FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SYLLABUS

B. TECH
COMPUTER SCIENCE AND ENGINEERING

JANUARY 2020
(FOR 2020-2024 BATCH)

CHRIST (Deemed to be University), Bangalore, Karnataka, India

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1. INTRODUCTION

CHRIST(Deemed to be University) blossomed out of the educational vision of the Carmelites of Mary Immaculate (CMI) congregation founded by St Kuriakose Elias Chavara. He was a visionary, an educationist and a social reformer of the nineteenth century who founded the Congregation in 1831 in South India.

CHRIST(Deemed to be University) was established in July 1969 as Christ College. It was the first institution in Karnataka to be accredited by the National Assessment and Accreditation Council (NAAC). University Grants Commission (UGC) conferred Autonomy to the institution in 2004. It became the first College in South India to be reaccredited with A+ by NAAC in 2005. UGC identified it as an Institution with Potential for Excellence in 2006.Under Section 3 of the UGC Act, 1956, Ministry of Human Resources Development of the Union Government of India, vide Notification No. F. 9-34/2007-U.3 (A), declared Christ College as a Deemed to be University, in the name and style of CHRIST(Deemed to be University)in July 2008. The CHRIST was accredited with 'A' Grade by NAAC in 2016.

CHRIST(Deemed to be University)offers 46 Bachelor, 47 Master, 16 MPhil and 17 PhD Programs in Humanities, Social Sciences, Sciences, Commerce and Management, Education, Law and Engineering. The Institution which celebrates diversity has students from all the states of India and 58 countries across the globe.

CHRIST(Deemed to be University)rooted in Gospel values, is committed to provide holistic education through the development of intellectual competence, personal skills, inter-personal skills and societal skills. CHRIST welcomes to its fold students from all over the country and the world in an environment of religious harmony and secularism.

VISION

"EXCELLENCE AND SERVICE"

- CHRIST(Deemed to be University), a premier educational institution, is an academic fraternity of individuals dedicated to the motto of excellence and service. We strive to reach out to the star of perfection through an earnest academic pursuit for excellence and our efforts blossom into 'service' through our creative and empathetic involvement in the society to transform it.
- Education prepares one to face the challenges of life by bringing out the best in him/her. If this is well accepted, education should be relevant to the needs of the time and address the problems of the day. Being inspired by Blessed Kuriakose Elias Chavara, the founder of Carmelites of Mary Immaculate and the pioneer in innovative education, CHRIST(Deemed to be University) was proactive to define and redefine its mission and strategies reading the signs of the time.

MISSION STATEMENT

"CHRIST(Deemed to be University) is a nurturing ground for an individual's holistic development to make effective contribution to the society in a dynamic environment."

CORE VALUES

The values which guide us at CHRIST(Deemed to be University) are:

Faith in God

Moral Uprightness

Love of Fellow Beings

Social Responsibility

Pursuit of Excellence

DEPARTMENT VISION

"To fortify Ethical Computational Excellence"

MISSION STATEMENT

1. Imparts core and contemporary knowledge in the areas of Computation and Information Technology
2. Promotes the culture of research and facilitates higher studies
3. Acquaints the students with the latest industrial practices, team building and entrepreneurship
4. Sensitizes the students to serve for environmental, social & ethical needs of society through lifelong learning.

GRADUATE ATTRIBUTE

- Ability to comprehend the problem in a specific domain and implementation of the solution in an ethical way.
- Ability to use skilled communication to enhance understanding and work in a team to contribute positively with an international perspective
- Ability to exhibit skills in research and enquiry based learning to identify and creatively tackle problems.
- Ability to execute a team project in the specific domain after going through the process of understanding, analyzing, designing, implementing and testing with real time data.
- Ability to execute a solution based for social cause.

PROGRAM OUTCOMES

1. An ability to apply Engineering knowledge of computing, mathematics, science, and computer science & engineering fundamentals for Problem solving.
2. An ability to think critically to identify, formulate, and solve complex computer science & engineering problems by developing models, evaluating validity and accuracy of solutions in terms of computer science and engineering validity measures.
3. An ability to analyze, design of complex problems, implement, and evaluate a computer-based system, to meet expected needs with appropriate considerations such as economic / environmental/societal.
4. An ability to conduct experiments to investigate problems based on changing requirements, analyze and interpret results.
5. An ability to create, select, adapt appropriate techniques and use of the modern computational tools, techniques and skills, and best of engineering practices.
6. To understand the impact of contextual knowledge on social aspects and cultural issues.
7. An ability to understand contemporary issues related to social & environmental context for sustainable development of engineering solutions.
8. An ability to understand professional & ethical responsibility to contribute for societal and national needs.

9. An ability to function and coordinate effectively as an individual, as a member or leader in diverse, multicultural& multidisciplinary teams.
10. An ability to communicate effectively.
11. An understanding of computer science and engineering & management principles to manage software projects.
12. A recognition and realization of the need for, and an ability to engage in lifelong learning.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1:**Professional Acumen**

Understand, analyze and design solutions with professional competency for the real world problems

PEO2:**Critical Analysis**

Develop software/embedded solutions for the requirements, based on critical analysis and research.

PEO3: **Team work**

Function effectively in a team and as an individual in a multidisciplinary/multicultural environment.

PEO4 :**Life Long Learning**

Accomplish holistic development comprehending professional responsibilities

PROGRAM SPECIFIC OUTCOMES

PSO1 :Software Architecture

Apply the concepts of software engineering to Design and develop software applications.

PSO2 :Resource Management

Utilize Resource Management ideas to efficiently develop and deploy projects.

PSO3 :Reflections through Service

Analyze Social Relevant Problems and design solutions through Service Learning

2. PROGRAMMES OFFERED

- **Undergraduate Programmes**(B.Tech, 8 Semester Program)
  - Bachelor of Technology in Automobile Engineering (AE)
  - Bachelor of Technology in Civil Engineering(CIVIL)
  - **Bachelor of Technology in Computer Science and Engineering (CSE)**
  - Bachelor of Technology in Electronics and Communication Engineering (ECE)
  - Bachelor of Technology in Electrical and Electronics Engineering (EEE)
  - **Bachelor of Technology in Information Technology (IT)**
  - Bachelor of Technology in Mechanical Engineering (ME)

- **Postgraduate Programmes**(M. Tech, 4 Semester Program)

- **Master of Technology in Computer Science and Engineering (CSE)**
- Master of Technology in Communication Systems(ECE)
- **Master of Technology in Information Technology(Data Analytics)**
- Master of Technology in Machine Design(MD)
- Master of Technology in Power Systems(PS)
- Master of Technology in Structural Engineering(SE)

- **Doctoral Programmes (Ph.D.)**(Doctor of Philosophy)
    - **Doctor of Philosophy (Ph.D.) in Computer Science and Engineering**
    - Doctor of Philosophy (Ph.D.) in Electronics and Communication Engineering
    - Doctor of Philosophy (Ph.D.) in Civil Engineering
    - Doctor of Philosophy (Ph.D.) in Electrical and Electronics Engineering
    - Doctor of Philosophy (Ph.D.) in Mechanical Engineering
    - **Doctor of Philosophy (Ph.D.) in Information Technology**

03. ELIGIBILITY CRITERIA

For Undergraduate Programmes

A pass in PUC (10+2) or equivalent with 50% marks in aggregate with Mathematics, Physics and Chemistry is the minimum eligibility for admission.

Lateral Entry:

Candidates who have successfully completed 3 year diploma in Engineering are eligible to apply for lateral entry into:

- Automobile Engineering (AE)
- B.Tech Civil Engineering (CE)
- B.Tech Mechanical Engineering (ME)
- **B.Tech Computer Science and Engineering (CSE)**
- B.Tech Electronics & Communication Engineering (ECE)
- B.Tech Electrical and Electronics Engineering (EEE)
- **B.Tech Information Technology (IT)**

Candidates will be admitted to second year of the programme only after appearing the CHRIST(Deemed to be University)selection process for Engineering programmes.

❖ **For Postgraduate Programmes**:

- For Master of Technology in Computer Science and Engineering
    - A Pass in B.Tech/B.E or M.Sc with 55% aggregate.
- For Master of Technology in Communication Systems
    - A Pass in B.Tech/B.E or M.Sc in Electronics and VLSI Design with 55% aggregate.
- For Master of Technology in Civil Engineering
    - A Pass in BE/B.Tech or M.Sc in Civil and VLSI Design with 55% aggregate.
- For Master of Technology in Mechanical Engineering
    - A Pass in BE/B.Tech with 55% aggregate.

- For Master of Technology in Information Technology(Data Analytics)
    - A Pass in B.Tech/B.E or M.Sc with 55% aggregate.

❖ **For Doctoral Programmes (Ph.D.):**

- A pass with 55% marks in post graduation and equivalent in the relevant subject from any recognized university.

- A research proposal (Maximum 1500 words) has to be submitted along with the application.

4. SELECTION PROCESS

1) Candidates can process the admission based on the Undergraduate Entrance Test and Ranking by COMEDK.

OR

2) CHRIST(Deemed to be University) Selection Process as given below:

Process	Particulars	Date	Venue/Centre
Entrance Test	CHRIST(Deemed to be University)Entrance test for each candidate	As per the E- Admit Card	As per the E- Admit Card
Personal Interview	Personal interview for 15 minutes for each candidate by an expert panel	As per the E-Admit Card	As per the E- Admit Card
Academic Performance	Assessment of past performance in Class 10, Class 11/12 during the Personal Interview	As per the E-Admit Card	As per the E- Admit Card

5. ADMISSION PROCESS

Candidates will be intimated about the Selection status (Selected/Wait Listed/Not Selected) through the University Notice Board/on the "Application Status" link on University website. The Selection results will be declared within 24 hours of Personal Interview session.

The selected candidates must process admission at **Office of Admissions, Central Block,** CHRIST(Deemed to be University) **within 3 working days of declaration of Selection Process results/ as per the stipulated date and time mentioned by Office of Admissions.**

Selected candidates should collect the Fee Challan from the Office of Admissions and remit the Annual fee at the South Indian Bank, CHRIST(Deemed to be University) Branch. The Offer of Admission will stand cancelled, if failing to remit the fee within the stipulated date and time.
Admission will not be processed <u>without the presence of the candidate</u> and the <u>mandatory original documents</u> mentioned below;

1. The Offer of Admission Card (E-Admission Card/Mail)
2. Class 10 Marks Statement
3. Class 11 Marks Statement, if Candidate is pursuing class 12 and appearing for final examination during March-April Month
4. Class 12 Marks Statement, if candidate has appeared and passed the Class 12 examination

The Institution ID card is a smart card, which is both an ID card as well as a South Indian Bank ATM card with a chip containing the student personal details. All transactions within the University campus after commencement of classes, including fees payment will be processed only through this card. It is also an access card for Library and other restricted places. Candidates are advised to collect the South Indian Bank account opening form along with fees challan and process it at the Bank branch within the Institution premises.

Candidates who fall under International student category (ISC), If selected, should register with the Foreigner Regional Registration Officer (FRRO/FRO) of the Local Police in Bangalore, India within 14 working days from the date of admission or arriving in Bangalore.
All International student category (ISC) candidates if studied in India should obtain an NOC from the previous qualifying institution.

6. GENERAL RULES

- There is a grading scheme for each paper and for all the courses.
- All marks will indicate the marks, percentage obtained, grade and grade point average.
- The grade point average will be calculated as follows: for each subject, multiply the grade point with the number of credits; divide the sum of product by the total number of credits.
- The CGPA [Cumulative GPA] is calculated by adding the total number of earned points [GP x Cr] for all semesters and dividing by the total number of credit hours for all semesters.

$$\mathbf{GPA=} \frac{\sum[\mathbf{GPA\ x\ Cr}]\sum[\mathbf{GPA\ x\ Cr}]}{\sum \mathbf{Cr} \qquad \sum \mathbf{Cr}}$$

7. GRADING SCHEME FOR EACH PAPER:

Undergraduate Courses

Percentage	Grade	Grade Point- 4 Point Scale	Grade Point-10 Point Scale	Interpretation	Class
80 and above	A	4.0	10.00	Outstanding	First Class with Distinction
73-79	A-	3.67	9.18	Excellent	First Class
66-72	B+	3.33	8.33	Very Good	
60-65	B	3.0	7.50	Good	
55-59	B-	2.67	6.68	Average	Second Class
50-54	C+	2.33	5.83	Satisfactory	
45-49	C	2.00	5.00	Pass	Pass Class
40-44	D	1.0	2.50	Pass	

39 and below	F	0	0.00	Fails	Fail

8. BRIEF HISTORY OF DEPARTMENT

Department of Computer Science and Engineering started of journey to produce qualified Engineers to society with variety of skills. The department offers the degrees Bachelor of Technology, Master of Technology, and Doctor of Philosophy in the areas of Computer Science and Engineering and Information Technology. The department has rich knowledge pool of faculty resource who are well trained in various fields like Artificial Intelligence, Machine learning, Computer Vision, Algorithms design, Cryptography, Computer Networking, Data mining, Data science, BIG DATA, Digital Image Processing, text mining, knowledge representation, soft computing, Cloud computing, etc.. The department has wide variety of labs setup namely open source lab, Machine learning lab, CISCO Networking Lab etc..Specifically for students for their lab curriculum and for their research.
The department periodically conducts hands-on workshop on recent technology like Internet of Things, Cloud computing, Machine learning etc..for the students so that they should be updated with current technology. The department imparts teaching in Holistic method, where students who are trained under holistic education will be better citizens of Nation .The main educational goal is to prepare students for research and career in industry or in universities.

09. PROGRAM OVERVIEW

The fundamental objective of the Department of Computer Science and Engineering of the CHRIST(Deemed to be University)is to develop a firm foundation in mathematics, science, and design methodology applied to the disciplines of Computer Science and Engineering. The various courses offered gives the fundamentals, working and expert subjects that provides enough learning environment where students understand and are able to apply the most contemporary and essential tools needed in the breadth and depth of Computer Science and Engineering.

The Department strives to give skills essential to practicing engineering professionals; it is also an objective to provide experience in leadership, management, planning, and organization. The department understands its role in developing and evaluating methods that encourage students to continue to learn after leaving the institution.

We believe that the student opportunities and experiences should lead to an appreciation of the holistic development of individual. We also try to pass to our students our passion for what we do, and to have the students comprehend that we also desire to continue to learn.

10. PROGRAM OBJECTIVE

The Undergraduate program in Computer Science and Engineering is aimed at creating computer science engineers by providing the fundamentals of engineering and basic skills in computing. The special focus on employability is clear from the inclusion of subjects based on demand of industry and mandatory internships. A well-chosen elective basket gives the ward an opportunity to widen their knowledge in any specific domain.

11 TEACHING PEDAGOGY

- Team/Class room teaching.
- PowerPoint presentations and handouts.
- Simulated situations and role-plays.

- Video films on actual situations.
- Assignments.
- Case Studies.
- Exercises are solved hands on.
- Seminars
- Industry / Field visits.
- Information and Communication Technology.
- Project work.
- Learning Management System- Moodle

12. ASSESSMENT RULES – B.TECH COURSE (CSE) 2020 BATCH

Following are the details of the modifications proposed for assessment pattern – B.Tech Program AY 2019-20

	Category	Weightage for CIA	Weightage for ESE
1	Courses with theory and practical	70	30
2	Courses with only theory	50	50
3	Courses with only Practical	50	50

COURSES WITH THEORY AND PRACTICAL				
	Component	**Assessed for**	**Minimum marks to pass**	**Maximum marks**
1	Theory CIA	30	-	30
2	Theory ESE	30	12	30
3	Practical CIA	35	14	35
4	Attendance	05	-	05
4	Aggregate	100	40	100

<table>
<tr><th colspan="11">DETAIL OF MARK FOR COURSES WITH THOERY AND PRACTICAL</th></tr>
<tr><th colspan="6">THEORY</th><th colspan="5">PRACTICAL</th></tr>
<tr><th></th><th>Component</th><th>Assessed for</th><th>Scaled down to</th><th>Minimum marks to pass</th><th>Maximum marks</th><th>Component</th><th>Assessed for</th><th>Scaled down to</th><th>Minimum marks to pass</th><th>Maximum marks</th></tr>
<tr><td>1</td><td>CIA-1</td><td>20</td><td>10</td><td>-</td><td>10</td><td rowspan="2">Overall CIA</td><td rowspan="2">50</td><td rowspan="2">35</td><td>14</td><td rowspan="2">35</td></tr>
<tr><td>2</td><td>CIA-2</td><td>50</td><td>10</td><td>-</td><td>10</td><td></td></tr>
</table>

3	CIA-3	20	**10**	-	**10**					
4	Attendance	05	**05**	-	**05**	Attendance	**NA**	**NA**	**-**	**-**
5	ESE	100	**30**	12	**30**	ESE	**NA**	**NA**	**-**	**-**
		TOTAL	**65**	-	**65**	TOTAL		**35**	**14**	**35**

- Minimum marks required to pass in practical component is 40%.
- Pass in practical component is eligibility criteria to attend Theory End semester examination for the same course.
- A minimum of 40 % required to pass in ESE -Theory component of a course.
- Overall 40 % aggregate marks in Theory & practical component, is required to pass a course.
- There is no minimum pass marks for the Theory - CIA component.
- Less than 40% in practical component is refereed as FAIL.
- Less than 40% in Theory ESE is declared as fail in the theory component.
- Students who failed in theory ESE have to attend only theory ESE to pass in the course

II. ASSESSMENT - ONLY FOR THEORY COURSE (without practical component)
- Continuous Internal Assessment (CIA) : 50% (50 marks out of 100 marks)
- End Semester Examination(ESE) : 50% (50 marks out of 100 marks)

Components of the CIA

CIA I : Subject Assignments / Online Tests : 10 marks
CIA II : Mid Semester Examination (Theory) : 25 marks
CIAIII: Quiz/Seminar/Case Studies/Project/Innovative Assignments/presentations/ publications : 10 marks
Attendance : 05 marks
Total **: 50 marks**

Mid Semester Examination (MSE) : Theory Papers:
- The MSE is conducted for 50 marks of 2 hours duration.
- Question paper pattern; Five out of Six questions have to be answered. Each question carries 10 marks

End Semester Examination (ESE):

The ESE is conducted for 100 marks of 3 hours duration.

The syllabus for the theory papers are divided into FIVE units and each unit carries equal Weightage in terms of marks distribution.

Question paper pattern is as follows.

Two full questions with either or choices will be outlined from each unit. Each question carries 20 marks. There could be a maximum of three sub divisions in a particular question. The objective of the question paper is to test the application and analytical skill of the student. The major purpose of the question paper is to bring clarity about the process of associating questions to their respective performance indicators and hence to improve the ratings in course outcomes. Further, these question papers demonstrate how bloom's taxonomy can be used to map the quality of question papers along with their effectiveness in the assessment pattern.

III. ASSESSMENT OF COMPREHENSION, INTERNSHIP and **SERVICE LEARNING**
COMPREHENSION
Maximum Marks = 50
Passing marks 40% min
Do not have ESE and completely evaluated through continuous assessment only,

The evaluation (minimum 2 presentations) shall be based on the
- Topic / report :40%
- Presentation: 40%
- Response to the questions asked during presentation: 20%.

INTERNSHIP

Maximum Marks = 50(Only credit will be displayed in the score card)
Passing marks 40% min
Do not have ESE and completely evaluated through continuous assessment only
Continuous Internal Assessment is based upon
- No of Internship Days : 20 marks
- Report on Internship : 15 marks
- Presentation on Internship : 15 marks

SERVICE LEARNING
Maximum Marks = 50
Passing marks 40% min
Do not have ESE and completely evaluated through continuous assessment only,
Comprising
- Internal Assessment with components like tests/quiz/written assignments: 25 marks
- Field Work or equivalent assignment as approved by the department panel: 25 marks

V. ASSESSMENT OF PROJECT WORK
Project Phase-I
Project work may be assigned to a single student (with due approval from department) or to a group of students not exceeding 4 per group.
Maximum Marks = 100
- Continuous Assessment: 50 marks.
- End Semester Examination (project report evaluation and viva-voce) : 50 marks.
- The continuous assessment and End Semester Examinations marks for Project Work and the Viva-Voce Examination will be distributed as indicated below.

CIA 50 MARKS						**ESE 50 MARKS**
REVIEW 1		**REVIEW 2**		**REVIEW 3**		
REVIEW COMMITTEE	GUIDE	REVIEW COMMITTEE	GUIDE	REVIEW COMMITTEE	GUIDE	EXAMINERES
10	05	10	05	10	10	**50**

TOTAL	**15**	**TOTAL**	**15**	**TOTAL**	**20**	

- There shall be **3** review **and t**he student shall make presentation on the progress made before the committee constituted by the Department
- The total marks obtained in the 3 reviews shall be 100 marks.

ESE 50 MARKS IS EVALUATED AS

- Initial Write Up : 05marks
- Viva Voce : 10 marks
- Demonstration : 20 marks
- Project Report : 15 marks

Project Phase-II

Project work may be assigned to a single student (with due approval from department) or to a group of students not exceeding 4 per group.

Maximum Marks = 300

- Continuous Assessment: 200 marks.
- End Semester Examination (project report evaluation and viva-voce) : 100 marks.
- The continuous assessment and End Semester Examinations marks for Project Work and the Viva-Voce Examination will be distributed as indicated below.

CIA 200 MARKS						**ESE 100 MARKS**
REVIEW 1		**REVIEW 2**		**REVIEW 3**		
REVIEWCOMMITTEE	GUIDE	REVIEW COMMITTEE	GUIDE	REVIEW COMMITTEE	GUIDE	EXAMINERES
30	20	40	30	30	50	**100**
TOTAL	**50**	**TOTAL**	**70**	**TOTAL**	**80**	

- There shall be **3** reviews and the student shall make presentation on the progress made before the committee constituted by the Department
- The total marks obtained in the 3 reviews shall be 100 marks.

ESE 100 MARKS IS EVALUATED AS

- Initial Write Up : 10marks
- Viva Voce : 25 marks
- Demonstration : 40 marks
- Project Report : 25 marks

Holistic Education:

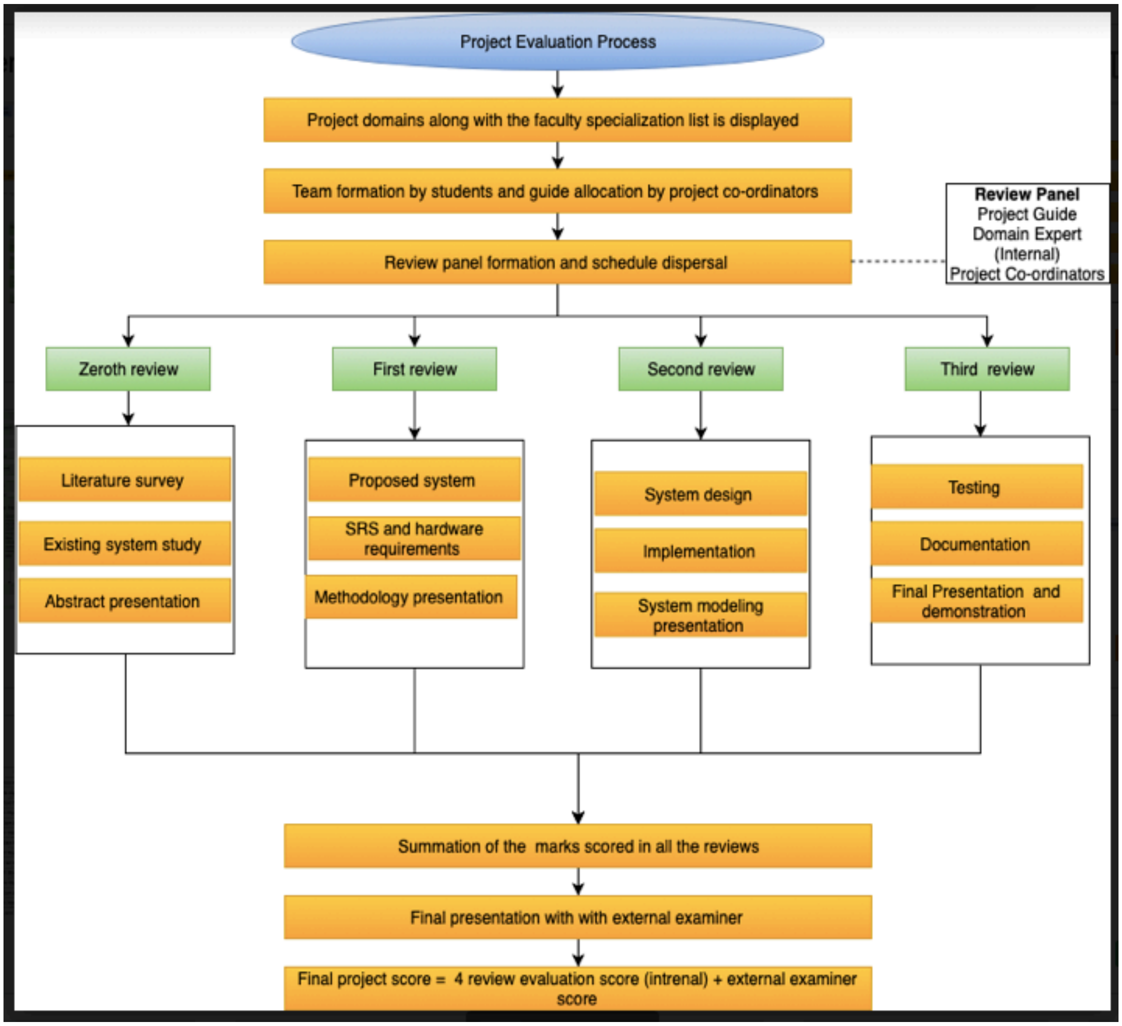
End Semester Examination :25 Marks
Participation :25 Marks
Total :50 Marks

PROJECT EVALUATION

The project work carries a total marks of 200 out of which 100 marks is CIA and 100 marks is allotted for ESE. The following process is carried for continuous monitoring and evaluation of the student project work.

- Once the supervisors are allotted to the students, the students have to regularly meet the project supervisor.
- On project days, the project coordinator takes attendance at three slots and the students have to maintain a notebook to record the activities done during that day and get it signed by the supervisor.
- Within one month of the beginning of the eighth semester, a zeroth review will be conducted where students need to present their findings based on literature survey to the panel members which will consist of the supervisor, project coordinator and faculty experts. Only if the panel members accept the project to be considered as a final year project, it can be carried out otherwise the student group will be given two weeks to modify their idea and present again.
- One review in front of the panel consisting of supervisor, project coordinator and faculty experts will be conducted every month thus resulting in 3 reviews including the zeroth review. The students shall prepare a PowerPoint presentation and present it to the panel. Each review will be awarded marks and will be considered for final CIA evaluation. The guide lines for preparing the power point slides are issued to the students by the project coordinator.
- The third review will be considered as the final review and a model presentation for the external viva-voce presentation of the project so that students are ready.
- Following process is adopted for project report finalizing
    - The Deanery has adopted a latex template for preparing the Project thesis report. Special one day training on latex and how to use the template will be given to the students by the faculty members.
    - The project report approved by the guide will then be sent to the project coordinator by the respective guides.
    - The project reports received by the project coordinator will then be forwarded to two internal reviewers for reviewing the report.
    - The student has to incorporate the changes mentioned by the reviewers and the modified report will be sent by the respective guides to the project coordinator and only on the final approval from the project coordinator, the students can go ahead with the hard binding of the reports.
    - The hard bound reports will then be signed by all the students, guide, head of the department, Dean and the external examiner.
- An end semester project viva voce is conducted with the panel of internal and external examiners. The external examiner from other institution / university is appointed by the controller of examinations

The project evaluation process is shown below:



Process to assess individual and team performance

- Project group size varies from 2 to 4 members. The groups are formed by the students based on their area of interest.
- Thus students should be assessed both individually as well as in a team. For this, the department follows a process of reviews where the students will present for three times in front of the same panel members starting from the zeroth review.
- This will have continuity and the faculty members assess individual performance as well as team performance.
- A rubric is also formed for the project work which clearly mentions the criteria for assessing individual performance thus making the students aware of what they need to do in the beginning of the semester itself.

A sample review evaluation sheet is shown below where students are assessed individually based on their performance in the review presentation

Below diagram shows the individual and team assessment through a rubric:

Dimension	Score 1	Score 2	Score 3	Score 4
1. Contribution to the team project/work	• Does not collect any relevant information • No useful suggestions to address team's needs	• Collects information when prodded • Tries to offer some ideas, but not well developed and/or clearly expressed to meet team's needs	• Collects basic, useful information related to the project • Occasionally offers useful ideas to meet the team's needs	• Collects and presents to the team a great deal of relevant information • Offers well-developed and clearly expressed ideas directly related to the group's purpose
2. Taking responsibility	• Does not perform assigned tasks • Often misses meetings and, when present, does not have anything constructive to say • Relies on others to do the work	• Performs assigned tasks but needs many reminders • Attends meetings regularly but generally does not say anything constructive • Sometimes expects others to do his/her work	• Performs all assigned tasks • Attends meetings regularly and usually participates effectively • Generally reliable	• Performs all tasks very effectively • Attends all meetings and participates enthusiastically • Very reliable.
3. Valuing other team members and quality of interactions	• Often argues with team mates • Doesn't let anyone else talk • Occasional personal attacks and "put-downs" • Wants to have things done his/her way and/or does not listen to alternate approaches	• Usually does much of the talking • Does not pay much attention when others talk • Often assumes others' ideas will not work • No personal attacks and put-downs but sometimes patronizing	• Generally listens to others' points of view • Always uses appropriate and respectful language • Tries to make a definite effort to understand others' ideas	• Always listens to others and their ideas • Helps them develop their ideas while giving them full credit • Always helps the team reach a fair decision

13. CURRICULUM DESIGN PROCESS

CHRIST (Deemed to be University), a premier educational institution, is an academic fraternity of individuals dedicated to the motto of "Excellence and Service".

- Department of Computer Science and Engineering is under the deanery of Faculty of Engineering of CHRIST (Deemed to be University).
- The department offers B.Tech in Computer Science and Engineering program whose curriculum should be approved by the Board of Studies (BoS) and University Academic Council (AC).

The University has laid down a regulation for Curriculum design, review and Approval which is as below:
Board of Studies is the primary academic body responsible for initiating all or any proposal concerning academic matters of the University including but not limited to

- Program structure
- Development and review of curriculum
- Syllabus
- Question paper pattern
- Question paper standards
- Examination systems
- Internal assessments
- Student development
- Teaching methodology
- Pedagogy
- Appointment of examiners
- Introduction of new programs/courses etc.

1. There shall be one Board of Studies (BoS) for each academic department of the University.
2. The Board of Studies of each department shall consist of:
    a. Dean of Faculty/Head of the Department – Chairperson.
    b. All Professors, Associate Professors, and Assistant Professors of the department.
    c. Two members from teaching profession (outside the University) of the specialization not below the rank of Associate Professor, nominated with the approval of the Academic Council.
    d. Up to two members from the Industry / Entrepreneurs, nominated with the approval of the Academic council.
    e. Chairperson may nominate one of the faculty members of the department to be the Secretary of Board of Studies.
3. The term of the nominated members shall be two years and they are eligible for re-nomination.
4. Meeting of Board of Studies may be convened as and when needed but shall be held at least once in a year.
5. The quorum for the meeting of Board of Studies shall be two-third of the total membership of the Board of Studies of the Department.
6. The functions of Board of Studies are:
    a. Preparation of syllabi for various program keeping in view the objectives of the program, interest of the stakeholders, and the level of knowledge expected of the subject. The syllabus must be as detailed as possible with breakup of topics and sub topics to enable meaningful preparation of course plan, and propose up-to-date suggested reading and reference books/material with author and publisher information.
    b. Review of curriculum periodically for updating and revision according to changes in theory and practices from time to time.
    c. Suggest innovative teaching practices and evaluation methods.
    d. Suggest procedure for continuous internal assessment of students.
    e. Recommend panel of examiners for approval by the Academic Council.
    f. Propose introduction of new undergraduate, postgraduate and pre-doctoral, Doctoral, Diploma and Certificate program along with details of program structure, curriculum, and duration, for consideration by the Academic Council.
    g. Coordinate research, teaching, extension and other academic activities relating to the department.
    h. Suggest panel of experts to be nominated to the Board of Studies.
    i. Suggest co-curricular activities for student development including holistic education materials.
    j. Suggest value-added program for improving the quality standard of the students.
    k. Suggest methods of enhancing quality of teaching and teacher training program.
    l. Review and suggest ways to enhance the quality and quantity of research and publications by students and faculty.
    m. Review and suggest modes of increasing external research projects and consultancies.
    n. Review and suggest measures to improve the quality of Refresher Courses, Quality Improvement Program (QIP), Seminars, Conferences, and Workshops relating to the Department.
    o. The Academic Council may direct any other functions, as it may deem necessary

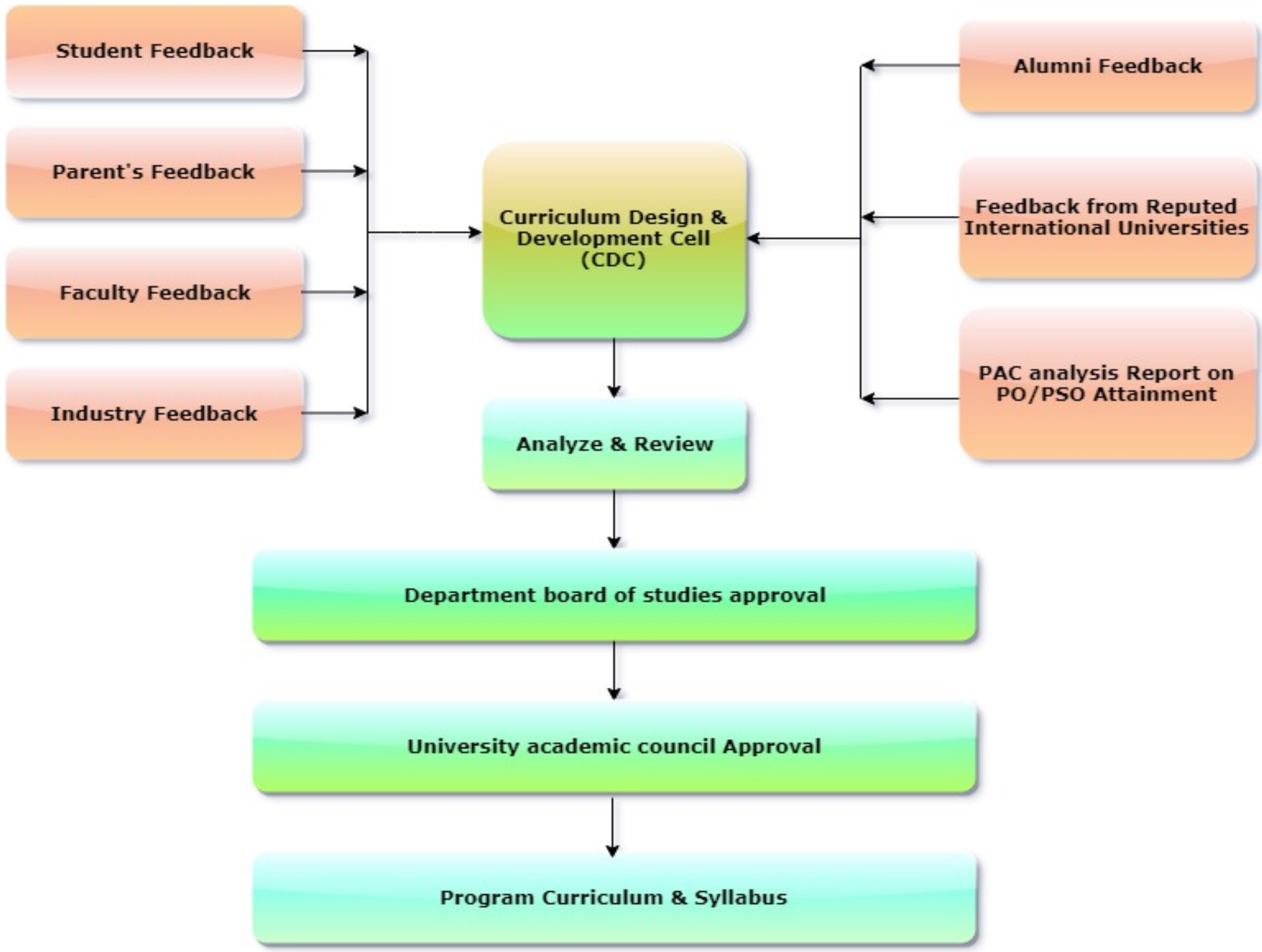


Figure 1 : Flow Chart for Curriculum Design Process

The Department of Computer Science and Engineering follows the following process for curriculum design:

1. The Head of the Department (HoD) in consultation with the Department Advisory Committee (DAC) nominates a BOS in-charge for the department.
2. In consultation with the BOS in-charge, the HoD formulates a Curriculum Design & Development Cell for the department (CDC). The CDC consists of professors, senior teachers with the HoD as the chairperson. The objective of the CDC is to review the curriculum and suggest recommendations every year to the BOS.
3. Meeting of the CDC Members may be convened as and when needed but should be held at least thrice in a year.
4. The CDC members will consolidate the feedback collected from all the stakeholders including students, faculty members, parents, alumni, employers, syllabus of reputed international universities and the entire course exit surveys collected in an academic year and analyze the feedbacks.
5. In consultation with Program Coordinator, HoD will formulate Program Assessment committee (PAC). PAC consists Program Coordinator, Domain Expert for each domain of

Courses, two Associate professors and two assistant professor as its members and Program coordinator will be chair person.

6. The Program Assessment Committee (PAC) analyses the results which includes both direct and indirect assessment and submits a report which includes either an action plan in case of non PO/PSO attainment or a target increment in case of PO/PSO attainment to the CDC for their review. Analysis is done for attaining the PO/PSO's through the curriculum.
7. The CDC members then review the analysis of the PAC as well as review the feedbacks collected on the curriculum from the various stakeholders and provide their recommendations to the BOS on HOD's approval.
8. On the approval of the Board of Studies, the final approval of the curriculum is done by the academic council of the University.

State the process used to identify extent of compliance of the curriculum for attaining the Program Outcomes and Program Specific Outcomes

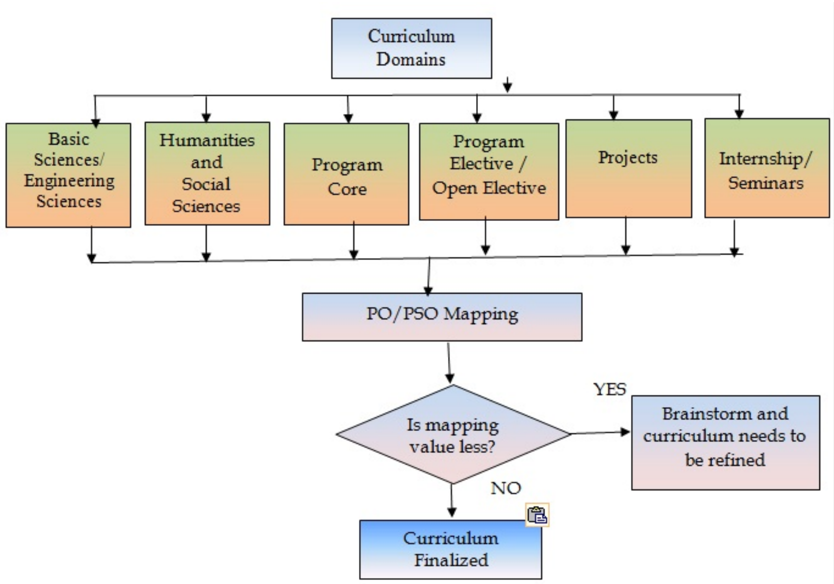
The following steps abstract the process of curriculum design and approval for the entire program:

- The curriculum is approved by the Board of Studies (BOS) which is held once every year in the month of either January/February.
- Before the BOS meeting, the department Curriculum Design & Development Cell (CDC) reviews all the feedbacks collected from the students, alumni, parents, recruiters and the faculty members and also analyze the PO and PSO attainment report submitted by PAC.
- The PO and PSO attainment with direct and indirect assessment is done by the PAC and the shortcomings, if any, are identified and recommended for consideration to the CDC.
- The CDC summarizes all the analysis and submit their recommendations for the approval of the BOS in the subsequent academic year.
- They are documented in the action plan of each PO/PSO and at the course level and reviewed every academic year for its attainment.

To satisfy the extent of compliance of curriculum for attaining the POs and PSOs, Course Outcomes for each subject in the programme is identified and each Course Outcome is mapped with POs and PSOs with the correlation level and attained the extent of compliance of the curriculum with the PO/PSO's.

- The curriculum is categorized based on the broader domains like basic sciences, engineering sciences, humanities and social sciences, program core, program electives, open elective, projects, seminars, internships etc.
- Each category is then mapped to the PO/PSO based on the courses from that category getting mapped to the PO/PSO's.
- This mapping gives us an idea where the PO/PSO are not getting mapped or getting mapped at a lower extent which allows the CDC to brainstorm on the categories on which curriculum needs to be improved.

Following is the process used to categorize the curriculum into broader domains and further mapped to PO/PSO's:



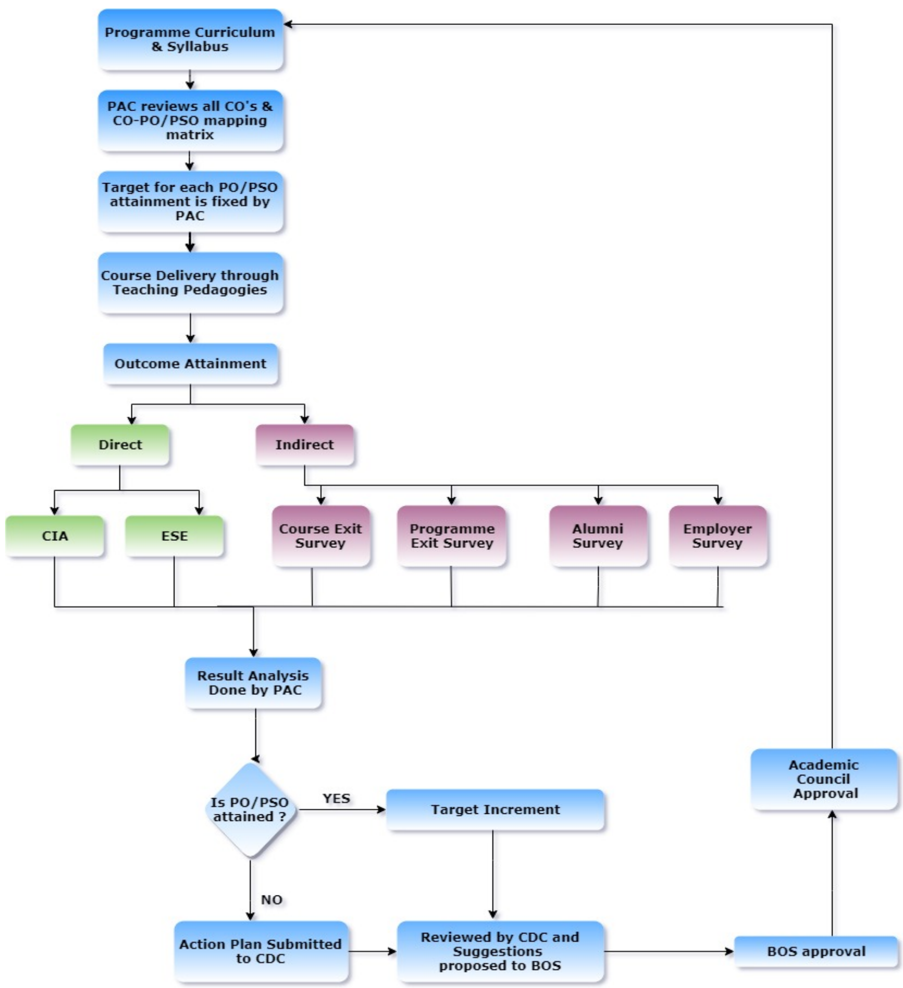


Figure 3: PO/PSO Attainment & Target Setting Process

Extent of compliance calculation is also analyzed through various feedback collected from various stakeholders. The following feedbacks are collected as part of indirect assessment of PO/PSO

Alumni Feedback

- The feedback regarding their adaptability to the industry or higher studies is taken and analyzed for further improvement of PO/PSO attainment.
- This feedback is also used as inputs in the curriculum development and design.

Student Feedback

- The feedback from students is collected for every course as well as at the end of the program. This feedback is analyzed for CO attainment of each course as well as in PO/PSO attainment.
- This feedback is also used as inputs in the curriculum development and design.

Employer Feedback

- This feedback is collected to enhance the program curriculum and allows us to understand where the PO attainment can be improved and thus helps in improved attainment.
- This feedback is also used as inputs in the curriculum development and design

Parent Feedback

- Parents are important stakeholders in any educational institution. This feedback is taken to survey the parent community as far as PO/PSO attainment is concerned.

14. EMPLOYABILITY ENHANCEMENT COURSES:

Employability Enhancement courses:

As a part of B.Tech (Computer Science and Engineering) program, the curriculum gives anedge to study additional courses that intends to help advanced learners to be employable and sustain intheir career progression.

Employability enhancement courses can be either, online courses (MOOC / NPTEL etc) orIndustry Oriented courses or workshops. The students will be permitted to register for a number of suchcourses, during his / her program study period between 3rd Semester and 7ThSemester after satisfyingthe basic eligibility criteria given by department. The student who takes these courses has to seek forpermission from the department, which a committee will recommend the students to take these coursesafter analyzing the eligibility of the students based on curricular aspirations and achievements.

Online courses should be of minimum 6 weeks proctored program and on successfulcompletion of the course Departmental committee will conduct evaluation for the award of marks.

A student who completes those courses (which are linked) successfully to obtain a minimum of 3 creditsmay acquire exemption from studying one Professional Elective. Such exemption is permitted forthree program elective courses, program elective 3,4 and 5.

In such case the credit points earned in those employability enhancement courses will be included forcalculation of Cumulative Grade Point Average (CGPA).These courses are added as group 1, group 2 andgroup 3 under program elective 3, 4 and 5 respectively. If student fails to complete such 3 courses beforehis / her 7thsemester, it is mandatory for him / her to register respective program elective during 7thsemester or 8thsemester whichever applicable.

Online Courses:

Students can register and earn credits for online courses approved by Department Committee consisting of HOD, Professor, subject expert and 3 other faculty members.

The list of online courses is to be approved by Chairman, Academic Council on the recommendation ofDepartment committee at the beginning of a semester if necessary, subject to confirmation in the nextAcademic council meeting.
The course offered will be centered to either tools or case study that is relevant to the core courses. Thesecourse lists will be updated twice in a year and published in the beginning of the academic year based onthe approved BOS.

Workshops or Industry Oriented courses
Students can register for any workshops or industry oriented courses which will be organized bydepartment, other department or industry cell of the institution that is approved by the Department Committee. The Committee will evaluate the performance of the student and recommend the grade orevaluate the candidate in 100% Continuous Internal Assessment (CIA) pattern.

Eligibility criteria

To undergo Employability Enhancement course a written permission will be sort by the studentduring the 3rdsemester. A minimum of 9 online courses that are listed by the department has to becompleted before the 7thsemester. However the student must not have any backlogs and the CGPA shouldbe above 7.

Evaluation Procedure
The department committee will evaluate the student's progress by conducting two presentations for eachcourse. During the presentation, the student's performance will be evaluated based on his attendance forthe course, assignments, performance in assessments. Based on performance in those components, thecommittee will recommend the grade for the respective course of the student.

Hourly attendance will be tracked and a Committee will monitor the progress of the student andrecommend the grade or evaluate the student for 100%. (Continuous Internal Assessment (CIA)).Thecommittee's marks will be converted to 90% and 10% will be based on the attendance and a single markentry scheme will be followed at the end of the semester.

15.B.Tech DEGREE WITH MINOR IN COMPUTER SCIENCE AND ENGINEERING

Students can get a B. Tech degree with minor **in Computer Science and Engineering (CSE)** by earning 20 extra credits in addition to B. Tech degree in non CSE branches. The minor courses are focussed on basic concepts of Computer Science & Engineering discipline.
A student completing minor courses will be well equipped for further higher studies or job opportunities in IT field. The detailed guideline are as follows.

Guidelines for Minor Degree

- Students admitted in B. Tech in non CSE branches are only eligible for B. Tech minor in CSE.
- Student interested in the Minor degree in CSE must enrol in the beginning of the second year only provided he/she must have obtained minimum first class in the first year B. Tech in non CSE branches.

- Student should get 20 extra credits from the following courses to acquire Minor degree in CSE.
- Minor courses include five courses each carries 4 credit. Student must take 01 course in III Sem, 03 courses in IV Sem and 1 Course in V Sem.
- In case a Student fails to complete the required 20 credits from the prescribed minor courses before the completion of degree, then the Degree will be awarded without mentioning any minor specialization

16. HONOURS DEGREE OFFERED BY THE DEPARTMENT

Students can get a B. Tech degree in CSE with **honours in specialization** by earning 20 extra credits in addition to BTech degree in CSE. Department of CSE is offering honour courses under three different area of specialization such as **Artificial Intelligence, Data Analytics and Cyber Security** along with the regular curriculum. A student completing these courses will be well equipped for further higher studies or research in the said specialization. The detailed guidelines are as follows.

