ANNAMALAI UNIVERSITY

FACULTY OF ENGINEERING AND TECHNOLOGY

B.E. (Four Year) Degree Programme (FULL–TIME)

Choice Based Credit System (CBCS)

REGULATIONS 2018- 19

1. Condition for Admission

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as courses of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamil Nadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma programme in Engineering of the State Board of Technical Education, Tamil Nadu (listed in Annexure-I) will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

2. Branches of Study in B.E.

BRANCH I	-	Chemical Engineering
BRANCH II	-	Civil Engineering
BRANCH III	-	Civil and Structural Engineering
BRANCH IV	-	Computer Science and Engineering
BRANCH V	-	Electrical and Electronics Engineering
BRANCH VI	-	Electronics and Communication Engineering
BRANCH VII	-	Electronics and Instrumentation Engineering
BRANCH VIII	-	Information Technology
BRANCH IX	-	Mechanical Engineering
BRANCH X	-	Mechanical Engineering (Manufacturing)

3. Courses of Study and Scheme of Examinations

The courses of study with respective syllabi and the scheme of Examinations are given separately.

4. Choice Based Credit System (CBCS)

The curriculum includes six components namely Humanities / Social Sciences /Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally have a blend of theory and practical courses. The total credits for the entire degree Programme is 166 (124 for lateral entry students).

5. Eligibility for the Degree

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period

of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to

5.1 Earn a minimum of 166 credits (124 for lateral entry students).

5.2 Serve in any one of the Co-curricular activities such as

- National Cadet Corps (NCC)
- National Service Scheme (NSS)
- National Sports Organization (NSO) and
- Youth Red Cross (YRC)

for at least one year. The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(or)

Enrol as a student member of a recognized professional society such as

- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IIChE, IEEE, SAE, ASHRAE, CSI and IWS

5.3 B.E (Honours) Degree

A student shall be eligible to get Under Graduate degree with Honours, if he/she completes an additional 20 credits. Thus the total credits are 186. Out of 186 credits (144 credits for lateral entry students), 20 credits must be earned by studying additional course offered by the same or allied Departments (listed in Annexure-II) in sixth, seventh and eighth semesters. These additional 20 credits could be acquired through the MOOC courses of SWAYAM portal also.

5.4 B.E Degree with Minor Engineering

A student shall be eligible to get Under Graduate degree with additional Minor Engineering, if he/she completes an additional 20 credits. Out of the 186 credits, 20 credits must be earned from the courses offered by any one of the Departments (listed in Annexure-II) in the Faculty of Engineering and Technology in sixth, seventh and eighth semesters . These additional 20 credits could be acquired through the MOOC courses offered in SWAYAM portal also.

6. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture/tutorial per week and half credit for one hour for laboratory or practical or drawing course per week.

7. Duration of the Programme

A student is normally expected to complete the B.E. programme in four years but in any case not more than seven years from the time of admission.

8. Registration for Courses

A newly admitted student will automatically be registered for all the courses prescribed for the first, second and third semesters without any option.

Every other student shall enrol for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 166 (124 for lateral entry students) credits in order to be eligible for obtaining the degree. However the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

8.1 Slow Learners

The **slow learners** may be allowed to withdraw certain courses with the approval by the Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with I Class. A student can withdraw a maximum of 2 courses per semester from IV semester to VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.

8.2 Advance Learners

The **advance learners** may be allowed to take up the open elective courses of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training/project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

9. Mandatory Internship (Industrial Training)

To promote industrial internship at the graduate level in technical institutes and also to enhance the employability skills of the students passing out from Technical Institutions, the internship for the students at different stages of the programme, is included in the curriculum. The student has to undergo the internship during the summer vacation, after the II semester / IV semester / VI semester of the programme as per the details outlined below. Further the student has to submit a report on completion of the internship during the subsequent Odd semester that is in the III / V / VII semesters respectively.

9.1 During the summer vacation, after the II Semester,

The student must get involved in any of the following **Inter/ Intra Institutional Activities** for **4 weeks** duration:

(i) Training with higher Institutions; Soft skill training organized by Training and Placement Cell.

(ii) Contribution at incubation/ innovation /entrepreneurship cell of the institute.

(iii) Participation in conferences/ workshops/ competitions.

(iv) Learning at Departmental Lab/ Institutional workshop.

(v) Working for consultancy/ research project within the University.

(vi) Participation in activities like IPR workshop / Leadership Talks/ Idea/ Design/ Innovation/ Technical Expos.

9.2 During the summer vacation, after the IV Semester and also after the VI Semester,

The student may choose any of the following **Internship / Innovation / Entrepreneurship** related activities for **4 weeks** duration:

(i) Work on innovation or entrepreneurial activities resulting in start-up

(ii) Undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises

(iii) Undergo internship with National Employment Enhancement Mission (NEEM) Facilitator.

10. Project Work

The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his/her period of study in an industry and complete his/her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

11. Mandatory Induction program

A 3-week long induction program for the UG students entering the institution, right at the start is proposed. Normal classes start only after the induction program is over. The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Physical Activity
Creative Arts
Imparting Universal Human Values
Literary Activities
Conduct of crash courses on soft skills
Lectures by Eminent People
Visits to Local Area
Familiarization to Dept./Branch & Innovative practices

12. Electives

The elective courses fall under two basic categories: Professional Electives and Open Electives.

12.1 Professional Elective courses

The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned.

12.2 Open Elective courses

Apart from the various Professional elective courses, a student must study three open elective courses two of which offered by the Department concerned and the other open elective course offered by any other Department in the Faculty of

Engineering & Technology during either sixth or seventh or eighth semester of study, with the approval of the Head of the Department and the Head of the Department offering the course.

12.3 MOOC (SWAYAM) Courses

Further, the student can be permitted to earn not more than 20 % of his total credits (that is 32 credits) by studying the Massive Open Online Courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent to the professional elective and/or open elective courses. Thus the credit earned through MOOC courses can be transferred and considered for awarding Degree to the student concerned.

12.4 Value added courses (Inter Faculty Electives)

Of the four open elective courses, a student must study one value added course that is offered by other Faculties in our University either in sixth or seventh semester of the B.E programme.

12.5 One Credit Courses

One credit courses shall be offered by a Department with the prior approval from the Dean, Faculty of Engineering and Technology.

12.5.1 Industry Expert

For one credit courses, a relevant potential topic may be selected by a committee consisting of the Head of the Department concerned and the Board of Studies member from the Department and a senior faculty member from the Department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two one credit courses (one each in VI and VII semesters). They shall be allowed to take one credit courses offered in other Departments with the permission of Head of the Department offering the courses. A separate mark sheet shall be issued for one credit courses.

12.5.2 NSQF Courses

A student can be permitted to acquire additional credits not more than two by undergoing any two of the one credit courses conducted under the auspices of National Skills Qualification Framework (NSQF). NSQF is a nationally integrated education and competency based skill and quality assurance framework that will provide for multiple pathways, horizontal as well as vertical, including vocational education, vocational training, general education and technical education, thus linking one level of learning to another higher level. This will enable a student to acquire desired competency levels, transit to the job market and at an opportune time, return for acquiring additional skills to further upgrade their competencies.

13. Assessment

13.1 Theory Courses

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I)	:	10 marks
Second assessment (Mid-Semester Test-II)	:	10 marks
Third Assessment	:	5 marks
End Semester Examination	:	75 marks

13.2 Practical Courses

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I)	:	15 marks
Second assessment (Test-II)	:	15 marks
Maintenance of record book	:	10 marks
End Semester Examination	:	60 marks

13.3 Project Work

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

13.4 Industrial Internship

After attending the internship during the summer vacation of even semester (II / IV / VI semester), the student has to present a report at the start of the subsequent odd semester (III / V / VII semester) to the committee which will assess and award marks out of 100. The committee is constituted with an Internship Coordinator and a minimum of two members nominated by the Head of the Department for each class.

14. Substitute Assessment

A student, who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.

15. Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

16. Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator. The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All the Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory/40 marks for seminar/ industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.

17. Attendance requirements

The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

18. Temporary break of study

A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

If a student wishes to apply for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period.

The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the Department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of seven years.

19. Procedure for withdrawing from the Examinations

A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade 'W' will appear in the mark sheet for such candidates.

20. Passing and declaration of examination results

All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of Examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), and prepare the mark sheets.

90 to 100 marks	:	Grade 'S'
80 to 89 marks	:	Grade 'A'
70 to 79 marks	:	Grade 'B'
60 to 69 marks	:	Grade 'C'
55 to 59 marks	:	Grade 'D'
50 to 54 marks	:	Grade 'E'
Less than 50 marks	:	Grade 'RA'
Withdrawn from the examination	:	Grade 'W'

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S, A, B, C, D or E for a course, is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA in the mark sheet must reappear for the examination of the courses except for Honours courses.

A student who obtains letter grade W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0

Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-valuation of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

21. Awarding Degree

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

21.1 Honours Degree

To obtain **Honours Degree** a student must earn a minimum of **186 credits** within four years (144 credits within three years for lateral entry students) from the time of admission, pass all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a CGPA of 8.25 or above.

21.2 First Class with Distinction

To obtain B.E Degree First Class with Distinction, a student must earn a minimum of 166 Credits within four years (124 credits within three years for lateral entry students) from the time of admission, by passing all the courses in the first attempt from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students) and obtain a CGPA of 8.25 or above.

21.3 First Class

To obtain B.E Degree First Class, a student must earn a minimum of 166 credits within ***five*** years (124 credits within ***four*** years for lateral entry students) from the time of admission and obtain a CGPA of 6.75 or above for all the courses from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

21.4 Second Class

For Second Class, the student must earn a minimum of 166 credits within **seven** years (124 credits within **six** years for lateral entry students) from the time of admission.

21.5 B.E Degree with Minor Engineering

For Minor Engineering, the student must earn a minimum of 186 credits within four years (144 credits within three years for lateral entry students) from the time of admission, pass all the courses. The rules for awarding the B.E degree in First Class with Distinction or in First Class or in Second Class will be applicable for this also.

22. Ranking of Candidates

The candidates who are eligible to get the B.E. degree with Honours will be ranked together on the basis of CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The candidates who are eligible to get the B.E. degree in First Class with Distinction will be ranked next after those with Honours on the basis of CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The Candidates passing with First Class will be ranked next after those with distinction on the basis of CGPA for all the courses of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

23. Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.

Annexure-I

Diploma Programmes Eligible for the B.E (Lateral Entry) Programmes offered in FEAT (from 2019-2020)

Sl.No.	Branches of Study	Eligible Diploma Programme (FT / PT / SW)
1.	**Chemical Engineering**	i. Petrochemical Engineering ii. Chemical Engineering iii. Environmental Engineering and Pollution Control iv. Leather Technology (Footwear) v. Leather Technology vi. Plastic Technology vii. Polymer Technology viii. Sugar Technology ix. Textile Technology x. Chemical Technology xi. Ceramic Technology xii. Petro Chemical Technology xiii. Pulp & Paper Technology xiv. Petroleum Engineering
2.	**Civil Engineering**	i. Civil Engineering ii. Civil Engineering (Architecture) iii. Environmental Engineering and Pollution Control (Full Time)
3.	**Civil and Structural Engineering.**	iv. Architectural Assistantship v. Civil Engineering (Rural Tech.) vi. Civil and Rural Engineering vii. Agricultural Engineering
4.	**Computer Science and Engineering**	i. Electronics and Communication Engineering ii. Computer Technology iii. Computer Science and Engineering iv. Information Technology v. Computer Engineering vi. Computer Networking vii. Electronics(Robotics) viii. Mechatronics Engineering
5.	**Electrical and Electronics Engineering**	i. Electrical and Electronics Engineering ii. Electronics and Communication Engg. iii. Electronics and Instrumentation Engg iv. Electronics Engineering(Instrumentation) v. Instrument Technology vi. Instrumentation and Control Engineering vii. Electrical Engineering (Instruments and Control) viii. Electrical Engineering ix. Instrumentation Technology x. Electronics (Robotics) xi. Mechatronics Engineering

6.	**Electronics and Communication Engineering**	i. Electronics and Communication Engineering ii. Computer Technology iii. Computer Science and Engineering iv. Information Technology v. Computer Engineering vi. Computer Networking vii. Electronics(Robotics) viii. Mechatronics Engineering ix. Electrical and Electronics Engineering x. Electronics and Instrumentation Engg
7.	**Electronics and Instrumentation Engineering**	i. Electrical and Electronics Engineering ii. Electronics and Communication Engg. iii. Electronics and Instrumentation Engg iv. Electronics Engineering(Instrumentation) v. Instrument Technology vi. Instrumentation and Control Engineering vii. Electrical Engineering (Instruments and Control) viii. Electrical Engineering ix. Instrumentation Technology x. Electronics (Robotics) xi. Mechatronics Engineering
8.	**Information Technology**	i. Electronics and Communication Engineering ii. Computer Technology iii. Computer Science and Engineering iv. Information Technology v. Computer Engineering vi. Computer Networking vii. Electronics(Robotics) viii. Mechatronics Engineering
9.	**Mechanical Engineering**	i. Mechanical Engineering ii. Mechanical and Rural Engineering iii. Mechanical Design and Drafting iv. Production Engineering v. Production Technology vi. Automobile Engineering vii. Automobile Technology viii. Metallurgy

10.	**Mechanical Engineering (Manufacturing Engineering)**	ix.	Mechatronics Engineering
		x.	Machine Tool Maintenance and Repairs
		xi.	Tool and Die making
		xii.	Tool Engineering
		xiii.	Tool Design
		xiv.	Foundry Technology
		xv.	Refrigeration and Air Conditioning
		xvi.	Agricultural Engineering
		xvii.	Agricultural Technology
		xviii.	Marine Engineering
		xix.	Mechanical Engineering(Production)
		xx.	Mechanical Engineering(Tool &Die)
		xxi.	Mechanical Engineering (Foundry)
		xxii.	Mechanical Engineering(R & A.C.)
		xxiii.	Electronics(Robotics)
		xxiv.	Mining Engineering
		xxv.	Agricultural Engineering and Farm Machinery
		xxvi.	Equipment Technology

Annexure-II

S.No.	Branch of Study in B.E	Honours Elective Courses from Same and Allied Departments of	Minor Engineering Courses from Other Departments of
1.	Chemical Engineering	1. Chemical Engineering 2. Pharmacy 3. Electronics and Instrumentation Engineering	1. Civil Engineering 2. Mechanical Engineering 3. Electronics and Instrumentation Engg 4. Information Technology 5. Civil and Structural Engg 6. Electrical Engineering 7. Electronics and Communication Engg 8. Mechanical (Manufacturing) Engg 9. Computer Science and Engineering
2.	Civil Engineering	1. Civil Engineering 2. Civil and Structural Engg.	1. Mechanical Engineering 2. Electrical Engineering 3. Chemical Engineering 4. Computer Science and Engineering 5. Mechanical (Manufacturing) Engg 6. Electronics and Instrumentation Engg 7. Information Technology 8. Electronics and Communication Engg
3.	Civil and Structural Engineering		
4.	Computer Science and Engineering	1. Computer Science and Engg. 2. Information Technology 3. Electronics and Communication Engineering	1. Civil Engineering 2. Electronics and Instrumentation Engg 3. Electronics and Communication Engg 4. Mechanical Engineering 5. Mechanical (Manufacturing) Engg 6. Civil and Structural Engg 7. Electrical Engineering 8. Chemical Engineering
5.	Electrical and Electronics Engineering	1. Electrical Engineering 2. Electronics and Instrumentation Engineering 3. Electronics and Communication Engineering	1. Civil Engineering 2. Civil and Structural Engg 3. Mechanical Engineering 4. Chemical Engineering 5. Mechanical (Manufacturing) Engg 6. Computer Science and Engineering 7. Information Technology
6.	Electronics and Communication Engg.		
7.	Electronics and Instrumentation Engg.		

8.	Information Technology	1. Computer Science and Engg. 2. Information Technology 3. Electronics and Communication Engineering	1. Civil Engineering 2. Electronics and Instrumentation Engg 3. Electronics and Communication Engg 4. Mechanical Engineering 5. Mechanical (Manufacturing) Engg 6. Civil and Structural Engg 7. Electrical Engineering 8. Chemical Engineering
9.	Mechanical Engineering	1. Mechanical Engineering 2. Mechanical (Manufacturing) Engg.	1. Civil Engineering 2. Civil and Structural Engg 3. Electrical Engineering 4. Chemical Engineering 5. Computer Science and Engineering 6. Electronics and Instrumentation Engg 7. Information Technology 8. Electronics and Communication Engg
10.	Mechanical (Manufacturing) Engg.		

SEMESTER I									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETBS101	**BS-I**	Physics	3	1	0	25	75	100	4
ETBS102	**BS-II**	Mathematics – I	3	1	0	25	75	100	4
ETES103	**ES-I**	Basic Electrical Engineering	3	1	0	25	75	100	4
ETBP104	**BSP-I**	Physics Laboratory	0	0	3	40	60	100	1.5
ETSP105	**ESP-I**	Electrical Engineering Laboratory	0	0	2	40	60	100	1
ETSP106	**ESP-II**	Engineering Workshop/ Manufacturing Practices	1	0	4	40	60	100	3
						Total Credits			**17.5**
SEMESTER II									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETHS201	**HS-I**	English	2	0	0	25	75	100	2
ETBS202	**BS-III**	Chemistry	3	1	0	25	75	100	4
ETES203	**ES-II**	Programming for Problem Solving	3	0	0	25	75	100	3
ETBS204	**BS-IV**	Mathematics – II	3	1	0	25	75	100	4
ETHP205	**HSP-I**	Communication Skills and Language Laboratory	0	0	2	40	60	100	1
ETBP206	**BSP-II**	Chemistry Laboratory	0	0	3	40	60	100	1.5
ETSP207	**ESP-III**	Computer Programming Lab	0	0	4	40	60	100	2
ETSP208	**ESP-IV**	Engineering Graphics and Drafting	1	0	4	40	60	100	3
						Total Credits			**20.5**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming III Semester.									

SEMESTER III									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSBS301	**BS-V**	Engineering Mathematics - III	3	1	-	25	75	100	4
ETES302	**ES-III**	Environmental Studies	3	-	-	25	75	100	3
CSES303	**ES-IV**	Analog Electronic Circuits	3	-	-	25	75	100	3
CSES304	**ES-V**	Digital Electronics	2			25	75	100	2
CSPC305	**PC-I**	Data Structures and Algorithms	3	-	-	25	75	100	3
CSPC306	**PC-II**	Object Oriented Programming	3	1		25	75	100	4
CSSP307	**ESP-V**	Digital Electronics Lab	-	-	3	40	60	100	1.5
CSCP308	**PCP-I**	Data Structures and Algorithms Lab	-	-	3	40	60	100	1.5
CSCP309	**PCP-II**	Object Oriented Programming Lab	-	-	3	40	60	100	1.5
ETIT310	**IT-I**	Internship Inter/ Intra Institutional Activities*	***Four*** *weeks during the summer vacation at the end of* ***II Semester***				100	100	**4.0**
For the ***Lateral entry students total credit for III Semester is ***23.5*** as they are exempted from internship during summer vacation of II semester.*							**Total Credits**		**27.5**

SEMESTER IV									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSBS401	**BS-VI**	Discrete Mathematics	3	-	-	25	75	100	3
CSES402	**ES-VI**	Design and Analysis of Algorithms	2	-	-	25	75	100	2
CSPC403	**PC-III**	Database Management Systems	3	-	-	25	75	100	3
CSPC404	**PC-IV**	Operating Systems	3	-	-	25	75	100	3
CSPC405	**PC-V**	Python Programming	3	-	-	25	75	100	3
CSPC406	**PC-VI**	Computer Organization and Architecture	3	-	-	25	75	100	3
CSCP407	**PCP-III**	Database Management Systems Lab	-	-	3	40	60	100	1.5
CSCP408	**PCP-IV**	Operating Systems Lab	-	-	3	40	60	100	1.5
CSCP409	**PCP-V**	Python Programming Lab	-	-	3	40	60	100	1.5
						Total Credits			**21.5**

Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming V Semester.

SEMESTER V									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSPC501	**PC-VII**	Theory of Computation	3	-	-	25	75	100	3
CSPC502	**PC-VIII**	Computer Graphics and Multimedia	3	-	-	25	75	100	3
CSPC503	**PC-IX**	Computer Networks	3	-	-	25	75	100	3
CSPC504	**PC-X**	Microprocessors	3			25	75	100	3
CSPE505	**PE-I**	Professional Elective I	3	-	-	25	75	100	3
CSPE506	**PE-II**	Professional Elective II	3	-		25	75	100	3
CSCP507	**PCP-VI**	Computer Graphics and Multimedia Lab	-	-	3	40	60	100	1.5
CSCP508	**PCP-VII**	Computer Networks Lab	-	-	3	40	60	100	1.5
CSCP509	**PCP-VIII**	Microprocessors Lab	-	-	3	40	60	100	1.5
ETIT510	**IT-II**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four*** *weeks during the summer vacation at the end of* ***IV Semester***				100	100	**4.0**
						Total Credits			**26.5**
SEMESTER VI									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSPC601	**PC-XI**	Compiler Design	3	-	-	25	75	100	3
CSPC602	**PC-XII**	Software Engineering	3	-	-	25	75	100	3
CSPE603	**PE-III**	Professional Elective - III	3	-	-	25	75	100	3
CSPE604	**PE-IV**	Professional Elective - IV	3	-	-	25	75	100	3
CSPE605	**PE-V**	Professional Elective -V	3	-	-	25	75	100	3
YYOE606	**OE-I**	**Open Elective - I (inter department - FEAT)**	3	-	-	25	75	100	3
CSCP607	**PCP-IX**	Compiler Design Lab	-	-	3	40	60	100	1.5
CSCP608	**PCP-X**	Software Engineering Lab	-	-	3	40	60	100	1.5
						Total Credits			**21.0**
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.									

