for 15 Marks. There shall be two Periodic Assessment (PA) examinations each of 25 marks during a semester. The weighted average in 80/20 ratio will be taken for 25 marks. The duration of exam is 90 minutes. The PA question paper contains 3 long answer questions with internal choice. Each Long answer question carries 7 marks. (3 * 7M = 21 marks). This will be scaled up to 25 marks)

ii. The first PA examination shall be conducted on Units I & II with either/or type question from each unit and the second PA examination shall be conducted on Units III, IV and V with either/or type question from each unit.

iii. The Teacher Assessment (TA) for 15 marks shall be based on assignments/projects/presentations /surprise tests/quizzes which the concerned course owner/subject teacher shall design. The TA methodology shall be approved upfront by the Board of Studies and the same shall be informed to the students at the beginning of the semester itself.

The weighted average in 80/20 ratio is calculated in the following manner. For example:

Marks obtained in first PA exam	: 25
Marks obtained in second PA exam	: 20
Final PA Marks: (25x0.8) + (20x0.2)	= 24

If the student is absent for any one PA examination, the final PA 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 PA:	Absent
Marks obtained in second PA:	25
Final PA Marks: (25x0.8) + (0x0.2)	=20

Final Continuous Assessment marks shall be evaluated as follows:

CA = Final PA + TA

b) Summative Assessment - Evaluation Pattern for 5-Unit/3-Credit courses

Summative Assessment examination of 3-credit theory subjects shall have the following pattern:

- The SA will be conducted for 60 Marks (**180 minutes**)
- Question Paper contains two parts: Part – A is for 50 Marks and Part – B is for 10 Marks.
- **In Part – A**, there shall be one question from each of the 5 units (with either/or choice) which will be evaluated for 10 marks each
- **In Part – B**, there will be 1 question of 10 marks (with either/or choice) that may be a case study or comprehensive examination treating the course as one complete whole.

c) Continuous Assessment (5-unit/2 Credit courses)

For a 2-credit theory course, Continuous Assessment is evaluated for 20 Marks and shall only include the Periodic Assessment (PA) examination. There will be no Teacher Assessment component for these courses. There shall be two PA examinations each of 20 marks. The weighted average in 80/20 ratio will be taken for 20 marks. The duration of exam is **90 minutes**. The PA question paper contains 3 long answer questions with internal choice. Each Long answer question carries 6 marks. (3 * 6M = 18 marks. This will be scaled up to 20 marks)

d) Summative Assessment – Evaluation Pattern for 5-Unit/2-Credit courses

Summative Assessment examination of 2-credit theory courses shall have the following pattern:

- The Examination will be conducted for 30 Marks (5 * 6 Marks).
- Question Paper contains 5 questions (with either/or choice), one from each unit.
- The duration of exam is for **120 minutes**.

PRACTICAL COURSES

Assessment Method	Marks
Continuous Assessment (CA)	40
Summative Assessment (SA)	60
Total	**100**

a) For practical subjects, there shall be a Continuous Assessment during the semester for 40 marks and Summative Assessment for 60 marks.

b) The CA shall include 2 components: Day-to-day work evaluated for 25 marks and Pre-Summative Assessment examination evaluated for 15 marks. Day-to-day work in the laboratory shall be evaluated by the concerned laboratory teacher based on the regularity/record/viva and the Pre-Summative Assessment Examination shall be conducted before the end of the semester.

c) The SA shall be evaluated for 60 marks, conducted by the concerned laboratory teacher and a senior expert in the subject from the same domain.

d) The Summative Assessment laboratory examination shall be conducted for **120 minutes** and assessment includes:

- Knowledge on Principles/concepts/Procedure: 20 Marks
- Experimental design /work, Results-Interpretation and analysis: 30 marks
- Viva voce: 10 marks.

e) Computer Aided Engineering Drawing – Evaluation Pattern

Assessment Method	Marks
Continuous Assessment (CA)	40
Summative Assessment (SA)	60
Total	**100**

a) The CA shall include 2 components: Day-to-day work evaluated for 25 marks and Pre-Summative Assessment examination evaluated for 15 marks. Day-to-day work shall be evaluated by the concerned subject teacher based on the reports/submissions prepared in the class. The Pre-Summative Assessment examination pattern shall consist of 3 questions (either/or type) of 5 marks each.

b) The Summative Assessment examination shall be evaluated for 60 marks, conducted by the concerned teacher and a senior expert in the subject from the same domain.

c) The question paper shall contain 3 questions (with either/or choice). Each question will be of 20 marks (5 marks for free hand drawing and list of commands and 15 marks for final drawing prepared in AutoCAD). A student shall answer all questions.

f) Computer Aided Geometric Design and Assembly Lab – Evaluation Pattern

Assessment Method	Marks
Continuous Assessment (CA)	40
Summative Assessment (SA)	60
Total	**100**

1. The CA shall include 2 components: Day-to-day work evaluated for 25 marks and Pre-Summative Assessment examination evaluated for 15 marks. Day-to-day work shall be evaluated by the concerned subject teacher based on class reports and submissions. The pre-summative examination question paper consists of two questions: one on modeling & drafting and one on assembly & drafting. Each question carries 5 marks. Student must answer both questions. And the remaining 5 marks are allocated for viva-voce.

2. The SA examination shall be evaluated for 60 marks, conducted by the concerned teacher and a senior expert in the subject from the same or related department.

3. The SA examination question paper consists of two questions: one on modeling & drafting and one on assembly & drafting. Each question

carries 25 marks (divided into 5 marks for free hand drawing & procedure and 20 marks for final drawings (modeling/ assembly/ drafting). Student must answer both questions and the remaining 10 marks are allocated for viva-voce.

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.

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, 40 marks for internal assessment and 60 marks for semester end examination.

Assessment Method	Marks
Continuous Internal	40
Semester End Examination	60
Total	100

Continuous Internal Assessment : (40 Marks)
Continuous assessment : 20 Marks
Internal test : 20 Marks

The end examination shall be evaluated for 60 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	: 10 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, 40 marks for internal assessment and 60 marks for semester end examination.

Assessment Method	Marks
Continuous Internal	40
Semester End Examination	60
Total	100

Continuous Internal Assessment : (40 Marks)

Continuous assessment	: 20 Marks
Internal test	: 20 Marks

The end examination shall be evaluated for 60 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	: 10 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 and may also include a certificate of internship.

The project report shall be evaluated with an external examiner. The total marks for project work is **200 marks** and the distribution shall be **80 marks** for continuous assessment and **120 marks** for summative assessment. The supervisor assesses the student for 40 marks (Report: 20 marks, Seminar: 20 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 40 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 120 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. An honor 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 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.

iii. 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.

iv. 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.

v. 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.

vi. Given the extensive scope for learning in blended mode, a student can seek consideration of time spent online or on course projects in lieu of attendance. The college academic committee will arbiter engagement of students on a case-to-case basis where a student falls short of the requisite attendance.

vii. For induction program 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 letter	Grade points
≥ 90	A+ (Outstanding)	10
≥ 80 and < 90	A (Excellent)	9
≥ 70 and < 80	B (Very Good)	8
≥ 60 and < 70	C (Good)	7
≥ 50 and < 60	D (Average)	6
≥ 40 and < 50	E (Pass)	5
< 40	F (Fail)	0
Absent	Ab (Absent)	0

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.

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.,

$$SGPA = \Sigma (C_i \times G_i)/\Sigma C_i$$

where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} 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.,

$$CGPA = \Sigma (C_i \times S_i) / \Sigma C_i$$

where "S_i" is the SGPA of the ith semester and C_i 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 A^+, A, B, C, D and F.

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	≥ 7.0 (Without any supplementary appearance)
First Class	≥ 6.0 and < 7.0
Second Class	≥ 5.0 and < 6.0
Pass Class	≥ 4.0 and < 5.0

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 x 10

20. With–holding of Results

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

21. 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.

22. 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.

23. Medium of Instruction:

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

24. Student Transfers:

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

25. 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 institution is final.
e. The institution 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 institution.
f. In the case of any doubt or ambiguity in the interpretation of the guidelines given, the decision of the 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 other body language methods.	Expulsion from the examination hall and cancellation of the performance in that subject only 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. (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. • 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.
	(ii) If the communication is with the person(s) outside the campus or people who are not related 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. • 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.

* * *

Ragging

Salient Features

- **Ragging within or outside any educational institution is prohibited.**
- **Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student**

	Imprisonment upto		Fine Upto
Teasing, Embarrassing and Humiliation	 **6 Months**	+	**Rs. 1,000/-**
Assaulting or Using Criminal force or Criminalintimidation	 **1 Year**	+	**Rs. 2,000/-**
Wrongfully restraining or confining or causing hurt	 **2 Years**	+	**Rs. 5,000/-**
Causing grievous hurt, kidnapping or Abducts or rape or committing unnaturaloffence	 **5 Years**	+	**Rs. 10,000/-**
Causing death or abetting suicide	 **10 Months**	+	**Rs. 50,000/-**

In Case of Emergency CALL TOLL FREE NO. : 1800 - 425 – 1288

LET US MAKE MVGR A RAGGING FREE CAMPUS

ABSOLUTELY SAY NO TO RAGGING

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 (R24) 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

(a) Award of the B.Tech. Degree / B.Tech. Degree with a Minor if he/she fulfils th 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.

(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 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.

(iii) Honors is to be completed simultaneously with B.Tech. programme.

2. 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).

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R24-MVGR
COURSE STRUCTURE
B. Tech. (Regular/Honors)- Information Technology
(Applicable from the academic year 2024-25 onwards)

I SEMESTER						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MPHYT001	Physics	3	0	0	3
2	R24MMATT001	Linear Algebra and Differential Equations	3	1	0	3
3	R24MMATT002	Multi Variables and Vector Calculus	3	1	0	3
4	R24MPHYL001	Physics Lab	0	0	2	1
5	R24MCIVT001	Environmental Studies	2	0	0	2
6	R24MENGT001	Language Proficiency	2	0	0	2
7	R24MSCSL001	Office Tools and Social Media Etiquette	0	0	3	2
8	R24MENGT003	Health and Wellness	2	0	0	2
9	R24MENGT004	Ethics and Human Values	2	0	0	2
	Total Credits					**20**

II SEMESTER						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MCHYT001	Chemistry	3	0	0	3
2	R24MMATT005	Discrete Mathematical Structures	3	1	0	3
3	R24MMATT006	Probability and Statistics	3	1	0	3
4	R24MSCST001	Procedural Programming	3	0	0	3
5	R24MCHYL001	Chemistry Lab	0	0	2	1
6	R24MSCSL002	Procedural Programming Lab	0	0	2	1
7	R24MMECD001	Computer Aided Engineering Drawing	1	0	2	2
8	R24MENGT002	Constitutional Values	2	0	0	2
9	R24MEEEW001	Electrical and Electronics Engineering Workshop	1	0	2	2
	Total Credits					**20**

III SEMESTER						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MSCST003	Data Structures	3	0	0	3
2	R24MSCST004	OOP with C++	3	0	0	3
3	R24MSCST005	Digital Logic Design	3	0	0	3
4	R24MSCST006	Principles of Programming Languages	3	0	0	3
5	R24MBMCT001/ R24MIACT001	Financial Management (BMC)/ Basic Electronics (IAC)	3	0	0	3
6	R24MBMCT002/ R24MIACT002	Leadership and Team Management (BMC)/ Control Systems & Instrumentation	3	0	0	3
7	R24MSCSL003	Data Structures Lab	0	0	3	2
8	R24MSCSL004	OOP with C++ Lab	0	0	3	2
9	R24MBMCL001/ R24MIACL001	Computer Aided Geometric Design and Assembly Lab (BMC)/ Basic Electronics Lab (IAC)	0	0	3	2
	Total Credits					**24**

IV Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MSCST007	Python Programming	3	0	0	3
2	R24MSCST008	Design and Analysis of Algorithms	3	0	0	3
3	R24MSCST009	Computer Architecture	3	0	0	3
4	R24MSCST010	Database Management Systems	3	0	0	3
5	R24MBMCT003/ R24MIACT003	Product Lifecycle Management (BMC) / Signal & Image Processing (IAC)	3	0	0	3
6	R24MBMCT004/ R24MIACT004	Quality Management (BMC) / Internet of Things (IAC)	3	0	0	3
7	R24MSCSL005	Python Programming Lab	0	0	3	2
8	R24MSCSL006	Database Management Systems Lab	0	0	3	2
9	R24MBMCL002/ R24MIACL002	Financial Accounting Lab (BMC) / Digital Logic Design Lab (IAC)	0	0	3	2
Total Credits						**24**

V Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MSCST011	Operating Systems	3	0	0	3
2	R24MSCST012	Advanced Java Programming	3	0	0	3
3	R24MSCST013	Automata and Compiler Design	3	0	0	3
4	R24MSCST014	Computer Networks	3	0	0	3
5	R24MSCSTXXX	DSC-E1	3	0	0	3
6	R24MBMCT005/ R24MIACT005	Entrepreneurship (BMC) / Industry 4.0 and IIOT (IAC)	3	0	0	3
7	R24MSCSL007	Advanced Java Programming Lab	0	0	3	2
8	R24MBMCL003/ R24MIACL003	Digital Engineering Lab (BMC)/ Virtual Instrumentation Lab (IAC)	0	0	3	2
9	R24MMATT007	Quantitative Problem Solving Techniques	2	0	0	2
Total Credits						**24**

VI Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MSCST015	Web Technologies	3	0	0	3
2	R24MSCST016	OOAD and Design Patterns	3	0	0	3
3	R24MSCST017	Microprocessors and Interfacing	3	0	0	3
4	R24MBMCT006/ R24MIACT006	Business Analysis (BMC)/ Embedded Systems (IAC)	3	0	0	3
5	R24MSCSTXXX	DSC-E2	3	0	0	3
6	R24MSCSTXXX	DSC-E3	3	0	0	3
7	R24MSCSL008	Web Technologies Lab	0	0	3	2
8	R24MBMCL004/ R24MIACL004	Business Analytics Lab (BMC) / Embedded Systems Lab (IAC)	0	0	3	2
9	R24MSCSP001	Community Project	0	0	2	2
Total Credits						**24**

VII Semester						
S. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1	R24MSCST018	Software Engineering (Self-Study/MOOCS)	3	0	0	3
2	R24MSCSTXXX	DSC-E4 (Self-Study/MOOCS)	3	0	0	3
3	R24MSCSTXXX	DSC-E5 (Self-Study/MOOCS)	3	0	0	3
4	R24MSCSP002	Mini Project	0	0	2	2
5	R24MSCSL009	Android Developer/ Mean Stack Development Lab/ 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	R24MBMCT007/ R24MIACT007	Strategic Management/ Robotics	3	0	0	3
	R24MBMCT008/ R24MIACT008	Digital Marketing/ Industrial Automation	3	0	0	
	R24MBMCT009/ R24MIACT009	Logistics and Supply Chain Management/ Electric Vehicle Technology	3	0	0	
2	R24MSCSP003	Major-Dissertation / Academic Project-Major	0	0	16	8
Total Credits						**11**

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	R24MSCST019	Data Warehousing and Data Mining	R
2	DSC-E2	VI	R24MSCST020	Statistical and Predictive Analytics	R
3	DSC-E3	VI	R24MSCST021	Machine Learning	R
4	DSC-E4	VII	R24MSCST022	Deep Learning	R
5	DSC-E5	VII	R24MSCST023	Natural Language Processing	R
Honor Thread (Artificial Intelligence) : CS-AI&ML					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R24MSCSHT01	Computing for AI-ML	H
2	HON-2	VI	R24MSCSHT02	Open Databases	H
3	HON-3	VII	R24MSCSHT03	Process Automation using UI Path	H
4	HON-4	VII	R24MSCSHT04	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	R24MSCST019	Data Warehousing and Data Mining	R
2	DSC-E2	VI	R24MSCST024	Data Analytics and Tools	R
3	DSC-E3	VI	R24MSCST021	Machine Learning	R
4	DSC-E4	VII	R24MSCST022	Deep learning	R
5	DSC-E5	VII	R24MSCST025	Mean Stack Web Development	R
Honor Thread (Business Intelligence) : CS-Business Intelligence					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R24MSCSHT02	Open Databases	H
2	HON-2	VI	R24MSCSHT01	Computing for AI-ML	H
3	HON-3	VII	R24MSCSHT05	Cloud Services	H
4	HON-4	VII	R24MSCSHT06	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	R24MSCST026	Statistical and Mathematical Foundations of Data Analytics	R
2	DSC-E2	VI	R24MSCST019	Data Warehousing and Data Mining	R
3	DSC-E3	VI	R24MSCST020	Statistical and Predictive Analytics	R
4	DSC-E4	VII	R24MSCST024	Data Analytics and Tools	R
5	DSC-E5	VII	R24MSCST027	Time Series Analysis in Data Science	R
Honor Thread (Data Science) : CS-DS					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R24MSCSHT01	Computing for AI-ML	H
2	HON-2	VI	R24MSCSHT02	Open Databases	H
3	HON-3	VII	R24MSCSHT06	Big Data Visualization	H
4	HON-4	VII	R24MSCST033	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	R24MSCST032	Cryptography and Information Security	R
2	DSC-E2	VI	R24MSCST033	Block Chain Essentials	R
3	DSC-E3	VI	R24MSCST034	Principles of IoT	R
4	DSC-E4	VII	R24MSCST035	IoT Development Boards and its Interfacing	R
5	DSC-E5	VII	R24MSCST036	Ad Hoc Networks	R
Honor 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	R24MSCSHT09/ R24MSCSHT10	Information Security and Forensics/ Routing and Switching Applications	H
2	HON-2	VI	R24MSCSHT11/ R24MSCSHT12	Penetration Testing/ Network Security, Firewalls and VPNs	H
3	HON-3	VII	R24MSCSHT13/ R24MSCSHT14	Information Security Governance and Complaince Standards/ Protocol Stacks	H
4	HON-4	VII	R24MSCSHT15	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	R24MSCST037	Information Security Management Standards	R
2	DSC-E2	VI	R24MSCST036	Ad Hoc Networks	R
3	DSC-E3	VI	R24MSCST038	Routing and Switching Concepts	R
4	DSC-E4	VII	R24MSCST039	Enterprise Networking, Security and Automation	R
5	DSC-E5	VII	R24MSCST040	Firewalls and VPN	R
Honor Thread (Computer Networks) : CS-Networks					
S. No	**Type of Course**	**Sem**	**Course Code**	**Course Title**	**Honors**
1	HON-1	VI	R24MSCSHT05	Cloud Services	H
2	HON-2	VI	R24MSCSHT14	Protocol Stacks	H
3	HON-3	VII	R24MSCSHT16	Cyber and Digital Forensics	H
4	HON-4	VII	R24MSCST033	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	R24MBMCT001	Financial Management	III	EOEC-L1	R24MBMCL001	Computer Aided Geometric Design and Assembly Lab	III
EOEC - T2	R24MBMCT002	Leadership and Team Management	III	EOEC-L2	R24MBMCL002	Financial Accounting Lab	IV
EOEC - T3	R24MBMCT003	Product Lifecycle Management	IV	EOEC-L3	R24MBMCL003	Digital Engineering Lab	V
EOEC - T4	R24MBMCT004	Quality Management	IV	EOEC-L4	R24MBMCL004	Business Analytics Lab	VI
EOEC – T5	R24MBMCT005	Entrepreneurship	V				
EOEC – T6	R24MBMCT006	Business Analysis	VI				
EOEC - E1 (Self-Study/ MOOCs)	R24MBMCT007	Strategic Management	VIII				
	R24MBMCT008	Digital Marketing					
	R24MBMCT009	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	R24MCSCT001	Data Structures	III	EOEC-L1	R24MCSCL001	Data Structures Lab	III
EOEC-T2	R24MCSCT002	Operating Systems	III	EOEC-L2	R24MCSCL002	Python Programming Lab	IV
EOEC-T3	R24MCSCT003	Python Programming	IV	EOEC-L3	R24MCSCL003	Database Management Systems Lab	V
EOEC-T4	R24MCSCT004	Database Management Systems	IV	EOEC-L4	R24MCSCL004	OOP with JAVA Lab	VI
EOEC-T5	R24MCSCT005	Software Engineering	V				
EOEC-T6	R24MCSCT006	OOP with JAVA	VI				
EOEC- E1 Self study / Moocs	R24MCSCT007	Computer Networks	VIII				
	R24MCSCT008	Artificial Intelligence: Principles and Techniques					
	R24MCSCT009	OOAD and Design Patterns					