Guidelines for Honour Degree

- For earning a B. Tech Degree in Computer Science and Engineering with Honours a student must choose 20 credits from any one of the three honors specialization(**AI/Data Analytics/ Cyber Security)** in addition to the regular curriculum.
- Honours courses include four core courses and one Capstone project/MOOC course/ Certificate courses.
- Student must take 01 course in V Sem, 02 courses in VI Sem and 01 Course along with Capstone project/MOOC course in VII Sem by satisfying the required pre-requisites.
- In case a Student fails to complete the required 20 credits from the prescribed honour courses before the completion of degree, then the Degree will be awarded without mentioning any honours specialization

17. LIST OF COURSES FOCUSSING ON EMPLOYABILITY/ENTREPRENEURSHIP/ SKILLDEVELOPMENT

Entrepreneurship	Employability	Skill Development

TE136/236P- Technical English (1st year) HS311- Technical writing(3rd semester) MC321- Cyber security(3rd semester) CS436- Professional Ethics(4th semester) MC422- Environmental Science(4th semester) CS512- Project Management & Finance(5th semester) MC823- Constitution of India(8th semester)	CS331P -Database Management Systems: Backend designing skill CS631P-Internet of Things : IoT applications, network of devices CS633P: Design patterns: Reusable Coding Skills IT633P: Data warehousing and data mining: data analytics skill CS662E01-Web Programming Concepts: Web design concept CS662E02-Java Programming: programming skills CS662E04-Introduction to Cloud Computing- cloud and storage management. CS662E05-Introduction to Data Science: data analytics CS662E08-Machine learning: self learning algorithm design skill CS662E09-Cryptography and Network security – security issues CS662E10-Service Oriented Architecture : storage related CS764E07- Microprocessor and micro controller: Embedded system designing CS764E09- Software Testing: Testing skill CS764E10-Information Retrieval: Storage management CS662E03-Software Testing Techniques: testing skill CS845E05-Introduction to Data mining: Data mining concepts CS764E02-Wireless Networks: IoT and other related applications CS865E03-Software Project Management: Project management skill CS541E01-Computer Graphics with Open GL: Animations and Graphics CS541E02-Internet and web programming: web designing CS541E03-Foundation of web science: web designing CS642E01-Mobile Application Development: Mobile app	CS134P / CS234P – Computer programming : C & C++ programming Skills CS433P -Programming Paradigm: Object oriented programming language CS432P- Operating Systems: Fundamentals of OS skill CS333- Software Engineering-Software product life cycle skill CS431-Probability and Queuing Theory: Fundamental subject for data analytics. CS332P-Data Structures and Algorithms: Problem Solving Skills CS434-Formal Language & Automata Theory: Compiler designing skill CS435P-Computer Organization & Architecture: system architecture and organization skill CS531P -Computer Networks: Network skill CS632-Compiler Design: compiler phases CS533P-Design and Analysis of Algorithms: problem solving techniques CS532-Introduction to Artificial Intelligence: R&D CS764E08-Digital Signal Processing: R&D CS846E05-Digital Image Processing: R & D CS764E01-Pattern Recognition: R & D CS764E04-Natural Language Processing: R & D CS764E05-Operational Research: problem solving techniques CS764E06-Bio Informatics: R & D CS642E02-Real Time Systems: R & D CS642E04-Computer Oriented

18. LIST OF COURSES FOCUSSING ON REGIONAL NEEDS, NATIONAL NEEDS AND GLOBAL NEEDS

Identification of local needs	Identification of regional needs	Identification of national needs	Identification of global needs	Supporting Evidences / Documents

TE136/236P-Technical English (1st year) HS311- Technical writing(3rd semester) MC321- Cyber security(3rd semester) CS436-Professional Ethics(4th semester) MC422-Environmental Science(4th semester) CS512- Project Management & Finance(5th semester) MC823-Constitution of India(8th semester) CS331P -Database Management Systems: Backend designing skill CS631P-Internet of Things : IoT applications, network of devices CS633P: Design patterns: Reusable Coding Skills	HS311- Technical writing(3rd semester) MC321- Cyber security(3rd semester) CS436-Professional Ethics(4th semester) MC422-Environmental Science(4th semester) CS512- Project Management & Finance(5th semester) MC823-Constitution of India(8th semester) CS764E09-Software Testing: Testing skill CS764E10-Information Retrieval: Storage management CS662E03-Software Testing Techniques: testing skill CS533P-Design and Analysis of Algorithms: problem solving techniques	HS311- Technical writing(3rd semester) MC321- Cyber security(3rd semester) CS436-Professional Ethics(4th semester) MC422-Environmental Science(4th semester) CS512- Project Management & Finance(5th semester) MC823-Constitution of India(8th semester) CS541E02-Internet and web programming: web designing CS541E03-Foundation of web science: web designing CS642E01-Mobile Application Development: Mobile app development skill CS642E03-Advanced Databases: DB designing CS743E01-Unix System Programming: OS administration skills CS743E02-TCP/IP Design and	HS311- Technical writing(3rd semester) MC321- Cyber security(3rd semester) CS436-Professional Ethics(4th semester) MC422-Environmental Science(4th semester) CS512- Project Management & Finance(5th semester) MC823-Constitution of India(8th semester) CS532-Introduction to Artificial Intelligence: R&D CS764E08-Digital Signal Processing: R&D CS846E05-Digital Image Processing: R & D CS764E01-Pattern Recognition: R & D CS764E04-Natural Language Processing: R & D CS764E05-Operational Research: problem solving techniques CS764E06-Bio Informatics: R & D	According to MIT Graduate survey report 2017, 79% graduating want enter the work force immediately (source: https://gecd.mit.edu/sites/default/files/about/files/2016-gss-survey.pdf) , in the following roles 1. Career as a network administrator or engineer. 2. Career as a Software Developer. 3. Career as an App Developer. 4. Development of System related Projects like Operating Systems, Compilers 5. Computer Hardware 6. Government sectors 7. Military 8. Data base administrator According to the survey conducted (Source: https://gecd.mit.edu/sites/default/files/about/files/2017-gss-survey-preview.pdf) among the all engineering

19. STAKE HOLDERS FEEDBACK

Category	Total Number of Requests	Total Number of Responses	Excellent	Good	Satisfactory	Average	Need to Improve
Alumni	**20**	**20**	**11**	**9**	**0**	**0**	**0**
Student	**250**	**203**	**58**	**82**	**52**	**9**	**2**
Industry	**20**	**21**	**11**	**10**	**0**	**0**	**0**
Parent	**20**	**19**	**16**	**3**	**0**	**0**	**0**
Teachers	**45**	**42**	**40**	**2**	**0**	**0**	**0**

20. COURSE STRUCTURE

COURSE STRUCTURE – CSE(Batch 2020-24)												
I SEMESTER – CHEMISTRY CYCLE												
Sl. NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	MA131	BSC	Mathematics – I	3	0	0	100	3	0	0	3	
2	CH132P	BSC	Chemistry	3	0	2	100	3	0	1	4	
3	EC133P	ESC	Basic Electronics	3	0	2	100	3	0	1	4	
4	CS134P	ESC	Computer Programming	3	0	2	100	3	0	1	4	
5	ME135	ESC	Basic Mechanical Engineering and Nano science	3	0	0	100	3	0	0	3	
6	TE136P	HSMC	Technical English	1	0	2	50	1	0	1	2	
7	ME 151	BSC	Workshop Practice Lab	0	0	2	50	0	0	1	1	
8	HE171		Holistic Education-I	1	0	0	---	1	0	0	1	
			Total	**17**	**0**	**10**	**600**	**17**	**0**	**5**	**22**	**0**

I SEMESTER – PHYSICS CYCLE												
Sl. NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	MA131	BSC	Mathematics – I	3	0	0	100	3	0	0	3	
2	PH132P	BSC	Physics	3	0	2	100	3	0	1	4	
3	EE133P	ESC	Basic Electrical Engineering	3	0	2	100	3	0	1	4	
4	CE134P	ESC	Basics of Civil Engineering & Engineering Mechanics	3	0	2	100	3	0	1	4	
5	EG135P	ESC	Engineering Graphics	2	0	2	100	2	0	1	3	
6	BS136	BSC	Bio Science	2	0	0	50	2	0	0	2	

7	HE171		Holistic Education-I	1	0	0	---	1	0	0	1	
			Total	**17**	**0**	**8**	**550**	**17**	**0**	**4**	**21**	**0**

II SEMESTER – CHEMISTRY CYCLE												
Sl.NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	MA231	BSC	Mathematics – II	3	0	0	100	3	0	0	3	
2	CH232P	BSC	Chemistry	3	0	2	100	3	0	1	4	
3	EC233P	ESC	Basic Electronics	3	0	2	100	3	0	1	4	
4	CS234P	ESC	Computer Programming	3	0	2	100	3	0	1	4	
5	ME235	ESC	Basic Mechanical Engineering and Nano science	3	0	0	100	3	0	0	3	
6	TE236P	HSMC	Technical English	2	0	0	50	2	0	0	2	
7	ME 251	BSC	Workshop Practice Lab	0	0	2	50	0	0	1	1	
8	HE171		Holistic Education-I	1	0	0	---	1	0	0	1	
			Total	**18**	**0**	**8**	**600**	**18**	**0**	**4**	**22**	**0**

II SEMESTER – PHYSICS CYCLE												
Sl.NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	MA231	BSC	Mathematics – II	3	0	0	100	3	0	0	3	
2	PH232P	BSC	Physics	3	0	2	100	3	0	1	4	
3	EE233P	ESC	Basic Electrical Engineering	3	0	2	100	3	0	1	4	
4	CE234P	ESC	Basics of Civil Engineering & Engineering Mechanics	3	0	2	100	3	0	1	4	
5	EG235P	ESC	Engineering Graphics	2	0	2	100	2	0	1	3	
6	BS 236	BSC	Bio Science	2	0	0	50	2	0	0	2	
7	HE271		Holistic Education-II	1	0	0	---	1	0	0	1	

			Total	**17**	**0**	**8**	**550**	**17**	**0**	**4**	**21**	**0**

III SEMESTER													
Sl. NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	CS331P	PCC	Database Management Systems	3	0	2	100	3	0	1	4	
2	CS332P	PCC	Data Structures and Algorithms	3	0	2	100	3	0	1	4	
3	CS333	PCC	Software Engineering	3	0	0	100	3	0	0	3	
4	EC337	PCC	Digital Systems	3	0	0	100	3	0	0	3	
5	MA334	BSC	Discrete Mathematics	3	0	0	100	3	0	0	3	
6	MC321	MC	Cyber Security	2	0	0	50	0	0	0	0	
7	HS311	HSMC	Technical Writing	2	0	0	50	2	0	0	2	
8	HOL312		Holistic Education-III	1	0	0	---	1	0	0	1	
			Total	**20**	**0**	**4**	**600**	**18**	**0**	**2**	**20**	**0**

IV SEMESTER												
Sl. NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	CS431	PCC	Probability and Queuing Theory	3	0	0	100	3	0	0	3	
2	CS432P	PCC	Operating Systems	3	0	2	100	3	0	1	4	
3	CS433P	PCC	Programming Paradigm	3	0	2	100	3	0	1	4	
4	CS434	PCC	Formal Language & Automata Theory	3	0	0	100	3	0	0	3	
5	CS435P	PCC	Computer Organization & Architecture	3	0	2	100	3	0	1	4	
6	BS451	BSC	Bio Science Laboratory	0	0	2	50	0	0	1	1	

7	CS436	HSMC	Professional Ethics	3	0	0	100	3	0	0	3	
8	MC422	MC	Environmental Science	2	0	0	50	0	0	0	0	
9	HOL411		Holistic Education-IV	1	0	0	-	1	0	0	1	
			Total	**22**	**0**	**6**	**700**	**20**	**0**	**3**	**23**	**0**

V SEMESTER													
Sl. NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	CS531P	PCC	Computer Networks	3	0	2	100	3	0	1	4	
2	CS532	PCC	Introduction to Artificial Intelligence	3	0	0	100	3	0	0	3	
3	CS533P	PCC	Design and Analysis of Algorithms	3	0	2	100	3	0	1	4	
4	CS541	PEC	Program Elective – 1	3	0	0	100	3	0	0	3	
5	CS561	OE	Open Elective - 1-(Global)	2	0	0	50	2	0	0	2	
6	CS512	HSMC	Project Management & Finance	3	0	0	100	3	0	0	3	
7	CS581	PROJ	Internship – 1	0	0	2	50	0	0	1	1	
8	HOXX541	HONS	Honours Elective – I	3	0	2	-	3	0	1	-	4
			Total	**17**	**0**	**6**	**600**	**17**	**0**	**3**	**20**	**4**

VI SEMESTER												
Sl. NO.	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	CS631P	PCC	Internet of Things	3	0	2	100	3	0	1	4	
2	CS632	PCC	Compiler Design	3	0	0	100	3	0	0	3	
3	CS633P	PCC	Design patterns	3	0	2	100	3	0	1	4	
4	CS662	OE	Open Elective -2(Global Elective)	3	0	0	100	3	0	0	3	
6	CS642	PEC	Program Elective – 2	3	0	0	100	3	0	0	3	

7	HOXX6 41	HONS	Honours Elective – II	3	0	2	-	3	0	1	-	4
8	HOXX6 42	HONS	Honours Elective – III	3	0	2	-	3	0	1	-	4
			Total	**18**	**0**	**4**	**500**	**15**	**0**	**2**	**17**	**8**

VII SEMESTER												
Sl. NO	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	CS743	PEC	Program Elective – 3	3	0	0	100	3	0	0	3	
2	CS744	PEC	Program Elective – 4	3	0	0	100	3	0	0	3	
3	CS763	PEC	Open Elective – 3	3	0	0	100	3	0	0	3	
5	CS764	OE	Open Elective - 4	3	0	0	100	3	0	0	3	
6	CS781	PROJ	Internship - 2	0	0	2	50	0	0	1	1	
7	CS782	PROJ	Service Learning	0	0	4	50	0	0	2	2	
8	CS783	PROJ	Project Phase-I	0	0	4	100	0	0	2	2	
9	HOXX741	HONS	Honours Elective – IV	3	0	2	-	3	0	1	-	4
10	HOXX742	HONS	Honours Elective – V	3	0	2	-	3	0	1	-	4
			Total	**12**	**0**	**12**	**600**	**12**	**0**	**5**	**17**	**8**

VIII SEMESTER												
Sl. NO	Course Code	Course Type	Course Name	Hours			Total Marks	Credits			Total Credits	Honours Credits
				L	T	P		L	T	P		
1	CS845	PEC	Program Elective – 5	3	0	0	100	3	0	0	3	
2	CS846	PEC	Program Elective – 6	3	0	0	100	3	0	0	3	
3	CS881	PROJ	Project Phase-II	0	0	18	300	0	0	9	9	
4	MC823	MC	Constitution of India	2	0	0	100	0	0	0	0	
			Total	**8**	**0**	**18**	**600**	**6**	**0**	**9**	**15**	**0**

CREDIT DETAILS	
Semester	**B.Tech-CSE**
I	22
II	21
III	20
IV	23
V	20
VI	17
VII	17
VIII	15
TOTAL CREDITS	**155**

CS561-OPEN ELECTIVE – 1	
SUBJECT	DEPARTMENT
DANCE COURSE	Department of Theatre and Performing Arts
THEATRE DIRECTION	Department of Theatre and Performing Arts
THEATRE PLAY	Department of Theatre and Performing Arts
VOICE IMPROVEMENT / VOCAL THERAPY	Department of Music
DIGITAL WRITING	Department of Media Studies
DIGITAL MEDIA	Department of Media Studies
INTELLECTUAL PROPERTY RIGHTS	School of Law

PROFESSIONAL PSYCHOLOGY	Department of Psychology
ORGANISATION BEHAVIOUR	Department of Social Work
CORPORATE SOCIAL RESPONSIBILITY	Department of Social Work
SOCIAL WELFARE ADMINISTRATION	Department of Social Work
CREATIVITY AND INNOVATION	Centre for Digital Innovation
LANGUAGES - FRENCH	Department of languages
GERMAN	Department of languages
JAPANESE	Department of languages
KOREAN	Department of languages
ASIAN CUISINE	Department of Hotel Management
IMAGINEERING	Department of Hotel Management
DIGITAL MARKETING	Institute of Management
DATA ANALYTICS THROUGH SPSS	Institute of Management
SELLING WITH EMOTIONAL INTELLIGENCE	Institute of Management
LEARNING THROUGH CASE STUDY	Institute of Management

OPEN ELECTIVE										
CS662-OPEN ELECTIVE – 2 (Global Elective)										
Sl.NO.	Course Code	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	CS662E01	Web Programming Concepts	2	0	2	100	2	0	1	3
2	CS662E02	Java Programming	2	0	2	100	2	0	1	3
3	CS662E03	Software Testing Techniques	2	0	2	100	2	0	1	3
4	CS662E04	Introduction to Cloud Computing	2	0	2	100	2	0	1	3
5	CS662E05	Introduction to Data Science	2	0	2	100	2	0	1	3
6	CS662E06	Data Structures	2	0	2	100	2	0	1	3

7	CS662E07	Python for Engineers	2	0	2	100	2	0	1	3
8	CS662E08	Machine learning	2	0	2	100	2	0	1	3
9	CS662E09	Cryptography and Network security	2	0	2	100	2	0	1	3
10	CS662E10	Service Oriented Architecture	2	0	2	100	2	0	1	3
CS763- OPEN ELECTIVE – 3										
1	CS763E01	Software Process and Project Management	3	0	0	100	3	0	0	3
2	CS763E02	Software Quality Management	3	0	0	100	3	0	0	3
3	CS763E03	Web Services and Service Oriented Architecture	3	0	0	100	3	0	0	3
4	CS763E04	Software Requirement Estimation	3	0	0	100	3	0	0	3
CS764-OPEN ELECTIVE – 4										
1	CS764E01	Pattern Recognition	3	0	0	100	3	0	0	3
2	CS764E02	Wireless Networks	3	0	0	100	3	0	0	3
3	CS764E03	Software Project Management	3	0	0	100	3	0	0	3
4	CS764E04	Natural Language Processing	3	0	0	100	3	0	0	3
5	CS764E05	Operational Research	3	0	0	100	3	0	0	3
6	CS764E06	Bio Informatics	3	0	0	100	3	0	0	3
7	CS764E07	Microprocessor and micro controller	2	0	2	100	2	0	1	3
8	CS764E08	Digital Signal Processing	2	0	2	100	2	0	1	3
9	CS764E09	Software Testing	2	0	2	100	2	0	1	3

10	CS764E10	I n f o r m a t i o n Retrieval	2	0	2	100	2	0	1	3
11	CS764E11	Software Coding Practices	2	0	2	100	2	0	1	3

PROGRAM ELECTIVE											
CS541- PROGRAM ELECTIVE – 1											
Sl.NO.	Course Code	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	CS541E01	Computer Graphics with Open GL	3	0	0	100	3	0	0	3
2	CS541E02	Internet and web programming	3	0	0	100	3	0	0	3
3	CS541E03	Foundation of web science	3	0	0	100	3	0	0	3
4	CS541C	Group-I	3	0	0	100	3	0	0	3
CS642- PROGRAM ELECTIVE – 2										
1	CS642E01	Mobile Application Development	3	0	0	100	3	0	0	3
2	CS642E02	Real Time Systems	3	0	0	100	3	0	0	3
3	CS642E03	Advanced Databases	3	0	0	100	3	0	0	3
4	CS642E04	Computer Oriented Numerical Analysis	3	0	0	100	3	0	0	3
5	CS642E05	Object Oriented Analysis and Design	3	0	0	100	3	0	0	3
6	CS642E06	System Software	3	0	0	100	3	0	0	3
7	CS642E07	Data warehousing and Data mining*	3	0	0	100	3	0	0	3
8	IT642E01	Design patterns *	3	0	0	100	3	0	0	3
9	CS642C	Group-II	3	0	0	100	3	0	0	3
CS642E07 – This course is open only for CSE students. **IT642E01- This course is open only for IT students.**										
CS743- PROGRAM ELECTIVE – 3										
1	CS743E01	Unix System Programming	3	0	0	100	3	0	0	3

2	CS743E02	TCP/IP Design and Implementation	3	0	0	100	3	0	0	3
3	CS743E03	Simulation and Modeling	3	0	0	100	3	0	0	3
4	CS743C	Group-III	3	0	0	100	3	0	0	3
CS744- PROGRAM ELECTIVE – 4										
1	CS744E01	Information Storage and Management	3	0	0	100	3	0	0	3
2	CS744E02	Data Base Administration	3	0	0	100	3	0	0	3
3	CS744E03	Network Storage Technologies	3	0	0	100	3	0	0	3
4	CS744E04	Network Administration	3	0	0	100	3	0	0	3
5	CS744E05	Research Methodology	3	0	0	100	3	0	0	3
CS845- PROGRAM ELECTIVE – 5										
1	CS845E01	Quantum Computing	3	0	0	100	3	0	0	3
2	CS845E02	Mobile Computing	3	0	0	100	3	0	0	3
3	CS845E03	Parallel Computing	3	0	0	100	3	0	0	3
4	CS845E04	Grid Computing	3	0	0	100	3	0	0	3
5	CS845E05	Introduction to Data mining	3	0	0	100	3	0	0	3
CS846- PROGRAM ELECTIVE – 6										
1	CS846E01	Computer Aided Decision Support Systems	3	0	0	100	3	0	0	3
2	CS846E02	Soft Computing	3	0	0	100	3	0	0	3
3	CS846E03	Introduction to Robotics	3	0	0	100	3	0	0	3
4	CS846E04	High Performance Computing	3	0	0	100	3	0	0	3
5	CS846E05	Digital Image Processing	3	0	0	100	3	0	0	3

CS782-Service Learning										
1	CS782E01	Free and Open Source Software	0	0	4	50	0	0	2	2
2	CS782E02	Digital Security and Principles	0	0	4	50	0	0	2	2

EMPLOYABILITY ENHANCEMENT COURSES										
CS541C-GROUP-I										
Sl.NO.	Course Code	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	CS541C01	Linux Certified Server Administration	0	0	2	-	0	0	1	1
2	CS541C02	Oracle certified Database Administration	0	0	2	-	0	0	1	1
3	CS541C03	Solaris Server Administration	0	0	2	-	0	0	1	1
4	CS541C04	Data Absorption	0	0	2	-	0	0	1	1
5	CS541C05	Virtualization	0	0	2	-	0	0	1	1
6	CS541C06	Robotic process and Automation	0	0	2	-	0	0	1	1
7	CS541C07	List of approved NPTEL / MOOC Courses of minimum 6 weeks duration.	0	0	2	-	0	0	1	1
8	CS541C08	CISCO/JAVA Fundamental/ NDG Linux/ Python/IOT	0	0	2	-	0	0	1	1
CS642C-GROUP-II										
1	CS642C01	Design Thinking	0	0	2	-	0	0	1	1
2	CS642C02	Scrum & Agile	0	0	2	-	0	0	1	1
3	CS642C03	Lean Six Sigma	0	0	2	-	0	0	1	1
4	CS642C04	Project Management Tool	0	0	2	-	0	0	1	1
5	CS642C05	Fog Computing	0	0	2	-	0	0	1	1
6	CS642C06	Dew Computing	0	0	2	-	0	0	1	1
7	CS642C07	Cognitive Computing	0	0	2	-	0	0	1	1

8	CS642C08	List of approved NPTEL / MOOC Courses of minimum 6 weeks duration.	0	0	2	-	0	0	1	1
CS743C-GROUP-III										
1	CS743C01	Server Side Programming	0	0	2	-	0	0	1	1
2	CS743C02	Client Side Programming	0	0	2	-	0	0	1	1
3	CS743C03	Web Designing	0	0	2	-	0	0	1	1
4	CS743C04	Shell Programming	0	0	2	-	0	0	1	1
5	CS743C05	Semantic Web	0	0	2	-	0	0	1	1
6	CS743C06	List of approved NPTEL / MOOC Courses of minimum 6 weeks duration.	0	0	2	-	0	0	1	1

HONOURSCOURSES											
Honoursin Artificial Intelligence											
Sl.NO.	Course Code	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	HOAI541	Statistical foundation for Artificial Intelligence	3	0	2	100	3	0	1	4
2	HOAI641	Artificial Intelligence and Machine Learning	3	0	2	100	3	0	1	4
3	HOAI642	Robotics and Process Automation	3	0	2	100	3	0	1	4
4	HOAI741	Computer Vision	3	0	2	100	3	0	1	4
5	HOAI742	AI Project / MOOC Courses/ Certificate Courses	3	0	2	100	3	0	1	4
		Total	**15**	**0**	**10**	**500**	**15**	**0**	**5**	**20**

Honours in Data Analytics										
Sl.NO.	Course Code	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	HODA541	Statistical foundation for Data Analytics	3	0	2	100	3	0	1	4
2	HODA641	Big Data Analytics	3	0	2	100	3	0	1	4
3	HODA642	Big Data Security Analytics	3	0	2	100	3	0	1	4
4	HODA741	Web Analytics	3	0	2	100	3	0	1	4
5	HODA742	DA Project / MOOC Courses/ Certificate Courses	3	0	2	100	3	0	1	4
		Total	**15**	**0**	**10**	**500**	**15**	**0**	**5**	**20**

Honours in Cyber Security						
	Course		Hours	Total Mark	Credits	

Sl.NO.	Course Code	Course Name	L	T	P	Marks	L	T	P	Total Credits
1	HOCS541	Probability and Random Process	3	0	2	100	3	0	1	4
2	HOCS641	Mobile and Network based Ethical Hacking	3	0	2	100	3	0	1	4
3	HOCS642	Cyber Forensics and Malware Detection	3	0	2	100	3	0	1	4
4	HOCS741	Intrusion detection and Incident Response	3	0	2	100	3	0	1	4
5	HOCS742	CS Project / MOOC Courses/ Certificate Courses	3	0	2	100	3	0	1	4
		Total	**15**	**0**	**10**	**500**	**15**	**0**	**5**	**20**

MINOR COURSES										
Minor in Computer Science and Engineering (offered by department of CSE for non- CSE/ IT students)										
Sl.NO.	Course Code	Course Name	Hours			Total Marks	Credits			Total Credits
			L	T	P		L	T	P	
1	CS332P	Data Structures and Algorithms	3	0	2	100	3	0	1	4
2	CS433P	Programming Paradigm	3	0	2	100	3	0	1	4
3	MICS435P	Basics of Computer Architecture & Operating Systems	3	0	2	100	3	0	1	4
4	CS531P	Computer Networks	3	0	2	100	3	0	1	4
5	MICS534P	Database System	3	0	2	100	3	0	1	4
		Total	**15**	**0**	**10**	**500**	**15**	**0**	**5**	**20**

LIST OF THE MINOR PROGRAMMESOFFERED BY OTHER DEPARTMENTS

S I NO.	TITLE OF THE MINOR PROGRAMME	OFFERING DEPARTMENT

1	Architecture	School of Architecture
2	Automation	Department of Mechanical and Automobile
3	Business Accounting	Department of Commerce
4	Computer Science	Department of Computer Science
5	E-Mobility	Department of Electrical and Electronics
6	Management	Department of Business Studies and Social Sciences
7	Psychology	Department of Psychology
8	Internet of Things	Department of Electronics and Communication

21. **DETAILED SYLLABUS**

<table>
<tr><td colspan="6" align="center">Course Name: Mathematics</td></tr>
<tr><td colspan="6" align="center">Course Code : MA131– I</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td align="right">Category</td><td>BSC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td align="right">CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td align="right">ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td align="right">Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
This course is outlined to those who intend to apply the subject at the proper place and time, while keeping him/her aware to the needs of the society where he/she can lend his/ her expert service, and also to those who can be useful to the community without even going through the formal process of drilling through rigorous treatment of Mathematics. At the end of this course, students will
have a solid base of understanding elementary linear algebra as required for further undergraduate work in engineering.
be able to differentiate a function partially with respect to each of its variables in turn
be able to utilize methods of integration to compute length of arcs, surface area and volume of solids
be skilled in using integration to compute problems important in physics and engineering
learn the meaning and computation of the curl and divergence of a vector field.
be able to solve first order differential equations that are separable, linear or exact</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Nil</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Linear Algebra</td></tr>
<tr><td colspan="5">Fundamental concepts of Matrix, Rank of a Matrix, Consistency and solution of linear simultaneous equations, Eigen values and Eigen Vectors, Diagonalization</td><td>5</td></tr>
<tr><td colspan="6">Unit-2 Differential Calculus – I</td></tr>
<tr><td colspan="5">Partial Differentiation: Partial derivatives, Total differential coefficient, differentiation of composite and implicit functions, Jacobians and properties. Leibnitz's Rule of differentiation under integral sign.</td><td>10</td></tr>
</table>

Unit-3 Integral Calculus – I	
Reduction formulae for the integration of $\sin^n x$, $\cos^n x$, $\sin^m x \cos^n x$ and evaluation of these integrals with standard limits - Problems. Derivative of arc length, Applications of integration to find surfaces of revolution and volumes of solids of revolution.	10
Unit-4 Differential Equation – I	
Solution of first order and first degree differential equations: Reducible to Homogeneous, Linear and Exact differential equation, Applications of differential equations. orthogonal trajectories.	10
Unit-5 Vector Calculus – I	
Vector differentiation. Velocity, Acceleration of a particle moving on a space curve. Vector point function. directional derivative, Gradient, Divergence, Curl, Laplacian. Solenoidal and Irrotational vectors - Problems. Standard vector identities.	10
Self-study : NIL	
Site/Industrial Visits :NIL	
Course outcomes: CO1:Discuss the consistency of the system of linear equations and the spectral matrix by using Eigen values and Eigen vectors. CO2: Illustrate the differentiation of multivariable functions using the concept of total derivatives, Jacobian, Solve definite integrals by Leibnitz rule of differentiation under integral sign. CO3:Solve definite integrals as surface area and volume of solid of revolution using reduction formulae. CO4: Examine first order nonlinear differential equations to solve non-homogenous, non-linear and exact forms. CO5: Calculate the velocity and acceleration of a moving particle, vector potential, scalar potential with the aid of vector differentiation.	
Text Books: T1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 39th Edition, Khanna Publishers, July 2005. T2. H. K. Das &RajnishVerma, "Higher Engineering Mathematics", S. Chand & Company Ltd., 2011.	

Reference Books:

R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons, Inc, 2005

R2. Thomas and Finney, "Calculus", 9th Edition, Pearson Education, 2004

R3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Publication, Canada, 2007

R4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw – Hill, 2009.

R5. Michael Artin, "Algebra", 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2002

R6. Kenneth Hoffman and Ray Kunze, "Linear Algebra", 2nd Edition, Prentice Hall of India Private Limited, New Delhi, 2002

R7. George F. Simmons and Steven G. Krantz, "Differential Equation, Theory, Technique and Practice", Tata McGraw – Hill, 2006.

R8. M. D. Raisinghania, "Ordinary and Partial Differential Equation", Chand (S.) & Co. Ltd., India, March 17, 2005.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-

Course Name: Chemistry					
Course Code : CH132P / CH232P					
	L	**T**	**P**	Category	**BSC**
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This paper contains five units which are Chemical Energy Sources, Electrochemical Energy Systems, Corrosion Science, Surface Chemistry & Catalysis, Material Characterization Techniques and Water Technology
This paper aims at enabling the students to know various energy sources, corrosion and its control, basics of surface chemistry, their application in catalysis, water technology and material characterization.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 Chemical Energy Sources	
Introduction to energy; Fuels - definition, classification, importance of hydrocarbons as fuels; Calorific value -definition, Gross and Net calorific values. Ultimate and proximate analysis of fuel, Determination of calorific value of a solid / liquid fuel using Bomb calorimeter. Cracking – Thermal Catalytic & fluidised cracking. Reformation, Knocking - mechanism, octane number, cetane number, prevention of knocking- anti-knocking agents, unleaded petrol, Power alcohol. synthetic petrol – Bergius process and Fischer Tropsch process. Solar Energy : Physical and chemical properties of silicon, production of silicon for photovoltaic cell – Mettalurgical grade, Solar grade. Purification of silicon – Zone refining crystal pulling technique - Photovoltaic cells- Introduction, VB Theory, definition, working of a PV cell, Merits and demerits.	10
Unit-2 Electrochemical Energy Systems	

Conductance, Ionic conductance, Transport number, Ionic mobility, activity coefficient and mean activity coefficients. Single electrode potential- origin, sign conventions. Derivation of Nernst equation. Standard electrode potential Construction of Galvanic cell–classification - primary, secondary and concentration cells, Concentration cell with and without transference, EMF of a cell, notation and conventions. Reference electrodes –calomel electrode, Ag/ AgCl electrode. Measurement of single electrode potential. Numerical problems on electrode potential and EMF. Ion-selective electrode- glass electrode, Determination of pH using glass electrode.	8
Unit-3 Corrosion Science	
Corrosion - definition, Chemical corrosion and Electro-chemical theory of corrosion, Types of corrosion, Differential metal corrosion, Differential aeration corrosion (pitting and water line corrosion), Stress corrosion. Factors affecting the rate of corrosion, Corrosion control: Inorganic coatings – Anodizing and Phosphating, Metal coatings –Galvanization and Tinning, Corrosion Inhibitors, Cathodic and Anodic protection.	9
Unit-4 Surface chemistry & Catalysis	
Introduction - Terminologies in surface chemistry – Adsorption - Characteristics, Classification, Application , Factors affecting Adsorption – Surface Area, temperature, pressure and nature of gas, desorption Activation Energy life time, Adsorption isotherms- Freudlich, Langmuir, BET Catalysis: Introduction, classification- Homogeneous and Heterogeneous, Active Sites-Single & dual- Solid catalysts- Classification- Supported, Unsupported, Metal Organic Frameworks Imprint catalysts, Hybrid catalysts, shape selective catalyst,– terminologies in material preparation- Precursor, calcination, Ageing, agglomeration regeneration	11
Unit-5 Material Characterization & Water Technology	
Theory and Applications of X-ray Photo electron Spectroscopy(XPS), Powder Xray diffraction (pXRD) Water Technology: Impurities in water,. Biochemical Oxygen Demand and Chemical Oxygen Demand. Numerical problems on BOD and COD. Sewage treatment. Purification of water- Desalination - Flash evaporation- Electro dialysis and Reverse Osmosis.	7
List of Experiments	**Practical Hours**
1. Determination of viscosity coefficient of a given liquid using Ostwald's viscometer.	2
2. Determination of copper by spectrophotometric method.	2
3. Conductometric estimation of an acid using standard NaOH solution	2

4. Determination of pKa value of a weak acid using pH meter.	2
5. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$ solution.	2
PART – B	
1. Determination of Total Hardness of a sample of water using disodium salt of EDTA.	2
2. Determination of percentage of Copper in brass using standard sodium thiosulphate solution.	2
3. Determination of Calcium Oxide (CaO) in the given sample of cement by Rapid EDTA method	2
4. Determination of Iron in the given sample of Haematite ore solution using potassium dichromate crystals by external indicator method.	2
5. Determination of Chemical Oxygen Demand (COD) of the given industrial waste Water sample.	2
Self-study : NIL	
Site/Industrial Visits : NIL	

Course outcomes:
CO1: Distinguish between renewable and non-renewable energy sources.
CO2: Outline the oxidation and reduction reactions which are relevant to study the concepts of corrosion science and electrochemistry.
CO3: Examine various types of corrosion occurring on metal surfaces.
CO4: Explain the basics of physical and chemical phenomena taking place at solid surfaces.
CO5: Identify physiochemical techniques for material characterization.

Text Books:
T1. Dr. B.S. Jai Prakash, "Chemistry for Engineering Students", Subhas Stores, Bangalore, Reprint 2015
T2. M. M. Uppal, "Engineering Chemistry", Khanna Publishers, Sixth Edition, 2002
T3. Jain and Jain, "A text Book of Engineering Chemistry", S. Chand & Company Ltd. New Delhi, 2009, Reprint- 2016

Reference Books:
R1. Atkins P.W. “Physical chemistry” ELBS 9 Edition 2009, London
R2. Stanley E. Manahan, “Environmental Chemistry”, Lewis Publishers, Reprint 2009
R3. B. R. Puri, L. R. Sharma & M. S. Pathania, ”Principles of Physical Chemistry”, S. Nagin Chand & Co., 33rd Ed., Reprint- 2016
R4. Kuriakose J.C. and Rajaram J. “ Chemistry in Engineering and Technology” Vol I & II, Tata McGraw – Hill Publications Co Ltd, NewDelhi, First edition Reprint 2010
R5. Ertl, H. Knozinger and J. Weitkamp, "Handbook of Heterogeneous Catalysis" Vol 1-5, Wiley - VCH.
R6. B. Viswanathan, S. Sivasanker , A.V. Ramaswamy, "Catalysis : Principles & Applications" CRC Press, March 2002, Reprint 2011.
R7. D K Chakrabarthy, B. Viswanathan,”Heterogeneous Catalysis” New Age Internatioanl Publishers,2008.
R8. J. Bassett, R.C. Denny, G.H. Jeffery, “Vogels text book of quantitative inorganic analysis”,5th Edition
R9. Sunita and Ratan Practical Engineering Chemistry, S.K. Kataria& Sons, 2013.

Online Resources:NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	1	2	-	-	-	-	-	-	-	-	-	-
CO2	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	3	2	1	2	-	-	-	-	-	-	-	-	-	-
CO4	2	1	-	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	1	-	-	-	-	-	-	-	-	-	-

Course Name: Basic Electronics					
Course Code : EC133P/EC233P					
	L	**T**	**P**	Category	**ESC**
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3

Course objectives:
This course aims at imparting knowledge about electronic and digital systems, semiconductor theory and operational amplifiers. This course also includes a practical component which allows the students to recognize the different elements used in electronics and digital systems.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 Basic Semiconductor And Pn Junction Theory	
Atomic Theory – Atom, Electron Orbits and Energy Levels - Conduction in solids – Electron Motion and Hole Transfer, Conventional Current and Electron Flow –Conductors, Insulators and Semiconductors – Energy Band Diagrams – Variation of band gap with temperature. Intrinsic and Extrinsic Semiconductors – Doping, n type and p type material, Majority and minority carriers, Charge Carrier Density, Mass Action Law. Semiconductor Conductivity – Drift Current, Diffusion Current, Charge Carrier Velocity, Conductivity.The pn Junction – Biased Junctions – Junction Currents and Voltages.VI Characteristics – Static and Dynamic Resistance.Zener diode characteristics, Zener and Avalanche breakdown.	9
Unit-2 Diode Applications	
Diode Approximations – DC Load Line Analysis - DC voltage applied to diodes (Si and zener diodes only). (Simple analysis using KCL and KVL). Rectifiers – Half Wave rectifier – Full Wave Rectifier – Bridge Rectifier : dc load current and voltage, rms load current and voltage, ripple factor, efficiency, PIV. Simple Capacitor Filter(Analysis not expected) – Simple Shunt Zener Voltage Regulator	9
Unit-3 Bipolar Junction Transistor	

Bipolar Junction Transistors: Transistor Construction – Operation – Common Base Configuration – Transistor Amplifying action – Common Collector – Common Emitter. Transistor currents. Common emitter current gain – Common Base Current gain – Relationship. Transistor Biasing : Operating Point – Significance – Fixed Bias and Voltage Divider Bias – Simple analysis.	9
Unit-4 Introduction To Operational Amplifiers	
Block diagram, Op-amp transfer characteristics, Basic Op-amp parameters and its value for IC 741- offset voltage and current, input and output impedance, Gain, slew rate, bandwidth, CMRR, Concept of negative feedback, Inverting and Non-inverting amplifiers, Summing Amplifier, Subtractor, Differential Amplifier, integrator, differentiator, Voltage follower, Introduction to Oscillators, the Barkhausen Criterion for Oscillations, Applications of Oscillator	9
Unit-5 Digital Electronics	
Sampling theorem, Introduction, decimal system, Binary, Octal and Hexadecimal number systems, addition and subtraction, fractional number, Binary Coded Decimal numbers. Boolean algebra, Logic gates, Two Variable and three variable K – maps - Half-adder, Full-adder, Logic Design based on two and three input variables only.	9
List of Experiments	**Practical Hours**
1. Use of basic voltage source and measuring instruments (Power supply, function generator, DSO, Digital Multimeter), familiarization of breadboard.Measurement of Voltage and Frequency using DSO	2
2. Study of step down transformer. Measuring the secondary voltage waveform on DSO and determination of peak and rms value	2
3. Identification and testing of electrical/electronic active and passive components	2
4. Color coding of resistors and capacitor coding	2
5. Study of Series and Parallel circuits to verify Kirchoff's Voltage Law and Current Law – using breadboard, DMM and DC power supply.	4
6. Half Wave Rectifier and Full Wave Rectifier : study of waveforms, determination of DC value of rectified wave	4
7. Study of different types of logic gates – NOT, OR, AND, NAND, NOR and Ex-OR	4
8. Verification of output of a logical expression using Basic gates/NAND gates/NOR gates	2

9. Soldering and de-soldering of electronic components on PCB	2
10. Determination of forward and reverse bias characteristics of silicon diode	4
11. Application of Zener diode as a basic voltage regulator	2

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
CO1: Describe the basic semiconductor principles , working of p-n junction diode and transistors.
CO2: Demonstrate the operation of diodes in rectifiers, voltage regulator and clipper.
CO3: Explain the operation of bipolar junction transistor including the amplification and biasing.
CO4: Explain the operation and applications of Operational Amplifier.
CO5: Discuss conversions between binary, decimal, octal and hexadecimal number system.

Text Books:
T1. David A. Bell, “Electronic Devices and Circuits” – Vth Edition, OUP, 2011
T2. N. P. Deshpande, “Electronic Devices and Circuits – Principles and Applications”, TMH, 2017
T3. Robert L Boylestad& Louis Nashelsky, "Electronic Devices and Circuit Theory", 3rd Edition, 2015
T4. Morris Mano, “Digital Logic and Computer Design”, PHI, EEE, 2014

Reference Books:
R1. Donald A. Neamen, “Electronic Circuits”, 3rd Edition, TMH, 2017
R2. Thomas L. Floyd, “Electronic Devices”, Seventh Edition, Pearson Education, 2012
R3. Albert Malvino, David. J. Bates, —Electronic Principle, 8th Edition, Tata McGraw Hill, 2015

Online Resources:
NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	1	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

CO4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td colspan="6" align="center">Course Name: Computer Programming</td></tr>
<tr><td colspan="6" align="center">Course Code : CS134P / CS234</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td align="right">Category</td><td>ESC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>2</td><td align="right">CIA Marks</td><td>70</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>30</td><td align="right">ESE Marks</td><td>30</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>1</td><td align="right">Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
● To provide exposure to problem-solving through programming.
● To provide a basic exposition to the goals of programming
● To enable the student to apply these concepts in applications which involve perception, reasoning and learning.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites:</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Algorithms And Flowcharts, Constants, Variables And Datatypes, Operators, Managing Input And Output Operations</td></tr>
<tr><td colspan="5">Algorithms and flowcharts: Algorithms, Flowcharts, Examples on algorithms and flowcharts. Basic structure of a C program, C Tokens, Data types.
Declaration of variables. Operators: Arithmetic operators, Relational operators, Logical operators, Assignment operators, Increment and Decrement operators, Conditional operator, Bitwise operators, Special operators, Arithmetic expressions, Evaluation of expressions, Precedence of Arithmetic operators, Type conversions in expressions, Operator precedence and associatively.
Managing input and output operations: Reading a character, writing a character, Formatted Input, Formatted Output</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 Decision Making And Branching, Looping</td></tr>
<tr><td colspan="5">Decision making and branching: Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statements, The else … if ladder, The switch statement, The ?: operator, The Goto statement
Looping: The while statement, The do statement, The for statement, Jumps in Loops</td><td>9</td></tr>
<tr><td colspan="6">Unit-3 Arrays, User Defined Functions</td></tr>
</table>

Arrays: One-dimensional Arrays, Declaration of one-dimensional Arrays, Initialization of one-dimensional Arrays, Two-dimensional Arrays, Initializing two-dimensional Arrays. User-defined functions: Need for User-defined Functions, A multi-function Program, Elements of user - defined Functions, Definition of Functions, Return Values and their types, Function Calls, Function Declaration, Category of Functions, No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Value, recursion –recursive functions, Limitations of recursion.	9
Unit-4 Pointers	
Understanding the pointers, Accessing the Address of a Variable, Declaring Pointer Variables, Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointer Expressions, Pointer Increments and Scale Factor, Pointers and Arrays, Pointers and Character Strings, Pointers as Function Arguments.	9
Unit-5 Strings, Derived Types, Files	
Strings: String concepts: declaration and initialization, String I/O functions, Array of strings, String manipulation function, Structure: Basic of structures, structures and Functions, Arrays of structures, structure Data types, type definition. Files: Defining, opening and closing of files, Input and output operations, Standard Library Functions for Files	9
List of Experiments	**Practical Hours**
1. To understand and realize the use of C tokens, Keywords and Identifiers, Variables, Data types, Declaration of variables, using operators, I/O functions.	4
2. To understand and implement concepts of Decision making statements.	4
3. To understand and implement concepts looping statements.	6
4. To understand and implement concepts of Arrays.	4
5. To understand and implement concepts of Pointers	4
6. To understand and implement concepts of User defined functions.	4
7. To understand and implement concepts of Strings and Structures.	4
Self-study : NA	

Site/Industrial Visits : NA
Course outcomes: CO1: Demonstrate the fundamental concepts of computer programming. CO2: Make use of the decision making, branchingand looping statements for solving problems. CO3: Build an application using arrays and functions to achieve code reuse. CO4: Inspect code optimization by using pointers. CO5: Develop applications using strings and files.
Text Books: T1. Deitel and Deitel, "C How to Program", Prentice Hall 2010 (Reprint). T2. Herbert Schildt, "C++ : The Complete Reference", McGraw - Hill Osborne Media; 3rd edition 2012 (Reprint). T3. YashvantKanetkar, "Let Us C 13E", BPB Publications – 13th Edition, 2013.
Reference Books: R1.Shelly and Junt, "Computers and Commonsense", 4th edition, Prentice Hall of India, 2010 (Reprint). R2. Dennis P. Curtin, Kim Foley, KunalSen, Cathleen Morin, "Information Technology: The Breaking wave", Tata MC GrawHill Companies, 2010 (Reprint). R3. Peter Norton, "Introduction to Computers", 2011 (Reprint).
Online Resources: W1.V. K. Myalapalli, J. K. Myalapalli and P. R. Savarapu, "High performance C programming," 2015 International Conference on Pervasive Computing (ICPC), Pune, 2015, pp. 1-6 W2. https://users.ece.cmu.edu/~eno/coding/CCodingStandard.html W3. https://www.w3resource.com/c-programming-exercises/

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	1	1	-	1	1
CO2	3	2	1	-	1	-	-	1	-	-	1	1	-	1	1
CO3	3	2	1	-	1	-	-	1	1	-	1	1	-	1	1
CO4	3	3	2	1	1	-	-	1	1	2	1	1	-	1	1
CO5	3	2	1	-	1	-	-	1	1	-	1	1	-	1	1

Course Name: Basic Mechanical Engineering and Nano science					
Course Code : ME135 / ME235					
	L	T	P	Category	ESC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3

Course objectives:

1. To elucidate and critically demonstrate the Energy sources and basic thermodynamic concepts behind energy transfer.
2. To distinguish and elaborate the different types of prime movers.
3. To describe the functioning of refrigeration and air-conditioning.
4. To evaluate and apply the concepts of nano-science in real engineering applications.
5. To demonstrate and apply the process of machining and metal joining in basic applications.

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 Energy Resources, Thermodynamics and Heat transfer	
Energy Resources Conventional Energy resources- Fossil fuel and nuclear fuel, Merits and demerits. Non-conventional energy sources- Solar, Wind, hydraulic, Ocean-thermal, Geo-thermal, Tidal energy and bio mass energy plants working principle. Thermodynamics Basic terms: State, path, process (reversible and irreversible), and cycle, System, surroundings and boundary. Closed system, Open system and Isolated Systems. Laws of Thermodynamics (statements and brief description). Heat engine and Heat pump (Definition). Heat Transfer Modes of Heat transfer and their basic governing equations. Heat exchangers-types. Fins – types and applications.	12

Unit-2 I.C. Engine and Turbines	
I.C. Engines Classification, I.C. Engines parts and their function, working of 2 Stroke and 4 stroke engines. Basic terms - Indicated power, brake power frictional power, thermal efficiency, mechanical efficiency (simple problems). Steam Generators Boilers, fire and water tube boilers (Lancashire and Babcock and Will Cox boiler-working with simple sketches). Steam turbines Classifications, Principle of operation of Impulse and reaction turbines. Gas Turbines Open cycle and closed cycle gas turbines working principle. Water Turbines Classification, working principle of Pelton wheel, Francis turbine and Kaplan turbine.	10
Unit-3 Refrigeration and Air-conditioning	
Refrigeration Types of refrigerants and properties of good refrigerant, Refrigerating effect and unit of Refrigeration (definition). Working principle of vapour Compression refrigeration and vapour absorption refrigeration (with sketch). Applications areas of refrigeration system. Air Conditioning Definition, types, Room air-conditioning working principle (with sketch), Applications.	6
Unit-4 Introduction to Nanotechnology	
Introduction to Nanotechnology Introduction to about Nanomaterials, characterization of nanomaterials-SEM, XRD, AFM and Mechanical properties, Advantages, limitations and applications of Nano materials.	7
Unit-5 Machine tools and Metal joining processes	
Machine tools Lathe Machine-Types, Parts and different operations like-turning, facing, grooving, parting off, taper turning, and threading (simple sketch) Drilling Machine-Types, Parts and different operations like-drilling, reaming, boring, counter boring, counter sinking and tapping (simple sketch). Milling Machine-Up milling, down milling, Plane milling, End milling, Slot milling and gear cutting (sketches only for following operations) Metal joining Definitions, classification of soldering, Brazing and welding. Differences between soldering, brazing and Welding. Description of Electric Arc welding and Oxy-Acetylene gas welding (Simple sketch).	10

Self-study:
Unit-1: Distillation process of crude oil, Harnessing of Ocean-thermal Energy.
Unit-2: 4 Stroke Diesel Engine, 2 Stroke petrol engine, Water turbines.
Unit-3: Office air-conditioning systems.
Unit-4: TEM, UTM techniques for characterization of Nanomaterials.
Unit-5: Trepanning operation, Vertical milling machine, brazing and soldering applications.

Site/Industrial Visits:
1. Heat Transfer Lab.
2. Fluid mechanics and Machinery Lab.
3. Metal Cutting Lab.
4. I.C. Engine Lab.

Course outcomes:
CO1: Elucidate and critically demonstrate the basic thermodynamic concepts behind energy transfer.
CO2: Distinguish and elaborate the types of prime movers for power generation and its transmission.
CO3: Describe the functioning of refrigeration and air-conditioning for its real time applications.
CO4: Evaluate and apply the concepts of nano-science in real engineering applications.
CO5: Demonstrate and apply the process of machining and metal joining in basic applications.

Text Books:
T1. K.R. Gopalkrishna, "A text Book of Elements of Mechanical Engineering", Subhash Publishers, Bangalore, 2008.
T2. S. Trymbaka Murthy, "A Text Book of Elements of Mechanical Engineering", 3rd revised edition, I .K. International Publishing House Pvt. Ltd., New Delhi. 2010.
T3. P.K.Nag, "Engineering Thermodynamics" Tata McGraw-Hill Education, 2005.
T4. B.S. Murthy, P. Shankar, Baldev Raj, B.B. Rath and James Munday, "Nano Science and Nano Technology ", University Press IIM, 2002.

Reference Books:
R1. Dr. R. P. Reddy, "Elements of Mechanical Engineering", 1st Edition, Himalaya Publishing House, New Delhi, 2012.
R2. HajraChoudhury S K, "Elements of Workshop Technology" 13th Edition, Volume 1, Machine Tools, India Book Distributing Company Calcutta, 2010.
R3. HajraChoudhury S K, "Elements of Workshop Technology" 13th Edition, Volume 2, Machine Tools, India Book Distributing Company Calcutta, 2012.
R4. Charles P. Poole and Frank J. Owens, "Introduction to Nanotechnology", Wiley India Edition, 2012.

Online Resources:
W1. http://www.hds.bme.hu/letoltesek/targyak/BMEGEVGAG01_ENG/ime.pdf
W2. http://www.nptel.ac.in/downloads/112108148.

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	-	-	-	1	1	-	-	-	-	1	-	-	-
CO2	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO4	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Course Name: Technical English					
Course Code : TE136P / TE236P					
	L	**T**	**P**	Category	**HSMC**
Contact Hrs./Week	**1**	**0**	**2**	CIA Marks	**25**
Contact Hrs./Sem.	**15**	**0**	**30**	ESE Marks	**25**
Credits.	1	0	1	Exam Hours	**2**

Course objectives: Upon Successful completion of this course, the student will have reliably demonstrated the ability to respond effectively, efficiently, and appropriately to writing in ways that demonstrate comprehension and evaluation of its purpose and meaning.

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 Vocabulary Building	
Concept of word formation, synonyms , antonyms, homophones, prefixes and suffixes, Misused and confused words.	8
Unit-2 Basic Writing Skills	
Sentence structure, parts of speech, Fragments, Run-on errors, Phrases and clauses, Misplaced and Dangling modifiers, Structure of paragraphs Techniques of writing precisely.	8
Unit-3 Identifying Common Errors In Writing	
Subject verb agreement(concord), articles, prepositions, Tenses, Redundancies, cliché's , Misused and confused words	9
Unit-4 Essay Writing (Lang. Lab)	
ESSAY WRITING (Lang. Lab), Structure of an Academic essay, writing introduction , thesis statement, writing body paragraphs , writing concluding paragraph, unity, support, coherence and sentence skills , Different types of essay.	10

Unit-5 Oral Communication	
(Interactive practical sessions in lang. lab), listening comprehensions, pronunciation, intonation, stress and rhythm, interview and formal presentation skills.	10
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes:	
Text Books:	
Reference Books:	
Online Resources:	

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1															
CO2															
CO3															
CO4															
CO5															

Course Name: Workshop Practice Lab					
Course Code : ME 151					
	L	**T**	**P**	Category	**BSC**
Contact Hrs./Week	0	0	2	CIA Marks	25
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	25
Credits.	**0**	**0**	**1**	Exam Hours	2

Course objectives:
To provide the students with the hands on experience on different trades of engineering like fitting, welding, carpentary& sheet metal.

List of Experiments	**Practical Hours**
1. Safety Precautions and description of workshop tools and equipments.	1
2. Study of fitting tools and equipments.	2
3. Demonstrate and make a square fitting model.	4
4. Demonstrate and make a V fitting model.	2
5. Demonstrate and make a dovetail fitting model.	4
6. Study of electric arc welding tools and equipments.	1
7. Demonstrate and make a Butt Joint welding model.	2
8. Demonstrate and make a Lap Joint welding model.	2
9. Demonstrate and make a T-Joint welding model.	2
10. Demonstrate and make a L-Joint welding model.	2
11. Study of sheet metal tools and equipments.	1
12. Demonstrate and make a rectangular tray.	2
13. Study and demonstration of Carpentry tools, joints and operations.	1
14. Study and demonstration of MIG welding.	2
15. Study and demonstration of TIG welding.	2
Self-study: NA	

Site/Industrial Visits: NA

Course outcomes:
CO1: Demonstrate an understanding of and comply with workshop safety regulations.
CO2: Select and perform a range of cutting and filing operations to produce a given fitting model
CO3: Demonstrate the knowledge of welding and sheet metal processes to prepare various models

Text Books:
T1. S. K. H. Choudhury, A. K. H. Choudhury, Nirjhar Roy, “The Elements of Workshop Technology”, Vol 1 & 2, Media Propoters and Publishers, Mumbai, 2018.

Reference Books:
R1. P. Kannaiah and K.L. Narayana, “Manual on Workshop Practice”, Scitech Publications, (1999).
R2. T Jeyapoovan, “Engineering Practices Lab - Basic Workshop Practice Manual,”
ISBN: 81-259-1800-0
R3. H.S.Bawa, “Workshop Practice”, Tata McGraw Hill Publishing Company Limited, (2007)

Online Resources:
W1. https://nptel.ac.in/noc/
W2. http://ecoursesonline.iasri.res.in

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	1	1	-	1	1	-	-	-	-	-
CO2	-	-	-	-	-	1	-	-	1	1	-	-	-	-	-
CO3	-	-	-	-	-	1	1	-	1	1	-	-	-	-	-

Course Name: Physics					
Course Code : PH132P					
	L	**T**	**P**	Category	**BSC**
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This paper contains five UNITS which are Modern Physics, Quantum Mechanics, Conductivity in Metals (Electrical and Thermal), Elastic, Dielectric and Optical Properties of Materials, Lasers, Optical Fibers.
At the end of the course, the students would be able to
- Identify the fundamental aspects of modern physics and quantum mechanics.
- Compare classical and quantum free electron theory.
- Outline the salient properties of elastic and dielectric materials.
- Apply the concepts learnt in Laser, Fiber optics in the field of Engineering.
- Apply optical phenomenon in technology.

Prerequisites:

Units	**Teaching Hours**
Unit-1 Modern Physics	
Introduction, Planck's theory - Deduction of Wien's displacement law and Rayleigh Jean's law from Planck's law, Compton effect, de Broglie hypothesis – extension to electron particle. Phase velocity, group velocity, expression for group velocity based on superposition of waves, relation between group velocity and particle velocity. Problems.	09
Unit-2 Quantum Mechanics	

Heisenberg's uncertainty principle and its physical significance. Application of uncertainty principle (Non-existence of electron in the nucleus). Wave function. Properties and Physical significance of a wave function Schrodinger - Time independent wave equation – Application: Setting up of a one dimensional Schrödinger wave equation of a particle in a potential well of infinite depth : Probability density and Normalization of wave function – Energy Eigen values and Eigen function. Problems.	09
Unit-3 Electrical and Thermal Conductivities of metals	
Classical free-electron theory. Introduction, assumptions and limitation of classical free-electron theory. Thermal Conductivity. Wiedemann - Franz law, calculation of Lorentz number. Quantum free-electron theory – Postulates of quantum fee electron theory, Fermi - Dirac Statistics. Fermi-energy – Fermi factor. Density of states. Carrier concentration in metals. Expression for electrical resistivity/conductivity - Merits of Quantum free electron theory. Problems.	10
Unit-4 Materials Science	
Elasticity : Introduction - Bending of beams – Single Cantilever – Application of Cantilever in AFM, Young's modulus-Non uniform bending. Problems. Dielectrics : Dielectric constant and polarisation of dielectric materials. Types of polarisation. Equation for internal fields in liquids and solids (one dimensional). Clausius – Mossotti equation. Ferro and Piezo – electricity(qualitative). Frequency dependence of dielectric constant. Important applications of dielectric materials. Problems.	09
Unit-5 Applied Optics	
Lasers: Principle and production. Einstein's coefficients (expression for energy density). Requisites of a Laser system. Condition for Laser action. Principle, Construction and working of He-Ne and semiconductor diode Laser. Applications of Laser – Laser welding, cutting and drilling. Measurement of atmospheric pollutants. Problems. Optical Fibers: Introduction, Principle and Propagation of light in optical fibers. Angle of acceptance. Numerical aperture. Types of optical fibers and modes of propagation. Applications –optical fiber communication system. Problems.	08

List of Experiments	**Practical Hours**
PART – A	
1. Basic Measuring Instruments Vernier Callipers Screw Gauge Travelling Microscope	
2. Verification of Stefan's law	
3. Planck's Constant (Determination of Planck's constant using LED or using the principle of photoelectric effect)	
4. Determination of Fermi energy.	
5. Young's modulus – Non-uniform bending.	
6. Measurement of Dielectric Constant (Charging & discharging of capacitor).	
7. Ultrasonic Interferometer.	
8. Interference at a wedge.	
9. Laser Diffraction (Determination of grating constant and number of rulings per inch using diffraction grating).	
10. Frequency determination – Melde's apparatus	
11. Photo Multiplier Tube – Demonstration only	
Course outcomes: CO1: Demonastratethe principles of Classical Physics and Modern Physics. CO2: Classify the materials according to the theories of Quantum Physics. CO3: Experiment the principles of Physics to solve the problems in different relevant topics. CO4: Examine the different materials for various scientific applications. CO5: Experiment the principles of optics in the field of LASERS and Optical Fiber. CO6: Evaluate the theories of quantum mechanics in various fields of LASERS, Materials sciences and future engineering applications.	

Text Books:

T1. M.N.Avadhanulu and P.G. Kshirsagar, “A Text Book of Engineering Physics”, S.Chand& Company Ltd, 9th Edition 2012.

T2. John Wiley “Engineering Physics”,Wiley India Pvt. Ltd, 1st Edition 2014.

T3. S.O. Pillai, “Solid State Physics”, New Age International, 6th Edition 2009.

T4. S.P. Basavaraju, “ Engineering Physics”, Revised Edition 2009.

T5. Charles Kittel, “Introduction to Solid State Physics” , 8th Edition.

T6. Arthur Beiser, “Concepts of Modern Physics” , Special Indian Edition 2009.

T7. AjoyGhatak, “Optics”,4th Edition 2009

Reference Books:

R1. R.K. Gaur and S.L. Gupta, "Engineering Physics", Dhanpatrai and Sons, New Delhi, 2001.

R2. Sehgal Chopra Sehgal, “ Modern Physics ", Tata McGraw-Hill, 6th Edition, 2005.

R3. Halliday, Resnick and Krane, "Fundamentals of Physics Extended", John Wiley and Sons Inc., New York, 5th Edition, 1997.

R4. P.Mani, “Engineering Physics”, Dhanam publishers, Revised Edition 2011.

R5. H.J. Sawant, "Engineering Physics", Technical Publications, 1st Edition, 2010.

R6. V. Rajendran, “Engineering Physics”, Tata Mcgraw Hill Publishing Company Limited, 1st Edition, 2009.

R7. K.Eric Drexler, “Nanosystems - Molecular Machinery, Manufacturing and Computation”, John Wiely& Sons, 2005.

R8. J David, N Cheeke , “Fundamentals and Applications of Ultrasonic Waves”, CRC Press 1st Edition, 2002.

R9. Frederic33k J Bueche and Eugene Hecht “Schaum Outline of Theory and Problems of College Physics”, Tata McGraw-Hill, 11th Edition, 2012.

R10. M. Ali Omar, “Elementary Solid State Physics”, Addison-Wesley 1st Edition, 1993.

Online Resources:

W1. https://en.wikipedia.org/wiki/Laser

W2. https://en.wikipedia.org/wiki/Ultrasound

W3. https://en.wikipedia.org/wiki/Optical_fiber

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	1	-	-	-	-	-	-
CO5	3	3	1	1	-	-	-	-	-	-	-	-	-	-	-

Course Name: Basic Electrical Engineering					
Course Code : EE133P					
	L	**T**	**P**	Category	**ESC**
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This course is aimed to solve and analyse DC and AC networks. It also covers the fundamental principles of alternator, transformer, motors, renewable energy systems and power converters. It also emphasise the concepts in smart grid and electrical vehicles to cope up with current trends in electrical engineering.