SEMESTER VII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
ETHS701	**HS-II**	Engineering Ethics	2	-	-	25	75	100	2
CSPC702	**PC-XIII**	Embedded Systems and Internet of Things (IoT)	3	-	-	25	75	100	3
CSPE703	**PE-VI**	Professional Elective-VI	3	-	-	25	75	100	3
CSPE704	**PE-VII**	Professional Elective-VII	3	-	-	25	75	100	3
YYOE705	**OE-II**	**Open Elective - II (inter department-Allied Branch)**	3	-	-	25	75	100	3
CSCP706	**PCP-XI**	Embedded Systems and Internet of Things (IoT) Lab	-	-	3	40	60	100	1.5
ETIT707	**IT-III**	Industrial Training / Rural Internship/Innovation / Entrepreneurship	***Four*** *weeks during the summer vacation at the end of* ***VI Semester***				100	100	**4.0**
						Total Credits			**19.5**

SEMESTER VIII									
Course Code	**Category**	**Course**	**L**	**T**	**P**	**CA**	**FE**	**Total**	**Credits**
CSOE801	**OE-III**	**Open Elective – III (from the same Department)**	3	-	-	25	75	100	3
CSOE802	**OE-IV**	**Open Elective – IV (from the same Department)**	3	-	-	25	75	100	3
CSPV803	**PV-I**	**Project Work and Viva-Voce**	-	**PR** 10	**S** 2	40	60	100	**6**
						Total Credits			**12**

L	No. of Lecture Hours	**TR**	No. of Hours for Discussion on Industrial Training
T	No. of Tutorial Hours	**S**	No. of Seminar Hours on Industrial Training / Project
P	No. of Practical Hours	**PR**	No. of Hours for Discussion on Project work
CA	Continuous Assessment Marks	**FE**	Final Examination Marks
Credits	Credit points allotted to that course	**Total**	Total Marks

PE – PROFESSIONAL ELECTIVES

1. Perl Programming
2. Visual Programming
3. Web Technology
4. Real Time Systems
5. Distributed Systems
6. Mobile App Development
7. Software Testing and Quality Assurance
8. Mobile Computing
9. Cryptography and Network Security
10. Pervasive Computing
11. Adhoc and sensor Networks
12. Digital Image Processing
13. Machine Learning
14. Digital Signal Processing
15. Cloud Computing
16. Speech Processing and Synthesis
17. Information Retrieval Techniques
18. Data Mining
19. Web Application Framework
20. Open Source Programming
21. Soft Computing Techniques

OE- OPEN ELECTIVES

1. Internet of Things
2. Enterprise Resource Planning
3. E-Commerce
4. Supply Chain Management
5. Cyber Forensics
6. System Modeling and Simulation
7. Big Data Analytics
8. Social Network Analysis

LIST OF HONORS ELECTIVE COURSES

S. No	Course Code	Course Name	Credits
1	CSHESCN	Software Project Management (or) Nano Computing	4
2	CSHESCN	Artificial Intelligence	4
3	CSHESCN	Graph Theory	3
4	CSHESCN	Deep Learning (or) Operation Research	3
5	CSHESCN	Parallel and Distributed Algorithms	3

LIST OF MINOR ENGINEERING ELECTIVE COURSES

S. No	Course Code	Course Name	Credits
1	CSMISCN	Object Oriented Programming	4
2	CSMISCN	Database Management Systems (or) Software Engineering	4
3	CSMISCN	Computer Networks	3
4	CSMISCN	Mobile App Development	3
5	CSMISCN	Internet of Things	3
6	CSMISCN	Big Data Analytics (or) Social Network Analysis	3
7	CSHESCN	Digital Watermarking and Steganography	3

I Semester

Course code	**ETBS101**				
Category	Basic Science Course				
Course title	**Physics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	

Oscillations, waves and optics

Pre-requisites (i) Mathematics course on Differential equations
(ii) Introduction to Electromagnetic theory

Unit 1: Simple harmonic motion, damped and forced simple harmonic oscillator
(7 lectures)

Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator.

Unit 2: Non-dispersive transverse and longitudinal waves in one dimension and introduction to dispersion (7 lectures)

Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigenfrequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

Unit 3: The propagation of light and geometric optics (10 lectures)

Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Mirrors and lenses and optical instruments based on them, transfer formula and the matrix method

Unit 4: Wave optics (6 lectures)

Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's

double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer.
Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power

Unit 5: Lasers (8)

Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers(ruby, Neodymium), dye lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications of lasers in science, engineering and medicine.

Suggested Reference Books

(i) Ian G. Main, Oscillations and waves in physics
(ii) H.J. Pain, The physics of vibrations and waves (iii)E. Hecht, Optics
(iv)A. Ghatak, Optics
(v)O. Svelto, Principles of Lasers

Course code	**ETBS102**				
Category	Basic Science Course				
Course title	**Mathematics - I**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	

Unit 1: Calculus: (6 lectures)

Evolutes- and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit 2: Calculus: (6 lectures)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders;
indeterminate forms and L'Hospital's rule; Maxima and minima.

Unit 3: Sequences and series: (10 lectures)

Convergence of sequence and series, tests for convergence; Power

series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Unit 4: Multivariable Calculus (Differentiation): (8 lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Unit 5: Matrices (10 lectures)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(iii) Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

(iv) Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

(v) D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

(vi) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(vii) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

The students will learn:

- To apply differential and integral calculus to notions of

curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

- The fallouts of Rolle's Theorem that is fundamental to application of analysis to
  Engineering problems.
- The tool of power series and Fourier series for learning advanced Engineering Mathematics.
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

Course Code	**ETES103**				
Category	Engineering Science Course				
Course Title	**Basic Electrical Engineering**				
Scheme and Credits	L	T	P	Credits	
	3	**1**	**0**	**4**	

Unit 1: DC Circuits (8 Hours)

Electrical circuit elements (R,L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Nortton theorems. Time domain analysis of first order RL and RC circuits.

Unit 2: AC Circuits (8 Hours)

Representation of sinusoidal waveforms, peak and rms values, phasorrepresentation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L,C,RL, RLC combinations (Series and Parallel), resonance, Three phase balanced circuits, voltage and current relations in star delta connections.

Unit 3: Transformers (6 Hours)

Magnetic Materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Unit 4: Electrical Machines (8 Hours)

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, significance of torque-slip characteristics. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristics and speed control of separately excited dc motor. Construction and working of synchronous generators.

Unit 5: Power Converters and Electrical Installations (12 Hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.Components of LT switchgear: Switch Fuse Unit(SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics of Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text/ Reference Books

(i) D.P.Kothari and I.J.Nagrath "Basic Electrical Engineering", Tata McGraw Hill, 2010.

(ii) D.C.Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.

(iii) L.S.Borow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.

(iv) E.Hughes, "Electrical and Electronics Technology", Pearson, 2010.

(v) V.D.Toro,"Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits.
- To study and working principles of electrical machines and power convertors.
- To introduce the components of low voltage electrical installations.

Course code	**ETBP104**				
Category	Basic Science Course				
Course title	**Physics Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	0	**0**	**3**	**1.5**	

List of Experiments:

1. Air Wedge
2. Newtons's Rings
3. Simple Pendulum
4. Dispersive power of the Prism
5. Diffraction Grating
6. Acoustic diffraction Grating
7. Compound Pendulum
8. Kunt's tube experiment
9. Young's double slit experiment
10. Laser Grating
11. Torsional Pendulum
12. Young's Modulus – Non-uniform Bending
13. Young's Modulus – Uniform Bending.

Course Code	**ETSP105**				
Category	Engineering Science Course				
Course Title	**Electrical Engineering Laboratory**				
Scheme and Credits	L	T	P	Credits	
	0	**0**	**2**	**1**	

List of experiments/ demonstrations:

- Basic safety precautions, Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
- Measuring the steady – state and transient time-response of R-L,R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L and R-C circuits – impedance calculation and verification. Observation of phase difference between current and voltage. Resonance in R-L-C circuits.
- Transformers: Observation of the no-load current waveform on an

oscilloscope (non- sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonies. Loading of a transformer: measurement of primary and secondary voltages and currents and power.

- Three-phase transformers: Star and Delta connections, Voltage and Current relationships (line-line voltage, phase –to – neutral voltage, line and phase currents). Phase-shifts between the primary and secondary sides. Cumulative three-phase power in balanced three-phase circuits.
- Demonstration of cut-out sections of machines: de machine (commutator - brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging – slip ring arrangement) and single–phase induction machine.
- Torque Speed Characteristic of separately excited de motor.
- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super synchronous speed.
- Synchronous Machine operating as a generator: stand-alone operation with a load.
- Control of voltage through field excitation.
- Demonstration of (a) dc-dc convertors (b) dc-ac convertors – PWM waveform (c) the use of dc-ac convertor for speed control of an induction motor and (d) Components of LT switchgear

Laboratory Outcomes

- Get an exposure to common electrical components and their ratings.
- Make electrical connections by wires of appropriate ratings.
- Understand the usage of common electrical measuring instruments.
- Understand the basic characteristics of transformers and electrical machines.
- Get an exposure to the working of power electronic converters.

Course code	**ETES106**				
Category	Engineering Science Courses				
Course title	**Engineering Workshop / Manufacturing Practices**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	1	**0**	**4**	**3**	

(i) Lectures & Videos: (10 hours)

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing
   methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical & Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

(ii) Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology",
4^{th} edition, Pearson Education India Edition, 2002.

(iii) Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson
Education, 2008.

(iv) Roy A. Lindberg, "Processes and Materials of Manufacture",
4^{th} edition, Prentice Hall India, 1998.

(v) Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House,
2017.

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

(ii) Workshop Practice: (60 hours)

1. Machine shop (10 hours)
2. Fitting shop (8 hours)
3. Carpentry (6 hours)
4. Electrical & Electronics(8 hours)
5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs)
6. Casting (8 hours)
7. Smithy (6 hours)

8. Plastic moulding & Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

II Semester

Course code	**ETHS201**				
Category	Humanities and Social Sciences including Management courses				
Course title	**English**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	2	**0**	**0**	**2**	

Unit 1: **Vocabulary Building**

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

Unit 2:**. Basic Writing Skills**

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation
2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

Unit 3: **Identifying Common Errors in Writing**

3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

Unit 4: **Nature and Style of sensible Writing**

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

Unit 5: **Writing Practices & Oral Communication**

5.1 Comprehension
5.2 Precis Writing
5.3 Essay Writing

Suggested Readings:

(i) *Practical English Usage.* Michael Swan. OUP. 1995.
(ii) *Remedial English Grammar.* F.T. Wood. Macmillan.2007
(iii)*On Writing Well.* William Zinsser. Harper Resource Book. 2001
(iv) *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press.
2006.
(v) *Communication Skills*. Sanjay Kumar and PushpLata. Oxford University Press.
2011.
(vi) *Exercises in Spoken English.* Parts. I-III. CIEFL, Hyderabad. Oxford University
Press

Course Outcomes

The student will acquire basic proficiency in English including reading and listening
comprehension, writing and speaking skills.

Course code	**ETBS202**				
Category	Basic Science Course				
Course title	**Chemistry**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	

Unit 1: Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

Unit 2: Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

Unit 3: Intermolecular forces and potential energy surfaces & Periodic properties (8 Lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

Unit 4: Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy.
Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.
Use of free energy considerations in metallurgy through Ellingham diagrams.

Unit 5: Stereochemistry Organic reactions (8 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Introduction to reactions involving substitution, addition,

elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan
(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane (iii)Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Course code	**ETES203**				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	0	0	**3**	

Unit 1: Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. From algorithms to programs; source code, variables (with data types) variables and memorylocations, Syntax and Logical Errors in compilation, object and executable code. **(8 lectures)**

Unit 2: Arithmetic expressions and precedence, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops. **(14 lectures)**

Unit 3: *Arrays: Arrays (1-D, 2-D), Character arrays and Strings, Basic Algorithms: Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required).* ***(12 lectures)***

Unit 4: Function: Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference, Recursion: Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort. (10 lectures)

Unit 5:

Structure: Structures, Defining structures and Array of Structures, Pointers: Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion oflinked list (no implementation). File handling (only if time is available, otherwise should be done as part of the lab). **(6 lectures)**

Suggested Text
Books

(i) Byron Gottfried, Schaum's Outline of Programming with C,McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, TataMcGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall ofIndia

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logicalproblems.
- To translate the algorithms to programs (in Clanguage).
- To test and execute the programs and correct syntax and logicalerrors.
- To implement conditional branching, iteration andrecursion.
- To decompose a problem into functions and synthesize a complete programusing divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms andprograms.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Course code	**ETBS204**				
Category	Basic Science Course				
Course title	**Mathematics - II**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**1**	**0**	**4**	

Unit 1: Multivariable Calculus (Integration): (10 lectures)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

Unit 2: First order ordinary differential equations: (6 lectures)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Unit 3: Ordinary differential equations of higher orders: (8 lectures)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power

series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Unit 4: Complex Variable – Differentiation: (8 lectures)

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Unit 5: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text/Reference Books

(i) G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

(ii) Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

(iii) W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

(iv) S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

(v) E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

(vi) E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

(vii) J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

(viii) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

(ix) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations and complex variables. It aims

to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Course code	**ETHP205**				
Category	Humanities and Social Sciences including Management courses				
Course title	**Communication Skills and Language Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	0	**0**	**2**	**1**	

List of Topics

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews
6. Formal Presentations

Suggested Software package: Globarena Package for communicative English

The Globarena Package consists of the following exercises

1. Reading comprehension
2. Listening comprehension
3. Vocabulary exercises
4. Phonetics
5. Role Play in dialogues
6. Auto Speak

Suggested Readings:

i. English Pronouncing Dictionary Daniel Jones Current Edition with CD.
i. Spoken English- R. K. Bansal and J. B. Harrison, Orient Longman 2006 Edn.
ii. A Practical course in English Pronunciation, (with two Audio cassettes) by

J. Sethi, KamleshSadanand& D.V. Jindal, Prentice-Hall of India Pvt. Ltd., New Delhi.

iii. A text book of English Phonetics for Indian Students by T.Balasubramanian (Macmillan)

iv. English Skills for Technical Students, WBSCTE with British Council, OL.

Course code	**ETBP206**				
Category	Basic Science Course				
Course title	**Chemistry Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	0	**0**	**3**	**1.5**	

List of Experiments:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Ion exchange column for removal of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductance of solutions
7. Potentiometry - determination of redox potentials and emfs
8. Saponification/acid value of an oil
9. Determination of the partition coefficient of a substance between two immiscible liquids
10. Adsorption of acetic acid by charcoal
11. Volumetric analysis

Course code	**ETSP207**				
Category	Engineering Science Course				
Course title	**Computer Programming Laboratory**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	0	**0**	**4**	**2**	

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given]

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at runtime
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use

them in defining self-referential structures.

- To be able to create, read and write to and from simple text files.

Course code	**ETSP208**				
Category	Engineering Science Courses				
Course title	**Engineering Graphics and Design**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	1	**0**	**4**	**3**	

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Unit 1: Introduction to Engineering Drawing covering,
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Unit 2: Orthographic Projections covering,
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Unit 3: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Unit 4:Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Unit 5:
Isometric Projections **covering,**
Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: 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.; Isometric Views of lines, Planes, Simple and compound Solids];

Customisation & CAD Drawing
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 and tolerancing; 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 (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two- dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section

views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Demonstration of a simple team design project *that illustrates*
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers

(v) (Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

B.E., COMPUTER SCIENCE AND ENGINEERING

(Students Admitted From the Academic Year 2018-2019)

VISION

To provide an academically ambient environment for individuals to develop and blossom as academically superior, socially conscious and nationally responsible citizens.

MISSION

- To impart high quality computer knowledge to the students by conducting education Programmes.
- To provide exposure to the students about the emerging technological advancements for meeting the demands of the industry.
- To advance discipline of computing through internationally recognized research and development.
- To foster an environment that promotes extension activities and continuing education.
- To discover new knowledge through innovative research and creative teaching and learning that lead to prosperity, economic and societal benefit to the people.

Sl. No.	PEO
PEO1	To prepare graduates with potential to get employed in the right role and/or become entrepreneurs to contribute to the society.
PEO2	To provide the graduates with the requisite knowledge to pursue higher education and carry out research in the field of Computer Science.
PEO3	To equip the graduates with the required skills to stay motivated and adapt to a dynamically changing world so as to remain successful in their career.
PEO4	To communicate the graduates with effectively, work collaboratively and exhibit high levels of professionalism and ethical responsibility.

B.E. (CSE) – PROGRAMME OUTCOMES (PO)

After the successful completion of the B.E(CSE) degree program the students will be able to :

Sl. No.	PROGRAMME OUTCOMES
PO1	**Life-long Learning** : Adapt the acquired knowledge for solving current and emerging issues and involved in lifelong learning.
PO2	**Engineering Knowledge :** Apply the engineering knowledge in various disciplines such as engineering, medicine, agriculture, banking, law, etc.
PO3	**Problem Analysis** : Assess and analyze the problem, breaking into components with clear boundaries and interaction among them to achieve the expected outcome within the stipulated duration.
PO4	**Conduct Investigations :** Utilize the knowledge acquired in programming laboratories for further analysis, modification and understanding of data for research.
PO5	**Design & Development of Solutions** : Identify and formulate algorithmic principles, mathematical knowledge and theory of Computer Science in modeling and design of computer based systems.
PO6	**The Engineer and Society** : Transmit the healthy engineering solutions to customers/users or peers.
PO7	**Modern Tool Usage** : Implement innovative notions and solutions to produce user friendly tools for the benefit of the society.
PO8	**Project Management :** Develop and deploy software and/or hardware systems with assured quality and efficiency.
PO9	**Ethics** : An understanding of professional, ethical, legal, security, and social issues and responsibilities for the computing profession.
PO10	**Communication Skills** : An ability to communicate and engage effectively with diverse stakeholders.
PO11	**Environment and Sustainability :** An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
PO12	**Individual and Team Work :** An ability to function effectively on teams to accomplish shared computing design, evaluation, or implementation goals.

B.E. (CSE) – MAPPING OF PO WITH PEO

Mapping PO with PEO												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
PEO1	✓	✓	✓	✓			✓	✓	✓	✓		✓
PEO2	✓			✓	✓				✓		✓	
PEO3		✓	✓			✓	✓				✓	✓
PEO4	✓	✓	✓		✓		✓	✓	✓	✓		✓

CSBS301	ENGINEERING MATHEMATICS III	L	T	P	C
		3	1	0	4

Course Objectives :

- To learn, partial differential equations, Fourier series, Boundary value problems.
- To learn the transforms such as Sine, Cosine, Fourier transform and Z-transforms.
- To gain knowledge of the method to find the Solution of difference equations.

UNIT - I Partial Differential Equations

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions - Solution of standard type of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients.

UNIT – II Fourier Series

Dirichle's conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval's identity.

UNIT – III Boundary Value Problems

Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT – IV Fourier Transform

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval's identity.

UNIT – V Z - Transform

Elementary properties – Inverse Z – Transform - Convolution theorem – Solution of difference equations using Z – Transform.

TEXT BOOKS :

1. Kandasamy P, Tilagavathy K and Gunavathy K, "Engineering Mathematics", 6thedition, (Vol I & II) S.Chand & Co Ltd. New Delhi, 2006.
2. Ventakataraman M K, "Engineering Mathematics", The National Publishing Co., Chennai, 2003.

REFERENCES :

1. Veerarajan T, "Engineering Mathematics", 3rd edition, Tata McGraw Hill Pub., 2005.
2. Singaravelu A, "Engineering Mathematics", Meenakshi Publications, Chennai, 2004.

Course Outcomes :

At the end of this course, the students will be able to

1. Solve partial differential equations.
2. Knowledge about Fourier series.
3. Understand Fourier transform.
4. Solve boundary value problems.
5. Understand Z-transform.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓		✓			✓	✓	✓	✓	✓
CO2	✓		✓	✓	✓	✓					✓	
CO3		✓			✓				✓			
CO4	✓			✓			✓			✓	✓	✓
CO5	✓	✓			✓			✓	✓			

ETES302	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To make the students conversant with basic principles of natural resources, forest resources, ecosystem and bio-diversity.
- To get knowledge about pollution and its control.

UNIT - I Introduction

Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness. Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. 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, Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. 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.

UNIT – II Concept of an Ecosystem

Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

UNIT – III Bio Diversity

Definition: genetic, species and ecosystem diversity - Bio geographical classification of India - Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, National and local levels - India as a mega-diversity nation - Hot-spots of biodiversity - Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts - Endangered and endemic species of India - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – IV Types of Pollution

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution- Noise pollution - Thermal pollution - Nuclear hazards- Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution – Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation - Consumerism and waste products - Environment Protection Act - Air (Prevention and Control of Pollution) Act - Water (Prevention and control of Pollution) Act - Wildlife Protection Act - Forest Conservation Act - Issues involved in enforcement of environmental legislation.

UNIT – V Environment and Human Health

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.

TEXT BOOKS :

1. Textbook of Environmental Studies, Erach Bharucha, University Press, 2005.
2. Environmental Studies, MP Poonia & SC Sharma, Khanna Publishing House, 2017.

REFERENCES :

1. Environmental Studies, Rajagopalan, Oxford University Press, 2005.
2. Brunner R.C., Hazardous Waste Incineration, McGraw Hill Inc., 1989.
3. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopaedia, Jaico Publ. House, Mumbai, 2001.
4. De A.K., Environmental Chemistry, Wiley Eastern Ltd. New Age International Limited, 3rd Edition, 2003.
5. Jadhav, H & Bhosale, V.M. Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995 .
6. Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998.

Course Outcomes :

At the end of this course, the students will be able to

1. To conversant with basic principles of natural resources, forest resources.
2. To conversant with basic principles of ecosystem and bio-diversity.
3. To identify the causes of pollution and its control measures.
4. Knowledge about Population Growth.
5. Understand the principles of Act.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓			✓						✓	✓
CO2			✓				✓		✓	✓		
CO3		✓				✓						
CO4		✓		✓			✓	✓		✓		✓
CO5			✓			✓						

CSES303	**ANALOG ELECTRONIC CIRCUITS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To study the qualitative and quantitative exposition of fundamental concepts of silicon and germanium semiconductor devices.
- To understand the principle, operation and characteristics of diode, bipolar junction transistor and metal oxide field effect transistor.
- To study the characteristics of operational amplifiers and its applications.

UNIT - I Diode

P-N junction diode, I-V characteristics of a diode-review of half-wave and full-wave rectifiers-Zener diodes-clamping and clipping circuits.

UNIT – II BJT

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model-biasing circuits- current mirror-common-emitter-common-base and common collector amplifiers-Small signal equivalent circuits, high-frequency equivalent circuits.

UNIT - III MOSFET Structure

I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers-small signal equivalent circuits - gain, input and output impedances- transconductance-high frequency equivalent circuit.

UNIT – IV Amplifiers

Differential amplifier; power amplifier-direct coupled multi-stage amplifier; internal structure of an operational amplifier-ideal op-amp- non-idealities in an op-amp (Output offset voltage-input bias current-input offset current-slew rate- gain bandwidth product).