Industrial Automation Cluster (IAC) (for CSE/IT/CSIT/AIML/DS)							
Type of Course	**Course code**	**Course Title**	**Sem**	**Type of Course**	**Course Code**	**Course Title**	**Sem**
EOEC - T1	R24MIACT001	Basic Electronics	III	EOEC-L1	R24MIACL001	Basic Electronics Lab	III
EOEC - T2	R24MIACT002	Control Systems & Instrumentation	III	EOEC-L2	R24MIACL002	Digital Logic Design Lab	IV
EOEC - T3	R24MIACT003	Signal & Image Processing	IV	EOEC-L3	R24MIACL003	Virtual Instrumentation Lab	V
EOEC - T4	R24MIACT004	Internet of Things	IV	EOEC-L4	R24MIACL004	Embedded Systems Lab	VI
EOEC-T5	R24MIACT005	Industry 4.0 and IIOT	V				
EOEC-T6	R24MIACT006	Embedded Systems	VI				
EOEC - E1 (Self-Study/MOOCs)	R24MIACT007	Robotics	VIII				
	R24MIACT008	Industrial Automation					
	R24MIACT009	Electric Vehicle Technology					

R24-MVGR
SYLLABUS
B. Tech. (Regular/Honors) –INFORMATION TECHNOLOGY
(Applicable from the academic year 2024-25 onwards)
I SEMESTER

R24MPHYT001	**PHYSICS**					
	Total Contact Hours	42 (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 introducing the learners to domains like crystallography, light wave phenomena, coherent radiation, quantum etiquettes, and magneto-dielectric materials.

Course Outcomes

After completion of the course, the students will be able to

1	**Examine** the crystallographic phase of the unknown specimen by using X-ray diffraction method. (**BL4**)
2	**Categorize** the dielectric polarization mechanisms, and **classify** the magnetic material for an intended application. (**BL4**)
3	**Analyze** the intensity variation of light due to interference, diffraction and polarization. (**BL4**)
4	**Analyze** the production of laser in the given medium; and **categorize** the optic fiber for envisioned communication requirements. (**BL4**)
5	Deduce the quantized aspects of a particle in a potential box; **analyze** the semiconductor carrier concentrations, and **inspect** their type by using the Hall effect. (**BL4**)
6	**Elaborate** the crystallographic phase, magneto-dielectric physiognomies, optical phenomena, and the essentials of photonics, quantum confinement effects, and the rudiments of semiconductor band model. (**BL6**)

SYLLABUS

Unit I	**CRYSTAL PHYSICS**	**8 hr**

Space Lattice- Unit cell- Crystal systems; Bravais lattices; Atomic packing fraction- Simple Cubic- BCC- FCC structures; Diamond cubic structure- Calculation of lattice constant; Crystal planes- Directions- Miller indices; Distance between successive h k l planes; X-ray Diffraction- Bragg's law; Powder X-ray diffraction method- Applications.

Unit II	**MAGNETIC AND DIELECTRIC MATERIALS**	**8 hr**

Magnetic dipole moment – Permeability- Magnetization- Atomic origin of magnetism; Dia, Para, Ferro, Anti-ferro and Ferrimagnetic materials; Hysteresis- Soft and Hard magnetic materials; Dielectric constant- Displacement Vector- Dielectric polarization – Relation between the electric vectors; Electronic polarization; Ionic polarization- Orientation polarization (Qualitative); Internal field in dielectrics; Clasius-Mossotti relation in dielectrics;

Unit III	**WAVE OPTICS**	**8 hr**

Principle of Superposition- Theory of interference fringes; Interference in thin film- Cosine law; Newton's rings-Applications; Diffraction at a single slit- Intensity distribution; Diffraction at N-parallel slits; Polarization by reflection- Brewester's law; Double refraction; Quarter and Half wave plates

Unit IV	**PHOTONICS**	**8 hr**

Absorption, Spontaneous and Stimulated emission of radiation; Einstein coefficients- Relation between the coefficients; Laser- Characteristics- Applications; Population inversion (3-level)- Components of laser system; Ruby laser- Construction- Working-

Advantages; Optic fiber- Principle- Components of fiber; Numerical aperture- Acceptance angle- Acceptance cone; Classification of optic fiber- Step Index- Graded Index fibers.		
Unit V	**QUANTUM PHYSICS AND SEMICONDUCTORS**	**8 hr**
Matter Wave- de Broglie wavelength of matter wave; Uncertainty principle- Wave function- Physical significance; Schrodinger Time-independent wave equation; Particle in a 1D potential box- Energies and Wave functions; Fermi-Dirac distribution function- Distinction between metals, insulators and semiconductors; Intrinsic semiconductors- Carrier concentration- Fermi level; Extrinsic semiconductors- Carrier concentration; Hall effect		
LEARNING RESOURCES		
TEXT BOOKS:		
1	B.K. Pandey and S. Chaturvedi, *Engineering Physics*, Second edition. Cengage Learning, 2021.	
2	M. N. Avadhanulu, P.G.Kshirsagar and TVS Arun Murthy, *A Text book of Engineering Physics*, Eleventh edition. S.Chand Publications, 2019.	
REFERENCE BOOKS:		
1	Hitendra K. Malik and A.K. Singh, *Engineering Physics*, Second edition. Mc. Graw Hill Publishers, 2017.	
2	M.R. Srinivasan, *Engineering Physics,* Second edition. New Age International Publishers, 2021.	
3	Shatendra Sharma and Jyotsna Sharma, *Engineering Physics*, First edition. Pearson Education, 2018.	
ADDITIONAL REFERENCE MATERIAL:		
1	https://www.youtube.com/watch?v=GQ5XpeS3e3U&list=PLLy_2iUCG87B_Tmfs0y2tR8GNIkyRIKpW	
2	https://archive.nptel.ac.in/courses/112/106/112106227/	
3	https://archive.nptel.ac.in/courses/122/107/122107035/	
4	https://archive.nptel.ac.in/courses/104/104/104104085/ https://archive.nptel.ac.in/courses/115/107/115107095/	
5	https://archive.nptel.ac.in/courses/115/101/115101107/ 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	BL4		X			
CO3	BL4			X		
CO4	BL4				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R24MMATT001	LINEAR ALGEBRA AND DIFFERENTIAL EQUATIONS					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Calculus and Matrices	**3**	**1**	**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

After completing this course, the students will be able to

1	Solve system of equation by Direct methods. **(BL3)**
2	Make use of Linear Algebra techniques to find higher powers and inverse of Matrices. **(BL3)**
3	Solve first order differential equations and make use of them to deal with real word problems like law of cooling, growth, and decay. **(BL3)**
4	Solve the higher order differential equations to make use of them to deal with real word problems. **(BL3)**
5	Make use of Laplace transforms to solve initial value problems. **(BL3)**
6	Formulate Mathematical models and estimate appropriate physical quantities. **(BL6)**

SYLLABUS

Unit I	**LINEAR ALGEBRA-1**	**8 hr**

Rank; Consistency criteria; Non homogeneous systems; Homogeneous systems; Characteristic equation; Eigen values; Eigen vectors; Properties.

Unit II	**LINEAR ALGEBRA-2**	**8 hr**

Cayley-Hamilton Theorem; Higher powers; Matrix polynomials; Inverse of Matrix; Diagonalization; Quadratic forms (QF); Canonical forms (CF); Reduction of QF to CF.

Unit III	**FIRST ORDER DIFFERENTIAL EQUATIONS & APPLICATIONS**	**8 hr**

Linear Differential Equations (DE); Solving Linear DE; Bernoulli's DE; Solving Bernoulli's DE; Exact DE; Non-exact DE; Newton's law of cooling; laws of natural growth and decay.

Unit IV	**HIGHER ORDER DIFFERENTIAL EQUATIONS**	**8 hr**

Homogeneous linear differential equations (DE)-1; Homogeneous linear DE -2; Non homogeneous linear DE (e^{ax}); Non homogeneous linear DE $(sin\,ax\,/\,cos\,ax)$; Non homogeneous linear DE (x^k); Non homogeneous linear DE $\left(e^{ax}\,v(x)\right)$; Particular integrals; Method of variation of parameters.

Unit V	**LAPLACE TRANSFORMS**	**8 hr**

Laplace transform (LT) of elementary functions-1; LT of elementary functions-2; LT using elementary properties-1; LT using elementary properties-2; Inverse LT (Partial Fractions); Convolution theorem; Initial value problems (IVP); Solving IVP.

LEARNING RESOURCES

TEXT BOOKS:

1	B.S.Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2	T.K.V. Iyengar et al, Engineering Mathematics, S. Chand Publishers, Revised edition

REFERENCE BOOKS:

1	Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2	B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
3	T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

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
CO6	BL6	X	X	X	X	X

R24MMATT002	MULTI VARIABLES AND VECTOR CALCULUS					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Calculus	**3**	**1**	**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

After completing this course, the students will be able to

1	Test for maxima and minima for functions of several variables. (**BL6**)
2	Evaluate double and triple integrals of functions of several variables in two and three dimensions. (**BL5**)
3	Interpret the physical meaning of different operators such as gradient, curl and divergence. (**BL5**)
4	Estimate the work done against a field, circulation and flux using vector calculus. (**BL6**)
5	Solve the partial differential equations by various methods. (**BL3**)
6	Formulate Mathematical models and estimate appropriate physical quantities. (**BL6**)

Unit I	**MULTIVARIABLE CALCULUS**	**8 hr**

Partial derivative; Total derivative; Chain rule; Taylor's Series for functions of two variables; Maclaurin's series; Jacobian and its properties; Maxima and minima; Lagrange's method of undetermined multipliers.

Unit II	**MULTIPLE INTEGRALS**	**8 hr**

Double integrals; Double integrals over a region; Double integrals in polar co-ordinates; Change of order; Change of variables in double integrals; Triple integrals; Change of variables; Applications of double and triple integrals.

Unit III	**VECTOR DIFFERENTIATION**	**8 hr**

Gradient; Normal vector to the surface; Angle between surfaces; Directional derivative; Divergence; Solenoidal vector; Curl of a vector; Irrotational vector.

Unit IV	**VECTOR INTEGRATION**	**8 hr**

Line integral; Circulation; Work done; Surface integral; Volume integral; Green's theorem; Gauss divergence theorem; Stokes theorem (without proofs).

Unit V	**PARTIAL DIFFERENTIAL EQUATIONS (PDE)**	**8 hr**

Formation of PDE (Eliminating arbitrary constants); Formation of PDE (Eliminating arbitrary functions); Lagrange's Linear PDE-1; Lagrange's Linear PDE-2; Homogeneous Linear PDE; Homogeneous Linear PDE (e^{ax+by}); Homogeneous Linear PDE (sin or cos $(ax + by)$); Homogeneous Linear PDE $(x^m\, y^n)$.

LEARNING RESOURCES

TEXT BOOKS:

1	B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.
2	T.K.V. Iyengar et al, Engineering Mathematics, S. Chand Publishers, Revised edition

REFERENCE BOOKS:

1	Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2	B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
3	T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

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	BL5			X		
CO4	BL6				X	
CO5	BL3					X
CO6	BL6	X	X	X	X	X

R24MPHYL001	PHYSICS LAB					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Higher Secondary School Physics	**0**	**0**	**2**	**1**

Course objectives

- To complement the classroom learning with laboratory experiments.
- Calibration of instruments like travelling-microscope, spectrometer, cathode-ray-oscilloscope, magnetometer, 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

After completion of course, the students will be able to

1	Interpret the given XRD pattern to analyze crystallographic phase of the given unknown specimen.
2	Conduct experiments to reconnoitre the interference and diffraction patterns of light.
3	Find the signature variation of magnetic field due to current, and the specifics of magneto-dielectric materials.
4	Estimate the wavelength of coherent radiation, the coercing parameter of optic fiber, and the perpetual aspects of a semiconductor diode.
5	Measure the elastic modulus of the material and determine the unknown fork frequency.

LIST OF EXPERIMENTS

1	Determination of the lattice constant and crystallographic phase of the unknown by using XRD patterns.
2	Determination of the Hysteresis energy loss of a ferromagnetic material by forming B-H curve.
3	Find the signature variation of magnetic field along the axis of a current carrying circular coil- Stewart and Gee's Method.
4	Determination of radius of curvature of a given plano-convex lens by forming Newton's rings.
5	Determination of thickness of the object by forming parallel interference fringes
6	Determination of the wavelength of spectral lines by using a plane transmission grating in normal incidence configuration.
7	Determination of wavelength of the Laser by using a diffraction grating.
8	Determination of numerical aperture and acceptance angle of the optic fiber.
9	Determination of energy gap of the semiconductor p-n junction diode.
10	Plot the I/V characteristics of Zener diode under forward and reverse conditions.

ADDITIONAL EXPERIMENTS

1	Determination of dielectric constant of solid dielectric.
2	Determination of rigidity modulus of the of the material of the wire- Torsional pendulum
3	Determination of frequency of the electrical vibrator- Melde's experiment

LEARNING RESOURCES

TEXT BOOK:

1	C.S. Robinson and Dr. Ruby Das, *A Textbook of Engineering Physics Practical*, First edition. Laxmi Publications Pvt. Ltd., 2016.

REFERENCE BOOK:

1	S. Balasubramanian and M.N. Srinivasan, *A Textbook of Practical Physics*, First

	edition. S. Chand Publishers, 2017
ADDITIONAL REFERENCE:	
1	www.vlab.co.in

R24MCIVT001	ENVIRONMENTAL STUDIES					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	NIL	**2**	**0**	**0**	**2**

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 apply and articulate

1. The roles of knowledge of biodiversity, ecosystem functionality, and resources in tackling pollution and environmental laws. (BL3)
2. The concepts of carbon cycle, climate systems, and microclimate and their connection to weather patterns and climate policies. (BL3)
3. The concepts of greenhouse gases, paleoclimate, energy balance, water cycle, and atmospheric motion and their role in climate systems. (BL3)
4. The knowledge of ocean, cryosphere, biosphere interactions and their influence on climate regulation. (BL3)
5. Sustainable practices such as energy and water conservation to promote environmental protection and resource efficiency. (BL3)

SYLLABUS

Unit I	**INTRODUCTION TO ENVIRONMENTAL STUDIES**	**5 hr**
Biodiversity and ecosystem functionality – Natural resources – Environmental pollution – Environmental episodes – Environmental legislation		
Unit II	**INTRODUCTION TO CLIMATE CHANGE**	**5 hr**
Carbon cycle – Earth's Climate System – Weather and Climate – Understanding Microclimate - Policy initiatives to Combat Climate Change		
Unit III	**SCIENCE BEHIND THE CLIMATE CHANGE – 1**	**5 hr**
Greenhouse gas effect - Paleoclimate - Energy Balance - Water Cycle – Atmospheric motion		
Unit IV	**SCIENCE BEHIND THE CLIMATE CHANGE – 2**	**5 hr**
Ocean changes - Cryosphere dynamics – Volcanoes - Biosphere and climate regulation - Mitigation strategies		
Unit V	**LIFESTYLE FOR ENVIRONMENT**	**5 hr**
Sustainability Challenges - Save Energy - Save Water - Reduce waste - Healthy Lifestyles		

LEARNING RESOURCES

TEXTBOOKS:

1. E. Bharucha, *Textbook of Environmental Studies for Undergraduate Courses*, 2nd ed. Hyderabad, India: Universities Press, 2012.
2. A. Schmittner, *Introduction to Climate Science*. Corvallis, OR: Oregon State University, 2018. [Online]. Available: https://open.oregonstate.education/climatechange/

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.
3. 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.
ADDITIONAL REFERENCE MATERIAL
1. Mission Life for Environment (https://missionlife-moefcc.nic.in/Download-Creatives-Save-Energy.php?id=MTE=)
ONLINE COURSES
1. Climate Change Science, IISc Bangalore, https://nptel.ac.in/courses/120108558
2. The Literature of Climate Crisis, Uni. of Hyderabad, https://nptel.ac.in/courses/109106733
3. Climate change: Extreme Events: IISER Bhopal https://nptel.ac.in/courses/105106707

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

R24MENGT001	LANGUAGE PROFICIENCY					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**2**	**0**	**0**	**2**

Course Objective

The student will be able to apply the concepts of comprehension, Interpretation and structured presentation in varied contexts and demonstrate skilled communication.