Prerequisites: NA

Units	**Teaching Hours**
Unit-1 DC circuits	
Basic electrical quantities, KCL, KVL, voltage and current division rules, circuit reduction using series, parallel and star-delta transformation of resistors. Superposition theorem, Thevenin's theorem, Source transformations- Electromagnetism- Faraday's laws, comparison of electric and magnetic circuits.	9
Unit-2 AC circuits	
Comparison of DC and AC , Generation of sinusoidal signal, Representation of AC, inductance and capacitance, behaviour of pure R, L and C in AC circuits, RL, RC and RLC series circuits- derivations, phasor diagrams, real power, reactive power, power factor and resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	9
Unit-3 Power System Components	
Power system components-overview, Alternator-construction, working and generated voltage equation, Transformer – types, construction, working, emf equation, voltage regulation and efficiency, Switchgears (Fuse, MCB, relay), earthing, electric safety, standards and best practices. DC Motor- construction and working, torque and speed equations of shunt motors, Single phase induction motors - construction and working, BLDC motor and its applications in e-mobility.	9

Unit-4 Power Converters and Renewable Energy	
Power supplies and converters, SCR as a switch single phase rectifiers and inverters, DC power supply. Solar standalone system and its characteristics, Solar PV grid tied system description, Wind energy systems- types, types of renewable systems- stand alone, grid tied systems and hybrid and micro-grids.	9
Unit-5 Smart Grid and Electric Vehicles	
Introduction to smart grid, Home automation systems, Application of IoT in electrical systems, smart meters, communication systems in electrical systems, Artificial intelligence in power system. Introduction to electric vehicles- building blocks, charging stations. Different types of batteries and terminologies and BMS applications	9
List of Experiments	**Practical Hours**
1. Verification of superposition theorem	2
2. Wiring practice – multiple switching and two way switching	2
3. Phase angle measurement in R, RL and RLC circuits	2
4. Energy measurement in single phase circuits – with R and RL loads	2
5. Power factor improvement	2
6. Regulation and efficiency of single phase transformer.	2
7. Speed – torque characteristics of a DC shunt motor	2
8. Speed – torque characteristics of single phase induction motor	2
9. Characteristics of solar PV modules	2
10. Electrical appliances control using Arduino	2
11. Variable DC voltage using DC-DC converter (Demonstration)	2
12. Power circuit control using relay and a contactor. (Demonstration)	2
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Demonstrate an understanding of the basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
CO2: Demonstrate an understanding of basic concepts of analysis of simple AC circuits.
CO3: Demonstrate an understanding of basic concepts voltage current relationships and power in three phase AC circuits
CO4: Demonstrate an understanding of electromagnetic principles and operational characteristics of DC motors with a view of practical applications
CO5: Demonstrate an understanding of basic concepts of transformers and three phase induction motors and their practical applications

Text Books:
D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
V K. Mehta, Vivek Mehta, "Principles of Power System", S. Chand, 2005, reprint 2015.
D. P. Kothari and K C.Singal, "Renewable Energy Sources and Emerging Technologies", PHI, 2011.
James Larminie, John Lowry, 'Electric Vehicle Technology Explained', Wiley , 2015.

Reference Books:
Weedy, Cory, Ekanayake, ' Electric Power Systems', John Wiley & Sons; 5th edition, 2012.
HinaFathima (Editor), 'Hybrid-Renewable Energy Systems in Microgrids: Integration, Developments and Control', Woodhead Publishing Series in Energy, 2018.
Nikos Hatziargyriou, 'Microgrids: Architectures and Control', Wiley, 2014
D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

Online Resources:
W1. https://nptel.ac.in/courses/108108076/
W2. https://nptel.ac.in/downloads/108105053/

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-

Course Name: Basics of Civil Engineering & Engineering Mechanics					
Course Code : CE134P					
	L	**T**	**P**	Category	**BSC**
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	45	0	30	ESE Marks	**30**
Credits.	3	0	1	Exam Hours	**3**

Course objectives:
The students will understand the basics of civil engineering and Engineering Mechanics
The students will understand the basic principles and laws of forces of nature, measurements, calculations and SI units.
The students will understand mechanics that studies the effects of forces and moments acting on rigid bodies that are either at rest or moving with constant velocity along a straight path for static condition only.
The students will understand the basic concepts of forces in the member, centroid, moment of inertia and Kinetics of bodies.

Prerequisites: Nil

Units	Teaching Hours
Unit-1	
Introduction To Civil Engineering Scope of different fields of Civil Engineering: Surveying, Building Materials, Construction Technology, Structural Engineering, Geotechnical Engineering, Environmental Engineering, Hydraulics, Water Resources Engineering, Transportation Engineering. Role of Civil Engineers in Infrastructure Development. Introduction to Engineering Mechanics Basic idealizations-Particle, Continuum, Rigid body and Point force, Newtons laws of motion. Force, classification of force systems, Principle of Physical Independence of forces, Principle of Superposition of forces and Principle of Transmissibilty of forces, Moment, Couple and its characteristics. Composition and resolution of forces, Parallelogram Law of forces, Polygon law. Resultant of coplanar concurrent force systems.	9
Unit-2	

Composition of Coplanar Concurrent and Non Concurrent Force System. Resultant of coplanar concurrent force systems. Varignon's Theorem, Resultant of coplanar non concurrent force systems. Equilibrium of force systems Free body Diagram, Lami'sTheorem ,Equations of Equilibrium, Equilibrium of coplanar concurrent forces.	9
Unit-3	
Support Reactions Types of loads and supports, Types of beams, Statically determinate and indeterminate beams, Support Reactions in beams, Numerical Problems on support reactions for statically determinate beams (point load, Uniformly distributed load, Uniformly varying load and moments) .	9
Unit-4	
Centroid and Moment of inertia Definition of centroid and centre of gravity, Centroid of simple plane figures and built up sections. Moment of inertia / Second Moment of area, Parallel axis theorem and Perpendicular axis theorem, Moment of Inertia of composite areas, Polar Moment of inertia and radius of gyration.	9
Unit-5	
Kinematics Definitions, Displacement, Average velocity, Instantaneous Velocity, Speed, Acceleration, Average Acceleration, Variable Acceleration, Acceleration due to gravity.Types of motion-Rectilinear, Curvilinear and Projectile motion. Relative motion and Motion under Gravity, Numerical Problems. Kinetics: D Alemberts Principle and its application in Plane motion.	9
List of Experiments	**Practical Hours**
1.To determine moisture content of fine Aggregates.	2
2.Sieve Analysis of Fine Aggregates.	2
3.Determination of Compressive Strength of Burnt Clay Bricks.	2
4. Determination of Fineness of Cement.	2
5. Setting out of rectangle in the field.	2
6. Setting out of polygon in the field.	2
7. To Verify the Polygon Law of Forces Using Universal Force Table.	2
8. To Verify Parallelogram Law of Forces Using Grave Sand's Apparatus.	2

9. To Determine Weight of Body Using Grave Sand's Apparatus.	2
10. To Verify Triangular law of Forces using Jib Crane Apparatus.	2
11. To determine the reactions for simply supported beam Using Parallel Force Apparatus.	2
12. To determine the center of gravity Using Parallel Force Apparatus.	2
Self-study: NA	
Site/Industrial Visits : Nil	
Course outcomes: After a successful completion of the course, the student will be able to: CO1: Understand basics of Civil Engineering, its scope of study and materials of construction. CO2: Comprehend the action of Forces, Moments and other loads on systems of rigid bodies. CO3: Compute the reactive forces and the effects that develop as a result of the external loads. CO4: Compute Centroid and Moment of Inertia of regular and built up sections CO5: Express the relationship between the motion of bodies and equipped to pursue studies in allied courses in Mechanics	
Text Books: T1. Bhavikatti S.S. Elements of Civil Engineering, 4th Edition and Engineering Mechanics ,2nd edition, New Delhi, Vikas Publishing House Pvt. Ltd, 2008. T2. SheshPrakash and Mogaveer, Elements of Civil Engineering and Engineering Mechanics, 1st edition, New Delhi , PHI learning Private Limited,2009. T3. Jagadeesh T.R. and Jay Ram, Elements of Civil Engineering and Engineering Mechanics, 2nd edition, Bangalore, Sapana Book House, 2008.	

Reference Books:

R1. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
R2. Meriam J. L, and Kraige, L. G, Engineering Mechanics, 5/E, Volume I, Wiley India Edition, India, Feburary 2018
R3. Irvingh H Shames, Engineering Mechanics, 4/E, PHI learning Private Limited, New Delhi, 2008
R4. Ferdinand P. Beer and E. Russel Johnston Jr., Mechanics for Engineers: Statics, McGraw-Hill Book Company, New Delhi. International Edition 2013
R5. Bansal R. K, Engineering Mechanics, Laxmi Publications (P) Ltd, New Delhi, 2015
Goyal and Raghuvanshi, Engineering Mechanics, New Edition, PHI learning Private Limited, New Delhi. 2011
R6. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.
R6. Kukreja C.B., Kishore K.RaviChawla., Material Testing Laboratory Manual, Standard Publishers & Distributors 1996.
R7. Gambhir M.L., Concrete Manual, DhanpatRai& Sons, New Delhi, 2014
Duggal S.K., Surveying, Vol-I, Tata McGraw Hill - Publishing Co. Ltd. New Delhi.
R8. Punmia. B.C., Surveying Vol–1, Laxmi Publications, New Delhi.

Online Resources:
W1.https://nptel.ac.in/courses/112103109/
W2. https://nptel.ac.in/courses/122104015/

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-

Course Name: Engineering Graphics					
Course Code : EG135P					
	L	**T**	**P**	Category	**ESC**
Contact Hrs./Week	2	0	2	CIA Marks	50
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	50
Credits.	2	0	1	Exam Hours	3

Course objectives:
To create an awareness and emphasise the need for Engineering Graphics.
To teach basic drawing standards and conventions.
To develop skills in three-dimensional visualization of engineering components.
To develop an understanding of 2D and 3D drawings using the Solidworks software

Prerequisites: Nil

Units	**Teaching Hours**
Unit-1 Introduction to Engineering Drawing& Orthographic Projections	
Introduction to Engineering Drawing Principles of Engineering Graphics and their significance, usage of Drawing instruments, BIS conventions, lettering, Scales – Plain, Diagonal and Vernier Scales. Orthographic Projections (First Angle Projection Only) Principles of orthographic projections, introduction to first angle and third angle projection, projections of points, lines (inclined to both planes) and planes. (No application problems)	14
Unit-2 Introduction of Computer Aided Engineering Drawing	
Introduction of Computer Aided Engineering Drawing (CAED) Introduction and customization of user interface consisting of set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning, orthographic constraints, snap to objects manually and automatically, producing drawings by using various coordinate input entry methods to draw straight lines, applying various ways of drawing circles. Annotations, layering & other functions covering applying dimensions to objects, applying annotations to drawings, setting up and use of layers, layers to create drawings, create, edit and use customized layers, changing line lengths through modifying existing lines.	2

Unit-3 Projections of Regular Solids &Sections of solids	
Projections of Regular Solids Projection of solids inclined to both the Planes, draw simple annotation, dimensioning and scale (both manual and CAD software). Sections of solids Sections and sectional views of right angular solids - Prism, Cylinder, Pyramid, Cone– Auxiliary Views; (both manual and CAD software)	20
Unit-4 Development of surfaces & Isometric Projections	
Development of surfaces Development of surfaces of right regular solids - prism, pyramid, cylinder and cone; draw the sectional orthographic views of geometrical solids. Isometric Projections Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of simple and compound Solids, conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.	20
Unit-5 Overview of Computer Graphics & Introduction to Modeling and Assembly	
Overview of Computer Graphics Demonstrating knowledge of the theory of CAD software: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Projection of solids, Isometric of Simple and compound Solids, sections of solids and development of surfaces. Introduction to Modeling and Assembly Introduction to Computer aided modeling of solid part and assembly using CAD software Parametric and non-parametric solid and wireframe models, part editing and 2D drafting of assembly.	20
Self-study: Three Modeling of Simple Machine Parts	
Site/Industrial Visits : Nil	

Course outcomes:
CO1: Construct the manual drawing of projection of points and lines with principle of first angle projection by using engineering drawing instruments following BIS standards.
CO2: Construct the manual drawing of projection of plane with principle of first angle projection by using engineering drawing instruments.
CO3: Construct the first angle projection of regular solids with principle of first angle projection by using engineering drawing instruments and CAD software.
CO4: Draw the isometric projection of combination of regular solids using drawing instruments/ CAD software.
CO5: Draw the development of surfaces of regular solids resting on horizontal plane using drawing instruments/ CAD software.

Text Books:
T1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
T2. N S Parthasarathy and Vela Murali (2015) Engineering Drawing, Oxford University Press
T3. Shah, M.B. &Rana B.C. (2009), Engineering Drawing and Computer Graphics, Pearson Education
T4. Agrawal B. &Agrawal C. M. (2012), Engineering Graphics, TMH Publication

Reference Books:
R1. S. Trymbaka Murthy, "Computer Aided Engineering Drawing", I.K. International Publishing House Pvt. Ltd., New Delhi.
R2. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech
R3. K.R. Gopalakrishna, "Engineering Graphics", 15th Edition, Subash Publishers Bangalore

Online Resources:

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	1	-	3	-	-	-	2	-	-	2	-	-	-
CO2	2	2	1	-	3	-	-	-	2	-	-	2	-	-	-
CO3	2	2	1	-	3	-	-	-	2	-	-	2	-	-	-
CO4	2	2	1	-	3	-	-	-	2	-	-	2	-	-	-
CO5	2	2	1	-	3	-	-	-	2	-	-	2	-	-	-

Course Name: Bio Science					
Course Code : BS136					
	L	**T**	**P**	Category	**BSC**
Contact Hrs./Week	2	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**0**	ESE Marks	**50**
Credits.	2	0	0	Exam Hours	**3**

Course objectives:
To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry

Prerequisites: Nil

Units	Teaching Hours
Unit-1 Introduction to Cell structure and biomechanism	
Biological Engineering - Classifications-Taxonomy- Prokaryotes and Eukaryotes- Morphology, NucleusProtein structure and function - Organelles for Protein synthesis and transport- Cell division - mitosis, meiosis- Biochemical pathways - metabolism, energy conversion, TCA cycle, electron transport, ATP, glycolysis, photosynthesis- DNA structure - Replication-Transcription- Translation	9
Unit-2 Biosensors	
General principles - Construction of biosensors, immobilization of receptor components in biosensors- Types –metabolism, semiconductor, optical, piezoelectric, immunosensors - Applications – lab-on-a-chip, food and beverage, defence, environmental applications, Medical instruments	10
Unit-3 Modern Imaging systems	
X ray, digital radiography – x-ray computed tomography- Nuclear medical imaging systems, Magnetic resonance imaging system, Ultrasonic imaging system, thermal imaging, haemodialysis system, anaesthesia and ventilator systems.	8
Unit-4 Biomechanics	

Key mechanical concepts - 9 fundamentals of biomechanics -Muscle action, Range of motion principle, Force motion principle - Tissue loads -Response of tissue to force -Biomechanics of passive muscle tendon unit- Biomechanics of bone - Biomechanics of ligaments - Mechanical characteristics of muscles- Force time principle - Stretch-shortening cycle	10
Unit-5 Materials for organs and devices	
Materials – polymers, metals, ceramics, hydrogels, degradable biomaterials - Host reaction to biomaterials and their evaluation -Application of biomaterials – heart valves, orthopaedic applications, Cochlear and dental implants, soft tissue replacements, Hard tissue replacements	8
Self-study :	
Site/Industrial Visits :	

Course outcomes:

CO1: Discuss the hierarchical of life and the classification of species.

CO2: Differentiate between single celled and multi-cellular organisms based on their cell structure.

CO3: Explain about structure, types and functioning of key components as proteins, carbohydrates, fats and DNA/RNA.

CO4: Elaborate on the different pathways for energy production, cell division, photosynthesis and genetic transfer.

CO5: Discuss about the construction and working of biosensors for various applications.

CO6: Discuss about the architecture and organization of implantable electronics, which are used to sense and monitor different body functions.

CO7: Discuss the fundamental of the common laboratory equipment, its functioning and the electronics associated with it.

Text Books:

T1. F. Scheller, F. Schubert, (1991) Biosensors, Volume 11 of Techniques and Instrumentation in Analytical Chemistry, Elsevier.

T2. Vinod Kumar Khanna, (2015) Implantable Medical Electronics: Prosthetics, Drug Delivery, and Health Monitoring, Springer.

T3. Khandpur, (2003) Handbook of Biomedical Instrumentation, Tata McGraw-Hill Education

T4. David A. Winter, (2009) Biomechanics and Motor Control of Human Movement, John Wiley & Sons.

T5. Duane Knudson, (2013) Fundamentals of Biomechanics, Springer Science & Business Media.

T6. Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons, (2012) Biomaterials Science: An Introduction to Materials in Medicine, Academic Press.

Reference Books:
R1. BansiDharMalhotra, Anthony Turner, (2003) Advances in Biosensors: Perspectives in Biosensors, Volume 5 of Advances in Biosensors, Elsevier.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1								1					
CO2	1	1								1					
CO3	1	1								1					
CO4	1	1								1					
CO5	1	1								1					
	1	1								1					
	1	1								1					

<table>
<tr><td colspan="6">Course Name: Mathematics – II</td></tr>
<tr><td colspan="6">Course Code : MA231</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>BSC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
Mathematics is a necessary avenue to scientific knowledge which opens new vistas of mental activity. A sound knowledge of engineering Mathematics is a ‘sine qua non’ for the modern engineer to attain new heights in all aspects of engineering practice. This course provides the student with plentiful opportunities to work with and apply the concepts, and to build skills and experience in mathematical reasoning and engineering problem solving. At the end of this course, the students will
be introduced to the tools of integration of multivariate functions over areas and volumes.
learn the technique of multidimensional change of variables to transform the coordinates over which integration proceeds by utilizing Jacobian. Specifically, students will learn how to transform between an integral over an area or volume in Cartesian coordinates to polar coordinates.
be able to solve higher order homogenous/ non-homogenous linear differential equations with constant coefficients
be able to solve Cauchy’s and Legendre’s equations.
learn the fundamental vector calculus integral theorems of Green, Stokes’ and Divergence. Students will also learn how these theorems represent conservation principles for physical vector fields important in gravitation and electric fields.
be able to perform operations with Laplace and inverse Laplace transforms to solve higher order differential equations</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Nil</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Differential Calculus – II</td></tr>
<tr><td colspan="5">Polar curves and angle between Polar curves. Pedal equations of polar curves, Radius of curvature – Cartesian, parametric, polar and pedal forms.</td><td>8</td></tr>
<tr><td colspan="6">Unit-2 Integral Calculus – II</td></tr>
</table>

Double integrals, Cartesian and polar co – ordinates, change of order of integration, change of variables between cartesian and polar co – ordinates, triple integration, area as a double integral, volume as a triple integral	14
Unit-3 Differential Equations – II	
Linear differential equations of second and higher order with constant coefficients. Method of variation of parameters. Legendre'a and Cauchy's homogeneous differential equations.	10
Unit-4 Laplace Transforms	
Definition - Transforms of elementary functions – Properties, Derivatives and integrals of transforms- Problems. Periodic function. Unit step function and unit impulse function Inverse transforms, Solutions of linear differential equations.	10
Unit-5 Vector Calculus – II	
Vector Integration - Green's theorem in a plane, Gauss's divergence theorems, Stoke's, (without proof) and simple application.	7
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Establish the Relation between Straight lines and planes and to calculate the Shortest Distance between Skew Lines. CO2: Describe the bending of the curves by finding the angle between them. CO3: Evaluate the Surface Area, and Volume of Revolution generated by a curve using Multiple Integrals. CO4: Solve Linear Differential Equations and verification of line, surface and volume integrals. CO5: Transform functions from time to frequency domain using Laplace Transformation.	
Text Books: T1. Dr. B. S. Grewal, "Higher Engineering Mathematics", 39th Edition, Khanna Publishers, July 2005. T2. H. K. Das &RajnishVerma, "Higher Engineering Mathematics", S. Chand & Company Ltd., 2011.	

Reference Books: R1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley & Sons, Inc, 2005 R2. Thomas and Finney, "Calculus", 9th Edition, Pearson Education, 2004 R3. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Publication, Canada, 2007 R4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw – Hill, 2009. R5. George F. Simmons and Steven G. Krantz, "Differential Equation, Theory, Technique and Practice", Tata McGraw – Hill, 2006. R6. M. D. Raisinghania, "Ordinary and Partial Differential Equation", Chand (S.) & Co. Ltd., India, March 17, 2005. R7. Paras Ram, "Engineering Mathematics through Applications", 1st Edition, CBS Publisher, 2011.
Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	1	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-

Course Name: Database Management Systems

Course Code :CS331P

	L	T	P	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3

Course objectives: To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram. To make a study of SQL and relational database design. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure. To have an introductory knowledge about the emerging trends in the area of distributed DB- OO DB- Data mining and Data Warehousing and XML. To implement the design of the tables in DBMS. To write queries to get optimized outputs. To store, retrieve and view the contents. To generate report based on customized need	
Prerequisites: CS134/234	
Units	**Teaching Hours**
Unit-1 INTRODUCTION AND CONCEPTUAL MODELING	
Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model – Relational Algebra and Calculus.	9
Unit-2 RELATIONAL MODEL	
SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Relational Database design – Functional dependences and Normalization for Relational Databases (up to BCNF).	9
Unit-3 DATA STORAGE AND QUERY PROCESSING	
Record storage and Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+ Tree – Query Processing.	9
Unit-4 TRANSACTION MANAGEMENT	
Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging.	9
Unit-5 CURRENT TRENDS	

Object Oriented Databases – Need for Complex Data types- OO data Model- Nested relations- Complex Types- Inheritance Reference Types - Distributed databases- Homogenous and Heterogenous- Distributed data Storage – XML – Structure of XML- Data- XML Document- Schema- Querying and Transformation. – Data Mining and Data Warehousing.	9
List of Experiments	**Practical Hours**
1. Data Definition Language (DDL) commands in RDBMS	**3**
2. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.	**3**
3. High-level language extension with Cursors.	**3**
4. High level language extension with Triggers	**3**
5. Procedures and Functions.	**3**
6. Embedded SQL.	**3**
7. Database design using E-R model and Normalization.	**3**
8. Design and implementation of Payroll Processing System.	**3**
9. Design and implementation of Banking System.	**3**
10. Design and implementation of Library Information System.	**3**
Self-study : postgresql	
Site/Industrial Visits : NA	
Course outcomes: CO1: Summarize the fundamental concepts of databases and Entity-Relationship (E-R) model. CO2: Apply E-R Model and Normalization principles to create relational databases for the given problems. CO3: Compare and contrast different file organization concepts for data storage in Relational databases CO4: Apply the transaction management principles on relational databases CO5: Demonstrate the current trends such as object oriented databases, distributed data storage in database technology	
Text Books: T1 : Abraham Silberschatz, Henry F. Korth and S. Sudarshan- "Database System Concepts", Sixth Edition, McGraw-Hill, 2010.	

Reference Books:
R1: RamezElmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third Edition, Pearson Education, 2008.
R2: Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003.

Online Resources:
W1. https://www.studytonight.com/dbms/
W2. https://lecturenotes.in/subject/38/database-management-system-dbms

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	2	-	-	-	-	-	-	-	-	-	-

Course Name: Data Structures and Algorithms					
Course Code : CS332P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3

Course objectives: To understand the basic concept of data structures for storage and retrieval of ordered or unordered data. Data structures include: arrays, linked lists, binary trees, heaps, and hash tables.

Prerequisites: CS134/CS234

Units	Teaching Hours
Unit-1INTRODUCTION	
Definition- Classification of data structures: primitive and non-primitive- Operations on data structures- Algorithm Analysis- Simple Generic Classes and Interfaces	8
Unit-2 LISTS, STACKS AND QUEUES	
Abstract Data Type (ADT) – The List ADT – The Stack ADT: Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations Conversion of an arithmetic Expression from Infix to postfix. Applications of stacks. The Queue ADT: Definition, Array representation of queue, Types of queue: Simple queue, circular queue, double ended queue (de-queue) priority queue, operations on all types of Queues	11
Unit-3 TREES	
Preliminaries – Binary Trees – The Search Tree ADT – Binary Search Trees – AVL Trees – Tree Traversals – Hashing – General Idea – Hash Function – Separate Chaining – Open Addressing –Linear Probing – Priority Queues (Heaps) – Model – Simple implementations – Binary Heap	10
Unit-4 SORTING	

Preliminaries – Insertion Sort – Shell sort – Heap sort – Merge sort – Quicksort – External Sorting	8
Unit-5 GRAPHS	
Definitions – Topological Sort – Shortest-Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm – Applications of Depth- First Search – Undirected Graphs – Bi-connectivity – Introduction to NP-Completeness-case study	8
List of Experiments	**Practical Hours**
1. Implement the applications Stack ADT	**3**
2. Implement the applications for Queue ADT	**3**
3. Operations on stack[e.g.: infix to postfix, evaluation of postfix]	**3**
4. Search Tree ADT - Binary Search Tree	**3**
5. Heap Sort	**3**
6. Quick Sort	**3**
7. Applications of Probability and Queuing Theory Problems to be implemented using data structures	**3**
8. To determine the time complexity of a given logic.	**3**
9. Implementing a Hash function/Hashing Mechanism.	**3**
10. Implementing any of the shortest path algorithms	**3**
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the basic concepts of datastructures and solve the time complexity of the algorithm CO2: Experiment with various operations on Linear Data structures CO3: Examine the Structures and Operations of Trees and Heaps Data Structures CO4: Compare various given sorting techniques with respect to time complexity CO5: Choose various shortest path algorithms to determine the minimum spanning path for the given graphs	
Text Books: T1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", 3rd Edition, Pearson Education 2013.	

Reference Books:
R1. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser , "Data Structures and Algorithms in Java™", Sixth Edition, Wiley Publications, 2012.
R2..Duane A. Bailey , "Java Structures- Data Structures in Java for the Principled Programmer", 7th Edition, 2012
R3.Pat Morin, "Open Data Structures (in Java)", 0.1G Edition

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	1	-	-	-	-	-	-	1	-	1	-
CO2	3	2	1	1	1	-	-	-	-	-	-	1	-	1	-
CO3	3	3	2	2	1	-	-	-	-	-	-	1	-	1	-
CO4	3	3	2	2	1	-	-	-	-	-	-	1	-	1	-
CO5	3	3	3	3	1	-	-	-	-	-	-	1	-	1	-

Course Name: Software Engineering					
Course Code :CS333					
	L	T	P	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3

Course objectives:
To be aware of Different life cycle models; Requirement dictation process; Analysis modeling and specification; Architectural and detailed design methods; Implementation and testing strategies; Verification and validation techniques; Project planning and management and Use of CASE tools.

Prerequisites: Programming Paradigm, Data Structures and Algorithms

Units	**Teaching Hours**
Unit-1 SOFTWARE PROCESS	
Introduction –S/W Engineering Paradigm – life cycle models (water fall, incremental, spiral, WINWIN spiral, evolutionary, prototyping, object oriented) - system engineering – computer based system – verification – validation – life cycle process – development process –system engineering hierarchy.	9
Unit-2 SOFTWARE REQUIREMENTS	
Functional and non-functional - user – system –requirement engineering process – feasibility studies – requirements – elicitation – validation and management – software prototyping – prototyping in the software process – rapid prototyping techniques – user interface prototyping -S/W document. Agile methods, Extreme Programming, SCRUM	9
Unit-3 DESIGN CONCEPTS AND PRINCIPLES	
Design process and concepts – modular design – design heuristic – design model and document. Architectural design – software architecture – data design – architectural design – transform and transaction mapping – user interface design – user interface design principles. Real time systems - Real time software design – system design – real time executives – data acquisition system - monitoring and control system. SCM – Need for SCM – Version control – Introduction to SCM process – Software configuration items.	9

Unit-4 TESTING	
Taxonomy of software testing – levels – test activities – types of s/w test – black box testing – testing boundary conditions – structural testing – test coverage criteria based on data flow mechanisms – regression testing – testing in the large. S/W testing strategies – strategic approach and issues - unit testing – integration testing – validation testing – system testing and debugging.	9
Unit-5 SOFTWARE PROJECT MANAGEMENT	
Measures and measurements – S/W complexity and science measure – size measure – data and logic structure measure – information flow measure. Software cost estimation – function point models – COCOMO model- Delphi method.- Defining a Task Network – Scheduling – Earned Value Analysis – Error Tracking - Software changes – program evolution dynamics – software maintenance – Architectural evolution. Taxonomy of CASE tools – Case Study.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the fundamental of Software development Life cycle and different software development process models. CO2: Apply various requirement elicitation methods in software development process. CO3: Develop the software processes and concepts using various design technique CO4: Analyze different testing techniques and maintenance principles in software development process. CO5: Formulate the cost estimation techniques and project scheduling methods in software development process.	
Text Books: T1. . Roger S. Pressman, Software engineering- A Practitioner's Approach, McGraw-Hill International Edition, 6th Edition.	
Reference Books: R1. AnirbanBasu, "Software Quality Assurance, Testing and Metrics", First Edition, PHI Learning, 2015. R2. Ian Sommerville, "Software engineering," Pearson education Asia, 9th Edition 2013. R3. PankajJalote- "An Integrated Approach to Software Engineering," Narosa publishing house 2011. R4. James F Peters and WitoldPedryez, "Software Engineering – An Engineering Approach", John Wiley and Sons, New Delhi, 2010. R5. Ali Behforooz and Frederick J Hudson, "Software Engineering Fundamentals", OUP India 2012.	

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	2	1	1	-	-	-	-	-	-	1	-	-	3	-	-
CO3	3	2	2	-	-	-	-	-	-	2	-	1	3	1	
CO4	3	3	3	2	1	1	-	1	2	2	2	1	3	1	1
CO5	3	3	3	2	1	-	-	1	2	-	3	1	3	-	1

Course Name : Digital Systems					
Course Code :EC337					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	3	0	0	CIA Marks	50
Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3

Course objectives:

- To study the switching theory and the realization of logic gates.
- To study minimization methods.
- To study combinational circuits.
- To study sequential circuits

Prerequisites: NIL

Units	Teaching Hours
Unit-1 INTRODUCTION	
Switching Theory: Laws of Boolean algebra, Theorems of Boolean algebra, Switching functions, Methods for specification of switching functions - Truth tables and Algebraic forms, Realization of functions using logic gates. Digital Logic Elements: Electronic logic gates, Positive and negative logic, Logic families -TTL, ECL and CMOS, Realization of logic gates	9
Unit-2 BOOLEAN ALGEBRA	
Simplification of Boolean Expressions and Functions: Algebraic methods, Canonical forms of Boolean functions, Minimization of functions using Karnaugh maps, Minimization of functions using Quine-McClusky method	9
Unit-3 COMBINATIONAL CIRCUITS	

Design of Combinational Logic Circuits: Gate level design of Small Scale Integration (SSI) circuits, Modular combinational logic elements - Decoders, Encoders, Priority encoders, Multiplexers and Demultiplexers. Design of Integer Arithmetic Circuits using Combinational Logic: Integer adders - Ripple carry adder and Carry look ahead adder, Integer subtractors using adders, Unsigned integer multipliers - Combinational array circuits, Signed integer multipliers - Booth's coding, Bit-pair recoding, Carry save addition and Wallace tree multiplier, Signed integer division circuits - Combinational array circuits, Complexity and propagation delay analysis of circuits. Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) devices, Design of multiple output circuits using PLDs	9
Unit-4 SEQUENTIAL CIRCUITS	
Sequential Circuit Elements: Latches -RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops. Analysis and Design of Synchronous Sequential Circuits: Models of sequential circuits - Moore machine and Mealy machine, Flip-flops - Characteristic table, Characteristic equation and Excitation table, Analysis of sequential circuits- Flipflop input expressions, Next state equations, Next state maps, State table and State transition diagram, Design of sequential circuits - State transition diagram, State table, Next state maps, Output maps, Expressions for flip-flop inputs and Expressions for circuit outputs, Modular sequential logic circuits- Shift registers, Registers, Counters and Random access memories, Design using programmable logic sequencers (PLSs). Design of Arithmetic Circuits using Sequential Logic : Serial adder for integers, Unsigned integer multiplier, Unsigned integer division circuits, Signed integer division, Floating-pint adder/subtractor - Design of control circuit, Floating - point multiplier	9
Unit-5 CASE STUDY AND INFORMAL LABORATORY	
Case study: Learn the Fundamentals of Digital Logic Design with VHDLInformalLaboratory:Design and implementation of binary adder / subtractor using basic gates Design and implementation of applications using multiplexers Design and implementation of Synchronous & Asynchronous Counters Design and implementation of Shift Registers Coding Combinational Circuits using Hardware Description Language (HDL)	9
Self-study : NIL	
Site/Industrial Visits : NIL	

Course outcomes:

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

CO1: Describe the characteristics of various digital integrated circuit families,logic gates and classify digital circuits based on their construction.

CO2;Demonstrate the methods of minimization of complex circuits using Boolean Algebra.

CO3: Interpret the methods of designing a combinational circuit.

CO4: Illustrate the methods of designing a sequential circuit.

CO5: Analyze the digital circuits design using VHDL.

Text Books:

T1.Donald P Leach, Albert Paul Malvino&GoutamSaha, "Digital Principles and Applications" , Tata McGraw Hill 7th Edition, 2010

Reference Books:

R1. Stephen Brown. ZvonkoVranesic, "Fundamentals of Digital Logic Design with VHDL", Tata McGraw Hill, 2nd Edition 2005

R2. R D Sudhaker Samuel, "Illustrative Approach to Logic Design. Sanguine-Pearson", 2010.

R3. Charles H. Roth, "Fundamentals of Logic Design", Cengage Learning, 5th Edition, 2004.

R4. Ronald J. Tocci, Neal S. Widmer. Gregory L. Moss, "Digital Systems Principles and Applications, " 10th Edition. Pearson Education, 2007

R5. TM Morris Mano, "Digital Logic and Computer Design", Pearson Education, 10th Edition, 2008

Online Resources:

NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	1	-	-	-	-	-	-	-	-	3	-
CO3	3	2	1	-	1	-	-	-	-	-	-	-	-	3	-
CO4	3	2	1	-	1	-	-	-	-	-	-	-	-	3	-
CO5	3	3	2	1	2	-	-	1	2	2	-	-	-	3	-

Course Name: Discrete Mathematics					
Course Code : MA334					
	L	**T**	**P**	Category	**BSC**
Contact Hrs./Week	3	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
To extend student's mathematical maturity and ability to deal with abstraction and to introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.

Prerequisites:

Units	**Teaching Hours**
Unit-1 Propositional Calculus	
Propositions – Logical connectives – Compound propositions – Conditional and bi conditional propositions – Truth tables – Tautologies and contradictions – Contrapositive – Logical equivalences and implications – De Morgan's Laws - Normal forms – Principal conjunctive and disjunctive normal forms – Rules of inference – Arguments - Validity of arguments.	9
Unit-2 Predicate Calculus	
Predicates – Statement function – Variables – Free and bound variables – Quantifiers – Universe of discourse – Logical equivalences and implications for quantified statements – Theory of inference – The rules of universal specification and generalization – Validity of arguments.	9
Unit-3 Set Theory	
Basic concepts – Notations – Subset – Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets –Types of relations and their properties – Matrix and Graph representation of a relation – Partial ordering – Poset – Hasse diagram – Lattices and their properties – Sublattices – Boolean algebra.	9
Unit-4 Functions	

Definitions of functions – Classification of functions –Types of functions - Examples – Composition of functions – Inverse functions – Characteristic function of a set – Hashing functions – Permutation functions.	9
Unit-5 Groups	
Groups - Properties – Subgroups - Cosets and Lagrange's theorem – Normal subgroups – Algebraic system with two binary operations – Preliminaries of Coding - Hamming Metric - group codes: – Basic notions of error correction - Error recovery in group codes.	9
Self-study : Nil	
Site/Industrial Visits : Nil	
Course outcomes: CO1: Distinguish the compound logical statements with logical connectives. CO2: Utilise the rules of inference and Predicate/Quantifiers in validating the set of arguments. CO3: Use partial order set, bounded concept to solve Lattices and Boolean algebra problems. CO4: Classify types of functions/permutation functions as even or odd and solve problems on inverse functions CO5: Compute coding and decoding problems using group theory and appropriate coding and decoding schemes.	
Text Books: T1. Trembly J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 2003. T2. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th, Pearson Education Asia, Delhi, 2009.	
Reference Books: R1. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", Fourth Indian reprint, Pearson Education Pvt Ltd., New Delhi, 2003. R2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Fifth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, 2003. R3. Richard Johnsonbaugh, "Discrete Mathematics", Fifth Edition, Pearson Education Asia, New Delhi, 2002.	
Online Resources: NIL	

Mapping with Program Outcomes (POs)

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

CO1	2	1	-	-	-	-	-	-	-	1	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	1	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	-	-	1	-	-	-	-	-

Course Name: Cyber Security					
Course Code : MC321					
	L	**T**	**P**	Category	**MC**
Contact Hrs./Week	**2**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**0**	ESE Marks	**-**
Credits.	**0**	**0**	**0**	Exam Hours	**-**
Course objectives: This course is aimed at providing a comprehensive overview of the different facets of Cyber Security. In addition, the course will detail into specifics of Cyber Security with Cyber Laws both in Global and Indian Legal environments.					
Prerequisites: NIL					

Units	**Teaching Hours**
Unit-1	
Security Fundamentals-4 As Architecture Authentication Authorization Accountability, Social Media, Social Networking and Cyber Security. Cyber Laws, IT Act 2000-IT Act 2008-Laws for Cyber-Security, Comprehensive National Cyber-Security Initiative CNCI – Legalities.	6
Unit-2	
Cyber Attack and Cyber Services Computer Virus – Computer Worms – Trojan horse. Vulnerabilities - Phishing - Online Attacks – Pharming - Phoarging – Cyber Attacks - Cyber Threats - Zombie- stuxnet - Denial of Service Vulnerabilities - Server Hardening-TCP/IP attack-SYN Flood.	6
Unit-3	
Cyber Security Management Risk Management and Assessment - Risk Management Process - Threat Determination Process -Risk Assessment - Risk Management Lifecycle. Security Policy Management - Security Policies - Coverage Matrix Business Continuity Planning - Disaster Types - Disaster Recovery Plan - Business Continuity Planning Process.	6
Unit-4	

Vulnerability - Assessment and Tools: Vulnerability Testing - Penetration Testing Black box- white box Architectural Integration: Security Zones - Devices viz Routers, Firewalls, DMZ. Configuration Management - Certification and Accreditation for Cyber-Security.	6
Unit-5	
Authentication and Cryptography: Authentication - Cryptosystems - Certificate Services Securing Communications: Securing Services - Transport – Wireless - Steganography and NTFS Data Streams Intrusion Detection and Prevention Systems: Intrusion - Defense in Depth - IDS/IPS -IDS/IPS Weakness and Forensic Analysis Cyber Evolution: Cyber Organization - Cyber Future	6
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Summarize the network security concepts and cyber laws CO2: Explain different cyber attacks with relevant examples CO3: Illustrate risk management process handled in the organization with business continuity planning CO4: Outline the vulnerabilities that affect the organizational network CO5: Identify cryptography algorithms for authentication purposes in the organizational network	
Text Books: T1. Matt Bishop, “Introduction to Computer Security”, Pearson, 6th impression, 2005	
Reference Books: R1. Thomas R, Justin Peltier, John, “Information Security Fundamentals”, Auerbach Publications. R2. AtulKahate, “Cryptography and Network Security”, 2nd Edition, Tata McGrawHill. R3. Nina Godbole, SunitBelapure, “Cyber Security”, Wiley India 1st Edition 2011. R4. .Jennifer L. Bayuk and Jason Healey and Paul Rohmeyer and Marcus Sachs, “Cyber Security Policy Guidebook”, Wiley; 1 edition , 2012 R5. Dan Shoemaker and Wm. Arthur Conklin, “Cybersecurity: The Essential Body Of Knowledge”, Delmar Cengage Learning; 1 edition (May 17, 2011) . R6.William Stallings, “Cryptography & Network Security - Principles & Practice”, Prentice Hall, 3rdEdition2002.	
Online Resources: NIL	

Mapping with Program Outcomes (POs)															
CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	1	-	-	-	-	-	-	-	-	2	-	1	-
CO2	2	-	1	-	-	-	-	-	-	-	-	2	-	1	-
CO3	2	-	1	-	-	-	-	-	-	-	-	2	-	1	-
CO4	2	-	1	-	-	-	-	-	-	-	-	2	-	1	-
CO5	2	-	1	-	-	-	-	-	-	-	-	2	-	1	-

Course Name: Technical Writing					
Course Code : HS311					
	L	**T**	**P**	Category	**HSMC**
Contact Hrs./Week	2	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**0**	ESE Marks	**50**
Credits.	**2**	**0**	**0**	Exam Hours	**3**

Course objectives:
To learn the technique writing skills

Prerequisites: NA

Units	**Teaching Hours**
Unit-1	
Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.	6
Unit-2	
Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	6
Unit-3	
Self Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity	6
Unit-4	

Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.	6
Unit-5	
Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.	6
Self-study :	
Site/Industrial Visits :	

Course outcomes:
CO1: Demonstrate the art of technical writing.

Text Books:
T1: David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. New York, 2004
T2: Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843) T3: Shiv Khera, You Can Win, Macmillan Books, New York, 2003.

Reference Books:
R1: Raman Sharma, Technical Communications, Oxford Publication, London, 2004.
R2: Dale Jungk, Applied Writing for Technicians, McGraw Hill, New York, 2004. (ISBN: 07828357-4) R3: Sharma, R. and Mohan, K. Business Correspondence and Report Writing, TMH New Delhi 2002.
R4: Xebec, Presentation Book, TMH New Delhi, 2000. (ISBN 0402213)

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	-	-	1	3	-	-	-	-	3

Course Name: Probability and Queuing Theory					
Course Code : CS431					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	3	0	0	Exam Hours	**3**

Course objectives:
: This course deals about the basics of probability in connection with discrete and continuous instances along with real world phenomenon of standard distributions. It also connects two dimensional random variables and markov process. However, the syllabus provides a brief understanding of queuing models at the end of the course.

Prerequisites: Mathematics I and Mathematics II

Units	Teaching Hours
Unit-1 PROBABILITY AND RANDOM VARIABLES	
Axioms of probability - Conditional probability - Total probability – Baye's theorem Random variable - Probability mass function - Probability density function - Properties – Moments - Moment generating functions and their properties.	9
Unit-2 STANDARD DISTRIBUTIONS	
Binomial, Poisson, Geometric, Negative Binomial, Uniform, Exponential, Gamma, Weibull and Normal distributions and their properties - Functions of a random variable.	9
Unit-3 TWO DIMENSIONAL RANDOM VARIABLES	
Joint distributions - Marginal and conditional distributions – Covariance – Correlation and regression - Transformation of random variables - Central limit theorem.	9
Unit-4 RANDOM PROCESSES AND MARKOV CHAINS	
Classification - Stationary process - Markov process - Poisson process - Birth and death process - Markov chains - Transition probabilities - Limiting distributions. Transition Diagram.	9
Unit-5 QUEUING THEORY	

Markovian models – M/M/1, M/M/C, finite and infinite capacity - M/M/∞ queues - Finite source model - M/G/1 queue (steady state solutions only) – Pollaczek – Khintchine formula – Special cases. Single and Multiple Server System.	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Explain the basic perceptions of probability of an event and associated random variables.
CO2: Compare and contrast various standard distributions with suitable statistical analysis.
CO3: Apply and solve two dimensional random variable problems through joint distributions and central limit theorem.
CO4: Analyze probabilistic environment using random process and markov chain techniques.
CO5: Build and implement queuing model associated to stochastic process.

Text Books:
T1. Ross, S., "A first course in probability", Sixth Edition, Pearson Education, Delhi, 2014.
T2. Medhi J., "Stochastic Processes", New Age Publishers, New Delhi, 2017. (Chapters 2, 3,4)
T3. T. Veerarajan, "Probability, Statistics and Random process", Second Edition, Tata McGraw Hill, New Delhi, 2017.

Reference Books:
R1. Allen A.O., "Probability, Statistics and Queuing Theory", Academic press, New Delhi, 2010.
R2. Taha H. A., "Operations Research-An Introduction", Seventh Edition, Pearson Education Edition Asia, Delhi, 2014.
R3. John F. Shortle , James M. Thompson, Donald Gross, Carl M. Harris Fundamentals of Queueing Theory; Wiley Series 2018

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	2	-	-	-	-	-	-	-	-	2	-
CO2	2	1	-	-	2	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	1	2	-	-	-	-	-	-	-	-	2	-

CO4	3	3	2	2	2	-	-	-	-	-	-	-	-	2	-
CO5	3	2	1	1	2	-	-	-	-	-	-	-	-	2	-

Course Name: Operating Systems					
Course Code : CS432P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	3	0	1	Exam Hours	**3**
Course objectives: This course is an overview of different types of operating systems. They also include understanding of the components of an operating system, process management, and knowledge of storage management and the concepts of I/O and file systems is also covered as an introductory level.					
Prerequisites: CS134/CS234					

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Introduction : What operating systems do, Computer System Architecture, Operating System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security; System Structures: Operating System Services, User Operating System Interface, System Calls, Types of System Calls.	9
Unit-2 PROCESS MANAGEMENT	
Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; Threads: Overview, Multithreading Models, Thread Libraries; CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling	9
Unit-3 PROCESS SYNCHRONIZATION AND DEADLOCKS	
Process Synchronization: Background, The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Monitors, Synchronization Examples, Deadlocks	9
Unit-4 MEMORY MANAGEMENT AND VIRTUAL MEMORY	

Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging. Virtual Memory : Background, Demand Paging, Copy on Write, Page Replacement, Allocation of frames, Thrashing, Allocating Kernel Memory	9
Unit-5 FILE SYSTEM INTERFACE AND FILE SYSTEM IMPLEMENTATION & MASS STORAGE STRUCTURE	
File System Interface: File System: File Concept, Access Methods, Directory Structure, File System Mounting, File Sharing, Protection. File System Implementation & Mass Storage Structure: Implementing File Systems: File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management. Disk structure, Disk Attachment, Disk Scheduling Methods, Disk Management, Swap-Space Management	9
List of Experiments	**Practical Hours**
1. Implementation of Simple Java programs to understand data types, variables, operators, strings, input and output, control flow, arrays.	**3**
2. Implementation of Classes and Objects – static fields, methods, method parameters, object construction.	**3**
3. Implementation of event driven programming	**3**
4. Implementation of Inheritance – how inheritance is handled using java keywords: extends and implements.	**3**
5. Implementation of Interfaces – programs on usage.	**3**
6. Implementation of Inner classes – programs on inner classes.	**3**
7. Implementation of Exceptions.	**3**
8. Implementation of Debugging using Assertions, logging and using a debugger.	**3**
9. Implementation of Generic programming.	**3**
10. Implementation of Multithreaded programs	**3**
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Demonstrate the Structure, Components and its basic functionalities of Operating System
CO2: Distinguish various process management principles for given problem using appropriate tool
CO3: Elucidate the process synchronization mechanisms, deadlock environment and its solutions in the given processes
CO4: Inspect various memory management strategies for the given problems in memory systems
CO5: Build file structure to distribute the same across the memory.

Text Books:
T1. Cay S. Horstmann and Gary Cornell, "Core Java, Volume I – Fundamentals " ,Ninth Edition, Prentice Hall, 2012.
T2. Martina Seidl, Marion Scholz, Christian Huemer and GertiKappel , "UML @ Classroom An Introduction to Object-Oriented Modeling Series: Undergraduate Topics in Computer Science", Springer, 2015.

Reference Books:
R1. Cay S. Horstmann , "Java SE8 for the Really Impatient: A Short Course on the Basics (Java Series)", 2014.
R2. Herbert Schildt, "Java: The Complete Reference (Complete Reference Series)", Ninth Edition, 2014.
R3. Bruce Eckel, "Thinking in Java", 4th Edition, Prentice Hall Professional, 2006.
R4. Doug Rosenberg and Matt Stephens, "Use Case Driven Object Modeling with UML: Theory and Practice (Expert's Voice in UML Modeling)",APress, 2013.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	1	-	-	-	-	-	-	1	-	2	-
CO2	3	3	2	-	1	-	-	-	-	-	-		-	2	-
CO3	3	2	1	1	1	1	-	-	-	1		1	-	2	-
CO4	3	2	1	1	1	-	-	1		2		1	-	2	1
CO5	3	2	1	-	1	-	-	1	-	-	-	-	-	2	-

Course Name: Programming Paradigm

Course Code : CS433P

	L	T	P	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
Software development in business environment has become more sophisticated, the software implementation is becoming increasingly complex and requires the best programming paradigm which helps to eliminate complexity of large projects. Object Oriented Programming (OOP) has become the predominant technique for writing software at present. Many other important software development techniques are based upon the fundamental ideas captured by object-oriented programming. The course also caters to the understanding of event driven programming, generic programming and concurrent programming.

Prerequisites: CS134/CS234

Units	**Teaching Hours**
Unit-1OBJECT-ORIENTED PROGRAMMING – FUNDAMENTALS	
Review of OOP - Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method – Arrays – Strings - Packages – JavaDoc comments.	9
Unit-2 OBJECT-ORIENTED PROGRAMMING – INHERITANCE	
Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes – the Object class – Reflection – interfaces – object cloning – inner classes	9
Unit-3 EVENT-DRIVEN PROGRAMMING	
Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images - Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – introduction to Swing – Model-View- Controller design pattern – buttons – layout management – Swing Components	9

Unit-4 GENERIC PROGRAMMING	
Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics – Exceptions – exception hierarchy – throwing and catching exceptions.	9
Unit-5 CONCURRENT PROGRAMMING	
Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – synchronizers – threads and event-driven programming, Parallel programming –fork, join framework.	9
List of Experiments	**Practical Hours**
1. Implementation of Simple Java programs to understand data types, variables, operators, strings, input and output, control flow, arrays.	**3**
2. Implementation of Classes and Objects – static fields, methods, method parameters, object construction.	**3**
3. Implementation of event driven programming	**3**
4. Implementation of Inheritance – how inheritance is handled using java keywords: extends and implements.	**3**
5. Implementation of Interfaces – programs on usage.	**3**
6. Implementation of Inner classes – programs on inner classes.	**3**
7. Implementation of Exceptions.	**3**
8. Implementation of Debugging using Assertions, logging and using a debugger.	**3**
9. Implementation of Generic programming.	**3**
10. Implementation of Multithreaded programs	**3**
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Demonstrate the fundamental concepts of Object Oriented Programming.
CO2: Make use of the inheritance and interface concepts for effective code reuse.
CO3: Inspect dynamic and interactive graphical applications using AWT and SWING.
CO4: Build an application using generic programming and exception handling concepts.
CO5: Assess and design concurrent and parallel applications using multithreaded concepts.

Text Books:
T1. Cay S. Horstmann and Gary Cornell, "Core Java, Volume I – Fundamentals " ,Ninth Edition, Prentice Hall, 2012.
T2. Martina Seidl, Marion Scholz, Christian Huemer and GertiKappel , "UML @ Classroom An Introduction to Object-Oriented Modeling Series: Undergraduate Topics in Computer Science", Springer, 2015.

Reference Books:
R1. Cay S. Horstmann , "Java SE8 for the Really Impatient: A Short Course on the Basics (Java Series)", 2014.
R2. Herbert Schildt, "Java: The Complete Reference (Complete Reference Series)", Ninth Edition, 2014.
R3. Bruce Eckel, "Thinking in Java", 4th Edition, Prentice Hall Professional, 2006.
R4. Doug Rosenberg and Matt Stephens, "Use Case Driven Object Modeling with UML: Theory and Practice (Expert's Voice in UML Modeling)",APress, 2013.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	2	-	-	-	-	-	-	1	-	2	1
CO2	3	2	1	-	2	-	-	1	-	-	-	1	-	2	1
CO3	3	3	2	1	2	-	-	1	1	-	2	-	-	2	1
CO4	3	2	1	-	2	-	-	1	1	-	2	1	-	2	1
CO5	3	3	3	2	2	-	-	1	1	-	2	1	-	2	1

Course Name:Formal Language & Automata Theory					
Course Code :CS434					
	L	T	P	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:

- To have an understanding of finite state and pushdown automata.
- To have a knowledge of regular languages and context free languages.
- To know the relation between regular language, context free language and corresponding recognizers.
- To study the Turing machine and classes of problems.

Prerequisites: Nil

Units	Teaching Hours
Unit-1 AUTOMATA	
Introduction to formal proof – Additional forms of proof – Inductive proofs – Finite Automata (FA) – Deterministic Finite Automata (DFA)– Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions.	9
Unit-2 REGULAR EXPRESSIONS AND LANGUAGES	
Regular Expression – FA and Regular Expressions – Proving languages not to be regular – Closure properties of regular languages – Equivalence and minimization of Automata.	9
Unit-3 CONTEXT-FREE GRAMMAR AND LANGUAGES	
Context-Free Grammar (CFG) – Parse Trees – Ambiguity in grammars and languages – Definition of the Pushdown automata – Languages of a Pushdown Automata – Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata.	9
Unit-4 PROPERTIES OF CONTEXT-FREE LANGUAGES	

Normal forms for CFG – Pumping Lemma for CFL - Closure Properties of CFL – Turing Machines – Programming Techniques for TM.	9
Unit-5 UNDECIDABILITY	
A language that is not Recursively Enumerable (RE) – An undecidable problem that is RE – Undecidable problems about Turing Machine – Post's Correspondence Problem - The classes P and NP.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Design finite automata with conversion between types of finite automata.
CO2: Develop regular expression and minimize the given finite automata for any regular language.
CO3: Develop context free grammar, parse trees and pushdown automata for a given context free language.
CO4: Experiment with CFLs and design of Turing machine for a given language
CO5: Explain decidable and undecidable problems, solvable and unsolvable problems with their complexity analysis.

Text Books:
T1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 2008.

Reference Books:
R1. H.R.Lewis and C.H.Papadimitriou, "Elements of The theory of Computation", Second Edition, Pearson Education/PHI, 2003
R2. J.Martin, "Introduction to Languages and the Theory of Computation", 3rd Edition, TMH, 2003.
R3. MichealSipser, "Introduction of the Theory and Computation", Thomson Brokecole, 3rd Edition, 2007.
R4. Thomas A. Sudkamp, "An Introduction to the Theory of Computer Science Languages and Machines", Pearson Education, 3rd Edition 2007

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-	-	2	-

CO4	3	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	2	-

Course Name: Computer Organization & Architecture					
Course Code :CS435P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**1**	Exam Hours	**3**
Course objectives: This course will help the students to learn about basic structure of computer system, design of arithmetic and logic unit with the implementation of fixed and floating point numbers. Further, it will give knowledge about design of control unit and pipelined processing concepts. It discusses about various parallel processing architectures, different memory systems and I/O Communication systems					
Prerequisites: CS134/CS234					

Units	**Teaching Hours**
Unit-1 FUNDAMENTALS OF COMPUTER SYSTEM	
Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.	9
Unit-2COMPUTER ARTHIMETIC	
Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism	9
Unit-3 BASIC PROCESSING AND CONTROL UNIT	
A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined datapath and control – Handling Data Hazards & Control Hazards – Exceptions.	9
Unit-4 PARALLELISM	
Parallel processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – Multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.	9

Unit-5 MEMORY AND I/O	
Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits - USB.	9
List of Experiments	**Practical Hours**
a) Search a key element in a list of 'n' 16-bit numbers using the binary search algrithm. **b)** Read the status of eight input bits from the Logic ControllerInterface and display 'FF' if it is even parity bits otherwise display 00. Also display number of 1's in the input data.	**5**
a) Write ALP macros: i. To read a character from the keyboard in the module (1) (in a different file) ii. To display a character in module (2) (from different file) iii. Use the above two modules to read a string of characters from the keyboard terminated by the carriage return and print the string on the display in the next line. b) Perform the following functions using the Logic Controller Interface. i. BCD up-down Counter **i.** Ring counter	**5**
a) Sort a given set of 'n' numbers in ascending and descending orders using the Bubble Sort algorithm. b) Read the status of two 8-bit inputs (X & Y) from the Logic Controller Interface and display X*Y.	**5**
a) Read an alphanumeric character and display its equivalent ASCII code at the center of the screen. b) Display messages FIRE and HELP alternately with flickeringeffects on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages (Examiner does not specify these delay values nor it is necessary for the student to compute these values).	**5**
a) Reverse a given string and check whether it is a palindrome or not. b) Assume any suitable message of 12 characters length and display it in the rolling fashion on a 7-segment display interface for a suitable period of time. Ensure a flashing rate that makes it easy to read both the messages. (Examiner does not specify these delay values nor it is necessary for the student to compute these values).	**5**

a) Read two strings, store them in locations STR1 and STR2. Check whether they are equal or not and display appropriated messages. Also display the length of the stored strings b) Convert a 16-bit binary value (assumed to be an unsigned integer) to BCD and display it from left to right and right to left for specified number of times on a 7 -segment display interface.	**5**

Self-study : NA

Site/Industrial Visits :NA

Course outcomes:
CO1: Demonstrate the functions of basic components of computer system and Instruction set Architecture
CO2: Identify suitable control unit design and pipelining principles in computer architecture design
CO3: Utilize appropriate instruction level parallelism concepts in multiprocessing environment
CO4: Select suitable arithmetic algorithm to solve given arithmetic and logical problems
CO5: Choose suitable memory and I/O system design

Text Books:
T1. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2014.
T2. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw Hill, 2012.