UNIT - V Analysis of op-amp Circuits

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier-differential amplifier- instrumentation amplifier- integrator-active filter- P, PI and PID controllers and lead/lag compensator using an op-amp-voltage regulator-oscillators (Wein bridge and phase shift). Analog to Digital Conversion- Hysteretic Comparator-Zero Crossing Detector-Square-wave and triangular-wave generators-Precision rectifier-peak detector- Astable Multivibrator.

TEXT BOOKS :

1. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
2. Theodore F Bogart, Jeffrey S. Beasley, Guillermo Rico, "Electronic Devices and Circuits", 6th Edition, Pearson Education India, 2004.

REFERENCES :

1. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
3. M.K. Achuthan and K.N. Bhat, “Fundamentals of Semiconductor Devices”, Tata McGraw-Hill Publishing Company Limited, 2007.
4. P. R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.
5. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
6. Behzad Razavi, Design of Analog CMOS Integrated Circuits, McGraw Hill International Edition, 2001.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the characteristics of transistors.
2. Design and analyze various rectifier.
3. Knowledge about amplifier circuits.
4. Understand the fundamental concepts of MOSFETs and their applications for analog electronics circuits.
5. Understand the functioning of OP-AMP and design OP-AMP based circuits.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓						✓	✓			✓	
CO2	✓	✓	✓	✓	✓				✓			✓
CO3				✓			✓	✓		✓		
CO4	✓	✓			✓						✓	✓
CO5	✓		✓		✓		✓	✓				

CSES304	DIGITAL ELECTRONICS	L	T	P	C
		2	0	0	2

Course Objectives :

- To understand the fundamentals of semiconductor devices, transistors and amplifiers.
- To introduce the laws of Boolean algebra and solve problems in combinational logic.
- To explain sequential logic and memory circuits and systems.

UNIT - I Digital Circuits-Introduction

Digital signals - digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations - Boolean algebra - examples of IC gates - number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes - error detecting and correcting codes - characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic.

UNIT - II Standard Representation for Logic Functions

K-map representation - Simplification of logic functions using K-map - minimization of logical functions, Don't care conditions - Multiplexer, De-Multiplexer/Decoders, Adders-Subtractors- BCD arithmetic- carry look ahead adder- serial adder- ALU- elementary ALU design- popular MSI chips- digital comparator- parity checker/generator-code converters- priority encoders-decoders/drivers for display devices- Q-M method of function realization.

UNIT - III Flip Flops and Counters

A 1-bit memory, the circuit properties of Bi stable latch, the clocked SR flip flop, J-K-T and D-type flip flops- applications of flip flops- shift registers-applications of shift registers-serial to parallel converter- parallel to serial converter- ring counter- sequence generator- ripple (Asynchronous) counters-synchronous counters- counters design using flip flops-special counter IC's-asynchronous sequential counters- applications of counters.

UNIT - IV ADC and DAC Converters

Digital to analog converters: weighted resistor/converter- R-2R Ladder D/A converter- specifications for D/A converters- examples of D/A converter lCs-sample and hold circuit- analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter-counting A/D converter- dual slope A/D converter-A/D converter using voltage to frequency and voltage to time conversion- specifications of A/D converters-example of A/D converter ICs.

UNIT - V Memory Organization

Memory organization and operation-expanding memory size-classification and characteristics of memories- sequential memory- read only memory (ROM)-read and write memory(RAM)- content addressable memory (CAM)- charge de coupled device memory (CCD)- commonly used memory chips- ROM as a PLD- Programmable logic array- Programmable array logic- complex Programmable logic devices (CPLDS)-Field Programmable Gate Array (FPGA).

TEXT BOOKS :

1. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

REFERENCES :

1. Floyd, “Electron Devices”, Pearson Asia, 5th Edition, 2013.
2. Donald P Leach, Albert Paul Malvino, Goutan Saha, “Digital Principles and Applications”, 7th Edition, 2010.
3. V.K. Mehta, Rohit Mehta, “Principles of Electronics”, S.Chand Publications, 2005.
4. Digital Electronics, Rishabh Anand, Khanna Publishing House,2nd edition, 2014.
5. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
6. Rashid, “Microelectronic circuits”, Thomson Publications, 2010.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the working of logic families and logic gates.
2. Design and implement Combinational and Sequential logic circuits.
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.
4. Be able to use PLDs to implement the given logical problem.
5. Knowledge about the Memories.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓					✓		✓	✓			
CO2		✓		✓			✓			✓	✓	✓
CO3				✓				✓		✓	✓	
CO4			✓		✓		✓			✓	✓	
CO5		✓	✓		✓	✓		✓	✓			✓

CSPC305	**DATA STRUCTURES AND ALGORITHMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To impart the basic concepts of data structures and algorithms.
- To understand concepts about searching and sorting techniques.
- To understand basic concepts about stacks, queues, lists, trees and graphs.
- To enable them to write algorithms for solving problems with the help of fundamental data structures.

UNIT - I Basic Terminologies

Elementary Data Organizations - Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm - Asymptotic Notations - Time-Space trade off. Searching-Linear Search and Binary Search Techniques- their complexity analysis.

UNIT – II ADT Stack and its operations

Algorithms and their complexity analysis- Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue- Types of Queue: Simple Queue, Circular Queue, Priority Queue- Operations on each types of Queues- Algorithms and their analysis.

UNIT - III Linked Lists

Singly linked lists-Representation in memory-Algorithms of several operation-Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue- Header nodes-Doubly linked list: operations on it and algorithmic analysis-Circular Linked Lists- all operations their algorithms and the complexity analysis.

UNIT - IV Trees

Basic Tree Terminologies- Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree- Tree operations on each of the trees and their algorithms with complexity analysis- Applications of Binary Trees-B Tree, B+ Tree: definitions-algorithms and analysis.

UNIT - V Sorting and Hashing

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort- Performance and Comparison among all the methods- Hashing- Graph: Basic Terminologies and Representations- Graph search and traversal algorithms and complexity analysis.

TEXT BOOKS :

1. Ellis Horowitz, Sartaj Sahni,“Fundamentals of Data Structures”, Illustrated Edition,Computer Science Press,1983.
2. Mark Allen Weiss, “Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition, Addison-Wesley Publishing Company, 4th Edition, 2014

REFERENCES :

1. RS Salaria, “Data Structures”, Khanna Publishing House, 5th edition, 2017.
2. Yashwant Kanetkar, “Data Structures through C”, BPB Publications, 2nd edition, 2009.
3. RB Patel, “Expert Data Structures with C++”, Khanna Publications, 2nd edition, 2012.

Course Outcomes :

At the end of this course, the students will be able to

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.

3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓		✓	✓						✓
CO2			✓				✓	✓		✓		
CO3				✓	✓	✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓		✓		✓					
CO5	✓	✓		✓	✓	✓		✓		✓	✓	✓

CSPC306	**OBJECT ORIENTED PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Course Objectives:

- To get a clear understanding of object-oriented concepts.
- To understand the basics of objects and classes, Inheritance, Polymorphism.
- To know the principles of packages and interfaces.
- To define exceptions and use thread to develop applications.

UNIT – I Introduction

Traditional Versus Object Orientation Approach – Benefits and applications of OOP – Characteristics of Object Oriented Programming Languages- C++ Programming Basics: Overview–C++ Data Types–Basics of object and class in C++ – Program structure– Member Functions and Member Variable – Techniques for Creating and Initializing Objects –Data Hiding – Namespace– Identifiers– Variables – Constants– Operators– Typecasting– Control structures– Loops and Decisions.

UNIT - II Member Functions and Overloading

Constructors and their types – Destructor – Access specifiers : Private Public and Protected members. C++ Functions: Simple functions- Arguments passed by value and by reference- Overloading of functions – Constructor Overloading-Inline functions - Passing and returning of objects- friend function - Friend Classes - Static Functions - Operator Overloading: Overloading Unary Operators- Overloading Binary Operators - Data Conversion: Conversions Between Objects and Basic Types -Conversions Between Objects of Different Classes.

UNIT - III Inheritance

Concept of Inheritance –Types of Inheritance: Single –Multiple – Multilevel – Hierarchical –Hybrid – Virtual Functions: Normal Member Functions Accessed with Pointers – Virtual Member Functions Accessed with Pointers – Abstract Classes and Pure Virtual Functions – Virtual Destructors –Virtual Base Classes – THIS Pointer.

UNIT – IV OOP in Java

Characteristics of Java - The Java Environment -Java Source File -Structure – Compilation- Fundamental Programming Structures in Java -Defining classes in Java –constructors- method access specifiers - Packages - Interfaces -defining an Interface- implementing interface - differences between classes and interfaces and extending interfaces-packages.

UNIT - V Threads

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups.

TEXT BOOKS :

1. Robert Lafore, "Object -Oriented Programming in C++", Sams Publication, 4th edition, 2002.
2. Balaguruswamy. E, “Programming with Java”, Tata McGraw-Hill Publication, 5th edition, 2014.

REFERENCES :

1. Balaguruswamy.E, “Object Oriented Programming with C++”, Tata McGraw-Hill Publication,6th edition,2013.
2. R.S. Salaria, “Mastering Object-Oriented Programming with C++”, Khanna Book Publishing, N.Delhi,6th edition,2016.
3. D.Samantha,”Object Oriented Programming in C++ and Java”, PHI, 1st edition,2004.
4. Tanweer Alam, “Internet and Java Programming”, Khanna Publishing House,1st edition,2012.

Course Outcomes :

At the end of this course, the students will be able to

1. Student should be able to analyze and design a computer program based on Object Oriented Principles.
2. Students will be able to solve a real world problems based on Object Oriented Principles.
3. Gain the basic knowledge on Object Oriented concepts.
4. Ability to develop applications using Object Oriented Programming concepts.
5. Ability to implement features of object oriented programming to solve real time problems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓	✓	✓						✓		
CO2	✓	✓	✓	✓	✓		✓	✓			✓	✓
CO3					✓			✓	✓			
CO4	✓			✓	✓	✓	✓	✓				
CO5	✓		✓	✓		✓			✓		✓	✓

CSSP307	**DIGITAL ELECTRONICS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To study and experiment the characteristics of semiconductor diode and Zener diode.
- To do estimation of parameters of amplifiers, oscillators and multivibrators.
- To implement the concepts of Digital Logic design such as logic gates, flip flops, multiplexer and demultiplexer.

LIST OF EXERCISES

1. Characteristics of semiconductor diode.
2. Characteristics of Zener diode and Zener diode as a voltage regulator.
3. Estimation of ripple factor and efficiency in a full wave / Bridge rectifier with and without filter.
4. Characteristics of CE PNP and NPN transistor.
5. Frequency response of RC coupled amplifier.
6. Estimation of gain and efficiency in a class B power amplifier.
7. Measurement of frequency of the output voltage in a RC phase shift oscillator.
8. Estimation of the frequency of the output voltage of a Bistable Multivibrator.
9. Verification of Truth table of AND / OR / NOT / NAND/ NOR / XOR gates.
10. Reduction of variables using K-Map.
11. Study of multiplexer and Demultiplexer.
12. Verification of state table of RS / JK flipflop.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the basic digital circuits and to verify their operation.
2. Construct basic combinational circuits and verify their functionalities.
3. Apply Boolean laws to simplify the digital circuits.
4. Understand the working principles of semiconductor diodes.
5. Understand the working principle of multiplexer and demultiplexer.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓	✓			✓			✓	✓
CO2					✓	✓	✓				✓	
CO3		✓	✓	✓		✓	✓		✓	✓		✓
CO4		✓										
CO5		✓		✓			✓			✓		

CSCP308	**DATA STRUCTURES AND ALGORITHMS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To learn how the choice of data structures and algorithm design methods impacts the performance of programs.
- To learn object-oriented design principles and gain experience writing programs in C++.
- To study specific data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs.
- To study specific algorithm design methods such as the greedy method, divide and conquer, dynamic programming, backtracking, and branch and bound.

LIST OF EXERCISES

1. Write a program to create a Stack and perform insertion and deletion operations on it.
2. Write a program to create a List and perform operations such as insert, delete, update and reverse.
3. Write a program to create a Queue and perform operations such as insertion and deletion.
4. Write a program to Implement Linear Search Algorithm.
5. Using iteration and recursion concepts write programs for finding the element in the array using the Binary Search method.
6. Write a program and simulate various graph traversing techniques.
7. Write a program and simulate various tree traversing techniques.
8. Write a program to Implement Binary Search Tree.
9. Write a program to simulate Bubble sort, quick sort and Merge sort algorithms.

Course Outcomes :

At the end of this course, the students will be able to

1. Design and analyze the time and space efficiency of the data structure.
2. Identity the appropriate data structure for given problem.
3. Have practical knowledge on the applications of data structure.
4. Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
5. Formulate new solutions for programming problems or improve existing code using learned algorithms and data structures.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓		✓	✓		✓	✓	✓
CO2				✓	✓	✓					✓	
CO3		✓	✓	✓					✓			✓
CO4		✓					✓					
CO5	✓						✓			✓		

CSCP309	**OBJECT ORIENTED PROGRAMMING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To learn object-oriented design principles and gain experience writing programs in C++ and java.
- Ability to develop applications using Object Oriented Programming Concepts.
- Ability to implement features of Object Oriented programming to solve real world problems.

LIST OF EXERCISES

C++ PROGRAM

1. Write a C++ program to design a class having static function names showcount() which has the property of displaying the number of objects created of the class.
2. Write a C++ program to find maximum of two numbers using friend function.
3. Write a C++ program using copy constructor to copy data of an object to another object.
4. Write a C++ program to design a class representing complex numbers and having functionality of performing addition and multiplication of two complex numbers using operator overloading.
5. Write a C++ program to design a student class representing student roll no. and a teats class (derived class of student) representing the scores of the student in various subjects and sports class representing the score in sports. The sport and test class should be inherited by the result class having the functionality to add the scores and display the final result for the student.
6. Write a C++ program to maintain the records of the person with details (Name and Age) and find the eldest among them. The program must use this pointer to return the result.
7. Write a C++ program to illustrate the use of virtual function in a class.
8. Write a C++ program showing data conversion between objects of different classes.

JAVA PROGRAM

1. Simple Java Applications
    a. Understanding References to an Instant of a Class
    b. Handling Strings

2. Simple Package Creation
    a. Creating User Defined Packages
    b. Creating User Defined Packages - Array of Objects

3. Interfaces
    a. Implementing User Defined Interfaces
    b. Implementing Pre Defined Exceptions

4. Threading
    a. Creation of Threading
    b. MultiThreading

5. Exception Handling Mechanism in Java
    a. Implementing Predefined Exceptions
    b. Implementing User Defined Exceptions

Course Outcomes :

At the end of this course, the students will be able to

1. Develop solutions for a range of problems using objects and classes using C++ and Java.
2. Use the Java SDK environment to create, debug and run simple Java programs.
3. Demonstrate how to achieve reusability using inheritance, interfaces and packages.
4. Demonstrate understanding and use of different exception handling mechanisms
5. and concept of multithreading.
6. Be able to write computer programs to solve real world problems in Java and C++.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓		✓	✓		✓	✓	✓
CO2		✓			✓	✓					✓	
CO3		✓	✓			✓	✓		✓			✓
CO4		✓		✓			✓					
CO5	✓			✓					✓	✓		

CSBS401	DISCRETE MATHEMATICS	L	T	P	C
		3	0	0	3

Course Objectives :

- Discrete Mathematics is designed to study various finite structures of Mathematics which are essential to develop the various concepts of Computer Science.
- The rise of the digital computer over the second half of the twentieth century has coincided with a growth of interest in these fields.
- Discrete Mathematics has now become a major area of Mathematics in its own right.

UNIT - I Mathematical Logic

Propositions – Connectives – Tautology and contradiction – Equivalence of prepositions – Tautological Implication – Normal Forms – Theory of Inference – Rules of Inference.

UNIT - II Set Theory and Relations

Set operations – Ordered pairs and Cartesian product – Relations – Type of relations – Operations or relations – Properties of relations – Equivalence classes – Partition of set – Matrix and Graphical representation of relation.

UNIT - III Lattice and Boolean Algebra

Partial ordered set – Hasse diagram – Lattices – Properties of Lattices – Boolean Algebra – Karnaugh map method.

UNIT - IV Group and Group code

Algebraic systems – Semi groups and Monoids – Groups – Permutation Group – Subgroups – Coding Theory – Group codes – Hamming codes – Procedure for Encoding and Decoding Group codes.

UNIT - V Graph Theory

Graphs – Special simple graphs – Matrix representation of graphs – Path cycles and connectives – Eulerian and Hamiltonian graphs – Shortest path algorithms.

Text BookS :

1. Veerarajan T, “Discrete Mathematics with Graph Theory and Combinatorics”, Tata McGraw Hill Publishing Company Ltd, 2014.
2. Discrete Mathematics and Its Applications, S. K. Chakraborty and B. K. Sarkar, Oxford,2011

REFERENCES :

1. Venkataraman M K, “Discrete Mathematics”, The National Publishing Company, 2008.
2. Kolman Busby Ross, “Discrete Mathematical Structures”, Pearson Education Pvt Ltd, 2000.
3. Trembley J P and Manohar R P, “Discrete Mathematical Structures with Applications to Computer Science”, Tata McGraw Hill Publishing Company Ltd, 2005.

Course Outcomes :

At the end of this course, the students will be able to

1. Acquire the basic concepts in Mathematical Logic and theory of inferences.
2. Understand the concepts of Set theory, Relations and equivalence classes with matrix representation.
3. Familiarize Lattice theory, Boolean algebra and Group theory.
4. Design coding and encoding group codes concept.
5. Understand the basic concepts of Graph theory, Eulerian and Hamiltonian graphs .

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓		✓		✓	✓	✓	✓		✓
CO2			✓	✓	✓			✓			✓	
CO3	✓	✓		✓		✓						
CO4	✓							✓				✓
CO5		✓			✓	✓	✓			✓	✓	

CSES402	**DESIGN AND ANALYSIS OF ALGORITHMS**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

Course Objectives :

- Analyze the asymptotic performance of algorithms.
- Demonstrate a familiarity with major algorithms and data structures.
- Apply important algorithmic design paradigms and methods of analysis.
- Synthesize efficient algorithms in common engineering design situations.

UNIT – I Introduction

Characteristics of algorithm - Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-off - Analysis of recursive algorithms through recurrence relations: Substitution method - Recursion tree method and Masters' theorem.

UNIT – II Fundamental Algorithmic Strategies

Brute-Force – Greedy - Dynamic Programming- Branch- and-Bound and Backtracking methodologies for the design of algorithms - Illustrations of these techniques for Problem-Solving - Bin Packing, Knap Sack TSP. Heuristics – characteristics and their application domains.

UNIT – III Graph and Tree Algorithms

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS) - Shortest path algorithms - Transitive closure - Minimum Spanning Tree - Topological sorting, Network Flow Algorithm.

UNIT – IV Tractable and Intractable Problems

Computability of Algorithms - Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

UNIT – V Advanced Topics

Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE.

TEXT BOOKS :

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, "Introduction to Algorithms", MIT Press/McGraw-Hill, 4th Edition, 2014.
2. Gajendra Sharma, "Design & Analysis of Algorithms", Khanna Publishing House, New Delhi, 4th edition, 2016.

REFERENCES :

1. Jon Kleinberg and ÉvaTardos, Pearson, "Algorithm Design",1st Edition, 2012.
2. Michael T Goodrich and Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", Wiley, 3rd Edition, 2009.
3. S. Sridhar, "Design & Analysis of Algorithms", Oxford, 1st edition, 2014.

Course Outcomes :

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
2. Describe the greedy paradigm and explain when an algorithmic design situation calls for it.
3. Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
4. Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
5. Develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓		✓		✓			✓
CO2				✓	✓			✓				
CO3			✓					✓				
CO4	✓	✓				✓	✓				✓	✓
CO5	✓		✓							✓		

CSPC403	DATABASE MANAGEMENT SYSTEM	L	T	P	C
		3	0	0	3

Course Objectives :

- To understand the fundamentals of DBMS and E-R Diagrams.
- To impart the concepts of the Relational model and SQL.
- To disseminate the knowledge on various Normal Forms.
- To inculcate the fundamentals of transaction management and Query processing.
- To give an introduction on current trends in data base technologies.

UNIT – I Introduction

File System vs. DBMS – Views of data – Data Models – Database Languages – Database Management System Services – Overall System Architecture – Data Dictionary – Entity – Relationship (E-R) – Enhanced Entity – Relationship Model.

UNIT – II Relational Approach

Relational Model – Relational Data Structure – Relational Data Integrity – Domain Constraints – Entity Integrity – Referential Integrity – Operational Constraints – Keys – Relational Algebra – Fundamental operations – Additional Operations –Relational Calculus - Tuple Relational Calculus – Domain Relational Calculus - SQL – Basic Structure – Set operations – Aggregate Functions – Null values – Nested Sub queries – Derived Relations – Views – Modification of the database – Joined Relations – Data Definition Language – Triggers.

UNIT – III Database Design

Functional Dependencies – Pitfalls in Relational Database Design – Decomposition – Normalization using Functional Dependencies – Normalization using Multi-valued Dependencies – Normalization using Join Dependencies – Domain - Key Normal form.

UNIT – IV Query Processing and Transaction Management

Query Processing Overview – Estimation of Query Processing Cost - Join strategies – Transaction Processing – Concepts and States – Implementation of Atomicity and Durability – Concurrent Executions – Serializability – Implementation of Isolation – Testing for Serializability – Concurrency control – Lock Based Protocols – Timestamp Based Protocols.

UNIT – V Trends in Data Base Technologies

Distributed Databases - Homogeneous and Heterogeneous Databases - Distributed Data Storage - Distributed Transactions - Commit Protocols - Concurrency Control in Distributed Databases - Availability - Distributed Query Processing - Heterogeneous Distributed Databases- Cloud-Based Databases - Directory Systems.

TEXT BOOKS :

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Tata McGraw Hill, Sixth Edition, 2010.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Addision Wesley, Sixth Edition, 2010.

REFERENCES :

1. Raghu Ramakrishnan, Johannes Gehrke "Database Management Systems", McGraw Hill,Third Edition, 2002.
2. Peter Rob and Carlos Coronel, "Database Systems – Design, Implementation and Management", Thompson Learning, Course Technology, Seventh Edition, 2006.
3. C. J. Date, A.Kannan, S.Swamynathan , "An Introduction to Database Systems", Addison Wesley, 8th Edition, 2012.
4. Database Management Systems, R.P. Mahapatra & Govind Verma, Khanna Publishing House, 2013.