Course Outcomes

1	Demonstrate the skill to comprehend, analyze and interpret information. (**BL3**)
2	Demonstrate the skill of structured thinking. (**BL3)**
3	Demonstrate Competency to summarize and paraphrase content in different materials. (**BL3)**
4	Demonstrate application of the skills of presentation in writing and speaking, meeting the requirement of the concept of constructive presentation. (**BL3**)
5	Demonstrate the skill to Communicate effectively in a group (**BL3)**

SYLLABUS

Unit I	**VOCABULARY ENRICHMENT**	
Understanding the meaning of a word by identifying the context – The technique; presenting an idea using a set of words; Vocabulary mind mapping; word choice & Connotation. Collocations. Understanding Jargon.		**5 hr**
Unit II	**THE ART OF READING**	
Understanding the process of reading; Reading an article and assimilating the rhetoric; Skimming & scanning a piece of text; Reading fiction to understand writer's perspective; The art of analyzing and appreciating a literary text.		**5 hr**
Unit III	**LISTENING & COMPREHENDING**	
Understanding the process of listening**;** Watching travel documentaries to master the technique of active listening; making a brochure; watching a film and drafting a review; watching interviews of successful entrepreneurs and sharing the take–away concepts/ideas**;** Watching documentaries on 'Engineering marvels' and sharing impressions.		**5 hr**
Unit IV	**WRITING FOR COMMUNICATION**	
Basics in writing**;** The technique of persuasion; genres of writing - Narrative writing, descriptive writing, expository writing; nuances of Journal writing; Letter Writing & its etiquette**.** Email writing & etiquette		**5 hr**
Unit V	**EXPRESSING ONESELF**	
Introducing oneself; Ted talk and the concept of structured presentation; Case debates on contemporary problems; open discussions on different perspectives of living – Adventures, society & life, science & religion, sports, cinema. Dialogues & language experimentation-Staging skits on relevant social themes.		**5 hr**

LEARNING RESOURCES

REFERENCE BOOKS:

1	Seely, John. *Oxford guide to effective Writing and Speaking*. Oxford Press. 2022.
2.	Atkins, Ros. *The art of explanation.* Wildfire publications. 2023.

ONLINE COURSES

1	www.purdueowl.com
2	www.voanews.com
3	www.learningenglish.vn
4	www.prowritingaid.com
5	www.eslcafe.com
6	www.5minutesenglish.com
7	www.livinglanguage.com
8	www.newsinlevels.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	BL3		X			
CO3	BL3			X		
CO4	BL3				X	
CO5	BL3					X

R24MSCSL001	OFFICE TOOLS AND SOCIAL MEDIA ETIQUETTE					
	Total Contact Hours	28 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**0**	**0**	**3**	**2**

Course Objective

- To get hands-on exposure to office automation software.
- To perform basic data analysis tasks using spreadsheets.
- To practice methods of social media etiquette and digital wellbeing.

Course Outcomes

After completing this course, the students will be able to

1	Create documents and letters for professional communication.
2	Analyze and interpret data and provide effective visualization.
3	Create presentations and slideshows.
4	Practice various mechanisms of social media etiquette.

LIST OF EXPERIMENTS

1	Create a simple document containing tables, images, smart art and flowchart symbols. Apply various font styles, sizes, designs, bullet points and page layouts.
2	Create a document containing hyperlinks, equations, symbols and charts. Apply various header and footer formats, bookmarks and macros.
3	Create a document with citations, bibliography, table of figures, cross-reference and index.
4	Create a simple presentation with various layouts, background design, fonts and geometric shapes with different effects
5	Create a presentation with transitions, animations with timings and audio files.
6	Create a presentation with hyperlinks to internal slides, external files and language translator.
7	Create a spreadsheet using numerical data and perform various mathematical, statistical and engineering operations using built-in formulae.
8	Create a spreadsheet using text data and perform Text operations like search, replace, concatenate, trim etc.; use Date format to perform various Date & Time operations.
9	Create a spreadsheet using numerical data which is imported from real time datasets and perform visualization using graphs, pivot charts etc.
10	Create a spreadsheet using all available data formats and perform data migration, validation and consolidation.
11	Create digital profile on LinkedIn and observe patterns of a professional profile. Follow influential people from technology and software domain.
12	Create a social media profile on any latest platform following social media etiquette and mark a professional digital footprint.

LEARNING RESOURCES

ONLINE COURSES

1	https://books.libreoffice.org/en/
2	https://www.w3schools.com/googlesheets/
3	https://support.microsoft.com/en-us/training
4	https://www.office.com/
5	https://www.google.com/docs/about/
6	https://workspace.google.com/products/sheets/
7	https://in.linkedin.com/
8	https://www.rd.com/list/social-media-etiquette/

R24MENGT003	HEALTH AND WELLNESS (Common to all Branches)					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**2**	**0**	**0**	**2**

Course Objective

This course aims to help students grasp the significance of a healthy diet, yoga, and stress management techniques in fostering their overall well-being.

Course Outcomes

After completing this course, the students will be able to

1	Identify and understand the current ways of living and develop a plan of action that promotes overall well-being. (**BL 3**)
2	Understand the importance of nutrition, a balanced diet and scheduled sleeping hours for maintaining a healthy lifestyle **(BL2)**
3	Understanding the use of yoga as a holistic tool in improving physical and mental health **(BL3)**
4	Interpret various stress management techniques for better physical and mental health **(BL3)**
5	Understand and identify the importance of Emotional intelligence in the aspects of stress relief, general health and social wellness **(BL2)**

SYLLABUS

Unit I	**INTRODUCTION TO HEALTH AND WELLNESS AND WELLNESS PLANNING**	**5 hr**

Understanding Health and Wellness as holistic concepts encompassing Physical, Mental, Emotional, Social and environmental well-being – need to develop personalized wellness plans, set goals, and track progress toward a healthier lifestyle.

Unit II	**HEALTHY LIFESTYLE CHOICE**	**5 hr**

Examine topics such as sleep, hygiene, substance abuse prevention, and the impact of lifestyle choices on health.

Unit III	**HOLISTIC WELLNESS: INTRODUCTION TO YOGA**	**5 hr**

Explore the interconnectedness of physical, mental, and emotional health and the importance of balance by introducing Yoga

Unit IV	**EMOTIONAL INTELLIGENCE AND STRESS MANAGEMENT**	**5 hr**

Regulation and management of feelings and emotions effectively-
Methods of stress management include unhooking; Acting on Your Values, Being Kind, Making Room for deep breathing, Taking a break; Making time for hobbies; Talking about your problems and Meditation.

Unit V	**SELF-CARE**	**5 hr**

Formulate practical self-care routines and strategies to maintain optimal physical and mental health, encompassing a holistic approach that addresses physical, emotional, intellectual, social, spiritual, and environmental well-being.

LEARNING RESOURCES

TEXTBOOKS:

1	B.K.S. Iyengar, *Yoga The Path to Holistic: The Definitive Step-by-step Guide,* DK Publishers, 2021.
2	C. Gopalan, B. V. Rama Sastri, S. C. Balasubramanian, *Nutritive value of Indian foods (NVIF),* National Institute of Nutrition, India, 2023.
3	ICMR-*National Institute of Nutrition, Short summary report of nutrient requirements for Indians,* 2020.
4	Emily Attached & Marzia Fernandez*, Mental Health Workbook,* 2021.

REFERENCE BOOKS:

1	C. Nyambichu & Jeff Lumiri, *Lifestyle Diseases: Lifestyle Disease Management*, 2018.

2	Nashay Lorick, *Mental Health Workbook for Women: Exercises to Transform Negative Thoughts and Improve Well-Being,* 2022.
3	Angela Clow & Sarah Edmunds, *Physical Activity and Mental Health*, 2013.
ADDITIONAL REFERENCE MATERIAL	
1	B.K.S. Iyengar, *Light on Yoga: The Classic Guide to Yoga by the World's Foremost Authority*, 2006.
2	Claude Bouchard, Steven N. Blair, William L. Haskell, *Physical Activity and Health*, Human Kinetics, 2012.
ONLINE COURSES	
1	http://vikaspedia.in/health/nutrition
2	https://yoga.ayush.gov.in/Yoga-Course/

Bloom's level - Units catchment articulation matrix

CO	Blooms Level	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	BL3	X				
CO2	BL2		X			
CO3	BL3			X		
CO4	BL3				X	
CO5	BL2					X

R24MENGT004	ETHICS AND HUMAN VALUES					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**2**	**0**	**0**	**2**

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.

<u>LEARNING RESOURCES</u>

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

***

II SEMESTER

R24MCHYT001	CHEMISTRY					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basics of 10 + 2 Chemistry	**3**	**0**	**0**	**3**

Course Objective

This course aims to help students

- To gain the comprehensive understanding of polymers and green chemistry
- To gain knowledge in electrochemistry, spectroscopic techniques and molecular machines.
- To get insight on phenomena of material deterioration and develop understanding on control and protective techniques

Course Outcomes

After completing this course, the students will be able to

1	Classify macromolecules as materials such as polymers, rubbers and make use of these materials as good engineering materials with improved properties. **(BL4)**
2	Apply fundamentals of electrochemistry and electro analytical techniques and judge a suitable storage device for desired engineering applications. **(BL5)**
3	Choose certain spectroscopic techniques for analysis of compounds and explain the behaviour of materials as molecular switches. **(BL5)**
4	Classify various types of material deterioration phenomena and identify suitable control and protective techniques. **(BL4)**
5	Explain the principles of green chemistry and develop understanding on nano materials and harnessing of solar energy. **(BL5)**
6	Choose suitable material, analytical technique for identification, analysis and develop an understanding on material use, protection and energy storage. **(BL6)**

SYLLABUS

Unit I	**HIGH POLYMERS**	**8 hr**

Introduction – Stereospecific Polymers**;** Types of Polymerizations – Co-ordination polymerization - Zieglar – Natta Catalysis – Mechanism**;** Plastics –Types - Thermoplastics – Thermosets –Differences**;** Preparation, Properties and Applications of –PVC - Teflon – Bakelite – Nylon**;** Rubbers – Natural - Synthetic –Vulcanization**;** Preparation, properties and applications of - BUNA – S, Thiokol rubber**;** Fiber Reinforced Plastics – Introduction - Types of FRP – Aramids – Kevlar and Nomex**;** Conducting polymers - Introduction – Classification – Intrinsic and extrinsic – Applications

Unit II	**ELECTROCHEMISTRY AND ITS APPLICATIONS**	**8 hr**

Introduction - Electrode Potential – Measurement of electrode potential - Electrochemical series**;** Expression for electrode potential – Electrochemical cell – EMF of the cell**;** Storage devices – Classification – Primary – Leclanché cell**;** Secondary - Solid state battery / Lithium-ion battery**;** Flow Cells - Fuel cells – Hydrogen – Oxygen fuel cell, Methanol – Oxygen fuel cell - Solid Oxide Fuel Cells**;** pH Metry**;** Conductometry**;** Potentiometry - Principle – Applications.

Unit III	**SPECTROSCOPY AND MOLECULAR SWITCHES**	**8 hr**

Introduction to spectroscopy - Electromagnetic radiation**;** Classification – Absorption and Emission spectroscopy**;** Laws of Absorption – Derivation of Beer – Lambert's law – Significance**;** UV – Visible Spectroscopy - 1 – Introduction – Principle**;** UV – Visible Spectroscopy – 2 - Instrumentation (block diagram) – Applications**;** Infra – Red Spectroscopy - 1 – Introduction to Infra - Red Spectroscopy – Principle**;** Infra – Red Spectroscopy – 2 - Instrumentation (block diagram) – Applications**;** Molecular switches - NOR and NOT logic gate operators - Characteristics - Rotaxanes and Catenanes as artificial molecular machines.

Unit IV	**CORROSION**	**8 hr**

Chemical Corrosion – Mechanism - Pilling Bed worth rule**;** Electrochemical Corrosion -

Mechanism - Difference between dry and wet corrosion - Galvanic series**;** Types of Corrosion - Differential aeration corrosion, galvanic corrosion, pitting corrosion, waterline corrosion and stress corrosion**;** Factors influencing rate of corrosion - Metal-based factors and Environment based factors; Corrosion control Methods – Proper design, Use of Pure metal, Use of Alloy**;** Cathodic protection – Sacrificial Anodic protection method – Impressed current cathodic protection method- Use of Inhibitors**;** Protective coatings - Types - Metal Coatings – Anodic - Galvanizing and Cathodic Coating – Tinning**;** Passivation and Pourbaix diagram - Pourbaix diagram.		
Unit V	**CONCEPTS OF GREEN CHEMISTRY, NANO CHEMISTRY AND SOLAR ENERGY**	**8 hr**
Green Chemistry - Introduction - Principles of Green Chemistry**;** Applications – Any green two reactions**;** Nanomaterials - Introduction – Classification**;** Synthesis of Nano material by Top down and bottom-up approach**;** CVD Method – Sol gel method – Synthesis of iron oxide nano particles**;** Carbon nano tubes – Introduction - Classification – Applications**;** Harnessing of Solar Energy – Construction and Working of PV Cell**;** Solar collectors – Concentrating.		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Jain and Jain, *Engineering Chemistry*, 17th ed. New Delhi, India: Dhanpat Rai Publications, 2015.	
2	S.S. Dara, *Text Book of Engineering Chemistry*, 12th ed. New Delhi, India: S. Chand, 2006.	
3	Y. Bharathi Kumari, *Text Book of Engineering Chemistry*, For JNTU R23 Hyderabad, India: VGS Publications, 2023	
REFERENCE BOOKS:		
1	T. F. Yen, *Chemistry for Engineers*. London, U.K.: Imperial College Press, 2008.	
2	S. K. Chawla, *Engineering Chemistry*, latest ed. New Delhi, India: Dhanpat Rai & Co., 2017	

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	BL5					X
CO6	BL6	X	X	X	X	X

R24MMATT005	DISCRETE MATHEMATICAL STRUCTURES					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**1**	**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. **(BL3)**
2	Apply the concepts related to primality, divisibility, and Greatest common divisors. **(BL3)**
3	Evaluate the problems using set theory and Apply basic counting techniques to solve combinatorial problems. **(BL3)**
4	Gain the conceptual background needed and analyze the structures of algebraic nature. **(BL4)**
5	Formulate problems and solve recurrence relations. **(BL5)**
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

R24MMATT006	PROBABILITY AND STATISTICS					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Probability and Calculus.	**3**	**1**	**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

After completing this course, the students will be able to

1	Analyze and comprehend the properties of different statistical distributions. (**BL4**)
2	Utilize statistical techniques to analyze bivariate data. (**BL3**)
3	Test a hypothesis concerning means and proportions for large samples. (**BL6**)
4	Test the hypothesis for small samples. (**BL6**)
5	Analyze and evaluate the performance of single server Queuing systems. (**BL4**)
6	Formulate Mathematical models and estimate appropriate physical quantities. (**BL6**)

SYLLABUS

Unit I	**RANDOM VARIABLES & PROBABILITY DISTRIBUTIONS**	**8 hr**

Discrete Random Variable; Discrete Probability Distribution; Expectation of Discrete random variable; Continuous random variable; Continuous probability distribution; Normal distribution; Probabilities of normal variable; Parameters of normal variable.

Unit II	**STATISTICAL METHODS**	**8 hr**

Fitting of Linear Curve-1; Fitting of Linear Curve-2; Fitting of Parabola; Fitting of Exponential Curve; Fitting of Power Curve; Correlation-1; Correlation-2; Regression.

Unit III	**SAMPLING DISTRIBUTIONS AND TESTING OF HYPOTHESIS (LARGE SAMPLES)**	**8 hr**

Sampling Distribution of Means with replacement; Sampling Distribution of Means without replacement; Confidence interval for means; Confidence interval for proportions; Testing of Hypothesis for single mean; Testing of Hypothesis for two means; Testing of Hypothesis for single proportion; Testing of Hypothesis for two proportions.

Unit IV	**TESTING OF HYPOTHESIS (SMALL SAMPLES)**	**8 hr**

t-test (single mean)-1; t-test (single mean)-2; t-test (difference of means); Paired t-test; F-test-1; F-test-2; Chi square test for good ness of fit; Chi square test for independent of attributes.

Unit V	**QUEUEING THEORY**	**8 hr**

Stochastic Process; Steady state condition; Structure of a queueing system; Probability distributions in queueing system; Queueing model (M/M/1 : ∞/ FIFO)-1; Queueing model (M/M/1 : ∞/ FIFO)-2; Queueing model (M/M/1 : N/ FIFO)-1; Queueing model (M/M/1 : N/ FIFO)-2.

LEARNING RESOURCES

TEXT BOOKS:

1	RE Walpole, SL Mayeres & K May, Probability and Statistics for Engineers & Scientists, 3/e, Pearson Publishers
2	T.K.V. Iyengar et al, Probability and Statistics, S. Chand Publications, Revised edition.

REFERENCE BOOKS:

1	Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011
2	B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010
3	T. Veerarajan, Higher Engineering Mathematics, Tata McGraw-Hill, 2008

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	BL6				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R24MSCST001	PROCEDURAL PROGRAMMING (Common to all Branches)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**3**	**0**	**0**	**3**

Course Objective

To develop proficiency in procedural programming using C through fundamental concepts, control structures, arrays, pointers, structures, and file handling.

Course Outcomes

After completing this course, the students will be able to

1	**Apply** the basics of software, hardware, number systems, and programming concepts to write simple C programs. **(BL3)**
2	**Implement** decision-making and control structures like if-else, switch, loops, and unconditional statements in C programs. **(BL3)**
3	**Analyze** and **manipulate** arrays and strings, and **design** modular programs using functions and recursion. **(BL4)**
4	**Utilize** pointers for dynamic memory allocation, pointer arithmetic, and complex data structure manipulation in C programs. **(BL3)**
5	**Construct** and **manage** complex data structures like structures and unions, and **develop** file handling operations in C. **(BL6)**
6	**Design** and **develop** comprehensive C programs by integrating various programming concepts to solve complex problems using procedural programming techniques. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO PROGRAMMING**	**8 hr**

Software, hardware, Number Systems (Binary, Hexadecimal, Octal, Decimal); Algorithms, pseudo code; Flowcharts, Program development steps; Structure of c program with example;

Tokens, Basic data types; Operators Arithmetic, logical, relational, bitwise; ternary, increment /decrement, special operators, assignment; Built-in Input/output Functions, Expressions, type casting.

Unit II	**SELECTION AND CONTROL STATEMENTS**	**8 hr**

Two way selection statements if, if-else with examples; Nested if with examples; Multiway selection statements - switch with examples; Nested switch with examples, else if ladders with examples; Iterative statements while, do-while with examples; for loop with examples; Nested loops with examples; Un conditional statements; break, continue, goto with examples.

Unit III	**INTRODUCTION TO ARRAYS AND STRINGS, MODULAR PROGRAMMING THROUGH FUNCTIONS**	**8 hr**

Array Definition, Declaration and accessing of 1D array; Declaration and accessing of integer 2D array; 2D array applications: matrix addition, multiplication; String definition, declaration and accessing of strings with examples;

Function Definition, prototype, declaration and accessing with examples; Parameter passing mechanisms with examples, Scope and Extent of Variables; Storage classes auto, static, Register and extern with examples; Definition of recursion, types of recursion (direct and indirect) Solving problems using recursive approach like finding factorial, Fibonacci series, Towers of Hanoi.