Reference Books:
R1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Eighth Edition, Pearson Education, 2010.
R2. John L. Hennessey and David A. Patterson, "Computer Architecture – A Quantitative Approach", Fifth Edition, Morgan Kaufmann / Elsevier Publishers, 2012.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-

CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	2	-

Course Name: Bio Science Laboratory					
Course Code : BS451					
	L	**T**	**P**	Category	BSC
Contact Hrs./Week	0	0	2	CIA Marks	50
Contact Hrs./Sem.	0	0	30	ESE Marks	50
Credits.	0	0	1	Exam Hours	3 hrs

Course objectives:
To train students in applications of biology in engineering domain. The course will deal with problems specific to the circuit branches

Prerequisites: BS136/236

Prerequisites: CS134/CS234

List of Experiments	**Practical Hours**
1. Experiment on biological sensors and their characteristics.	**6**
2. Development of a biomedical instrument using sensors and signal processors.	**6**
3. Imaging technology for biological signals.	**6**
4. Integration and testing of the biomedical instrumentation systems.	**6**

5. Measurement of air quality.	**6**
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: To measure biological signals
CO2: To implement signal processing in the biomedical instrument
CO3: To test imaging technique
CO4: To integrate and test an air quality test instrument

Text Books:
T1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.
T2. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

Reference Books:
R1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
R2. ErachBharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad, 2015.
R3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
R4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															
CO5															

<table>
<tr><td colspan="6" align="center">Course Name: Professional Ethics</td></tr>
<tr><td colspan="6" align="center">Course Code : CS436</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>HSMC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
Able to understand the importance of Values and Ethics in their personal and professional lives.
Able to learn the rights and responsibilities as an employee, team member and a global citizen.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: NIL</td></tr>
</table>

Units	**Teaching Hours**
Unit-1 Introduction to Professional Ethics	
Basic Concepts, Governing Ethics, Personal & Professional Ethics, Ethical Dilemmas, Life Skills, Emotional Intelligence, Thoughts of Ethics, Value Education, Dimensions of Ethics, Profession and professionalism, Professional Associations, Professional Risks, Professional Accountabilities, Professional Success, Ethics and Profession.	9
Unit-2 Ethical Theories	
Ethical Theories: Basic Ethical Principles, Moral Developments, Deontology, Utilitarianism, Virtue Theory, Rights Theory, Casuist Theory, Moral Absolution, Moral Rationalism, Moral Pluralism, Ethical Egoism, Feminist Consequentialism, Moral Issues, Moral Dilemmas, Moral Autonomy.	9
Unit-3 Ethics in Engineering profession	
Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers – The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walk away Collapse.	9

Unit-4Work Place Rights & Responsibilities	
Ethics in changing domains of Research, Engineers and Managers; Organizational Complaint Procedure, difference of Professional Judgment within the Nuclear Regulatory Commission (NRC), the Hanford Nuclear Reservation. Ethics in changing domains of research – The US government wide definition of research misconduct, research misconduct distinguished from mistakes and errors, recent history of attention to research misconduct, the emerging emphasis on understanding and fostering responsible conduct, responsible authorship, reviewing & editing.	9
Unit-5 Global issues	
Introduction – Current Scenario, Technology Globalization of MNCs, International Trade, World Summits, Issues, Business Ethics and Corporate Governance, Sustainable Development Ecosystem, Energy Concerns, Ozone Deflection, Pollution, Ethics in Manufacturing and Marketing, Media Ethics; War Ethics; Bio Ethics, Intellectual Property Rights.	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Describe the values of Ethics in our lives.
CO2: Illustrate the professional Ethical theories
CO3 Discuss the ethics in working place.
CO4: Investigate the need of ethics as global issue.
CO5: Summarize professional ethics, professional rights , responsibilitiesof an engineer.

Text Books:
T1. Professional Ethics: R. Subramanian, Oxford University Press, 2015.
T2. Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.

Reference Books:
R1.Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e ,Cengage learning, 2015.
R2. Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	-	3	-	-	-	-	-	1	2

CO2	-	-	-	-	-	-	-	3	-	-	-	-	-	1	2
CO3	-	-	-	-	-	-	-	3	-	-	-	-	-	1	2
CO4	-	-	-	-	-	-	-	3	-	-	-	-	-	1	2
CO5															

Course Name: Environmental Science					
Course Code :MC422					
	L	**T**	**P**	Category	**MC**
Contact Hrs./Week	2	0	0	CIA Marks	
Contact Hrs./Sem.	**30**	**0**	**0**	ESE Marks	
Credits.	0	0	0	Exam Hours	

Course objectives:
Study about the environment to understand the relationship between living organism and environment, the importance of environment by assessing its impact on the human world, and finding scientific, technological and sustainable solutions to environmental problems.

Prerequisites: NIL

Units	Teaching Hours
Unit-1 ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	
Definition, scope, importance of Environment – Ecosystem – types, structure and their functions- Biodiversity-Definition, value of biodiversity - threats to biodiversity- conservation of biodiversity	9
Unit-2ENVIRONMENTAL POLLUTION	
Definition – Types – Causes, effects and control measures of all types of pollution-prevention of pollution– Waste Management – disaster management – Case studies of pollution – field study of a polluted site.	9
Unit-3 NATURAL RESOURCES	

Natural resources - Water resource- sources of water - Use and over-utilization from different sources - Forest resources: Use, Over Exploitation, Causes and Effects- Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies - Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.	9
Unit-4 SOCIAL ISSUES AND THE ENVIRONMENT	
From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.	9
Unit-5 HUMAN POPULATION AND THE ENVIRONMENT	
Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Explain the importance and the functions of ecosystem, biodiversity
CO2 Identify different types of environmental pollution and control measures.
CO3: Compares the exploitation and utilization of conventional and non-conventional resources.
CO4:Explain the relevance and importance of the natural resources in the sustenance of life on earth and living standard.
CO5: Correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and prevention.
CO6 : Finding scientific, technological and sustainable solutions to environmental problems by assessing the impact of human world to the environment

Text Books:
T1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006.
T2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

Reference Books:
R1. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India Pvt Ltd, New Delhi, 2007.
R2. ErachBharucha, "Textbook of Environmental Studies", Universities Press(I) Pvt, Ltd, Hydrabad, 2015.
R3. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
R4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	-	-	-	-	-	3	-	-	-	-	3	-	1	1
CO2	2	3	3	3	-	-	3	-	-	-	-	3	-	-	1
CO3	-		-	3	-	-	3	-	-	-	-	3	-	-	1
CO4	-	3	-	3	-	-	3	-	-	-	-	3	-	-	1
CO5	-	3	3	3	-	-	3	-	-	-	-	3	-	-	1
CO6	2	3	3	3	-	1	3	1	1	-	-	3	-	-	1

Course Name: Computer Networks					
Course Code :CS531P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**50**
Credits.	3	0	1	Exam Hours	**3**

Course objectives:
To understand the concepts of data communications.
To study the functions of different layers. To introduce IEEE standards employed in computer networking.
To make the students to get familiarized with different protocols and network components.
To build foundation of Networks in Algorithms and its analysis, Software Engineering Models and Theory of Automata.

Prerequisites: NA

Units	**Teaching Hours**
Unit-1 DATA COMMUNICATIONS	
Components – Direction of Data flow – networks – Components and Categories – types of Connections – Topologies –Protocols and Standards – ISO / OSI model – Transmission Media – Coaxial Cable – Fiber Optics – Line Coding – Modems – RS232 Interfacing sequences.	9
Unit-2 DATA LINK LAYER	
Error – detection and correction – Parity – LRC – CRC – Hamming code – low Control and Error control - stop and wait – go back-N ARQ – selective repeat ARQ- sliding window – HDLC. - LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.11 – FDDI - SONET – Bridges.	9
Unit-3 NETWORK LAYER	
Internetworks – Packet Switching and Datagram approach – IP addressing methods – Subnetting – Routing – Distance Vector Routing – Link State Routing – Routers.	9

Unit-4 TRANSPORT LAYER	
Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion Control – Quality of services (QOS) – Integrated Services.	9
Unit-5 APPLICATION LAYER	
Domain Name Space (DNS) – SMTP – FTP – HTTP - WWW – Security – Cryptography-Case study.	9
List of Experiments	**Practical Hours**
Implement the data link layer framing methods such as Byte stuffing.	3
Implement the data link layer framing methods such as Bit stuffing.	3
Implement CRC Error Detection Method.	3
Simulation of Sliding-Window protocol (Go back-N).	3
Simulation of Sliding-Window protocol (Selective Repeat).	3
Implement Dijkstra's Algorithm to find the shortest path for a given graph of N nodes. Repeat the experiment for different values of N, and plot a graph of the time taken versus N.	3
Develop a Client – Server application for chat using TCP.	3
Develop a Client – Server application for chat using UDP.	3
Using RSA / Diffie - Hellman algorithm encrypt a text data and Decrypt the same.	3
Compute the Transitive Closure for a given Network using Warshall's Algorithm	3
Self-study : Nil	
Site/Industrial Visits : Nil	
Course outcomes: CO1: Outline the basic concepts of reference models and Identify the functionality of physical layer in computer communications CO2: Illustrate the data link layer protocols for error detection and corrections mechanism CO3: Demonstrate the IP addressing schemes and routing protocols in network layer CO4: Distinguish the functionality and features used in UDP and TCP protocols CO5: Examine the Application layer protocols and cryptographic algorithms used in networking environment	

Text Books:

T1: Behrouz A. Forouzan, "Data communication and Networking", Tata McGraw-Hill, 2013.

Reference Books:

R1: James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education, 2012.

R2: Larry L.Peterson and Peter S. Davie, "Computer Networks", Fifth Edition, Harcourt Asia Pvt. Ltd., Second Edition, Publishers, 2012.

R3: Andrew S. Tanenbaum, "Computer Networks", 5^{th} Edition, Pearson 2012.

R4: William Stallings, "Data and Computer Communication", Sixth Edition, Pearson Education, 2007.

Online Resources: Nil

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	-	-	-	-	-	-	-	-	-	-	1	2	-	-
CO2	3	3	1	-	2	-	-	-	1	1	-	1	2	2	-
CO3	3	3	1	-	2	2	-	-	-	1	-	-	1	-	-
CO4	3	3	1	2	-	2	-	1	-	-	-	-	1	-	1
CO5	3	3	1	2	2	2	-	-	-	1	1	-	1	-	1

Course Name: Introduction to Artificial Intelligence					
Course Code : CS532					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	3	0	0	Exam Hours	**3**

Course objectives:
This course provides a strong foundation of fundamental concepts in Artificial Intelligence. To provide a basic exposition to the goals and methods and to enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Prerequisites: Basic Python / R Programming

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Intelligent Agents – Agents and environments - Good behavior – The nature of environments – structure of agents - Problem Solving - problem solving agents – example problems – searching for solutions – uniformed search strategies - avoiding repeated states – searching with partial information.	9
Unit-2 SEARCHING TECHNIQUES	
Informed search and exploration – Informed search strategies – heuristic function – local search algorithms and optimistic problems – local search in continuous spaces – online search agents and unknown environments - Constraint satisfaction problems (CSP) – Backtracking search and Local search for CSP – Structure of problems - Adversarial Search – Games – Optimal decisions in games – Alpha – Beta Pruning – imperfect real-time decision – games that include an element of chance.	9
Unit-3 KNOWLEDGE REPRESENTATION	
First order logic – representation revisited – Syntax and semantics for first order logic – Using first order logic – Knowledge engineering in first order logic - Inference in First order logic – prepositional versus first order logic – unification and lifting – forward chaining – backward chaining - Resolution - Knowledge representation - Ontological Engineering - Categories and objects – Actions - Simulation and events - Mental events and mental objects	9
Unit-4 LEARNING	

Learning from observations - forms of learning - Inductive learning - Learning decision trees - Ensemble learning - Knowledge in learning – Logical formulation of learning – Explanation based learning – Learning using relevant information – Inductive logic programming - Statistical learning methods - Learning with complete data - Learning with hidden variable - EM algorithm - Instance based learning - Neural networks - Reinforcement learning – Passive reinforcement learning - Active reinforcement learning - Generalization in reinforcement learning	9
Unit-5 DEEP LEARNING	
Convolutional Neural Networks, Motivation, Convolution operations, Pooling, Image classification, Modern CNN architectures, Recurrent Neural Network, Motivation, Vanishing/Exploding gradient problem, Applications to sequences, Modern RNN architectures,	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Identify the fundamental knowledge of Intelligent agents, searching strategies and syntax and semantics of first order logic.
CO2: Discover the complex problem solving agents, constraint satisfaction problems and optimal decisions in game.
CO3: Inspect the knowledge engineering in first order logic, knowledge representation and chaining mechanisms, knowledge in learning and different forms of learning
CO4: Determine and build planning strategies, Communication and analysis of grammar and its interpretation
CO5: Asses a system that utilize artificial intelligence to a complicated task with limited resources in the form of time and computations

Text Books
T1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, 3rd Edition, Pearson Education, 2014.
T2. Elaine Rich and Kevin Knight, “Artificial Intelligence”, 3rd Edition, Tata McGraw-Hill, 2012.
T3. Francois Chollet “Deep Learning with Python”, 1st Edition Manning Publication, 2018

Reference Books:
R1. Nils J. Nilsson, “Artificial Intelligence: A New Synthesis”, 1st Edition, Harcourt Asia Pvt. Ltd., 2012.
R2. George F. Luger, “Artificial Intelligence-Structures and Strategies for Complex Problem Solving”, 6th Edition, Pearson Education / PHI, 2009.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO2	3	3	2	1	-	-	-	-	-	-	-	1	-	-	1
CO3	3	3	2	1	-	-	-	-	-	-	-	1	-	1	1
CO4	3	3	3	2	-	-	-	-	-	-	-	1	1	1	1
CO5	3	3	3	3	-	-	-	-	-	-	-	1	1	1	1

Course Name: Design and Analysis of Algorithms					
Course Code : CS533P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
To introduce basic concepts of algorithms; To introduce mathematical aspects and analysis of algorithms; To introduce sorting and searching algorithms; To introduce various algorithmic techniques; To introduce algorithm design methods.

Prerequisites: Nil

Units	Teaching Hours
Unit-1 INTRODUCTION AND FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY	
Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Important Problem Types, Fundamentals of the Analysis Framework, Mathematical Analysis of Non-recursive Algorithm, Mathematical Analysis of Recursive Algorithm and examples, Empirical Analysis of Algorithms and Algorithm Visualization.	9
Unit-2 ALGORITHM DESIGN TECHNIQUES	
Brute Force and Exhaustive Search: Selection Sort, Bubble Sort, Sequential Search and Brute-force string matching, Travelling Salesman Problem, Knapsack Problem, Assignment Problem. Decrease and Conquer: Insertion Sort and Topological Sorting and Fake Coin Problem, Russian Peasant Multiplication, Josephus Problem	9
Unit-3 ALGORITHM DESIGN TECHNIQUES	
Divide and conquer: Merge sort, Quick Sort, Binary Tree Traversals and Related Properties and Multiplication of Large Integers and Strassen's Matrix Multiplication. Transform and Conquer: Presorting, Notion of Heap and Heapsort, Horner's Rule and Binary Exponentiation.	9
Unit-4 ALGORITHM DESIGN TECHNIQUES	

Space and Time Trade - Offs: Sorting by Counting, Horspool's and Boyer - Moore Algorithm for String Matching, Hashing. Dynamic Programming: Knapsack Problem, Warshall's and Floyd's Algorithm. Greedy Techniques: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm.	9
Unit-5 ALGORITHM DESIGN TECHNIQUES	
Limitations of Algorithm Power: Decision Trees, P, NP and NP Complete Problems, Challenges in Numerical Algorithms. Backtracking: n-Queen's Problem, Hamiltonian Circuit problem and Subset-Sum problem. Branch and Bound: Assignment problem, Knapsack problem and Traveling salesman problem.	9
List of Experiments	**Practical Hours**
1. Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Run the program for varied values of n> 5000 and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using the random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.	5
2. Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Run the program for varied values of n> 5000, and record the time taken to sort. Plot a graph of the time taken versus non graph sheet. The elements can be read from a file or can be generated using random number generator. Demonstrate using Java how the divide and- conquer method works along with its time complexity analysis: worst case, average case and best case.	5
3. Implement in Java, the 0/1 Knapsack problem using (a) Dynamic Programming method (b) Greedy method.	5
4. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.	5
5. Find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm. Use Union-Find algorithms in your program.	5
6. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm.	5

7.	Write Java programs to (a) Implement All-Pairs Shortest Paths problem using Floyd's algorithm. (b) Implement Travelling Sales Person problem using Dynamic programming.	5
8.	Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn} of n positive integers whose SUM is equal to a given positive integer d. For example, if S ={1, 2, 5, 6, 8} and d= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution.	5
9.	Design and implement in Java to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using backtracking principle.	5
10.	A. Write a Java program to read two integers a and b. Compute a/b and print, when b is not zero. Raise an exception when b is equal to zero. B. Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer for every 1 second; second thread computes the square of the number and prints; third thread will print the value of cube of the number.	5

Self-study :

Site/Industrial Visits :

Course outcomes:

CO1: Demonstrate the process of algorithmic problem solving with time and space complexity
CO2: Identify algorithm design techniques for searching and sorting
CO3: Inspect algorithms under divide and conquer technique
CO4: Solve problems by applying dynamic programming technique and determine the efficiency of algorithms.
CO5: Interpret the limitations of Algorithm power and demonstrate backtracking technique

Text Books:

T1. AnanyLevitin, “Introduction to the Design and Analysis of Algorithm”, 3/e, Pearson Education Asia, Reprint 2012.
T2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, “Data Structures and Algorithms in Java”, 6/e, Wiley, 2014.

Reference Books:

R1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: “Introduction to Algorithms”, 3rd Edition, The MIT Press, 2014.

R2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, Computer Algorithms, Second Edition, Universities Press, 2007.

R3. Richard Neapolitan, “Foundations of Algorithms”, 5/e, Jones & Bartlett Learning, 2014.

R4. Richard Johnsonbaugh, Marcus Schaefer, “Algorithms”, Pearson Education, 2009.

R5. Clifford A Shaffer, “Data Structures and Algorithm Analysis in Java”, 3rd Edition, Courier Corporation, 2014.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1										1		2	
CO2	3	2	1									1		2	1
CO3	3	3	2	1								1		2	1
CO4	3	2	1		1				1			1		2	1
CO5	2	1										1		2	1

Course Name: Computer Graphics with Open GL					
Course Code : CS541E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
The students will gain a strong foundation on concept of Computer Graphics;
The students will learn the various Input and Output graphics devices;
The students will understand the techniques of 2D and 3D transformations;
The students will study OpenGL in Java and JOGL and how to create graphics object with JOGL

Prerequisites: Object Oriented Programming, Mathematics

Units	Teaching Hours
Unit-1	
A survey of Computer Graphics, Video Display Devices, Raster-Scan Systems, Graphics Workstation and Viewing Systems, Input Devices, Hard-Copy Devices, Graphics Networks, Graphics on the Internet.	9
Unit-2	
Line Drawing Algorithms, DDA Algorithms, Bresenham's Line Algorithm, Circle-Generating Algorithms, Midpoint Circle Algorithms, Ellipse Algorithms, Basic Two Dimensional Transformations, Matrix Representation, Three Dimensional Translation, Three Dimensional Rotation, Three Dimensional Scaling, Other Three Dimensional Transformations - Reflection and Shears.	9
Unit-3	
Java Graphics in 2D, Two-Dimensional Graphics in Java, Transformations and Modeling, Basics of OpenGL and JOGL, Basic OpenGL 2D Programs, Into the Third Dimension, Drawing in 3D, Normal and Textures	9
Unit-4	

Geometry, Vectors, Matrices and Homogeneous Coordinates, Primitives, Polygonal Meshes, Drawing Primitives, Viewing and Projections, Perspective Projection, Orthographic Projection, The Viewing Transform, A Simple Avatar, Viewer Nodes in Scene Graphics	9
Unit-5	
Light and Material, Vision and Color, OpenGL Materials, OpenGL Lighting, Lights and Materials in Scenes, Case Study: Textures, Texture targets, Mipmaps and Filtering, Texture Transformations, Creating Texture with OpenGL, Loading Data into Texture, Texture Coordinate Generation, Texture Objects	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Demonstrate the fundamentals of applications and techniques involved in computer graphics.
CO2: Build 2D and 3D transformations using matrices representations in homogeneous coordinates.
CO3: Examine OpenGL functions and relate to Cross-platform API for writing applications.
CO4: Evaluate various properties of geometry
CO5: Support transformation principles ,various types of light and material properties.

Text Books:
T1. David J. Eck, “Fundamentals of Computer Graphics with Java, OpenGL and JOGL”, Hobart and Williams Smith colleges, 2010.
T2. Donald Hearn, Pauline Baker and Warren Carithers, “Computer Graphics with OpenGL”, 4th Edition Pearson, 2010.

Reference Books:
R1. Donald Hearn and M.Pauline Baker, “Computer Graphics C Version”, Pearson Education, 2003.
R2. Foley, Vandam, Feiner and Huges, “Computer Graphics: Principles & Practice”, second edition, Pearson Education, 2003.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	1	1	-	-	-	1	-
CO2	3	2	1	-	1	-	-	-	1	1	-	-	-	1	-

CO3	3	3	2	1	2	-	-	-	1	1	-	-	-	1	-
CO4	3	3	2	1	2	-	-	-	1	1	-	-	-	1	-
CO5	3	3	3	2	2	-	-	-	1	1	-	-	-	1	-

Course Name: Internet and web programming					
Course Code : CS541E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: Explain tools for developing applications in Web programming; Describe scripting languages – Java Script; Under case study: Exposure to a web platform.					
Prerequisites: Database Management System					

Units	**Teaching Hours**
Unit-1 HTML5	
Why HTML5 exists? Structuring a Web Page, Forms, Multimedia (video, audio) markup and APIs, Canvas, Data Storage, Drag & Drop, Messaging & Workers	9
Unit-2 CSS3	
Understanding CSS and the Modern Web, Learning CSS Syntax and Adding Presentational Styles, Creating Styles Using Property Values, Adding Presentational Styles, Creating A Basic Page Structure, Understanding Display, Position, and Document Flow, Changing and styling fonts, Adding transitions and animations.	9
Unit-3 JAVASCRIPT	
Basic JavaScript Instructions, Functions, Methods & Objects, Decisions & Loops, Document Object Model, Events	9
Unit-4 NOSQL	
Installing MariaDB, Configuring MariaDB, MariaDB Security, MariaDB User Account Management, MariaDBDatatypes, Date and String functions in MaraiaDB, Using MariaDB,	6

Unit-5 CASE STUDY – Node.js

The Node Module System, The Node Programming Model, Events and Timers, The Command Line Interface, The File System, Streams, Binary Data, Executing Code, Network Programming, HTTP, Express Framework	12

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Build the basic web page using HTML concepts.
CO2: Experiment with the concepts of CSS to build the web pages.
CO3: Determine the usage of Javascript scripts for making the effective web pages.
CO4: Develop backend connection using MariaDB
CO5: Design web applications using platforms like Node.js.

Text Books:
T1.Bruce Lawson, Remy Sharp, "Introducing HTML 5", Pearson Education, 2011
T2. Ian Lunn, "CSS3 Foundations", Wiley Publishers, 2012
T3. Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", Wiley Publishers: 2014
T4. Daniel Bartholomew, "Getting started with MariaDB", 2013
T5. Colin J. Ihrig, "Pro Node.js for Developers", APRESS, 2013

Reference Books:
R1. Matt West, "HTML5 Foundations", Wiley Publishers: 2012
R2. Training Guide Programming in HTML5 with JavaScript and CSS3 (MCSD) (Microsoft Press Training Guide), 2013.
R3. Elizabeth Castro , Bruce Hyslop , "HTML and CSS: Visual QuickStart Guide" 8th edition, 2013.
R4.Eric Freeman, Elisabeth Robson "Head First HTML5 Programming: Building Web Apps withJavaScript"1stEdition

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	-	3	-	-	1	2	1	1	-	1	2	1
CO2	3	2	1	-	3	-	-	1	2	1	1	-	1	2	1

CO3	3	3	3	2	3	-	-	1	2	1	1	-	1	2	1
CO4	3	2	1	-	3	-	-	1	2	1	1	-	1	2	1
CO5	3	3	3	3	3	-	-	1	2	1	1	-	1	2	1

<table>
<tr><td colspan="6">Course Name: Foundation of web science</td></tr>
<tr><td colspan="6">Course Code : CS541E03</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>PEC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives: This syllabus introduces the basics of web foundations such as Web Search Engines, Web Servers, Application Server and key concepts of semantic web, different Ontology Development methods that are currently used to create applications on web. It also explains the principal of software agents and overview of information retrieval on the web.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: : Basics of Computer Science and Engineering(CS134/CS234)
Internet and Web Programming</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 WEB FOUNDATIONS</td></tr>
<tr><td colspan="5">The Evolution of the Web, Components of the Web, Web Search Engines, Web Servers, Application Server.</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 SEMANTIC WEB OVERVIEW</td></tr>
<tr><td colspan="5">Syntactic Web, Semantic Web, Applications of Semantic Web, Defining the term Ontology, Classifying Ontologies, Semantic Web Architecture-RDF and RDF Schema-OWL</td><td>9</td></tr>
<tr><td colspan="6">Unit-3ONTOLOGY DEVELOPMENT METHODS</td></tr>
<tr><td colspan="5">Uschold and King Ontology Development Method- Toronto Virtual Enterprise Method- Methontology- KACTUS Project Ontology Development Method-Ontology Development 101.</td><td>9</td></tr>
<tr><td colspan="6">Unit-4SOFTWARE AGENTS</td></tr>
</table>

What is a Software Agent?-Scope of Intelligent Agents-Nwana's Typology-Franklin and Graesser's Agent Taxonomy-Why Software Agents?-Agent Enabled System Architecture. Agents from Direct Manipulation to Delegation-Interface Agents-M System Case Study- Agent Oriented Programming: Software with a Mental State- Generic Agent Interpreter-Agent 0.	9
Unit-5 OVERVIEW OF INFORMATION RETRIEVAL ON THE WEB	
Introduction to Web Data Mining- General IR System Architecture-Information Retrieval Models-Evaluation Methods-Text and Web Page Pre-Processing-Web Search	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:

1. Illustrate the core concepts of the Internet and the World Wide Web and effectively evaluate the Components of the Web.
2. Interpret the fundamental concepts in Semantic Web as well as analyze the Classification of Ontologies.
3. Interpret and adapt to several Ontology Development Methods.(Interpret)
4. Evaluate the necessity of Agent Oriented Programming with relevant case studies.
5. Examine the several strategies of Information Retrieval from the web

Text Books:

T1. Web Technology: Theory and Practice, By: M. Srinivasan, Pearson Education India, 2012
T2.Breitman, Karin, Marco Antonio Casanova, and Walt Truszkowski. Semantic web: concepts, technologies and applications. SpringerScience& Business Media, Third Reprint 2015.
T3.Bradshaw, Jeffrey M. Software agents. MIT press, Reprint PHI Learning Private Limited, 2010.
T4.Liu, Bing. Web data mining: exploring hyperlinks, contents, and usage data. Springer Science & Business Media, 2011 (Revised Edition).

Reference Books:
R1.SoumenChakrabarti, Mining the Web, Morgan Kaufmann Publishers, 2005
R2.Gomez-Perez, Asuncion, Mariano Fernandez-Lopez, and Oscar Corcho. "Ontological Engineering: with examples from the areas of knowledge management, ecommerce and the Semantic Web." Book by Springer (2004)
R3.Hitzler, Pascal, Markus Krotzsch, and Sebastian Rudolph. Foundations of semantic web technologies. CRC press, 2009.
R4.Alexander Maedche, "Ontology Learning for the Semantic Web", Springer; 1 edition, 2002
R5.Steffen Staab (Editor), Rudi Studer, "Handbook on Ontologies (International Handbooks on
R6. Information Systems)", Springer 1st edition, 2004
R7. Dean Allemang (Author), James Hendler (Author) "Semantic Web for the Working Ontologist:
R8.Effective Modeling in RDFS and OWL" (Paperback), Morgan Kaufmann, 2008
R9.Grigoris Antoniou, Frank van Harmelen, "A Semantic Web Primer (Cooperative InformationSystems)", The MIT Press, 2004

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	1						1				**1**		
CO2	1	1		2									**1**		
CO3	2	2	2	1	2								**1**		
CO4	2	2		2					1				**1**		
CO5	2	2	2	2						1			**1**		

Course Name: Linux Certified Server Administration					
Course Code : CS541C01					
	L	**T**	**P**	Category	
Contact Hrs./Week	0	0	2	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	

Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:

Prerequisites:

Units	**Teaching Hours**
Unit-1	
Process management—Introduction to processes--Process priorities—Background Jobs Disk management—Disk devices--Disk partitions—File systems-Mounting—Troubleshooting tools—Introduction to RAID—Logical volume management Boot management—boot loaderSystem management—scheduling—logging –memory management—resource monitoring—package management Network management—general networking—interface configuration—network sniffing—Introduction to NFS –NetworkingKernel management—Linux Kernel-library management Backup management	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Experiment on Linux Server installation and creation.(Analyze)(PO1,PO3,PO5)

Text Books:

Reference Books:

Online Resources:

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2		2		2									1	

Course Name: Oracle certified Database Administration					
Course Code : CS541C02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:

- To understand the architecture of the oracle database
- To understand the administrative tools used in oracle database
- To understand the oracle account creation and its maintenance

Prerequisites: Database Management Systems

Units	**Teaching Hours**
List of Experiments	**Practical Hours**
• Exploring the Oracle Database Architecture • Oracle Database Architecture Overview, Oracle ASM Architecture Overview, Process Architecture, Memory structures, Logical and physical storage structures, ASM storage components • Installing your Oracle Software • Tasks of an Oracle Database Administrator, Tools Used to Administer an Oracle Database, Installation: System Requirements, Oracle Universal Installer (OUI), Installing Oracle Grid Infrastructure, Installing Oracle Database Software • Creating an Oracle Database • Planning the Database, Using the DBCA to Create a Database, Password Management, Creating a Database Design Template, Using the DBCA to Delete a Database	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Experiment on Oracle database installation and creation.

Text Books:

Reference Books:

Online Resources:

Mapping with Program Outcomes (POs)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2		2		2										

Course Name: Solaris Server Administration					
Course Code : CS541C03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	
Course objectives:					
Prerequisites:					

Units	**Teaching Hours**
Unit-1	
Creating and Managing User Accounts, Users & Groups - Access to System and Data , The /etc/passwd File, The /etc/group File, Creating User Accounts using tools, Managing User Accounts from the Command Line, The /etc/skel Directory , Customizing User Accounts Performing System Security, Monitoring System Access , Switching users on a system, Controlling system access, Restricting access to data in files.	15
Self-study : NA	
Site/Industrial Visits : NA	
Online Resources: NIL	

Course outcomes: CO1: Experiment on Solaris Server installation and Administration. (Analyze)(PO1,PO3,PO5)
Reference Books:
Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-

Course Name: Data Absorption

Course Code : CS541C04

	L	T	P	Category	PEC
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
To understand the basics of R and its applications.

Prerequisites:

Units	Teaching Hours
Unit-1	

Introduction to R Data Types and Basic Operations—Installation of R on different platforms—R data types and basic operations—The R object structure and mode conversion—Factor and its types—Basic Data Manipulation—Acquiring data—Vector and matrix operations –Factor manipulation – Factors from numeric variables – Date processing using lubridate—Character manipulation Subscripting and subsetting – Data manipulation using plyr and dplyr Applications-- Assimilation Shield--Enhanced Condition--Data Breath—Digital Empowerment--Digital Immunity--Digital Regeneration—Variations.	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:

CO1:Discussing the basics of R language, its installations on different platforms and its applications in different domains.

Text Books:

Reference Books:

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	-	-	1	-	-	-	-	-	-	-	1	1	1

<table>
<tr><td colspan="6">Course Name: Virtualization</td></tr>
<tr><td colspan="6">Course Code :CS541C05</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>PEC</td></tr>
<tr><td>Contact Hrs./Week</td><td>0</td><td>0</td><td>2</td><td>CIA Marks</td><td></td></tr>
<tr><td>Contact Hrs./Sem.</td><td>0</td><td>0</td><td>30</td><td>ESE Marks</td><td></td></tr>
<tr><td>Credits.</td><td>0</td><td>0</td><td>1</td><td>Exam Hours</td><td></td></tr>
<tr><td colspan="6">Course objectives:
The basic components of object oriented system development with five methodologies are explained. The Unified Modelling Language oriented with unified approach has been demonstrated. The second part of the content gives detailed knowledge in Object Oriented analysis and design phases followed by maintenance and monitoring activities of delivered software products.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Object Oriented Analysis and Design, Software Engineering</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1</td></tr>
<tr><td colspan="5">Virtualizing Storage Devices. Examining Storage in a Virtual Machine. Creating Virtual Storage Environments. Dynamic and Static Storage. Understanding RAID and Cloud Storage VIII. Cloning and Copying. Redundancy vs. Backup Cloning and Templates. Snapshots and Checkpoints, Managing Devices in Virtualization. Utilizing Peripheral Devices in VM Environments. VM Tools. Configuring USB and Other Devices to Work with VMs.</td><td>15</td></tr>
<tr><td colspan="6">Self-study : NA</td></tr>
<tr><td colspan="6">Site/Industrial Visits : NA</td></tr>
<tr><td colspan="6">Course outcomes:
CO1: Explain the basic concepts of Virtualization
CO2: Understand different storage techniques
CO3: Demonstrate VM Tools</td></tr>
<tr><td colspan="6">Text Books:</td></tr>
<tr><td colspan="6">Reference Books:</td></tr>
<tr><td colspan="6">Online Resources:</td></tr>
<tr><td colspan="6">Mapping with Program Outcomes (POs)</td></tr>
</table>

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	3	-	3	-	3	-	-	-	-	-	2	2	1
CO2	3	-	3	3	3	-	-	-	3	-	3	-	1	1	-
CO3	3	1	3	-	3	-	3	-	-	-	-	-	2	1	-

Course Name: Robotic process and Automation					
Course Code :CS541C06					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives: Robotic Process Automation (RPA) is an advanced technology that automates huge quantities of redundant tasks by applying artificial intelligence (AI). RPA can be used for processing transactions, manipulating data, triggering responses and communicating with other digital systems. RPA has applications in a plethora of industries including insurance claims processing, invoice processing, customer feedback analysis, onboarding of employees, HR operations, and much more.	
Prerequisites:	
Units	**Teaching Hours**
Unit-1	
Robotic process automation How RPA works ROI Building a business case RPA Implementation RPA Tools Case study	15
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1:Demonstrate the concept of Robotic process automation.(PO1,PO3,PO5)	
Text Books:	
Reference Books:	
Online Resources:	
Mapping with Program Outcomes (POs)	

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2		2		2										

Course Name: Project Management & Finance					
Course Code : CS512					
	L	**T**	**P**	Category	**HSMC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	3	0	0	Exam Hours	**3**
Course objectives: This course introduces to Planning & Analysis of projects, Generation and Screening of Project Ideas, Financial Analysis, and financing options.					
Prerequisites: NIL					

Units	**Teaching Hours**
Unit-1 Introduction	
Generation of ideas – Monitoring, the environment - regulatory framework for projects - corporate appraisal - preliminary screening - project rating index. Market and demand analysis: Situational analysis and specification of objectives - collection of secondary information - conduct of market survey.	9
Unit-2 Project Management	
Forms of Project Organization - Project Planning, Project Control, Human aspects of project Management - Prerequisites for successful Project Implementation. Network techniques for Project Management - Development of Project Network - Time Estimation - Determination of critical path - scheduling when resources are limit - PERT and CPM models	9

Unit-3 Planning & Analysis Overview	
Phases of Capital Budgeting - Levels of Decision Making – Objective, Resource Allocation Framework: Key Criteria for Allocation of Resource - interface between Strategic Planning and Capital Budgeting.	9
Unit-4 Financial Analysis	
Financial Analysis: Estimation of cost of project and means of financing - estimates of sales and production - cost of production - working capital requirement and its financing - estimates of working results . Project cash flows: Basic principles of measurement of cash flows - components of the cash flow streams - viewing a project from different points of view	9
Unit-5 Social Cost Benefit Analysis	
Rationale for Social Cost Benefit Analysis (SCBA) – UNIDO Approach to SCBA - Little and Mirle Approach to SCBA, Qualitative Considerations-Social Cost Benefit Analysis, Contribution to Government Revenue, Political Stability, Priority and Evaluation of International Competitiveness.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Demonstrate the manage the flow of project information during the various phases of the project. CO2: Explain various types and sources of risk that are the primary responsibility of the project supervisor. CO3: Explain the role of planning and scheduling project. CO4: Estimate cost, finance and cash flow for financial analysis CO5: Identify Social cost Benefit and evaluate the competitiveness	
Text Books: T1. Prasanna Chandra (2014). Project Preparation Appraisal Budgeting and Implementation (8th ed.). New Delhi. Tata McGraw Hi	

Reference Books:
R1. Bennet P. Lientz, Kathryn P. Rea (2010). Breakthrough Technology Project Management (2nd ed.). New Delhi. Academic Press.
R2. Machiraju, H.R. (2009). Introduction to Project Finance, New Delhi. Vikas Publishing House.
R3. Narendra Singh (2009). Problems and Solutions in Project Management and Control. New Delhi. Himalaya Publishing House.
R4. Prasanna Chandra (2014). Project Preparation Appraisal Budgeting and Implementation (8th ed.). New Delhi. Tata McGraw Hill.
R5. Rao.P.C.K (2009). Project Management and control. New Delhi. Sultan Chand & Sons

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	1	-	-	-	-	-	-	1	-	-	1	-	1	1
CO2	-	1	-	-	-	1	-	-	-	-	-	1	-	1	-
CO3	-	-	-	-	-	1	-	-	1	1	1	1	-	1	1
CO4	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-
CO5	-	-	-	-	-	1	-	-	-	-	1	1	-	1	1

Course Name: Internship – 1					
Course Code : CS581					
	L	**T**	**P**	Category	
Contact Hrs./Week	0	0	2	CIA Marks	**50**
Contact Hrs./Sem.				ESE Marks	**-**
Credits.	0	0	1	Exam Hours	**-**

Course objectives:

INTERNSHIP POLICY, GUIDELINES AND PROCEDURES

INTRODUCTION

Internships are short-term work experiences that will allow a student to observe and participate in professional work environments and explore how his interests relate to possible careers. They are important learning opportunities trough industry exposure and practices. More specifically, doing internships is beneficial because they provide the opportunity to:

- Get an inside view of an industry and organization/company
- Gain valuable skills and knowledge
- Make professional connections and enhance student's network
- Get experience in a field to allow the student to make a career transition

Regulations

1.The student shall undergo an Internship for30 days starting from the end of 2nd semester examination and completing it during the initial period of 3rd semester.
2.The department shall nominate a faculty as a mentor for a group of students to prepare and monitor the progress of the students
3. The students shall report the progress of the internship to the mentor/guide at regular intervals and may seek his/her advise.
4. The Internship shall be completed by the end of 7th semesters.
5. The students are permitted to carry out the internship outside India with the following conditions, the entire expenses are to be borne by the student and the University will not give any financial assistance.
6. Students can also undergo internships arranged by the department during vacation.
7. After completion of Internship, students shall submit a report to the department with the approval of both internal and external guides/mentors.
8. There will be an assessment for the internship for 2 credits, in the form of report assessment by the guide/mentor and a presentation on the internship given to department constituted panel

Site/Industrial Visits :

Course outcomes:
CO1: Design solutions to real time complex engineering problems using the concepts of Computer Science and Information Technology through independent study.
CO2: Demonstrate teamwork and leadership skills with professional ethics.
CO3: Prepare an internship report in the prescribed format and demonstrate oral communication through presentation of the internship work.

Text Books:

Reference Books:

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	-	-	-	-	-	-	-	2	1	-
CO2	-	-	-	-	-	-	-	2	2	-	-	-	2	2	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	2	2	-
CO5															

Course Name: Internet of Things					
Course Code : CS631P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This course introduces the basic concepts of IoT, the functionalities of different types of sensors, actuators and micro controllers. It covers the protocols used in different layers and gives insight on programming IoT for different domains.

Prerequisites: Computer Networks,Basics of Programming

Units	Teaching Hours
Unit-1 INTRODUCTION AND BACKGROUND 1	
Definition and Characteristics of IoT, Physical Design of IoT: Things in IoT, Logical Design of IoT: IoT functional Blocks, IoT Communication Blocks, IoT communication APIs, IoT Enabling Technologies: WSN, Cloud Computing, Big Data Analysis, Communication Protocols, Embedded Systems.	9
Unit-2 IOT HARDWARE, DEVICES AND PLATFORMS	
Basics of Arduino: The Arduino Hardware, The Arduino IDE, Basic Arduino Programming, Basics of Raspberry pi: Introduction to Raspberry Pi, Programming with Raspberry Pi, CDAC IoT devices: Ubimote, Wi-Fi mote, BLE mote, WINGZ gateway, Introduction to IoT Platforms, IoT Sensors and actuators.	9
Unit-3 IOT PROTOCOLS	
Arduino Programming: Serial Communications, Getting input from sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication. Programming with Raspberry Pi: Basics of Python Programming, Python packages of IoT, IoT Programming with CDAC IoT devices.	9
Unit-4 IOT PROGRAMMING	

Arduino Programming: Serial Communications, Getting input from sensors, Visual, Physical and Audio Outputs, Remotely Controlling External Devices, Wireless Communication. Programming with Raspberry Pi: Basics of Python Programming, Python packages of IoT, IoT Programming with CDAC IoT devices.	9
Unit-5 DOMAIN SPECIFIC IOT	
Home automation, Smart cities, Smart Environment, IoT in Energy, Logistics, Agriculture, Industry and Health & Life style secors. Case Studies: A Case study of Internet of Things Using Wireless Sensor Networks and Smartphones, Security Analysis of Internet-of-Things: A Case Study of August Smart Lock, OpenIoT platform.	9
List of Experiments	**Practical Hours**
1. Controlling LEDs blinking pattern through UART.	**3**
2. On-chip Temperature measurement through ADC.	**3**
3. Communication of two Motes over the radio frequency.	**3**
4. Generation of alarm through Buzzer.	**3**
5. Proximity detection with IR LED.	**3**
6. Demonstration of a Peer-to-Peer network topology using Coordinator and end device network device types	**3**
7. IP based sensor monitoring through Ubi-Sense	**3**
8. IP based lighting control through Data Acquisition Card	**3**
9. Transmitting the measured physical value from the UbiSense over the Air.	**3**
10. Pushing data from device to cloud	**3**
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Explain the fundamental building blocks of an IoT environment from a logical and physical perspective.
CO2: Summarize various IoT protocols in Application and Network layers by outlining their advantages and disadvantages.
CO3: Develop programing skills to design IoT solutions using Arduino and Raspberry Pi to solve real life problems
CO4: Experiment with Arduino, CDAC, and Raspberry Pi to choose the appropriate hardware for different IoT projects.
CO5: Survey successful IoT products and solutions to analyze their architecture and technologies.

TexText Books
T1. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
T2. Margolis, Michael. “Arduino Cookbook: Recipes to Begin, Expand, and Enhance Your Projects. " O'Reilly Media, Inc.", 2011.
T3. Monk, Simon. Raspberry Pi cookbook: Software and hardware problems and solutions. " O'Reilly Media, Inc.", 2016.

Reference Books:
R1. The Internet of Things: Applications to the Smart Grid and Building Automation by – Olivier Hersent, Omar Elloumi and David Boswarthick – Wiley Publications -2012.
R2. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2012.
R3. David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.
R4Al-Fuqaha, Ala, et al. "Internet of things: A survey on enabling technologies, protocols, and applications." IEEE Communications Surveys & Tutorials 17.4 (2015): 2347-2376.
R5.Tsitsigkos, Alkiviadis, et al. "A case study of internet of things using wireless sensor networks and smartphones." Proceedings of the Wireless World Research Forum (WWRF) Meeting: Technologies and Visions for a Sustainable Wireless Internet, Athens, Greece. Vol. 2325. 2012.
R6.Ye, Mengmei, et al. "Security Analysis of Internet-of-Things: A Case Study of August Smart Lock."

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	1	-	-	-	-	-	-	-	3	-	-
CO2	2	1	-	-	1	-	-	-	-	-	-	-	3	2	-

CO3	3	2	1	-	2	2	2	1	2	-	-	1	3	-	-
CO4	3	2	1	-	2	3	3	1	3	-	1	1	3	-	1
CO5	3	3	2	1	2	-	3	-	3	-	1	1	3	-	1

Course Name: Compiler Design					
Course Code : CS632					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives: To have the better understanding of:

- Design principles of a Compiler.
- Various parsing techniques
- Different levels of translation
- Optimization and generation of machine codes..

Prerequisites: FORMAL LANGUAGE AND AUTOMATA THEORY

Units	Teaching Hours
Unit-1 INTRODUCTION TO COMPILERS	
Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics.	9
Unit-2 LEXICAL ANALYSIS	
Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions- Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying LexicalAnalyzers-LEX-Design of Lexical Analyzer for a sample Language.	9
Unit-3 SYNTAX ANALYSIS	
Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies- Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item- Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery inSyntaxAnalyzer-YACC-Design of a syntax Analyzer for a Sample Language	9
Unit-4 SYNTAX DIRECTED TRANSLATION & RUN TIME ENVIRONMENT	

Syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker- Equivalence of Type Expressions-Type Conversions. RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation- Parameter Passing-Symbol Tables-Dynamic Storage Allocation-Storage Allocation in FORTAN.	9
Unit-5 CODE OPTIMIZATION AND CODE GENERATION	
Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis- Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Explain the concepts and different phases of compilation with Compiler Construction Tools
CO2: Interpret language tokens using regular expressions and design lexical analyzer for a language.
CO3: Build top down parsing, bottom up parsing and parse tree representation of the input.
CO4: Outline intermediate code for the statements during the process of compilation.
CO5: Experiment the optimization techniques to intermediate code and generate machine code for high level language program.

Text Books:
T1. Alfred V Aho, Monica S. Lam, Ravi Sethi and Jeffrey D Ullman, "Compilers – Principles, Techniques and Tools", 2nd Edition, Pearson Education, 2007.

Reference Books:
R1. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence-based Approach", Morgan Kaufmann Publishers, 2002.
R2. Steven S. Muchnick, "Advanced Compiler Design and Implementation, "Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
R3. Keith D Cooper and Linda Torczon, "Engineering a Compiler", Morgan Kaufmann Publishers Elsevier Science, 2004.

Online Resources: NIL

Mapping with Program Outcomes (POs)

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

CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	1	-

<table>
<tr><td colspan="6">Course Name: Design patterns</td></tr>
<tr><td colspan="6">Course Code : CS633P</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>PCC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>2</td><td>CIA Marks</td><td>70</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>30</td><td>ESE Marks</td><td>30</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>1</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
The students should develop an understanding of the tools and techniques that may be used for the automatic analysis and evaluation of software; To build foundation on different patterns and Software Engineering Models</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Software Engineering, Programming Paradigms.</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 SINGLE RESPONSIBILITY PRINCIPLE AND OPEN/CLOSED PRINCIPLE</td></tr>
<tr><td colspan="5">Single Responsibility principle: Problem statement - SRP and the Decorator pattern - Using the Strategy pattern instead of switch - Conclusion - Open/ Closed Principle: Introduction to Open/Closed principle - Extension points - Protected variation – Conclusion.</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 LISKOV SUBSTITUTION PRINCIPLE AND INTERFACE SEGREGATION</td></tr>
<tr><td colspan="5">Liskov Substitution principle: Introduction to the Liskoc substitution principle - Cotracts - Covariance and contra variance - Conclusion - Interface segregation: A segregation example - Client construction - Splitting interfaces – Conclusion.</td><td>9</td></tr>
<tr><td colspan="6">Unit-3 DEPENDENCY INJECTION</td></tr>
<tr><td colspan="5">Dependency injection: Humble beginnings - Beyond simple injection – conclusion.</td><td>9</td></tr>
<tr><td colspan="6">Unit-4 CREATIONAL AND STRUCTURAL PATTERNS</td></tr>
<tr><td colspan="5">Creational Patterns: Abstract Factory - Builder - Factory Method - Prototype - Singleton - Structural Patterns: Adapter - Bridge - Composite - Decorator - Facade - Flyweight – Proxy.</td><td>9</td></tr>
</table>

Unit-5 BEHAVIORAL PATTERNS AND COMMON PATTERNS	
Behavioral Patterns: Chain of Responsibility - Command - Interpreter - Iterator - Mediator - Memento - Observer - State - Strategy - Template Method - Visitor – Case study-Common Patterns: Null Object - Simple Factory - Model View Controller - Layers - Sample 3-Tier Application..	9
List of Experiments	**Practical Hours**
1. SRP Implementation	5
2. Open closed Principle	5
3. Liskov Substitution principle	5
4. Interface segregation principle	5
5. Dependency injection	5
6. Creational and structural pattern	2.5
7. Behavioral Pattern	2.5
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Describe the SOLID principle as major design principles. CO2: Implement the efficient coding practices learnt. CO3: Examine Creational design patterns to exploit object creation. CO4: Interpret Structural design patterns to understand the class-object relation. CO5: Justify Behavioural design patterns to analyse the class behaviour..	
Text Books: T1.Gary Mclean Hall, "Adaptive Code via C#", Microsoft Press, 2014. T2.Tony Bevis, "C# Design Pattern Essentials", 2012..	
Reference Books: R1. Bishop, "Design Patterns C# 3.0", O'REILLY , 2008 R2.Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson, "Head First Design Patterns", O'REILLY, 2004 R3.Steven John Metsker, "Design Patterns in C# (Software Patterns)", Addison Wesley, 1st Edition 2004.	
Online Resources:	

Mapping with Program Outcomes (POs)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	1	-	1	3	-	-	-	3	3	-	-
CO2	3	2	1	1	2	-	1	3	-	-	-	3	3	-	-
CO3	3	2	1	1	2	-	-	-	-	-	1	3	3	-	-
CO4	3	2	1	1	2	-	-	-	-	-	1	3	3	-	-
CO5	3	3	2	2	3	-	-	-	-	1	-	3	3	-	-

Course Name: Web Programming Concepts					
Course Code : CS662E01					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	2	0	2	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**
Course objectives: In this syllabus gets you the simple and practical Web Development for beginners covering basics of web programming, HTML5, CSS3, JavaScript and jQuery. The programs and examples trained in each chapter will help you learn all the principles and concepts very quickly and easily. It also provides elementary insights and an overview of the subject that is necessary to understand the world of web technologies.					
Prerequisites: Basics of Computer Science and Engineering(CS134/CS234)					

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO WEB PROGRAMMING	
Internet and WWW, Web Browsers, Web Servers, URL, HTTP, Introduction to HTML5, CSS3, Exploring Visual Studio 2013	6
Unit-2 HTML5	

Getting Started with HTML5, Understanding HTML, XHTML, and HTML5, Creating an HTML5 Document, Embedding Content, Presentational Elements Working with Hyperlinks, Adding Multimedia Content, Lists, Tables, Forms	6
Unit-3 JAVASCRIPT	
Understanding Java Script, Using statements, Working with functions, Scoping variables, Conditional Programming, Handling Errors, Writing Testing, Debugging Java Script, JavaScript Arrays, Working with objects	6
Unit-4 CSS3	
Introducing CSS3, Defining & Applying a style, Creating style sheets, Understanding selectors, specificity, and cascading, Working with CSS properties	6
Unit-5 jQuery	
Introduction to jQuery, jQuery Selectors, jQuery Events	6
List of Experiments	**Practical Hours**
1. Create a HTML5 static page, the page should consists of following information: i. University Information ii. Academic Details iii. Contact Information	3
2. Create a HTML5 page to demonstrate the use of hotspots.	3
3. Create a HTML5 page to display various online courses with video lessons from your university.	3
4. Create a HTML5 static page to display the curriculum vitae (CV).	3
5. Design and Develop a HTML5 page using JavaScript script to perform following operations: i. Arithmetic Operations ii. Largest of three numbers iii. Factorial of a given number	3
6. Design and Develop a HTML5 dynamic page using JavaScript script to read three students information such as Register Number, Name of the Student, Department, Email Id and Contact No and display all the student information in tabular format.	3

7. Design and Develop a HTML5dynamic page using JavaScript script to perform following operations: i. To count the number of occurrence of words in a given sentence ii. To count the number of odd and even numbers in an array	3
8. Apply CSS3 style properties to display the curriculum vitae (CV) HTML5 static page.	3
9. Create a HTML5 web page that displays university information using various style sheets and CSS3 properties.	3
10. Using jQuery demonstrate selecting Elements, Getting Values, and Setting Values from webpage.	3

Self-study : MySQL Database, JSP, ASP

Site/Industrial Visits :NA

Course outcomes:
CO1: Demonstrate understanding of the basics of web programming concepts.
CO2: Experiment simple web applications using HTML5 tags
CO3: Implement Javascript Scripts for building interactive web applications
CO4: Apply and use CSS3 for HTML elements.
CO5: Implement jQuery scripts.

Text Books:
T1. Training Guide Programming in HTML5 with JavaScript and CSS3 (MCSD) (Microsoft Press Training Guide), 2013

Reference Books:
R1. Matt West, "HTML5 Foundations", Wiley Publishers: 2012
R2. Bruce Lawson, Remy Sharp, "Introducing HTML 5", Pearson 2011
R3. Ian Lunn, "CSS3 Foundations",Wiley Publishers, 2012
R4.Jon Duckett, "JavaScript and JQuery: Interactive Front-End Web Development", Wiley Publishers: 2014.

Online Resources:
W1. www.w3schools.com

Mapping with Program Outcomes (POs)

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	2	-	-	-	-	-	-	-		-	-
CO2	3	2	1	1	3	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	1	3	-	-	-	1	1	-	-	2	-	-
CO4	3	2	1	1	3	-	-	-	1	1	-	-	2	-	-
CO5	3	2	1	1	3	-	-	-	1	1	-	-	3	-	-

Course Name: Java Programming					
Course Code : CS662E02					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**2**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**
Course objectives: : Introduce the Java programming language, its syntax, structures and libraries. Develop object oriented design and programming techniques. Practice robustness and transparency in software design and implementation using Java platform. Learn the Java programming language: its syntax, idioms, patterns, and styles. Become comfortable with object oriented programming: Learn to think in objects; learn the essentials of the Java class library					
Prerequisites: CS134/CS234					

Units	Teaching Hours
Unit-1 INTRODUCTION TO JAVA PROGRAMMING	
Java As a Programming Platform – History of Java. Characteristics of Java. The Java Buzzwords, The Java Environment – JVM, JDK & JRE– Installing the Java Development Kit – Using an Integrated Development Environment – OOP Principles. Comparison of Java with C and C++.Features of Java. Data Types, Variables, Expressions, Keywords, Operators and Control Flow Statements. Arrays – Java File Structure. Creating and Running Java Programs. Comments in Java.	6
Unit-2 CLASS, OBJECTS AND INHERITANCE	
Creating class and Objects, Methods, this keyword, Constructors, the finalize()method. Access Control.StaticBlocks.Finalkeyword.Nested and Inner Classes. Command Line Arguments Inheritance in classes, Using super, Method Overriding, Dynamic Method Dispatch.Abstract Classes, Using final with inheritance, The Object Class.	6
Unit-3 INTERFACES, PACKAGES AND EXCEPTION HANDLING	

Inheritance in java with Interfaces – Defining Interfaces, Implementing Interfaces, Extending Interfaces.Creating Packages, CLASSPATH variable, Access protection, Importing Packages. Exception-Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try-catch-finally mechanism, throw statement, throws statement. Java's Built-in Exceptions.	6
Unit-4 COLLECTIONS AND INPUT / OUTPUT	
I/O Basics, Streams, Byte Streams and Character Streams, The Predefined Streams, Reading Console Input, Writing Console Output, File, Byte Stream and Character Stream Classes.	6
Unit-5 APPLET and JDBC	
Applet Basics, Applet Architecture, An Applet Skeleton, Simple Applet Display Methods, A simple Applet program. Introduction to JDBC- JDBC Drivers, Basic steps in JDBC, A Simple JDBC program	6
List of Experiments	**Practical Hours**
1. Implementation of Simple Java programs to understand data types, variables, operators, strings, input and output, control flow, arrays.	1
2. Implementation of Classes and Objects – static fields, methods, method parameters, object construction.	1
3. Implementation of Constructor overloading and method overloading	2
4. Implement the Interface Concept	2
5. Implementation of Exception	2
6. Implementation of Exception Handling	2
7. Implementation of Input Output classes	2
8. Implementation of Simple Applet program	2
9. Implementation of JDBC Programs	2
Self-study : NIL	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Demonstrate the use of basic features of java programming to build java applications(Understanding)
CO2: Illustrate the use of Object Oriented Concepts in java programming
CO3: Develop robust java applications with help of exception handling, packages and interfaces
CO4: Develop programs using Generic classes in java
CO5: Experiment with Input and Output classes in java programming

Text Books:
T1. Herbert Schildt, " Java: The Complete Reference", Tenth Edition, Tata McGraw Hill, 2017

Reference Books:
R1. Kathy Sierra, Bert Bates, "Head First Java, 2nd Edition " O`Relly
R2. C. Xavier, "Java Programming: A Practical Approach", Tata McGraw 2011.
R3. Herbert Schildt , " Java : A Beginner`s Guide, Seventh Edition, Oracle Press , 2017

Online Resources:W1. https://docs.oracle.com/javase/tutorial/

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	2	-	-	-	-	-	-	-	1		-
CO2	2	1	-	-	2	-	-	-	-	-	-	-	1		-
CO3	3	2	1	1	3	-	-	-	-	-	-	-	1	2	-
CO4	3	2	1	1	3	-	-	-	-	-	-	-	1		-
CO5	3	2	1	1	3	-	-	-	-	-	-	-	1		-

Course Name: Software Testing Techniques					
Course Code : CS662E03					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	2	0	2	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**

Course objectives:
To give an overview of the software testing techniques. To design and understand test cases, various levels of testing and related concepts.