Course Outcomes :

At the end of this course, the students will be able to

1. Differentiate database systems from file systems by enumerating the features provided by database systems.
2. Analyze data storage problem and derive a data model using E-R Diagrams.
3. Formulate the solutions to a broad range of query and data update problems using SQL.
4. Understand the normalization theory and apply such knowledge to the normalization of a database.
5. Inculcate the various implementation techniques and current trends.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓				✓			✓
CO2		✓		✓				✓		✓		
CO3					✓		✓	✓				✓
CO4	✓	✓		✓	✓				✓	✓		✓
CO5		✓	✓		✓	✓				✓	✓	

CSPC404	**OPERATING SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To introduce students with basic concepts of operating system its function and services.
- To teach the features of operating system and the fundamental theory associated with process, memory and file management component of operating systems.
- To provide the knowledge about UNIX operating system.

UNIT - I Introduction

Concept of Operating Systems- Generations of Operating systems-Types of Operating Systems-OS Services-System Calls-Structure of an OS - Layered, Monolithic, Microkernel Operating Systems-Concept of Virtual Machine-Case study on UNIX and WINDOWS Operating System.

UNIT - II Processes and Scheduling

Definition - Process Relationship - Different states of a Process - Process State transitions, Process Control Block (PCB), Context switching-Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads-Process Scheduling-Foundation and Scheduling objectives - Types of Schedulers, Scheduling criteria-CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time-Scheduling algorithms- Pre-emptive and Non pre-emptive, FCFS, SJF, RR-Multiprocessor scheduling-Real Time scheduling-RM and EDF.

UNIT - III Inter- Process Communications

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution- The Producer Consumer Problem-Semaphores, Event Counters, Monitors, Message Passing-Classical IPC Problems- Reader's & Writer Problem, Dinning Philosopher Problem etc. Deadlocks-Definition, Necessary and sufficient conditions for Deadlock- Deadlock Prevention, Deadlock Avoidance-Banker's algorithm-Deadlock detection and Recovery.

UNIT – IV Memory Management

Basic concept-Logical and Physical address map, memory allocation-Contiguous Memory allocation –Fixed and variable partition– Internal and External fragmentation -Compaction; Paging-Principle of operation – Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging -Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT – V File and Directories

I/O Hardware - I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure:-Disk structure, Disk scheduling algorithms-File Management:-Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

TEXT BOOKS :

1. Silberschatz, Galvin, and Gagne, "Operating System Concepts",WileyIndia Pvt Ltd, 9th Edition 2013.
2. William Stallings, "Operating Systems – internals and design principles", Prentice Hall, 7thEdition, 2011.

REFERENCES :

1. Charles Crowley, "Operating System: A Design-oriented Approach", 1st Edition Irwin Publishing,1996.
2. Maurice Bach, "Design of the Unix Operating Systems", 8th Edition Prentice-Hall of India,2011.
3. Ekta Walia, "Operating Systems", Khanna Publishing House, Delhi, 2nd edition,2010.
4. Dhananjay M. Dhamdhere, "Operating Systems A Concept-Based Approach", McGraw Hill,1st edition,2008.

Course Outcomes:

At the end of this course, the students will be able to

1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.
3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.
4. Design and implement file management system.
5. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓				✓			✓
CO2				✓				✓			✓	✓
CO3					✓			✓			✓	
CO4	✓	✓			✓	✓	✓	✓	✓	✓		
CO5	✓								✓			

CSPC405	**PYTHON PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, recursion and function calls.
- To learn how to use basic data structures such as List, Dictionary and be able to manipulate text files and images.
- To understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language – Python.

UNIT - I Introduction

Elementary Programming, Selections and Loops: History of Python – Getting Started with Python – Programming Style – Writing a Simple Program – Reading Input from the Console – Identifiers – Variables, Assignment Statements, and Expressions – Simultaneous Assignments – Named Constants – Numeric Data Types and Operators – Type Conversions and Rounding–Introduction – Boolean Types, Values, and Expressions – if Statements – Two-Way if-else Statements – Nested if and Multi-Way if-elif-else Statements – Logical Operators – Conditional Expressions – Operator Precedence and Associativity – Detecting the Location of an Object Case Study: Computing Body Mass Index – The while Loop – The for Loop – Nested Loops – Keywords break and continue – Case Studies: Displaying Prime Numbers and Random Walk.

UNIT - II Python Function

Mathematical Functions, Strings and User Defined Functions: Simple and Mathematical Python Built–in Functions – Strings and Characters **–** Introduction to Objects and Methods – Formatting Numbers and Strings – Drawing Various Shapes – Drawing with Colors and Fonts – Defining a Function – Calling a Function – Functions with/without Return Values – Positional and Keyword Arguments – Passing Arguments by Reference Values – Modularizing Code – The Scope of Variables – Default Arguments – Returning Multiple Values –Function Abstraction and Stepwise Refinement – Case Study: Generating Random ASCII Characters.

UNIT - III Class and Object

Introduction to Object – Oriented Programming – Basic principles of Object – Oriented Programming in Python – Class definition, Inheritance, Composition, Operator Overloading and Object creation – Python special Unit – Python Object System – Object representation, Attribute binding, Memory Management, and Special properties of classes including properties, Slots and Private attributes.

UNIT - IV Files and Exception Handling

Files, Exception Handling and Network Programming: Introduction –Text Input and Output – File Dialogs – –Exception Handling – Raising Exceptions – Processing Exceptions Using Exception Objects – Defining Custom Exception Classes – Binary IO Using Pickling – Case Studies: Counting Each Letter in a File and Retrieving Data from the Web–Client Server Architecture–sockets – Creating and executing TCP and UDP Client Server Unit – Twisted Framework – FTP – Usenets – Newsgroup – Emails – SMTP – POP3.

UNIT - V Database and GUI

Database and GUI Programming: DBM database – SQL database – GUI Programming using Tkinter: Introduction – Getting Started with Tkinter – Processing Events – The Widget Classes – Canvas – The Geometry Managers – Displaying Images – Menus – Popup Menus – Mouse, Key Events, and Bindings – List boxes – Animations – Scrollbars – Standard Dialog Boxes–Grids.

TEXT BOOKS :

1. Mark Lutz, "Learning Python, Powerful OOPs", O'Reilly, 2011.
2. Guttag, John, "Introduction to Computation and Programming Using Python", MIT Press, 2013.

REFERENCES :

1. Jennifer Campbell, Paul Gries, Jason montajo, Greg Wilson, "Practical Programming An Introduction To Computer Science Using Python" The Pragmatic Bookshelf , 2009.
2. Wesley J Chun "Core Python Applications Programming", Prentice Hall, 2012.
3. Jeeva Jose, "Taming Python by Programming", Khanna Publishing House,1st edition,2017.
4. J.Jose, "Introduction to Computing and Problem Solving with Python", Khanna Publications,1st edition,2015.
5. Reema Thareja, "Python Programming", Pearson,1st edition,2017.

Course Outcomes :

At the end of this course, the students will be able to

1. Gain knowledge about the basic concepts of python programming.
2. Solve the basic design problems using object and classes.
3. Able to demonstrate systematic knowledge of backend and front end by developing an appropriate application.
4. Understand the principles of File operation.
5. Obtain the knowledge of DBM and SQL databases from python.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			✓		✓	✓			✓			✓
CO2			✓					✓			✓	✓
CO3		✓		✓	✓	✓		✓				
CO4	✓		✓		✓		✓		✓	✓		
CO5			✓	✓	✓			✓	✓			

CSPC406	**COMPUTER ORGANIZATION AND ARCHITECTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the basic structure and operation of digital computer.
- To study the two types of control Unit techniques and the concept of pipelining.
- To study the hierarchical memory system including cache memories and virtual memory.
- To study the different ways of communicating with I/O devices and standard I/O interfaces.

UNIT – I Introduction

Functional Units – Basic operational concepts – Bus structures – Performance and metrics – Instructions and instruction sequencing – Instruction set architecture – Addressing modes – RISC – CISC.

UNIT – II Fundamental Concepts

ALU design – Execution of a complete instruction – Multiple bus organization – Hardwired control – Micro programmed control – Nano programming.

UNIT – III Memory

Semiconductor RAM – ROM – Speed – Size and cost – Cache memories – Improving cache performance – Virtual memory – Memory management requirements – Associative memories – Secondary storage devices.

UNIT – IV I/O Devices

Accessing I/O devices – Programmed I/O – Interrupts – Direct memory access – Buses – Interface Circuits – Standard I/O interfaces (PCI, SCSI, and USB) – I/O Devices and processors.

UNIT - V Parallel Processing

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network - Data hazards – Instruction hazards – Influence on instruction sets – Data path and control considerations – Performance considerations – Exception handling.

TEXT BOOKS :

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, “Computer Organization”, McGraw-Hill, 5th edition, Reprint 2012.
2. David A. Patterson and John L. Hennessy, “Computer Architecture-A Quantitative Approach”, Elsevier, a division of reed India Private Limited, 5th edition, 2012.

REFERENCES :

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, 6th Edition, Pearson Education, 2003.
2. Hayes, J.P., “Computer Architecture and Organization”, 3rd Edition, Tata Mc-Graw Hill, 1998.
3. Ghosh T. K., “Computer Organization and Architecture”, Tata McGraw-Hill, 3rd edition, 2011.
4. Behrooz Parahami, “Computer Architecture”, Oxford University Press, 8th Impression, 2011.
5. Heuring, V.P. and Jordan, H.F., “Computer Systems Design and Architecture”, 2nd edition, Pearson Education, 2004.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the functional Units of a computer, bus organizations and addressing modes.
2. Design and analyze the pipelining concepts.
3. Knowledge about the principles Hazards.
4. Analyze RAM, ROM, Cache memory and virtual memory concepts.
5. Evaluate the various I/O interfaces.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓		✓				✓			✓
CO2	✓	✓	✓	✓			✓	✓			✓	✓
CO3		✓			✓	✓		✓				
CO4			✓		✓	✓	✓		✓	✓		✓
CO5	✓						✓	✓	✓			

CSCP407	**DATABASE MANAGEMENT SYSTEMS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To enable students to understand and use a relational database system
- To understand the role of a database management system in an organization
- To understand basic database concepts, including the structure and operation of the relational data model.
- To construct simple and moderately advanced database queries using Structured Query Language (SQL).
- To understand and successfully apply logical database design principles, including E-R diagrams and database normalization.
- To design and implement a small database project using Microsoft Access.

LIST OF EXERCISES

1. Implementation of queries for student data base.
2. Data Definition Language – with constraint and without constraint.
3. Data Manipulation language – Insert, Delete, Update, Select and truncate.
4. Transaction Control Statement – Commit, Save point, Roll back.
5. Data Control Statement – Grant, Revoke.
6. Data Projection Statement – Multi column, alias name, arithmetic operations, Distinct records, concatenation, where clause.
7. Data Selection Statement – Between, and, not in, like, relational operators and logical operators.
8. Aggregate functions – count, maximum, minimum, sum, average, order by, group by, having.
9. Joint queries – inner join, outer join, self join, Cartesian join, or cross join.
10. Sub queries – in, not in, some, any, all, exist, not exist.
11. Set operations – union, union all, intersect, minus.
12. Database objects – synonym, sequences, views and index.

13. Cursor.
14. Functions and procedures.
15. Trigger.
16. Exceptions.
17. Packages.
18. Factorial of a number.
19. Checking whether a number is prime or not.
20. Fibonacci series.

Course Outcomes :

At the end of this course, the students will be able to

1. Design and implement a database schema for a given problem-domain.
2. Populate and query a database using SQL DML/DDL commands.
3. Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.
4. Applying PL/SQL for processing database.
5. Analyze front end tools to design forms, reports and menus.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓				✓		✓	✓
CO2				✓	✓			✓				✓
CO3					✓			✓				
CO4	✓	✓			✓	✓	✓	✓	✓	✓		
CO5	✓								✓			

CSCP408	**OPERATING SYSTEMS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To understand the basic concepts such as techniques, management of operating systems.
- To understand Operating System features and its difference from structured design.
- To use the Unix as a modeling and communication utilities.
- To utilize the step of the process to produce better software .

LIST OF EXERCISES

1. Job scheduling techniques.
2. Disk scheduling techniques.
3. Memory allocation techniques.
4. Memory management techniques.
5. Page replacement techniques.
6. Producer consumer problem.
7. Bankers algorithm.

8. Dining Philosophers problem.
9. Write a shell script to perform the file operations using UNIX commands.
10. Write a shell script to perform the operations of basic UNIX utilities.
11. Write a shell script for arrange 'n' numbers using 'awk'.
12. Write a shell script to perform ^{n}Cr calculation using recursion.
13. Write a shell script to sort numbers and alphabetic from a text file using single 'awk' command.
14. Write a Shell script to display all the files which are accessed in the last 10 days and to list all the files in a directory having size less than 3 blocks, greater than 3 blocks and equal to 3 blocks.
15. Write a Shell script to display the numbers between 1 and 9999 in words.
16. Write a Shell script for Palindrome Checking.

Course Outcomes :

At the end of this course, the students will be able to

1. Choose the best CPU scheduling algorithm for a given problem instance.
2. Identify the performance of various page replacement algorithms.
3. Develop algorithm for deadlock avoidance, detection and file allocation strategies.
4. Use disk management and disk scheduling algorithms for better utilization of external memory.
5. Experiment with Unix commands and shell programming.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓				✓	✓		✓
CO2			✓	✓				✓			✓	✓
CO3		✓			✓			✓				
CO4	✓	✓			✓	✓	✓	✓	✓	✓		
CO5	✓								✓		✓	

CSCP409	**PYTHON PROGRAMMING LAB**	**L**	**T**	**P**	**C**
		0	0	3	1.5

COURSE OBJECTIVES :

- To understand and be able to use the basic programming principles such as data types, variable, conditionals, loops, array, recursion and function calls.
- To learn how to use basic mathematical problems are evaluated and be able to manipulate text files and file operations.
- To understand the process and will acquire skills necessary to effectively attempt a programming problem and implement it with a specific programming language - Python.

LIST OF EXERCISES

Write a Python program for the following:

1. To check if a Number is Positive, Negative or Zero.
2. To check prime numbers.
3. To check Armstrong Number.
4. To Solve Quadratic Equation.
5. To Transpose a Matrix.
6. To Find the Size (Resolution) of Image.
7. To Display the Multiplication Table using FOR loop.
8. To Find ASCII Value of Character.
9. To Convert Decimal to Binary, Octal and Hexadecimal.
10. To Swap Two Variables Using Function.
11. To Display Fibonacci sequence Using Recursion.
12. To Shuffle Deck of Cards.
13. To Merge Mails.
14. To Find Hash of File.
15. To Root search.
16. To Solving initial value problem using 4^{th} order Runge-Kutta method.

Course Outcomes :

At the end of this course, the students will be able to

1. Create, debug and test a software application using python programming language.
2. Understand and implement modular approach using python.
3. Develop real world applications using oops and exception handling provided by python.
4. Understand the concepts of file I/O and be able to read data from a text file using Python.
5. Plot data using appropriate Python visualization libraries.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓				✓		✓	✓
CO2				✓			✓	✓				✓
CO3					✓			✓			✓	
CO4	✓	✓			✓	✓	✓	✓	✓	✓		
CO5	✓								✓			✓

CSPC501	THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

Course objectives :

- Understand various computing models like Finite State Machine, Pushdown Automata and Turing Machine.
- Be aware of decidability and undecidability of various problems.
- Learn types of grammars.

UNIT- I Finite Automata

Introduction- Basic Mathematical Notation and techniques- Finite State systems – Basic Definitions – Finite Automaton – DFA and NDFA – Finite Automaton with €- moves –Regular Languages- Regular Expression – Equivalence of NFA and DFA – Equivalence of NDFA's with and without €-moves – Equivalence of finite Automaton and regular expressions –Minimization of DFA- - Pumping Lemma for Regular sets – Problems based on Pumping Lemma.

UNIT- II Grammars

Grammar Introduction– Types of Grammar - Context Free Grammars and Languages–Derivations and Languages – Ambiguity- Relationship between derivation and derivation trees – Simplification of CFG – Elimination of Useless symbols - Unit productions – Null productions – Greibach Normal form – Chomsky normal form – Problems related to CNF and GNF.

UNIT - III Pushdown Automata

Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL - pumping lemma for CFL – problems based on pumping Lemma.

UNIT – IV Turing Machines

Definitions of Turing machines – Models – Computable languages and functions –Techniques for Turing machine construction – Multi head and Multi tape Turing Machines - The Halting problem – Partial Solvability – Problems about Turing machine-Chomskian hierarchy of languages.

UNIT – V Unsolvable Problems and Computable Functions

Primitive recursive functions –Recursive and recursively enumerable languages – Universal Turing machine. Measuring and Classifying Complexity: Tractable and Intractable problems-Tractable and possibly intractable problems – P and NP completeness - Polynomial time reductions.

TEXT BOOKS :

1. Hopcroft J.E., Motwani R. and Ullman J.D, "Introduction to Automata Theory, Languages and Computations", Pearson Education, 2nd edition, 2008 (UNIT 1, 2, 3).
2. John C Martin, "Introduction to Languages and the Theory of Computation", Tata McGraw Hill Publishing Company, 3 rd edition, New Delhi, 2007 (UNIT 4, 5).

REFERENCES :

1. Mishra K L P and Chandrasekaran N, "Theory of Computer Science - Automata, Languages and Computation", Prentice Hall of India, 3rd edition, 2004.
2. Harry R Lewis and Christos H Papadimitriou, "Elements of the Theory of Computation", Pearson Education, 2nd edition, New Delhi, 2003.
3. Peter Linz, "An Introduction to Formal Language and Automata", Narosa Publishers, 3rd edition, New Delhi, 2002.
4. Kamala Krithivasan and Rama. R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009.

Course Outcomes:

At the end of this course, the students will be able to

1. Design Finite state Machine, Pushdown Automata.
2. The decidability or undecidability of various problems.
3. The concept of different types of grammars.
4. Knowledge about Recursive Function.
5. Understand the principle of Turing Machine.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓	✓		✓			✓	✓
CO2			✓	✓					✓	✓		✓
CO3	✓		✓			✓		✓			✓	
CO4	✓		✓	✓		✓		✓				
CO5						✓					✓	✓

CSPC502	**COMPUTER GRAPHICS AND MULTIMEDIA**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To develop, design and implement two dimensional and three dimensional graphical Structures.
- To acquire knowledge in OpenGL programming.
- To understand various aspects of multimedia.
- To learn the concept of sound, images and videos.

UNIT- I Introduction

Overview of Graphics System – Coordinate Representation – Graphics Output Primitives – Attributes of Graphics Primitives – Implementation Algorithms for Graphics Primitives – Introduction to OpenGL – OpenGL functions for Graphics Primitives.

UNIT- II 2D Concepts

2D Transformations – 2D Viewing – Window Viewport Transformation – Line, Polygon, Curve and Text Clipping Algorithms – OpenGL Functions for 2D Transformations and 2D Viewing.

UNIT- III 3D Concepts

3D Concepts: 3D Transformations – 3D Viewing – 3D Object Representations – Spline Representation – Visible Surface Detection Methods – Color Models – OpenGL Functions for 3D Transformations and 3D Viewing.

UNIT- IV Multimedia Systems Design

Multimedia Basics − Multimedia Applications − Multimedia System Architecture − Evolving Technologies for Multimedia − Defining Objects for Multimedia Systems − Multimedia Data Interface Standards − Multimedia Databases.

UNIT- V Multimedia File Handling and Hypermedia

Compression and Decompression − Data and File Format Standards − Multimedia I/O Technologies − Digital Voice and Audio − Video Image and Animation − Full Motion Video − Storage and Retrieval Technologies – Multimedia Authoring and User Interface − Hypermedia Messaging.

TEXT BOOKS :

1. Donald D. Hearn, M. Pauline Baker and Warren Carithers, “Computer Graphics with OpenGL”, Fourth Edition, Pearson Education, 2010.
2. Andleigh, P. K and Kiran Thakrar, “Multimedia Systems and Design”, PHI, 2003.

REFERENCES :

1. Francis S Hill Jr. and Stephen M Kelley, “Computer Graphics Using OpenGL”,3rd Edition, Prentice Hall, 2007.
2. Foley, Vandam, Feiner and Huges, “Computer Graphics: Principles and Practice”, 2nd Edition, Pearson Education, 2003.
3. Ralf Steinmetz and Klara Steinmetz, "Multimedia Computing, Communications and Applications", Pearson Education, 2004.
4. Judith Jeffcoate, “Multimedia in practice: Technology and Applications”, PHI, 1998.

Course Outcomes:

At the end of this course, the students will be able to

1. Design 2D and 3D graphical structures.
2. Apply 2D and 3D transformations.
3. Implement clipping techniques.
4. Create graphical structures using OpenGL.
5. Gain knowledge of multimedia systems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓		✓				✓			✓
CO2	✓	✓	✓		✓	✓						
CO3				✓	✓		✓	✓			✓	
CO4		✓		✓				✓	✓			
CO5	✓		✓	✓						✓		

CSCP503	**COMPUTER NETWORKS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives :

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks.
- (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming.
- To provide a WLAN measurement ideas.

UNIT-I Data communication Components

Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

UNIT-II Data Link Layer and Medium Access Sub Layer

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD,CDMA/CA.

UNIT-III Network Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT-IV Transport Layer and Application Layer

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

UNIT-V Services Mechanism

Attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).Finite Fields And Number Theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields-Polynomial Arithmetic –Prime numbers-Fermat's and Euler's theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

Text books:

1. Data and Computer Communication, 10th Edition, William Stallings, Pearson Prentice Hall India, 2013.
2. Cryptography and Network Security: 5th Edition, William Stallings, Principles and Practice, PHI, 2006.

References :

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw- Hill.
2. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.
3. Computer Networks, M. Dave, Cengage Learning India, 1st Edition,2012.
4. An Engineering Approach to Computer Networking, keshav,Pearson,1st Edition,2014.
5. An Integrated Approach to Computer Networks, Bhavneet Sidhu, Khanna Publications, 1st Edition,2015.
6. Telecommunication Switching System and Networks, Viswanathan, PHI, 2nd Edition.