Unit IV	**POINTERS AND DYNAMIC MEMORY ALLOCATION**	**8 hr**

Definition of pointers, declaration, initialization, Pointer arithmetic; Representing 1D array using pointers with examples; Representing 2D arrays using pointers with examples; Pointer to pointer, constant pointers with examples, Pointer to constant variable, void pointer, generic pointer with examples;

Pointers to Functions; Difference between static and dynamic memory allocation,

Dynamic memory allocation using built-in functions (malloc (), calloc ()) ; Dynamic memory allocation using built-in functions (realloc (), free ()) ; Dangling pointer and unreferenced memory problem.		
Unit V	**STRUCTURES, UNIONS AND FILE HANDLING**	**8 hr**
Structure definition, declaration, initialization and accessing structure members; Nested structures with examples, arrays of structures; Pointer to structures with examples, Self-Referential structures; Unions, Bitfields, typedef with examples; Concept of a file and file modes, Formatted I/O; File handling functions; fopen (), fclose (), fscanf (), fprintf (); Random access files handling functions, command line arguments ; Text files, Binary files, Differences between text and Binary files, fread (), fwrite ()		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Brian W Kernighan and Dennis M Ritchie, *The C programming Language*, Second Edition, 2015, Pearson.	
2	Pradip Dey, Manas Ghosh, *Programming In C*, 2nd Edition, 2011, Oxford Higher Education.	
REFERENCE BOOKS:		
1	Dr Reema Thareja, *Programming in C*, Third Edition, 2023, Oxford Press	
2	Byron Gottfried, *Programming with C*, Third Edition. 2017, Schaums Outlines Series.	
3	Ajay Mittal, *Programming in C - A Practical Approach*, 2010, Pearson.	
ONLINE COURSES		
1	https://mvgrce.codetantra.com	
2	www.netacad.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	BL3		X			
CO3	BL4			X		
CO4	BL3				X	
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R24MCHYL001	CHEMISTRY LAB (Common to all Branches)					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basics of 10 + 2 Chemistry	**0**	**0**	**2**	**1**

Course Objective

This course aims to help students

- To verify the fundamental concepts with experiments

Course Outcomes

After completing this course, the students will be able to

1	Determine total hardness, dissolved oxygen, strength of acid in a lead acid battery, using volumetric analysis
2	Explain conductometric, potentiometric, pH metric titrations and colorimetric determinations.
3	Explain the synthesis of a polymer, nano materials.

LIST OF EXPERIMENTS

1	Determination of HCl using sodium carbonate
2	Determination of Strength of an acid in Pb-Acid battery
3	Determination of Iron (II) using potassium dichromate.
4	Determination of Hardness of a groundwater sample.
5	Determination of Dissolved oxygen in ground water sample.
6	Potentiometric titration of Fe (II) with potassium dichromate
7	Condcutometric titration of Strong acid VS Strong base
8	Condcutometric titration of Weak acid VS strong base
9	pH metric titration of strong acid and strong base.
10	Determination of percentage of Iron in Cement sample by colorimetry

ADDITIONAL EXPERIMENTS

1	Preparation of nanomaterials by precipitation method
2	Preparation of Bakelite
3	Determination of Cell constant of a conductivity cell.

ADVANCED DESIGN EXPERIMENTS

1	Determination of viscosity of polymer solution using survismeter.
2	Measurement of 10Dq by spectrophotometric method.

LEARNING RESOURCES

TEXTBOOKS:

1	A.I. Vogel, "Quantitative Chemical Analysis," 6th ed. Boston, MA, USA: Cengage Learning, 2000
2	D. A. Day and A. L. Underwood, Quantitative Chemical Analysis. Upper Saddle River, NJ, USA: Prentice Hall, 1991.
3	K. Mukkanti, Practical Engineering Chemistry. Hyderabad, India: B.S. Publications, 2009.

REFERENCE BOOKS:

1	J. Cherukui, Laboratory Manual of Engineering Chemistry-II, VGS Techno Series, 2012.
2	Department of Chemistry, MVGR College of Engineering, Laboratory Manual.

R24MSCSL002	PROCEDURAL PROGRAMMING LAB (Common to all Branches)					
	Total Contact Hours	28 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**0**	**0**	**2**	**1**

Course Objective

To get practical exposure to the Structured 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 write and execute simple C programs, demonstrating understanding of basic input/output operations and program structure.
2	Students will use various operators and control structures to perform decision-making and repetitive tasks.
3	Students will declare, initialize, and perform operations on one-dimensional and multi-dimensional arrays, as well as handle string operations.
4	Students will define, call, and pass parameters to functions, including recursive functions, to solve problems in a modular and efficient manner.
5	Students will use pointers for dynamic memory allocation, manipulate structures and unions, and perform file operations for reading and writing data in text and binary formats.

LIST OF EXPERIMENTS

1	Week-1: Introduction to Programming with operators 1. Write a C program to print "Hello, World!" and understand the structure of a basic C program. 2. Write a C program to demonstrate the use of basic I/O statements (printf, scanf) 3. Write a C program for calculating the sum of two numbers.
2	Week-2: Expressions and Operators 1. Write a C program to finding the maximum of three numbers using conditional operator. 2. Write a C Program to convert temperature from Celsius to Fahrenheat and vice versa 3. Write a C Program to to calculate simple and compound interest
3	Week 3: Selection Statements 1. Write a C program to find the largest of three numbers using if-else statements. 2. Write a program to demonstrate the use of switch-case statements to perform arithmetic operations based on user choice. 3. Write a program to demonstrate the use of else-if ladder to grade student marks.
4	Week-4: Loops 1. Write a C program to print sum of the digits of the given number. 2. Write a C program to print the Fibonacci series up to n terms using a for loop. 3. Write a C program to check the given number is a palindrome or not. 4. Write a C program to calculate the factorial of a number using a while loop.
5	Week-5: Nested Loops and branching 1. Write a C program to print a pyramid patterns using nested loops. 2. Write a C program to print prime numbers between 1 to 100 3. Write a C program to demonstrate the use of break and continue statements within loops.
6	Week 6: Arrays 1. Write a C program to find the sum of all elements in a 1D array.

	2. Write a C program to read and print the 2D Array elements in a matrix form. 3. Write a C program to perform matrix addition using 2D arrays. 4. Write a C program to find the transpose of a given matrix.
7	Week-7: String Handling 1. Write a program to demonstrate string operations (copy, concatenate, compare, length) using built-in functions. 2. Write a C program to count the number of vowels in a string. 3. Write a C program to concatenate two strings without using the library function strcat.
8	Week-8: Functions 1. Write a program to define and use a function to find the sum of two numbers. 2. Write a C program to check the given number is prime or not using a function. 3. Demonstrate passing of an array to a C function.
9	Week-9: Recursive Functions 1. Write a recursive program to generate Fibonacci series. 2. Write a C program to find the GCD of two numbers using a recursive function. 3. Write a C Program to find the nCr value for the two positive numbers where n > r using recursion.
10	Week-10: Pointers & Dynamic Memory Allocation 1. Write a program to demonstrate pointer arithmetic. 2. Write a program to use pointers to access elements of an array. 3. Write a program to dynamically allocate memory for an array using malloc and calloc. 4. Write a program to demonstrate the use of realloc and free for dynamic memory allocation.
11	Week-11: Structures & Unions 1. Write a program to define, declare, and access members of a structure. 2. Write a program to demonstrate the use of nested structures. 3. Write a C program to store and display student information using structures.
12	Week-12: File Handling 1. Write a program to demonstrate file handling functions (fopen, fclose, fscanf, fprintf). 2. Write a program to read and write data to a binary file using fread and fwrite. 3. Write a C program to simulate copy command using command line arguments.

LEARNING RESOURCES

TEXTBOOKS:

1	Brian W Kernighan and Dennis M Ritchie, *The C programming Language*, Prentice Hall.
2	Pradip Dey, Manas Ghosh, *Programming In C*, Oxford Higher Education.

REFERENCE BOOKS:

1	Dr Reema Thareja, *Programming in C*, Third Edition, Oxford Press
2	Byron Gottfried, *Programming with C*, Schaums Outlines Series, Third Edition.
3	Ajay Mittal, *Programming in C - A Practical Approach*, Pearson

ONLINE COURSES

1	https://www.tutorialspoint.com/learn_c_by_examples

R24MMECD001	COMPUTER AIDED ENGINEERING DRAWING					
	Total Contact Hours	14(T)+28(P)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**1**	**0**	**2**	**2**

Course Objective: To enable the students to learn various concepts of engineering graphics using the CAD tool.

Course Outcomes

1	Sketch the two-dimensional drawings using draw, modify, and annotation commands in CAD software
2	Draw the projections and solve the problems in projections of points, lines, planes & solids.
3	Create orthographic projections and isometric projections and create composite solids using CAD software.

SYLLABUS

Module 1: Overview of CAD Software: Computer technologies that impact graphical communication, Demonstrating knowledge of CAD software such as The Menu System, Toolbars, Command window, and Status Bar. Set up the drawing page and the printer, Scale settings, setting up of units and drawing limits, standards for annotations, and 3D Modeling.

Module 2: Introduction to Orthographic Projections: Projections of points, straight lines, planes and simple solids

Module 3: Development of surfaces of simple solids, isometric views, Conversion of isometric views to orthographic views. And create complex compound solids in CAD.

List of Exercises

1	Creation of simple 2-D geometries
2	Creation of complex 2-D geometries & Engineering Curves –Generic method for Conic sections
3	Engineering Curves – Cycloids & Involutes
4	Orthographic Projection of Points
5	Projection of lines in simple positions and inclined to one plane
6	Projection of lines inclined to both planes
7	Projection of planes is simple and inclined to one plane
8	Projection of planes inclined to both planes
9	Projection of solids simple positions
10	Development of simple Solids (Prisms, Pyramids, Cylinder & Cone)
11	Conversion of orthographic views to isometric views
12	Modeling of complex 3D geometries and their conversion to orthographic views

LEARNING RESOURCES

TEXT BOOKS:

1	N. D. Bhatt, *Engineering Drawing*, Charotar Publishing House, 2016.
2	Dhananjay Jolhe, *Engineering Drawing with an Introduction to AutoCAD*, Tata McGraw Hill, 2017

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.

ADDITIONAL REFERENCE MATERIAL

1	https://nitc.ac.in/imgserver/uploads/attachments/Ed__5c3343c5-c3f9-468a-b114-8f33556810b4_.pdf

R24MENGT002	CONSTITUTIONAL VALUES (Common to all Branches)					
	Total Contact Hours	28 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	-	**2**	**0**	**0**	**2**

Course Objective

The course aims at creating awareness regarding different provisions enshrined in the Constitution and makes students understand the concept of Fundamental Rights.

Course Outcomes

1	Demonstrate understanding of the principles of the Constitution of India. **(BL3)**
2	Demonstrate understanding of Constitutional values. **(BL3)**
3	Demonstrate understanding of Fundamental Rights and their relevance. **(BL3)**
4	Demonstrate understanding of the role of Judiciary in the interpretation and protection of Fundamental Rights. **(BL3)**
5	Develop understanding of the role of institutions like National Human Rights Commission in the protection of Fundamental Rights. **(BL3)**

SYLLABUS

Unit I	Constitution & Democracy; Understanding the spirit of Indian Constitution; Constitutional Values – social, economic and political Justice; Liberty in thought, expression, belief, faith and worship, equality before law; Fraternity	**5 hr**
Unit II	Interpretation of Articles 14 -31: Right to equality (Articles 14 -18); Right to freedom (Articles 19-22); Right against exploitation (Articles 23-24).	**5 hr**
Unit III	Right to freedom of Religion (Articles 25-28); Cultural and educational Rights (Articles 29-30);	**5 hr**
Unit IV	Right to Life and personal liberty (Article 21); Right to constitutional remedies (Article 32)	**5 hr**
Unit V	Role of Judiciary and other institutions in the protection of Fundamental Rights; Case Studies.	**5 hr**

LEARNING RESOURCES

REFERENCE BOOK:

1	Durga Das Basu, et al., *Introduction to the Constitution of India*, Lexis Nexis, 2022.

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	X	X
CO3	BL3		X	X	X	X
CO4	BL3		X	X	X	X
CO5	BL3					X

R24MEEEW001	ELECTRICAL AND ELECTRONICS ENGINERING WORKSHOP					
	Total Contact Hours	14 (L) + 28 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Fundamentals of electrical and electronics engineering	**1**	**0**	**2**	**2**

Course Objective	
To impart knowledge on design and practical verification basic electrical and electronic circuits and simple energy calculation.	
Course Outcomes	
Students will be able to	
1	Design and analyze simple circuits.
2	Design and analyze electrical circuits to measure resistance, power and energy consumption.
3	Understand the series and parallel connection.
4	Design simple electronic circuits to verify their applications.
5	Explain the operation of digital circuits.
List of Experiments	
1	Measurement of Resistance, Voltage, Current, Power and Power factor for a simple circuit
2	Implementation of one-way and two-way switch wiring connection
3	Measurement of Electrical Energy for domestic premises
4	Measurement of parameters using CRO
5	Characteristics of Solar PV panel
6	Implementation of a converter circuit
7	Verification and interpretation of truth table for AND, OR, NOT, NAND, NOR, Ex-OR & Ex-NOR gates
8	Implementation of series and parallel connection of batteries
9	Implementation of inverter wiring using simulation
10	Design a solar PV roof top system for a domestic application
Additional Experiments	
1	Practice of Soldering and De-soldering
2	Measurement of earth resistance
LEARNING RESOURCES	
TEXT BOOKS:	
1	D. C. Kulshreshtha, *Basic Electrical Engineering*, Tata McGraw Hill, 2019
2	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/

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III SEMESTER

R24MSCST003	DATA STRUCTURES (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (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, graphs, hashing and will be able to select and implement the appropriate data structures to solve the given problem.

Course Outcomes

1	Will be able to apply various searching and sorting techniques and analyze their time complexities. (BL3)
2	Will be able to apply Linked Lists and its variants and utilize them for various applications. (BL3)
3	Will be able to compare arrays and Linked Lists and conclude which storage structure is appropriate for the given problem/data structure. (BL4)
4	Will be able to develop novel solutions to small scale programming challenges involving data structures such as stacks, queues, trees and graphs. (BL6)
5	Will be able to recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems. (BL6)
6	Will be able to collaborate in teams to design and implement innovative solutions by choosing and combining the appropriate data structure(s). (BL6)

SYLLABUS

Unit I	**INTRODUCTION TO LINEAR DATA STRUCTURES**	**8 hr**

Data Structures- Introduction, need for a data structure, Types of Data Structures; Overview of time and space complexity analysis, asymptotic notations; Recursion- Introduction, Types of recursions; Searching-Linear Search algorithm, Binary Search algorithm

Sorting techniques- Bubble Sort, Selection Sort; Insertion Sort; Quick Sort; Merge Sort.

Unit II	**LINKED LISTS**	**8 hr**

Introduction to Linked List, Variations/Types of Linked Lists, Applications; Single Linked List Operations: creation, insertion; Deletion, Traversal/Search; Circular Linked Lists- Insertion, Deletion, Traversal/Search.

Double Linked Lists and Operations- Creation, Insertion; Deletion, Traversal/Search; Applications of Linked List-Representation of Sparse Matrix using Single Linked List, Representation of Polynomials using Single Linked List; Polynomial Operations (Addition) using Linked List

Unit III	**STACKS AND QUEUES**	**8 hr**

Introduction to Stack data structures, basic operation, implementation of Stack using array; Stack implementation using Linked Lists, advantages & disadvantages; Applications of Stack: Infix to postfix conversion; postfix expression evaluation, Factorial using Stack.

Introduction to Queue data structures, basic operation, implementation of Queue using array; Queue operations implementation using Linked Lists; Circular Queues using Arrays; Double Ended Queues.

Unit IV	**TREE- BINARY TREE, BINARY SEARCH TREE, BALANCED TREE**	**8 hr**

Tree – Introduction, Types of Trees; Binary Tree – Introduction, Properties, Various ways of representing Binary Tree in memory; Recursive Binary tree traversals, Construction of Binary tree given tree traversals (In-order, Pre-order & In-order, Post-order); Tree applications- Heap(Min/Max) Binary Search tree operations- Creation, Insertion; Deletion, Traversal/Search; Balanced Binary trees – Introduction, Operations on AVL

Trees –Insertion; AVL Tree Deletion, Search.		
Unit V	**GRAPHS AND HASHING**	**8 hr**
Basic concepts, Representation of Graph using Adjacency Matrix and Adjacency List; Graph Traversals (BFS, DFS); minimum spanning tree using Prim's Algorithm; minimum spanning tree using Kruskal's algorithm Single Source Shortest Distance- Dijkstra's algorithm, transitive closure; Introduction to Hashing, Hash Functions; Collision Resolution Techniques: Open hashing -chaining, Open Addressing- linear probing; quadratic probing, double hashing.		

LEARNING RESOURCES

TEXT BOOKS:	
1	Mark Allen Weiss, *Data Structures and algorithm analysis in C*, Pearson, 2nd Edition.
2	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, *Fundamentals of data structures in C*, Silicon Press, 2008.
3	Richard F, Gilberg , Forouzan, Cengage, *Data Structures*, 2/e.
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
ADDITIONAL REFERENCE MATERIAL	
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
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc24_cs45/preview
2	https://www.coursera.org/learn/data-structures
3	https://www.coursera.org/specializations/boulder-data-structures-algorithms

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	X
CO4	BL6			X	X	X
CO5	BL6					X
CO6	BL6	X	X	X	X	X

R24MSCST004	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

R24MSCST005	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 learns 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 Edition, Cambridge.	
2	Switching Theory and Logic Design by A. Anand Kumar, PHI, 2nd Edition	
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-tutorials/	

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

R24MSCST006	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 the principles, paradigms, and implementation of programming languages, fostering effective problem-solving and software development skills.