Prerequisites: Software Engineering

Units	Teaching Hours
Unit-1 INTRODUCTION	
Testing as a Process – Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer	6
Unit-2 TEST CASE DESIGN	
Introduction to Testing Design Strategies – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – positive and negative testing – Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing – error guessing - compatibility testing – user documentation testing – domain testing Using White–Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing - Covering Code Logic – Paths – Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria.	6
Unit-3 LEVELS OF TESTING	
The Need for Levels of Testing – Unit Test – Unit Test Planning –Designing the Unit Tests. Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – scenario testing –System Testing – types of system testing - Acceptance testing – performance testing - Regression Testing – internationalization testing – ad-hoc testing - Alpha – Beta Tests – usability and accessibility testing	6

Unit-4 TEST MANAGEMENT	
People and organizational issues in testing – organization structures for testing teams – testing services - Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process - Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist	6
Unit-5 CONTROLLING AND MONITORING	
Software test automation – skills needed for automation – scope of automation – challenges in automation - Test metrics and measurements – project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – Evaluating software quality – defect prevention	6
List of Experiments	**Practical Hours**
1. Decision table approach for solving triangle problem	3
2. Decision table for triangle problem	3
3. Boundary value analysis program	3
4. Boundary Value Analysis for triangle problem	3
5. equivalence class partitioning program	3
6. Equivalence class Analysis for triangle problem	3
7. Strong Robust Equivalence class Testing	3
8. Dataflow Testing for commission calculation	3
9. Data Flow Testing for Commission Program	3
10. Boundary , Equivalence and Decision Test Case for Commission Problem	3
Self-study : NA	
Site/Industrial Visits : NA	

Course Outcomes:
CO1: To explain the Software testing Principles and testing as a process.
CO2: To illustrate the test case strategies and different types of software testing.
CO3: To interpret and explain different levels of software testing
CO4: To summarize software test plan components and test process
CO5: To apply the knowledge of automation testing tools in software testing process and software change management.

Text Books:
T1.Boris Beizer, "Software Testing Techniques", Dreamtech. Second Edition, 2009
T2. SrinivasanDesikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson education, 2008.

Reference Books:
R1. Elfriede Dustin, "Effective Software Testing", Pearson Education, First Edition, 2008.
R2. Edward Kit, "Software Testing in the Real World", Pearson Education, 2008.
R3. AdityaP.Mathur, "Foundations of Software Testing", Pearson Education, 2011.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	1	-	-	-	-	-	-	1	1	-	3
CO2	2	1	-	-	1	-	-	-	-	-	-	1	1	2	-
CO3	2	1	-	-	1	-	-	-	-	-	-	1	1	-	-
CO4	2	1	-	-	1	-	-	1	1	-		1	1	2	-
CO5	3	2	1	1	2	-	-	-	-	-	2	1	1	-	3

Course Name: Introduction to Cloud Computing					
Course Code : CS662E04					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	2	0	2	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**

Course objectives:
Cloud computing is a model for enabling ubiquitous, convenient, on-demand access to a shared pool of configurable computing resources. Cloud computing paradigm possesses tremendous momentum but its unique aspects exacerbate security and privacy challenges. Cloud computing enables increasing number of IT services to be delivered over the Internet. The cloud platform enables business to run successfully without dedicated hardware, software and services.

Prerequisites: Operating System , Computer Networks

Units	Teaching Hours
Unit-1 UNDERSTANDING CLOUD COMPUTING	
Cloud computing is a model for enabling ubiquitous, convenient, on-demand access to a shared pool of configurable computing resources. Cloud computing paradigm possesses tremendous momentum but its unique aspects exacerbate security and privacy challenges. Cloud computing enables increasing number of IT services to be delivered over the Internet. The cloud platform enables business to run successfully without dedicated hardware, software and services.	6
Unit-2 UNDERSTANDING CLOUD COMPUTING	
Hardware and Infrastructure: Clients – Security – Network –Services; Accessing the Cloud: Platforms – Web Applications – Web API; Cloud Storage	6
Unit-3 USING CLOUD PLATFORMS	
Understanding Abstraction and Virtualization– Capacity Planning – Exploring Platform as a Service – Using Google web services	6
Unit-4 CLOUD SERVICES AND APPLICATIONS	

Understanding Service Oriented Architecture– Moving Applications to the cloud – Working with cloud based storage – Working with productive software	6
Unit-5 DEVELOPING APPLICATIONS, THIN CLIENTS AND MIGRATION	
Develop applications using Google, Microsoft – Google App Engine – Microsoft Windows Azure – Virtualizing your Organization – Server Solutions	6
List of Experiments	**Practical Hours**
Introduction to cloud computing.	6
Creating a Warehouse Application in SalesForce.com.	3
Creating an Application in SalesForce.com using Apex programming Language.	3
Implementation of SOAP Web services in C#/JAVA Applications.	3
Implementation of Para-Virtualization using VM Ware's Workstation/ Oracle's Virtual Box and Guest O.S.	3
Installation and Configuration of Hadoop.	3
Create an application (Ex: Word Count) using Hadoop Map/Reduce.	3
Case Study: PAAS(Facebook, Google App Engine)	3
Case Study: Amazon Web Services.	3
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Exaplain the fundamentals of Cloud Storage, Cloud Architecture and Cloud Computing (Understand) (PO1)
CO2: Explain Cloud Computing technologies with respect to platforms, services, network, security and applications (Understand) (PO1)
CO3: Build Cloud platforms using Google, Amazon and Microsoft services (Apply) (PO1, PO2,PO3, PO5)
CO4: Examine Cloud services and applications using Web mail, Media and Streaming(Analyze)) (PO1, PO2,PO3, PO4)
CO5: Experiment Cloud based solutions for individuals and enterprises using Google and Microsoft cloud offerings (Create)) (PO1, PO2,PO3, PO4,PO5)

Text Books:
T1. Anthony Velte, Toby Velte and Robert Elsenpeter, "Cloud Computing – A Practical Approach", 1st Edition, McGraw Hill. 2010.
T2.Rajkumar Buyya and Vecchiola, Selvi, "Mastering Cloud Computing", 1st Edition, McGraw Hill. 2013.
T3.Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, John Wiley & Sons, 2010.

Reference Books:
R1.Massimo Cafaro and Giovanni Aloisio, "Grids, Clouds and Virtualization", Springer, 2011.
R2. RajkumarBuyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", Wiley Publications, 2011.
R3. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	-	1		
CO2	3	1	-	2	-	-	-	-	-	-	-	-	2		1
CO3	3	3	2	2	-	-	-	1	-	-	-	-	3	2	
CO4	3	3	2	2	-	-	-	1	-	-	-	-	2	2	1
CO5	3	3	2	2	-	-	-	-	-	2	-	-		2	

<table>
<tr><td colspan="6">Course Name: Introduction to Data Science</td></tr>
<tr><td colspan="6">Course Code : CS662E05</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>OE</td></tr>
<tr><td>Contact Hrs./Week</td><td>2</td><td>0</td><td>2</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>30</td><td>0</td><td>30</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>2</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
• To study the concepts of data pre-process.
• To study various pattern discovery methods.
• To study the basic concepts of classification techniques.
• To study the basic concepts of clustering techniques.
• To learn about the recent trends in Data Science</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Probability And Queuing Theory, Data Structures and Algorithms, Data Base Management Systems</td></tr>
</table>

Units	Teaching Hours
Unit-1 INTRODUCTION AND DATA PRE-PROCESSING	
Why Data Mining?, What Is Data Mining?, What Kinds of Data Can Be Mined?, What Kinds of Patterns Can Be Mined?, Which Technologies Are Used? Which Kinds of Applications Are Targeted?, Major Issues in Data Mining, Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization	6
Unit-2 Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods	
Basic Concepts, Frequent Itemset Mining Methods, Which Patterns Are Interesting?—Pattern Evaluation Methods	6
Unit-3CLASSIFICATION: BASIC CONCEPTS	
Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Lazy Learners (or Learning from Your Neighbours)	6
Unit-4 CLUSTER ANALYSIS: BASIC CONCEPTS AND METHODS	
Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Evaluation of Clustering	6

Unit-5 INTRODUCTION TO R	
Reading and getting data into R – ordered and unordered factors – arrays and matrices – lists and data frames – reading data from files – probability distributions – statistical models in R - manipulating objects – data distribution.	6
List of Experiments	**Practical Hours**
1. Introduction to R language and Weka	6
2. Apriori and FP growth algorithm case study	6
3. Classification algorithm case study	6
4. Classification algorithm case study	6
5. Clustering algorithm case study	6
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:

CO1: Demonstrate the fundamental concepts, applications and pre-processing of data science.
CO2: Illustrate the concepts of association rule mining for various applications.
CO3: Apply the different classification algorithms and principles in mining knowledge.
CO4: Apply the clustering techniques and principles in mining the knowledge.
CO5: Analysethe latest trends in data science.

Text Books:

T1. J. Han, M. Kamber, "Data Mining: Concepts and Techniques", Harcourt India / Morgan Kauffman, 2011.
T2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.

Reference Books:

R1. K.P.Soman, ShyamDiwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI, 2012
R2. David Hand, Heikki Manila, PadhraicSymth, "Principles of Data Mining", PHI 2012.
R3. W.H.Inmon, "Building the Data Warehouse", 3rd Edition, Wiley, 2011.
R4. Alex Bezon, Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", MeGraw-Hill Edition, 2001
R5. PaulrajPonniah, "Data Warehousing Fundamentals", Wiley-Interscience Publication, 2003.

Online Resources: NIL															
Mapping with Program Outcomes (POs)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	1	-	-	2	-	-	2	-	-	-	2	3	-
CO2	3	1	1	-	-	1	-	-	2	-	-	-	2	3	-
CO3	3	3	3	1	1	3	-	-	3	-	-	-	3	3	2
CO4	3	3	3	1	1	3	-	-	3	-	-	-	3	3	2
CO5	3	3	3	1	1	3	-	-	3	-	-	-	3	3	2

<table>
<tr><td colspan="6">Course Name: DATA STRUCTURES</td></tr>
<tr><td colspan="6">Course Code : CS662E06</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>PCC</td></tr>
<tr><td>Contact Hrs./ Week</td><td>2</td><td>0</td><td>2</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./ Sem.</td><td>30</td><td>0</td><td>30</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>2</td><td>0</td><td>1</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives: To understand the basic concept of data structures for storage and retrieval of ordered or unordered data. Data structures include: arrays, linked lists, binary trees, heaps, and hash tables.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: CS134/CS234</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 INTRODUCTION</td></tr>
<tr><td colspan="5">Definition- Classification of data structures: primitive and non-primitive- Operations on data structures- Algorithm Analysis- Simple Generic Classes and Interfaces</td><td>6</td></tr>
<tr><td colspan="6">Unit-2 LISTS, STACKS AND QUEUES</td></tr>
<tr><td colspan="5">Abstract Data Type (ADT) – The List ADT – The Stack ADT: Definition, Array representation of stack, Operations on stack: Infix, prefix and postfix notations Conversion of an arithmetic
The Queue ADT: Definition, Array representation of queue</td><td>6</td></tr>
<tr><td colspan="6">Unit-3TREES</td></tr>
<tr><td colspan="5">Preliminaries – Binary Trees – The Search Tree ADT – Binary Search Trees – AVL Trees – Tree Traversals – Hashing – General Idea – Hash Function – Separate Chaining</td><td>6</td></tr>
<tr><td colspan="6">Unit-4SORTING</td></tr>
<tr><td colspan="5">Preliminaries – Insertion Sort – Shell sort – Heap sort – Merge sort – Quicksort – External Sorting</td><td>6</td></tr>
<tr><td colspan="6">Unit-5 GRAPHS</td></tr>
</table>

Definitions – Topological Sort – Shortest-Path Algorithms – Unweighted Shortest Paths – Dijkstra's Algorithm – Minimum Spanning Tree – Prim's Algorithm	6
List of Experiments	**Practical Hours**
11. Implement the applications Stack ADT	**3**
12. Implement the applications for Queue ADT	**3**
13. Operations on stack[e.g.: infix to postfix, evaluation of postfix]	**3**
14. Search Tree ADT - Binary Search Tree	**3**
15. Heap Sort	**3**
16. Quick Sort	**3**
17. Applications of Probability and Queuing Theory Problems to be implemented using data structures	**3**
18. To determine the time complexity of a given logic.	**3**
19. Implementing a Hash function/Hashing Mechanism.	**3**
20. Implementing any of the shortest path algorithms	**3**
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:

CO1: Explain the basic concepts of datas tructures (Understand) (PO2,PO7)

CO2: Experiment with various operations on Stack and Queue Data structure (PO1, PO3, PO5)

CO3: Examine the Structures and Operations of Linked List and Trees Data Structures (Analyze) (PO1, PO2, PO3, PO5)

CO4: Choose various shortest path algorithms to determine the minimum spanning path for the given graphs (PO1, PO4)

CO5: Examine the applications of data structures through case study (PO1, PO2, PO3, PO4, PO7)

Text Books:

T1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in Java", 3rd Edition, Pearson Education 2013.

Reference Books:
R1. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser , "Data Structures and Algorithms in Java™", Sixth Edition, Wiley Publications, 2012.
R2..Duane A. Bailey , "Java Structures- Data Structures in Java for the Principled Programmer", 7th Edition, 2012
R3.Pat Morin, "Open Data Structures (in Java)", 0.1G Edition

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO's	**PO's**											**PSO's**		
CO1	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO2	**2**	**1**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	1	**-**	1	**-**
CO3	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	1	**-**	1	**-**
CO4	**3**	**3**	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	1	**-**	1	**-**
CO5	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	1	**-**	1	**-**

<table>
<tr><td colspan="6">Course Name: Python Programming for Engineers</td></tr>
<tr><td colspan="6">Course Code : CS662E07</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>OE</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>70</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>30</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3 hrs</td></tr>
<tr><td colspan="6">Course objectives:
Specifically, the course has the following objectives. By the end of the course, students will be able to:
• Develop a working knowledge for how computers operate and how computer programs are executed.
• Evolve critical thinking and problem-solving skills using an algorithmic approach.
• Learn about the programmer’s role in the software development process.
• Translate real-world issues into computer-solvable problems.</td></tr>
<tr><td colspan="6">Prerequisites: Basics of Computer Programming</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Introduction</td></tr>
<tr><td colspan="5">Basic methods offered by Python of formatting and outputting data, together with the primary kinds of data and numerical operators, their mutual relationships and binding .Introduce the concept of variables and variable naming conventions. Present the assignment operator, along with the rules governing the building of expressions .Introduce the inputting and converting of data.</td><td>09</td></tr>
<tr><td colspan="6">Unit-2 Conditional Statements Looping and array</td></tr>
<tr><td colspan="5">Concept of Boolean values, in order to compare difference values and to control the execution paths using the if and if-else instructions. Introduce the utilization of loops (while and for) and how to control their behavior using the break and continue instructions. Present the difference between logical and bitwise operations. Acquaint the student with the concept of lists and list processing, including the iteration provided by the for loop, and slicing. Explain the idea of multi-dimensional arrays.</td><td>09</td></tr>
<tr><td colspan="6">Unit-3 Functions</td></tr>
<tr><td colspan="5">Defining and using of functions–their rationale, purpose, conventions, and traps. Present the concept of passing arguments indifferent ways and setting their default values, along with the mechanisms of returning the function’s results. Explain names cope issues. Introduce new data aggregates– tuples and dictionaries –and show their role in data processing.</td><td>09</td></tr>
</table>

Unit-4 Modules	
Python modules: the irrationale, function, how to import the min different ways, and present the contents of some standard modules provided by Python. Present the way in which modules are coupled together to make packages. Acquaint the student with the concept of an exception and Python's implementation of it, including the try-except instruction, with its applications, and the raise instruction. Introduce strings and their specific methods, together with their similarities and differences compared to lists.	09
Unit-5 Fundamentals of OOP	
Fundamentals of OOP (Object Oriented Programming) and the way they are adopted in Python, showing the difference between OOP and the classical, procedural approach. Present the standard objective features: inheritance, abstraction, encapsulation, and polymorphism, along with Python-specific issues like instance vs. class variables, and Python's implementation of inheritance. Exceptions are discussed again in a more detailed way, showing their objective nature. Familiarize the student with Python's generators (the yield instruction) and closures (the lambda keyword). Demonstrate the means Python developers can use to process (create, read, and write) files	09
Course outcomes: 1. Demonstrate the basic methods of formatting, outputting data, kinds of data, operators and variables. 2. Interpret with the concepts of Boolean values, utilization of loops and operators. 3. Experiment with functions, passing arguments and data processing. 4. Illustrate the concept of modules, exceptions, strings and lists. 5. Apply the fundamentals of OOP and its implementation.	
Text Books: 1. Eric Matthes, "Python Crash Course", 2nd Edition: A Hands-On, Project-Based Introduction to Programming, No Starch Press, Inc, 2016 2. Paul Barry, "Head first Python", 2nd Edition, O'Reilly, 2017.	
Reference Books: R1: Paul Barry, "Head First Python: A Brain-Friendly Guide", Shroff/O'Reilly; Second edition (1 December 2016) R2: Martin C. Brown,"Python: The Complete Reference", McGraw Hill Education; Forth edition (20 March 2018)	

Online Resources:

1. https://www.netacad.com/courses/programming/pcap-programming-essentials-python
2. John Zelle, “Python Programming”, 3rd Edition, Franklin - Beedle Pub, 2017.
3. Allen Downey, “Learning with Python: How to Think Like a Computer Scientist”, 3rd Edition, Green Tea Press, 2019.
4. https://education.pythoninstitute.org/course_datas/display/97/789#
5. https://www.tutorialspoint.com/python/
6. https://www.python-course.eu/python3_input.php

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**2**	**1**											**1**		
CO2	**2**	**1**											**1**		
CO3	**2**	**1**			**1**								**1**		
CO4	**3**	**2**	**1**		**1**								**1**		
CO5	**3**	**3**	**2**	**1**	**1**								**1**		

Course Name: Machine Learning					
Course Code : CS662E08					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**2**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**

Course objectives:

- To understand the need for machine learning
- To discover supervised and unsupervised learning paradigm of machine learning
- To learn various machine learning techniques
- To design suitable machine learning algorithms for solving problems

Prerequisites: NIL

Units	**Teaching Hours**
Unit-1 Supervised Learning	
Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes. Linear models: Linear Regression, Logistic Regression, Generalized Linear Models. Support Vector Machines.	6
Unit-2 Unsupervised Learning	
Clustering: K-means/Kernel K-means,Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion.	6
Unit-3 Neural Networks	
Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics.	6
Unit-4 Bayesian and Computational Learning	
Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm.	6
Unit-5 Instance-Based, Analytical Learning and Inductive based Learning	

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning- Learning from perfect domain theories- Explanation based learning-Search control knowledge.	6
List of Experiments	**Practical Hours**
a. Experiment on supervised learning	6
6. Experiment on supervised learning	6
7. Experiment on unsupervised learning	6
8. Experiment on unsupervised learning	6
9. Experiment on neural network	6
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Describe various supervised learning methods(Understand) (PO1, PO2)
CO2: Discuss various unsupervised learning methods(Understand) (PO1, PO2)
CO3: Explain the basics of neural networks and back propagation algorithm for problem solving (Understand) (PO1, PO2, PO3)
CO4: Describe the usage of genetic algorithms in problem solving(Understand)) (PO1, PO2, PO3)
CO5: Use the concept of Bayesian theory to machine learning (Apply)

Text Books:
T1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
T2. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.

Reference Books:
R1. EthemAlpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
R2.Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
R3.T. Hastie, R. Tibshirani, J. H. Friedman, "The Elements of Statistical Learning", Springer; 1st edition, 2001.
R4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
R5.Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO											PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2											**1**		
CO2	2	2											**1**		
CO3			3	3	3								**1**		
CO4			3	3	3								**1**		
CO5			3	3	3								**1**		

Course Name: Cryptography and Network security					
Course Code : CS662E09					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	2	0	2	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**

Course objectives:
To understand the principles of encryption algorithms; conventional and public key cryptography. To have a detailed knowledge about authentication, hash functions and Network & application level security mechanisms.

Prerequisites: Computer Programming, Computer Networks

Units	Teaching Hours
Unit-1 Introduction	
OSI Security Architecture, Classical Encryption techniques, Cipher Principles, DES, Crypto analysis of DES, AES, Block Cipher Design Principles and Modes of Operation, Triple DES, Placement of Encryption Function, Traffic Confidentiality.	6
Unit-2 Public Key Cryptography	
Introduction to Number theory, Deffie Hellman Key Exchange, Key Management, Elliptic curve Cryptography, Confidentiality using Symmetric Encryption, Public Key Cryptography and RSA.	6
Unit-3 Authentication & Hash Functions	
Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Functions, MD5, SHA, RIPEMD and HMAC Standards	6
Unit-4 Network Security	
Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security.	6
Unit-5 Application Security	

Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems, CASE-Study	6
List of Experiments	**Practical Hours**
1. Study on generating Cipher text from Plain Text using DES algorithm	3
2. Study on generating Cipher text from Plain Text using AES algorithm	3
3. Develop a code which supports any one substitution Cipher	3
4. Develop a model to support Public Key Cryptography using RSA	3
5. Develop a code to generate Public and Private Keys using ECC	3
6. Develop a model to support Public Key Cryptography using Deffie-Hellman Algorithm	3
7. Study the frame work of an IT based organization for its strengths and weakness in terms of data security	3
8. Study on OPENSSL tool for evaluating the performance of RSA Algorithm	3
9. Study on OPENSSL tool for evaluating the performance Hash and Message Digest Algorithm	2
10. Study on OPENSSL tool for evaluating the performance of Digital Signature Standard	2
11. Study the relevance of X509 and Kerbros in real time environment.	2
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain various features of Security mechanisms and services to study Standard Block Ciphers along with their design principles CO2: Utlize the basic concepts and algorithms of Public key encryption mechanism for secure data transmission. CO3: Compare various Cryptographic authentications protocols, Hash Functions, Algorithms and Standards. CO4: Identify Various Protocols and Standards in Network Security CO5: Make use of various applications at system level security	

Text Books:
T1.William Stallings, "Cryptography and Network Security – Principles and Practices", 6th Edition, 2016.

Reference Books:
R1. AtulKahate, "Cryptography and Network Security", Tata McGraw-Hill, 2013.
R2.Bruce Schneier, "Applied Cryptography", John Wiley & Sons Inc, 2015.
R3.Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fifth Edition, Pearson Education, 2015.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	1	-	-	-	-	-	-	-	1	-	1
CO2	3	2	1	1	2	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-	-	1	-	1
CO5	3	2	1	1	2	-	-	-	-	-	-	-	1	-	1

Course Name: Service Oriented Architecture					
Course Code : CS662E10					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	2	0	2	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**

Course objectives:

- To provide an exposure to various software architectures.
- To provide an understanding of SOA Enterprise applications
- To enable the student to analyses and design models of SOA.

Prerequisites: Nil

Units	Teaching Hours
Unit-1 SERVICE ORIENTED ARCHITECTURE BASICS	
Software Architecture; Need for Software Architecture, Objectives of Software Architecture, Types of IT Architecture, Architecture Patterns and Styles, Service oriented Architecture; Service Orientation in Daily Life, Evolution of SOA, Drives for SOA, Dimension of SOA, Key components, perspective of SOA, Enterprise-wide SOA; Considerations for Enterprise-Wide SOA, Strawman Architecture For Enterprise-Wide-SOA-Enterprise	6
Unit-2 ENTERPRISE APPLICATIONS , SOFTWARE PLATFORMS FOR ENTERPRISE APPLICATIONS, SERVICE ORIENTED ENTERPRISE APPLICATIONS	
Enterprise Applications: Architecture Considerations, Solution Architecture for enterprise application, Software platforms for enterprise Applications: Package Application Platforms, Enterprise Application Platforms, Service-oriented-Enterprise Applications: Considerations for Service-Oriented Enterprise Applications, Patterns for SOA	6
Unit-3 SERVICE ORIENTED ARCHITECTURE ANALYSIS AND DESIGN	
SOA analysis and design: Need For Models, Principles of Service Design, Design of Activity Services, Design of Data services, Design of Client services and Design of business process services, Technologies of SOA.	6
Unit-4 SECURITY AND TRENDS IN SERVICE ORIENTED ARCHITECTURE	

Business case for SOA: Stakeholder OBJECTIVES, Benefits of SOA, Cost Savings, Return on Investment, SOA Governance, Security and implementation: SOA Governance, SOA Security, approach for enterprise wide SOA implementation	6
Unit-5 SERVICE ORIENTED ARCHITECTURE BEST PRACTICES AND TECHNOLOGIES	
SOA best practices, Basic SOA using REST. Role of WSDL, SOAP and JAVA/ XML Mapping in SOA. SOA Technologies-PoC: Loan Management System (LMS), PoC-Requirements Architectures of LMS.	6
List of Experiments	**Practical Hours**
1. Case study on Unit -1	6
2. Case study on Unit -2	6
3. Case study on Unit -3	6
4. Case study on Unit -4	6
5. Case study on Unit -5	6
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the different IT architectures (Remember) (PO3) CO2: Explain SOA based applications (Understand) (PO3) CO3: Examinethe SOA models (Apply) (PO3) CO4: Illustrate web service and realization of SOA (Apply) (PO3) CO5:Implement RESTful services (Apply) (PO3,PO6)	
Text Books: T1. Shankar Kambhampaly, "Service–Oriented Architecture for Enterprise Applications", Wiley Second Edition, 2014. T2. Mark D. Hansen, "SOA using Java Web Services", Practice Hall, 2007.	
Reference Books: R1. WaseemRoshen, "SOA-Based Enterprise Integration", Tata McGraw-Hill, 2009.	
Online Resources: NIL	
Mapping with Program Outcomes (POs)	

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1			1										1		
CO2			1										1		
CO3			2										1		
CO4			2										1		
CO5			2			1							1		

Course Name: Mobile Application Development					
Course Code : CS642E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
This course introduces the basic design and development of Mobile application and focuses on development of mobile application for Windows, Android and IOS.

Prerequisites: Basics of Programming, User Interface Design

Units	Teaching Hours
Unit-1 Introduction	
Introduction to mobile applications – cost of development - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications. Third party Frameworks. - Mobile Content- Mobile Applications.	9
Unit-2 BASIC DESIGN	
Introduction to Web Services– Web service language Format –Creating a Web service using Microsoft stack – Using the Linux Apache MySQL PHP (LAMP) Stack-Debugging Web Services. Mobile User Interface Design. -Mobile Web Apps Using HTML5.Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing 9environment – Design patterns for mobile applications.	9
Unit-3 TECHNOLOGY II – ANDROID 1	
Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.	9

Unit-4 TECHNOLOGY II – ANDROID 2	
Animating views - Scenes and Transitions, Frame Animations, Tween Animation, scale, rotate, translate, alpha, Interpolation, Canvas/Drawing into a view, Surface View/Surface Holder, Adding animations - Crossfading two views. Graphics: Graphics & Multimedia – Introduction to Graphics, displaying bitmaps, displaying graphics with OpenGL ES, defining and drawing shapes	9
Unit-5 TECHNOLOGY III - IOS	
Introduction to Objective C – iOS features – UI implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi – CASE STUDY- iPhone marketplace and mobile application development.	9
List of Experiments	**Practical Hours**
Self-study :	
Site/Industrial Visits :	

Course outcomes:
CO1: Explain the concepts in mobile applications and its development
CO2: Build interface for mobile applications and web applications.
CO3: Design mobile application for Android platform using primitive UI features, SQLite and GPS
CO4: Design a mobile application for Android platform using advanced features like animations and graphics.
CO5: Develop mobile application for IOS platform.

Text Books:
T1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, Wiley Publications, 2012.
T2. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, Manning Publications Co., 2012.

Reference Books:
R1. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012
R2. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	2	-	-	1	2	1	1	-	2	1	1
CO3	3	2	1	-	2	-	-	1	2	1	1	-	2	1	1
CO4	3	3	3	3	2	-	-	1	2	1	1	-	3	1	1
CO5	3	2	1	-	2	-	-	1	2	1	1	-	2	1	1

Course Name: Real Time Systems					
Course Code : CS642E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To know about the specification, design techniques, real time task communication, synchronization queuing models and integration of a Real Time System.					
Prerequisites: Operating System, Embedded Systems					

Units	Teaching Hours
Unit-1 Fundamentals of Real-Time Systems	
Concepts and Misconceptions – Definitions for Real-Time Systems - Usual Misconceptions - Multidisciplinary Design Challenges - Influencing Disciplines - Birth and Evolution of Real-Time Systems - Diversifying Applications - Advancements behind Modern Real-Time Systems	9
Unit-2 Hardware for Real-Time Systems	
Basic Processor Architecture – Memory Technologies – Architectural Advancements – Peripheral Interfacing – Microprocessor versus Microcontroller – Distributed Real-Time Architectures	9
Unit-3 Real-Time Operating Systems (RTOS)	
From Pseudo kernels to Operating Systems – Theoretical Foundations of Scheduling – System Services for Application Programs – Memory Management Issues – Selecting Real-Time Operating Systems	9
Unit-4 Programming Languages for Real-Time Systems	
Coding of Real-Time Software – Assembly Language - Procedural Languages – Object-Oriented Languages – Overview of Programming Languages – Automatic Code Generation – Compiler Optimizations of Code	9
Unit-5 Requirements Engineering Methodologies	

Requirements Engineering for Real-Time Systems – Formal Methods in System Specification - Semiformal Methods in System Specification - Qualities of Real-Time Software – Software Engineering Principles.	9
List of Experiments	**Practical Hours**

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Explain the fundamentals of real time systems, challenges and its applications
CO2: Explain the processor architectures like RTO, ARM memory technology and concepts of microprocessor and microcontroller.
CO3: Experiment the variety of scheduling mechanisms suitable for soft and hard real time systems.
CO4: Experiment using assembly, procedural, object-oriented language for real time systems.
CO5: Design and implement systems that support real-time applications.

Text Books:
T1. Philip A. Laplante and Seppo J. Ovaska, "Real time system design and analysis" 2012 Fourth Edition Wiley India Pvt Ltd.

Reference Books:
R1. Hermann Kopetz, "Real-Time Systems: Design Principles for Distributed Embedded Applications", 2011
R2. Jane W. S. Liu, "Real-Time Systems", 2009
R3.M. Krishna and Kang G Shin, "Real time systems", TMH, 2009
R4.Stuart Bennelt, "Real time computer control – and introduction", Pearson education, 2003
R5.Allen Burns, Andy Wellings, "Real Time Systems and Programming Languages", Pearson Education, 2003

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	-	-	-	-	-	2	-	-	1	2	-	-	-	-
CO2	2	-	-	-	-	2	2	-	-	2	2	-	-	-	-
CO3	3	3	3	3	3	-	-	-	2	-	3	2	-	-	-
CO4	3	2	3	3	3	-	1	-	-	-	3	1	-	-	-

CO5	1	1	-	-	1	-	-	-	3	2		1	-	-	-

Course Name: Advanced Databases					
Course Code : CS642E03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	3	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: Provides insight on the needs of different databases, data models, get familiarized with transaction management and intelligent of the database.					
Prerequisites: : Database Management Systems					

Units	Teaching Hours
Unit-1 DATABASE MANAGEMENT	
Relational Data Model – SQL - Database Design - Entity-Relationship Model – Relational Normalization – EER- Relational Database Design Using ER-to-Relational Mapping -Mapping EER Model Constructs to Relations	9
Unit-2 ADVANCED DATABASES	
Object Databases – Object database Extensions to SQL-ODMG and ODL – Object Database Conceptual Design – XML Hierarchical model– XML Documents DTD and XML Schema – Distributed Data bases – Types and Architectures- data fragmentation, Replication and Allocation Techniques.s	9
Unit-3 QUERY AND TRANSACTION PROCESSING	
Query Processing Basics – Heuristic Optimization –Selectivity, Cost, Size Estimation – Transaction and System Concepts-Properties of Transactions – Architecture – Characterizing Schedules Based on Recoverability – Characterizing Schedules Based on Serializability –Transaction Support in SQL	9
Unit-4 CONCURRENCY CONTROL AND RECOVERY	

Concurrency Control – Two-Phase Locking Techniques for Concurrency Control - Concurrency Control Based on Timestamp Ordering - Multiversion Concurrency Control Techniques - Granularity of Data Items and Multiple Granularity Locking- Recovery Concepts- Recovery Techniques Based on Immediate Update- The ARIES Recovery Algorithm - Recovery in Multidatabase Systems.	9
Unit-5 DATABASE SECURITY	
Introduction to Database Security Issues- Discretionary Access Control Based on Granting and Revoking Privileges- Mandatory Access Control and Role-Based Access Control for Multilevel Security - SQL Injection- Statistical Database Security- Flow Control- Encryption and Public Key Infrastructures-Privacy Issues and Preservation- Challenges of Database Security- Oracle Label-Based Security.	9

Self-study : NA

Site/Industrial Visits :NA

Course outcomes:
CO1: Explain the fundamental concepts of databases and Entity-Relationship (E-R) model.
CO2: Apply the object database concepts and object model for real time database applications.
CO3: Examine Web, semi structured data and XML queries.
CO4: Apply database model, triggers
CO5: Explain the concept of various database.

Text Books:
T1. R. Elmasri and S.B. Navathe, "Fundamentals of Database Systems", 6th Edition, Addison Wesley, 2010
T2. Abraham Silberschatz, Henry. F. Korth, S.Sudharsan, "Database System Concepts", 6th Edition., Tata McGraw Hill, 2010

Reference Books:
R1. Raghu Ramakrishnan& Johannes Gehrke, "Database Management Systems", 3rd Edition, TMH, 2003
R2. Philip M. Lewis, Arthur Bernstein, Michael Kifer, "Databases and Transaction Processing: An Application-Oriented Approach", Addison-Wesley, 2002.

Online Resources: NIL

Mapping with Program Outcomes (POs)

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

CO1	3	2	2	2	2	-	-	-	-	-	-	-	-	1	-
CO2	3	2	2	2	2	-	-	-	-	-	-	-	-	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	2	2	-	-	-	-	-	-	-	-	-	1	-

Course Name: Computer Oriented Numerical Analysis					
Course Code : CS642E04					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
With the present development of the computer technology, it is necessary to develop efficient algorithms for solving problems in science, engineering and technology. This course gives a complete procedure for solving different kinds of problems occur in engineering numerically.

Prerequisites: Mathematics I and Mathematics II.

Units	**Teaching Hours**
Unit-1 SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	
Introduction to Errors and their computations. Linear interpolation methods (method of false position) – Newton's method, Solution of linear system by Gaussian elimination and Gauss-Jordon methods- Iterative methods: Gauss Jacobi and Gauss-Seidel methods- Inverse of a matrix by Gauss Jordon method – Eigenvalue of a matrix by power method.	9
Unit-2 INTERPOLATION AND APPROXIMATION	
Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.	9
Unit-3 NUMERICAL DIFFERENTIATION AND INTEGRATION	
Derivatives from difference tables – Divided differences and finite differences –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpson's rules.	9
Unit-4 INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	

Single step methods: Taylor series method – Euler and modified Euler methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods.	9
Unit-5 BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATION	
Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit methods – One dimensional wave equation and two dimensional Laplace and Poisson equations- Case Studies - implement concepts using python	9
List of Experiments	**Practical Hours**
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Illustrate the interpretation and convergence criteria of numerical errors in Linear Interpolation techniques CO2: Solve a range of problems numerically based on Interpolation and Approximation. CO3: Plan approximate solutions for Numerical Differentiation and Integration and to validate its effectiveness CO4: Examine the accuracy of Initial Value problems for Ordinary Differential equations. CO5: Evaluate mathematical models for Boundary value problems in ordinary and partial differential equations.	
Text Books: T1. JaanKiusalaas, "Numerical Methods in Engineering with Python", Cambridge University Press; 3rd Edition, 2013 (REPRINT) T2. P. B. Patil, U. P. Verma , "Numerical Computational Methods" , Alpha Science Intl Ltd., Revised Edition Reprint 2013.(REPRINT) T3. J. N. Sharma , "Numerical Methods for Engineers and Scientists", Alpha Science Intl Ltd., 2nd Edition Reprint 2008.(REPRINT) t4.P. Dechaumphai, N. Wansophark , "Numerical Methods in Engineering Theories with MATLAB, Fortran, C and Pascal Programs", Alpha Science Intl Ltd., 2015. (REPRINT) T5. E. Balagurusamy, "Numerical Methods", Tata McGraw-Hill Pub. Co. Ltd, Reprint Edition, 2008.(REPRINT) T6.V. Rajaraman "Computer Oriented Numerical Methods", PHI, 5th Edition.(REPRINT)	

Reference Books:
R1.P. Kandasamy, K. Thilagavathy, and K. Gunavathy, “Numerical Methods”, S.Chand Co. Ltd., New Delhi, 2003. (Reprint)
R2. C.F Gerald, and P.O Wheatley, “Applied Numerical Analysis”, 6th Edition, Pearson Education Asia, New Delhi, 2002.(Reprint)
R3. Burden, R.L and Faires, T.D., “Numerical Analysis”, 7th Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.(Reprint)

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	3	2	-	-	-	-	-	-	-	-	-	1	1

Course Name: Object Oriented Analysis and Design					
Course Code : CS642E05					
	L	T	P	Category	PEC
Contact Hrs./Week	3	0	0	CIA Marks	50
50Contact Hrs./Sem.	45	0	0	ESE Marks	50
Credits.	3	0	0	Exam Hours	3

Course objectives:
To understand the object oriented life cycle; To know how to identify objects, relationships, services and attributes through UML; To understand the use-case diagrams; To know the Object Oriented Design process; To know about software quality and usability.

Prerequisites: Software Engineering

Units	Teaching Hours
Unit-1 INTRODUCTION	
An Overview of Object Oriented Systems Development - Object and Classes Basics – Object Oriented Systems Development Life Cycle	9
Unit-2 OBJECT ORIENTED METHODOLOGIES	
Rumbaugh Methodology - Booch Methodology - Jacobson Methodology - Patterns – Frameworks – Unified Approach – Unified Process Model – Unified Modeling Language – Use case - class diagram - Interactive Diagram - Package Diagram - Collaboration Diagram - State Diagram - Activity Diagram.	9
Unit-3 OBJECT ORIENTED ANALYSIS	
Identifying use cases - Object Analysis - Classification – Identifying Object relationships - Attributes and Methods.	9
Unit-4 OBJECT ORIENTED DESIGN	
Design axioms - Designing Classes – Access Layer - Object Storage - Object Interoperability.	9
Unit-5 SOFTWARE QUALITY AND USABILITY	

Designing Interface Objects – Software Quality Assurance – System Usability - Measuring User Satisfaction – Case Study	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Explain the basic concepts and the lifecycle of Object -Oriented System Development
CO2: Develop UML diagrams based on Unified Approach
CO3: Draw Class diagrams for Real Time Systems
CO4: Demonstrate the concept of design axioms and object interoperability in Modeling Language.
CO5: Validate UML frameworks for real world systems with assured quality and user satisfaction

Text Books:
T1. Ali Bahrami, "Object Oriented Systems Development", Tata McGraw-Hill, 2008 (Unit I, III, IV, V).
T2.Martin Fowler, "UML Distilled", Third Edition, PHI/Pearson Education, 2011 Edition. (UNIT II).

Reference Books:
R1.Robert A. Maksimchuk , Bobbi J. Young ,Grady Booch , Jim Conallen , Michael W. Engel , Kelli A. Houston, "Object-Oriented Analysis and Design with Applications", Pearson India, 3rd Edition 2009.
R2. James Rumbaugh, Ivar Jacobson, Grady Booch "The Unified Modeling Language User Guide", Pearson Education, 2nd Edition, 2007.
R3. Hans-Erik Eriksson, Magnus Penker, Brain Lyons, David Fado, "UML2 Toolkit", OMG Press Wiley Publishing Inc., 1st Edition 2011

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	1	-	-	-	-	-	-	-	-	1	-
CO2	3	2	1	-	2	-	-	-	-	-	1	1	-	2	-
CO3	3	3	2	2	2	-	-	-	-	-	1	1	-	2	-
CO4	3	2	1	-	2	-	-	-	-	-	-	-	-	2	-
CO5	3	3	3	3	3	-	-	-	-	-	1	1	-	2	-

Course Name: System Software					
Course Code : CS642E06					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	3	0	0	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
To understand the relationship between system software and machine architecture; To know the design and implementation of assemblers; To know the design and implementation of linkers and loaders; To have an understanding of macro processors; To have an understanding of system software tools.

Prerequisites: Software Engineering

Units	Teaching Hours
Unit-1 MACHINE STRUCTURE AND EVOLUTION OF A PROGRAMMING SYSTEM	
Introduction to System Software, Components of System Software, Evolution of System Software, Assembler, Loader, Macros, Compilers, Simplified Instructional Computer: SIC machine architecture, SIC/XE machine architecture, SIC programming examples.	9
Unit-2 ASSEMBLER	
Basic assembler functions (SIC assembler, algorithm and data structure), Machine dependent assembler features (Instruction formats and addressing modes, program relocation), Machine independent assembly features (Literals, Symbol defining statements, expressions, program blocks, control sections and program linking), Assembler design options (One pass assembler, multi pass assembler)	9
Unit-3 LOADERS AND LINKERS	
Basic loader functions (Design of an absolute loader, simple bootstrap loader), Machine dependent loader features (Relocation, program linking, algorithm and data structures for a linking loader), Machine independent loader features (Automatic library search, loader options), Loader design options (Linkage editor, dynamic linking, bootstrap loaders).	9

Unit-4 MACRO PROCESSOR	
Macro Instructions, Features of a macro facility (Macro instruction arguments, Conditional macro expansion, Macro calls within macro, Macro instructions defining macros), Implementation (Two pass algorithm, Single pass algorithm).	9
Unit-5 COMPILERS	
Part1: Basic elements, Syntactic units and interpreting meaning, Intermediate form (Arithmetic statements, Non-arithmetic statements, Non-executable statements), Storage allocation, Code generation, Optimization (Machine independent, Machine dependent, Assembly phase). **Part2:** Phases of the compiler (Lexical phase, Syntax phase, Interpretation phase, Optimization, Storage assignment, Code generation, Assembly phase), Passes of a compiler. Case study.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Summarize the basic concepts of SIC and SIC/XE architecture.
CO2: Make Use of the concept of assembler according to SIC and SIC/XE architecture with real world cases.
CO3: Utilize the detailed working of linker and loader with respect to SIC and SIC/XE architecture for real world cases .
CO4: Make use of Microprocessor functionalities according to SIC and SIC/XE architecture with real world cases
CO5: Examine the role of compiler in programming environment.

Text Books:
T1. Donovan, "John, System programming", Tata McGraw-Hill, Reprint 2008 Beck, Leland,

T2. "System Software An Introduction to System Programming", Addison-Wesley, 3rd Edition, Reprint 2009II).

Reference Books:
R1. Dhamdhere D M, "Systems programming and operating systems", Tata McGraw-Hill, Reprint 2006.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	1	-	-	-	-	1	-	-	2	3	-
CO2	3	2	1	1	2	-	-	-	1	1	-	1	3	3	1
CO3	3	2	1	1	2	-	-	-	1	1	-	1	3	3	1
CO4	3	2	1	1	2	-	-	-	1	1	-	1	2	3	-
CO5	3	3	2	2	2	-	-	-	1	1	-	1	2	3	-

Course Name: Data warehousing and Data mining					
Course Code : CS642E07					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
To introduce the necessary background of data warehouse, the basic data mining algorithms and its applications. Syllabus focuses on data warehousing architecture, Multidimensional Data Model, Pre-processing, Association rule mining, Classification, Prediction , Clustering and Recent trends in higher order database systems

Prerequisites: Database Management System

Units	Teaching Hours
Unit-1 INTRODUCTION AND DATA WAREHOUSING	
Introduction, Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Implementation, Further Development, Data Warehousing to Data Mining	9
Unit-2 DATA PREPROCESSING, LANGUAGE, ARCHITECTURES, CONCEPT DESCRIPTION	
Why Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation, Data Mining Primitives, Query Language, Graphical User Interfaces, Architectures, Concept Description, Data Generalization, Characterizations, Class Comparisons, Descriptive Statistical Measures.	9
Unit-3 ASSOCIATION RULES	
Association Rule Mining, Single-Dimensional Boolean Association Rules from Transactional Databases, Multi-Level Association Rules from Transaction Databases	9
Unit-4 CLASSIFICATION AND CLUSTERING	

Classification and Prediction, Issues, Decision Tree Induction, Bayesian Classification, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Cluster Analysis, Types of data, Categorization of methods, Partitioning methods, Outlier Analysis.	9
Unit-5 RECENT TRENDS	
Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Databases, Multimedia Databases, Time Series and Sequence Data, Text Databases, World Wide Web, Applications and Trends in Data Mining	9
Self-study :	
Site/Industrial Visits :	
Course outcomes: CO1: Identify the differences between relational database and data warehouses, the need for data warehousing to formulate the decision support system an engineering specialization for the prediction and modelling to complex engineering activities CO2: Summarize the dominant data warehousing architectures and analyse their implementation details to develop multidimensional data models to analyse complex engineering problems. CO3: Implement various data pre-processing techniques to design data warehouses that meet the specified needs of the society with appropriate environmental considerations CO4: Analyse the various clustering and classification algorithm functionalities and evaluate their merits and demerits to acquire research based knowledge for the synthesis of the information to provide valid conclusion CO5: Explain advanced data mining concepts and outline their scope of providing IT solutions for different domains which helps in the betterment of life	
Text Books: T1. J. Han, M. Kamber, “Data Mining: Concepts and Techniques”, Harcourt India / Morgan Kauffman, 2011. T2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.	
Reference Books: R1.K.P.Soman, ShyamDiwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI, 2012 R2. David Hand, Heikki Manila, PadhraicSymth, “Principles of Data Mining”, PHI 2012. R3. W.H.Inmon, “Building the Data Warehouse”, 3rd Edition, Wiley, 2011. R4. Alex Bezon, Stephen J.Smith, “Data Warehousing, Data Mining & OLAP”, MeGraw-Hill Edition, 2001 R5. PaulrajPonniah, “Data Warehousing Fundamentals”, Wiley-Interscience Publication, 2003.	
Online Resources: Nil	

Mapping with Program Outcomes (POs)															
CO	**PO**											**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**3**	**2**	**1**	**1**	**3**	-	1	3	-	-	-	3	2	2	1
CO2	**2**	**1**	-	-	**2**	-	1	3	-	-	-	3	1	1	1
CO3	**3**	**2**	**1**	**1**	**3**	-	-	-	-	-	1	3	1	1	1
CO4	**3**	**3**	**2**	**2**	**3**	-	-	-	-	-	1	3	1	1	1
CO5	**3**	**3**	**3**	**3**	**3**	-	-	-	-	1		3	1	1	1

Course Name: Design patterns					
Course Code : IT642E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
The students should develop an understanding of the tools and techniques that may be used for the automatic analysis and evaluation of software; To build foundation on different patterns and Software Engineering Models

Prerequisites: Software Engineering, Programming Paradigms.

Units	Teaching Hours
Unit-1 SINGLE RESPONSIBILITY PRINCIPLE AND OPEN/CLOSED PRINCIPLE	
Single Responsibility principle: Problem statement - SRP and the Decorator pattern - Using the Strategy pattern instead of switch - Conclusion - Open/ Closed Principle: Introduction to Open/Closed principle - Extension points - Protected variation – Conclusion.	9
Unit-2 LISKOV SUBSTITUTION PRINCIPLE AND INTERFACE SEGREGATION	
Liskov Substitution principle: Introduction to the Liskoc substitution principle - Cotracts - Covariance and contra variance - Conclusion - Interface segregation: A segregation example - Client construction - Splitting interfaces – Conclusion.	9
Unit-3 DEPENDENCY INJECTION	
Dependency injection: Humble beginnings - Beyond simple injection – conclusion.	9
Unit-4 CREATIONAL AND STRUCTURAL PATTERNS	
Creational Patterns: Abstract Factory - Builder - Factory Method - Prototype - Singleton - Structural Patterns: Adapter - Bridge - Composite - Decorator - Facade - Flyweight – Proxy.	9
Unit-5 BEHAVIORAL PATTERNS AND COMMON PATTERNS	

Behavioral Patterns: Chain of Responsibility - Command - Interpreter - Iterator - Mediator - Memento - Observer - State - Strategy - Template Method - Visitor – Case study-Common Patterns: Null Object - Simple Factory - Model View Controller - Layers - Sample 3-Tier Application..	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Describe the SOLID principle as major design principles.
CO2: Implement the efficient coding practices learnt.
CO3: Examine Creational design patterns to exploit object creation.
CO4: Interpret Structural design patterns to understand the class-object relation.
CO5: Justify Behavioral design patterns to analyze the class behavior..

Text Books:
T1.Gary Mclean Hall, "Adaptive Code via C#", Microsoft Press, 2014.
T2.Tony Bevis, "C# Design Pattern Essentials", 2012..

Reference Books:
R1. Bishop, "Design Patterns C# 3.0", O'REILLY , 2008
R2.Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson, "Head First Design Patterns", O'REILLY, 2004
R3.Steven John Metsker, "Design Patterns in C# (Software Patterns)", Addison Wesley, 1st Edition 2004.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	1	-	1	3	-	-	-	3	3	-	-
CO2	3	2	1	1	2	-	1	3	-	-	-	3	3	-	-
CO3	3	2	1	1	2	-	-	-	-	-	1	3	3	-	-
CO4	3	2	1	1	2	-	-	-	-	-	1	3	3	-	-
CO5	3	3	2	2	3	-	-	-	-	1	-	3	3	-	-

<table>
<tr><td colspan="6" align="center">Course Name: Design Thinking</td></tr>
<tr><td colspan="6" align="center">Course Code : CS642C01</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td align="right">Category</td><td>PEC</td></tr>
<tr><td>Contact Hrs./Week</td><td>0</td><td>0</td><td>2</td><td align="right">CIA Marks</td><td></td></tr>
<tr><td>Contact Hrs./Sem.</td><td>0</td><td>0</td><td>30</td><td align="right">ESE Marks</td><td></td></tr>
<tr><td>Credits.</td><td>0</td><td>0</td><td>1</td><td align="right">Exam Hours</td><td></td></tr>
<tr><td colspan="6">Course objectives:
The subject reveals about different design working models and visualization processes. The Prototyping sample creation using various tools and applying the gained design thinking knowledge in real time domains.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Design Patterns, User Interface Design Concepts</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="5">List of Experiments</td><td>Practical Hours</td></tr>
<tr><td colspan="5">Why Design Thinking, The Design Process, Design Brief, Visualization, Ethnograph, Identifying Insights (using Mind-Mapping design tool), Assumption Testing, Prototyping, Co-Creation, Applying Design Thinking</td><td>15</td></tr>
<tr><td colspan="6">Self-study : NA</td></tr>
<tr><td colspan="6">Site/Industrial Visits : NA</td></tr>
<tr><td colspan="6">Course outcomes:
CO1: Demonstrate the usage of qualitative data analysis tools like Ethnograph and design tools like Mind-Mapping in identifying, creating sample prototypes, visualizing and testing the designs.
CO2: Experiment the knowledge gained in design thinking by solving real world problems.</td></tr>
<tr><td colspan="6">Online Resources: NIL</td></tr>
<tr><td colspan="6">Reference Books:</td></tr>
<tr><td colspan="6">Online Resources:</td></tr>
<tr><td colspan="6">Mapping with Program Outcomes (POs)</td></tr>
<tr><td>CO</td><td colspan="4" align="center">PO</td><td>PSO</td></tr>
</table>

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	3	-	-	-	-	-	-	-	3	1	1
CO2	3	-	1	1	3	-	-	-	3	-	3	-	3	1	1

Course Name: Scrum & Agile					
Course Code : CS642C02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	
Course objectives: The understanding of scrum and agile models by adopting the moral principles and values in the working environment are explained in detail. The monitoring process to bring team work in an effective way has been described.					
Prerequisites: Software Engineering, Object Oriented Analysis and Design					
Units					**Teaching Hours**
List of Experiments					**Practical Hours**

Planning Agile Projects, Planning for Agile Teams • Scrum Teams • XP Teams • General Agile Teams • Collaboration Rooms • Team Distribution, Agile Project Lifecycles • Typical Agile Project Lifecycles • Activities within each Phase • Create product vision • Producing a Minimum Marketable Feature, Release Planning • Creating the Product Backlog • User Stories • Prioritizing and Estimating • Creating the Release Plan, Monitoring and Adapting • Task Boards and Information Radiators • Control Limits, Variance and Trend Analysis • Managing Risks and Issues • Retrospectives, Introduction to Scrum • Scrum as a force for Organizational Change • Scrum Artifacts, Meetings, and Roles • Scrum Master vs. Project Manager, Definition of Done • Why all the meetings?, Scrum Team Simulation • Scrum is a Team Sport, Additional Scrum Topics • Simple but difficult • Common misunderstandings	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Explain the planning process for agile and scrum project teams, product vision, distribution, release charts with continuous monitoring techniques.
CO2: Determine the assessment criteria and deliver business values by adopting Agile Values and Principles
CO3: Categorize the roles, events and artefacts of Scrum with tracking and reporting progress by improving the process retrospectively.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	2	-	1	-	-	3	-	-	-	-	-	-	2	-
CO2	3	-	-	2	-	-	3	-	3	-	3	-	-	2	-
CO3	-	-	-	-	-	-	-	2	3	2	3	-	-	-	1

Course Name: Lean Six Sigma					
Course Code : CS642C03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
Introduction about the Syllabus and contents to be covered in this syllabus

Prerequisites: NA

Units	Teaching Hours
Unit-1 Defining a Six Sigma Project, Quality Management, Quality Tools	
Defining a Six Sigma Project. You will learn to avoid common mistakes when defining your Six Sigma projects. These include making the scope too broad, considering too many Ys (outputs) for improvement. You will also learn to avoid having multiple goals and process owners across numerous departments. Quality Management. Green Belt training deals partly with implementing and improving standards. During training, you will learn how to proliferate a quality management system, with appropriate procedures. Moreover, you will learn how to use Six Sigma to identify potential improvement opportunities. You will also develop your ability to identify worthy problems to tackle, as well as how to recognize 'just do it' situations. Quality Tools. Our Green Belt course teaches basic quality tools and how to use them. Check sheets, Pareto charts, scatter plots, bar charts, pie charts, time series plots, histograms, and box plots.	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Learn the core principles of Lean Six Sigma,
CO2: Adapt Green Belt training tool to promote quality management system.

Text Books:
T1. 1. Six Sigma For Dummiesby CraigGygi, Neil DeCarlo.