Course Outcomes :

At the end of this course, the students will be able to

1. Explain the functions of the different layer of the OSI Protocol.
2. Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.
3. For a given requirement (small scale) of wide-area networks (WANs) local area networks (LANs) and wireless LANs (WLANs) design it based on the market available component.
4. For a given problem related TCP/IP protocol developed the network programming.
5. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP,SNMP, Bluetooth, Firewalls using open source available software and tools.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓	✓		✓	✓				✓	
CO2				✓	✓				✓	✓		
CO3		✓			✓	✓	✓	✓		✓		✓
CO4		✓	✓	✓	✓	✓					✓	
CO5	✓	✓		✓			✓	✓			✓	✓

CSPC504	**MICROPROCESSORS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To study the architecture of 8086 microprocessor and other processors.
- To learn the design aspects of I/O and memory interfacing circuits.
- To study about I/O peripheral communication and bus interfacing.
- To study the architecture of 8051 microcontroller.

UNIT-I Introduction to 8086

Microprocessor architecture – Addressing modes – Instruction set and assembler directives – Assembly language programming – Modular Programming – Linking and Relocation – Stacks – Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT-II 8086 Processese

8086 Architecture –Basic Configuration – 8086 Minimum and Maximum mode configurations – Addressing modes – Basic Instructions – System bus timing – System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure — 8086 Interrupts – Assembly levels programming – Introduction to 80186 – 80286 – 80386 – 80486 and Pentium processors.

UNIT-III 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 Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT-IV Microcontroller

Architecture of 8031/ 8051 – Special Function Registers (SFRs) – I/O Pins Ports and Circuits – Instruction set – Addressing modes – Assembly language programming -Introduction to 16 bit Microcontroller.

UNIT-V Advanced Topics

Programming 8051 Timers – Serial Port Programming – Interrupts Programming – LCD & Keyboard Interfacing – ADC, DAC & Sensor Interfacing – External Memory Interface- Stepper Motor and Waveform generation.

TEXT BOOKS :

1. Yu-Cheng Liu, Glenn A. Gibson, "Microcomputer Systems: The 8086 / 8088 Family –Architecture, Programming and Design", Prentice Hall of India, 2nd Edition, 2007.
2. Muhammed Ali Mazidi, Janice Gillispie Mazidi, RolinMcKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2nd Edition, 2011.

REFERENCES :

1. Doughlas V. Hall, "Microprocessors and Interfacing, Programming and Hardware", TMH, 2012.
2. Ramesh S. Gaonkar, "Microprocessor Architecture Programming and Applications with 8085", Penram International Publishing, 4th Edition, 2000.
3. Kenneth J. Ayala., "The 8051 Microcontroller Architecture Programming and Applications", Penram International Publishing (India), 1996.

Course Outcomes :

At the end of this course, the students will be able to

1. Develop the 8086 based assembly language programs for different applications.
2. Familiarize the architecture and instruction set of various advanced processors.
3. Acquire knowledge in interfacing the memory and I/O devices with microprocessor.
4. Design 8051 microcontroller based computing systems.
5. Knowledge about ADC and DAC.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓		✓	✓				✓		
CO2		✓						✓				✓
CO3	✓			✓	✓		✓	✓		✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓					✓
CO5		✓	✓			✓		✓	✓			

CSCP507	COMPUTER GRAPHICS AND MULTIMEDIA LAB	L	T	P	C
		0	0	3	1.5

Course Objectives :

- To develop, design and implement two dimensional and three dimensional graphical structures.
- To provide knowledge in OpenGL programming.
- To understand various aspects of multimedia and to learn the concept of sound, images and videos.

LIST OF EXERCISES

1. Implementation of Bresenham's Algorithm – Line and Circle.
2. Implementation of Bresenham's Algorithm – Ellipse.
3. Implementation of Line, Circle and Ellipse attributes.
4. Two Dimensional transformations - Translation, Rotation, Scaling, Reflection, Shear.
5. Cohen Sutherland 2D line clipping and Windowing.
6. Sutherland – Hodgeman Polygon clipping Algorithm.
7. Three dimensional transformations - Translation, Rotation, Scaling.
8. Drawing three dimensional objects and Scenes.
9. Lline DDA, chain of diamonds, chessboard.
10. Generating Fractal images.

GIMP**:**

1. Creating Logos.
2. Simple Text Animation.

Audacity:

1. Silencing,Trimming and Duplicating the Audio signal.
2. Giving the Advanced Effect to the Audio Signal.

Windows Movie Maker:

1. Applying Effect to Video.
2. Creating Titles in Video.

Swish:

1. Text Effects.
2. Pre-Loader.

Flash:

1. Changing the shape of the Object.
2. Imaging Viewing using Mask.

Photo Impact:

1. Text Effects.
2. Image Slicing.

Course Outcomes:

At the end of this course, the students will be able to

1. To understand the various computer graphics hardware and display technologies
2. 2D and 3D viewing technologies.
3. Various 2D and 3D objects transformation techniques.
4. To understand the multimedia concepts for animation.
5. Design and implement computer animation with morphing.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓		✓					✓	✓		✓
CO2	✓	✓	✓		✓	✓	✓					
CO3			✓		✓		✓	✓			✓	
CO4	✓	✓		✓		✓				✓		✓
CO5	✓	✓	✓	✓		✓	✓	✓	✓		✓	✓

CSCP508	**COMPUTER NETWORKS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course objectives :

- To understand the working principle of various communication protocols.
- To analyze the various routing algorithms.
- To know the concept of data transfer between nodes.

LIST OF EXERCISES

1. Networking Commands.
2. Implementation of Socket program for Echo.
3. Implementation of client and server for chat using TCP.
4. File transfer between client and server using TCP/IP.
5. Implementation of Remote command execution.
6. Client and Server application using UDP.
7. Implementation of Address Resolution Protocol.
8. Socket Program to download a web page.
9. Implementation of Remote method Invocation.
10. Implementation of server in C and Client in Java.

Course Outcomes :

At the end of this course, the students will be able to

1. Execute and Evaluate Network Administration Commands.
2. Demonstrate the Installation and Configuration of Network Simulator.
3. Implement the Socket programming for Client Server Architecture.
4. Analyze the Packet Contents of different Protocols.
5. Implementation of the routing Protocols..

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓								✓		✓
CO2			✓				✓	✓			✓	
CO3	✓		✓	✓	✓	✓			✓	✓		
CO4	✓	✓			✓				✓			✓
CO5	✓	✓	✓	✓				✓			✓	✓

CSCP509	**MICROPROCESSORS LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To understand the basic concept of microprocessor and its applications.
- To study the architecture of 8085 and 8086 microprocessors.
- To acquire the in-depth knowledge in assembly language programming using 8085 microprocessor.
- To familiarize with the microprocessor interfacing and its applications.

LIST OF EXERCISES

1. Study of 8085 and study of 8086 microprocessor.
2. 8-bit Arithmetic Operation.
3. 16-bit Arithmetic Operation.
4. Find the number of even and odd number in a block of data.
5. Fibonacci series.
6. Hexadecimal to binary conversion.
7. Matrix Addition.
8. Sorting an array of numbers.
9. Searching a string.
10. Digital clock.
11. Square wave generation using 8253IC.
12. Stepper motor interface using 8255IC.
13. Data transfer using USART.
14. Keyboard status.
15. Message display 8279IC.
16. Simulation of traffic light control signal.

Course Outcomes :

At the end of this course, the students will be able to

1. Write Assembly level programs using the 8085 and 8086 instruction set.
2. Write modular programs using procedures and macros.
3. Interface 8086 to 8255, Keyboard, display and stepper motors.
4. Generate waveforms using Microprocessors.
5. Simulate traffic light control signal.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓					✓		✓		✓	
CO2			✓	✓								
CO3		✓	✓		✓			✓	✓	✓	✓	✓
CO4	✓		✓	✓	✓		✓	✓			✓	✓
CO5	✓	✓			✓	✓	✓		✓			✓

CSPC601	**COMPILER DESIGN**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives :

- To understand and list the different stages in the process of compilation.
- Identify different methods of lexical analysis.
- Design top-down and bottom-up parsers.
- Identify synthesized and inherited attributes.
- Develop syntax directed translation schemes.
- Develop algorithms to generate code for a target machine.

UNIT – I Introduction to Compilers

Programming Language basics-Language processors – Analysis of the source program – Translators-Compilation and Interpretation- The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools – Applications of Compiler Technology.

UNIT – II Lexical analysis

Lexical Analysis – Role of the lexical analysis – Input Buffering – Specification of tokens- Recognition of tokens – Lexical analyzer generator- LEX- Finite Automata – Regular Expression to an NFA – Conversion of an NFA to a DFA –Optimization of DFA based pattern matchers.

UNIT – III Syntax analysis

Need and Role of the Parser – Context-Free Grammars – Writing a Grammar – Top-Down Parsing- Recursive-Descent Parsing FIRST and FOLLOW – LL(1) Grammars- Non recursive Predictive Parsing- Error Recovery in Predictive Parsing Bottom-Up Parsing – Shift-Reduce Parsing –Introduction to LR parsing – SLR Parser – Canonical LR Parser – LALR- Parser Generators- YACC.

UNIT – IV 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. Runtime environments –Storage organizations-stack allocation of space –Access to nonlocal data on the stack- Heap Management- Introduction to Garbage Collection.

UNIT-V Code Generation

Intermediate-code generation - Variants of Syntax Trees – Three-Address Code – Types and Declarations – Translation of Expressions – Type Checking – Control Flow – Back patching – Switch-Statements –Intermediate Code for Procedures. Code generation: Issues in the Design of a Code Generator The Target Language – Addresses in the target Code– Basic Blocks and Flow Graphs – Principal Sources of Optimization- Optimization of Basic Blocks – Loops in flow graphs – A Simple Code Generator –Peephole Optimization.

TEXT BOOKS :

1. Compilers: Principles, Techniques and Tools by Alfred V.Aho, Monica S. Lam,
2. RaviSethi, Jeffrey D.Ullman, Pearson Publishers,2008.
3. Allen I. Holub, "Compiler Design in C", Prentice Hall of India, 2003.
4. Bennet J.P., Introduction to Compiler Techniques, Tata McGraw-Hill, 2nd edition, 2003.

REFERENCES :

1. Henk Alblas and Albert Nymeyer,, Practice and Principles of Compiler Building with C, PHI, 2001.
2. Kenneth C. Louden, Compiler Construction: Principles and Practice, Thompson Learning, 2003.
3. Charles N. Fischer, Richard. J. LeBlanc, "Crafting a Compiler with C", Pearson Education, 2008.
4. Compilers: Principles, Techniques, and Tools by Alfred V.Aho, MonicaS. Lam, RaviSethi, JeffreyD.Ullman, Pearson Publishers,2008.

Course Outcomes :

At the end of this course, the students will be able to

1. For a given grammar specification develop the lexical analyser.
2. For a given parser specification design top down and bottom-up parsers.
3. Develop syntax directed translation schemes.
4. Develop algorithms to generate code for a target machine.
5. Develop algorithms for intermediate code.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓		✓				✓	✓		
CO2		✓			✓		✓				✓	✓
CO3					✓	✓		✓				✓
CO4		✓		✓			✓			✓	✓	
CO5		✓		✓			✓				✓	

CSPC602	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives :

- To understand the phases of development of a Software Project.
- To understand the major considerations for enterprise integration and deployment concepts of requirements engineering and Analysis Modeling.
- To learn various testing, maintenance measures and risk management methods.
- To learn the Software quality management and configuration management concepts.

UNIT- I Introduction to Software Process

The Software process- A Generic Process Model- Perspective Process Models-Specialized Process Models- The Unified Process-Personal and team process models-Agile Development-Extreme Programming (XP)- Requirements Engineering-Requirements Analysis-Establishing the Groundwork- Eliciting Requirements-Developing Use Cases- Negotiating Requirements- Validating Requirements-Requirements Analysis-Scenario-Based Modeling.

UNIT- II Design Concepts

The Design Process-Design Concepts-The Design Model- Architectural Design-Assessing Alternative Architectural Designs- Architectural Mapping Using Data Flow-Component-level design-Designing Class-Based Components-Conducting Component-Level Design-User Interface design-User Interface Analysis and Design-Interface Analysis-Pattern based Design- WebApp design-WebApp Design Quality-WebApp Interface design.

UNIT- III Quality Management

Software Quality- The Software Quality Dilemma- Achieving Software Quality-Review techniques-Cost Impact of Software Defects-Defect Amplification and Removal-Review Metrics and Their Use-Informal Reviews-Formal Technical Reviews-Software Quality Assurance- Test Strategies for Conventional Software-Test Strategies for Object-Oriented Software-SQA Tasks, Goals, and Metrics-Statistical Software Quality Assurance-A Strategic Approach to Software Testing-System Testing-The Art of Debugging.

UNIT- IV Configuration Management

The SCM Repository-The SCM Process-Configuration Management for Web Apps-A Framework for Product Metrics-Metrics for the Requirements Model-Metrics for the Design Model- Project Management concepts- The management spectrum-People-The Product- The Process-Metrics in the Process and Project Domains.

UNIT- V Software Project Estimation

Decomposition Techniques-Empirical Estimation Models-The Make/Buy Decision-Project Scheduling-Defining a Task Set for the Software Project-Defining a Task Network-Reactive versus Proactive Risk Strategies-Risk Identification-Risk Projection-Risk Refinement-The RMMM Plan-Business Process Reengineering-Software Reengineering-Reverse Engineering-Restructuring-Forward Engineering-The SPI Process-The CMMI-The People CMM-SPI Return on Investment-SPI Trends.

TEXT BOOKS :

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010.
2. Software Engineering, K.K. Aggarwal & Yogesh Singh, New Age International,2nd edition,2006.

REFERENCES :

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011.
2. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009.
3. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
4. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.
5. Stephen R.Schach, "Software Engineering", Tata McGraw-Hill Publishing Company Limited, 2007.

Course Outcomes :

At the end of this course, the students will be able to

1. Comprehend the basic elements of Software Project Models.
2. Visualize the significance of the different kind of Software Testing methods.
3. Explore the various Management methods in Software Development Projects.
4. Analyze the strategies in Software Designing.
5. Knowledge about Risk Management in Software Engineering.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓	✓	✓	✓			✓	✓			
CO2		✓			✓	✓	✓				✓	✓
CO3	✓			✓		✓		✓		✓		
CO4			✓	✓		✓					✓	✓
CO5		✓	✓		✓			✓		✓		

CSCP607	**COMPILER DESIGN LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To make the students experiment on the basic techniques of compiler construction and tool.
- To perform syntax-directed translation of a high-level programming language into an executable code.
- To design and implement language processors in C by using tools to automate parts of the implementation process.
- To provide deeper insights into the more advanced semantics aspects of programming languages, code generation, machine independent optimizations, dynamic memory allocation, and object orientation.

LIST OF EXERCISES

1. Implementation of Lexical Analyser for IF Statement.
2. Implementation of Lexical Analyser for Arithmetic Expression.
3. Construction of NFA from Regular Expression.
4. Construction of DFA from NFA.
5. Implementation of Shift Reduce Parsing Algorithm.
6. Implementation of Operator Precedence Parser.
7. Implementation of Recursive descent Parser.
8. Implementation of Code Optimization Techniques.
9. Implementation of Code Generator.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the Lexical Analyzer Operation.
2. Implementation of language Recognizer.
3. Implementation of Various Parsers.
4. Implementation of Code Optimization.
5. Construction Symbol tables.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓								✓	✓		
CO2		✓	✓	✓	✓	✓		✓			✓	✓
CO3		✓			✓		✓	✓		✓		
CO4		✓	✓	✓			✓	✓	✓		✓	
CO5	✓		✓	✓	✓		✓					✓

CSCP608	**SOFTWARE ENGINEERING LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To provide the students with simple experiments to understand the basic aspects about the behavior of the testing techniques to detect the errors in the software.
- To understand standard principles to check the occurrence of defects and its removal.
- To learn the functionality of automated testing tool.

LIST OF EXERCISES

1. Write a C program for matrix multiplication to understand the causes of failures.
2. Write a C program for Binary Search - Path Testing.
3. Write a C program to derive test cases based on boundary value analysis
4. Write a C program for cause effect graph to check whether defect is found in the program.
5. Write a C program to perform data flow testing for the given code and find out all d-use Pairs.
6. Write a C program to demonstrate the working of the looping constructs.
7. Write and test a program to count number of check boxes on the page checked and
8. unchecked count using selenium tool.
9. Write and test a program to provide total number of objects available on the page using selenium tool.
10. Write and test a program to login a specific web page using selenium tool.
11. Write and test a program to select the number of students who have scored more than 60 in any one subject (or all subjects).
12. Write a Java script to develop a web page which calculates the GCD of 2 numbers using Selenium tool.
13. Write and test a program to update 10 student records into table into Excel file using selenium tool.

Course Outcomes :

At the end of this course, the students will be able to

1. Investigate the Reasons for Bugs and Analyze the principles in Software Testing.
2. Implement various Test Processes for Quality Improvement.
3. Design Test Planning.
4. Apply the Software Testing Techniques in Commercial Environment.
5. Manage the Test Processes and Track the Progress of a Project.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓			✓		✓	✓		
CO2		✓	✓			✓					✓	✓
CO3		✓		✓	✓							✓
CO4		✓	✓	✓	✓		✓	✓	✓		✓	
CO5						✓		✓		✓		

ETHS701	ENGINEERING ETHICS	L	T	P	C
		2	0	0	2

Course Objectives:

- To provide basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues.
- To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards, Exposure to Safety and Risk, Risk Benefit Analysis.
- To have an idea about the Collegiality and Loyalty, Collective Bargaining, Confidentiality, Occupational Crime, Professional, Employee, Intellectual Property Rights.
- To have an adequate knowledge about MNC's, Business, Environmental, Computer Ethics, Honesty, Moral Leadership, sample Code of Conduct.

UNIT-I Introduction

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories.

UNIT-II Challenges

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study.

UNIT – III Risk Analysis

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl Case Studies and Bhopal.

UNIT – IV Loyalty

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

UNIT – V Business Ethics

Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TEXT BOOKS:

1. Govindarajan M, Natarajan S and Senthilkumar V S, "Professional Ethics and Human values", PHI Learning, New Delhi, 2013.
2. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 2005.

REFERENCES :

1. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, 2000.
2. Charles D Fleddermann, "Engineering Ethics", Prentice Hall, New Mexico, 1999. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, 2003.
3. Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, 2001.
4. David Ermann and Michele S Shauf, "Computers, Ethics and Society", Oxford University Press, 2003.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the relationship between the engineer and the society.
2. Learn the importance of codes in engineering practice.
3. Acquire knowledge on the legal, moral and ethical aspects in engineering.
4. Understand the Risk analysis in Ethics.
5. Knowledge about Collegiality and Loyalty

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓			✓		✓			
CO2						✓					✓	✓
CO3	✓	✓	✓		✓			✓		✓		
CO4			✓	✓		✓			✓			✓
CO5	✓	✓								✓	✓	

CSPC702	**EMBEDDED SYSTEMS AND INTERNET OF THINGS(IOT)**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives:

- To familiarize the students about the trends and challenges of Embedded System.
- To impart the knowledge in RTOS and scheduling algorithms.
- To understand the concepts of Internet of Things.
- To introduce network and communication protocols of IoT.
- To introduce Internet of Everything and its benefits.

UNIT – I Introduction to Embedded Sytems

Introduction, Applications of embedded system, Features and Attributes of Embedded System, Challenges in Embedded System, Selection of Processors, Recent trends in embedded system, Embedded Firmware design approaches and development languages, embedded development life cycle.

UNIT – II Real Time Operating Systems

Prime Movers: Real time without RTOS, Task states, Task table and data– Multitasking operating systems–Context switches–Kernels–Task swapping methods–Scheduler algorithms –Inter process communication mechanism-memory communication, Message passing, Signals.

Overview of ARM Architecture, Programmer's model and Development Tools.

UNIT – III Introduction to IoT

Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software defined Network (SDN).

UNIT - IV Network and Communication Aspect

Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination. Applications of IoT: Home automation, Industry applications, Surveillance applications, Other IoT applications.

UNIT - V Rasperry PI with Python and Arduino

Building IOT with RASBERRY PI- IoT Systems - Logical Design using Python – IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi - Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms – Arduino - Evolution of IOE and its benefits.

TEXT BOOKS :

1. Marilyn Wolf, "Computers as Components-Principles of Embedded Computing System Design", Morgan Kaufmann Publishers, 3rd edition, 2012.
2. **V**ijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach" Orient Blackswan Pvt. Ltd., New Delhi, 2015.

REFERENCES :

1. Shibu K.V, "Introduction to Embedded System", Tata McGraw-Hill, 2009.
2. David E. Simon, "An Embedded Software Primer", Pearson Education Asia, Addison Wesley, 2001.
3. Rajkamal, "Embedded Systems", Architecture, Programming and Design", Tata McGraw Hill, 2003.
4. Steve Heath, "Embedded Systems Design", Newnes /An imprint of Elsevier, 2nd edition,2005.
5. Internet of Things, Jeeva Jose, (ISBN: 978-93-86173-591) KBP House,1st edition,2018.

Course Outcomes :

At the end of this course, the students will be able to

1. Recognize the key features of embedded systems in terms of computer hardware and be able to discuss their functions.
2. Know the extra-functional that are imposed on embedded systems.
3. Identify the key factors affecting the evolution of computing hardware.
4. Understand the concepts of IoT and IoE.
5. Analyze basic protocols in wireless sensor network.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓						✓	✓	✓			✓
CO2			✓	✓	✓	✓					✓	
CO3	✓	✓	✓	✓	✓			✓	✓	✓		
CO4		✓					✓					
CO5	✓		✓	✓	✓	✓		✓			✓	✓

CSCP706	**EMBEDDED SYSTEM AND INTERNET OF THINGS (IoT) LAB**	**L**	**T**	**P**	**C**
		0	**0**	**3**	**1.5**

Course Objectives :

- To understand the working principle of Embedded System.
- To make use various sensors in IoT.
- To know how to use various tools in IoT for designing applications.

LIST OF EXERCISES

Embedded System

1. Alphanumeric LCD interface using 8051.
2. Study of ARM evaluation system.
3. Flashing of LEDs using ARM (LPC2148).
4. Interfacing keyboard and LCD using ARM (LPC2148).
5. Temperature sensor interface using ARM (LPC2148).

IoT

1. Distance Measurement.
2. Identifying Moisture content in Agricultural Land.
3. Fire Alarm Indicator.
4. Basic Home Automation.
5. Identifying Room Temperature.
6. How to Control PWM Signals.
7. Designing a Calculator using NumPi.
8. Designing Game using PyGame.