Course Outcomes

1	Students will be able to apply fundamental programming concepts, including syntax, variables, data types, and memory management. **(BL3)**
2	Students will be able to analyze expressions, selection & iteration statements, and different parameter-passing mechanisms in subprograms. **(BL4)**
3	Students will be able to analyze subprograms, concurrency mechanisms, and inter-process communication techniques. **(BL4)**
4	Students will be able to evaluate object-oriented programming features such as encapsulation, inheritance, polymorphism, abstraction, and exception handling. **(BL5)**
5	Students will be able to develop basic programs using functional and logic programming paradigms. **(BL3)**
6	Students will be able to make choices and integrate multiple programming paradigms for solving real-world computational problems. **(BL6)**

SYLLABUS

Unit I	**INTRODUCTION TO BASICS OF PROGRAMMING**	**8 hr**

Reasons for Studying Concepts of Programming Languages; Programming Paradigms – Imperative, Object-Oriented, Logical, Functional; Compilation vs. Interpretation – How Programs Run; Memory Management Basics – Stack vs. Heap Allocation in C; The general problem of describing syntax, Formal methods of describing syntax : Basic Syntax and Semantics of BNF (Terminal, Non Terminal symbols and Production Rules);Names, Variables, Concept of Binding, Scope and Lifetime; Scalar Data Types - Primitive Types and Character, String types and user defined ordinal types; Basic Vector Data Types - Arrays and Indices, Array Initialization, Rectangular and Jagged Arrays and Implementation of Array Types;

Unit II	**DATA TYPES, EXPRESSIONS, SELECTION AND ITERATION STATEMENTS AND SUB PROGRAMS**	**8 hr**

Advanced Vector Data Types : Associative Arrays, Tuple, List, Union; Type Checking, Strong Typing, Type Equivalence and Type Conversion; Arithmetic expressions - Associativity and Precedence, overloaded operators in C(& operator);Relational and Boolean expressions, short- circuit evaluation, assignment statements, mixed-mode assignment; Control Structures – introduction, selection statements(one-way, two-way, n-way and nested);Iterative statements(Counter and Logic Controlled Loops), Unconditional Branching; Introduction to sub programs - Fundamentals of subprograms, Types of subprograms (procedures, functions, closures,sub routines, coroutines); Parameter-passing methods(in-mode,out-mode,in-out mode,call by value, call by reference);

Unit III	**SUBPROGRAMS AND CONCURRENCY**	**8 hr**

Overloaded subprograms, generic subprograms, design issues for functions; User defined overloaded operators, General semantics of calls and returns; Implementing simple subprograms, Implementing subprograms with stack-dynamic local variables; Nested subprograms, blocks, implementing dynamic scoping; Introduction to

subprogram level concurrency; Semaphores, Monitors; Introduction to Thread Programming; Synchronization, IPC - Message Passing;		
Unit IV	**INTRODUCTION TO IMPERATIVE & OBJECT-ORIENTED FEATURES**	**8 hr**
Characteristics and Applications of Imperative Languages; Introduction to Classes and Objects – Real-World Analogies, Constructors and Destructors – Lifecycle of an Object; Encapsulation – Private and Public Members, Access Modifiers, Inheritance – Code Reusability, Types of Inheritance; Polymorphism – Function Overloading and Virtual Functions; The concept of abstraction (Total & Partial Abstraction), introductions to data abstraction, design issues; Parameterized ADT, encapsulation constructs, naming encapsulations; Exception Handling: Introduction, exception handling; Introduction to event handling ;		
Unit V	**LOGICAL PROGRAMMING & FUNCTIONAL PROGRAMMING PARADIGMS**	**8 hr**
Characteristics and Applications of Declarative Languages; Brief Introduction to Predicate Calculus; Basic elements of Prolog; Deficiencies of prolog, applications of logic programming; Introduction to Functional Programming – How It Differs from Imperative/OOP; First-Class Functions and Higher-Order Functions; Lambda Expressions – Writing Anonymous Functions, Recursion vs. Iteration – Tail Recursion Optimization; Lazy Evaluation – Avoiding Unnecessary Computations;		

LEARNING RESOURCES

TEXTBOOKS:

1	Concepts of Programming Languages, Robert. W. Sebesta 11th edition, Pearson Education.
2	Programming Language Design Concepts, D. A. Watt, Wiley India Edition.

REFERENCE BOOKS:

1	Programming Languages, K. C. Louden and K A Lambert., 3rd edition, Cengage Learning.
2	Programming Language Concepts, C Ghezzi and M Jazayeri, Wiley India.
3	Programming Languages 2nd Edition Ravi Sethi Pearson.

ADDITIONAL REFERENCE MATERIAL

1	Programming Languages, K. C. Louden and K A Lambert., 3rd edition, Cengage Learning.
2	Introduction to Programming Languages Arvind Kumar Bansal CRC Press.

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	BL4	X	X	X		
CO3	BL4	X		X		
CO4	BL5		X		X	
CO5	BL3			X		X
CO6	BL6	X	X	X	X	X

R24MBMCT001	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

R24MIACT001	BASIC ELECTRONICS (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Semiconductor Physics	**3**	**0**	**0**	**3**

Course Objective

To equip students with a foundational understanding of electronic components, circuit analysis, semiconductor devices, and their applications in power regulation, amplification, signal processing, and communication systems, enabling them to analyze and design basic electronic circuits relevant to computing and IT applications.

Course Outcomes

1	Evaluate the performance and suitability of various electronic components in designing and analyzing electronic circuits using Kirchhoff's laws, mesh and nodal analysis.(BL5)
2	**Analyze and evaluate** the performance of rectifiers, filtering circuits, voltage regulators, and wave-shaping circuits. (BL5).
3	**Analyze and evaluate** the operation of BJTs in different configurations, assess biasing techniques for optimal circuit design. (BL5).
4	**Analyze and evaluate** the characteristics and applications of FETs and OP-Amps.(BL5).
5	Evaluate the role and performance of feedback amplifiers, oscillators, signal processing in communication systems and power semiconductor devices. (BL5).
6	**Design and develop** electronic circuits and systems by integrating knowledge of components like diodes, transistors, Op-Amps etc to create functional solutions for real-world applications (BL6).

SYLLABUS

Unit I	**Introduction to Electrical and Electronic components**	**8hr**

Introduction to electronics, fixed and variable resistors; special type of resistors (LDR, Thermistor); Potential divider, capacitor and coils; transformers, Relays;
Kirchhoff's laws, mesh analysis; nodal analysis; Diode characteristics; working principles of LED, Photodiode;

Unit II	**Rectifiers and Filters**	**8hr**

Half wave rectifier; Full(Center-tapped) wave rectifier; Full (Bridge) wave rectifier; Principle of capacitor filter, LC and CLC filters (Qualitative Treatment only); Zener diode as voltage regulator; block diagram of regulated power supply; wave shaping using diodes (clippers); RC filters;

Unit III	**Transistor Characteristics and Biasing Circuits**	**8 hr**

Construction and working of BJT; Input and output characteristics of CE configuration; Input and output characteristics of CB and CC configurations; Comparison of CE, CB and CC configurations; Need for biasing, transistor fixed bias circuit; Self bias circuit; Transistor as switch and amplifier; h-parameter modelling of BJT in three configurations;

Unit IV	**FET Characteristics and Operational Amplifiers**	**8hr**

JFET characteristics, parameters; MOSFET characteristics and applications; Frequency response of an amplifier, concept of multistage amplifier;
Principle of power amplifier; Integrated circuit (types, packages), digital ICs; Operational amplifier and its characteristics; applications of Operational Amplifiers;

Unit V	**Oscillators, Role of Electronics in Communications and Power Electronics**	**8 hr**

Concept feedback, Types of feedback amplifiers; Characteristics of negative feedback amplifier; Classification of oscillators, operation of crystal oscillator; Power Semiconductor Devices: SCR characteristics and applications; TRIAC and DIAC characteristics and applications;

Role of basic electronics in communications: Basics of analog signals ,need for modulation; AM modulators and demodulators; Comparison between analog and digital signals ; Introduction to PCM.	
LEARNING RESOURCES	
TEXT BOOKS:	
1	Electronic Devices and Circuits- G.K.Mithal, Khanna publishers-2010.
2	Electronic Devices and Circuits- J.B.Gupta, S.K. Kataria& Sons-2012.
3	Principle of Electronics by V.K Mehta, Rohit Mehta, S.Chand publishers, 2014
4	Op-Amps & Linear ICs by Ramakanth A. Gayakwad,Pearson, 2015
REFERENCE BOOKS:	
1	Electronic Devices and Circuits –S Salivahanan , N Suresh Kumar, McGraw Hill,Education-2015
2	Electronic Devices and Circuits- G.S.N Raju, I.K.International publishers.-2006.
3	Communication Systems– R.P. Singh, S P Sapre, Second Edition TMH, 2011
ONLINE COURSES	
1	https://nptel.ac.in/courses/117/103/117103063/
2	https://nptel.ac.in/courses/122/106/122106025/
3	https://nptel.ac.in/courses/108/101/108101091

Bloom'slevel – Unitscatchmentarticulationmatrix

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

R24MBMCT002	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

R24MIACT002	CONTROL SYSTEMS AND INSTRUMENTATION (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Electronics	**3**	**0**	**0**	**3**

Course Objective

Students will

Have ability to analyze the time response and stability of control system.

Have ability to analyze the construction and working principle of various instruments; temperature and motion transducers ;various flow; pressure and force transducers in real world scenario

Provide opportunities to develop basic skills in the design of electronic equipment.

Course Outcomes

1	After the completion of this course; the students will get: An ability to represent the mathematical modeling of physical systems and to represent the system in I/O form by applying reduction techniques. **(BL3)**
2	A capability to understand the time response and performance improvement of a system; and to apply few techniques for stability analysis of systems. **(BL3)**
3	To identify general configurations and functional descriptions of various measuring instruments and transducers. **(BL3)**
4	Will be able to distinguish various transducers for the measurement of motion and temperature. **(BL4)**
5	An ability to explain functionality and application of different pressure and force transducers. **(BL5)**
6	Have an ability to analyze the performance of control system and choose various transducers in the field of instrumentation to draft solutions. **(BL6)**

SYLLABUS

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

Basics and classification of control systems; open loop system; closed loop system; Mathematical modeling of electrical system; Block diagram algebra-1; Block diagram algebra- 2; Signal flow graph; Feedback characteristics and effects.

Unit II	**TIME RESPONSE ANALYSIS AND STABILITY ANALYSIS**	**8hr**

Basics of Time response analysis; standard test inputs; Steady state errors and error constants; Time response of first and second order systems; Time domain specifications; PI and PD controllers; Stability; Routh-Hurwitz stability criterion.

Unit III	**CHARACTERISTICSOF SIGNALS AND INSTRUMENTS**	**8hr**

General Configuration of measuring instruments; Classification of measuring instruments; Static Characteristics; Dynamic Characteristics; Error in the measurement; Errors in Instrumentation System; Statistical analysis; Active and Passive Transducers.

Unit IV	**MOTION & TEMPERATURE TRANSDUCERS**	**8hr**

Resistive strain gauge; LVDT; Gyroscope; Accelerometer; Thermometer; Thermistor; RTD; Thermocouple and their characteristics.

Unit V	**FORCE ,PRESSURE flow level TRANSDUCERS**	**8 hr**

Elastic transducers; flow sensor; ultrasonic sensor; hall effect transducer, piezo electric transducer ; MEMS sensor, hydraulic load cell ; pneumatic load cell.

LEARNING RESOURCES

TEXT BOOKS:

1	Control Systems Engineering; by I. J. Nagrath and M. Gopal; New Age International (P) Limited; Pub. 2 nd edition.
2	A course in Electrical and Electronics Measurements and Instrumentation; by A.K. Sawhney; Dhanpat Rai & Co. 3rd edition Delhi; 2010.

3	Kalsi H. S. "Electronic Instrumentation"; Tata McGraw-Hill Education.
REFERENCE BOOKS:	
1	Automatic Control Systems 8th Edition; by B.C. Kuo 2003; John Wiley and Sons.
2	Instrumentation Measurement and Analysis; by Nakra B.C; Chaudhary K.K Second Edition; Tata McGraw-Hill Publication Ltd.2006.
3	D.V.S. Murty; "Transducers and Instrumentation"; Prentice Hall India.
ADDITIONAL REFERENCE MATERIAL	
1	Control Systems by N.K.Sinha; New Age International (P) Limited Publishers; 3 r d Edition; 1998
2	Modern Control Engineering by Katushiko Ogata; Prentice Hall of India Pvt. Ltd.;3rd Edition; 1998.
3	Sensor & transducers; D. Patranabis; 2nd edition; PHI
4	Instrument transducers; H.K.P. Neubert; Oxford University press.
5	Measurement systems: application &design;E.A.Doebelin;McGraw Hill
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc23_ee105
2	https://nptel.ac.in/courses/108102191
3	https://nptel.ac.in/courses/108102191

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	BL4				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R24MSCSL003	DATA STRUCTURES LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Programming	**0**	**0**	**3**	**2**

Course Objective

To get hands-on exposure to linear and non-linear data structures and to identify and apply the suitable data structures for the given real-world problem.

Course Outcomes

1	Student will be able to implement recursive algorithms and will be able to understand the role of linear data structures in organizing and accessing data efficiently using searching and sorting techniques.
2	Student will be able to implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
3	Student will be able to develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
4	Student will be able to apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between linear queues and circular queues, and apply them appropriately.
5	Student will be able to devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, trees, graphs.
6	Student will be able to recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

LIST OF EXPERIMENTS

1	**WEEK 1(SEARCH TECHNIQUES)** • Write a C Program to search an element in the given list using Linear Search Technique. (using recursive and non-recursive functions) Write a C Program to search an element in the given sorted list using Binary Search Technique. (using recursive and non-recursive functions)
2	**WEEK 2(SORTING TECHNIQUES)** • Write a C Program to sort a given list of integers in ascending order using Bubble Sort non-recursive Technique. • Write a C Program using recursive function to sort a given list of integers in ascending order using Quick Sort Technique. • Write a C Program using recursive function to sort a given list of integers in ascending order using Merge Sort Technique.
3	**WEEK 3(LINKED LIST)** • Write a C Program to create a Single linked list and perform basic operations on Single Linked List.
4	**WEEK 4 (OTHER VARIANTS OF LINKED LIST)** • Write a C Program to create a Circular linked list and perform basic operations. • Write a C Program to create a Double linked list and perform basic operations.
5	**WEEK 5 (STACKS & APPLICATIONS)** • Write a C Program to implement Stack operations using arrays. • Write a C Program to implement Stack operations using linked list. • Write a C Program to implement Infix to postfix conversion using stacks. • Write a C Program to evaluate the Postfix Expression using stacks.
6	**WEEK 6 (QUEUES)** • Write a C Program to implement Queue operations using arrays. • Write a C Program to implement Queue operations using linked list

	• Write a C Program to implement Circular Queue operations.
7	**WEEK 7 (BINARY TREE)** • Write a C Program to implement Binary Tree Creation. • Write a C Program to implement Recursive Binary Tree Traversals.
8	**WEEK 8 (BINARY SEARCH TREE(BST))** • Write a C Program to implement Binary Search Tree creation. • Write a C program to implement Insertion, Deletion, Search operations on Binary Search Tree.
9	**WEEK 9 (GRAPHS & TRAVERSAL TECHNIQUES)** • Write a C Program to create a Graph (using Adjacency Matrix or Adjacency List). • Write a C Program to implement Graph Traversals -Breadth First Search and Depth First Search.
10	**WEEK 10 (GRAPH APPLICATIONS)** • Write a C Program to implement Prim's & Kruskal's Algorithm for finding Minimum Cost Spanning Tree. • Write a C Program to implement Single Source Shortest Path -Dijkstra's Algorithm.
11	**WEEK 11 (HEAPS)** • Write a C Program to implement Binary Heap (Min Heap or Max Heap).
12	**WEEK 12 (HASHING)** • Write a C Program to implement Collision Resolution Techniques using Linear probing (Open Addressing) Technique using Division method as hash function.
LEARNING RESOURCES	
TEXT BOOKS:	
1	Mark Allen Weiss, *Data Structures and algorithm analysis in C*, Pearson, 2nd Edition.
2	Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, *Fundamentals of data structures in C*, Silicon Press, 2008.
3	Richard F, Gilberg , Forouzan, Cengage, *Data Structures*, 2/e.
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
ADDITIONAL REFERENCE MATERIAL	
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
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc24_cs45/preview
2	https://www.coursera.org/learn/data-structures
3	https://www.coursera.org/specializations/boulder-data-structures-algorithms

R24MSCSL004	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

R24MBMCL001	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.

R24MIACL001	BASIC ELECTRONICS LAB (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Electronics	**0**	**0**	**3**	**2**

Course Objective

To provide hands-on experience in fundamental electronic circuits and components, enabling students to analyze, design, and implement various circuits, including diode and transistor characteristics, rectifiers, wave shaping, filters, amplifiers, oscillators, operational amplifier applications, SCR characteristics, diode detecor, and basic microprocessor programming.

Course Outcomes:

On successful completion of the course students will be able to

1. Analyze the characteristics of basic semiconductor devices
2. Design and analyze rectifier circuits and filters
3. Demonstrate non-linear wave shaping and signal clipping/clamping
4. Analyze amplifier and oscillator circuits using transistors and Op-Amps
5. Develop and simulate basic analog/digital communication and processor-based systems

S.No	The following are the list of experiments. Minimum 10 experiments should be conducted.
1	VI Characteristics of PN diode
2	Zener diode as voltage regulator
3	Full wave rectifier without filter
4	Full wave rectifier with capacitor filter
5	Non Linear waveshaping – Clippers.
6	Non Linear wave shaping- Clampers
7	Design of RC low pass filter/RC high pass filter
8	Transistor CE characteristics
9	CE amplifier frequency response
10	Implementing any one application using Op-Amp
11	RC phase shift oscillator
12	SCR characteristics
13	Implementing AM demodulation using diode detector
14	Implementing arithmetic operation of two numbers using 8086 microprocessor

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IV SEMESTER

R24MSCST007	PYTHON PROGRAMMING (CSE,IT,CSIT,AIML,DS,ICB)					
	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; User Defined modules creation and importing a user defined module; NumPy – Functions on 1D arrays, Functions on 2D arrays; Pandas Module- Creation of Series, DataFrames, indexing objects;

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;
Functions: Syntax and basics of function and usage; Passing Parameters, arguments in a function – Default, keyword, positional and Variable - length arguments; local and global scope of variable; return statement, recursive function, recursion vs iteration;

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; Lambda functions, Map, filter and reduce;
Tuples- Tuples are immutable, Tuple operations; Tuple as return values, List Comprehension, Comparison of Lists and tuples; Dictionaries – Dictionary Creation, operations, Looping through dictionaries; Dictionary Comprehension, Applying dictionary methods to counter objects, Reverse Lookup dictionary;

Unit IV	**FILES AND PANDAS**	**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 ());
Pandas-DataFrame creation with dictionaries, list of dictionaries, dictionary of series, renaming columns and rows labels; Importing data from CSV to DataFrame (Pandas),

Inspecting data in DataFrame (head (), tail (), info()), Statistical summary (describe ()); Slicing and Sorting in Pandas; Modifying DataFrames, Data Cleaning in Pandas;		
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

R24MSCST008	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.
2	Students will be able to apply Divide and Conquer algorithms, Pattern matching techniques in real world problems.
3	Students will be able to apply Greedy programming techniques for cost optimization to real world problems.
4	Students will be able to solve several problems using Dynamic programming and understand its benefits over other techniques.
5	Students will be able to apply the Backtracking and Branch and Bound techniques to solve real world problems and identify P, NP classes of problems.
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.