Online Resources: NIL

Reference Books: Nil

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**2**	**1**							**1**	**2**			1	2	2
CO2	3	3	2	2		3			2						

Course Name: Project Management Tool					
Course Code : CS642C04					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
To provide various modern tools and techniques for Software Project modelling and management, also it provide students a systematic approach to initiate, plan, execute, control and close a software project and understanding of the financial and risk aspects of various projects.

Prerequisites: Software Engineering , Object Oriented Analysis and Design

Units	Teaching Hours
Unit-1	
Project Modelling and Management with Applications in MS-Project: Project Management Simulation Exercise – Scope, Resources, & Scheduling, An Introduction to MS-Project, Interpreting the output of an MS-Project Report, Applications to Technical Scheduling and Resource Scheduling, Resource Levelling, Tracking and Monitoring Project Progress, Modern tools for Project Management (TILOS, Bentley, SD BIM Modelling, RIB2), Financial & Risk Aspects of Projects, Application of Financial Techniques for Analysis of Projects (NPV, IRR, Payback, Discounted Payback), Earned Value Management, the PMI Standard, and the ANSI/EIA-748-B Standard for EVM Systems, Project Budgeting & Cost Control, Project Cost Estimation & Cost Reduction Strategies for Ongoing Projects, Workshop on Risk Assessment & Management in Projects, Financial Risk Assessment, Designing a Project Risk Management Plan (Risk Identification, Risk Prioritization, Risk Response, Risk Management Strategies)	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Demonstrate project progress and scheduling using MS-Project Tool.
CO2: Adapt various modern tools for project modelling and management.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-	1

Course Name: Fog Computing					
Course Code : CS642C05					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
The basic components of object oriented system development with five methodologies are explained. The Unified Modeling Language oriented with unified approach has been demonstrated. The second part of the content gives detailed knowledge in Object Oriented analysis and design phases followed by maintenance and monitoring activities of delivered software products.

Prerequisites: CS632- Object Oriented Analysis and Design, CS532 – Software Engineering

Units	Teaching Hours
Unit-1	
What Is It?, Examples of Fog Applications, When to Consider Fog Computing, How Does Fog Work?, Benefits of Fog Computing	15

Self-study :

Site/Industrial Visits :

Course outcomes:
CO1: Investigate financial and risk aspects of the software projects.
CO2: Explain the working mechanism of fog computing and its benefits.
CO3 : Illustrate the application of fog computing in real world scenarios

Online Resources: NIL

Reference Books:

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	2	3	_	_	_	_	_	_	_	2	_	1
CO2	3	2	1		3	_	3	_	_	_	_	_	1	_	_
CO3	3		2	2	3	_	_	_	3		3	_	_	2	_

Course Name: Dew Computing					
Course Code : CS642C06					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
The courses on Dew computing fully realize the potentials of computers and cloud services.

Prerequisites: Cloud computing

Units	**Teaching Hours**
Unit-1	
Introduction to Dew Computing-Definition of Computing, Dew Computing Architecture, Components of the Dew Computing architecture, Categories of Dew computing-Web in Dew-Storage in Dew-Database in Dew- Software in Dew-Platform in Dew- Infrastructure as Dew- Data in Dew, Dew Computing and Its Applications.	15

Self-study :

Site/Industrial Visits :

Course outcomes:
CO1: Illustrate the architecture and categories of Dew computing
CO2: Classify various dew computing application based on its category

Text Books:
T1: Wang, Yingwei (2015-09-16). "Cloud-dew architecture". International Journal of Cloud Computing (IJCC). 4(3): 199–210.

Reference Books:

R1. Yingwei, Wang, (2015). "The initial definition of dew computing". Dew Computing Research.

R2. Yingwei (2016). "Definition and Categorization of Dew Computing". Open Journal of Cloud Computing. 3 (1). ISSN 2199-1987.

Online Resources:

W1. Y. Wang, "The Initial Definition of Dew Computing," Dew Computing Research, http://www.dewcomputing.org/index.php/2015/11/10/the-initial-definition-of-dew-computing/, accessed April 8, 2016.

W2. Y. Wang. (2015, Nov. 12). The relationships among cloud computing, fog computing, and dew computing, dew computing research [Online]. Available: http://www.dewcomputing.org/index.php/2015/11/12/the-relationships-among-cloud-computing-fog-computing-and-dew-computing.

W3. https://github.com/yingweiwang/dewblock

W4. Dewblock. [Online]. Available: http: //www.dewblock.com/

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1	1	**-**	**-**
CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	1	**-**	1	**-**

Course Name: Cognitive Computing					
Course Code : CS642C07					
	L	**T**	**P**	Category	
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
To study Cognitive Computing, Deep Learning Applications, Cognitive Systems Fundamentals, Cognitive Systems and Reasoning, Cognitive System Design Principles. Building Cognitive Applications, Application of Cognitive Computing and Systems.

Prerequisites: Internet and Web Programing

Units	**Teaching Hours**
Unit-1	
Introduction to Cognitive Computing, Building Cognitive Applications, Building Deep Learning Applications, Cognitive Systems Fundamentals, Cognitive Systems and Reasoning, Cognitive System Design Principles. Building Cognitive Applications, Application of Cognitive Computing and Systems	15

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1:Explain the fundamentals of Cognitive Systems and their design principles. (Understand)(PO1,PO2,PO5)
CO2: Understand Cognitive Computing, Cognitive systems and reasoning.(Understand) (PO1,PO2,PO3,PO4,PO5,PO11)
CO3: Design Deep learning applications(Apply) (PO1,PO2,PO3,PO5,PO6,PO7,PO8,PO9,PO10,PO12)
CO4: Design Cognitive applications and Cognitive Computing Systems (Apply) (PO1,PO2,PO3,PO4,PO5,PO6,PO8,PO9)

Text Books:
T1. Judith S. Hurwitz, Marcia Kaufman, Adrian Bowles, "Cognitive Computing and Big Data Analytics", Wiely Publication 2015

Reference Books:
R1. Vijay V Raghavan, Venkat N. Gudivada, VenuGovindaraju, "Cognitive Computing: Theory and Applications", 2016, Elsevier B.V
Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	1		1										
CO2	3	2	1	2	1						2				
CO3	3	1	3		1	1	2	1	2	1		1			
CO4	3	1	3	2	1	1		1	2						

Course Name: Unix System Programming					
Course Code : CS743E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
This course will enable the student to understand the UNIX file organization and management, various system calls, process architecture, process control, scheduling and memory management in Unix Internals.

Prerequisites: Basics of CSE CS134/CS234, Operating Systems CS332

Units	**Teaching Hours**
Unit-1 General Overview of the System	
History – System structure – User perspective – Operating system services – Assumptions about hardware. Introduction to the Kernel: Architecture of the UNIX operating system – Introduction to system concepts – Kernel data structures – System administration – Summary and Preview.	9
Unit-2 Buffer Cache and Internal Representation Of Files	
Buffer headers – Structure of the buffer pool – Advantages and disadvantages of the buffer cache. Internal Representation Of Files: Inodes – Structure of a regular file – Directories – Conversion of a path name to an I-node – Super block – Other file types.	9
Unit- 3 System Calls For File System	
Open – Read – Write – File and record locking – Adjusting the position of file I/O –LSEEK – Close – File creation – Creation of special files – Pipes – Dup – Mounting and un mounting file systems	9
Unit-4 The Structure of Processes	
Process states and transitions – Layout of system memory – The context of a process – Saving the context of a process. Process Control: Process creation – Signals – Process termination – Awaiting process termination – Invoking other programs – The shell – System boot and the INIT process.	9

Unit-5 Process Scheduling, Memory Management and I/Os	
Process Scheduling And Time: Process Scheduling –System Calls for time-Clock. Memory Management Policies : Swapping – A hybrid system with swapping and demand paging. The I/O Subsystem : Driver Interfaces– Disk Drivers-Terminal Drivers. Case study: System calls.	9
List of Experiments : NIL	**Practical Hours**

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Explain the architecture of UNIX operating systems and Kernel.
CO2: Explain the internal representation of files and the concept of buffer cache in Unix OS.
CO3: Examine system calls for UNIX file system with their implementation.
CO4 :Explain the structure of processes and process control mechanisms in Unix OS.
CO5: Analyze process scheduling and memory management policies and explain I/O subsystem in Unix OS.

Text Books:
T1. Maurice J. Bach, "The Design of the Unix Operating System", Edition 15, Prentice Hall of India, 2012.
T2. Uresh Vahalia, "Unix Internals: The New Frontiers", Prentice Hall, Edition 2-2010

Reference Books:
R1. Kay A. Robbins, Steven Robbins, "Unix Systems Programming", Prentice Hall Professional, 2008.
R2. J. Leffler, M. K. Mckusick, M. J. Karels and J. S. Quarterman., "The Design And Implementation of the 4.3 BSD Unix Operating System", Addison Wesley, 1998.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2												**1**		
CO2	2		1										**1**		
CO3	2	1											**1**		
CO4	2												**1**		
CO5	2		2										**1**		

Course Name: TCP/IP Design and Implementation					
Course Code : CS743E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
In this course we study about basic functionalities of TCP/IP protocol, internals of TCP/IP, implementation of the TCP/IP protocols and understands the interaction among the protocols in a protocol stack and timer management.

Prerequisites:

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Internetworking concepts and architectural model- classful Internet address – CIDR-Subnetting and Supernetting –ARP- RARP- IP – IP Routing –ICMP – Ipv6	9
Unit-2 TCP	
Services – header – connection establishment and termination- interactive data flow- bulk data flow- timeout and retransmission – persist timer - keepalive timer- futures and performance	9
Unit-3 IP IMPLEMENTATION	
IP global software organization – routing table- routing algorithms-fragmentation and reassembly- error processing (ICMP) –Multicast Processing (IGMP)	9
Unit-4 TCP IMPLEMENTATION I	
Data structure and input processing – transmission control blocks- segment format- comparison-finite state machine implementation-Output processing-mutual exclusion-computing the TCP data length.	9
Unit-5 TCP IMPLEMENTATION II	

Timers-events and messages- timer process- deleting and inserting timer event- flow control and adaptive retransmission-congestion avoidance and control – urgent data processing and push function.	9
List of Experiments : NIL	**Practical Hours**

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:

CO1: Explain the internetworking concepts and architectural model, network addressing and different protocols.

CO2: Illustrate the internals of TCP/IP protocol suite with respect to connection, timer process, retransmission.

CO3: Exhibit the routing and fragmentation and reassembling functionalities of Internet protocol in networking environment.

CO4: Illustrate the basic functionalities of TCP in terms of processing data, finite state machine.

CO5: Determine the timer management, retransmission process, congestion avoidance and data processing in TCP.

Text Books:

T1. 1. Douglas E.Comer – "Internetworking with TCP/IP Principles, Protocols and Architecture", Vol. 1 &2 , Fourth Edition, PHI 2010. (Unit I in Comer Vol. 1, Units II, IV & V – Comer Vol. 2)

T2. W.Richard Stevens, "TCP/IP illustrated", Volume 1 Pearson Education, 2012 (Unit II)

T3. Douglas E. Comer – "Internetworking with TCP/IP", Volume One (6th Edition) Hardcover May 5, 2013

T4.Kevin R. Fall (Author), W. Richard Stevens (Author) – "TCP/IP Illustrated, Volume 1

T5.The Protocols (2nd Edition) (Addison-Wesley Professional Computing Series) – 2014

Reference Books:

R1. Forouzan, "TCP/IP protocol suite", 2nd edition, TMH, 2003

R2. W.Richard Stevens "TCP/IP illustrated" Volume 2 Pearson Education 2003.

R3. Philip M Miller, "TCP/IP: Ultimate Protocol Guide Data Delivery & Routing", Vol. 1–2011

R4. Jeffrey L Carrell "Guide to TCP/IP" – 2012.

Online Resources: NIL

Mapping with Program Outcomes (POs)

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

CO1	3	3								1				2	
CO2	3	3												2	
CO3	3	3	2							1				3	
CO4	3	3	2											2	
CO5	3	3												1	

Course Name: Simulation and Modelling					
Course Code : CS743E03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
Simulation and Modeling is becoming an important tool of industrial design and development and so, it is necessary to train the students in the techniques of S& M and this course is introduced with that aim to all the students across the disciplines. S & M has matured over the years with its own body of knowledge, theory, and research methodology. At the core of the discipline is the realization that every system need not be studied in all its complexity to reflect reality and depending on the objective, simplified models may be constructed incorporating only the relevant aspects for the purpose.

Prerequisites: Engineering Mathematics and Linear Algebra.

Units	Teaching Hours
Unit-1 INTRODUCTION	
Systems, modeling, general systems theory, Concept of simulation, Simulation as a decision making tool, types of simulation.	9
Unit-2 RANDOM NUMBERS	
Pseudo random numbers, methods of generating random variables, discrete and continuous distributions, testing of random numbers.	9
Unit-3 DESIGN OF SIMULATION EXPERIMENTS	
Problem formulation, data collection and reduction, time flow mechanism, key variables, logic flow chart, starting condition, run size, experimental design consideration, output analysis and interpretation validation.	9
Unit-4 SIMULATION LANGUAGES	
Comparison and selection of simulation languages, study of anyone simulation language.	9

Unit-5 CASE STUDIES	
Development of simulation models using simulation language studied for systems like queuing systems, Production systems, Inventory systems, maintenance and replacement systems and Investment analysis.	9
List of Experiments : NIL	**Practical Hours**

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:

CO1: demonstrate the concepts which include the techniques of simulation, major application areas, concept of a system, environment, continuous and discrete system models

CO2: apply probability concepts in simulation including discrete and continuous, probability functions, numerical evaluation of continuous probability functions

CO3: Devoping of Simulation experiments and sampling concepts.

CO4: Analyze discrete system and Continues system simulation and study on different simulation languages.

CO5: identify the role of simulation studies in practical systems.

Text Books:

T1. Geoffrey Gordon, “System Simulation”, 2nd Edition, Prentice Hall, India, 2011

T2. Narsingh Deo, “System Simulation with Digital Computer, “Prentice Hall, India, 2009

Reference Books:

R1. Jerry Banks and John S. Carson, Barry L. Nelson, David M. Nicol, “Discrete Event System Simulation”, 3rd Edition, Prentice Hall, India, 2002.

R2. Shannon, R.E. “Systems simulation: The art and science”, Prentice Hall, 1975.

R3 .Thomas J. Schriber, “Simulation using GPSS”, John Wiley, 1991.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1					1					1	2		
CO2	2	1		2			1					1	2		
CO3	3	2	1				1					1	2		
CO4	2	1		1			1					1	2		

CO5	3	2	2	1			1					1	2		

Course Name: Server Side Programming					
Course Code : CS743C01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:

- To provide a strong foundation of fundamental concepts in Server Side programming
- To provide a basic exposition to the goals and methods of Server Side Programming.
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Prerequisites:

Units	Teaching Hours
Unit-1	
A simple introductory assignment in JSP/servlets. •A simple introductory assignment in JSF (which will not be part of the overall project). •Implementing a common user interface for your site using JSF facelets. •Creating support classes and shopping carts based on the Model-View-Control paradigm. •Implementing validation and informative error messages for pages where users enter data. •Storing/retrieving information from your site using the Java Persistence Architecture. • Implementing a simple web service (platform TBA).	15
List of Experiments : NIL	**Practical Hours**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
Develop a web service.

Online Resources: NIL

Mapping with Program Outcomes (POs)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1			3		1								2	2	2

Course Name: Client Side Programming					
Course Code : CS743C02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
- To provide a strong foundation of fundamental concepts in Client Side programming
- To provide a basic exposition to the goals and methods of Client Side Programming.
- To enable the student to apply these techniques in applications which involve perception, reasoning and learning.

Prerequisites:

Units	Teaching Hours
Unit-1	
• JavaScript • VBScript • HTML (Structure) • CSS (Designing) • AJAX • jQuery etc.	15
List of Experiments :NIL	**Practical Hours**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
1. Develop a client server system.

Online Resources: NIL

Mapping with Program Outcomes (POs)

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

CO1			3		1								1	2	1

Course Name: Web Designing					
Course Code : CS745C03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	
Course objectives: Explain tools for developing applications in Web programming.					
Prerequisites: Internet and Web Programming					
Units					**Teaching Hours**
Unit-1 Web designing principles					
HTML5 coding, CSS3, Adobe Dreamweaver CS3-Create Web pages and Website					5
Unit-2 Building Web site					
Interactive websites for mobile and desktop applications using JavaScript, and the Bootstrap framework, Domain names and hosting, Links, Images and Formatting, Publishing Website					10
List of Experiments: NIL					**Practical Hours**
Self-study : NIL					
Site/Industrial Visits : NIL					
Course outcomes: Design Interactive websites for mobile and desktop applications using Bootstrap framework.					
Online Resources: NIL					
Mapping with Program Outcomes (POs)					

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

CO1	3	3	3	3	3								2	2	1

Course Name: Shell Programming

Course Code : CS743C04

	L	T	P	Category	PEC
Contact Hrs./Week	**0**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**30**	ESE Marks	
Credits.	**0**	**0**	**1**	Exam Hours	

Course objectives:
This course will introduce the students to various shell programming constructs

Prerequisites:
Basics of CSE CS134/CS234, Operating Systems CS332

Units	**Teaching Hours**
Unit-1	
Ordinary and environment variables. The .profile. Read and read only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. File inodes and the inode structure. File links – hard and soft links. Filters. Head and tail commands. Cut and paste commands. The sort command and its usage with different options. The umask and default file permissions. Two special files /dev/null and /dev/tty.	15
List of Experiments	**Practical Hours**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
CO1: Experiment the shell programming constructs to write shell scripts for a given requirement.(Apply)(PO1,PO2,PO3,PO4)

Text Books:
T1. Newham, Cameron, and Bill Rosenblatt. Learning the bash shell: Unix shell programming. " O'Reilly Media, Inc.", 2005.

Reference Books:
R1. Sobell, Mark G., and Matthew Helmke. A practical guide to Linux commands, editors, and shell programming. Prentice Hall Professional Technical Reference, 2005.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	1	1						2			1		

Course Name: Semantic Web

Course Code : CS743C05

	L	T	P	Category	PEC
Contact Hrs./Week	0	0	2	CIA Marks	
Contact Hrs./Sem.	0	0	30	ESE Marks	
Credits.	0	0	1	Exam Hours	

Course objectives:
To study various schemas, Ontology and Reasons.

Prerequisites: Internet and WebProgramming

Units	Teaching Hours
Unit-1	
Introduction, DTD and XML Schema, RDF and RDF Schema, OWL Protégé Lab, Jena RDF API, Jena Ontology API, Jena Reasoner.	
List of Experiments :NIL	**Practical Hours**

Self-study : NIL

Site/Industrial Visits : NIL

Course outcomes:
CO1: Build sematic web using DTD, RDF and XML Schemas.
CO2: Desgin sematic web application using the Jena Framework.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1	3								1	1	1

CO2	3	3	3	3	3								2	2	1

Course Name: Information Storage and Management					
Course Code : CS744E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
The course on Information Storage and Management aims at emphasizing the need for Information storage, provides an in depth coverage of technologies in the various phases of designing, building and sustaining an Information Storage System and to provide an overview of various management techniques.

Prerequisites: Computer Networks, Data base management system

Units	Teaching Hours
Unit-1 INTRODUCTION TO STORAGE TECHNOLOGY	
Data proliferation and the varying value of data with time & usage, sources of data and states of data creation, Data center requirements and evolution to accommodate storage needs, Overview of basic storage management skills and activities, The five pillars of technology, Overview of storage infrastructure components, Evolution of storage, Information Lifecycle Management concept, Data categorization within an enterprise, Storage and Regulations	9
Unit-2 STORAGE SYSTEMS ARCHITECTURE	
Intelligent disk subsystems overview, Contrast of integrated vs. modular arrays, Component architecture of intelligent disk subsystems, Disk physical structure components, properties, performance, and specifications, Logical partitioning of disks, RAID & parity algorithms, hot sparing, Physical vs. logical disk organization, protection, and back end management, Array caching properties and algorithms, Front end connectivity and queuing properties, Front end to host storage provisioning, mapping, and operation, Interaction of file systems with storage, Storage system connectivity protocols	9

Unit-3 INTRODUCTION TO NETWORKED STORAGE	
JBOD, DAS, SAN, NAS, & CAS evolution, Direct Attached Storage (DAS) environments: elements, connectivity, & management, Storage Area Networks (SAN): elements & connectivity, Fibre Channel principles, standards, & network management principles, SAN management principles, Network Attached Storage (NAS): elements, connectivity options, connectivity protocols (NFS, CIFS, ftp), &management principles, IP SAN elements, standards (iSCSI, FCIP, iFCP), connectivity principles, security, and management principles, Content Addressable Storage (CAS): elements, connectivity options, standards, and management principles, Hybrid Storage solutions overview including technologies like virtualization & appliances	9
Unit-4 INTRODUCTIONS TO INFORMATION AVAILABILITY	
Business Continuity and Disaster Recovery Basics, Local business continuity techniques, Remote business continuity techniques, Disaster Recovery principles & techniques. Managing & Monitoring. Management philosophies (holistic vs. system & component), Industry management standards (SNMP, SMI-S, CIM), Standard framework applications, Key management metrics (thresholds, availability, capacity, security, performance), Metric analysis methodologies & trend analysis, Reactive and proactive management best practices, Provisioning & configuration change planning, Problem reporting, prioritization, and handling techniques, Management tools overview	9
Unit-5 SECURING STORAGE AND STORAGE VIRTUALIZATION	
Define storage security, List the critical security attributes for information systems, describe the elements of a shared storage model and security extensions, Define storage security domains, List and analyze the common threats in each domain, Identify different virtualization technologies, describe block-level and file level virtualization technologies and processes.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Illustrate the core concepts of information lifecycle and Storage management technologies.
CO2: Interpret the functioning of Physical and logical disk organization.
CO3: Summarize the concept of network storage elements and connectivity.
CO4: Apply disaster recovery principles & techniques with industry management standards..
CO5: Examine the various virtualization technologies in storage.

Text Books:
T1. Information Storage and Management, Storing, Managing, and Protecting Digital Information in Classic, Virtualized, and Cloud Environments, 2nd Edition, EMC Educational Services, Wiley 2012.

Reference Books:
R1. EMC students guide.
R2. Marc Farley Osborne, "Building Storage Networks", Tata Mcgraw Hill.
R3. Robert Spalding, "Storage Networks: The Complete Reference", Tata Mcgraw Hill.
R4. Storage Area Network Fundamentals , Meeta Gupta, Pearson Education Limited
R5. Information Storage & Retrieval Systems Theory & Implementation, Gerald J Kowalski / Mark T Maybury, BS Publications.
R6. Disaster Recovery & Business Continuity - Thejendra BS, Shroff Publishers & Distributors.
R7. Blade Servers & Virtualization - Barb Goldworm / Anne Skamarock, Wiley India Pvt.Ltd

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1											1		
CO2	2	1											1		
CO3	2	1			2								1		
CO4	3	2	1	1	1								1		
CO5	3	3	2	2	3								1		

Course Name: Database Administration					
Course Code : CS744E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives: The course will discuss the rationale, current trends and features of modern database practice, also it provides students with the tools and techniques to implement and administer complex database systems including backup,recovery and it equips them with the skills required to develop creative solutions to information system problems using the latest database technologies.

Prerequisites: Database Management System

Units	Teaching Hours
Unit-1 INTRODUCTION	
General Definition of DBA and Security, System Management & Database Design Roles of DBA – DBA Job Classification. Types of Databases: Online Transaction Processing System and Decision Support System Databases, Development, Test & Production Databases. Daily Routine of a DBA.	9
Unit-2 ORACLE 10G ARCHITECTURE	
Database Structures: Logical & Physical, Trace Files, Data Files & Tablespaces, Oracle Managed Files. Processes: Interaction between User & Oracle Processes, The Server Process, Background Processes. Memory Structures: SGA, PGA. Oracle Transactions: Anatomy of SQL Transactions. Data Consistency & Concurrency: Database Writer & Write Ahead Protocol, The System Change Number, Undo Management. Backup and Recovery Architecture: User managed, RMAN, Flashback Techniques Data Dictionary and Dynamic Performance Views: Data Dictionary, V$ views, The Oracle Optimizer. Oracle utilities, Automatic Database Management, Advisory Framework.	9
Unit-3 DATABASE CREATION, CONNECTIVITY & NETWORKING	

Installing Oracle 10g: Following OFA, System and Owners Pre-Installation Tasks, Installing Software, System Administrator and Oracle Owner's Post-Installation Tasks, Uninstalling Oracle 10g. Database Creation: Creating SPFILE and pfile, Initialization Parameters, Creating a new Database, Using SPFILE, Starting up and Shutting Down Database. Database Connectivity and Networking: Working of Oracle Network – instance names, global database names, connect descriptors, identifiers and strings, Establishing Connectivity, Oracle Client, Installing the Client, Naming and Connectivity – Local, Easy connect, External and Directory naming methods.	9
Unit-4 Database User Management & Database Security	
Managing Users: Creating, altering and dropping users, Creating user Profiles & Resources, Database Resource Manager, Controlling Access to Data – Roles, Privileges and using Views, Stored Procedures to Manage Privileges, Auditing Database – Standard Auditing, Authentication – Database, External, Centralized user and Proxy Authentication. Database Security Do's & Don'ts: User Accounts, Passwords, OS authentication, Auditing Database, Granting Appropriate Privileges, Permissions, Application Security.	9
Unit-5 Data Loading, Backup, Recovery & Database Performance Tuning	

Overview of extraction loading and Transformation, Loading Data: Using the SQL Loader Utility, Using External Tables to Load Data. Overview of Common Techniques used for Transforming Data, Introduction to Data Pump Technology – Benefits, Uses and Components of Data Pump. Access method, Data Pump Files, Privileges, Mechanics of Data Pump Job. Backing Up Oracle Databases: Backup Terms, Guidelines, Strategies, Examining Flash Recovery Area – benefits of Flash recovery Area, Looking into Flash Recovery Area, Setting size of Flash Recovery Area Creating Flash Recovery Area, Backing up Flash Recovery Area, RMAN – Benefits, Architecture, Connecting to RMAN. SQL Query Optimization: Approach to Performance Tuning, Optimizing Oracle Query Processing, Cost-based Optimizer, Drawbacks of CBO. SQL Performance Tuning Tools – EXPLAIN PLAN, Autotrace, SQL Trace and TKPROF. Tuning the instance: Introduction, Automatic Tuning vs. Dynamic Views. Tuning Oracle Memory: Tuning Shared Pool – Library Cache, Dictionary Cache, Hard vs. Soft Parsing, Sizing Shared Pool, Tuning Buffer Cache – Sizing buffer Cache, Multiple pools for Buffer Cache, Tuning Large, Streams and Java Pools. Tuning PGA Memory – Automatic PGA Memory Management. Introduction to iSQL*Plus: Installation, configuration, Starting and Stopping iSQL*Plus, Logging into and disconnecting from iSQL*Plus. Case study.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the fundamental concepts of databases Administration. CO2: Identify database structures of oracle 10g architecture. CO3: Discover the aspects of database creation ,connectivity and networking. CO4: Illustrate various security and user management aspects of the Databases. CO5: Examine the concepts of recovery and backup management.	

Text Books:
T1. Ross Mistry, Stacia Misner , “Introducing Microsoft SQL Server 2014”, (2014)
T2. Arup Nanda and Steven Fewrstein, “Oracle PL/SQL for DBAs”, O'Reilly Media, Inc.
T3. Craig S. Mullins, “Database Administration: The Complete Guide to DBA Practices and Procedures”, Addison-Wesley, 11-Oct-2012
T4. Alapati, Sam R., Expert Oracle Database 10g Administration, Springer India Pvt. Ltd., 2005

Reference Books:
R1. Kyte, Thomas, “Expert Oracle”, Oracle Press Publication, Signature Edition, 2005.
R2. Day, John & Craig Van Slyke, “Starting Out with…Oracle”, Dream tech Publication.
R3. Loney, Kevin & Koch, George, “Oracle9i The Complete Reference”, Author’s Press/ Dreamtech Publication.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1							1	1				2	
CO2	3	2	1						1	1	1			2	
CO3	3	3	2	1							1			2	
CO4	2	1			1			1	1	1				2	
CO5	3	3	2	1	1						1			2	

Course Name: Network Storage Technologies					
Course Code : CS744E03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: Introduction about the Syllabus and contents to be covered in this syllabus.					
Prerequisites: Storage area networks					

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks, The Data Storage and Data Access problem; The Battle for size and access. Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.	9
Unit-2 I/O Techniques	
The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system.	9
Unit-3 File System and NAS	

Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fiber Channel and NAS. Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network.	9
Unit-4 SAN Architecture and Hardware devices	
Overview, Creating a Network for storage; SAN Hardware devices; The fiber channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective	9
Unit-5 Software Components of SAN	
The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.9. Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Recognize the architecture of server centric IT and intelligent disk systems. (Understand) (PO1) CO2:Demonstrate I/O techniques and Network Attached Storage. (NAS)(Understand) (PO1,PO12) CO3: Exhibit the concepts of file systems, storage virtualization with respect to NAS. (Apply) (PO1,PO2, PO5) CO4: Use the concepts of SAN architecture to create a network for storage . (Apply) (PO1,PO2) CO5: Illustrate the software components of SAN with availability, capacity and serviceability. (Apply) (PO1,PO5,PO12)	
Text Books: T1. .Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India,2007	

Reference Books:

R1.Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.

R2. Robert Spalding: "Storage Networks - The Complete Reference", Tata McGraw-Hill, 2003.

R3. Richard Barker and Paul Massiglia: "Storage Area Network Essentials A Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

R4. Nigel Poulton, "Data Storage Networking: Real World Skills for the Comp TIA Storage+ Certification and Beyond", John Wiley & Sons (29 April 2014).

R5.Fujitsu Siemens Computers , "An Introduction to the Fundamentals of Storage Technology " Publisher: Fujitsu Siemens Computers (January 2009)

Online Resources:NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3													**2**	
CO2	3											1		**2**	
CO3	3	2			1									**2**	
CO4	3	2												**2**	
CO5	3				1							1		**2**	

Course Name: Network Administration					
Course Code : CS744E04					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./ Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./ Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: In this syllabus the basics of network planning and Red Hat installation and configuration is taught. Configuring a database server, creating a VNC server, monitoring performance, providing Web services, exploring SELinux security basics, and exploring desktops					
Prerequisites: Operating systems, network security, computer networks					
Units					**Teaching Hours**
Unit-1 INTRODUCTION					
Introduction to System Administration, The Unix Way , Essential Administrative Tools and Techniques , Startup and Shutdown. System and Network Administration Defined, Duties of the System Administrator, Planning the Network, Standard Installation , Kickstart Installation , Exploring the Desktops, System Startup and Shutdown , The File System Explained , Examining the System Configuration Files					9
Unit-2 Network Services					
Network Services, Managing the X Window System , Configuring Printers , TCP/IP Networking , Managing user and groups, Security, managing network services, The Network File System, The Network Information System ,Connecting to Microsoft and Novell Networks ,Configuring a Database Server, Creating a VNC Server, Providing Additional Network Services, Optimizing Network Services.					9

Unit-3 Internet Services	
Internet Services, Configuring BIND: The Domain Name System , Configuring Mail Services , Configuring FTP Services ,Configuring a Web Server, Providing Web Services ,Optimizing Internet Services.	9
Unit-4 System Administration	
System Administration, Upgrading and Customizing the Kernel , Configuring the System at the Command Line , Administering Users and Groups , Installing and Upgrading Software Packages, Backing Up and Restoring the File System , Performance Monitoring	9
Unit-5 System Security and Problem Solving	
System Security and Problem Solving , Exploring SELinux Security, Implementing Network Security, Troubleshooting and Problem Solving, Case studies.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Illustrate the basic principles of system administration and role of System administrator . CO2: Interpret role of network services with respect to different services in Windows environment and Configuring a database server, creating a VNC server, monitoring performance. CO3: Discuss about different services, configuration and optimization of services. CO4: Recall the responsibilities of system administrator with respect to data storage. CO5: Demonstrate the security issues and troubleshooting process.	
Text Books: T1. Thomas A. Limoncelli ,"The Practice of System and Network Administration", Addison-Wesley Professional, second edition ,Published Feb 2012. T2.Terry Collings, Kurt Wall, "Red Hat Linux Networking and System Administration", 3rd Edition T3.Leen Frisch, "Essential System Administration", 3rd Edition , O'Reilly Media, 2002.	
Reference Books: R1. . Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, "Unix and Linux System Administration Handbook" , Prentice Hall	
Online Resources: NIL	

Mapping with Program Outcomes (POs)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2			2		2	2	2				1		2	
CO2	2	2	2			2	2	2						2	
CO3			3											3	
CO4	2	2	2												
CO5	3	3	3	2										3	

Course Name: Research Methodology					
Course Code : CS744E05					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:

- To orient the student to make an informed choice from the large number of alternative methods and experimental designs available.
- To enable the student to present a good research proposal.
- To familiarize the student with the nature of research and scientific writing
- To empower the student with the knowledge and skills they need to undertake a research project, to present a conference paper and to write a scientific article.

Prerequisites: PROBABILITY AND QUEUING THEORY
Design and Analysis of Algorithm

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
An Introduction Meaning of Research, Objectives of Research , Motivation in Research , Types of Research , Research approaches ,Research Method versus Methodology ,Research and Scientific Method, Importance of Knowing How Research is Done , Research Process, Criteria of Good Research, problem Encountered by Researchers in India. Defining the Research Problem: Definition of Research Problem, Selecting the Problem, Necessity of Defining the Problem Technique Involved in Defining a Problem	9
Unit-2MEASUREMENT AND SCALING TECHNIQUE	

Measurement in Research, Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling, Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques. Processing and Analysis of Data: Processing Operations, Some Problems in Processing, Elements /Types of Analysis, Statistics in Research, Measures of Central Tendency, Measures of Dispersion Measures of Asymmetry (Skewness), Measures of Relationship, Partial Correlation, Association in case of Attributes, Other Measures.	9
Unit-3 RANDOM VARIABLE	
Introduction, Review of Probability Theory, Definition of a Random Variable, Conditions for a Function to be a Random Variable, Discrete, Continuous and Mixed Random Variables, Distribution and Density functions, Properties, Binomial, Poisson, Uniform, Gaussian, Exponential, Rayleigh, Conditional Distribution, Conditional Density, Properties.	9
Unit-4 SAMPLING FUNDAMENTALS	
Need for Sampling, Some Fundamental Definitions, Central Limit Theorem, Sampling Theorem, Sandler's A-test, Concept of Standard Error, Estimation, Estimating the Population Mean, Estimating the Population Proportion, Sample size and its Determination, Determination of Sample Size through the Approach, Based on Precision Rate and Confidence Level, Determination of Sample Size through the Approach, Based on Bayesian Statistics. Analysis of Variance and Covariance: Analysis of variance (ANOVA), basic principles, technique, setting up analysis of variance table, short cut method for one- way ANOVA, coding method, two-way-ANOVA, ANOVA in Latin-Square-Design, Analysis of Co-variance(ANOCOVA), technique, assumption in ANOCOVA.	9
Unit-5 INTERPRETATION AND REPORT WRITING	
Meaning Of Interpretation, Technique of Interpretation: Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing a Research Report, Case study .	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:

CO1: Explain research, research methods, methodologies and the problems faced by researchers.

CO2: Make use of the statistical techniques in scaling, skewness, correlation, and association for data processing..

CO3: Identify discrete, continuous and mixed random variables and distribution techniques for interpretation of data.

CO4: Examine the large population of data using sampling techniques, variance and covariance methods.

CO5: Build appropriate reports with the use of interpretation techniques that illustrates the research results.

Text Books:

T1. Kothari C.R. , Research Methodology – Methods and Techniques, New Age International , New Delhi, (reprint 2011)

T2. Montgomery, Douglas C., Design and Analysis of Experiments, Willey India, 2007

T3. Montgomery, Douglas C. & Runger, George C. ,Applied Statistics & Probability for Engineers, Wiley India , 2010.

Reference Books:

R1. Krishnaswamy, K.N. Sivkumar , Appa Iyer and Mathiranjan M., Management Research Methodology: Integration of Principles, Method and Techniques,Pearson Education, New Dehli, 2009

R2. Charlie Catlett, Wolfgang Gentzsch, Lucio Grandinetti, Gerhard Joubert, and José Luis Vasquez-Poletti, Cloud computing and big data , Published/ Distributed:Amsterdam : Washington, DC : IOS Press, [2013]

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1													
CO2	3	2	1		1										1
CO3	3	2	1		1										
CO4	3	3	2	1	1										1
CO5	2	2	1		1				1	1	1				

Course Name: Software Process and Project Management					
Course Code : CS763E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To provide basics for various Process and Project management models, also it provide students a systematic approach to initiate, plan, execute, control and close a software project and understanding of the best practices, and techniques used in project management processes, knowledge of ISO 9000 and CMMI, and process improvement techniques.					
Prerequisites: Basics of C Programming , Software Engineering,					
Units					**Teaching Hours**
Unit-1 SOFTWARE PROCESS MATURITY					

Software maturity Framework, Principles of Software Process Change, Software Process Assessment, The Initial Process.	9
Unit-2 PROCESS REFERENCE MODELS	
Capability Maturity Model (CMM), CMMi, PCMM, PSP, TSP, IDEAL, Process Definition Techniques.	9
Unit-3 SOFTWARE PROJECT MANAGEMENT RENAISSANCE	
Conventional Software Management, Evolution of Software Economics, Improving Software Economics, The old way and the new way.	9
Unit-4 SOFTWARE MANAGEMENT PROCESS FRAMEWORK	
Software management process framework: life-cycle phases, artifacts of the process, model based software architecture, work flow process, check points of the process.	9
Unit-5 SOFTWARE MANAGEMENT DISCIPLINES	
Software management disciplines: iterative process planning, project organization and responsibilities, Process automation. CCPDS-R Case Study and Future Software Project Management Practices Modern Project Profiles, Next-Generation software Economics, Modern Process Transitions	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Explain the Software maturity frame work and process assessment.
CO2: Demonstrate the software process reference model and techniques.
CO3: Utilize the classical models of software management.
CO4: Examine the life cycle phases of software process management.
CO5: Analyze the various process in software management disciplines.

Text Books:
T1. Watts S. Humphrey, “Managing the Software Process”, Pearson Education 2012.
T2. Walker Royce, “Software Project Management”, Pearson Education 2010.

Reference Books:
R1. Pankaj Jalote, “Software Project Management in Practice”, Pearson Education 2010.
R2. Chris Kemerer, “Software Project Management Readings and Cases”, 2010.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1						1		1			1		2
CO2	2	1												1	
CO3	3	2	1	1							1		1		
CO4	3	3	2	2							1			1	
CO5	3	3	2	2							1		1		1

Course Name: Software Quality Management					
Course Code : CS763E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: It provide students to understand an integrated approach to software development incorporating quality management methodologies, Software quality models, Quality measurement and metrics, Quality plan, implementation and documentation, Quality tools including CASE tools, Complexity metrics and Customer Satisfaction and International quality standards – ISO, CMM.					
Prerequisites: Software Engineering.					

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO SOFTWARE QUALITY	
Software Quality – Hierarchical models of Boehm and McCall – Quality measurement – Metrics measurement and analysis – Gilb's approach – GQM Model	9
Unit-2 SOFTWARE QUALITY ASSURANCE	
Quality tasks – SQA plan – Teams – Characteristics – Implementation – Documentation – Reviews and Audits	9
Unit-3 QUALITY CONTROL AND RELIABILITY	
Tools for Quality – Ishikawa's basic tools – CASE tools – Defect prevention and removal – Reliability models – Rayleigh model – Reliability growth models for quality assessment	9
Unit-4 QUALITY MANAGEMENT SYSTEM	
Elements of QMS – Rayleigh model framework – Reliability Growth models for QMS – Complexity metrics and models – Customer satisfaction analysis.	9
Unit-5 QUALITY STANDARDS	

Need for standards – ISO 9000 Series – ISO 9000-3 for software development – CMM and CMMI – Six Sigma concepts.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the Software Quality Models and Metrics. CO2 : Experiment the knowledge of Software Quality Assurance plans, tasks, various practices and standards, Conduction of Reviews and audits. CO3: Experiment the function of Ishikawa's basic tools, control charts, CASE tools, Reliability and Exponential models for Software Quality Assurance. CO4: Outline the Basic measures Quality Management system to ensure Software Quality. CO5: Explain the different internationals standards of software.	
Text Books: T1. Allan C. Gillies, "Software Quality: Theory and Management", Thomson Learning, 2003. (UI : Ch 1-4 ; UV : Ch 7-8) T2.Stephen H. Kan, "Metrics and Models in Software Quality Engineering", Pearson Education (Singapore) Pte Ltd., 2002. (UI : Ch 3-4; UIII : Ch 5-8 ; UIV : Ch 9-11)	
Reference Books: R1. Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson, 2003 R2. Mordechai Ben – Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Pte Ltd, 2003. R3. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education (Singapore) Pte Ltd, 2003. R4. ISO 9000-3 "Notes for the application of the ISO 9001 Standard to software development".	
Online Resources: NIL	

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1											2		
CO2	3	2	1				1						2		
CO3	3	2	1	1			1						2		
CO4	2	1					1						2		

CO5	2	1				1						1	2		

<table>
<tr><td colspan="6">Course Name: Web Services and Service Oriented Architecture</td></tr>
<tr><td colspan="6">Course Code : CS763E03</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>PEC</td></tr>
<tr><td>Contact Hrs./ Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./ Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives: This course introduces service-oriented architectures and their basic principles. Also providing basic and advanced concepts of web services such as protocols, SOAP, RESTful, and building enterprise solutions.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Internet and Web Programming(CS634)
Advanced Java Programming
Design Patterns</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 INTRODUCTION TO SOA - TERMINOLOGY, CONCEPTS AND GOALS</td></tr>
<tr><td colspan="5">Service Terminology - Service Terminology Context - Basic Terminology and Concepts - Further Reading - Case Study Example - REST Constraints - Goals of the REST Architectural Style</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 SERVICE CONTRACTS AND SERVICE-ORIENTATION WITH REST</td></tr>
<tr><td colspan="5">Uniform Contract Elements - REST Service Capabilities and REST Service Contracts - REST Service Contracts vs. Non-REST Service Contracts - The Role of Hypermedia - REST Service Contracts and Late Binding - “SOA vs. REST" or "SOA + REST"? - Design Goals - Design Principles and Constraints</td><td>9</td></tr>
<tr><td colspan="6">Unit-3 SOA METHODOLOGY, ANALYSIS AND SERVICE MODELING AND SERVICE-ORIENTED DESIGN WITH REST</td></tr>
</table>

Service Inventory Analysis - Service-Oriented Analysis (Service Modeling) - Service-Oriented Design (Service Contract) - Service Logic Design - Service Discovery - Service Versioning and Retirement - Uniform Contract Modeling and REST Service Inventory Modeling - REST Service Modeling - Uniform Contract Design Considerations - REST Service Contract Design - Complex Method Design	9
Unit-4 FUNDAMENTAL AND ADVANCED SERVICE COMPOSITION WITH REST WITH CASE STUDY	
Service Composition Terminology - Service Composition Design Influences - Composition Hierarchies and Layers - REST Service Composition Design Considerations - A Step-by-Step Service Activity - Service Compositions and Stateless - Cross-Service Transactions with REST - Event-Driven Interactions with REST - Service Composition with Dynamic Binding and Logic Deferral - Service Composition Across Service Inventories - Revisiting the Confer Student Award Process - Application Submission and Task Service Invocation - Confer Student Award Service Composition Instance - Review of Pending Applications and Task Service Invocation	9
Unit-5 DESIGN PATTERNS, SERVICE VERSIONING WITH REST AND UNIFORM CONTRACT PROFILES	
REST-Inspired SOA Design Patterns - Other Relevant SOA Design Patterns - Versioning Basics - Version Identifiers - Uniform Contract Profile Template - REST Service Profile Considerations – Case Study Example	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Demonstrate the applicability of SOA Concepts and the goals of the REST Architectural Style. CO2: Apply requirements towards the creation of a REST web service , Design Principles and Constraints. CO3: Analyze Service Modeling, Service Contract in SOA and Service Oriented Desgin With REST. CO4: Develop RESTful services as part of service-oriented solutions in conjunction with service-oriented architecture (SOA). CO5: Design solutions for web services that follow the REST architectural style.	

Text Books:
T1. Thomas Erl, Benjamin Carlyle, Cesare Pautasso, Raj Balasubramanian, "SOA with REST: Principles, Patterns & Constraints for Building Enterprise Solutions with REST", Prentice Hall Service Technology 2012.
T2. Arnon Rotem-Gal-Oz, "SOA Patterns, Manning".

Reference Books:
R1. "Java Web Services: Up and Running, 2nd Edition, A Quick, Practical, and Thorough Introduction", O'Reilly 2013.
R2. Bill Burke, "Restful Java with JAX-RS 2.0, Designing and Developing Distributed Web Services", 2nd Edition, O'Reilly 2013.
R3. "Developing RESTful Services with JAX-RS 2.0, WebSockets, and JSON, A complete and practical guide to building RESTful Web Services with the latest Java EE7 API", Packet Publishing, 2013.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1			2								1	1	
CO2	3	2	1	1	3								1	1	
CO3	3	3	2	2	3								2	2	
CO4	3	3	3	3	3								2	2	1
CO5	3	3	3	3	3								2	2	1

<table>
<tr><td colspan="6" align="center">Course Name: Software Requirement Estimation</td></tr>
<tr><td colspan="6" align="center">Course Code : CS763E04</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td align="right">Category</td><td>PEC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td align="right">CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td align="right">ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td align="right">Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
To give students an understanding of management of software requirements, software cost, effort, schedule estimation, software product quality and tools available in software estimation.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Software Engineering</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Software Requirements</td></tr>
<tr><td colspan="5">Software Requirements: What and Why Essential Software requirement, Good practices for requirements engineering, Improving requirements processes, Software requirements and risk management. Software Requirements Engineering: Requirements elicitation, requirements analysis documentation, review, elicitation techniques, analysis models, Software quality attributes, risk reduction through prototyping, setting requirements priorities, verifying requirements quality.</td><td align="center">9</td></tr>
<tr><td colspan="6">Unit-2 Software Requirements Management</td></tr>
<tr><td colspan="5">Requirements management Principles and practices, Requirements attributes, Change Management Process, Requirements Tracebility Matrix, Links in requirements chain. Software Requirements Modeling:Use Case Modeling, Analysis Models, Dataflow diagram, state transition diagram, class diagrams, Object analysis, Problem Frames</td><td align="center">9</td></tr>
<tr><td colspan="6">Unit-3 Software Estimation</td></tr>
</table>

Components of Software Estimations, Estimation methods, Problems associated with estimation, Key project factors that influence estimation. Size Estimation:Two views of sizing, Function Point Analysis, Mark II FPA, Full Function Points, LOC Estimation, Conversion between size measures.	9
Unit-4 Effort, Schedule and Cost Estimation	
What is Productivity? Estimation Factors, Approaches to Effort and Schedule Estimation, COCOMO II, Putnam Estimation Model, Algorithmic models, Cost Estimation.	9
Unit-5 Tools	
Tools for Requirements Management and Estimation, Requirements Management Tools: Benefits of using a requirements management tool,commercial requirements management tool, Rational Requisite pro, Caliber – RM, implementing requirements management automation, Software Estimation Tools: Desirable features in software estimation tools, IFPUG, USC's COCOMO II, SLIM (Software Life Cycle Management) Tools, CASE study.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: To Explain requirements elicitation and analysis methods in software development. CO2 : To Outline knowledge on requirement management principles and practices.. CO3: To apply knowledge of Cost Estimation methods in software development. CO4: To Build software Estimation concepts with respect to effort, schedule and cost. CO5: To Illustrate the software estimation models and tools.	
Text Books: T1. Karl E. Weigers, Joy Beatty, "Software Requirements",2013 edition	
Reference Books: R1. Rajesh Naik and Swapna Kishore, "Software Requirements and Estimation", Tata Mc Graw Hill, 2001 edition	
Online Resources: NIL	
Mapping with Program Outcomes (POs)	

CO	**PO**	**PSO**

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1											2	1	
CO2	2	1											2	1	
CO3	3	2	1	1									2	1	
CO4	2	1							2				2	1	
CO5	2	1											2	1	

Course Name: Pattern Recognition					
Course Code : CS764E01					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: 1) The design and construction and a pattern recognition system and 2) The major approaches in statistical and syntactic pattern recognition. The student should also have some exposure to the theoretical issues involved in pattern recognition system design such as the curse of dimensionality. Finally, the student will have a clear working knowledge of implementing pattern recognition techniques and the scientific Python computing environment					
Prerequisites:					

Units	**Teaching Hours**
Unit-1 Introduction	
Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation.	9
Unit-2 Bayesian Decision Theory	
Introduction, Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density; Discriminant functions for the normal density	9
Unit-3 Maximum-likelihood and Bayesian Parameter Estimation	
Introduction; Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.	9
Unit-4 Non-parametric Techniques	
Introduction; Density Estimation; Parzen windows; kn – Nearest-Neighbor Estimation; The Nearest- Neighbor Rule; Metrics and Nearest-Neighbor Classification.	9
Unit-5 Unsupervised Learning and Clustering	

Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering; Criterion Functions for Clustering.	9

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:
CO1: Explain Machine perception, and basics principles of Pattern Recognition System.
CO 2: explain the classifiers using Baysian decision theory .
CO3:Examine the Maximum-likelihood and Bayesian Parameter Estimation to solve classification problem.
CO4:Explain Non-parametric Techniques for classification problems.
CO5: Examine Unsupervised Learning for classifications and construct techniques of clustering for classifications of data.

Text Books:
T1. Richard O. Duda, Peter E. Hart, and David G.Stork: Pattern Classification, 2nd Edition, Wiley-Interscience, 2001.

Reference Books:
R1. Earl Gose, Richard Johnsonbaugh, Steve Jost: Pattern Recognition and Image Analysis, PHI, Indian Reprint 2008.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2													1	
CO2	2													1	
CO3			2											1	
CO4			2											1	
CO5			2											1	

Course Name: Wireless Networks					
Course Code : CS764E02					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To learn the basics of wireless communication, cellular communication, GSM and CDMA technologies and emerging wireless technologies in wireless networks					
Prerequisites: Computer Networks					

Units	Teaching Hours
Unit-1 Introduction To Wireless Networks	
Elements of a wireless communication system – signal and noise - the radio – frequency spectrum –Analog modulation schemes -Amplitude modulation – frequency and phase modulation – sampling – pulse code modulation – delta modulation – data compression.	9
Unit-2 Digital Modulation And Radio Propagation	
Digital communication- sampling –pulse code modulation – delta modulation - Frequency shift keying – Phase shift keying – Multiplexing and Multiple access – spread spectrum systems - radio propagation.	9

Unit-3Principles of Cellular Communication and Multiple Access Techniques	
Cellular terminology - Cell structure and Cluster – Frequency reuse concept – Cluster size and system capacity – method of locating co channel cells – frequency reuse distance – frequency division multiple access – time division multiple access – space division multiple access – code division multiple access.	9
Unit-4GSM and CDMA Digital Cellular Standards	
GSM network architecture –GSM signaling protocol architecture – Identifiers in GSM – GSM channels –GSM handoff procedures – Edge technology – wireless local loop – DECT system – GPRS.	9
Unit-5 Emerging Wireless Technologies	
IEEE 802.11 system architecture – mobile ad hoc networks – Mobile IP and mobility management – Mobile TCP - wireless sensor networks – RFID technology – Blue tooth – Wi –Fi standards – Wimax standards. – Femtocell network – Push -to –talk technology for SMS. Case Study.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Outline the basic concepts and terminologies in wireless communication systems. CO2: Interpret modulation techniques in wireless communication. CO3: Make use of the principles in cellular communications and multiple access techniques to solve real-world problems. CO4: Examine the principles of GSM, GPRS and DECT Standards in real time environments. CO5: Explain the emerging wireless technologies with respect to different parameters.	
Text Books: T1 .Roy Blake, "Wireless communication technology", 6th Edition, CENGAGE Learning, 2010 (Indian reprint 2010) T2. Singal T.L. , "Wireless communication" Tata Mc Graw Hill Education, Private limited, 2011. T3. Dharma Prakash Agrawal, Qing –An Zeng, "Introduction to wireless and Mobile systems" , first edition, CENGAGE Learning, 2012.	

Reference Books:

R1. Upena Dalal, "Wireless communication", first edition, Oxford University press, 2009.

R2. Kaveh Pahlavan, Prashant Krishnamurthy, "Wireless Networks" PHI. Learning PrivateLimited.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1										1		1	
CO2	3	3	2	1	1			1						1	
CO3	3	2	1		1			1						1	
CO4	3	3	2	1										1	
CO5	2	1										1		1	

Course Name: Software Project Management					
Course Code : CS764E03					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives: The main goal of software development projects is to create a software system with a predetermined functionality and quality in a given time frame and with given costs. For achieving this goal. models are required for determining target values and for continuously controlling these values. This course focuses on principles, techniques, methods & tools for model-based management of software projects. Assurance of product quality and process adherence (quality assurance), as well as experience-based creation & improvement of models (process management). The goals of the course can be characterized as follows.

- Understanding the specific roles within a software organization as related to project and process management
- Understanding the basic infrastructure competences (e.g., process modeling and measurement)
- Understanding the basic steps of project planning, project management. Quality assurance, and process management and their relationships.

Prerequisites: Software Engineering

Units	Teaching Hours
Unit-1	
Conventional Software Management: The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics. Pragmatic software cost estimation.	9
Unit-2	
Improving Software Economics: Reducing Software product size, Improving software processes, improving team effectiveness. Improving automation, Achieving required quality, peer inspections. The old way and the new- The principles of conventional software engineering. Principles of modem software management, transitioning to an iterative process.	9

Unit-3	
Life cycle phases: Engineering and production stages, inception. Elaboration, construction, transition phases. Artifacts of the process: The artifact sets. Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures: A Management perspective and technical perspective.	9
Unit-4	
Work Flows of the process: Software process workflow, Inter trans workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning Work breakdown structures, planning guidelines, cost and scheduled estimating, Interaction, planning process, Pragmatic planning.	9
Unit-5	
Project Control and Process instrumentation: The server care Metrics, Management indicators, and quality indicators. Life cycle expectations pragmatic Software Metrics, Metrics automation. Tailoring the Process: Process discriminates, Example. Future Software Project Management: Modem Project Profiles Next generation Software economics modem Process transitions. Case Study: The Command Center Processing and Display System. Replacement (CCPDS. R).	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the specific roles within a Conventional Software Management organization as related to project. CO2: Describe and determine the purpose and importance of project management from the perspectives of planning, cost, tracking and completion of project. CO3 : Evaluate a project to develop the scope of work, provide accurate cost estimates and to plan the various activities. CO4: Implement a project to manage project schedule, expenses and resources with the application of suitable protect management tools. CO5: Identify the resources required for a project to produce a work plan with resource Schedule and compare organization , project structures.	

Text Books:
T1. Software Project Management. Walker Royce, Pearson Education 2010.
T2. Software Project Management, Bob Hughes & Mike Cotterell, fourth edition, Tate McGraw HD 2012

Reference Books:
R1. Applied Software Project Management, Andrew SteIbian 8 Jennifer Greene, O'Reilly. 2006
R2. Head First PMP, Jennifer Greene & Andrew Steliman, ORoiHy.2007
R3. Software Enneeñng Project Managent. Richard H. Thayer & Edward Yourdon, second edition, Wiley India, 2004.
R4. Ale Project Management, Jim Highsniith. Pearson education, 2004
R5. The art of Project management. Scott Berkun. O'Reilly, 2005.
R6. Software Project Management in Practice. Pankaj Jalote. Pearson Educabon,2002.