9. Designing frontend GUI using TKinter.
10. Identification of Earthquake.
11. Implementation of sorting mechanism.
12. Accessing GPIO using Google Assistance.
13. How to create a video player.
14. Uploading data to cloud and monitoring in cloud.
15. Connecting social media (twitter).

Course Outcomes:

At the end of this course, the students will be able to

1. Comprehend the basic elements of Microcontroller and their Programming.
2. Knowledge of Various Sensors.
3. Knowledge of Raspberry Pi3 in Peripheral and in Trouble shooting.
4. Evaluate networking technologies for application within IoT.
5. Identify the Kits required for solving the Real World Problem and to write the Code.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓				✓		✓		✓	
CO2						✓			✓			
CO3			✓		✓		✓		✓	✓		✓
CO4		✓		✓	✓			✓			✓	✓
CO5		✓	✓	✓			✓	✓		✓		

CSST707	**INDUSTRIAL TRAINING/RURAL INTERNSHIP/ INNOVATION/ENTREPRENEURSHIP**	**L**	**TR**	**S**	**C**
		0	1	2	4

Note: * - Four weeks during the summer vacation before the end of sixth semester

COURSE OBJECTIVES :

- To work/train on a technical topic/field work related to Computer Science and Engineering to acquire the ability of written/oral presentation and to have a practical knowledge in carrying out the Computer Science and Engineering related problems.
- To acquire the ability of writing technical papers for Conferences.
- To train and develop skills in solving problems during execution of the problems related to Computer Science and Engineering.

The students will work for two periods per week guided by student counsellor. They will be asked to present a seminar of not less than 15 minutes and not

more than 30 minutes on any technical topic of student's choice related to Computer Science and Engineering and to engage in discussion with audience. They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the student counsellor based on the technical presentation, the report and also on the interaction shown during the seminar.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of sixth semester) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the seventh semester. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES :

At the end of this course, the students will be able to

1. Face the audience and to interact during group discussion in the corporate interviews confidently.
2. To acquire the ability to work in the actual environment and to use the technical resources.
3. Apply prior acquired knowledge in problem solving and to demonstrate the use, interpretation and application of an appropriate international Computer Science and Engineering standard in a specific situation.
4. Analyze a given Computer Science and Engineering problem and to identify and implement appropriate problem solving methodology to propose a meaningful solution.
5. Present the solution acquired in the form of written and oral presentation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓		✓	✓	✓		✓	✓		
CO2		✓		✓		✓		✓			✓	
CO3	✓		✓	✓	✓		✓	✓			✓	✓
CO4	✓	✓		✓		✓	✓			✓		
CO5			✓		✓	✓		✓	✓			✓

CSPV803	**PROJECT WORK AND VIVA VOCE**	**L**	**PR**	**S**	**C**
		0	**10**	**2**	**6**

Course objectives :

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

Course outcomes :

At the end of this course, the students will be able to

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Carry out any experiment based on Computer software and Hardware available.
3. Present the conclusions with understandability using appropriate tables and graph in the form of report.
4. Analyses any short coming while implementing a technical problem and to handle the same.
5. Implement any research problem in current thrust area using the gained practice knowledge.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓						✓		✓			
CO2		✓		✓		✓		✓			✓	✓
CO3					✓				✓			
CO4		✓	✓	✓	✓					✓		
CO5		✓	✓	✓			✓	✓			✓	✓

PE – PROFESSIONAL ELECTIVES

CSPESCN	**PERL PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the basic Perl language features.
- To understand Perl language as a tool for convenient text, data storage and file processing.
- Execute programs from Perl environment and process their result.

UNIT - I An overview of Perl

Getting started, Scalar data – Numbers – Strings – Built-in warnings - Operators – Variables – Output with print – Control structures – Getting user input – More control structures.

UNIT - II Lists and Hashes

Introduction to lists, Simple lists, Complex lists, Accessing list values, List slices, Ranges, Combining ranges and Slices. Arrays – Accessing single and Multiple elements from an array – Interpolating Arrays into Strings – For Control Structure – Array functions (pop, push, shift, unshift, and sort) – Array manipulations; Introduction to Hashes – Hash element access – Hash functions – Typical use of hash.

UNIT - III Files and Data

Input from standard input – Diamond operator – Invocation Arguments – Standard Output – Formatted Output using printf – File Handles – Opening a file handle – Fatal errors – Using file handle – Reopening a standard file handle – Output with say – File handles in a scalar**.**

UNIT - IV Subroutines and Unit

Introduction to subroutines – Defining – Invoking – Return Values – Arguments – Private variables – Variable length parameter list – Lexical variables – Use strict pragma – Return operator – Non-scalar return values – Perl Unit – Finding and Installing Unit – Using simple Unit- CGI.

UNIT - V Regular Expressions

Introduction to regular expressions- Simple patterns – Character classes – Matching with regular expression – Processing text with regular expression – Substitutions – Split operator – Join function.

TEXT BOOKS :

1. Stephen Spainhour, Ellen Siever, Nathan Patwardhan," Perl in a Nutshell", O'Reilly Media Publications,1998.
2. Simon Cozens, Peter Wain Wrigth, "Beginning Perl", Wrox press, 1st edition, 2000.

REFERENCES :

1. Tom Christiansen, Brian D Foy, Larry Wall, Jon Orwant, "Programming Perl", O'Reilly Media, 4th Edition, 2012.
2. Randal L. Schwartz, Brian D Foy, Tom Phoenix, "Learning Perl", O'Reilly Media, 6th Edition, 2011.
3. Ellie Quigley, "Perl by Example", Prentice Hall, 5th Edition, 2014.

Course Outcomes:

At the end of this course, the students will be able to

1. Ability to apply prerequisite basic programming concepts to Perl.
2. Write, compile, and run Perl programs, analyze the effects of using Perl structures that implement decisions, loops, and store arrays and use these structures in a well-designed, OOP program.
3. Create Perl programs that make use of various directories and use several files linked together.
4. Understand the concepts of Subroutines.
5. Knowledge about the Files.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓	✓			✓
CO2	✓		✓	✓	✓	✓		✓		✓	✓	
CO3		✓						✓				
CO4	✓			✓	✓	✓	✓					
CO5								✓				✓

CSPESCN	VISUAL PROGRAMMING	L	T	P	C
		3	0	0	3

Course Objectives :

- To get an introduction about .NET concepts.
- To enable the students to develop applications in VB.NET.
- To know about the implementation of object oriented concepts using VB.NET.
- To understand some advanced concepts in .NET technologies.

UNIT - I Visual Basic Fundamentals

Basic .NET Concepts- Exploring the Development Environment- Creating a Visual Basic .NET Project- Event-driven programming- classes- objects- properties- methods- events- Message Box function- multiple forms.

UNIT – II Programming with .NET

Introduction to Data Types- Using Variables- Variable Scope- Converting Data Types- Creating and Using Structures- Storing Data in Arrays- Conditional Expressions- Using Decision Structures- Using Conditional Loop Structures- Restricting User Input- Validating Field Data- Validating Form Data- Built-In Functions- Mathematical and String Functions- User Defined Functions and Procedures.

UNIT – III Programming with Controls

Properties, Events and Methods of Form, Label, Textbox, List Box, Combo Box, Radio Button, Button, Check Box, Progress Bar, Date Time Picker, Calendar, Picture Box, Scrollbar, VScrollBar, Group Box, Tooltip, Timer. Creating MDI Parent and Child.

UNIT – IV Object Orientation with .Net

Understanding Classes- Working with Classes- Using Shared Members- Inheritance- Polymorphism- Namespaces- Types of Errors- Using the Debugger- Handling Exceptions- Creating Menus- Creating Status Bars- Creating Toolbars.

UNIT – V Advance Concepts

Working with Web Forms- Using XML Web Service- Database Concepts- Overview of ADO.NET- Working with Data- Introduction to Deployment- Deploying a Windows-based Application.

TEXT BOOKS :

1. Steven Holzner, “Visual Basic.Net Black Book”, Dreamtech Press, 2009.
2. Jeffery R. Shapiro, “The Complete Reference Visual Basic .NET”, Tata McGraw Hills, 2009.

REFERENCES :

1. Anne Prince, “Murach’s Beginning Visual basic .Net”, Mike Murach & Associates, Incorporated, 2002.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand .NET Framework and describe some of the major enhancements to the new version of Visual Basic.
2. Describe the basic structure of a Visual Basic.NET project and use main features of the integrated development environment (IDE).
3. Create applications using Microsoft Windows Forms.
4. Understand the concepts of XML.
5. Knowledge about the classes.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓		✓	✓		✓	✓		✓
CO2	✓		✓		✓			✓			✓	
CO3		✓		✓		✓				✓		
CO4	✓	✓	✓				✓		✓			✓
CO5				✓		✓		✓		✓		✓

CSPESCN	**WEB TECHNOLOGY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the concept of static web designing using HTML.
- To understand the concept of dynamic web designing using Java Script and XML.
- To understand the concept of server-side web designing using PHP.
- To develop the different technologies used in the World Wide Web including XML, Perl, Rails and PHP.

UNIT - I XHTML

Evolution of HTML and XHTML- Standard XHTML Document Structure- Basic Text Markup- Images-Hypertext Links-Lists- Tables- Forms- Frames. Cascading Style Sheets Introduction to CSS – Levels of Style Sheets- Style Specification Formats- Selector Forms- Property Value Forms – Font Properties- List Properties – Color- Alignment of Text – Background Images- Span and Div Tags.

UNIT – II Introduction to SGML

Features of XML - XML as a subset of SGML – XML Vs HTML – Views of an XML document - Syntax of XML- XML Document Structure – Namespaces- XML Schemas- simple XML documents – Different forms of markup that can occur in XML documents - Document Type declarations – Creating XML DTDs – Displaying XML Data in HTML browser – Converting XML to HTML with XSL minimalist XSL style sheets – XML applications.

UNIT - III Overview of PERL

Origin and Use of Perl- Scalars and their Operations – Assignment Statements and Simple Input and Output – Control Statements- Fundamentals of Arrays – Hashes References- Functions- Pattern Matching – File Input and Output – Simple programs in Perl -Using Perl for CGI Programming.

UNIT - IV Overiew of PHP

Origin and Use of PHP - PHP- General Syntactic Characteristics Operations and Expressions- Control Statements- Arrays- Functions-Pattern Matching- Form Handling- Files-Cookies-Session Tracking - Database Connectivity, Simple programs in PHP and MySQL.

UNIT - V RAILS

Overview of Rails- Document Requests- Processing Forms- Rails Application with Databases – Layouts -AJAX - Ajax Overview of Ajax – Basics of Ajax – Rails with Ajax.

TEXT BOOKS :

1. Deitel & Deitel, Nieto, Lin, Sadhu, XML How to Program, Pearson Education, New Delhi, 2016.
2. Kogent Learning Solutions Inc, Web Technologies Black Book, Dreamtech Press, New Delhi, 2013.

REFERENCES :

1. Chris Bates, Web Programming Building Internet Applications 3rd ed., Wiley India Edition, New Delhi, 2012.
2. Bankim Patel, Lal Bihari Barik, Introduction to Web Technology & Internet, Acme Learning Private Limited, New Delhi, 2015.
3. Pankaj Sharma, Introduction to Web Technology, Katson Books, New Delhi, 2014.
4. Phil Ballard, Michael Moncur, Sams Teach Yourself Ajax, JavaScript and PHP, Pearson Education,New Delhi, 2012.
5. Achyut S Godbole, Atul Kahate, Web Technologies TCP/IP Architecture and Java Programming, 2nd ed., Tata McGraw Hill Education Private Limited, New Delhi, 2015.

Course Outcomes :

At the end of this course, the students will be able to

1. Develop web pages using basic HTML.
2. Apply XML techniques in web design.
3. Implement CGI using Perl.
4. Implement PHP & MySQL database connectivity for real world applications.
5. Use AJAX with Rails.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓		✓	✓			✓	✓	✓	✓	
CO2		✓	✓				✓	✓			✓	
CO3			✓	✓	✓				✓			
CO4		✓				✓	✓	✓		✓		✓
CO5		✓	✓	✓	✓			✓				✓

CSPESCN	REAL TIME SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the fundamental problems, concepts, and approaches in the design and analysis of real-time systems.
- To emphasize the issues related to the design and analysis of systems with real-time constraints.
- To study the real time applications and their functional semantics.
- To provide a comprehensive idea about time management, language and tool support, real time operating systems, scheduling and communication, and related fault tolerance issues.

UNIT - I Introduction

Issues in Real-Time computing - structure of a Real-time system - task classes - Characterization of Real-Time systems and tasks - performance measures of real-time systems - Estimation of Program Run Times - Real-Time Specification and Design Techniques - Real Time Applications : Digital control systems, High level control systems, Signal processing and Multimedia applications.

UNIT – II Task Assignment and Scheduling

Classical Uniprocessor scheduling Algorithms - Clock-driven approach, weighted round robin approach, Priority driven approach, dynamic versus static systems, Effective release times and deadlines, Optimality of EDF and LST algorithms, Challenges in validating timing constraints in priority driven systems, Offline versus online scheduling. Task Assignment - Mode Changes - Fault Tolerant Scheduling.

UNIT – III Real-Time Communication

Network topologies - Protocols - Real-Time Databases: Introduction - Real Time vs. General Purpose Database - Main memory Databases - Transaction Priorities and Aborts - Concurrency control issues, Disk Scheduling Algorithms, Two-phase approach to improve predictability, serialization consistency, Databases for Hard Real-Time systems - Fault Tolerance Techniques - Fault Types, Fault Detection - Fault Error containment Redundancy, Data Diversity, Reversal Checks, Integrated Failure handling.

UNIT – IV Real-time Memory Management

Process Stack Management - Dynamic Allocation - Resources and Resource Access Control : Assumptions on resources and their usage, effects of resource contention and resource access control - basic priority-inheritance protocol, basic priority-ceiling protocol – Real-time Kernels: Polled loop Systems - Phase/State - Driven Code - Co-routines - Interrupt Driven Systems - Foreground/ Background Systems - Capabilities of commercial real - time operating systems, Predictability of general-purpose operating systems – Full - Featured Real-time Operating Systems.

UNIT – V Programming Languages and Tools

Desired language characteristics, Data typing, control structures, Facilitating hierarchical decomposition, packages, Run-Time error (exception) handling, overloading and generics - Multitasking, Low-level programming, Task scheduling - Timing specifications, Run-time-support Programming environments.

TEXT BOOKS :

1. C.M.Krishna and Kang G. Shin, "Real-Time Systems", Tata McGraw Hill, 2010.
2. Philip.A.Laplante, "Real Time Systems Design and Analysis", 3rd edition, Wiley-IEEE Press, 2004.

REFERENCES :

1. Jane W.Liu, "Real-Time Systems", Pearson Education, 2001.
2. Alan Burns Andy Wellings, "Real Time systems and their programming languages", 4th edition, Addison Wesley, 2009.
3. C.Sivamurthy and G.Manimaran, "Resource Management in Real-time Systems and Networks", Prentice Hall of India, 2005.
4. Rajib Mall, "Real-Time Systems: Theory and Practice," Pearson, 2008.
5. Alan C. Shaw, "Real-Time Systems and Software", Wiley, 2001.

Course Outcomes :

At the end of this course, the students will be able to

1. Apply formal software engineering methods and practices to the design, analysis and development of several small real-time systems.
2. Characterize various real-time approaches for reliability and fault tolerance issues.
3. Acquire the basic programming skills in the development of real-time computing systems.
4. Understand the general purpose and full featured real-time operating systems.
5. Characteristics of Memory Management.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓	✓		✓	✓		✓		✓	
CO2			✓		✓	✓						✓
CO3	✓	✓		✓	✓		✓	✓		✓		
CO4	✓	✓		✓				✓			✓	
CO5	✓								✓			✓

CSPESCN	MOBILE APP DEVELOPMENT	L	T	P	C
		3	0	0	3

Course Objectives:

- To demonstrate the understanding of the fundamentals of Android operating systems.
- To demonstrate the skills of using Android software development tools.
- To demonstrate the ability to develop software with reasonable complexity on mobile platform.
- To demonstrate the ability to debug programs running on mobile devices.

UNIT – I Android

An Open Platform for Mobile Development - Native Android Applications - Android SDK features - Understanding the Android Software Stack - The Dalvik Virtual Machine - Android Application Architecture - Android Libraries - Creating the Android Application - Types of Android Applications - Android Development Tools - Externalizing the Resources - The Android Application Lifecycle.

UNIT – II Building User Interface

Fundamental Android UI design - Android User Interface fundamentals - Layouts - Linear - Relative - Grid Layouts - Fragments - Creating new fragments - The Fragments Lifecycle -Introducing the Fragment Manager - Adding Fragments to Activities - Interfacing between Fragments and Activities.

UNIT – III Intents And Broadcasts Receivers

Introducing Intents - Using intents to launch Activities - Introducing Linkify - Using Intents to Broadcast Events - Introducing the Local Broadcast Manager - Introducing pending intents - Using Intent filters to service implicit Intents - Using Intent Filters for Plugins and extensibility - Listening for Native Broadcast Intents - Monitoring Device State Changes Using Broadcast Intents.

UNIT – IV Files , Saving State And Preferences

Saving Simple Application Data - creating and Saving Shared Preferences - Retrieving Shared Preferences – Introducing the Preference Framework and the Preference Activity – Working with the File System – Introducing Android Databases - Introducing SQLite – Content Values and Cursors – Working with SQLite Databases - Creating Content Providers, Using Content Providers.

UNIT – V Advanced Topics

Alarms - Creating and using alarms - Using Location Based Services – Using the Emulator with Location-Based Services - Finding the Current Location – Using the Geocoder - Creating Map-Based Activities.

TEXT BOOKS :

1. Reto Meier, “Professional Android 4 Application Development”, John Wiley & Sons, Inc, India, (Wrox), 4th edition, 2012.
2. Android Application Development for Java Programmers, James C Sheusi, Course Technology Cengage Learning, 1st edition, 2013.

REFERENCES :

1. Wei-Meng Lee, "Beginning Android 4 Application Development", Wiley India (Wrox), 2013.
2. Wei – Meng Lee," Beginning Android Application Development", Wiley, 2011.
3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", Dream Tech., 2012.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the existing state of mobile app development via researching existing apps, meeting with industry professionals, and formulating new ideas.
2. Display proficiency in coding on a mobile programming platform.
3. Understand the limitations and features of developing for mobile devices.
4. Create a complete Mobile app with a significant programming component, involving the sensors and hardware features of the phone.
5. Understand the economics and features of the app marketplace by offering the app for download.

1. Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓						✓		✓	✓	✓	✓
CO2		✓			✓			✓				
CO3			✓			✓						
CO4				✓			✓		✓	✓		✓
CO5								✓			✓	✓

CSPESCN	**DISTRIBUTED SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand the foundations of Distributed System.
- To introduce the idea of peer to peer services and file system.
- To understand the components and support required for distributed system.
- To understand the remote method invocation and objects.
- To understand the design process and resource management systems.

UNIT - I Introduction

Examples of Distributed System – Trends in Distributed System – Focus on resource sharing – Challenges – Case study: World Wide Web – System Model – Physical models – Architectural models – Fundamental models.

UNIT - II System Model

Inter process Communication – the API for internet protocols – External data representation and Multicast communication. Network virtualization: Overlay networks. Case study: MPI Remote Method Invocation and Objects: Remote Invocation – Introduction – Request – reply protocols - Remote procedure call – Remote method invocation. Case study: Java RMI – Group communication – Publish – subscribe systems – Message queues – Shared memory approaches – Distributed objects – Case study: Enterprise Java Beans – from objects to components.

UNIT - III Peer to peer Systems

Introduction – Napster and its legacy – Peer to peer – Middleware –Routing overlays. Overlay case studies: Pastry, Tapestry – Distributed File Systems – Introduction – File service architecture – Andrew File system. File System: Features - File model – File accessing models – File sharing semantics naming: Identifiers, Addresses, Name Resolution – Name Space Implementation – Name Caches – LDAP.

UNIT – IV Clocks, events and process states

Synchronizing physical clocks – Logical time and logical clocks – Global states – Coordination and Agreement – Introduction – Distributed mutual exclusion – Elections Transactions and Concurrency Control – Transactions – Nested transactions – Locks – Optimistic concurrency control – Timestamp ordering – Atomic Commit protocols - Distributed deadlocks – Replication – Case study – Coda.

UNIT – V Process Management

Process Migration: Features, Mechanism – Threads: Models, Issues, Implementation. Resource Management: Introduction – Features of Scheduling Algorithms – Task Assignment Approach – Load Balancing Approach – Load Sharing Approach.

TEXT BOOKS :

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, 5th Edition, Pearson Education, 2012.
2. Pradeep K Sinha, “Distributed Operating Systems: Concepts and Design”, Prentice Hall of India, 2007.

REFERENCES :

1. Tanenbaum A.S., Van Steen M., “Distributed Systems: Principles and Paradigms”, Pearson Education, 2007.
2. Liu M.L., “Distributed Computing, Principles and Applications”, Pearson Education, 2004.
3. Nancy A Lynch, “Distributed Algorithms”, Morgan Kaufman Publishers, USA, 2003.

Course Outcomes :

At the end of this course, the students will be able to

1. Acquiring Knowledge on foundations of Distributed System.
2. Familiarizing the idea of peer to peer services and file system.
3. Familiarizing the components and support required for distributed system.
4. Acquiring Knowledge on remote method invocation and objects.
5. Gaining experienced skills on design process and resource management systems.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓			✓		✓			✓
CO2		✓		✓		✓		✓		✓		
CO3		✓			✓	✓					✓	
CO4	✓			✓	✓							
CO5			✓				✓	✓		✓		✓

CSPESCN	**SOFTWARE TESTING AND QUALITY ASSURANCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To impart knowledge on software testing, quality and Software Quality Assurance (SQA).
- To introduce the various software testing techniques and different levels of testing.
- To introduce the SQA standards and components of SQA system.
- To explain the components of quality plan for software projects.

UNIT - I Phases of Software Project

Quality, Quality assurance and quality control – Testing, Verification and Validation – White box testing – Static testing – Structural testing – Black box testing – Definition, need for black box testing – Black box testing techniques - Requirements based testing, Positive and Negative testing, Boundary Value Analysis, Decision Tables, Equivalence Partitioning, Graph based Testing, Compatibility Testing, Domain Testing.