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 and Hamiltonian cycles; Branch and Bound general method, Control abstraction of LC-Search; 0/1 Knapsack Problem using LC Branch and Bound; Travelling Sales Person Problem; P,NP,NP-Hard, NP-Complete problems; Satisfiability, Cook's theorem;

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 AForouzan, 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	BL3		X			
CO3	BL3			X		
CO4	BL3				X	
CO5	BL3					X
CO6	BL6	X	X	X	X	X

R24MSCST009	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 designing of 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 **analyze** the basic structure and functionality of computer systems, the significance of Register Transfer Language (RTL) in defining and representing micro-operation sequences in a concise symbolic form, and explain its role in facilitating the design process of digital systems, particularly in the design of Arithmetic Logic Units (ALUs) and control units. **(BL4)**
2	Students will be able to **analyze** the different phases of the instruction cycle, the key components of an efficient instruction set, and **examine** the impact of various computer organizations, instruction formats, interrupts and addressing modes. (BL4).
3	Students will be able to **apply** micro-programming techniques to design a micro programmed control unit, **identify** the key differences between hardwired and micro programmed control strategies, and **solve** problems related to arithmetic operations on binary and BCD data. **(BL3)**
4	Students will be able to **evaluate** the effectiveness of memory hierarchy, cache memory, and its mapping techniques; **appraise** and **criticize** the data transfer methods such as program-controlled I/O, interrupt-driven I/O, and direct memory access, in terms of their impact on system efficiency. **(BL5)**
5	Students will be able to analyze the operation, structure, and principles of parallel processing, pipelining, and multiprocessor systems, including interconnection structures, cache coherence solutions, and arbitration mechanisms. **(BL4)**
6	Students will be able to design and construct key components of computer systems by applying principles from micro-operations, memory management, I/O systems, and pipelining to enhance system performance and efficiency. **(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	**BASIC COMPUTER ORGANIZATION AND DESIGN**	**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	**MICROPROGRAMMED CONTROL AND COMPUTER ARITHMETIC**	**8 hr**
Micro-programmed control concepts- Control memory, address sequencing; Microprogram Example – Computer configuration, Microinstruction format, Symbolic microinstructions; Microprogram Example – The fetch routine, Symbolic microprogram, binary microprogram; Design of Microprogrammed Control Unit; Hardwired vs Microprogrammed Control, Signed binary addition/subtraction with negative numbers in 2`s complement form; Binary multiplication with negative numbers in 2`s complement form (Booth's Algorithm); Division with negative numbers in signed magnitude form (restoring & nonrestoring); Decimal Arithmetic – BCD addition and subtraction;		
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	BL4	X	X	X	X	
CO2	BL4		X			
CO3	BL3		X	X		
CO4	BL5				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R24MSCST010	DATABASE MANAGEMENT SYSTEMS (CSE,IT,CSIT,AIML,DS,ICB)					
	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. **(BL5)**
5	Students will be able to ***justify*** the importance of concurrency and recovery Management
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	BL5					X
CO5	BL5					X
CO6	BL6	X	X	X	X	

R24MBMCT003	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 **(BL5)**
2	Create a suitable development process for an engineering product **(BL6)**
3	Develop a PLM implementation strategy for a product company **(BL6)**
4	Assess a physical product in terms of product data management requirements **(BL5)**
5	Recommend suitable PLM process requirements for a product **(BL5)**

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

R24MIACT003	SIGNAL & IMAGE PROCESSING (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42(L)	**L**	**T**	**P**	**C**
	Pre-requisite	Differential Equations and Vector Calculus, Engineering Physics	**3**	**0**	**0**	**3**

Course Objectives

This course aims to help students grasp comprehensive understanding of the fundamental techniques and methodologies used in processing digital images

Course Outcomes

The students will be able to

1	Apply various digital signal processing techniques **(BL3)**
2	Represent an image and apply various operations on images (**BL3**)
3	Apply intensity transformation techniques, various spatial filters and frequency domain filters to enhance image quality. (**BL3**)
4	Analyze the effectiveness of various spatial filters in restoring images and evaluate methods to enhance and compress images (**BL5**)
5	Analyze the strengths and limitations of various edge detection techniques.**(BL4)**
6	Design and implement an image processing system (**BL6**)

SYLLABUS

Unit I	**Introduction to Digital Signal Processing**	**8 hr**

classification of signals; Digital Signal Processing system; Operations on discrete-time signals; classification of LTI systems; Discrete Time Fourier Transform, Discrete Fourier Transform, Properties; System function, Impulse response; Convolution, Correlation; Introduction to Z transform

Unit II	**Introduction to Image Processing**	**8 hr**

Introduction, Types of Images, Applications; Image Sensing and Acquisition; Fundamental Steps in Image Processing, Image components; Digital Image Representation: Sampling and Quantization, Resolution; Basic Relationships between pixels;Distance Metrics, interpolation; Mathematical tools used indigital image processing.

Unit III	**Image Enhancement**	**8 hr**

Image Transforms, 2D DFT and properties; Image Enhancement:Basic Intensity Transformation Functions; Piecewise Linear TransformationFunctions; Histogram-based Techniques; Spatial Filters for Image Smoothing; Spatial Filters for Sharpening; Image Smoothing in Frequency Domain; Sharpening in Frequency Domain.

Unit IV	**Image Restoration and Image Compression**	**8 hr**

Image Degradation; Noise models; Mean and Order statistics filters; Adaptive filter, Inverse Filtering & Wiener Filtering; Need for image compression, image Compression Model, Types of Redundancy;Compression techniques-Huffman coding, run length coding ; Predictive coding; Image and Video Compression standards.

Unit V	**Image Segmentation and Color Image Processing**	**8 hrs**

Point, Line detection, edge models; edge detection and edge linking; Thresholding techniques; region based segmentation; Color Fundamentals; Color models–RGB, HSI,CMY; Pseudo color image processing, Basics of full-color image processing; Color transformations

LEARNING RESOURCES

TEXTBOOKS:

1	Digital Image Processing, R.C. Gonzalez and R.E. Woods, Second Edition, Pearson Education, 2008
2	Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G. Manolakis, Pearson Education, PHI, 2007.

REFERENCE BOOKS:	
1	Digital Image processing, S Jayaraman, S Esakkirajan, T Veerakumar, Tata McGraw Hill.
2	Digital Image Processing, S. Sridhar, Oxford University Press, 2016
ADDITIONAL REFERENCE MATERIAL	
1	https://nptel.ac.in/courses/117/104/117104020
2	https://nptel.ac.in/courses/117/105/117105135
3	https://nptel.ac.in/courses/108/106/108106168/
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc22_ee116/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	BL3		X			
CO3	BL3			X		
CO4	BL5				X	
CO5	BL4					X
CO6	BL6	X	X	X	X	X

R24MBMCT004	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

R24MIACT004	INTERNET OF THINGS (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Procedural Programming	**3**	**0**	**0**	**3**

Course Objectives:

- To provide a comprehensive understanding of the fundamental concepts of IoT and to familiarize students with the enabling technologies of IoT.
- To equip students with detailed knowledge of various IoT communication protocols, and to develop the ability to select appropriate protocols for specific IoT applications.
- To introduce students to various IoT prototyping boards and to develop skills in programming IoT systems using relevant tools and libraries.
- To familiarize students with the concepts of various IoT cloud platforms and storage models, enabling students to make decisions regarding cloud services for IoT deployments.
- To develop students' understanding of data analytics and security services in IoT.

Course Outcomes

After going through this course, the student will be able to

1	Apply the basic concepts and principles of IoT to identify and describe various IoT components and architectures in practical scenarios.(BL3)
2	Analyze different IoT communication protocols and use cases to determine the most suitable protocol for specific IoT applications.(BL4)
3	Examine and differentiate between various IoT prototyping boards and communication modules for IoT project development.(BL4)
4	Evaluate different IoT cloud platforms and storage models to make decisions on cloud services for IoT deployments.(BL5)
5	Assess the methods of IoT data analytics and security protocols in IoT cloud platforms and systems.(BL5)
6	Design and develop an end-to-end IoT solution that integrates knowledge from all units to address a real-world problem or opportunity.(BL6)

SYLLABUS

Unit I	**INTRODUCTION TO IOT**	**8 hr**

Competency Group1:

IoT – Definition, advantages and disadvantages, history/evolution; Characteristics of IoT and enabling technologies of IoT; IoT Architecture, Physical Design – Things/modules in IoT and IoT protocol suite; Logic Design of IoT – Functional blocks of IoT

Competency Group2:

Communication models of IoT; IoT levels Domain Specific application of IoT: Home Automation, Smart cities, Environment, Domain Specific application of IoT: Energy, Retail, Logistics, Agriculture, Industry, and Health & Life Style.

Unit II	**IOT PROTOCOL SUITE**	**8 hr**

Competency Group1:

M2M – Introduction, network/gateway, characteristics, Differences between IoT and M2M; CoAP - Introduction, key features and architecture; MQTT -1- Introduction, architecture, terminology. MQTT -2- Structure of control packet.

Competency Group2:

6LoWPAN – Introduction, network, working and security; Wi-Fi – Introduction, standards, security, advantages and disadvantages; IEEE 802.15.4 LRWPAN 1– Introduction, key features. IEEE 802.15.4 LRWPAN 2– Node types and network types.

Unit III	PROTOTYPING AND PROGRAMMING	8 hr

Competency Group1:

Prototyping boards – Arduino UNO R3, ESP8266 NodeMCU; Communication techniques and modules- UART, SPI, I2C; HC-05 Bluetooth module; Zigbee – Introduction, Types of networks;

Competency Group2:

Programming Internet of Things Systems – Introduction to IDE,Sketch, Basic Functions- Digital and analog I/O; Libraries and Functions – Liquid crystal, Servo, Software serial; Programming of sensors-1. Programming of sensors-2.

Unit IV	IOT PHYSICAL SERVERS AND CLOUD PLATFORMS	8 hr

Competency Group1:

Introduction to Cloud storage models and API – Definition, communication APIs in IoT (REST &WebSocket); Fog & Edge computing and differences between them;

Advantages and key features of cloud platforms; Selection criteria and application domain of IoT cloud platforms.

Competency Group2:

IoT cloud storage – Introduction, advantages and disadvantages; IoT cloud platforms- ThingSpeak, Thingworx, Microsoft Azure, IoT cloud platforms- Amazon AWS IoT core, Google cloud IoT; Android IoT Apps-Blynk, ThingSpeak, MQTT.

Unit V	DATA AND ANALYTICS FOR IOT	8 hr

Competency Group1:

Introduction to data analytics for IoT, IoT Data analytics- overview, Challenges;

Machine Learning in IoT, Predictive Analysis;

Competency Group2:

IoT Security –Network Analytics Common challenges in OT Security; Phased application security in operational Environments OT Network Characteristics Impacting Security.

LEARNING RESOURCES

TEXTBOOKS:	
1	"Internet of Things: A Hands-On Approach" by ArshdeepBahga and Vijay Madisetti.
2	"Designing the Internet of Things", Adrian McEwen Hakim Cassimally, 1st Ed, John Wiley, 2014
3	"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 RajkumarBuyya, Amir VahidDastjerdi, and editors.
2	"Practical IoT Projects with LoRa, NodeMCU and ESP8266" by AgusKurniawan.
3	"Cloud Computing: Concepts, Technology & Architecture" by Thomas Erl, Zaigham Mahmood, and Ricardo Puttini.
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc24_cs115/preview
2	https://onlinecourses.swayam2.ac.in/ntr24_ed44/preview
3	Coursera and edX: Platforms offering courses on IoT, networking, and related topics from universities and institutions worldwide.

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		
CO3	BL4			X		
CO4	BL5				X	
CO5	BL5				X	X
CO6	BL6	X	X	X	X	X

<table>
<tr><td rowspan="3">R24MSCSL005</td><td colspan="6">PYTHON 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">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.
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.</td></tr>
<tr><td>5</td><td colspan="6">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.</td></tr>
</table>

	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 and inspect data in DataFrame using head(), tail (), info() and describe() functions in pandas. 2. Write a program to perform sorting and slicing operations in pandas. 3. Write a program to perform dataframe modification and data cleaning 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

R24MSCSL006	DATABASE MANAGEMENT SYSTEMS LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	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 of data 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 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.
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

R24MBMCL002	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

R24MIACL002	DIGITAL LOGIC DESIGN LAB (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Digital Logic Design	**0**	**0**	**3**	**2**

Course Objective

To get hands-on exposure on digital logic circuits using Verilog Hardware Description Language (HDL), enabling students to understand digital system behavior and implement designs on FPGA platforms.

Course Outcomes

1	Understand the basics of Hardware Description Languages, Program structure and basic language elements of Verilog HDL.
2	Understand types of modelling, modules, functions of Verilog and simulate and synthesize related Programs.
3	Design, Simulate and synthesize various Verilog HDL descriptions for Combinational circuits.
4	Design, Simulate and synthesize various Verilog HDL descriptions for Sequential circuits.
5	Developing test benches to verify the functionality of combinational and sequential Circuits.
6	The students come to terms with the understanding of how to verify the implemented logic withFPGA hardware module/kit.

Note: The students are required to design and draw the internal logical structure of the following digital Circuits and to develop Verilog HDL Source code, perform simulation using test bench with relevant simulator then analyze the obtained simulation results using necessary synthesizer and then validate the implemented logic with different hardware modules/kits (FPGAkits).

Atleast five experiments are required to verify and implement the logical operations on the FPGA Hardware in the Laboratory.

LIST OF EXPERIMENTS(Minimum of Ten Experiments has to be performed)

1	Realization of Logic Gates
2	Full Adder
3	3 to 8 Decoder
4	Priority Encoder
5	8X1 Multiplexer and 1X4 De-multiplexer
6	4 Bit Comparator
7	D Flip-Flop
8	Decade Counter
9	Random Counter
10	Shift Register
11	Universal Shift register
12	First In & First Out (FIFO)

Software requirements:

Vivado Xilinx Design Suite software tool

Hardware requirements:

FPGA Hardware Kit, Computer Systems with required specifications

LEARNING RESOURCES

TEXT BOOKS:

1	Verilog HDL-A guide to Digital Design and Synthesis-Samir Palnitkar-ISBN: 0134516753; Pub: Prentice Hall PTR.
2	Fundamentals of Digital logic with Verilog design-2e, Brown Vranesic, McGraw Hill education, ISBN-13:978-0-07-066724-2
3	Digital Design Principles & Practices by John F. Wakerly, PHI Publications, Third

	Edition. 2005
ADDITIONAL REFERENCE MATERIAL	
1	https://vlsiverify.com/verilog
2	https://www.geeksforgeeks.org/electronics-engineering/getting-started-with-verilog/
3	https://www.intel.com/content/www/us/en/programmable/customertraining/webex/Verilog/presentation_html5.html
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc25_cs155/preview
2	https://onlinecourses.nptel.ac.in/noc25_ee180/preview
3	https://onlinecourses.nptel.ac.in/noc25_ee106/preview

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V SEMESTER

R24MSCST011	OPERATING SYSTEMS (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basics of computer systems	**3**	**0**	**0**	**3**

Course Objective

Students will be able to understand how an operating system manages a computer's hardware resources like CPU, memory, file and storage providing a user-friendly interface to interact with the system, enabling them to grasp the principles of managing a computer system efficiently.

Course Outcomes

1	Students will be able to analyze the diverse structures and functionalities of operating systems to evaluate their impact on computer system performance. **(BL4)**
2	Students will be able to explain the different **process management related aspects of operating system and will be able to analyze various process scheduling algorithms. (BL5)**
3	Students will be able to perceive the significance of process synchronization and deadlock handling mechanisms in the operating system. **(BL5)**
4	Students will be able to compare and analyze the various memory **management techniques. (BL4)**
5	Students will be able to explain various **file management, storage management, protection and security services** offered by the operating system. **(BL5)**
6	Students will be able to discuss how an operating system manages a computer's hardware resources like CPU, memory, and storage, allowing them to effectively utilize these resources through concepts like process management, memory allocation, file systems. **(BL6)**

SYLLABUS

Unit I	**COMPUTER SYSTEM AND OPERATING SYSTEM OVERVIEW**	**8 hr**

Overview Computer System Hardware, What Operating System do?; Computer System Organization & Computer System Architecture; OS Functions and Services; The Evolution of OS; Computing Environment; OS System Structure; System Calls and types of system calls; User Operating System Interface, Protection and Security.

Unit II	**PROCESS MANAGEMENT**	**8 hr**

Process description, Process States & Transitions, PCB; Process Scheduling-Scheduling queues, Schedulers, Context Switching; Operations on processes; Multithreading-Motivation, Benefits & Multithreading Models; Process Scheduling-Basic Concepts & Scheduling Criteria; Scheduling Algorithms-Non-Preemptive. (FCFS, SJF & Priority); Scheduling Algorithms-Preemptive (Round Robin & Priority); Multilevel Queue Scheduling, Multilevel-feedback Queue Scheduling.

Unit III	**PROCESS SYNCHRONIZATION AND DEADLOCKS**	**8 hr**

Process Synchronization-Background, The Critical section problem; Software-Based Solution (Peterson's Solution), Synchronization Hardware; Semaphores- Usage, Implementation; Classical Problems Synchronization-Bounded Buffer, Readers Writer's problem; Deadlock-System model, Deadlock Characterization; Methods of handling deadlocks, Deadlock Prevention; Deadlock Avoidance; Deadlock Detection, Recovery from Deadlock.

Unit IV	**MEMORY MANAGEMENT**	**8 hr**

Background-Basic Hardware, Address Binding, Logical vs Physical; Swapping, Contiguous

Memory Allocation; Paging- Basic Method, Hardware; Structure of page tables; Segmentation -Basic Methods, Hardware; Virtual Memory-Background, Demand Paging-Basic Concepts; Page Replacement Algorithm-Basic Page replacement, FIFO, Optimal; Page Replacement Algorithm-LRU, Thrashing-Causes of Thrashing.		
Unit V	**FILE & STORAGE MANAGEMENT, PROTECTION AND SECURITY**	**8 hr**
File Concept-File Attributes, File Operations, File Types; Directory Structure- Overview, Single level, Two level, Tree Structure; File Allocation Methods- Contiguous, Linked, Indexed; Mass Storage-Magnetic Disk, Magnetic Tape, Disk Structure; Disk Scheduling; Goals of Protection, Principals of Protection, Access Matrix, ACL; The Security Problems, Program threats- Trojan, Trap Door, Ransomware; User Authentication-Passwords, Password Vulnerabilities, Encrypted Password, OTP, Bio-Metric.		