Online Resources:
W1.SEI.CMMI-Tutorial,www.sei.cmu.edu/cmmi/publications/stc.presentations/tutorial.html

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	2											**1**	
CO2	1	2	2											**1**	
CO3		1	2											**1**	
CO4		1	2											**1**	
CO5	1		2			1								**1**	

<table>
<tr><td colspan="6">Course Name: Natural Language Processing</td></tr>
<tr><td colspan="6">Course Code : CS764E04</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>OE</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives: To provide a general introduction to natural language processing, fundamentals of parsing words in natural language , advanced feature like structures and realistic parsing methodologies with methods to handle questions with recent trends in typical natural language processing applications</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Formal Languages and Automaton Theory
Compiler Design</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Introduction to Natural Language Processing</td></tr>
<tr><td colspan="5">Introduction to Natural Language Processing, Different Levels of language analysis, Representation and understanding, Linguistic background. Language and Grammar-Processing Indian Languages</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 Grammars and Parsing</td></tr>
<tr><td colspan="5">Grammars and parsing, Top down and Bottom up parsers, Transition Network Grammars, Feature systems and augmented grammars, Morphological analysis and the lexicon, Parsing with features, Augmented Transition Networks.</td><td>9</td></tr>
<tr><td colspan="6">Unit-3 Grammars for Natural Language</td></tr>
<tr><td colspan="5">Grammars for natural language, Movement phenomenon in language, Handling questions in context free grammars, Hold mechanisms in ATNs, Gap threading,</td><td>9</td></tr>
<tr><td colspan="6">Unit-4 Ambiguity Resolution, Language Models</td></tr>
</table>

Human preference in parsing, Shift reduce parsers, Deterministic parsers, Statistical methods for Ambiguity resolution. Language Models: The Milton Model, The Meta Model	9
Unit-5 Recent Trends and Case Studies	
Recent Trends in NLP, Principle based NLP, Reframing and Chunking Patterns, Research issues in NLP. A Case Study in Natural Language Based Web Search: In Fact System Overview, The GlobalSecurity.org Experience	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:

CO1: Demonstrate the representation of language with the levels of language analysis.

CO2: Illustrate the process of top down parsing and bottom up parsing of strings and morphological analysis of lexicons.

CO3: Experiment the techniques for handling questions and ambiguity resolution with analyzing movement phenomenon in language.

CO4: Examine the semantic interpretation of words and linkage between and syntax and semantics.

CO5: Explains language models required to verify its significance with recent trends in natural language.

Text Books:

T1. James Allen, "Natural Language Understanding", Second Edition, 2003, Pearson Education. Reprint 2013

T2. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.

Reference Books:

R1. Steven Bird, Ewan Klein, Edward Loper, "Natural Language Processing with Python", O'Reilly Media; First edition (July 10, 2009)

R2. Daniel Jurafsky and James H Martin, "Speech and Language Processing:

R3. Anintroduction to Natural Language Processing, Computational Linguistics and SpeechRecognition", 2nd Edition, Prentice Hall, 2008

Online Resources: NIL

Mapping with Program Outcomes (POs)															
CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1													
CO2	2	1												1	
CO3	3	2	1											1	
CO4	3	3	2	1										1	
CO5	2	1												1	

Course Name: Operational Research					
Course Code : CS764E05					
	L	**T**	**P**	Category	**OE**
Contact Hrs./ Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./ Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To study the concepts behind Operations Research.To understand the concepts of linear programming, duality Theory and other optimization Techniques related to Tranportation and assignment problems, game theory ,decision theory , Metaheuristics.					
Prerequisites: Mathematics I and Mathematics II.					
Units					**Teaching Hours**
Unit-1 INTRODUCTION, LINEAR PROGRAMMING					

INTRODUCTION The origin, nature and impact of OR; Defining the problem and gathering data; Formulating a mathematical model; Deriving solutions from the model; Testing the model; Preparing to apply the model; Implementation. Introduction to Linear Programming: Prototype example; The linear programming (LP) model. LINEAR PROGRAMMING – 2, SIMPLEX METHOD – 1 Assumptions of LP; Additional examples. The essence of the simplex method; Setting up the simplex method; Algebra of the simplex method; The simplex method in tabular form; Tie breaking in the simplex method	9
Unit-2 SIMPLEX METHOD AND DUALITY THEORY	
SIMPLEX METHOD – 2 Adapting to other model forms; Post optimality analysis; Computer implementation. Foundation of the simplex method. The revised simplex method, a fundamental insight. DUALITY THEORY The essence of duality theory; Economic interpretation of duality. Primal dual relationship; Adapting to other primal forms.	9
Unit-3 DUALITY THEORY AND OTHER ALGORITHMS OF LP, TRANSPORTATION AND ASSIGNMENT PROBLEMS	
DUALITY THEORY AND OTHER ALGORITHMS OF LP Duality Theory, The role of duality in sensitive analysis; The dual simplex method; TRANSPORTATION AND ASSIGNMENT PROBLEMS The transportation problem; A streamlined simplex method for the transportation problem; The assignment problem; A special algorithm for the assignment problem.	9
Unit-4 GAME THEORY, DECISION ANALYSIS	
GAME THEORY, DECISION ANALYSIS Game Theory: The formulation of two persons, zero sum games; Solving simple games- a prototype example; Games with mixed strategies; Graphical solution procedure; Solving by linear programming, Extensions. Decision Analysis: A prototype example; Decision making without experimentation; Decision making with experimentation; Decision trees.	9

Unit-5 METAHEURISTICS	
METAHEURISTICS The nature of Meta heuristics, Tabu Search, Simulated Annealing, Genetic Algorithms-Case study	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Explain key terms, theories/concepts and practices within the field of resource management Techniques to translate a real-world problem, given in words, into a mathematical formulation
CO2: Solve by using simplex method after developing operational research models from the verbal description of the real system and implementation of it.
CO3: Solve by using Duality theory, assignment and transportation strategies .
CO4: Use game theory and decision theory to solve real life problems.
CO5: Investigate metaheuristics algorithms and create computer code to solve problems by using metaheuristics techniques , including (a) mathematical optimisation problem and solution of proposed models (b) using existing optimisation toolkits and develop operational research models from the verbal description of the real system and implementation of OR algorithms using modern tools .

Text Books:
T1. Frederick S. Hillier and Gerald J. Lieberman , "Introduction to Operations Research" Tata McGraw Hill, 9th Edition, 2010. (reprint)
T2.Hamdy A Taha ,"Operations Research: An Introduction", 8th Edition, Prentice Hall India, 2012 (Reprint)
T3.Dr. Prem Kumar Gupta, Dr. D.S Hira ,"Operations Research", 8th Edition, S. Chand Publishing, 1992(Reprint)

Reference Books:
R1. Wayne L. Winston , "Operations Research Applications and Algorithms", Thomson Course Technology, 4th Edition, 2003 (Reprint)
R2. Vohra, "Quantitative Techniques in Management", Tata McGraw Hill, 2006.(Reprint)
R3. AnandSarma, "Operation Research", Himalaya Publishing House, 2014. (Reprint)
Winston ,"Operation Research", Thomson Learning, 2003.(Reprint)
R4.JK Sharma, "Operations Research theory and applications", Macmillan India, 2009, Thomson Learning, 4th edition, 2009. (Reprint)

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3								3			**1**	
CO2	3	3	3								3			**1**	
CO3	3	3	3								3			**1**	
CO4	3	3	3								3			**1**	
CO5	3	3	3											**1**	

<table>
<tr><td colspan="6">Course Name: Bio Informatics</td></tr>
<tr><td colspan="6">Course Code : CS764E06</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>OE</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
This course provides computational management and use of biological information to solve biological problems. This includes descriptions of genetic and biological databases and relevant tools available to retrieve and analyse the information through evolutionary analysis, data mining, protein structure/function and computational drug discovery.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Basic Python / R Programming/</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 DATABASES & SEQUENCE ALIGNMENT TOOLS:</td></tr>
<tr><td colspan="5">Introduction to Bioinformatics, Bioinformatics resources and Databases: NCBI, EBI, ExPASy, RCSB. GenBank, DDBJ, EMBL, Uniprot-KB, SWISS-PROT. Format of databases- Gene bank flat file. Protein Data Bank (PDB) flat file; FASTA Format; Structure file formats- PDBLite, Pfam, ProDOM; Specialized databases: NCBI, Pubmed, OMIM. Substitution scores, substitution matrices, PAM, BLOSUM, FASTA, BLAST, Multiple Sequence Alignment, Progressive Alignment Methods, CLUSTALW, Motifs and Patterns, PROSITE, MeMe, PSI-BLAST, PHI-BLAST, Hidden Markov Models (HMMs).</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 PHYLOGENETIC ANALYSIS AND PREDICTIVE METHODS:</td></tr>
</table>

Introduction to Phylogenetic analysis, Phylogenetic Data Analysis: Alignment, Substitution Model Building, Tree Building, and Tree Evaluation, Tree - Building Methods-Distance based and character based methods, Evaluating Trees and Data-Phylogenetic software (CLUSTALW), Predictive Methods using Nucleotide sequences: Framework, Masking repetitive DNA, Codon Bias Detection, Detecting Functional Sites in the DNA (promoters, transcription factor binding sites, translation initiation sites), Integrated Gene Parsing, finding RNA Genes, Web based tools (GENSCAN, GRAIL, GENEFINDER). Predictive Methods using Protein sequences: Protein Identity based on composition, Physical properties Based on sequence, secondary structure and folding classes, specialized structures or features, tertiary structure.	9
Unit-3 GENOME BIOINFORMATICS:	
Sequencing methods, Bioinformatics tools and automation in Genome Sequencing, analysis of raw genome sequence data, Utility of EST database in sequencing, Bioinformatics in detection of Polymorphisms, SNPs and their relevance, Bioinformatics tools in Next Gen Sequencing (RNA Seq). Tools for comparative genomics: BLAST2, AVID, Vista, MUMmer, COG, VOG. Qualitative discussions on Machine Learning Tools (Artificial Intelligence, Genetic algorithm and Neural networks).	9
Unit-4 MOLECULAR MODELING & VIZUALIZATION:	
Scope and applications of insilico modeling. Comparative modeling- molecular superposition and structural alignment, concept of energy minimization, interactions and formulation of force fields. Basic MD algorithm. Structure Visualization and Graphical representation of molecular structures: small molecules (low molecular weight – peptides, nucleotides, disaccharides, simple drugs molecules) and macromolecules. Usages of visualization software available in public domain like VMD, Rasmol, Pymol, SpdbViewer, Chime, Cn3D and GRASP. Rotameric Structures of Proteins, Canonical DNA Forms (DNA Sequence Effects).	9
Unit-5 PLASMID MAPPING, PRIMER DESIGN AND INSILICO DRUG DESIGN:	

Restriction mapping, Utilities, DNA strider, MacVector and OMIGA, gene construction KIT, Vector NTI, Web based tools (MAP, REBASE); Primer design – need for tools, Primer design programs and software (PRIME3). Molecular modeling in drug discovery, deriving bioactive conformations, molecular docking, quantitative structure-activity relationship (QSAR), deriving the Pharmacophoric Pattern, Receptor Mapping, Estimating Biological Activities, Ligand - Receptor Interactions: Docking softwares (AUTODOCK, HEX) Calculation of Molecular Properties, Energy Calculations.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Recall various databases, tools, repositories and be able to use each one to extract specific biological information (Remember) (PO1,PO2,PO3,PO4,PO5,PO6,PO7) CO2: Explain the basic principles that underpin Bioinformatics analyses, and apply these principles when analysing biological data(Understand) (PO1,PO2,PO3,PO4,PO5,PO6,PO7) CO3: Examine and justify appropriate choices in technology, strategy, and analysis for a range of applications involving DNA, RNA, or protein sequence data. (Analyze) (PO1,PO2,PO3,PO4,PO5,PO6,PO7) CO4: Discover features on the sequence such as coding regions, restriction enzyme sites, etc. and interpret sequence analysis for biological functional regions. (Apply) (PO1,PO2,PO3,PO4,PO5,PO6,PO7) CO5: Interpret correctly the outputs from tools used in the field of Drug Discovery and make meaningful predictions from these outputs. (Understand) (PO1,PO2,PO3,PO4,PO5,PO6,PO7)	
Text Books: T1. Jonathan Pevsner, "Bioinformatics and Functional Genomics", 3rd Edition, Wiley, 2017 T2. David M Mount, "Bioinformatics Sequence and Genome Analysis", 2nd Edition, Cold Spring, 2005 T3. Kristian Stromgaard, Povl Krogsgaard-Larsen, Ulf Madsen "Textbook of Drug Design and Discovery" CRC Press; 5 edition 2016	

Reference Books:

R1. Supratim Choudhuri, " Bioinformatics for Beginners: Genes, Genomes, Molecular Evolution, Databases and Analytical Tools", 1st Edn, Academic Press Co , 2014

R2. Conrad Bessant, Ian Shadforth, Darren Oakley "Building Bioinformatics Solutions: with Perl, R and MySQL", 1st Edn, Oxford University Press, 2009

R3. Pavel Pevzner, Ron Shamir, " Bioinformatics for Biologists", 1st Edn, Cambridge University Press , 2011

R4. Lee Banting , Tim Clark , David E. Thurston , Rob J. Deeth, Drug Design Strategies: Computational Techniques and Applications. Royal Society of Chemistry; 2012

R5. Jenny Gu, Philip E. Bourne Structural Bioinformatics, Wiley-Blackwell; 2009

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	3	3	2	2							**1**	
CO2	2	3	2	3	2	2	2							**1**	
CO3	3	2	2	2	2	3	2							**1**	
CO4	2	2	3	2	3	2	2							**1**	
CO5	2	3	2	3	2	3	2							**1**	

Course Name: Microprocessor and micro controller					
Course Code : CS764E07					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**2**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**
Course objectives: This course will introduce the students to the basics of Microprocessors and Microcontrollers					
Prerequisites: Digital Systems					

Units	**Teaching Hours**
Unit-1 THE 8086 MICROPROCESSOR	
Introduction to 8086 – Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks	6
Unit-2 8086 SYSTEM BUS STRUCTURE	
8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor	6
Unit-3 I/O INTERFACING	
Memory Interfacing and I/O interfacing – Parallel communication interface – Serial communication interface – D/A and A/D Interface – Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications	6
Unit-4 MICROCONTROLLER	
Architecture of 8051 – Special Function Registers(SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming.	6
Unit-5 INTERFACING MICROCONTROLLER	

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.	6
List of Experiments	**Practical Hours**
1. Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.	6
2. Implement assembly level program using 8086 a) Addition of 2 - 8 bit numbers b) Subtraction of 2 - 8 bit numbers	3
3. Implement assembly level program using 8086 a) Addition of 2 - 16 bit numbers b) Subtraction of 2 – 16 bit numbers	3
4. Implement assembly level program using 8086 a) Multiplication of 2 - 8 numbers b) Division of 2 - 8 bit numbers	3
5. Implement assembly level program using 8086 a) Ascending order b) Descending order	3
6. Implement assembly level program using 8086 a) Fibonaci Series b) Sum of finite series	3
7. Stepper motor rotate forward and reverse direction	3
8. Digital analog conversion	3
9. Microcontroller a) Addition b) Subtraction c) Multiplication d) Division	3
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Experiment theassembly language programs for the 8086 microprocessor. (Apply) (PO1,PO2,PO3,PO4)
CO2:Explain the system bus structure for the 8086 microprocessor. (Understand) (PO1)
CO3: Experiment with I/O and memory devices by interfacing them with the microprocessor. (Apply) (PO1,PO2,PO3,PO4)
CO4: Experiment theassembly language programs for the 8051 microcontroller. (Apply) (PO1,PO2,PO3,PO4)
CO5:Experiment with I/O and memory devices by interfacing them with 8051 microcontroller. (Apply) (PO1,PO2,PO3,PO4)

Text Books:
T1. Yu-Cheng Liu, Glenn A.Gibson, Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design, Second Edition, Prentice Hall of India, 2007.
T2.Mohamed Ali Mazidi, Janice GillispieMazidi, RolinMcKinlay, ―The 8051 Microcontroller and Embedded Systems: Using Assembly and C, Second Edition, Pearson education,2011

Reference Books:
R1. DoughlasV.Hall, Microprocessors and Interfacing, Programming and Hardware, TMH, 2012.
R2. A.K.Ray,K.M.Bhurchandi, Advanced Microprocessors and Peripherals ―3rd edition, Tata McGrawHill, 2012

Online Resources:

nptel.ac.in/courses/.../IIT.../5_Programming%20of%20microprocessor.doc

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	1	1										**1**	
CO2	2													**1**	
CO3	2	2	2	1										**1**	
CO4	2	1	1	1										**1**	
CO5	2	2	2	1										**1**	

Course Name: Digital Signal Processing					
Course Code : CS764E08					
	L	**T**	**P**	Category	OE
Contact Hrs./Week	2	0	1	CIA Marks	50
Contact Hrs./Sem.	30	0	30	ESE Marks	50
Credits.	2	0	1	Exam Hours	3 hrs
Course objectives: • To study the switching theory and the realization of logic gates. • To study minimization methods. • To study combinational circuits. • To study sequential circuits					
Prerequisites: NIL					
Units					**Teaching Hours**
Unit-1SIGNALS & SYSTEMS					
Basic elements of digital signal Processing Concept of frequency in continuous time and discrete time signals, Sampling theorem, Discrete time signals, Discrete time systems, Analysis of Linear time invariant systems, Z transform, Convolution and correlation.					9
Unit-2FAST FOURIER TRANSFORMS					
Introduction to DFT, Efficient computation of DFT, FFT algorithms, Radix2 and Radix4 FFT algorithms, Decimation in Time and Decimation in Frequency algorithms					9
Unit-3IIR FILTER DESIGN					
Structure of IIR System, Design of Discrete time IIR filter fromcontinuous time filter, IIR filter design by Impulse Invariance. Bilinear transformation, Design of digital Butterworth and Chebyshev Filters.					9
Unit-4FIR FILTER DESIGN					
Symmetric & Anti symmetric FIR filter, Linear phase filter, Windowing technique - Rectangular, Hamming, Hanning, Frequency sampling techniques, Structure for FIR systems.					9

Unit-5INFORMAL LABORATORY

Case study: Learn the Fundamentals ofDigital Signal processing using MATLAB. Minimum 6 experiments in MATLAB including generation of discrete time signals, Verification of sampling theorem, design of FIR filter, deign of IIR filter.	9

Self-study : NIL

Site/Industrial Visits :NIL

Course outcomes:
At the end of the course, the student will be able to :
CO1: Explain the basic elements of digital signal Processing.
CO2: Describe the basics of DFT and FFT concepts.
CO3: Explain the design FIR filters.
CO4: Explain and design of IIR filters.
CO5: Explain the and analyze the Finite Word Length Effects.

Text Books:
T1.John G Proakis- Dimtris G Manolakis, Digital Signal Processing Principles-Algorithms and Application, Pearson/PHI- 4th Edition, 2007
T2. S. K. Mitra- "Digital Signal Processing- A Computer based approach", TataMc-Graw-Hill, 2001, New Delhi

Reference Books:
R1. Alan V. Oppenheim, Alan S. Willsky with S. Hamid Nawab, Signals & Systems, 2ndedn., Pearson Education, 2015.
R2. Allan V.Openheim, Ronald W. Sehafer& John R. Buck-"Discrete Time Signal Processing", Third edition, Pearson/Prentice Hall,2014

Online Resources:
NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1			1									1	
CO2	2	1			1									1	
CO3	2	1			1									1	
CO4	2	1			1									1	
CO5	2	1			1									1	

Course Name: Software Testing					
Course Code : CS764E09					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**2**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**
Course objectives: To give an overview of the software testing techniques. To design and understand test cases, various levels of testing and related concepts.					
Prerequisites: Software Engineering					

Units	**Teaching Hours**
Unit-1 INTRODUCTION	
Testing as a Process – Basic Definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer	6
Unit-2 TEST CASE DESIGN	
Introduction to Testing Design Strategies – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – positive and negative testing – Boundary Value Analysis – decision tables - Equivalence Class Partitioning state-based testing – error guessing - compatibility testing – user documentation testing – domain testing Using White–Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing - Covering Code Logic – Paths – Their Role in White–box Based Test Design – code complexity testing – Evaluating Test Adequacy Criteria.	6
Unit-3 TESTING	

The Need for Levels of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests. Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – scenario testing –System Testing – types of system testing - Acceptance testing – performance testing - Regression Testing – internationalization testing – ad-hoc testing - Alpha – Beta Tests – usability and accessibility testing	6
Unit-4 TEST MANAGEMENT	
People and organizational issues in testing – organization structures for testing teams – testing services - Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process - Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist	6
Unit-5 CONTROLLING AND MONITORING	
Software test automation – skills needed for automation – scope of automation – challenges in automation - Test metrics and measurements –project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – Evaluating software quality – defect prevention	6
List of Experiments	**Practical Hours**
1. Case study/ project on Unit Testing	6
2. Case study/ project on Integration Testing	6
3. Case study/ project on System Testing	6
4. Case study/ project on White box Testing	6
5. Case study/ project on Regression Testing	6
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Identify the reason for bugs and device mechanism forpreventing /fixing bugswith respect tothe principles in software testing .
CO2: Interpret the existing procedures for software testing which would enhance the software quality.
CO3: Construct a software test plan to validate the software with respect to defined test scenarios.
CO4: Justify the test processes applied in the testing framework and incorporate the procedures as a formatted report.
CO5: Analyze the available techniques in software testing which would validate any given software product in a commercial environment.

Text Books:
T1.Boris Beizer, "Software Testing Techniques", Dreamtech. Second Edition, 2009
T2. SrinivasanDesikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson education, 2008.

Reference Books:
R1. Elfriede Dustin, "Effective Software Testing", Pearson Education, First Edition, 2008.
R2. Edward Kit, "Software Testing in the Real World", Pearson Education, 2008.
R3. AdityaP.Mathur, "Foundations of Software Testing", Pearson Education, 2011.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2		1					3	1			1		
CO2	2	1			2				2	2			1		
CO3	3	2	1						2	1			1		
CO4	3	3	3	3					2	2			1		
CO5	3	3		2			2		1				1		

Course Name: Information Retrieval					
Course Code : CS764E10					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**2**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**
Course objectives: The course provides good understanding of the foundation concepts of information retrieval techniques and be able to apply these concepts into practice.					
Prerequisites: DAA, Internet Programming.					
Units					**Teaching Hours**
Unit-1					
Boolean retrieval. The term vocabulary and postings lists. Dictionaries and tolerant retrieval. Index construction and compression.					6
Unit-2					

Scoring, term weighting and the vector space model. Computing scores in a complete search system. Evaluation in information retrieval. Relevance feedback and query expansion.	6
Unit-3	
XML retrieval. Probabilistic information retrieval. Language models for information retrieval. Text classification. Vector space classification.	6
Unit-4CONCURRENCY CONTROL AND RECOVERY	
Support vector machines and machine learning on documents, Flat clustering, Hierarchical clustering, Matrix decompositions and latent semantic indexing.	6
Unit-5 DATABASE SECURITY	
Web search basics. Web crawling and indexes, Link analysis. Case study of Google Information Retrieval System or any web based system.	6
List Of Experiments	**Practical Hours**
Experiment 1 : Boolean Retrieval	3
Experiment 2 : Index Construction	3
Experiment 3: Implementation of Vector Space Model	3
Experiment 4: Feedback Relevance and Query Expansion	3
Experiment 5: Implementation of Text Classification	3
Experiment 6: Implementation of SVM	3
Experiment 7: Clustering using Hierarchal approach	3
Experiment 8: Matrix Decomposition	3
Experiment 9 : Implementation of Web Search	3
Experiment 10 : Web Crawling	3
Self-study : NA	
Site/Industrial Visits : Na	

Course outcomes: CO1: Elaborate various retrieval techniques and index construction.(Understand) (PO1,PO2,PO3,PO4) CO2: Compute score in search system and estimate the informational retrieval using feedback and query expansion.(Apply) (PO1,PO2,PO3,PO4) CO3:Acquire knowledge on various retrieval and classification techniques(Apply) (PO1,PO2,PO3,PO4) CO4: Explore various clustering and indexing techniques.(Apply) (PO1,PO2,PO3,PO4) CO5: Illustrate web search, web crawling and indexing for real time web based system (Analyze) (PO1,PO2,PO3,PO4)
Text Books: T1. Introduction to Information Retrieval, Christopher D. Manning, PrabhakarRaghavan and HinrichSchütze, Cambridge University Press. 2008
Reference Books: R1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald, Mark T Maybury, Springer 2009. R2. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007. R3. Information Retrieval: Algorithms and Heuristics, David A Grossman and OphirFrieder, 2nd Edition, Springer, 2008
Online Resources: NIL
Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2										1	
CO2	3	3	3	2										1	
CO3	3	3	3	2										1	
CO4	3	2	2	2										1	
CO5	3	3	3	2										1	

Course Name: Software Coding Practices					
Course Code : CS764E11					
	L	**T**	**P**	Category	**OE**
Contact Hrs./Week	**2**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**30**	**0**	**30**	ESE Marks	**50**
Credits.	**2**	**0**	**1**	Exam Hours	**3**

Course objectives: .The students should develop an understanding of the tools and techniques that may be used for the automatic analysis and evaluation of software; To build foundation on different patterns and Software Engineering Models

Prerequisites: Software Engineering, Programming Paradigms.

Units	**Teaching Hours**
Unit-1 SINGLE RESPONSIBILITY PRINCIPLE AND OPEN/CLOSED PRINCIPLE	
Single Responsibility principle: Problem statement - SRP and the Decorator pattern. Open/Closed Principle: Introduction to Open/Closed principle - Extension points	6
Unit-2 LISKOV SUBSTITUTION PRINCIPLE AND INTERFACE SEGREGATION	
Liskov Substitution principle: Introduction to the Liskoc substitution principle - Cotracts - Covariance and contra variance - Conclusion	6
Unit-3 DEPENDENCY INJECTION	
Dependency injection: Humble beginnings	6
Unit-4 CREATIONAL AND STRUCTURAL PATTERNS	
Creational Patterns: Abstract Factory - Builder - Factory Method - Prototype - Singleton	6
Unit-5 BEHAVIORAL PATTERNS AND COMMON PATTERNS	

Behavioral Patterns: Chain of Responsibility - Command - Interpreter - Iterator - Mediator - Memento - Observer - State - Strategy - Template Method - Visitor – Case study-Common Patterns: Null Object - Simple Factory	6
List of Experiments	**Practical Hours**
Implementation of Single Responsibility principle.	3
Implementation of Open/Closed principle.	3
Implementation of Liskov Substitution principle.	3
Implementation of Interface segregation.	3
Implementation of Dependency injection.	3
Implementation of Creational patterns.	3
Implementation of Structural patterns.	3
Implementation of Behavioral patterns.	3
Implementation of Common patterns	3
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Describe the SOLID principle as major design principles. CO2:Apply the efficient coding practices learnt. CO3: Examine Creational design patterns to exploit object creation. CO4: Interpret Structural design patterns to understand the class-object relation . CO5: Justify Behavioral design patterns to analyze the class behaviour and demonstrate MVC, Layers and other efficient design patterns.	
Text Books: T1.Gary Mclean Hall, "Adaptive Code via C#", Microsoft Press, 2014. T2.Tony Bevis, "C# Design Pattern Essentials", 2012..	

Reference Books:
R1. Bishop, "Design Patterns C# 3.0", O'REILLY , 2008
R2.Eric Freeman, Bert Bates, Kathy Sierra, Elisabeth Robson, "Head First Design Patterns", O'REILLY, 2004
R3.Steven John Metsker, "Design Patterns in C# (Software Patterns)", Addison Wesley, 1st Edition 2004.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1						1						1	
CO2	1	1	1			1								1	
CO3	2	2	2	2		2								1	
CO4	2	2	2	2	2	2						2		1	
CO5					2	2			2					1	

CS781	Internship - 2	Hours			Credits			
		L	T	P	L	T	P	C
		0	0	2	0	0	2	1

INTERNSHIP POLICY, GUIDELINES AND PROCEDURES

INTRODUCTION

Internships are short-term work experiences that will allow a student to observe and participate in professional work environments and explore how his interests relate to possible careers. They are important learning opportunities trough industry exposure and practices. More specifically, doing internships is beneficial because they provide the opportunity to:

- Get an inside view of an industry and organization/company
- Gain valuable skills and knowledge
- Make professional connections and enhance student's network
- Get experience in a field to allow the student to make a career transition

Regulations

1.The student shall undergo an Internship for30 days starting from the end of 2nd semester examination and completing it during the initial period of 3rd semester.

2.The department shall nominate a faculty as a mentor for a group of students to prepare and monitor the progress of the students

3. The students shall report the progress of the internship to the mentor/guide at regular intervals and may seek his/her advise.

4. The Internship shall be completed by the end of 7th semesters.

5. The students are permitted to carry out the internship outside India with the following conditions, the entire expenses are to be borne by the student and the University will not give any financial assistance.

6. Students can also undergo internships arranged by the department during vacation.

7. After completion of Internship, students shall submit a report to the department with the approval of both internal and external guides/mentors.

8. There will be an assessment for the internship for 2 credits, in the form of report assessment by the guide/mentor and a presentation on the internship given to department constituted panel.

Course outcomes:

CO1: Design solutions to real time complex engineering problems using the concepts of Computer Science and Information Technology through independent study.

CO2 : Demonstrate teamwork and leadership skills with professional ethics.

CO3: Prepare an internship report in the prescribed format and demonstrate oral communication through presentation of the internship work.

Mapping with Program Outcomes (POs):

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2								2	1	
CO2								2	2				2	2	
CO3										3			2	2	

CS782	Service Learning	Hours			Credits			
		L	T	P	L	T	P	C
		0	0	4	0	0	2	2

Course outcomes:

CO1:Apply the concepts of Computer Science and Information Technology to solve given real world societal problems through prototypes.
CO2:Design solutions to given real world societal problems through working prototypes. .
CO3:Select appropriate hardware and software as per the requirement of the project designed to solve given real world societal problems.
CO4:Understand the impact of the developed projects on environmental factors.
CO5:Demonstrate project management skills including handling the finances in doing projects for given real world societal problems.

Mapping with Program Outcomes (POs):

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1			2							2	1	1
CO2	3	3	3	3		3							2	1	3
CO3			3		3	2							2	1	1
CO 4						2	1								2
CO5											3		3		1

CS783	Project Phase-I	Hours			Credits			
		L	T	P	L	T	P	C
		0	0	6	0	0	3	3

Course objectives: To perform a task involving research or design, that is carefully planned to achieve a particular aim. To learn modular programming - analyse problems, design solutions, learn new tools and implement the system as a team/ individual.

Course outcomes:

CO1: Design engineering solutions to complex real world problems using research literature for societal applications through independent study.
CO2: Use appropriate hardware and software depending on the nature of the project with an understanding of their limitations.
CO3: Demonstrate teamwork and leadership skills with professional ethics and prepare a project report in the prescribed format.
CO4: Understand the impact of the developed projects on environmental factors.
CO5: Demonstrate project management skills including handling the finances in doing projects for given real world societal problems.

Mapping with Program Outcomes (POs):

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3		3						3	3	3	2
CO2					3							2	2	2	2
CO3								3	3	3		2	2	2	2
CO 4						3	3					2	2	2	2
CO5						3					3	2	2	2	2

Course Name: Quantum Computing					
Course Code : CS845E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: Sound knowledge and understanding of the fundamentals of Quantum Computing, Concepts in quantum computation with examples, building blocks of Quantum Computers, Concepts applications and limitations of Quantum operations and basic concepts in quantum error correction and fault tolerant quantum computing.					
Prerequisites: Engineering Physics , Computer Organization and Architecture, Design and Analysis of Algorithms					

Units	**Teaching Hours**
Unit-1 FUNDAMENTAL CONCEPTS	
Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms.	9
Unit-2 QUANTUM COMPUTATION	
Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database.	9
Unit-3 QUANTUM COMPUTERS	

Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance.	9
Unit-4 QUANTUM INFORMATIONS	
Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information.	9
Unit-5 QUANTUM ERROR CORRECTION	
Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource. Case study.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain basic concepts in Quantum computing. CO2: Demonstrate applications of Quantum computing. CO3: Explain principles in the design of Quantum Computers. CO4: Identify applications and limitations of Quantum operations. CO5: Apply concepts in Quantum Error Correction.	
Text Books: T1. 1. Michael A. Nielsen. & Issac L. Chiang, "Quantum Computation and Quantum Information", 10th Anniversary edn, Cambridge University Press, 2010	
Reference Books: R1. Mika Hiravensalo, "Quantum computing" II edition, Springer- 2004	
Online Resources: NIL	
Mapping with Program Outcomes (POs)	

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

CO1	2	1													
CO2	2	1													1
CO3	2	1													
CO4	3	2													1
CO5	3	2	1											1	1

Course Name :Mobile Computing					
Course Code : CS845E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./ Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./ Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: At the end of the course, the student should understand to provide basics for various techniques in Mobile Communications and Mobile Content services. To learn the basics of wireless voice and data communications technologies. To build working knowledge on various telephone and satellite networks. To study the working principles of wireless LAN and its standards.To build knowledge on various mobile computing algorithms.To build skills in working with wireless application protocols to develop mobile content applications.					
Prerequisites: NA					

Units	Teaching Hours
Unit-1 WIRELESS COMMUNICATION FUNDAMENTALS	
Introduction – Wireless transmission – Frequencies for radio transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC – SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.	9
Unit-2 TELECOMMUNICATION NETWORKS	
Telecommunication systems – GSM – GPRS – DECT – UMTS – IMT-2000 – Satellite Networks - Basics – Parameters and Configurations – Capacity Allocation – FAMA and DAMA – Broadcast Systems – DAB - DVB.	9
Unit-3 WIRLESS LAN	
Wireless LAN – IEEE 802.11 - Architecture – services – MAC – Physical layer – IEEE 802.11a - 802.11b standards – HIPERLAN – Blue Tooth.	9
Unit-4 MOBILE NETWORK LAYER	

Mobile IP – Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics.	9
Unit-5 TRANSPORT AND APPLICATION LAYERS	
Traditional TCP – Classical TCP improvements – WAP, Case Study.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Demonstrate basis of wireless technology and media access schemes for classical systems.
CO2: Present different wireless communication systems and to show how they transfer data between communication partners.
CO3: Illustrate MAC Layer Protocols for wireless communication.
CO4: Compare the performance of different routing algorithms supported by mobile communication.
CO5: Organize TCP performance and WAP features in Mobile environment.

Text Books:
T1: Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition, Reprint edition 2012.
T2: William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2009. (Unit I Chapter – 7&10-Unit II Chap 9)

Reference Books:
R1: Kaveh Pahlavan, Prasanth Krishnamoorthy, "Principles of Wireless Networks", PHI/ Pearson Education, 2003.
R2: Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
R3: Hazysztof Wesolowshi, "Mobile Communication Systems", John Wiley and Sons Ltd, 2002.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2												1	1	
CO2	3	2	1										1	1	
CO3	3	2	1										2	2	1
CO4	3	3	2	1									3	2	1
CO5	3	3	2	1	1								3	2	1

Course Name: Parallel Computing					
Course Code : CS845E03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To study the scalability, clustering issues, parallel programming models, shared memory programming and enabling technologies for parallel computing.					
Prerequisites: Digital Systems and Microprocessors Computer Organization and Architecture					

Units	Teaching Hours
Unit-1 SCALABILITY AND CLUSTERING	
Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts Of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction / Communication Issues – Semantic Issues In Parallel Programs.	9
Unit-2 ENABLING TECHNOLOGIES	
System Development Trends – Principles of Processor Design – Microprocessor Architecture Families – Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques – Multithreaded Latency Hiding.	9
Unit-3 PARALLEL PROGRAMMING	
Paradigms And Programmability – Parallel Programming Models – Shared Memory Programming using OpenMP	9
Unit-4 MESSAGE PASSING PROGRAMMING	
Message Passing Paradigm – Message Passing Interface – MPI programming.	9
Unit-5 GPU AND CUDA PROGRAMMING	

GPU Architecture – Basics of CUDA – CUDA Threads – CUDA Memories – Synchronization Handling – Performance Issues – Application Development	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Justify the need for parallel computing from a performance point of view.
CO2: Explain massive parallelism in modern parallel computers with shared memory and distributed memory from an architectural perspective.
CO3: Examine the functionalities of buses, crossbars and multistage switches as interconnection networks for parallel computers.
CO4: Differentiate parallel computing models based on shared address space platforms, distributed memory systems and heterogeneous platforms for their performance and scalability.
CO5: Design and Propose parallel algorithms using programming models OpenMP and MPI and compare performance with the serial implemenations.

Text Books:
T1. Kai Hwang and Zhi.Wei Xu, "Scalable Parallel Computing", Tata McGraw-Hill, 2003

Reference Books:
R1. Michael J. Quinn, "Parallel Programming in C with MPI & OpenMP", Tata McGraw-Hill, New Delhi, 2003.
R2. Kai Hwang, "Advanced Computer Architecture" Tata McGraw-Hill, New Delhi, 2003
R3. David E. Culler & Jaswinder Pal Singh, "Parallel Computing Architecture: A Hardware/Software Approach", Morgan Kaufman Publishers, 1999
R4. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann, 2011.
R5. John L. Hennessey and David A. Patterson, "Computer Architecture – A quantitative
Approach", Morgan Kaufmann / Elsevier Publishers, 5th. Edition, 2012.
R6. Shane Cook, "CUDA Programming: —A Developer's Guide to Parallel Computing with GPUs(Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2012.
R7. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors - A Hands-on Approach", Second Edition, Morgan Kaufmann, 2012

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3													
CO2	2	1												1	
CO3	3	2		1										2	
CO4	3	3		2											
CO5	3	3	3	3	2								2	2	1

Course Name: Grid Computing					
Course Code : CS845E04					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**

Course objectives:
Grid computing is the use of widely distributed computer resources to reach a common goal. The grid can be thought of as a distributed system with non-interactive workloads that involve a large number of files.

Prerequisites: CS435-Computer Networks

Units	**Teaching Hours**
Unit-1 INTRODUCTION TO GRID COMPUTING	
Introduction to Grid Computing: Grid Computing Concept, History of Distributed Computing Computational Grid Applications, Grid Computing Infrastructure Development, Grid Computing Software Interface Job Submission: Introduction, Globus Job Submission, Transferring Files.	9
Unit-2 SCHEDULING AND SECURITY	
Schedulers: Scheduler Features, Scheduler Examples, Grid Computing Meta-Schedulers, Distributed Resource Management Application (DRMAA). Security Concepts: Introduction, Symmetric Key Cryptography, Asymmetric Key Cryptography, (Public Key Cryptography), Public Key Infrastructure, Systems/Protocols Using Security Mechanisms. Grid Security: Introduction, Grid Security Infrastructure (GSI), Delegation, Higher-Level Authorization Tools.	9
Unit-3 GRID INFRASTRUCTURE	

System Infrastructure I: Web Services: Service-Oriented Architecture, Web Services and Web Service Implementation. System Infrastructure II: Grid Computing Services: Grid Computing and Standardization Bodies, Interacting Grid Computing Components, Open Grid Services Architecture (OGSA), WSRF. User-Friendly Interfaces: Introduction Grid Computing Workflow Editors, Grid Portals.	9
Unit-4 APPLICATIONS IN GRID COMPUTING	
Grid-Enabling Applications: Introduction, Parameter Sweep, Using an Existing Program on Multiple Grid Computers, Writing an Application Specifically for a Grid, Using Multiple Grid Computers to Solve a Single Problem.	9
Unit-5 CASE STUDIES	
Globus: Overview of Globus Toolkit 4, Installation of Globus, GT4 Configuration, Main Components and programming Model, Using Globus. gLite: Introduction, Internal Workings of gLite, Logging and Bookkeeping (LB), Security Mechanism Using gLite. Resource management using Gridway and Gridbus. Scheduling using Condor, SGE, PBS, LSF Grid scheduling with QoS.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Illustrate the core concepts of the grid computing paradigm and applications. CO2: Interpret the functioning of scheduling and security concepts in grid. CO3: Summarize the concept of grid Service Oriented Architecture and Open Grid Services Architecture. CO4: Utilize grid based applications to solve multiple grid Computers problem. CO5: Examine the various components in Globus Toolkit.	
Text Books: T1. Barry Wilkinson, "Grid Computing Techniques and Applications", CRC Press, 2010. T2. Frederic Magoules, Jie Pan, Kiat-An Tan, Abhinit Kumar, “Introduction to Grid Computing”, CRC Press, 2009.	

Reference Books:
R1. Vladimir Silva, "Grid Computing for Developers ", Dreamtech Press, 2006.
R2. Ian Foster, Carl Kesselman. "The Grid 2- Blueprint for a new computing Infrastructure”, Elsevier Series, 2004.
R3. Fran Berman, Geoffrey Fox. Anthony J.G Hey, "Grid Computing: Making the Global Infrastructure a Reality", Wiley, 2003.
R4. Joshey Joseph, Craig Fellenstein, "Grid computing", IBM Press, 2004.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1											1		
CO2	2	1											1		
CO3	2	1			1								1		
CO4	3	2	1		1								1		
CO5	3	3	2	2	1								1		

<table>
<tr><td colspan="6">Course Name: Introduction to Data Mining</td></tr>
<tr><td colspan="6">Course Code : CS845E05</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td>PEC</td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td>0</td><td>0</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td>0</td><td>0</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td>0</td><td>0</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
To introduce the necessary background of data warehouse, the basic data mining algorithms and its applications. Syllabus focuses on data warehousing architecture, Multidimensional Data Model, Preprocessing, Association rule mining, Classification, Prediction , Clustering and Recent trends in higher order database systems.</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites: Database Management System</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 INTRODUCTION</td></tr>
<tr><td colspan="5">Relation To Statistics, Databases- Data Mining Functionalities-Steps In Data Mining Process-Architecture Of A Typical Data Mining Systems-Classification Of Data Mining Systems - Overview Of Data Mining Techniques.</td><td>6</td></tr>
<tr><td colspan="6">Unit-2 DATA PREPROCESSING</td></tr>
<tr><td colspan="5">Why Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation, Data Mining Primitives, Query Language, Graphical User Interfaces, Architectures, Concept Description, Data Generalization, Characterizations, Class Comparisons, Descriptive Statistical Measures.</td><td>6</td></tr>
<tr><td colspan="6">Unit-3 ASSOCIATION RULES</td></tr>
<tr><td colspan="5">Association Rule Mining, Single-Dimensional Boolean Association Rules from Transactional Databases, Multi-Level Association Rules from Transaction Databases</td><td>6</td></tr>
<tr><td colspan="6">Unit-4 PREDICTIVE MODELING</td></tr>
</table>

Classification and Prediction, Issues, Decision Tree Induction, Bayesian Classification, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Cluster Analysis, Types of data, Categorization of methods, Partitioning methods, Outlier Analysis.	6
Unit-5 RECENT TRENDS	
Multidimensional Analysis and Descriptive Mining of Complex Data Objects, Spatial Databases, Multimedia Databases, Time Series and Sequence Data, Text Databases, World Wide Web, Applications and Trends in Data Mining	6
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Identify the differences between relational database and data warehouses, the need for data warehousing to formulate the decision support system an engineering specialization for the prediction and modeling to complex engineering activities CO2: Summarize the dominant data warehousing architectures and analyze their implementation details to develop multidimensional data models to analyze complex engineering problems. CO3: Implement various data preprocessing techniques to design data warehouses that meet the specified needs of the society with appropriate environmental considerations. CO4: various clustering and classification algorithm functionalities and evaluate their merits and demerits to acquire research based knowledge for the synthesis of the information to provide valid conclusion. CO5: Experiment Data mining techniques and methods on large data sets and explain advanced data mining concepts and outline their scope of providing IT solutions for different domains which helps in the betterment of life.	
Text Books: T1. J. Han, M. Kamber, "Data Mining: Concepts and Techniques", Harcourt India / Morgan Kauffman, 2011. T2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson Education, 2012.	

Reference Books:

R1. K.P.Soman, ShyamDiwakar, V.Ajay: Insight into Data Mining – Theory and Practice, PHI, 2012

R2. David Hand, Heikki Manila, PadhraicSymth, "Principles of Data Mining", PHI 2012.

R3. W.H.Inmon, "Building the Data Warehouse", 3rd Edition, Wiley, 2011.

R4. Alex Bezon, Stephen J.Smith, "Data Warehousing, Data Mining & OLAP", MeGraw-Hill Edition, 2001

R5. PaulrajPonniah, "Data Warehousing Fundamentals", Wiley-Interscience Publication, 2003.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2						1						1	
CO2	3	3	2			1								1	
CO3	2	1	1	2		2								1	
CO4	3	3	3	2	3	2						1		1	
CO5					3	2			2					1	

Computer Aided Decision Support System					
CS846E01					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./ Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./ Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: The course will provide students with a working knowledge of topics related to Decision Support Systems design and implementation. Concepts and tools will be introduced that will be applied to different problems in Computer Science Engineering. Students will be introduced to the concepts of modeling, including simulation models and/or mathematical and empirical models, to provide for decision support.					
Prerequisites: DBMS					

Units	**Teaching Hours**
Unit-1	
Introduction to information system analysis and design, decision support systems, Database management systems, query languages, user interfaces.	9
Unit-2	
User interface languages, usability designs and considerations, model- base management systems	9
Unit-3	
Development of decision support models, basic simulation models, mathematical and empirical models. Model validation and verification, algorithms for decision support, alternative analysis, Implementing EOQ models	9
Unit-4	
Advancements in decision support systems, Knowledge based systems, enterprise resource planning systems, manufacturing resource planning systems.	9
Unit-5	

Application of decision support system in any engineering domain.Case study and implementation.	9
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:
CO1: Explain the fundamental concepts of Information system, decision system, Databases and user interfaces.
CO2: Explain model- base management systems.
CO3: Outline Decision supporting system to realize the development of decision support models, simulation models, mathematical models , verification and validation Process.
CO4: Explain recent trends related to DSS, KBS,ERP etc.
CO5: Summarize applications of Decision support system to investigate a case study.

Text Books:
T1. Vicki L Sauter, "Decision Support Systems", John Wiley & Sons, Inc. 2010

Reference Books:
R1: Ramez Elmasri and Shamkant Navathe, "Fundamentals of Database Systems", Addison Wesley Company.
R2: Efraim Turban, Jay Aronson, Ting- Peng Liang, and Ramesh Sharda, "Decision Support and Business Intelligence Systems", Prentice Hall Inc.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1												2	
CO2	2	1												2	
CO3	2	1												2	
CO4	2	1												2	
CO5	2	1												2	

Soft Computing					
CS846E02					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./ Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./ Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: The course will introduce the basic concepts in Soft computing, give an overview of Soft Computing approaches VIZ Fuzzy Logic, Genetic algorithms, Simulated Annealing and Artificial Neural Networks and familiarize with soft computing solutions to problems.					
Prerequisites: Discrete Mathematics					
Units					**Teaching Hours**
Unit-1 FUZZY SET THEORY					
Introduction to Soft Computing. Fuzzy sets – basics – Properties - Set theoretic operations. Fuzzy relations – operations – composition – tolerance and equivalence relation. Membership functions – features – Fuzzification - membership value assignments (intuition, inference, rank ordering) – Defuzzification – Lambda cuts (sets and relations) – Max-membership, centroid and weighted average methods.					9
Unit-2 FUZZY SYSTEMS					
Fuzzy Logic – approximate reasoning – different forms of implication. Natural language and Linguistic hedges. Fuzzy Rule-based systems – graphical techniques for inference. Extension principle and Fuzzy arithmetic.					9
Unit-3 OPTIMIZATION					

Derivative-based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method. Derivative-free Optimization -Simulated Annealing – Random Search – Downhill Simplex Search. Genetic algorithm – Biological background – Search space – Basic terminologies in GA – a simple GA – General GA – Operators in GA (Encoding, Selection, Crossover – mutation) – stopping conditions – Constraints – Problem solving - The schema theorem – advantages – applications.	9
Unit-4 NEURAL NETWORKS	
Supervised Learning Neural Networks – Perceptrons - Adaline – Backpropagation Mutilayer Perceptrons – Radial Basis Function Networks – Unsupervised Learning Neural Networks – Competitive Learning Networks – Kohonen Self-Organizing Networks.	9
Unit-5 SOFT COMPUTING SYSTEMS	
Introduction to Extreme Learning Machines- Convolutional Neural networks – Deep Neural Networks. Hybrid Systems – ANFIS. Case studies (ONE EACH)- Fuzzy systems, Genetic Algorithm, ANN.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1:Solve Fuzzy set, relation, reasoning and rulebased problems. CO2:Explain basic concepts in Genetic Algorithm,Simulated Annealing, random search and Downhill simplex search. CO3: Experiment with the concepts in Steepest Descent method,Genetic Algorithm, Simulated Annealing, random search and Downhill simplex search in optimization problems. CO4: Explain the basic concepts in Artificial neural networks. CO5: Build ANN techniques based solutions for Classification and Clustering problems.	
Text Books: T1: Sivanandam & Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India, 2011 T2: T. J. Ross, "Fuzzy Logic with Engineering Applications", 3rd Edition, Wilev, 2014	
Reference Books: R1: Rajasekaran and G A V Pai, " Neural Networks, Fuzzy Logic and Genetic Algorithm", 1st Edn, PHI, 2011 R2: D. E. Goldberg, "Genetic Algorithms in Search, Optimization and Machine Learning", 1st Edn, Pearson, 2016 R3: J S R Jang, C T Sun and E Mizutani, " Neuro-Fuzzy and Soft Computing", 1st Edn, Pearson, 2015	
Online Resources: NIL	
Mapping with Program Outcomes (POs)	

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1											1	2
CO2	2	1													
CO3	3	2	1												1
CO4	2	1													
CO5	3	2	1		3									1	2

Introduction to Robotics					
CS846E03					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./ Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./ Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To study microcontroller operations for robotics. To study how different interfaces are actually implemented in a microcontroller. To learn how Microchip PIC micro PIC16F627 can be erased and reprogrammed. To learn how different sensors, outputs, and peripherals can be wired to a microcontroller to work cooperatively and create a high-level control program and to design robots in a real time environment.					
Prerequisites: Micro Controllers, System Software					

Units	**Teaching Hours**
Unit-1 MICROCONTROLLER IN ROBOTS	
Support components - Memory and device programming – Interrupts - Built in peripherals - Interfacing the controller to robots.	9
Unit-2 SOFTWARE DEVELOPMENT	
Source files, object files, libraries, linkers and hex files – Assemblers – Interpreters – Compilers - Simulators and Emulators - Integrated development environments.	9
Unit-3 THE MICROCHIP PIC micro (R) MICROCONTROLLER	
Different PIC micro MCU devices and features - Application development tools - Basic circuit requirements - The PIC16F627 - EL cheapo PIC micro programmer circuit.	9
Unit-4 THE MICROCONTROLLER CONNECTIONS	

Hardware interface sequencing- Robot C programming template – Protyping with the PIC micro microcontroller – Intercomputer communications- RS232 - HyperTerminal RS 232 terminal emulator- RS 232 interface example between PC and PIC micro MCU – Bidirectional synchronous interfaces – Output devices – LEDS – PWM power level control – Sensors – Whiskers for physical object detection – iR collision detection sensors- IR remote controls- Ultrasonic distance measurement- Light level sensors- Sound sensors- Odometry for motor control and navigation – Radio control servos.	9
Unit-5 BRINGING ROBOTS TO LIFE	
Real time operating system (RTOS) – Example application running in an RTOS – State machines – Randomly moving a robot application with IR remote control - Behavioral programming - Neural networks and Artificial intelligence, Case Study.	9
Self-study : NA	
Site/Industrial Visits : NA	
Course outcomes: CO1: Explain the components of Microcontroller with interfacing to Robots. CO2: Explain the components of Microcontroller with interfacing to Robots. CO3: Construct Integrated development environments by associating Simulators and Emulators of Robot. CO4: Experiment with a PIC micro programmer circuit by identifying various PIC micro MCU devices and features. CO5: Develop Program to make arobot to do specific task by incorporating Input, Output and Interfacing Devices.	
Text Books: T1: Myke Predko, "Programming Robot Controllers" – McGrawHill, 1ST edition, 2003. (Digitized 2007 no reprint available)	
Reference Books: R1: Michael slater, "Microprocessor – based design: A comprehensive Guide to Effective Hardware Design", Prentice Hall, 1989. Reprint 1998 R2:Myke Predko, "Programming and customizing the 8051- micro-controller", Tata McGraw-Hill, New Delhi, 2000. (Digitized 2007 no reprint available) R3: Kenneth J. Ayala, "The 8051 micro-controller architecture, programming and applications", Penram International publishers, Mumbai, 1996. (Edition 3) R4: Murphy Robin R," Introduction to AI Robotics", MIT Press, 2000. no reprint available R5: Siegwart R and Nourbakhsh I.R, "Introduction to Autonomous mobile Robots", Prentice Hall India, 2005. no reprint available	
Online Resources: NIL	
Mapping with Program Outcomes (POs)	

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1			2										
CO2	3	2	1	1	3						2				
CO3	3	2	1	1	3				2						
CO4	3	2	1	1	3				1				1		
CO5	3	2	1	1	3	1	1	1	2		1		1		1

Course Name: High Performance Computing					
Course Code : CS846E04					
	L	**T**	**P**	Category	**PEC**
Contact Hrs./Week	**3**	**0**	**0**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**0**	ESE Marks	**50**
Credits.	**3**	**0**	**0**	Exam Hours	**3**
Course objectives: To Study various computing technology architecture. • To know Emerging trends in computing technology. • To highlight the advantage of deploying computing technology.					
Prerequisites: **OS, Computer Networks**					

Units	**Teaching Hours**
Unit-1 CLUSTER COMPUTING AT A GLANCE	
Cluster Computing at a Glance, Introduction, Eras of Computing , Scalable Parallel Computer Architectures, Towards Low Cost Parallel Computing and Motivations, Windows of Opportunity , A Cluster Computer and its Architecture, Clusters Classifications , Commodity Components for Clusters, Processors , Memory and Cache, Disk and I/O, System Bus , Cluster Interconnects , Operating Systems , Network Services/Communication SW , Cluster Middleware, Middleware Layers , SSI Boundaries, Middleware Design Goals , Key Services of SSI and Availability Infrastructure , Resource Management and Scheduling (RMS).	9
Unit-2 CLUSTER SETUP AND ADMINISTRATION	

Cluster Setup and Administration: Introduction, Setting up the cluster ,Security, System Monitoring , System Tuning	9
Unit- INTRODUCTION TO GRID AND ITS EVOLUTION	
Introduction to Grid and its Evolution: Introduction to Grid and its Evolution: Beginning of the Grid, Building blocks of Grid, Grid Application and Grid Middleware, Evolution of the Grid: First, Second & Third Generation	9
Unit-4 INTRODUCTION TO CLOUD COMPUTING	
Introduction to Cloud Computing: Defining Clouds ,Cloud Providers , Consuming Cloud Services , Cloud Models – Iaas, Paas, SaaS , Inside the cloud , Administering cloud services , Technical interface , Cloud resources	9
Unit-5 NATURE OF CLOUD AND CLOUD ELEMENTS	
Nature of Cloud: Tradition Data Center, Cost of Cloud Data Center , Scaling computer systems , Cloud work load , Managing data on clouds , Public, private and hybrid clouds, Cloud Elements: Infrastructure as a service , Platform as a service , Software as a service	9
List of Experiments	**Practical Hours**
1. NA	
Self-study :	
Site/Industrial Visits :	
Course outcomes: 1. Illustrate the basic knowledge of computing technology. 2. Demonstrate the architecture of computing technology. 3. Explain the cloud computing service models. 4. Discuss emerging trends in computing technology. 5. Illustrate the HPC concepts in big data and hadoop architecture.	
Text Books: 1. High Performance Cluster Computing, Volume 1, Architecture and Systems, Rajkumar Buyya, Pearson Education	

Reference Books:

1. Berman, Fox and Hey, Grid Computing – Making the Global Infrastructure a Reality, Wiley India.
2. Hurwitz, Bllor, Kaufman, Halper, Cloud Computing for Dummies, Wiley India.
3. Ronald Krutz, Cloud Security, Wiley India. 2. Cloud Computing, A Practical Approach, Anthony Velte, Toby Velte, Robert Elsenpeter, McGrawHill.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1			1									1	
CO2	2	1			1									1	
CO3	2	1			1									1	
CO4	2	1			1									1	
CO5	2	1			1									1	

Course Name: Digital Image Processing					
Course Code : CS846E05					
	L	T	P	Category	OE
Contact Hrs./Week	2	0	2	CIA Marks	50
Contact Hrs./Sem.	30	0	30	ESE Marks	50
Credits.	2	0	1	Exam Hours	3

Course objectives: The students will learn the fundamental concepts of Image Processing. The students will learn image enhancement techniques in spatial & frequency domain The students will learn the restoration & compression models. Help the students to segmentation and representation techniques for the region of interests. The students will learn the how to recognize objects using pattern recognition techniques.	
Prerequisites: Graphics with Open GL	
Units	**Teaching Hours**
Unit-1 DIGITAL IMAGE FUNDAMENTALS	
Image formation, Image transforms – Fourier transforms, Walsh, Hadamard, Discrete cosine transforms	6
Unit-2 IMAGE ENHANCEMENT & RESTORATION	
Histogram modification techniques - Image smoothening - Image Sharpening - Image Restoration - Degradation Model – Noise models - Spatial filtering – Frequency domain filtering	6
Unit-3 IMAGE COMPRESSION & SEGMENTATION	
Compression Models - Elements of information theory - Error free Compression -Image segmentation –Detection of discontinuities – Region based segmentation – Morphology	6
Unit-4 REPRESENTATION AND DESCRIPTION	
Representation schemes- Boundary descriptors- Regional descriptors - Relational Descriptors	6
Unit-5 OBJECT RECOGNITION AND INTERPRETATION	
Patterns and pattern classes - Decision-Theoretic methods - Structural methods	6
List of Experiments	Practical Hrs
Develop a project to demonstrate the all the smoothing & sharpening filters on a given image using GUI tools.	8

Develop a project to demonstrate the all the morphological operations on an image using GUI tools.	8
Develop a project to identify the denomination present in the Indian currency note image.	7
Develop a project to segment the bank logo from the bank cheque image.	7

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:

CO1:Review the fundamental concepts of image formation and Fourier transformations.