UNIT - II Integration Testing

Integration testing as a type of testing - Integration testing as a phase of testing – Scenario testing – Defect bash - System and Acceptance testing – System testing overview – Need for System testing – Functional system testing – Non-functional testing – Acceptance testing.

UNIT – III Performance Testing

Factors governing performance testing – Methodology for performance testing – Tools for performance testing – Process for performance testing – Regression testing – Types of Regression testing – When and how to do Regression testing – Test planning – Test management – Test process – Test reporting.

UNIT - IV Software Quality

Definition - Software quality assurance – definition and objectives - Software quality assurance and software engineering - Software quality factors - The components of the software quality assurance system – The SQA system - SQA architecture-Pre-project components - Software project life cycle components - Infrastructure components for error prevention and improvement - Management SQA components - SQA standards, system certification, and assessment components - Organizing for SQA – The human components - Considerations guiding construction of an organization's SQA system.

UNIT – V Development plan and Quality Plan

Objectives - Elements of the development plan - Elements of the quality plan - Development and quality plans for small projects and for internal projects - Integrating quality activities in the project life cycle - Classic and other software development methodologies - Factors affecting intensity of quality assurance activities in the development process - Verification, validation and qualification - A model for SQA defect removal effectiveness and cost.

TEXT BOOKS :

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson Education India, 1st edition, 2005.
2. Daniel Galin, "Software quality assurance – from theory to implementation", Pearson Education India, 1st edition, 2009.

REFERENCES :

1. Aditya Mathur, "Foundations of software testing", Pearson Education, 1st edition, 2008.
2. Ron Patton, "Software Testing", Pearson education, 2nd edition, 2007.
3. William E. Perry, "Effective Methods for Software Testing: Includes Complete Guidelines, Checklists, and Templates", Wiley Publishing, 3rd edition, 2006.
4. Alan C Gillies, "Software Quality Theory and Management", Cengage Learning, 2nd edition, 2003.

Course Outcomes :

At the end of this course, the students will be able to

1. Techniques and skills on use of modern software testing tools to support software testing projects.
2. Planning a test project, design test cases and data, conduct testing operations, manage software problems and defects, generating a test report.
3. Advanced software testing topics, such as object-oriented software testing methods, and component-based software testing issues, challenges, and solutions.
4. Knowledge of Software Quality.
5. Understand the concepts of Qualification and Validation.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1		✓	✓		✓	✓		✓			✓	✓
CO2				✓	✓		✓					
CO3	✓		✓	✓				✓	✓	✓		✓
CO4						✓	✓					
CO5	✓		✓	✓				✓				✓

CSPESCN	**MOBILE COMPUTING**	**L**	**T**	**P**
		4	0	0

Course Objectives :

- To study the concepts of mobile computing.
- To study the concepts of medium access control protocol.
- To understand the concepts of GSM.
- To study the concepts of mobile IP and mobile TCP.

UNIT – I Mobile Computing

Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application- Need and types of multiplexing techniques - modulation types - use of spread spectrum - cellular Systems.

UNIT – II MAC

Motivation for a specialized MAC –SDMA–FDMA– TDMA–CDMA and comparison of these methods.

UNIT – III GSM

Mobile services - system architecture - radio interface – protocols - localization and calling - handover – security - new data services – DECT : system and protocol architecture – TETRA.

UNIT – IV Infrared Transmission

Introduction - Infrared vs. radio transmission - Infrastructure and ad-hoc networks - IEEE 802.11: system and protocol architecture - physical and MAC layer – HIPERLAN: protocol architecture - physical layer and MAC sub layer - Bluetooth: physical and MAC layer.

UNIT – V Mobile IP

Mobile IP – Dynamic host configuration protocol – Ad- hoc networks -- Mobile transport layer – Traditional TCP – Indirect TCP - Snooping TCP - Mobile TCP - Wireless Application Protocol – architecture - datagram protocol - transport layer security – Transaction and session protocol.

TEXT BOOKS :

1. Jachen Schiller, "Mobile Communications", Addison, Wesley, 2014.
2. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi, 2012.

REFERENCES :

1. Reza B, Far, "Mobile Computing Principles:, Designing And Developing Mobile Application With UML and XML", Cambridge University Press, 2005.
2. William C.Y.Lee, "Mobile Communication Design Fundamentals", John Wiley, 2010.
3. William Stallings,"Wireless Communications and Networks", Pearson Education, 2009.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the principles and concepts of mobile communication.
2. Analyze and compare the multiplexing techniques.
3. Describe the architecture of GSM.
4. Understand the protocol architecture of Bluetooth and HIPERLAN.
5. Knowledge of TCP Protocol.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓									✓	✓	✓
CO2			✓			✓		✓				
CO3					✓							
CO4				✓			✓		✓	✓	✓	✓
CO5	✓		✓				✓					

CSPESCN	**CRYPTOGRAPHY AND NETWORK SECURITY**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To Study the concepts of Computer Security and Cryptography.
- To Understand the Symmetric Key Algorithms and AES.
- To Study the concepts of Asymmetric Key Algorithms- Digital Signatures and RSA.
- To Understand the Network Security, Firewalls and Virtual Private Networks and Internet Security Protocols.

UNIT – I Introduction

Need for security -Principles of Security - Types of Attacks - Plain text and Cipher Text – Substitution techniques- Caesar Cipher- Mono alphabetic Cipher- Polygram- Polyalphabetic Substitution- Play air- Hill Cipher- Transposition

techniques- Encryption and Decryption- Symmetric and Asymmetric Key Cryptography- Steganography- Key Range and Key Size-Possible Types of Attacks.

UNIT – II Cryptography Algorithms

Algorithms types and modes- Overview of Symmetric key Cryptography- Data Encryption Standard (DES)-International Data Encryption Algorithm (IDEA)- RC4-RC5- Blowfish- Advanced Encryption Standard (AES).

UNIT – III Asymmetric Key Cryptography

Brief history of Asymmetric Key Cryptography- Overview of Asymmetric Key Cryptography- RSA algorithm- Symmetric and Asymmetric key cryptography together- Digital Signatures-Knapsack Algorithm- Some other algorithms (Elliptic curve Cryptography- ElGamal-problems with the public key exchange).

UNIT – IV Primary Key Management

Digital Certificates-Private Key Management- The PKIX Model-Public Key Cryptography Standards (PKCS)-XML-PKI and Security- Hash functions- Key Predistribution- Blom's Scheme- Diffie-Hellman Key Predistribution- Kerberos-Diffie-Hellman Key Exchange- The Station-to-station Protocol.

UNIT – V TCP/IP and Firewalls

Introduction to TCP/IP- Firewalls- IP Security- Virtual Private Networks (VPN)-Intrusion-Internet Security Protocols: Basic concepts- Secure Socket Layer (SSL)-Transport Layer Security (TLS) - Secure Hyper Text Transfer Protocol (SHTTP)-Time Stamping Protocol (TSP) - Secure Electronic Transaction (SET) - SSL vs SET- 3-D Secure Protocol- Electronic Money- E-mail Security- Wireless Application Protocol (WAP) Security- Security in GSM- Security in 3G.

TEXT BOOKS :

1. Atul Kahate "Cryptography and Network Security", Tata McGrawHill, 4th Edition, 2008.
2. Charlie Kauffman, Radia Perlman, Mike Spciner, "Network Security", Pearson Education, 2nd Edition, 16 March 2012

REFERENCES :

1. William Stallings "Cryptography and Network Security", Pearson Education, 7th Edition, 2017.
2. Cryptography & Network Security, Atul Kahate, McGraw Hill, 3rd edition, 2013.
3. Cryptography & Network Security, V.K. Jain, Khanna Publishing House, 2013.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the concepts of Computer Security, Cryptography, Symmetric Key Algorithms, AES, Asymmetric Key Algorithms- Digital Signatures, RSA.
2. Understand the Digital Certificates, Public Key Infrastructure (PKI).
3. Understand the Network Security, Firewalls and Virtual Private Networks and Internet Security Protocols.
4. Understand the concepts of 3G.
5. Knowledge about Secure Electronic Transaction and Secure Socket Layer.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓				✓							
CO2			✓				✓					
CO3						✓			✓	✓	✓	✓
CO4			✓					✓				✓
CO5				✓		✓						

CSPESCN	**PERVASIVE COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To introduce the characteristics, basic concepts and systems issues in pervasive computing.
- To illustrate architecture and protocols in pervasive computing and to identify the trends and latest development of the technologies in the area.
- To analyze and compare the performance of different data dissemination techniques and algorithms for mobile real-time applications.

UNIT - I Introduction

Technologies: Past - Present- Future - Pervasive Computing - The pervasive computing market - m-Business - Conclusions and Challenges – Future. Application Examples: Retail - Airline check-in and booking - Sales Force Automation – Healthcare - Tracking – car information systems – Email access via WAP and voice.

UNIT – II Device Technology

Hardware - Human-machine interfaces - Biometrics - Operating Systems - Java for Pervasive devices. Device Connectivity: Protocols - Security - Device Management. Web Application Concepts: History of World Wide Web - World Wide Web Architecture - Protocols - Transcoding - Client Authentication via the Internet.

UNIT – III WAP

Introduction - Components of the WAP architecture - WAP infrastructure - WAP Security Issues - Wireless Markup Language - WAP push - Products - i-mode. Voice Technology: Basics of speech recognition - Voice standards - Speech applications - Speech and pervasive computing - Security.

UNIT – IV Server Side Programming in Java

Architecture - J2EE and overview - Servlets- Enterprise Java Beans - Java Server Pages - Extensible Markup Language - Web services - Model-View-Controller Pattern. Pervasive web application architecture: Background- scalability and availability- Development of pervasive computing web applications- Pervasive application architecture.

UNIT – V Application

Introduction- User Interface overview- Architecture- Implementation. Access from PCs: Smart Card-based authentication via the Internet- Ordering goods. Access via WAP: WAP functionality- Implementation. Access via voice: Extending the example application to voice access.

TEXT BOOKS :

1. Jochen Burkhardt, Dr. Horst Henn, Stefan Hepper, Klaus Rintdorff, Thomas schaeck "Pervasive Computing Technology and Architecture of Mobile Internet Applications", Pearson Education, 6th edition, 2009.
2. Debashis Saha, "Networking Infrastructure for Pervasive Computing: Enabling Technologies", Kluwer Academic Publisher, Springer; 1st edition, 2002.

REFERENCES :

1. Seng Loke, "Context-Aware Computing Pervasive Systems", Auerbach Publication, New York, 2007.
2. Uwe Hansmann etl, "Pervasive Computing", Springer, New York, 2001.
3. Frank Adelstein, Sandeep KS Gupta, Golden Richard, "Fundamentals of Mobile and Pervasive Computing", McGraw-Hill, 2005.

Course Outcomes:

At the end of this course, the students will be able to

1. Develop an attitude to propose solutions with comparisons for problems related to pervasive computing system through investigation.
2. Gives knowledge about the strengths and limitations of the tools and devices for development of pervasive computing systems.
3. Discovers the characteristics of pervasive computing applications including the major system components and architectures of the systems.
4. Knowledge about WAP infrastructure.
5. Understand about interface.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1					✓			✓	✓		✓	
CO2	✓		✓	✓			✓			✓		✓
CO3		✓				✓			✓			✓
CO4			✓	✓				✓				
CO5						✓						

CSPESCN	**ADHOC AND SENSOR NETWORKS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- Understand the design issues in ad hoc and sensor networks.
- Learn the different types of MAC protocols.
- Be familiar with different types of ad hoc routing protocols.
- Learn the architecture and protocols of wireless sensor networks.

UNIT – I Routing

Cellular and Ad hoc wireless networks – Issues of MAC layer and Routing – Proactive, Reactive and Hybrid Routing protocols – Multicast Routing – Tree based and Mesh based protocols – Multicast with Quality of Service Provision.

UNIT – II Quality of Services

Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS Solutions – MAC layer classifications – QoS Aware Routing Protocols – Ticket based and Predictive location based QoS Routing Protocols.

UNIT – III Energy Management

Need for Energy Management – Classification of Energy Management Schemes – Battery Management and Transmission Power Management Schemes – Network Layer and Data Link Layer Solutions – System power Management schemes.

UNIT – IV Sensor Networks

Introduction – Sensor Network architecture – Data Dissemination – Data Gathering – MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks – Evolving Standards – Other Issues – Recent trends in Infrastructure less Networks.

UNIT – V Hybrid Wireless Networks

Introduction – Next Generation Hybrid Wireless Architectures – Routing in Hybrid Wireless Networks – Pricing in Multi-Hop Wireless Networks – Power Control Schemes in Hybrid Wireless Networks – Load Balancing in Hybrid Wireless Networks.

TEXT BOOKS :

1. C. Siva Ram Murthy and B.S. Manoj, "Ad hoc Wireless Networks – Architectures and Protocols", 1st Edition, Pearson Education, 2006.Feng Zhao and Leonidas Guibas.
2. Feng Zhao and Leonidas Guibas,"Wireless Sensor Networks – An Information Processing Approach", 1st Edition, Morgan Kaufman Publishers, 2004.

REFERENCES :

1. C.K.Toh, "Adhoc Mobile Wireless Networks: Protocols and Systems", Pearson Education, 2002.
2. Thomas Krag and Sebastin Buettrich, "Wireless Mesh Networking", O'Reilly Publishers, 2007.
3. Carlos De Morais Cordeiro, Dharma Prakash Agarwal, "Adhoc and Sensor Networks: Theory and Applications", World Scientific Publishing Company Private Limited, 2006.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the principles of mobile ad hoc networks (MANETs) and what distinguishes them from infrastructure-based networks.
2. Analyze the protocol design issues of ad hoc and sensor networks.
3. Understanding the principles and characteristics of wireless sensor networks.
4. Knowledge of the current topics in MANETs and WSNs, both from an industry and research point of view.
5. Knowledge about the Hybrid Wireless Networks.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓								✓	✓	✓	✓
CO2		✓	✓	✓	✓							
CO3								✓				
CO4					✓		✓			✓		✓
CO5		✓					✓					

CSPESCN	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To introduce basic concepts like acquiring, storing and processing of images.
- To provide details about enhancing the quality of images.
- To introduce techniques for extraction and processing of region of interest.
- To understand the applications of Image Processing.

UNIT - I Fundamentals

Digital Imaging: Introduction – Steps in Image Processing Systems – Image Acquisition – Image Sampling and Quantization – Pixel Relationships – Linear and Nonlinear Operations. MATLAB: The MATLAB Desktop – Using the MATLAB Editor/Debugger – Getting Help – Saving and Retrieving work Session Data – Digital Image Representation – Image I/O and Display – Classes and Image Types – M-Function Programming.

UNIT - II Image Enhancement

Spatial Domain – Gray level Transformations – Histogram Processing – Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain – DFT, FFT, DCT – Smoothing and Sharpening filters – Homomorphic Filtering.

UNIT - III Image Segmentation

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Morphological Watersheds – Motion Segmentation.

UNIT - IV Multi Resolution Analysis and Compression

Image Pyramids – Multi resolution expansion – Wavelet Transforms image Compression: Fundamentals – Models – Elements of Information Theory – Error Free Compression – Lossy Compression – Compression Standards.

UNIT - V Morphological Processing and Representation

Morphological Image Processing – Preliminaries – Dilation and Erosion – Opening and Closing – The Hit-or-Miss Transformation-Representation – Boundary Descriptors – Regional Descriptors – Use of Principal Components for Description – Relational Descriptors – Applications of Image Processing – Image Watermarking – Fingerprint Recognition – Iris Recognition.

TEXT BOOKS :

1. Rafael C.Gonzalez and Richard E.Woods, "Digital Image Processing", 3rd edition, Pearson Education, 2009.
2. Rafael C.Gonzalez, Richard E.Woods and Steven L.Eddins, "Digital Image Processing Using Matlab", 2nd edition, McGraw Hill, 2010.

REFERENCES :

1. AL. Bovik, "The Essential Guide to Image processing", 2nd edition, Elsevier, 2009.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", PHI, 2006.
3. Sanjit K. Mitra, & Giovanni L. Sicuranza, "Non Linear Image Processing", Elsevier, 2007.
4. Maria Petrou, Costas Petrou, "Image Processing: The Fundamentals", Wiley,2nd edition, 2010.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the basic image enhancement techniques in spatial & frequency domains.
2. Understand the basic multi-resolution techniques.
3. Understand the basic of segmentation methods.
4. Apply this concept for image handling in various fields.
5. Knowledge about Morphological operations.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓							
CO2			✓	✓	✓							
CO3		✓				✓	✓	✓				
CO4			✓	✓	✓				✓	✓	✓	✓
CO5		✓				✓	✓	✓				✓

CSPESCN	**MACHINE LEARNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives :

- To introduce the fundamental concepts of machine learning and its applications
- To learn the classification, clustering and regression machine learning algorithms
- To understand the methods of solving real life problems using the machine learning techniques

Unit – I Introduction

Machine perception - pattern recognition systems - design cycle – learning and adaptation. Bayesian decision theory: Continuous features – minimum-error-rate classification - classifiers, discriminant functions, and decision surfaces - normal density - discrete features - Bayesian belief networks.

Unit – II Maximum-likelihood and Bayesian Parameter Estimation

Maximum-likelihood estimation - Bayesian estimation - Bayesian parameter estimation: Gaussian case. Problems of dimensionality.

Unit – III Component analysis and discriminants

Principal component analysis - Fisher linear discriminant - multiple discriminant analysis. Expectation-maximization algorithm. Introduction to hidden Markov models.

Unit – IV Classification Algorithms

Perceptron and backpropagation neural network - radial basis function neural network - probabilistic neural network - k-nearest-neighbor rule. Support vector machine: Training - multicategory generalizations. Decision trees: classification and regression tree - random forest.

Unit – V Clustering and Regression Algorithms

k-means clustering - fuzzy k-means clustering - Gaussian mixture models - autoassociative neural network. Regression analysis - support vector regression- Introduction to combining multiple learners.

Text Book:

1. R. O. Duda, E. Hart, and D.G. Stork, "Pattern classification", Second edition, John Wiley & Sons, Singapore, 2003.
2. Tom M. Mitchell, ―Machine Learning‖, McGraw-Hill Education (India) Private Limited, 2013.

REFERENCES :

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. C. M. Bishop, “Pattern Recogniti on and Machine Learning”, Springer, 2006.
3. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
4. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.

COURSE OUTCOMES :

At the end of this course, the students will be able to

1. Understand the basic concepts of machine learning
2. Understand the classification, clustering and regression algorithms
3. Implement the classification, clustering and regression algorithms
4. Combine the evidence from two or more models/methods for designing a system.
5. Design and implement a method for solving real life problem using a suitable machine learning technique

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓				✓	✓			✓		
CO2	✓	✓	✓		✓			✓				
CO3				✓		✓			✓	✓	✓	✓
CO4		✓	✓	✓				✓				
CO5	✓					✓	✓			✓		✓

CSPESCN	**DIGITAL SIGNAL PROCESSING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To study the basic components of DSP systems.
- To study DFT and its computation.
- To study the design techniques for digital filters (IIR & FIR).
- To study the finite word length effects and applications in signal processing.

UNIT - I Basic of Digital Signal Processing Systems

Classification of Signals - The concept of frequency in Continuous time and Discrete time domain - Discrete-time Signals and Systems - Analysis of Discrete Time - Linear Shift-Invariant Systems – Linearity - Causality and Stability criterion. Discrete-time Systems described Difference Equation - Correlation of Discrete - Time Signals.

UNIT – II Introduction to DFT

Properties of DFT - Filtering methods based on DFT - Relation between DTFT and DFT - FFT computations using Decimation in time and Decimation in frequency algorithms - Overlap-add and save methods.

UNIT – III Filters

General Consideration - Design of IIR filters - IIR Filter Design by Impulse Invariance & Bilinear Transformation - pre warping - Realization using direct, cascade and parallel forms - Design of Linear Phase FIR Filters - Design of FIR filter using Windows and by Frequency Sampling Method - Frequency Transformation in the Analog Domain and Digital Domain - Realization of FIR filters - Transversal, Linear phase and Polyphase structures.

UNIT – IV Quantization

Fixed point and floating point number representations - Comparison - Truncation and Rounding errors - Quantization noise - derivation for quantization noise power - coefficient quantization error - Product quantization error - Overflow error - Round off noise power - limit cycle oscillations due to product round off and overflow errors - signal scaling.

UNIT – V Multirate Signal Processing

Speech Compression - Adaptive Filter - Musical Sound Processing - Image enhancement - Applications of Multi rate signal Processing

TEXT BOOKS :

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing Principles, Algorithms and applications", Pearson education / Prentice Hall, 4th edition, 2007.
2. AlanV.Oppenheim, Ronald W.R.Back, "Discrete Time Signal Processing", Pearson Education, 2nd edition, 2005. Schafer and Hohn.

REFERENCES :

1. S.Salivahanan, A.Vallavaraj, C.Gnanapriya, "Digital Signal Processing", TMH/McGraw Hill International, 2007.
2. S.K. Mitra, "Digital Signal Processing, A Computer Based approach", Tata McGraw Hill, 1998.
3. Johny R. Johnson, Introduction to Digital Signal Processing, PHI, 2006.

COURSE OUTCOMES :

At the end of this course, the students will be able to

1. Design both analog and digital filters.
2. Design DSP processors.
3. Do projects in Signal processing, Image processing and Speech Processing.
4. Understand the Multirate signal processing.
5. Knowledge about quantization.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓				✓	✓		✓		✓
CO2		✓	✓	✓	✓	✓						
CO3					✓		✓		✓		✓	✓
CO4			✓	✓								
CO5		✓			✓	✓	✓	✓		✓		✓

CSPESCN	**CLOUD COMPUTING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To know the fundamentals of cloud computing.
- To acquire the knowledge of cloud computing technologies and architecture.
- To be familiar with cloud services and applications of cloud computing.

UNIT – I Introduction

Layers of Cloud Computing - Types - Cloud Computing Versus Cloud services - Cloud Computing Features - Platforms - Challenges - Cloud Computing Security - Model Application Methodology - Cloud-Based High Performance Computing Clusters - Virtual Private Clouds - Data Centers - Applications.

UNIT – II The Role of Networks in Cloud Computing

Cloud Deployment Models and Network - Network Architectures for Clouds - Requirements and Architecture for Hybrid Cloud Networking - Data-Intensive Technologies for Cloud Computing - Characteristics of Data-Intensive Computing Systems - Data-Intensive System Architecture - Distributed Agent Based Scheduling Platform Inside Clouds -Basics of Grid and Cloud Computing - Layered Models and Usage patterns in Grid and Cloud.