LEARNING RESOURCES

TEXTBOOKS:	
1	Operating systems concepts by Abraham Silberschatz, peter B. Galvin, and Greg Gagne.
2	Operating systems: Internals and design principles by William Stallings.
REFERENCE BOOKS:	
1	Modern operating systems by Andrew S. Tanenbaum
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	https://www.geeksforgeeks.org/operating-systems/
2	https://www.tutorialspoint.com/operating_system/os_overview.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	BL5		X			
CO3	BL5			X		
CO4	BL4				X	
CO5	BL5					X
CO6	BL6	X	X	X	X	X

R24MSCST012	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, 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

R24MSCST013	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

R24MSCST014	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. **(BL4)**
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

R24MSCST019 (DSC-E1)	DATA WAREHOUSING AND DATA MINING (CSE,IT,CSIT,AIML,DS)					
	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

R24MSCST026 (DSC-E1)	STATISTICAL AND MATHEMATICAL FOUNDATION OF DATA ANALYTICS (CSE,IT,CSIT,DS)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Mathematical Methods, calculus and probability & statistics	**3**	**0**	**0**	**3**

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

Course Outcomes

1	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)**
2	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)**
3	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)**
4	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)**
5	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)**
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)**

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	BL4				X	X
CO4	BL4	X		X		
CO5	BL5		X			X
CO6	BL6		X		X	X

R24MSCST032 (DSC-E1)	CRYPTOGRAPHY AND INFORMATION SECURITY (CSE,IT,CSIT,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-**	**8 hr**

	COMMERCE SECURITY	
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

R24MSCST037 (DSC-E1)	INFORMATION SECURITY MANAGEMENT STANDARDS (CSE,IT,CSIT)					
	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

R24MBMCT005	ENTREPRENEURSHIP (CSE,IT,CSIT,AIML,DS,ICB)					
	Total Contact Hours	40 (L) + 2	**L**	**T**	**P**	**C**
	Prerequisite	None	**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

R24MIACT005	INDUSTRY 4.0 AND IIOT (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	40 (L) +2 (Orientation)	**L**	**T**	**P**	**C**
	Prerequisite	Basic Electronics, IOT	**3**	**0**	**0**	**3**

Course Objectives

- To introduce fundamentals of Industrial IOT and Industry 4.0.
- To explore Artificial intelligence, Big data analysis and cyber security.
- To describe Business Model and Reference Architecture of IIOT.
- To explain Big Data Analytics, Software Defined Networks and Security.

Course Outcomes:

Students will be able to

1	Understand the fundamentals of Industrial IOT and Industry 4.0and to Evaluate the Principles of the Fourth Industrial Revolution and Their Applications (BL3)
2	Design and Integrate Cyber-Physical Systems in Industry 4.0 and apply Augmented Reality (AR) and Virtual Reality (VR) for Industrial Training and Maintenance (BL4)
3	Examine different Business Model and Reference Architecture of IIOT(BL4)
4	Integrate and Evaluate Software Defined Networks (SDN) in IIoT Systems(BL5)
5	Appraise about the security and Fog computing (BL5)
6	Apply Augmented Reality (AR) and Virtual Reality (VR) for Safety and Maintenance in Industrial Environments and to create IIoT Solutions for Various Industry Applications (Healthcare, Manufacturing, Energy, etc.)(BL6)

SYLLABUS

Unit 1	**INTRODUCTION TO INDUSTRY 4.0 AND INDUSTRIAL IOT**	**8 hr**

Evolution of Industrial Automation- Introduction to IOT, What is IIOT? IOT Vs. IIOT, History of IIOT

Overview of Industrial IoT-1: Components of IIOT -Sensors, Interface,

Overview of Industrial IoT-2 : Networks, People & Process

Introduction to Industry 4.0: Enabling Technologies – AI, Robotics, IOT, Enabling Technologies Cyber-Physical Systems, Smart Factories, Supporting systems for Industry 4.0 Comparison of Industry 3.0 vs 4.0

Unit 2	**ARCHITECTURES of IIOT**	**8 hr**

Overview of IOT components ;Various Architectures of IOT and IIOT, Advantages & disadvantages, Industrial Internet - Reference Architecture; IIOT System components: Sensors, Gateways, Routers, Modem, Cloud brokers, Servers and its integration, Introduction to WSN, WSN Architecture WSN network design for IOT

Unit 3	**ARTIFICIAL INTELLIGENCE, BIG DATA ANALYSIS AND CYBER SECURITY OF INDUSTRY 4.0**	**8 hr**

Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis, Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Industrial Processes Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Unit 4	**INDUSTRIAL IOT: BIG DATA ANALYTICS ,SOFTWARE DEFINED NETWORKS,SECURITY AND FOG COMPUTING**	**8 hr**

Industrial IoT: Big Data Analytics, Software Defined Networks and SDN in IIoT, Edge Computing in IIoT (2),Fog Computing in IIoT (2),Security in IIoT (2)

Unit 5	**INDUSTRIAL IOT: APPLICATION DOMAINS**	**8 hr**

Industrial IoT Application Domains:

Factories and Assembly Line, Food Industry. Healthcare, Automotive, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications) -(2)

LEARNING RESOURCES	
TEXT BOOKS:	
1	S. Misra, A. Mukherjee, and A. Roy, 2020. *Introduction to IoT*. Cambridge University Press
2	S. Misra, C. Roy, and A. Mukherjee, 2020. *Introduction to Industrial Internet of Things and Industry 4.0.* CRC Press.
REFERENCE BOOKS:	
1	Industry 4.0: The Industrial Internet of Things", by Alasdair Gilchrist (Apress)
2	Industrial Internet of Things: Cyber manufacturingSystems"by Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer)
ONLINE COURSES	
1	https://onlinecourses.nptel.ac.in/noc24_cs95/announcements?force=true

Bloom's level – Units catchment articulation matrix

CO	Blooms Level	UnitI	UnitII	Unit III	UnitIV	UnitV
CO1	BL3	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">R24MSCSL007</td><td colspan="6">ADVANCED JAVA 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>-</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>
<tr><td>3</td><td colspan="6">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.</td></tr>
</table>

	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

R24MBMCL003	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'

R24MIACL003	VIRTUAL INSTRUMENTATION LAB (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic Programming	**0**	**0**	**3**	**2**

Course Objective

To design, develop, and implement real-time graphical applications using LabVIEW.

Course Outcomes

1	Create complex LabVIEW applications by integrating various programming concepts and techniques learned throughout the course, demonstrating the ability to design modular and scalable solutions.

Topics to be covered week wise

Part A: Implement graphical applications in LabVIEW using the following programming concepts.

1	Create VI and SubVI; FOR Loops; WHILE Loop.
2	Feedback Nodes, Formula Node; Shift Registers; Case Structures; Control Timing.
3	Sequence Structure: Flat or Stacked; Event Structure; Timed Structures; Local and Global variables; Property Node.
4	Array Functions; Clusters functions; Error Handling.
5	Waveform Charts; Waveform Graphs; XY Graphs, Intensity Charts and Graphs; Digital Waveforms.
6	String function; File Input/Output.

Part B: Implement the following real-time applications using LabVIEW with either NI myDAQ, NI myRIO, or an Arduino board.

7	Gas Leakage Detection system.
8	Automatic Street Lights control system.
9	Automatic Overhead tank water level Indication.
10	Water Quality monitor system.
11	Automatic Rain sensing wiper.
12	Earthquake detection system.
13	Smart Dustbin.
14	Smart Irrigation system.

LEARNING RESOURCES

TEXT BOOKS:

1	LabVIEW for Everyone: Graphical Programming Made Easy and Fun by Jeffrey Travis, Jim Kring Third Edition, Prentice Hall, 2006.
2	Virtual Instrumentation Using LabVIEW by Jovitha Jerome, PHI Learning Pvt. Ltd, 2010.

REFERENCE BOOKS:

1	VIRTUAL INSTRUMENTATION LAB MANUAL by B. Srinivas, S M Vali, M. Satyanarayana, 1st edition, Notion Press, 2022.
2	LabVIEW Graphical Programming by Gary W. Johnson, Richard Jennings , Fourth Edition, McGraw-Hill publications, 2006

ON-LINE LINKS:

1	https://www.ni.com/docs/en-US/
2	https://sensorkit.arduino.cc/sensorkit/module/getting-started/lesson/00-getting-started

R24MMATT007	QUANTITATIVE PROBLEM SOLVING TECHNIQUES (Common to all Branches)					
	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

R24MSCST015	**WEB TECHNOLOGIES (CSE,IT,CSIT,AIML,DS,ICB)**					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Object-Oriented Programming (OOP) using Java, Database Management Systems	**3**	**0**	**0**	**3**

Course Objective

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.

Course Outcomes

1	Students will be able to **analyze** requirements and design effective web pages using HTML and CSS. **(BL4)**
2	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)**
3	Students will be able to **interpret** the applications of JavaBeans and analyze web application development using Servlets. **(BL4)**
4	Students will be able to **compare** JSP and Servlets, and evaluate their usage by compiling and deploying them for effective web application development. **(BL5)**
5	Students will be able to **develop** complete web applications and integrate them with a database using JDBC for efficient data management. **(BL5)**
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)**

SYLLABUS

Unit I	**INTRODUCTION TO WEB TECHNOLOGIES, HTML & CSS**	**8 hr**

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);

Unit II	**JAVASCRIPT & XML**	**8 hr**

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;

Unit III	**JAVABEANS, WEBSERVERS & SERVLETS**	**8 hr**

Introduction to JavaBeans, Bean Features, and advantages ; Introspection using Bean Info interface, Bean Properties, Persistence ; Bean Deployment Using 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.
REFERENCE BOOKS:	
1	
2	
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
ONLINE COURSES	
1	
2	

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

R24MSCST016	OOAD & DESIGN PATTERNS (CSE,IT,CSIT,AIML,DS,ICB)					
	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

R24MSCST017	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 MICROCONTROLLER**	**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

R24MBMCT006	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

R24MIACT006	EMBEDDED SYSTEMS (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	**MPI**	**3**	**0**	**0**	**3**

Course Objective

Students will ….

- Gain a foundational understanding of embedded systems and comprehend the design process, challenges, and metrics associated with embedded systems.
- Develop proficiency in working with both hardware and software platforms used in embedded systems and understand the principles of hardware-software interfacing.
- Master the skills required for embedded C programming and apply these programming skills in practical scenarios through project examples.
- Delve into the architecture and programming of ARM-based microcontrollers

Course Outcomes

1	Identify the key components involved in Embedded systems and select suitable hardware and software components (BL3)
2	Analyze the features and functions of various peripheral devices and interfaces and the challenges associated with embedded system design (BL4)
3	Evaluate different hardware and software platforms used in embedded systems, considering their advantages and disadvantages. (BL5)
4	Analyze and integrate advanced concepts and skills in embedded C programming to design, develop, and debug complex applications. (BL4)
5	Critically evaluate and justify the selection of specific ARM-based microcontroller architectures for diverse applications by comparing their features, addressing modes, and programming paradigms. (BL5)
6	Create efficient solutions for real-world problems using embedded systems. (BL6)

SYLLABUS

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

Competency Group1:

Definition, characteristics, and examples of embedded systems, Embedded system components: processors, memory, Embedded system components: peripherals, sensors, actuators, etc., Embedded system design process: requirements, specifications, modeling,

Competency Group2:

Embedded system design process: simulation, implementation, Embedded system design process: testing, debugging, etc. Embedded system design challenges: performance, power, reliability, security, etc. Embedded system design metrics: cost, quality, time, etc.

Unit II	**EMBEDDED HARDWARE AND SOFTWARE PLATFORMS**	**8 hr**

Competency Group1:
Embedded hardware platforms: microcontrollers, microprocessors, Embedded hardware platforms: DSPs, FPGAs, SoCs.
Embedded software platforms: operating systems, middleware, drivers, libraries,
Embedded hardware, and software interfacing: buses, protocols, standards.
Competency Group2:
Embedded Firmware design approaches.
Embedded Firmware development languages, Programmed I/O, ISR concept.
Embedded Software development process and tools. The integrated development environment (IDE)-cross-compilers, compilers, assemblers, linkers, debuggers, emulators, simulators.

Unit III	**EMBEDDED SYSTEMS PROGRAMMING**	**8 hr**

Competency Group1:
Embedded C programming: syntax, data types, operators, Embedded C programming: control structures, functions, Embedded C programming: pointers, arrays, strings. Embedded C programming: input/output, interrupts, timers
Competency Group2:
Serial communication, bit manipulation, memory management, data structures.
Embedded C programming 1: interfacing LED, LCD display,
Embedded C programming 1: interfacing keypad

Unit IV	**ARM-BASED MICROCONTROLLERS - I**	**8 hr**

Competency Group1:
Introduction to LPC 2148 ARM Processors: features; Memory Organization in ARM Processor, ARM instruction set: data processing, data transfer, ARM instruction set: control flow
Competency Group2:
ARM addressing modes: register, immediate, shifted register, etc. Basics of ARM programming: Assembly and C programming; Arithmetic operations, Logic operations

Unit V	**ARM-BASED MICROCONTROLLERS - II**	**8 hr**

Competency Group1:
LPC 2148 ARM Processor Peripherals: GPIO,
LPC 2148 ARM Processor Peripherals: ADC, DAC,
LPC 2148 ARM Processor Peripherals: PWM.
LPC 2148 ARM Processor Peripherals: Timers
Competency Group2:
LPC 2148 ARM Processor Peripherals: UART,
LPC 2148 ARM Processor Peripherals: SPI, I2C.
LPC 2148 ARM Processor Interfacing: LCD
LPC 2148 ARM Processor Interfacing: RTC

LEARNING RESOURCES

TEXT BOOKS:

1	"Embedded Systems: Introduction to ARM Cortex-M Microcontrollers" by Jonathan Valvano
2	"Embedded Systems" by Rajkamal, TMH, 2017
3	"The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors" by Joseph Yiu

REFERENCE BOOKS:

1	"Embedded System Design: A Unified Hardware/Software Introduction", By F. Vahid and T. Givargis, Wiley India Pvt. Ltd., 2002.
2	"ARM System Developer's Guide: Design and Optimizing System Software", A.N. Sloss, D. Symes and C. Wright, by Morgan Kaufman Publishers, 2004.
3	"ARM System Developer's Guide: Designing and Optimizing System Software" by Andrew Sloss, Dominic Symes, and Chris Wright

4	"Programming Embedded Systems: With C and GNU Development Tools" by Michael Barr and Anthony Massa
ADDITIONAL REFERENCE MATERIAL	
1	"RTOS for Arm Cortex-M Microcontrollers" by Jonathan Valvano
ONLINE COURSES	
1	https://nptel.ac.in/courses/108102045
2	https://onlinecourses.nptel.ac.in/noc20_cs14/preview
3	https://onlinecourses.nptel.ac.in/noc20_ee98/
4	https://archive.nptel.ac.in/courses/106/105/106105193/

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	X
CO2	BL4	X				X
CO3	BL5		X			
CO4	BL4			X		
CO5	BL5				X	X
CO6	BL6	X	X	X	X	X

R24MSCST020 (DSC-E2)	STATISTICAL PREDICTIVE ANALYTICS (CSE,IT,CSIT,AIML,DS)					
	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

R24MSCST024 (DSC-E2)	DATA ANALYTICS AND TOOLS (CSE,IT,CSIT,DS)					
	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

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

R24MSCST019 (DSC-E2)	DATA WAREHOUSING AND DATA MINING (CSE,IT,CSIT,AIML,DS)					
	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

R24MSCST033 (DSC-E2)	BLOCK CHAIN ESSENTIALS (CSE,IT,CSIT,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	
ADDITIONAL REFERENCE MATERIAL		

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

R24MSCST036 (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

R24MSCST021 (DSC-E3)	MACHINE LEARNING (CSE,IT,CSIT,AIML)					
	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

R24MSCST020 (DSC-E3)	STATISTICAL PREDICTIVE ANALYTICS (CSE,IT,CSIT,AIML,DS)					
	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

R24MSCST034 (DSC-E3)	PRINCIPLES OF IOT (CSE,IT,CSIT,ICB)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Prerequisite	Python, Computer Networks and Communication Protocols	**3**	**0**	**0**	**3**

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.

Course Outcomes

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

1	Analyze IoT's architecture, enabling technologies, and deployment models to understand its role in various domains such as smart cities, healthcare, and agriculture. **(BL4)**
2	Examine IoT communication models, protocols, and message structures to differentiate between IoT networking technologies like MQTT, CoAP, and Zigbee. **(BL4)**
3	Evaluate different IoT cloud platforms, storage models, and computing paradigms (Edge, Fog, and Cloud) to select appropriate solutions for real-world IoT applications. **(BL4)**
4	Assess IoT data analytics techniques, including predictive analytics, machine learning, and distributed analytics, to optimize decision-making in IoT-based applications. **(BL5)**
5	Critically evaluate IoT security risks, authentication mechanisms, and encryption techniques to enhance the resilience of IoT networks against cyber threats. **(BL5)**
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)**

SYLLABUS

Unit I	**INTRODUCTION TO IOT**	**8 hr**

Definition of IoT, Advantages and disadvantages of IoT, History/Evolution of IoT; Characteristics of IoT, Enabling Technologies of IoT; Physical Design of IoT-Things 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.

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

R24MSCST038 (DSC-E3)	ROUTING AND SWITCHING CONCEPTS (CSE,IT,CSIT)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Computer Networks	**3**	**0**	**0**	**3**

Course Objective

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

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**	**8hr**

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

TEXT BOOKS:

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	BL3	X				
CO2	BL6		X			
CO3	BL4			X		
CO4	BL5				X	
CO5	BL3					X
CO6	BL6	X	X	X	X	X

<table>
<tr><td rowspan="3">R24MSCSL008</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">Introduction to Programming</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 an 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.</td></tr>
<tr><td>3</td><td colspan="7">1. Write an HTML Program to create a form for collecting personal details using all input types and its attributes.
2. Write an HTML Program to EXPLORE HTML5 BLOGGING TAGS</td></tr>
<tr><td>4</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>5</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</td></tr>
</table>

	not. 3. Write a JavaScript program to check whether a given number is Armstrong or not 4. Write a JavaScript program to demonstrate linear search.
6	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 characters 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).
7	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 Write an internal Document Type Definition (DTD) document to validate the above XML file. 2. 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. Write an external Document Type Definition (DTD) document to validate the above XML file.
8	1. Create a schema for ship order where order person, ship to and item details as elements? OrderID is a compulsory attribute, shipto can have colony, city, pin. Item details 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. Write an XML Schema Document (XSD) / Schema to validate the above XML file.
9	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
10	1. Create a servlet program (by implementing Servlet Interface) to demonstrate servlet life cycle methods. 2. Write a servlet program that displays "MVGR AUTONOMOUS" message on a web page using GenericServlet class. 3. Implement a servlet program to implement a dynamic HTML using Servlet (Username and password should be accepted using HTML and displayed using a Servlet). 4. Implement a servlet program to add two numbers. (The numbers should be accepted from the HTML page and displayed using a Servlet).
11	1. Implement a servlet program to demonstrate the following a) how to read Initialization parameters. b) how to read Context parameters. 2. Implement a JAVA Servlet Program to implement sessions using HTTP

	Session Interface. 3. Implement a JAVA Servlet Program to implement sessions using Cookies.
12	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. 3. 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 DA-DMS allowances= 90% of basic HRA=10% of basic Gross salary= basic +DA+HRA
Additional experiments	
1	Create a web form that dynamically updates based on user input using JavaScript, and validate the form using both client-side and server-side techniques.
2	Implement a servlet program that connects to a database, retrieves data, and dynamically displays it on a web page.
3	Design a secure user authentication system using JavaServer Pages (JSP), incorporating sessions and cookies for user management.
Demonstration experiments	
1	Develop static pages (using only HTML) of an online Book store. 1. The website should consist of the following pages. 2. Home page, Registration and user Login, User profile page, Books catalog, Shopping cart, Payment By credit card, order confirmation.
2	1. Install a database (MySQL) 2. 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).
3	
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

R24MBMCL004	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

R24MIACL004	EMBEDDED SYSTEMS LAB (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (P)	**L**	**T**	**P**	**C**
	Pre-requisite	MPI,ES	**0**	**0**	**3**	**2**

Course Objective

Students will gain understanding of hardware architecture and functional blocks of Arduino Uno and ARM32 LPC2148 microcontroller.
Students will get exposure to the programming of Arduino Uno and ARM32 LPC2148 microcontroller.