CO2: Analyze histogram of images to enhance images based on matching and specification techniques.

CO3: Evaluate degradation function for distorted images and compare compression techniques.

CO4: Categorize Morphological processing for representation of images.

CO5:Integrate descriptors and patterns to describe an image for Object recognition.

Text Books:

T1. Gonzalez.R.C & Woods. R.E., "Digital Image Processing", 3rd Edition, Pearson Education, Indian edition published by Dorling Kindersely India Pvt. Ltd. Copyright © 2009, Third impression 2011.

T2.Gonzalez.R.C & Woods. R.E., "Digital Image Processing using MATLAB", 2nd Edition, McGraw Hill Education (India) Pvt Ltd 2011 (Asia)

T3.Madan, " An Introduction to MATLAB for Behavioural Researchers", Sage Publications, 2014

Reference Books: NIL

Online Resources: NIL

Mapping with Program Outcomes (POs)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P O 1 0**	**PO11**	**PO12**
CO1	3		2									
CO2	3	2	2	3								2
CO3	2			2								
CO4	3	2	3									
CO5	2		2	3								2

Course Name: Project Phase - II					
Course Code : CS881					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**0**	**0**	**18**	CIA Marks	
Contact Hrs./Sem.	**0**	**0**	**0**	ESE Marks	**300**
Credits.	**0**	**0**	**9**	Exam Hours	**3**

Course objectives: To perform a task involving research or design, that is carefully planned to achieve a particular aim. To learn modular programming - analyse problems, design solutions, learn new tools and implement the system as a team/ individual.

Prerequisites:

Self-study : NA

Site/Industrial Visits : NA

Course outcomes:

CO1: Design engineering solutions to complex real world problems using research literature for societal applications through independent study.
CO2: Use appropriate hardware and software depending on the nature of the project with an understanding of their limitations.
CO3:Demonstrate teamwork and leadership skills with professional ethics and prepare a project report in the prescribed format.
CO4:Understand the impact of the developed projects on environmental factors.
CO5:Demonstrate project management skills including handling the finances in doing projects for given real world societal problems.

Mapping with Program Outcomes (POs):

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3		3						3	3	3	2
CO2					3							2	2	2	2
CO3								3	3	3		2	2	2	2
CO4						3	3					2	2	2	2

CO5						3					3	2	2	2	2

MC 823 –Constitution of India
(Offered by School of Law)

22. MINOR IN CSE : COURSE DETAILS

Course Name: Basics of Computer Architecture & Operating Systems					
Course Code : MICS435P					
	L	**T**	**P**	Category	PCC
Contact Hrs./Week	3	0	2	CIA Marks	**70**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**30**
Credits.	3	0	1	Exam Hours	**3**
Course objectives: This course helps the students to learn about basic structure of computer system and gives the overview of different types of operating systems. They also include understanding of the components of an operating system, process management, and knowledge of storage management and the concepts of I/O and file systems is also covered as an introductory level.					
Prerequisites: CS134/CS234					

Units	**Teaching Hours**
Unit-1 FUNDAMENTALS OF COMPUTER SYSTEM	
Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.	9
Unit-2 INTRODUCTION to OS	
Introduction : What operating systems do, Computer System Architecture, Operating System Structure, Operating System Operations, Process Management, Memory Management, Storage Management, Protection and Security; System Structures: Operating System Services, User Operating System Interface, System Calls, Types of System Calls.	9
Unit-3 PROCESS MANAGEMENT	

Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication; Threads: Overview, Multithreading Models, Thread Libraries; CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple- Processor Scheduling	9
Unit-4 PROCESS SYNCHRONIZATION AND DEADLOCKS	
Process Synchronization: Background, The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Monitors, Synchronization Examples	9
Unit-5 MEMORY MANAGEMENT AND VIRTUAL MEMORY	
Memory Management: Background, Swapping, Contiguous Memory Allocation, Paging. Virtual Memory : Background, Demand Paging, Copy on Write, Page Replacement, Allocation of frames, Thrashing, Allocating Kernel Memory	9
List of Experiments	**Practical Hours**
11. Implementation of Simple Java programs to understand data types, variables, operators, strings, input and output, control flow, arrays.	**3**
12. Implementation of Classes and Objects – static fields, methods, method parameters, object construction.	**3**
13. Implementation of event driven programming	**3**
14. Implementation of Inheritance – how inheritance is handled using java keywords: extends and implements.	**3**
15. Implementation of Interfaces – programs on usage.	**3**
16. Implementation of Inner classes – programs on inner classes.	**3**
17. Implementation of Exceptions.	**3**
18. Implementation of Debugging using Assertions, logging and using a debugger.	**3**
19. Implementation of Generic programming.	**3**
20. Implementation of Multithreaded programs	**3**
Self-study : NA	
Site/Industrial Visits : NA	

Course outcomes:

CO1: Demonstrate the functions of basic components of computer system.

CO2: Demonstrate the Structure, Components and its basic functionalities of Operating System

CO3: Distinguish various process management principles for given problem using appropriate tool

CO4: Elucidate the process synchronization mechanisms, deadlock environment and its solutions in the given processes

CO5: Inspect various memory management strategies for the given problems in memory systems

Text Books:

T1. Cay S. Horstmann and Gary Cornell, "Core Java, Volume I – Fundamentals " ,Ninth Edition, Prentice Hall, 2012.

T2. Martina Seidl, Marion Scholz, Christian Huemer and GertiKappel , "UML @ Classroom An Introduction to Object-Oriented Modeling Series: Undergraduate Topics in Computer Science", Springer,2015.

Reference Books:

R1. Cay S. Horstmann , "Java SE8 for the Really Impatient: A Short Course on the Basics (Java Series)", 2014.

R2. Herbert Schildt, "Java: The Complete Reference (Complete Reference Series)", Ninth Edition, 2014.

R3. Bruce Eckel, "Thinking in Java", 4th Edition, Prentice Hall Professional, 2006.

R4. Doug Rosenberg and Matt Stephens, "Use Case Driven Object Modeling with UML: Theory and Practice (Expert's Voice in UML Modeling)",APress, 2013.

Online Resources: NIL

Mapping with Program Outcomes (POs)

CO	**PO**												**PSO**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1	-
CO2	2	1	-	-	1	-	-	-	-	-	-	1	-	2	-
CO3	3	3	2	-	1	-	-	-	-	-	-		-	2	-
CO4	3	2	1	1	1	1	-	-	-	1		1	-	2	-
CO5	3	2	1	1	1	-	-	1		2		1	-	2	1

Course Name: Database System					
Course Code : MICS534P					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	3	0	2	CIA Marks	70
Contact Hrs./Sem.	45	0	30	ESE Marks	30
Credits.	3	0	1	Exam Hours	3

Course objectives:
To learn the fundamentals of data models and to conceptualize and depict a database system using ER diagram. To make a study of SQL and relational database design. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure. To have an introductory knowledge about the emerging trends in the area of distributed DB- OO DB- Data mining and Data Warehousing and XML. To implement the design of the tables in DBMS. To write queries to get optimized outputs. To store, retrieve and view the contents. To generate report based on customized need

Prerequisites: CS134/234

Units	**Teaching Hours**
Unit-1 INTRODUCTION AND CONCEPTUAL MODELING	
Introduction to File and Database systems- Database system structure – Data Models – Introduction to Network and Hierarchical Models – ER model – Relational Model.	9
Unit-2 RELATIONAL MODEL	
Relational Algebra, SQL – Data definition- Queries in SQL- Updates- Views – Integrity and Security – Schema level constraints.	9
Unit-3 DATA STORAGE AND QUERY PROCESSING	
Relational Database design – Functional dependences and Normalization for Relational Databases (up to BCNF). Record storage and Primary file organization- Secondary storage Devices- Operations on Files- Heap File- Sorted Files- Hashing Techniques – Index Structure for files –Different types of Indexes- B-Tree - B+ Tree.	9
Unit-4 TRANSACTION MANAGEMENT	

Transaction Processing – Introduction- Need for Concurrency control- Desirable properties of Transaction- Schedule and Recoverability- Serializability and Schedules – Concurrency Control – Types of Locks- Two Phases locking- Deadlock- Time stamp based concurrency control – Recovery Techniques – Concepts- Immediate Update- Deferred Update - Shadow Paging.	9
Unit-5 CURRENT TRENDS	
Object Oriented Databases – Need for Complex Data types- OO data Model- Nested relations- Complex Types- Inheritance Reference Types - Distributed databases- Homogenous and Heterogenous- Distributed data Storage – XML – Structure of XML- Data- XML Document- Schema- Querying and Transformation. – Data Mining and Data Warehousing.	9
List of Experiments	**Practical Hours**
11. Data Definition Language (DDL) commands in RDBMS	**3**
12. Data Manipulation Language (DML) and Data Control Language (DCL) commands in RDBMS.	**3**
13. High-level language extension with Cursors.	**3**
14. High level language extension with Triggers	**3**
15. Procedures and Functions.	**3**
16. Embedded SQL.	**3**
17. Database design using E-R model and Normalization.	**3**
18. Design and implementation of Payroll Processing System.	**3**
19. Design and implementation of Banking System.	**3**
20. Design and implementation of Library Information System.	**3**
Self-study : postgresql	
Site/Industrial Visits : NA	
Course outcomes: CO1: Summarize the fundamental concepts of databases and Entity-Relationship (E-R) model. CO2: Apply E-R Model and Normalization principles to create relational databases for the given problems. CO3: Compare and contrast different file organization concepts for data storage in Relational databases CO4: Apply the transaction management principles on relational databases CO5: Demonstrate the current trends such as object oriented databases, distributed data storage in database technology	

Text Books:
T1 : Abraham Silberschatz, Henry F. Korth and S. Sudarshan- “Database System Concepts”, Sixth Edition, McGraw-Hill, 2010.

Reference Books:
R1: RamezElmasri and Shamkant B. Navathe, “Fundamental Database Systems”, Third Edition, Pearson Education, 2008.
R2: Raghu Ramakrishnan, “Database Management System”, Tata McGraw-Hill Publishing Company, 2003.

Online Resources:
W1. https://www.studytonight.com/dbms/
W2. https://lecturenotes.in/subject/38/database-management-system-dbms

Mapping with Program Outcomes (POs)

CO	PO											PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	-	-	2	-	-	-	-	-	-	-	-	3	-
CO2	3	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO3	3	3	2	2	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	1	1	-	-	-	-	-	-	-	-	2	-
CO5	2	1	-	-	2	-	-	-	-	-	-	-	-	-	-

23. HONOURS COURSE DETAILS

HONOURS IN ARTIFICIAL INTELLIGENCE

Course Name: Statistical foundation for Artificial Intelligence					
Course Code : HOAI541					
	L	**T**	**P**	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**50**
Credits.				Exam Hours	**50**

Course objectives:

- Discuss the core concepts Statistical Analytics and Data manipulation
- Apply the basic principles, models, and algorithms supervised and unsupervised learning mechanisms.
- Analyse the structures and algorithms of regression methods
- Explain notions and theories associated to Convolutional Neural Networks
- Solve problems in High-Dimensional Regression

Prerequisites:

Units	**Teaching Hours**
Unit-1 Statistical Analytics and Data manipulation	
Knowledge discovery: finding structure in data, Data quality versus data quantity, Statistical modeling versus statistical description. Data types, Data summarization, Means, medians, and central tendency, Summarizing variation, Summarizing (bivariate) correlation, Data diagnostics and data transformation, Outlier analysis, Entropy, Data transformation Simple smoothing techniques, Binning, Moving averages, Exponential smoothing. Introduction to SPSS (IBM's) statistical tool.	9
Unit-2 Techniques for supervised and unsupervised learning	
The simple linear model, Multiple inferences and simultaneous confidence bands, Regression diagnostics, Weighted least squares (WLS) regression, Correlation analysis. Unsupervised versus supervised learning, Principal component analysis, Principal components, Implementing a PCA, Exploratory factor analysis.	9
Unit-3 Neural Networks	

Projection Pursuit Regression, Neural Networks, Fitting Neural Network, Some Issues in Training Neural Networks, Bayesian Neural Nets, 0 Computational Considerations.	9
Unit-4 Random Forests and Ensemble Learning	
Definition of Random Forests, Details of Random Forests- Out of Bag Samples, Variable Importance, Proximity Plots; Analysis of Random Forests; Ensemble Learning, Boosting and Regularization Paths, Learning a Good Ensemble, Rule Ensembles.	9
Unit-5 High-Dimensional Problems: p ≫ N	
Diagonal Linear Discriminant Analysis and Nearest Shrunken Centroids, Linear Classifiers with Quadratic Regularization, Linear Classifiers with L1 Regularization, Classification When Features are Unavailable, High-Dimensional Regression, Feature Assessment and the Multiple-Testing Problem	9
List of Experiments	**Practical Hours**
1. Statistical parameters (eg: Correlation analysis)	2
2. Linear and polynomial Regression	2
3. Prediction analysis (eg: Stocks)	2
4. Time Series: predict web traffic	2
5. Convolutional Neural Network - Step by Step	2
Self-study :	
Site/Industrial Visits :	
Course outcomes: • Understand and explain concepts associated to Statistical Analytics and Data manipulation L2 • Infer details of supervised and unsupervised learning mechanisms. L2 • Solve problems connected to regression methods. L3 • Analyse concepts of Convolutional Neural Networks. L4 • Appraise concepts of High-Dimensional Regression. L5	
Text Books: 1. Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. *The elements of statistical learning: data mining, inference, and prediction*. Springer Science & Business Media, 2017. 2. Russell, Stuart J., and Peter Norvig. *Artificial intelligence: a modern approach*. Malaysia; Pearson Education Limited,, 2016.	

Reference Books:

1. Ghahramani, Zoubin. "Probabilistic machine learning and artificial intelligence." Nature 521.7553 (2015): 452.
2. Ian Goodfellow and Yoshua Bengio and Aaron Courville," Deep Learning ", MIT Press, March 2018.
3. Wu, James, and Stephen Coggeshall. Foundations of predictive analytics. Chapman and Hall/CRC, 2012.
4. Marcoulides, George A., and Scott L. Hershberger. Multivariate statistical methods: A first course. Psychology Press, 2014.
5. Morgan, George A., et al. IBM SPSS for introductory statistics: Use and interpretation. Routledge, 2012

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	1	2			1	1	2					
CO2	2	2	2	1	2			1	1	2					
CO3	2	3	3	1	2			1	1	2					
CO4	1	3	1	1	2			1	1	2					
CO5	1	2	1	1	2			1	1	2					

<table>
<tr><td colspan="6">Course Name: Artificial Intelligence and Machine Learning</td></tr>
<tr><td colspan="6">Course Code : HOAI641</td></tr>
<tr><td></td><td>L</td><td>T</td><td>P</td><td>Category</td><td></td></tr>
<tr><td>Contact Hrs./Week</td><td>3</td><td></td><td>2</td><td>CIA Marks</td><td>50</td></tr>
<tr><td>Contact Hrs./Sem.</td><td>45</td><td></td><td>30</td><td>ESE Marks</td><td>50</td></tr>
<tr><td>Credits.</td><td>3</td><td></td><td>1</td><td>Exam Hours</td><td>3</td></tr>
<tr><td colspan="6">Course objectives:
• Discuss the core concepts Statistical Analytics and Regression
• Apply the basic principles, models, and algorithms for Multiple and Non Linear Regression
• Analyse the structures and algorithms of Convolutional Neural Networks
• Explain notions and theories associated to Convolutional Neural Networks
• Solve problems in Deep Unsupervised Learning</td></tr>
<tr><td colspan="6"></td></tr>
<tr><td colspan="6">Prerequisites:
CS532, CS642E07</td></tr>
<tr><td colspan="5">Units</td><td>Teaching Hours</td></tr>
<tr><td colspan="6">Unit-1 Regression</td></tr>
<tr><td colspan="5">Relationship between attributes using Covariance and Correlation, Relationship between multiple variables: Regression (Linear, Multivariate) in prediction. Residual Analysis, Identifying significant features, feature reduction using AIC, multi-collinearity, Non-normality and Heteroscedasticity</td><td>9</td></tr>
<tr><td colspan="6">Unit-2 Multiple and Non Linear Regression</td></tr>
<tr><td colspan="5">Polynomial Regression, Regularization methods, Lasso, Ridge and Elastic nets, Categorical Variables in Regression, Logit function and interpretation, Types of error measures (ROCR)
Logistic Regression in classification</td><td>9</td></tr>
<tr><td colspan="6">Unit- 3 Convolutional Neural Networks I</td></tr>
<tr><td colspan="5">Invariance, stability. Variability models (deformation model, stochastic model). Scattering networks, Group Formalism, Supervised Learning: classification. Properties of CNN representations: invertibility, stability, invariance. Covariance/invariance: capsules and related models.</td><td>9</td></tr>
</table>

Unit-4 Convolutional Neural Networks II	
Connections with other models: dictionary learning, LISTA. Other tasks: localization, regression. Embeddings (DrLim), inverse problems, Extensions to non-euclidean domains Dynamical systems: RNNs.	9
Unit-5 Deep Unsupervised Learning	
Autoencoders (standard, denoising, contractive, Variational Autoencoders Adversarial Generative Networks, Maximum Entropy Distributions	9
List of Experiments	**Practical Hours**
1. Linear, Multivariate Regression	
2. Polynomial Regression	
3. Lasso Regression	
4. Ridge Regression	
5. Logistic Regression with a neural network mindset	
6. Deep Neural Network - Application	
7. Regularization	
8. Gradient Checking	
9. Tensorflow Tutorial	
10. Convolutional Neural Network - Step by Step	
11. Keras Tutorial	
12. Case Study	
Self-study :	
Site/Industrial Visits :	
Course outcomes: • Understand and explain concepts associated Statistical Analytics and Regression L2 • Infer details of Multiple and Non Linear Regression mechanisms. L2 • Solve problems connected to Convolutional Neural Networks. L3 • Analyse concepts of Convolutional Neural Networks. L4 • Appraise concepts of Deep Unsupervised Learning. L5	

Text Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville," Deep Learning ", MIT Press, March 2018.

2. Sebastian Raschka and Vahid MirjaliliPython Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and TensorFlow 2, 3rd Edition, Packt, 2019

Reference Books:

1. Seber, Linear Regression Analysis 2ed,Wiley India Exclusive (Cbs), 2018
2. Jeremy Arkes, Regression Analysis: A Practical Introduction, Routledge, 2019
3. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn, Keras and Tensor Flow: Concepts, Tools and Techniques to Build Intelligent Systems, Shroff/O'Reilly, 2019
4. Andreas Muller, Introduction to Machine Learning with Python: A Guide for Data Scientists, Shroff/O'Reilly, 2016
5. François Chollet, Deep Learning with Python, Manning Publications, 2017

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	1	2			1	1	2	2	2	1	1	2
CO2	2	2	2	1	2			1	1	2	2	2	2	1	2
CO3	2	3	3	1	2			1	1	2	2	3	3	1	2
CO4	1	3	1	1	2			1	1	2	1	3	1	1	2
CO5	1	2	1	1	2			1	1	2	1	2	1	1	2

Course Name: Robotics and Process Automation					
Course Code : HOAI642					
	L	T	P	Category	
Contact Hrs./Week	3		2	CIA Marks	50
Contact Hrs./Sem.	45		30	ESE Marks	50
Credits.	3		1	Exam Hours	3

Course objectives:

- To understand about RPA and its concepts
- Apply RPA tools and functionalities
- Understand the challenges and risks in RPA implementation
- Understand about bots and its usage in real time applications

Prerequisites:

Units	Teaching Hours
Unit-1 Introduction	
Introduction to RPA, what should be automated, what can be automated, Techniques of automation, Benefits of RPA, Components of RPA, RPA Platforms, Record and Play.	9
Unit-2 Sequencing and Data Manipulation	
Sequence, Activities, Control flow and Decision Making, Variables and Scope, Collections, Arguments-Purpose and use, Data Table, File Operation,	9
Unit- 3 Taking Control of the Controls	
Finding and attaching windows, Finding the control, Techniques for waiting for a control, Act on controls – mouse and keyboard activities, Handling events	9
Unit-4 Handling User Events and Assistant Bots	
Assistant Bots, Monitoring system event triggers, Monitoring image and element triggers, Launching an assistant bot on a keyboard event, Exception handling	9
Unit-5 Managing the Code and Maintaining the Bot	

Project organization, Nesting workflows, Reusability of workflows, Overview of Orchestration Server, Using Orchestration Server to control bots, Using Orchestration Server to deploy bots	9
List of Experiments	**Practical Hours**
1. Implement record and play.	2
2. Implement Control Flow and Decision Making	2
3. Implement file operations	2
4. Implement mouse and keyboard activities, Handling events	2
5. To automate the action of getting the title of an active window.	2
6. Implement system event triggers	2
7. Implement keyboard event & Exception handling	2
8. To automate the action of closing a notepad window.	2
9. To automate the task of replacing a few characters from a string.	2
10. To automate the task of extracting a table / image from a webpage.	2
11. To automate the task of extracting a text from a window and displaying the output.	2
12. To automate the task of extracting the data from multiple PDF documents and storing the data into a CSV file.	2
Self-study : NIL	
Site/Industrial Visits : NIL	
Course outcomes: CO1: Illustrate the advantages, techniques of RPA CO2: Experiment with data manipulation and sequencing CO3: Experiment with Conditional and Control activities CO4: Implement event handling and launching the bots CO5: Organize the project using project management tools	
Text Books: 1. Tripathi Alok Mani," Learning Robotic Process Automation", Packt Publishing, March 2018.	
Reference Books:	

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1													
CO2	3	2	1		1										
CO3	3	2	1		1										
CO4	3	2	1		1										
CO5	2	1	1		1										

Course Name: COMPUTER VISION

Course Code : MIAI741

	L	T	P	Category	
Contact Hrs./Week	3	0	2	CIA Marks	50
Contact Hrs./Sem.	45	0	30	ESE Marks	50
Credits.	3		1	Exam Hours	3

Course objectives:

- To provide an introduction to concepts in Computer Vision including fundamental Image Processing Operations, Image enhancement, edge detection, Texture, boundary, shape and motion analysis, object segmentation, image transformation and 3D vision.
- To provide practical experience in implementing Computer Vision algorithms.

Prerequisites: Linear Algebra. Differential Equations. Probability and Statistics. Calculus.

Units	Teaching Hours
Unit-1	
Images and imaging operations – Image filtering and morphology – Thresholding.	9
Unit-2	

Edge detection, Corner, interest point, and invariant feature detection – Texture analysis	
Unit- 3	
Binary shape analysis – Boundary pattern analysis – Line, Circle, and Ellipse detection – generalized Hough transform	
Unit-4	
Object Segmentation and shape models - The three Dimensional world – Perspective n-point problem – invariants and perspective	
Unit-5	
Image transformation and camera calibration – Motion. Case studies – Face detection and recognition, surveillance , In-vehicle vision systems	
List of Experiments	**Practical Hours**
1. Basic filters (Mean, mode, unsharp masking …)	
2. Thresholding algorithms	
3. Edge and corner detection algorithms.	
4. Morphological operations	
5. GLCM feature extraction and classification	
6. Application of object labelling, size filtering, boundary tracking and skeletonizing.	
7. Line, circle, ellipse detection and Hough transformation.	
8. Image transformation and camera calibration	
9. Optical flow / Kalman Filter	
10. Case study	
Self-study : Foundations of Image Processing – Image formation, pixel relations, basic intensity transformations, Spatial filtering, Fourier transforms and	
Site/Industrial Visits :	

Course outcomes:

1. Experiment with basic image processing operations – filtering, Morphology and thresholding. (L3)
2. Develop programs for the detection of edges, corners, points of interest and for texture analysis. (L3)
3. Experiment with shape analysis algorithms. (L3)
4. Apply object segmentation and shape modelling for object detection and extraction. (L3)
5. Construct Computer Vision solution for a given problem. (L6)

Text Books:

1.E.R. Davies, Computer Vision: Principles, Algorithms, Applications, Learning, 5e, AP, 2018

Reference Books:

1. Ponce Jean & Forsyth David , Computer Vision: A Modern Approach, 2e, Pearson, 2015
2. Richard Szeliski, Computer vision: Algorithms and Applications, 1e, Springer, 2010
3. J. R. Parker, Algorithms for Image Processing and Computer Vision, 2e, Wiley, 2010

Online Resources:

1. https://homepages.inf.ed.ac.uk/rbf/CVonline/
2. https://www.forbes.com/sites/bernardmarr/2019/04/08/7-amazing-examples-of-computer-and-machine-vision-in-practice/#438110d21018
3. http://www.elsevierdirect.com/companion.jsp?ISSN=9780123869081

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2		1									1	
CO2	3	2	2		1									1	
CO3	3	2	2		1									1	
CO4	3	2	2		1									1	
CO5	3	2	3	2	2								1	1	1

HONOURS IN DATA ANALYTICS

Course Name: Statistical foundation for Data Analytics					
Course Code : HODA541					
	L	T	P	Category	
Contact Hrs./Week	3	0	2	CIA Marks	50
Contact Hrs./Sem.	45	0	30	ESE Marks	50
Credits.	3	0	1	Exam Hours	50

Course objectives: • Discuss the core concepts Statistical Analytics and Data manipulation • Apply the basic principles, models, and algorithms supervised and unsupervised learning mechanisms. • Analyse the structures and algorithms of regression methods • Analyse the use of SVM in Data Science • Explain notions and theories associated to Convolutional Neural Networks	
Prerequisites:	
Units	**Teaching Hours**
Unit-1 Statistical Analytics and Data manipulation	
Knowledge discovery: finding structure in data, Data quality versus data quantity, Statistical modeling versus statistical description. Data types, Data summarization, Means, medians, and central tendency, Summarizing variation, Summarizing (bivariate) correlation, Data diagnostics and data transformation, Outlier analysis, Entropy, Data transformation Simple smoothing techniques, Binning, Moving averages, Exponential smoothing. Introduction to SPSS (IBM's) statistical tool.	9
Unit-2 Techniques for supervised and unsupervised learning	
The simple linear model, Multiple inferences and simultaneous confidence bands, Regression diagnostics, Weighted least squares (WLS) regression, Correlation analysis. Unsupervised versus supervised learning, Principal component analysis, Principal components, Implementing a PCA, Exploratory factor analysis.	9
Unit-3 Neural Networks	
Projection Pursuit Regression, Neural Networks, Fitting Neural Network, Some Issues in Training Neural Networks, Bayesian Neural Nets, 0 Computational Considerations.	9
Unit-4 Support Vector Machines and Flexible Discriminants	
Introduction, The Support Vector Classifier, Support Vector Machines and Kernels, Generalizing Linear Discriminant Analysis, Flexible Discriminant Analysis, Penalized Discriminant Analysis, Mixture Discriminant Analysis	9
Unit-5 Random Forests and Ensemble Learning	

Definition of Random Forests, Details of Random Forests- Out of Bag Samples, Variable Importance, Proximity Plots; Analysis of Random Forests; Ensemble Learning, Boosting and Regularization Paths, Learning a Good Ensemble, Rule Ensembles.	9
List of Experiments	**Practical Hours**
1. Statistical parameters (eg: Correlation analysis)	2
2. Linear and polynomial Regression	2
3. Prediction analysis (eg: Stocks)	2
4. Time Series: predict web traffic	2
5. Convolutional Neural Network - Step by Step	2
Self-study :	
Site/Industrial Visits :	

Course outcomes:

- Understand and explain concepts associated to Statistical Analytics and Data manipulation L2
- Infer details of supervised and unsupervised learning mechanisms. L2
- Analyse concepts of Convolutional Neural Networks. L4
- Appraise concepts of Support Vector Machine. L5
- Solve problems connected to random forest and ensemble learning methods. L3

Text Books:

1. Hastie, Trevor, Robert Tibshirani, and Jerome Friedman. *The elements of statistical learning: data mining, inference, and prediction*. Springer Science & Business Media, 2017.
2. Russell, Stuart J., and Peter Norvig. *Artificial intelligence: a modern approach*. Malaysia; Pearson Education Limited,, 2016.

Reference Books:

1. Ghahramani, Zoubin. "Probabilistic machine learning and artificial intelligence." Nature
2. 521.7553 (2015): 452.
3. Ian Goodfellow and Yoshua Bengio and Aaron Courville," Deep Learning ", MIT Press, March 2018.
4. Wu, James, and Stephen Coggeshall. Foundations of predictive analytics. Chapman and Hall/CRC, 2012.
5. Marcoulides, George A., and Scott L. Hershberger. Multivariate statistical methods: A first course. Psychology Press, 2014.
6. Morgan, George A., et al. IBM SPSS for introductory statistics: Use and interpretation. Routledge, 2012

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	1	2			1	1	2					
CO2	2	2	2	1	2			1	1	2					
CO3	1	3	1	1	2			1	1	2					
CO4	1	2	1	1	2			1	1	2					
CO5	2	3	3	1	2			1	1	2					

Course Name: BIG DATA ANALYTICS					
Course Code : HODA641					
	L	**T**	**P**	Category	**PCC**
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**3**	**0**	**2**	ESE Marks	**50**
Credits.	**3**	**0**	**1**	Exam Hours	**3**
Course objectives: To Understand big data for business intelligence To Learn business case studies for big data analytics To Understand Nosql big data management To manage Big data without SQL To understanding map-reduce analytics using Hadoop and related tools					
Prerequisites: **CS642E07, DBMS**					

Units	**Teaching Hours**
Unit-1 UNDERSTANDING BIG DATA	
What is big data – why big data –.Data!, Data Storage and Analysis, Comparison with Other Systems, Rational Database Management System , Grid Computing, Volunteer Computing, convergence of key trends – unstructured data – industry examples of big data – web analytics – big data and marketing – fraud and big data – risk and big data – credit risk management – big data and algorithmic trading – big data and healthcare – big data in medicine – advertising and big data– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.	9
Unit-2 NOSQL DATA MANAGEMENT	
Introduction to NoSQL – aggregate data models – aggregates – key-value and document data models – relationships –graph databases – schema less databases – materialized views – distribution models – sharding –– version – Map reduce –partitioning and combining – composing map-reduce calculations	9
Unit-3 BASICS OF HADOOP	

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures	9
Unit-4 MAPREDUCE APPLICATIONS	
MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution –MapReduce types – input formats – output formats	9
Unit-5 HADOOP RELATED TOOLS	
Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model –cassandra examples – cassandra clients –Hadoop integration. Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation –HiveQL queries-case study.	9
List of Experiments	**Practical Hours**
6. Exercise on Map reduce Concept of Hadoop	2
7. Exercise using Hbase	2
8. Data Analysis lab : Case study 1	2
9. Data Analysis lab: Case study 2	2
10. Data Explorer Lab	2
Self-study : NA	
Site/Industrial Visits :	
Course outcomes: • Describe big data and use cases from selected business domains • Discuss open source technologies • Explain NoSQL big data management • Discuss basics of Hadoop and HDFS • Discuss map-reduce analytics using Hadoop along with as HBase, Cassandra, Pig, and Hive for big data Analytics	

Text Books:

1. Tom White, "Hadoop: The Definitive Guide", 4^{th} Edition, O'Reilley, 2012.
2. Eric Sammer, "Hadoop Operations",1^{st} Edition, O'Reilley, 2012.

Reference Books:

1. VigneshPrajapati, Big data analytics with R and Hadoop, SPD 2013.
2. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
3. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3												**1**	
CO2	3	3												**1**	
CO3			2		3									**1**	
CO4			2		3									**1**	
CO5	3	3			3									**1**	

Course Name: Big Data Security Analytics					
Course Code : HODA642					
	L	**T**	**P**	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**50**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
To provide the fundamental techniques and principles of security model in Big Data

Prerequisites: Cryptography and Network Security, Cyber Security

Units	**Teaching Hours**
Unit-1 Security Models	
Critical characteristics of Information - NSTISSC Security Model -Components of information System –SDLC – Information assurance - Security Threats and vulnerabilities - Overview of Security threats-– Security Standards .	9
Unit-2 Web Security	
Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.	9
Unit- Network Security	
Network security - Intrusion Prevention, detection and Management - Firewall – Ecommerce Security - Computer Forensics - Security for VPN and Next Generation Networks.	9
Unit-4 Attacks & Security Mechanisms	

Host and Application security -Control hijacking, Software architecture and a simple buffer overflow - Common exploitable application bugs, shellcode - Buffer Overflow - Side-channel attacks - Timing attacks, power analysis, cold-boot attacks, defenses – Malware - Viruses and worms, spyware, key loggers, and botnets; defenses auditing, policy - Defending weak applications - Isolation, sandboxing, virtual machines.	9
Unit-5 : Digital Water Marking	
Introduction, Difference between Watermarking and Steganography, Types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Attacks and Tools (Attacks by Filtering, Remodulation, Distortion, Geometric Compression, Linear Compression), Watermark security & authentication.	9
List of Experiments	**Practical Hours**
1. Implementation of Hadoop cluster	6
2. Implementation of NoSQL Database, Apache HBase.	6
3. Implementation of MapReduce application on Hadoop cluster	6
4. Triggering DDOS attack	6
5. Analysing the network security logs for security analytics	6
Self-study :	
Site/Industrial Visits :	
Course outcomes: CO1: Explain the various security models and threats(K2) CO2: Outline the need of security services, manage and address the challenges in web applications(K2) CO3: Examine various network security models(K4) CO4: Classify the various security threats, attacks and counter measures in securing data. (K4) CO5: Conclude the attacks and counter measure tools using watermarking technique(K4)	

Text Books: 1. William Stallings, “Cryptography and Network Security: Principles and Practice”, 6 th Edition, PHI, 2014. 2. Michael E. Whitman and Herbert J Mattord, "Principles of Information Security", 6 th edition, Vikas Publishing House, 2017. 3. Peter Wayner, Disappearing Cryptography–Information Hiding: Steganography & Watermarking, Morgan Kaufmann Publishers, New York, 2002. 4. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, Digital Watermarking and Steganography, Margan Kaufmann Publishers, New York, 2008.
Reference Books: 1. Bill Nelson, Amelia Phillips, F.Enfinger and Christopher Stuart, “Guide to Computer Forensics and Investigations, 4 th ed., Thomson Course Technology, 2010. 4. Matt Bishop, “Computer Security: Art and Science”, 1 st edition, Addison-Wesley Professional, 2015. 3. Neil F. Johnson, Zoran Duric, Sushil Jajodia, Information Hiding: Steganography and Watermarking-Attacks and Countermeasures, Springer, 2012. 4. Stefan Katzenbeisser, Fabien A. P. Petitcolas, Information Hiding Techniques for Steganography and Digital Watermarking, Artech House Print on Demand, 1999.

Online Resources:
http://www-01.ibm.com/software/data/bigdata/use-cases/security-intelligence.html
http://blogs.cisco.com/security/big-data-in-security-part-i-trac-tools/
http://blogs.cisco.com/security/big-data-in-security-part-ii-the-amplab-stack/
http://blogs.cisco.com/security/big-data-in-security-part-v-anti-phishing-in-the-cloud/

Email scam
http://blogs.igalia.com/dpino/2012/08/07/metamail-email-analysis-with-hadoop/
http://blogs.cisco.com/security/big-data-in-security-part-iv-email-auto-rule-scoring-on-hadoop/

Security analysis
http://healthitsecurity.com/2013/10/11/csa-report-big-data-analytics-can-improve-it-security/
http://www.cisco.com/web/ME/connect2014/saudiarabia/pdf/ahmed_fakahany_ibm_sbm_big_data_internet_of_things.pdf
http://bigdatablog.emc.com/2013/01/30/rsa-security-analytics/
http://cybersecurity.mit.edu/2013/11/mobile-malware-analysis-in-hadoop/
http://blogs.cisco.com/security/threat-detection-a-big-data-approach-to-security/
Reasoning Reference:
http://machinelearningbigdata.blogspot.com/
http://www.bigdatatraining.in/machine-learning-training/
http://www.slideshare.net/Cataldo/apache-mahout-tutorial-recommendation-20132014

Big data sets:
http://www.kdnuggets.com/2011/02/free-public-datasets.html
http://aws.amazon.com/publicdatasets/
http://www.quora.com/Where-can-I-find-large-datasets-open-to-the-public
http://stackoverflow.com/questions/2674421/free-large-datasets-to-experiment-with-hadoop
http://www.ll.mit.edu/mission/communications/cyber/CSTcorpora/ideval/data/

Mapping with Program Outcomes (POs)

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

C O 5	**2**												**1**		

Course Name: Web Analytics					
Course Code : HODA741					
	L	**T**	**P**	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**50**
Credits.	**3**	**0**	**1**	Exam Hours	**3**
Course objectives: This Web Analytics course covers fundamental concepts of web analytics and dives deep into web, social and content and analytics, illustrating common analytical scenarios and how to use popular web analytics tools used by marketers across the major industry domains. The course approaches web analytics from a strategic and practical perspective, showcasing techniques for using Google Web analytics and other platforms and tools. You'll keep pace with the most important analytics trends and prepare for a career in web and digital analytics.					
Prerequisites: Internet and Web Programming Basics of Data Analytics					

Units	**Teaching Hours**
Unit-1	
The Bold New World of Web Analytics 2.0 State of the Analytics Union, State of the Industry, Rethinking Web Analytics: Meet Web Analytics 2.0 **The Awesome World of Clickstream Analysis: Metrics** *Eight Critical Web Metrics:* Visits and Visitors, Time on Page and Time on site, Bounce Rate, Exit Rate, Conversion rate, Engagement. Web Metrics Demystified, Strategically-aligned Tactics for Impactful Web Metrics	9
Unit-2	

Competitive Intelligence Analysis **CI Data Sources:** Toolbar Data, Panel Data, ISP(Network) Data, Search Types and Secrets **Website Traffic Analysis:** Comparing Long Term Traffic Trends, Analyzing Competitive Sites Overlap and Opportunities, Analyzing Referrals and Destinations **Search and Keyword Analysis** Top Keywords Performance Trend, Geographic Interest and Opportunity Analysis, Related and Fast Rising searches, Share-of Shelf Analysis, Competitive Keyword Advantage Analysis, Keyword Expansion Analysis	9
Unit-3	
Emerging Analytics: Social, Mobile and Video *Measuring the New Social Web:* The Data Challenge, The Content Democracy Evaluation, The Twitter Revolution Analyzing Offline Customer Experiences(applications), *Analyzing mobile customer Experience:* Mobile Data Collection, Mobile Reporting and Analysis *Measuring the success of Blogs:* Raw Author Contribution, Holistic Audience growth, Citations and Ripple Index, Cost of Blogging, Benefit(ROI) from Blogging *Quantifying the Impact of Twitter:* Growth in Number of Followers, Message Amplification, Click-Through Rates and Conversions, Conversation Rate, Emerging Twitter Metrics *Analyzing Performance of Videos* Data Collection for Videos, Key Video Metrics and Analysis, Advanced Video Analysis	9
Unit-4	

Case Study: Google Analytics- Part 1 **Defining Web Analytics,** What Google Analytics Contributes, How Google Analytics Fits in the Analytics Ecosystem**.** **Creating An Implementation Plan**: Gather Business Requirements, Analyze and Document Website Architecture, Create an account and configure your profile, Configure the tracking code ad tag pages, Tag Marketing Campaigns ,Create Additional User Accounts and Configure Reporting ,Perform operational Configuration Steps **Under the Covers: How Google Analytics works** Data Collection and Processing, Reports, About the tracking code, Understanding Page views.	9
Unit-5	
Case Study: Google Analytics- Part 2 **Tracking Visitor Clicks, Outbound Links and Non HTML Files** About the Tracking Cookies **Google Analytics Accounts and Profiles** Google Analytics Accounts, Creating a Google Analytics Account: Creating Additional Profiles, Access Levels, All about Profiles: Basic Profile Settings, Profile Name, Website URL, Time Zone, Default Page, Exclude URL Query Parameters, E-commerce settings, Tracking On-site Search, Applying Cost Data	9
List of Experiments	**Practical Hours**
1. Perform setting up and Installing Hadoop	
2. Implement the following file management tasks in Hadoop: Adding files and directories Retrieving files Deleting files	
3. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm. i)Find the number of occurrence of each word appearing in the input file(s) ii)Performing a MapReduce Job for word search count (look for specific keywords• in a file	

4. Install, Deploy & configure Apache Spark Cluster. Run apache spark applications using Scala.	
5. Data analytics using Apache Spark on Amazon food dataset, find all the pairs of items frequently reviewed together	
6. Tracking Visitor Clicks, Outbound Links using a Google Analytics.	
7. Creating a Google Analytics Account and Creating Additional Profiles, Access Levels.	
8. Basic Profile Settings, Profile Name using a Google Analytics.	

Self-study : NA

Site/Industrial Visits :NA

Course outcomes:

- Demonstrate the fundamental concepts of web analytics.(L2)
- Illustrate various competitive intelligence analysis in web analytics.(L2)
- Analyze and Examine Social, Mobile and Video Emerging Analytics.(L3)
- Examine working of Google Analytics and creating an Implementation Plan.(L3)
- Develop Google Analytics Accounts and Profiles.(L5)

Text Books:

1. Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity, Avinash Kaushik , First Edition, Wiley Publishing, 2010. (UNIT 1,2 and 3).

2. Google Analytics: Understanding Visitor Behavior , Justin Cutroni, First Edition, O'Rielly Media,2010. (UNIT 4 and 5).

Reference Books:

1. Practical Web Analytics for User Experience How Analytics Can Help You Understand Your Users by Beasley, Michael,Elsevier,2013.
2. Mining the Social Web, 3rd Edition, Mikhail Klassen , Matthew A. Russell,O'Reilly Media, Inc,2019.
3. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Content, and Usage Data", 2 nd Edition, Springer, 2011.
4. Justin Cutroni, "Google Analytics", O'Reilly, 2010. 6. Eric Fettman, Shiraz Asif, Feras Alhlou , "Google Analytics Breakthrough", John Wiley & sons, 2016

Online Resources:

https://nptel.ac.in/courses/110106072/
https://nptel.ac.in/courses/110/107/110107092/
https://nptel.ac.in/courses/110/105/110105089/

Mapping with Program Outcomes (POs)

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	**2**	**1**	**1**		**1**								**2**	**2**	
CO2	**2**	**2**	**2**		**1**								**2**	**2**	
CO3	**3**	**2**	**2**		**2**								**2**	**2**	**1**
CO4	**3**	**2**	**2**		**2**								**2**	**2**	**1**
CO5	**3**	**3**	**2**		**2**								**2**	**2**	**1**

HONOURS IN CYBER SECURITY

Course Name: PROBABILITY AND RANDOM PROCESS					
Course Code : HOCS541					
	L	**T**	**P**	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**50**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
After learning the course for a semester, the student will be aware of the important statistical information for addressing cryptography, error correction and coding, information theory and cryptanalysis. The student would also get a clear idea on some of the cases with their analytical studies in information coding and its related fields.

Prerequisites: Probability and Queuing Theory

Units	**Teaching Hours**
Unit-1	
Probability Fundamentals, Bayes' rule, Markov chains and application to pattern search algorithms, Classical statistical inference, Bayesian statistical inference, Regression techniques	9
Unit-2	
Information coding, Pseudorandom number generators, discrete random variables, special distributions and mixed random variables, link and rank analysis , probability bounds, limiting theorem and convergence	9
Unit-3	
Risk M Basics of statistical learning: models, regression, curse of dimensionality, overfitting, etc. Optimization and convexity, Gradient descent, Newton's method	9
Unit-4	
Classification and similarity analysis, linear discriminative analysis, regression analysis, iterative permutation analysis, Support vector machines, nearest neighbor and application of entropy	9

Unit-5	
Clustering algorithms, graph analysis, pattern detection, Knowledge driven system design, learning with errors, Basics of neural networks	9
List of Experiments	**Practical Hours**
6. Markov chains, pattern search algorithms, Regression techniques	
7. Mixed random variables, Rank analysis, limiting theorem	
8. Optimization, Gradient descent, Newton's method	
9. Support vector machines, Nearest neighbour	
10. Neural Networks	
Self-study :	
Site/Industrial Visits : Visit to Forensic lab	

Course outcomes:
CO 1: To define pattern searching algorithms for different applications
CO 2: To classify vulnerability of subsystem based on the information gathered from different resources
CO 3: To estimate different optimized process and models
CO 4: To provide means to find the similarities between the applications and vulnerabilities of the sub-system/system
CO 5: To analyze about best possible patterns to cluster the possible solutions for different vulnerabilities

Text Books:

1. Gnedenko, Boris V. Theory of probability. Routledge, 2018.
2. Beichelt, Frank. Applied Probability and Stochastic Processes. Chapman and Hall/CRC, 2016.
3. Li, X. Rong. Probability, random signals, and statistics. CRC press, 2017

Reference Books:

1. Grimmett, Geoffrey, Geoffrey R. Grimmett, and David Stirzaker. Probability and random processes. Oxford university press, 2001.
2. Papoulis, Athanasios, and S. Unnikrishna Pillai. Probability, random variables, and stochastic processes. Tata McGraw-Hill Education, 2002.
3. Rozanov, Yu. Probability theory, random processes and mathematical statistics. Vol. 344. Springer Science & Business Media, 2012.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO	PSO

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2			2					2	2	
CO2	3	3	3	2	1			2					2	2	
CO3	3	3	2	2				2					2	2	
CO4	3	3	2	1				2					2	2	
CO5	3	3	2					2					2	2	

Course Name: MOBILE AND NETWORK BASED ETHICAL HACKING					
Course Code : HOCS641					
	L	**T**	**P**	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	
Credits.	**3**	**0**	**1**	Exam Hours	

Course objectives:
After learning the course for a semester, the student will be aware of the hacking concepts in cyber security for addressing cryptography, data protection, information-network security and detection of attacks. The student would also get a clear idea on some of the cases with their analytical studies in cyber-attacks and hacking in the related fields.

Prerequisites: : Cryptography and Network security-BTCS631

Units	**Teaching Hours**
Unit-1	
Introduction to ethical hacking, IP addressing, Network routing protocols, network security, network scanning, and vulnerability assessment OpenVAS, Nessus, etc. of computation device (mobile, pc, etc.) and network of the system	9
Unit-2	
Computation system hacking, modes of gathering information, password cracking, penetration testing including backdoor issues, Malware threats and different cyber-related attacks	9
Unit-3	
Introduction to Mobile Hacking, encryption types and attacks, different mobile platforms and corresponding vulnerabilities	9
Unit-4	
Evading firewalls, standard detection systems and frameworks, and other possible ways of detecting attacks	9
Unit-5	

Case studies: various hacking scenarios and their information gathering along with possible solutions.	9
List of Experiments	**Practical Hours**
1. Network scanning and vulnerability detection approaches	2
2. Information gathering modes, penetration testing, threat response process	2
3. Mobile hacking, encryption-attacks testing, mobile platform vulnerability	2
4. Evading firewalls and detection of attacks based on different parameters	2
5. Any one hacking scenarios and their information gathering response for mobile platform and network	2
Self-study :	
Site/Industrial Visits :	

Course outcomes:

CO 1: to describe the vulnerability scanning for network

CO 2: to identify the information gathering resources for any attack on the network

CO 3: to evaluate different hacking process and corresponding attacks for mobile platforms

CO 4: to provide means to evade fire-walls and other security parameter for ethical hacking

CO 5: to analyze about best possible solutions for different vulnerabilities that are exploited for hacking

Text Books:

1. Thompsons, Josh. Hacking: Hacking For Beginners Guide On How To Hack, Computer Hacking, And The Basics Of Ethical Hacking (Hacking Books). CreateSpace Independent Publishing Platform, 2017.
2. Weidman, Georgia. Penetration testing: a hands-on introduction to hacking. No Starch Press, 2014.
3. Dwivedi, Himanshu. Mobile application security. Tata McGraw-Hill Education, 2010

Reference Books:

1. Engebretson, Patrick. The basics of hacking and penetration testing: ethical hacking and penetration testing made easy. Elsevier, 2013.
2. McNab, Chris. Network security assessment: know your network. " O'Reilly Media, Inc.", 2007.
3. Simpson, Michael T., Kent Backman, and James Corley. Hands-on ethical hacking and network defense. Cengage Learning, 2010

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2			2					2	2	
CO2	3	3	3	2	1			2					2	2	
CO3	3	3	2	2				2					2	2	
CO4	3	2						2	3				2	2	
CO5	3	2				2		2	3			2	2	2	

Course Name: Cyber Forensics and Malware Detection					
Course Code : HOCS642					
	L	T	P	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**15**	ESE Marks	**50**
Credits.	**3**	**0**	**1**	Exam Hours	**3**

Course objectives:
This course is designed to explore fundamental concepts of cyber forensic, cyber laws and Data recovery and its analysis. This course covers the topics of malware detection, classification, tools & methodology applied to analysis and protection from malware.

Prerequisites: Probability and Random Process (Honour 1)
Mobile and Network based Ethical Hacking(Honour 2)

Units	**Teaching Hours**
Unit-1	
Introduction to Cyber Forensics; Windows Forensics; Linux Forensics, Mac OS Forensics; Anti-forensics; Network Forensics; Mobile Forensics; Cloud Forensics	9
Unit-2	
Malware Forensics; Web Attack Forensics; Emails and Email Crime, Bitcoin Forensics; Cyber Law and Cyberwarfare; Data Recovery & Data Analysis	9
Unit-3	
Introduction to malware, OS security concepts, malware threats, evolution of malware, malware types- viruses, worms, rootkits, Trojans, bots, spyware, adware, logic bombs, malware analysis, static malware analysis, dynamic malware analysis	9
Unit-4	

STATIC ANALYSIS: Analyzing Windows programs, Anti-static analysis techniques- obfuscation, packing, metamorphism, polymorphism DYNAMIC ANALYSIS: Live malware analysis, dead malware analysis, analyzing traces of malware- system-calls, api-calls, registries, network activities. Anti-dynamic analysis techniques- anti-vm, runtime-evasion techniques, Malware Sandbox, Monitoring with Process Monitor, Packet Sniffing with Wireshark, Kernel vs. User-Mode Debugging, OllyDbg, Breakpoints, Tracing, Exception Handling, Patching	9
Unit-5	
Malware Functionality: Downloader, Backdoors, Credential Stealers, Persistence Mechanisms, Privilege Escalation, Covert malware launching- Launchers, Process Injection, Process Replacement, Hook Injection, Detours, APC injection **Malware Detection Techniques**: Signature-based techniques: malware signatures, packed malware signature, metamorphic and polymorphic malware signature Non-signature based techniques: similarity-based techniques, machine-learning methods, invariant inferences	9
List of Experiments	**Practical Hours**
1. Set up a safe virtual environment to analyse malware	
2. Quickly extract network signatures and host-based indicators	
3. Overcome malware tricks like obfuscation, anti-disassembly, anti-debugging, and anti-virtual machine techniques	
4. Develop a methodology for unpacking malware and get practical experience with five of the most popular packers	
5. Install Reanimator in your Windows machine and scan the system for Malware and prepare one report for the same	
Self-study :	
Site/Industrial Visits :	

Course outcomes:

1. Students will be able to understand the fundamentals of Cyber forensic over different flatforms.
2. Students are able understand concepts of Malware Forensics; Web Attack Forensics; Bitcoin Forensics; Cyber Laws and Data Recovery & Analysis
3. Students will be able to understand the nature of malware, its capabilities, and how it is combated through detection and classification
4. Students will be able to apply the tools and methodologies used to perform static and dynamic analysis on unknown executables.
5. Students will be able to understand the malware functionality and malware detection techniques

Text Books:

1. Practical Cyber Forensics: An Incident-Based Approach to Forensic Investigations: Reddy, Niranjan, Published by Apress, Berkeley, CA, DOIhttps://doi.org/ 10.1007/978-1-4842-4460-9, Print ISBN 978-1-4842-4459-3, 2019
2. Practical malware analysis The Hands-On Guide to Dissecting Malicious Software by Michael Sikorski and Andrew Honig ISBN-10: 159327-290-1, ISBN-13: 978-1-59327-290-6, 2012 2

Reference Books:

1. Malware Detection A Complete Guide - 2019 Edition, Gerardus Blokdyk, Published by 5STARCooks, 2019, ISBN: 0655900845, 9780655900849

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1												2		2
CO2	1												2		2
CO3	2	2											2		2
CO4		2		1	1								2		2
CO5	1												2		2

Course Name: INTRUSION DETECTION AND INCIDENT RESPONSE					
Course Code : HOCS741					
	L	**T**	**P**	Category	
Contact Hrs./Week	**3**	**0**	**2**	CIA Marks	**50**
Contact Hrs./Sem.	**45**	**0**	**30**	ESE Marks	**50**
Credits.				Exam Hours	**3**

Course objectives:
After learning the course for a semester, the student will be aware of the intrusion detections concepts in cyber-attacks and its corresponding preventions and incident responses to ensure the data is recovered in time and whole system is operational. The student would also get a clear idea on some of the cases with their analytical studies in IDS and Incident responses

Prerequisites: Cryptography and Network security-BTCS631

Units	Teaching Hours
Unit-1	
Introduction to computer incident, legal environment, Network security and attacks, basics of incident detection, parameters for assessment of intrusion detection, Intrusion detection system and Detection approaches, Misuse detection, anomaly detection, specification based detection, hybrid detection and statistics	9
Unit-2	
Centralized, Distributed, Cooperative Intrusion Detection, Tiered architecture, Intrusion detection in security, Tool Selection and Acquisition Process, Bro Intrusion Detection, Prelude Intrusion Detection, Cisco Security IDS, Snorts Intrusion Detection, NFR security, Architecture models of IDs and IPs	9
Unit-3	
Basics of Incident Response, Preparing for Incident Response, Live Data Collection, Preparation, Identification, Containment, Eradication, Recovery	9
Unit-4	

Introduction to legal evidence preparation for incident response, Forensics Duplication, Network Surveillance/Evidence, statistical Analysis Investigating Windows, Investigating Unix, Malware Triage, ways of detecting residual after attacks	9
Unit-5	
Case studies: various intrusion scenarios and their incident response and evidence gathering along with possible solutions.	9
List of Experiments	**Practical Hours**
11. Intrusion detection system and Detection approaches	
12. Intrusion detection in security, Tool Selection and Acquisition Process	
13. Preparing for Incident Response, Live Data Collection, Preparation, Identification	
14. Forensics Duplication, Network Surveillance/Evidence, statistical Analysis	
15. Any one intrusion scenarios and their incident response	
Self-study :	
Site/Industrial Visits :	

Course outcomes:
CO 1: to evolve from design protection to detection of intrusions
CO 2: to identify the incident response when a computer intrusion occurs.
CO 3: to evaluate the intrusions at a better pace and quickly recover from the incidents while bring the intruders/hackers to justice.
CO 4: to provide hands-on demonstration based on the parameters to detect intrusions
CO 5: to analyze about best practices that comprise intrusions with incident responses.

Text Books:

1. Ali A. Ghorbani, Wei Lu, "Network Intrusion Detection and Prevention: Concepts and Techniques", Springer, 2010
2. Luttgens, Jason T., Matthew Pepe, and Kevin Mandia. Incident response & computer forensics. McGraw-Hill Education, 2014

Reference Books:

3. Earl Carter, Jonathan Hogue, "Intrusion Prevention Fundamentals", Pearson Education, 2006
4. Casey, Eoghan. Digital evidence and computer crime: Forensic science, computers, and the internet. Academic press, 2011.

Online Resources:

Mapping with Program Outcomes (POs)

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	2	2	2		2					2	2	
CO2	3	3	3	2	2			2					2	2	
CO3	3	3	3	2	1			2					2	2	
CO4	3	2	1					2	3				2	2	
CO5	3	2						2	3			2	2	2	