Course Outcomes: The students will be able to

1	Write and execute programs using KeilUVision and Arduino IDE.
2	Perform Interfacing of I/O devices to Arduino and LPC2148 Microcontroller Boards

List of Experiments (Any 12 Experiments)

1	Programming –Digital Read and Write I/O Operations on Arduino Uno Hardware Kit.
2	Programming - Analog Read and Write I/O Operations on Arduino Uno Hardware Kit.
3	Programming - UART Operations on Arduino Uno Hardware Kit.
4	Programming - SPI Operations on Arduino Uno Hardware Kit.
5	Programming –I2C Operations on Arduino Uno Hardware Kit.
6	Programming - I/O Ports, Buzzer, LED's, Switches on LPC2148 Hardware Kit.
7	Programming - LCD on LPC2148 Hardware Kit.
8	Programming – UART in poll mode on LPC2148 Hardware Kit.
9	Programming – ADC in poll mode on LPC2148 Hardware Kit.
10	Programming – Timer/Counter in poll mode on LPC2148 Hardware Kit.
11	Programming – External Hardware Interrupts on LPC2148 Hardware Kit.
12	Programming – UART, ADC, Timer/Counter in interrupt mode on LPC2148 Hardware Kit.
13	Programming – EEPROM on LPC2148 Hardware Kit.
14	Programming – SPI, I2C on LPC2148 Hardware Kit.
15	Programming –RTC on LPC2148 Hardware Kit.

Additional experiment

1	Programming – PS2 Keyboard, SD card Interface.

Demonstration experiment

1	DC Motor and Servo Motor interfacing withLPC2418 Microcontroller.

LEARNING RESOURCES

TEXT BOOKS:

1	Real-Time Operating Systems for ARM Cortex-M.
2	Joseph Yiu (Auth.) - The Definitive Guide to Arm® Cortex®-M3 and Cortex®-M4 Processors-Newnes (2014)

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VII SEMESTER

R24MSCST018	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

R24MSCST022 (DSC-E4)	DEEP LEARNING (CSE,IT,CSIT,AIML)					
	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

R24MSCST024 (DSC-E4)	DATA ANALYTICS AND TOOLS (CSE,IT,CSIT,DS)					
	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

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

R24MSCST035 (DSC-E4)	IoT DEVELOPMENT BOARDS AND ITS INTERFACING (CSE,IT,CSIT,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

R24MSCST039 (DSC-E4)	ENTERPRISE NETWORKING, SECURITY AND AUTOMATION (CSE,IT,CSIT)					
	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

R24MSCST023 (DSC-E5)	NATURAL LANGUAGE PROCESSING (CSE,IT,CSIT,AIML)					
	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

R24MSCST025 (DSC-E5)	MEAN STACK WEB DEVELOPMENT (CSE,IT,CSIT)					
	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

R24MSCST027 (DSC-E5)	TIME SERIES ANALYSIS IN DATA SCIENCE (CSE,IT,CSIT,DS)					
	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

R24MSCST036 (DSC-E5)	AD HOC NETWORKS (CSE,IT,CSIT,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

R24MSCST040 (DSC-E5)	FIREWALLS AND VPN (CSE,IT,CSIT)					
	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

R24MSCSL009	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 views
ONLINE REFERENCES:	
1	https://developer.android.com/studio
2	https://developer.android.com/community

R24MSCSL009	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					

R24MSCSL009	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
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
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

***

VIII SEMESTER

EOEC-E1(Self-Study/MOOCs)

R24MBMCT007	**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

R24MBMCT008	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

R24MBMCT009	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

R24MIACT007	ROBOTICS (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42(L)	**L**	**T**	**P**	**C**
	Prerequisite	Mathematics, Physics	**3**	**0**	**0**	**3**

Course Objective

This course provides a comprehensive foundation in robotics, covering its history, evolution, and core concepts. It explores robot anatomy, classifications, end effectors, and kinematic modeling techniques. Students will learn about various actuators, control architectures, sensors, and machine vision basics. The curriculum includes programming languages, simulation tools, and online/offline programming methods. Industrial and emerging applications, including AI and ML integration, are examined. The course prepares students to design, analyze, and apply robotic systems safely and effectively in diverse fields.

Course Outcomes

After completing this course, the students will be able to

1	Apply fundamental concepts to differentiate between robots and non-robots in various scenarios. (**BL3**)
2	Analyze and map coordinate frame transformations for rotated, translated, and combined vector frames and selection criteria for grippers (**BL4**)
3	Analyze vector transformations related to rotations and translations to facilitate manipulator movement planning.(**BL4**)
4	Analyze the characteristics and working principles of hydraulic, pneumatic, electric, and smart material actuators as well as sensor data from internal and external sensors to support effective robot control and machine vision integration**(BL-4)**
5	Analyze offline and online programming techniques for robotic systems, along with diverse industrial and emerging applications—including safety considerations and human-robot interaction aspects—to optimize overall robotic system performance(**BL5**)
6	Critically evaluate and integrate robotics fundamentals, kinematics, control, programming, and emerging AI technologies to design, optimize, and assess innovative robotic systems for diverse industrial and societal applications with safety and efficiency in mind (**BL5**)

SYLLABUS

Unit I	**INTRODUCTION TO ROBOTICS**	**8 hr**

An overview of Robotics-History, Evolution of robots; Laws of robots, what is robot and what is not a robot; Progressive advancements in robots; Robot anatomy, links, joints, degree of freedom; Classification based on control system; Classification based on coordinate system and work volume; Classification of robots based on mobility, autonomy and application; present and Future prospects of robotics.

Unit II	**END EFFECTORS AND TRANSFORMATIONS OF FRAMES**	**8 hr**

Types of End effector; mechanical grippers; Other type of grippers; Requirements and challenges of end effectors and Gripper design considerations and selection of a gripper; Mapping, mapping between rotated frames; Mapping between translated frames, mapping between translated and rotated frames, Transformation of vectors, rotation, translation of vectors; Principal axes rotation, Fixed angle rotation.

Unit III	**KINEMATICSAND PATH PLANNING**	**8 hr**

Mechanical structure and notations, description of links and joints; Kinematic modelling of the manipulator; Denavit-Hartenberg notation; Kinematic relationship between adjacent links; forward kinematics for planar manipulator; inverse kinematics for planar manipulator; path planning basics and terminology; jstcst

Unit IV	**ACTUATORS AND SENSORS**	**8 hr**
Hydraulic actuators; Pneumatic actuator; Electric actuator and smart material as actuators; Control Architecture – Open Loop and Closed Loop; Basic Controllers – PID and On/Off and types of controllers; Sensors – Internal (Position, Velocity, Acceleration); Sensors – External (Proximity, Force/Torque);Machine vision, sensor integration		
Unit V	**PROGRAMMING AND APPLICATIONS**	**8 hr**
Introduction to Robot Programming Languages (e.g., VAL, RAPID, Python); Offline and Online Programming Techniques; Simulation Tools – Robot, MATLAB, ROS (Basics); Industrial Applications – Pick & Place, Welding, Painting; Robotics in Emerging Fields – Medical, Defense, Agriculture; Human-Robot Interaction and Safety Standards; AI in robotics; ML in Robotics		
LEARNING RESOURCES		
TEXTBOOKS:		
1	Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, *"Industrial Robotics Technology, Programming and Applications",* Tata – McGraw Hill Pub. Co.	
2	R. K. Mittal, I. J. Nagrath*, Robotics and Control*, TATA McGraw Hill Publishing Co Ltd, New Delhi	
REFERENCE BOOKS:		
1	S. K. Saha, *Introduction to Robotics* 2e, TATA McGraw Hills Education.	
2	Fu. K. S, Gonzalez. R. C & Lee. C. S. G, *"Robotics control, sensing, vision and intelligence"*, Tata- McGraw Hill Pub. Co.	
3	Deb. S. R and Sankha Deb, *"Robotics Technology and Flexible Automation",* Tata McGraw Hill Publishing Company Limited.	
ADDITIONAL REFERENCE MATERIAL		
1	Robert J Schilling, *Fundamentals of Robotics*, Prentice Hall India, 2001	
2	John J Craig, *Introduction to Robotics*, Prentice Hall International, 2005	
ONLINE COURSES		
1	https://onlinecourses.nptel.ac.in/noc20_de11/preview	
2	https://ocw.mit.edu/courses/2-12-introduction-to-robotics-fall-2005/	
3	https://www.coursera.org/learn/robotics-motion-planning?specialization=robotics	

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	BL4		X	X	X	
CO3	BL4	X	X	X	X	
CO4	BL4	X	X	X	X	
CO5	BL5	X	X	X	X	X
CO6	BL5			X	X	X

R24MIACT008	INDUSTRIAL AUTOMATION (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42(L)	**L**	**T**	**P**	**C**
	Prerequisite	CSI, IOT, IIOT	**3**	**0**	**0**	**3**

Course Objectives

Understand the fundamentals of industrial automation, smart manufacturing, and digital integration.
Explore Industry 4.0 and IoT technologies for intelligent factory design and monitoring.
Learn the role of data analytics, AI, and ML in process optimization.
Gain hands-on understanding of rapid prototyping technologies and their use in iterative design.

Course Outcomes

After completing this course, the students will be able to

1	Apply knowledge of automation types, PLC programming, CNC systems, and robotics to design solutions for integrated manufacturing processes. **(BL3)**
2	Analyze the core technologies of Industry 4.0, including cyber-physical systems, IoT, digital twins, and additive manufacturing, and explain their role in smart factories. **(BL4)**
3	Apply IoT architectures, protocols, and edge/cloud computing concepts to design connected manufacturing systems with secure data acquisition and monitoring. **(BL3)**
4	Utilize AI/ML tools for predictive maintenance, process optimization, defect detection, and decision support in intelligent production environments. **(BL4)**
5	Develop knowledge of additive manufacturing processes, materials, and applications, and design products suitable for rapid prototyping and digital fabrication. **(BL6)**
6	Design, analyze, and implement intelligent, automated, and digitally integrated manufacturing solutions by applying principles of automation, IoT, AI/ML, and additive manufacturing, bridging the gap between mechanical systems and computer science applications. **(BL6)**

SYLLABUS

Unit I	**AUTOMATION IN MANUFACTURING**	**8 hr**

Introduction to Industrial Automation; Types of Automation: Fixed, Programmable, Flexible; Sensors and Actuators in Automation; Open-loop vs. Closed-loop Control; PLC Architecture and Ladder Logic; CNC Machines: Basics and Interfacing; Industrial Robots: Types and Programming; Overview of CAM and Computer-Integrated Manufacturing (CIM).

Unit II	**FUNDAMENTALS OF INDUSTRY 4.0**	**8 hr**

Evolution from Industry 1.0 to 4.0; Core Enabling Technologies of Industry 4.0; Cyber-Physical Systems (CPS); Smart Factories and Digital Manufacturing; Interoperability and IoT Integration; Digital Twin and Real-Time Simulations; Human-Robot Collaboration (Cobots); Role of Additive Manufacturing in Industry 4.0.

Unit III	**IOT IN MANUFACTURING**	**8 hr**

IoT Architecture and Elements; Industrial Sensing and Smart Devices; Communication Protocols: MQTT, CoAP, Zigbee, LoRaWAN; IoT Gateways, Edge vs. Cloud Computing; IoT in Condition Monitoring and Maintenance; Integration with PLCs and SCADA Systems; Data Acquisition and Real-Time Dashboards; Cybersecurity in Industrial IoT (IioT).

Unit IV	**AI, ML, AND DATA ANALYTICS IN MANUFACTURING**	**8 hr**

Hydraulic actuators; Pneumatic actuator; Electric actuator and smart material as actuators; Control Architecture – Open Loop and Closed Loop; Basic Controllers – PID and On/Off and types of controllers; Sensors – Internal (Position, Velocity, Acceleration); Sensors – External (Proximity, Force/Torque); Machine vision, sensor integration

Unit V	RAPID PROTOTYPING AND ADDITIVE MANUFACTURING	8 hr
Introduction to Rapid Prototyping (RP); Differences Between RP and Traditional Manufacturing; Classification of RP Processes (FDM, SLA, SLS, etc.); CAD to Part: STL Format and File Preparation; Materials Used in RP: Plastics, Metals, Composites; Applications in Product Development and Tooling; Design for Additive Manufacturing (DfAM); Case Studies on Prototyping in IoT and Embedded Products.		

LEARNING RESOURCES

TEXTBOOKS:	
1	Mikell P. Groover, Mitchell Weiss, Roger N Nagel, Nicholas G Odrey, *"Industrial Robotics Technology, Programming and Applications",* Tata – McGraw Hill Pub. Co.
2	**Alasdair Gilchrist** – *Industry 4.0: The Industrial Internet of Things*, A press
3	**Chua C.K., Leong K.F.** – *Rapid Prototyping: Principles and Applications*, World Scientific
REFERENCE BOOKS:	
1	Raj Kamal – *Internet of Things*, McGraw-Hill
2	T.J. Boucher – *Computer Automation in Manufacturing*
3	IEEE and Elsevier Journals on AI, IoT, and Additive Manufacturing

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	BL6					X
CO6	BL6	X	X	X	X	X

R24MIACT009	ELECTRIC VEHICLE TECHNOLOGY (CSE,IT,CSIT,AIML,DS)					
	Total Contact Hours	42 (L)	**L**	**T**	**P**	**C**
	Pre-requisite	Basic electrical and electronics	**3**	**0**	**0**	**3**

Course Objective

To provide students with a comprehensive understanding of electric vehicle technologies, covering fundamentals, architecture, components, control systems, charging methods, and smart integrations, enabling them to analyze and design modern EV systems and contribute to the evolving EV ecosystem.

Course Outcomes

1	**Apply** knowledge of EV evolution, types, and societal relevance to real-world case studies. ***(BL3 – Apply)***
2	**Analyze** EV architecture and compare propulsion systems using different electric motors. ***(BL4 – Analyze)***
3	**Apply and Model** different battery technologies and charging infrastructures for EV applications. ***(BL3 – Apply / Model)***
4	**Analyze** embedded control systems, particularly Battery Management Systems (BMS), for safety and efficiency. ***(BL4 – Analyze)***
5	**Evaluate** smart integration technologies such as wireless charging, Vehicle-to-Grid (V2G), and IoT-based systems. ***(BL5 – Evaluate)***
6	**Design** an electric vehicle based on given performance requirements, considering efficiency, safety, and sustainability. ***(BL6 – Create)***

SYLLABUS

Unit I	**FUNDAMENTALS OF ELECTRIC VEHICLES**	**8hr**

History and evolution of EVs; Types of EVs;HEVs; Basic EV components;
Energy efficiency;Environmental benefits; Challenges in EV adoption; Government policies and incentives;

Unit II	**EV ARCHITECTURE AND MOTORS**	**8hr**

EV drivetrain ; EV Drive cycle ;BLDC motor ;PMSM motor;
Induction Motor ;Motor performance characteristics; Motor selection for different EV types; Motor control ;

Unit III	**ENERGY STORAGE AND CHARGING SYSTEMS**	**8hr**

Basics of power converters ;Motor controllers; Battery types and sizing; Fuel Cell ;
Super Capacitor;Flywheel; Fuel cell ; EV charging methods;

Unit IV	**CONTROL AND EMBEDDED SYSTEMS IN EVS**	**8hr**

Embedded systems in EVs; CAN bus communication; BMS logic; State of charge estimation;
Battery Management Systems (BMS);Active cell balancing; Passive cell balancing;Energy Management Strategies;

Unit V	**SMART TECHNOLOGIES AND EV ECOSYSTEM**	**8hr**

Wireless EV charging;Battery swapping; Integration with renewable energy; Vehicle-to-Grid (V2G);Vehicle to Home (V2H); V2X concepts; IoT monitoring for EV systems; EV infrastructure for smart cities-Case Study: Ola , Tesla

LEARNING RESOURCES

TEXT BOOKS:

1	**Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi**,'Modern electric, hybrid electric, and fuel cell vehicles fundamentals, theory, and design'. Power Electronics and Applications Series CRC Press ,2004
2	**Iqbal Husain,** 'Electric and Hybrid Vehicles: Design Fundamentals',CRC Press,2021
3	**Larminie , James; Lowry, John,** 'Electric vehicle technology explained',John Wiley and Sons Ltd .2012

4	**C. Mi, M. A. Masrur and D. W. Gao**, 'Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives', John Wiley & Sons, 2011.
REFERENCE BOOKS:	
1	**S. Onori, L. Serrao and G. Rizzoni,** "Hybrid Electric Vehicles: Energy Management Strategies", Springer, 2015.
2	T. Denton, "Electric and Hybrid Vehicles", Routledge, 2016.
ONLINE COURSES	
1	SWAYAM course on "**EV Dynamics and Motor Drives** " by Jain and Tripathi IIT Delhi
2	SWAYAM Course **on "Electric Vehicles and Renewable Energy",** By Prof. Ashok Jhunjhunwala, Prof. Kaushal Jha, Prof. L Kannan, Prof. Prabhjot Kaur | IIT Madras
3	SWAYAMCourse**"Introduction to Electric and Hybrid Electric Vehicle**", By Dr. R. N. Patel and Dr.Lalit Kumar Sahu | Chhattisgarh Swami Vivekanand Technical University, Bhila

Bloom's level – Units catchment articulation matrix

CO	Bloom's 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

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