UNIT – III Enterprise Architecture

Enterprise Knowledge Management - Enterprise Knowledge Architecture - Enterprise Computing Clouds - Enterprise Knowledge Clouds - Enterprise Knowledge Cloud Technologies - The VCL Cloud Architecture - Integrating High-Performance Computing into the VCL Cloud Architecture - Overview of SwinDeW-G Environment - SwinDeW-C System Architecture - Architecture of SwinDeW-C Peers.

UNIT - IV Cloud Services and Cloud Roles

Infrastructure as a Service - Platform as a Service - Software as a Service - Grids and Clouds - Application Scalability - Automating Scalability - General Cloud Architectures for Scaling - Delivering Scientific Computing services in the Cloud - A Dynamic Collaborative Cloud Services Platform.

UNIT - V Amazon Web Services

Google App Engine - Microsoft Azure - Scientific Applications - Business and Consumer Applications - Case Study: Cloud as Infrastructure for an Internet Data Center - Cloud Computing for Software Parks - Cloud Computing Supporting SaaS.

TEXT BOOKS :

1. L Borko Furht and Armando J. Escalante, “Handbook of Cloud Computing”, Springer, 2010.
2. Dr. Rajkumar Buyya, Dr. Christian Vecchiola and Dr. S Thamarai Selvi, “Mastering Cloud Computing”, Tata McGraw Hill, 1st Edition, 2013.

REFERENCES :

1. Michael Miller, “Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate”, Que Publishing, 1st Edition, 2008.
2. D Anthony T Velte, Toby J Velte and Robert Elsenpeter, “Cloud Computing : A Practical Approach”, Tata McGraw-Hill, 1st Edition, 2010.
3. John Rittinghouse & James Ransome, “Cloud Computing, Implementation, Management and Strategy”, CRC Press, 1st Edition, 2010.

Course Outcomes :

At the end of this course, the students will be able to

1. Identify the fundamentals and technologies of cloud computing.
2. Address different cloud architectures and cloud services.
3. Explore various applications by integrating the cloud services.
4. Fundamentals of Web services.
5. Knowledge about Cloud Platform.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓	✓			
CO2	✓		✓	✓	✓	✓		✓				✓
CO3		✓						✓		✓	✓	
CO4	✓			✓	✓	✓	✓					
CO5								✓				✓

CSPESCN	**SPEECH PROCESSING AND SYNTHESIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To provide Knowledge with speech signals and their representations.
- To analyze the feature extraction techniques in both frequency and spectral domain.
- To provide knowledge on pattern comparison Techniques
- To provide the overview of speech based applications (speech recognition and synthesis).

UNIT – I Basic Concepts

Speech Fundamentals: Articulatory Phonetics – Production and Classification of Speech Sounds; Acoustic Phonetics – acoustics of speech production; Review of Digital Signal Processing concepts; Short-Time Fourier Transform, Filter-Bank and LPC Methods.

UNIT – II Speech Analysis

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale, LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT –III Speech Modeling

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.

UNIT – IV Speech Recognition

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary continuous speech recognition system – acoustics and language models – n- grams, context dependent sub-word units; Applications and present status.

UNIT – V Speech Synthesis

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub- word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

TEXT BOOKS :

1. Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2008.

REFERENCES :

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing, 2nd Edition, 1999.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education, 2001.
3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
4. Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.

Course Outcomes:

At the end of this courses Students will able to

1. Understand the basic characteristics of speech signals.
2. Recall various feature extraction techniques used in many speech related projects.
3. Understand the algorithms for speech models.
4. Develop a speech recognition system.
5. Work on various speech based applications in their projects.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓				
CO2	✓		✓	✓	✓	✓		✓	✓			✓
CO3		✓						✓				
CO4	✓			✓	✓	✓	✓			✓	✓	
CO5								✓				✓

CSPESCN	**INFORMATION RETRIEVAL TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the basics of Information Retrieval.
- To understand machine learning techniques for text classification and clustering.
- To understand various search engine system operations.
- To learn different techniques of recommender system.

UNIT - I Introduction

Information Retrieval – Early Developments – The IR Problem – The Users Task – Information versus Data Retrieval – The IR System – The Software Architecture of the IR System – The Retrieval and Ranking Processes – The Web – The e-Publishing Era – How the web changed Search – Practical Issues on the Web – How People Search – Search Interfaces Today – Visualization in Search Interfaces.

UNIT - II Basic IR models

Boolean Model – TF-IDF (Term Frequency/Inverse Document Frequency) Weighting – Vector Model – Probabilistic Model – Latent Semantic Indexing Model – Neural Network Model – Retrieval Evaluation – Retrieval Metrics – Precision and Recall – Reference Collection – User-based Evaluation – Relevance Feedback and Query Expansion – Explicit Relevance Feedback.

UNIT - III Classification, Searching and Indexing

A Characterization of Text Classification – Unsupervised Algorithms: Clustering – Naïve Text Classification – Supervised Algorithms – Decision Tree – k-NN Classifier – SVM Classifier – Feature Selection or Dimensionality Reduction – Evaluation metrics – Accuracy and Error – Organizing the classes – Indexing and Searching – Inverted Indexes – Sequential Searching – Multi-dimensional Indexing.

UNIT - IV Web – Search Engine Architectures

The Web – Search Engine Architectures – Cluster based Architecture – Distributed Architectures – Search Engine Ranking – Link based Ranking – Simple Ranking Functions – Learning to Rank – Evaluations — Search Engine Ranking – Search Engine User Interaction – Browsing – Applications of a Web Crawler – Taxonomy – Architecture and Implementation – Scheduling Algorithms – Evaluation.

UNIT - V Content-based Recommender Systems

Recommender Systems Functions – Data and Knowledge Sources – Recommendation Techniques – Basics of Content-based Recommender Systems – High Level Architecture – Advantages and Drawbacks of Content-based Filtering – Collaborative Filtering – Matrix factorization models – Neighborhood models.

TEXT BOOKS :

1. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, 2nd edition, ACM Press Books, 2011.
2. Ricci, F, Rokach, L. Shapira, B.Kantor, —Recommender Systems Handbook, 1st edition, 2011.

REFERENCES :

1. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.
2. Stefan Buettcher, Charles L. A. Clarke and Gordon V. Cormack, —Information Retrieval: Implementing and Evaluating Search Engines, The MIT Press, 2010.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the basics of Information Retrieval and its models.
2. Use an open source search engine framework and explore its capabilities.
3. Apply appropriate method of classification or clustering.
4. Design and implement innovative features in a search engine.
5. Design and implement a recommender system.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓				✓
CO2	✓		✓	✓	✓	✓		✓		✓		
CO3		✓						✓				
CO4	✓			✓	✓	✓	✓		✓		✓	✓
CO5								✓		✓		

CSPESCN	**DATA MINING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To Understand Data mining principles and techniques and Introduce DM as a cutting edge business intelligence.
- To expose the students to the concepts of Data warehousing Architecture and Implementation.
- To study the overview of developing areas – Web mining, Text mining and ethical aspects of Data mining.
- To identify Business applications and Trends of Data mining.

UNIT – I Evolution of Decision Support Systems

Data warehousing Components – Building a Data warehouse - Data Warehouse and DBMS - Data marts – Metadata - Multidimensional data model - OLAP Vs OLTP - OLAP operations - Data cubes - Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations.

UNIT – II Types of OLAP Servers

Three – Tier data warehouse architecture - distributed and virtual data warehouses - Data warehouse implementation - tuning and testing of data warehouse - Data Staging (ETL) Design and Development - data warehouse visualization - Data Warehouse Deployment – Maintenance – Growth - Business Intelligence Overview - Data Warehousing and Business Intelligence Trends - Business Applications - tools- SAS.

UNIT – III Data Mining

KDD versus data mining - Stages of the Data Mining Process - task primitives -Data Mining Techniques - Data mining knowledge representation – Data mining query languages - Integration of a Data Mining System with a Data Warehouse – Issues-Data preprocessing – Data cleaning - Data transformation - Feature selection - Dimensionality reduction - Discretization and generating concept hierarchies - Mining frequent patterns – association - correlation.

UNIT – IV Decision Tree Induction

Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – Partitioning methods - k-means- Hierarchical Methods – distance based agglomerative and divisible clustering - Density-Based Methods – expectation maximization - Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis.

UNIT – V Statistics and Data Analysis

EDA – Small and Big Data – Logistic Regression Model - Ordinary Regression Model - Mining complex data objects – Spatial databases – Temporal databases – Multimedia databases – Time series and sequence data – Text mining – Web mining – Applications in Data mining.

TEXT BOOKS :

1. Jiawei Han and Micheline Kamber, Data Mining: Concepts and Techniques, Morgan Kaufmann Publishers, third edition, 2011.
2. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", Tata McGraw Hill Edition, Tenth Reprint, 2007.

REFERENCES :

1. G. K. Gupta, "Introduction to Data Min Data Mining with Case Studies", Prentice Hall of India, Easter Economy Edition, 2006.
2. Ian.H.Witten, Eibe Frank and Mark.A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd edition, (Then Morgan Kufmann series in Data Management systems), 2011.
3. Mehmed kantardzic, "Data mining concepts, models, methods, and algorithms", Wiley- Interscience, IEEE Press, 2nd Edition, 2003.
4. Ian Witten, Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann, 3rd edition, 2011.
5. George M Marakas, "Modern Data Warehousing, Mining and Visualization", Prentice Hall, 2nd edition, 2003.

Course Outcomes :

At the end of this course, the students will be able to

1. Evolve Multidimensional Intelligent model from typical system.
2. Discover the knowledge imbibed in the high dimensional system.
3. Evaluate various mining techniques on complex data objects.
4. Evaluate the performance of different data-mining algorithms
5. Understand and apply the data mining techniques ,such as text mining and web mining

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓			✓	✓
CO2	✓		✓	✓	✓	✓		✓			✓	
CO3		✓						✓	✓	✓		✓
CO4	✓			✓	✓	✓	✓					
CO5								✓	✓	✓	✓	✓

CSPESCN	**WEB APPLICATION FRAMEWORK**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives:

- To understand programming constructs of Ruby.
- To learn Rails Techniques.
- To use Rails conventions to avoid redundant code.
- To deploy Ruby on Rails.

UNIT - I Introduction

Introduction to Web Application - Introduction to Ruby – Hello Application – Nature of Ruby – Object Oriented Programming – Ruby basics – Classes, Objects and Variables – Built-in Classes and Modules: Scalar Objects – Collections. Control Flow: Conditionals – Loops, Blocks, and Iterators – Exception handling – Advanced Ruby Techniques.

UNIT – II Rails

Introduction to Rails - History of Rails- Installing Rails on Windows, Linux – Setting Development Environment – What is Ruby on Rails – Rails Architecture – Rails Scripts – Creating First Rails Application.

UNIT – III Ruby

Active Record – Basics – Setting up a Model – Migrations – CRUD Operations – Defining Relationships – implementing Validations – Custom Validations – Advanced Active Record. Action Controller – Routing – Creating and using Controllers – Using Filters – Working with Sessions – Caching. Action View – Embedded Ruby – Layouts – Partials – Helpers – JavaScript, Ajax and RJS.

UNIT – IV Developing Book Shelf

Application Overview – Creating a Skeleton – Create Home Page – Implementing Users. Adding Core Functionality: Adding Support – Refactor Sidebar Code – Implementing Search – Implementing Addition and Deletion Operations – Display content. Testing Application: Using Test::Unit – Testing Rails – Test Database – Functional Test – Unit Tests – Integration Tests – Running, Test Coverage and Debugging Techniques.

UNIT – V Prototype

Overview – Extension to JavaScript – OOP with Prototype – Event Handling - Ajax. Script.aculo.us: Overview – Visual Effects – Controls – Drag and Drop – JavaScript Testing. Extending Rails: Generators – Plugins – Writing Plugins – Techniques used to develop plugins – Pagination – exception notifier – Adding User Authentication. RESTful Rails – Working with Legacy Databases – Using Action Mailer – Active Resource and XML – Deploying with Capistrano.

TEXT BOOKS :

1. Timothy Fisher, "Ruby on Rails Bible", Wiley India Pvt. Ltd., 2009.

REFERENCES :

1. Chad Pytel, Tammer Saleh," Rails AntiPatterns: Best Practice Ruby on Rails Refactoring", 1st edition, Addison-Wesley, 2010.
2. David A. Black, "The Well-Grounded Rubyist", Manning Publications, 2nd edition, 2014.
3. Peter Cooper, "Beginning Ruby: From Novice to Professional", A press, 3rd edition, 2016.

Course Outcomes :

At the end of this course, the students will be able to

1. Able to understand Rails framework and also know program constructs in Ruby.
2. Able to develop application in Ruby on Rail.
3. Acquire knowledge about Object-Relational Mapping with ActiveRecord.
4. Apply knowledge to deploy Rails.
5. Understand the knowledge of Protocol.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓	✓		✓	
CO2	✓		✓	✓	✓	✓		✓		✓		✓
CO3		✓						✓			✓	
CO4	✓			✓	✓	✓	✓			✓		✓
CO5								✓			✓	

CSPESCN	**OPEN SOURCE PROGRAMMING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To learn about Unix commands and Unix programming.
- To familiarize students with the Unix Utilities.
- To learn the Unix file systems.

UNIT - I Introduction to Open Source

Need – Advantages – Application of open sources – Open source operating systems: LINUX: Introduction – General overview – Kernel mode and user mode Process – Scheduling – Personalities Cloning Signals – Development with Linux.

UNIT - II Introduction to PHP

Introduction – Variables types in PHP – Understanding data types – Loose typing – Testing variable – Changing variables data type – Type casting – Operators and expressions – Operator types – Operator precedence Constants – Decisions and loops – Strings- Arrays – Functions.

UNIT - III Working with Files and Directories

Getting information on files – Opening and closing files – Reading and writing to files – Reading and writing strings of characters – Testing – Reading and writing entire files – Working with file permissions – Working with directories – Introduction to databases and SQL.

UNIT - IV Exploring Python

Creating python programs Statements Building blocks Testing functions – Strings – Lists and tuples String functions – Sets – Dictionaries Combining dictionaries Making copies Zip list Loops Dynamic programming Persistent variables.

UNIT – V Files Operations Commands

Files Operating system commands Errors and exceptions – Input and output – Functions Modules Classes: Constructors Boundaries Object reference Inheritance – Types – Tests Variables Classes as dynamic records – Object oriented programming.

TEXT BOOKS :

1. Remy Card, The Linux Kernel Book, Wiley Publications, 2012.
2. Timothy A Budd, Exploring Python, Tata McGrawHill, 2014.

REFERENCES :

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux In A Nutshell”, 6th edition, OReilly Media, 2009.
2. Kenneth A. Lambert, The Fundamentals of Python: First Programs, 2011.
3. Matt Doyle, Beginning PHP 5.3, Wiley Publishing, 2013.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand the fundamentals of Linux operating system.
2. Describe the working of PHP programming.
3. Elucidate the concepts of file handling and database programming in PHP.
4. Analyze the basic concepts in Python.
5. Explain the programming concepts of files and error handling using Python.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓	✓				✓		✓	
CO2			✓		✓	✓	✓	✓		✓		✓
CO3			✓	✓		✓						
CO4	✓	✓		✓	✓		✓			✓	✓	
CO5		✓				✓		✓				✓

CSPESCN	**SOFT COMPUTING TECHNIQUES**	**L**	**T**	**P**	**C**
		3	0	0	3

Course Objectives :

- To learn the various soft computing frame works.
- To be familiar with design of various neural networks.
- To be exposed to fuzzy logic.
- To learn genetic programming.

UNIT - I Artificial neural network Introduction

Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks- basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

UNIT - II Learning Networks

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network – unsupervised learning networks: Kohonen self organizing feature maps, LVQ – CP networks, ART network.

UNIT – III Membership Function

Membership functions: features, fuzzification, methods of membership value assignments- Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT – IV Genetic Algorithm and Search Space

General genetic algorithm – operators - Generational cycle - stopping condition – constraints - classification - genetic programming – multilevel optimization – real life problem- advances in GA.

UNIT – V Neoro- Fuzzy Hybrid Systems

Genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TEXT BOOKS :

1. J.S.R.Jang, C.T. Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI / Pearson Education 2004.
2. S.N.Sivanandam and S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt Ltd, 2011.

REFERENCES :

1. Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.
2. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
3. Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011.
4. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis & Applications", Prentice-Hall of India Pvt. Ltd., 2006.
5. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013.

Course Outcomes:

At the end of this course, the students will be able to

1. Apply various soft computing frame works.
2. Design various neural networks.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Apply genetic algorithms to combinatorial optimization problems.
5. Applications of soft computing to solve problems in varieties of application domains.

1. **Mapping of Course Outcomes with Programme Outcomes**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✓	✓	✓		✓				✓			✓
CO2		✓			✓	✓					✓	
CO3	✓			✓				✓	✓	✓		
CO4				✓			✓				✓	
CO5	✓			✓			✓	✓				✓

OPEN ELECTIVES

CSOESCN	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

Course Objectives :

- To understand the concepts of Internet of Things.
- To introduce network and communication protocols of IoT.
- To build IoT applications.

UNIT – I Introduction to IoT

Defining IoT- Characteristics of IoT-Physical design of IoT- Logical design of IoT- Functional blocks of IoT-Communication models & APIs, Machine to Machine-Difference between IoT and M2M-Software defined Network(SDN).

UNIT – II Network and Communication Aspects

Network and communication aspects:Wireless medium access issues- MAC protocol survey, Survey routing protocols- Sensor deployment & Node discovery-Data aggregation & dissemination.

UNIT – III Challenges of IoT

Design challenges- Development challenges-Security challenges- Other challenges-Applications of IoT- Home automation, Industry applications, Surveillance applications- Other IoT applications.

UNIT – IV Rasperry PI with Python and Arduino

Introduction to Python -Building IOT with RASPERRY Pi- IoT Systems - IoT Physical Devices & Endpoints - IoT Device -Building blocks -Raspberry Pi -Board - Linux on Raspberry Pi - Raspberry Pi Interfaces -Programming Raspberry Pi with Python - Other IoT Platforms – Arduino.

UNIT – V Development IoTs

Developing sensor based application through embedded system platform, - Industrial automation, smart grid, Commercial building automation, Smart cities - participatory sensing - Data Analytics for IoT

TEXT BOOKS :

1. Vijay Madisetti, Arshdeep Bahga, “Internet of Things: A Hands-On Approach”, Orient Blackswan Pvt., Ltd., New Delhi, 2015.
2. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice", A John Wiley and Sons, Ltd., Publication, 2010.

REFERENCES :

1. Jeeva Jose, “Internet of Things”, (ISBN: 978-93-86173-591) KBP House,1st edition,2018.

Course outcomes :

At the end of this course, the students will be able to

1. Understand the concepts of Internet of Things.
2. Analyze basic protocols in wireless sensor network.
3. Design IoT applications in different domain and be able to analyze their performance.
4. Implement basic IoT applications on embedded platform.
5. Explore IoT using Rasperry Pi and Arduino.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓			✓		✓			
CO2			✓							✓		
CO3					✓						✓	✓
CO4		✓					✓					✓
CO5				✓				✓			✓	✓

CSOESCN	**ENTERPRISE RESOURCE PLANNING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To know the basics of ERP.
- To understand the key implementation issues of ERP.
- To know the business units of ERP.
- To be aware of some popular products in the area of ERP.
- To appreciate the current and future trends in ERP.

UNIT – I ERP

Enterprise - An Overview – Basic ERP Concepts – Risks of ERP - Benefits of ERP - ERP and Related Technologies – Business Intelligence(BI) - Business Process Reengineering (BPR) - Data Warehousing - Data Mining – OLAP – SCM.

UNIT - II ERP Implementation

Implementation Challenges – Implementation Strategies - ERP Implementation Lifecycle - Implementation Methodologies - Vendors and Consultants - Contracts with Vendors - Consultants and Employees - Project Management and Monitoring – Post Implementation Activities.

UNIT – III Maintenance and Management

Business Unit of an ERP Package - Finance, Manufacturing - Human Resources - Plant Maintenance - Materials Management - Quality Management – Marketing - Sales and Distribution.

UNIT - IV ERP Market Place

ERP Market Place and Market Place Dynamics - SAP AG – PeopleSoft - JD Edwards – Oracle Corporation – QAD Inc – QAD Analytics - QAD Open Technology – SSA Global – Lawson Software - Epicor – Intuitive – ERP Unit.

UNIT – V Advanced Topics

Turbo Charge the ERP System – Limitations of ERP Systems – Enterprise Application Integration (EAI) - ERP and E-Business – ERP, Internet and WWW – ERP and Total Quality Management - Future Directions and Trends in ERP.

TEXT BOOKS :

1. Alexis Leon, “ERP Demystified”, Tata McGraw Hill, New Delhi, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.

REFERENCES :

1. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology, USA, 2012.
2. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI, New Delhi, 2003.
3. K.Ganesh, Sanjay Mohapatra, S.P.Anbuudayasankar, P.Sivakumar, "Enterprise Resource Planning: Fundamentals of Design and Implementation", Springer, 2014.

Course outcomes :

At the end of this course, the students will be able to

1. Design and develop ERP implementation cycle.
2. Have awareness of core and extended units of ERP.
3. Know about the business units of ERP.
4. Know about different ERP vendors.
5. Understand the latest implementation methodologies of ERP.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓	✓			✓			✓	✓
CO2		✓	✓			✓	✓			✓		✓
CO3		✓		✓			✓	✓	✓		✓	
CO4	✓		✓			✓			✓			✓
CO5	✓			✓		✓	✓	✓			✓	

CSOESCN	**E- COMMERCE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives :

- To provide basic knowledge about the types of Electronic payment systems.
- To Provide guiding principles behind the design and strategy of the customer web interface.
- To illustrate the concepts of various On-Demand Education and Software Agents.
- To Understand the traditional and new communication/marketing approach.

UNIT – I E-Commerce Infrastructure

E-Commerce framework – Media Convergence – Anatomy of E-Commerce Applications – Consumer and Organization Applications – Market forces influencing the I-way – Components of the I-way – Network Access Equipment – Distribution Networks – Issues – Internet Terminology – NSFNET – Research and Education network – Internet Governance.

UNIT - II E-Commerce and Web

E-Commerce and Web: Architecture frame work for E- Commerce – WWW as the architecture – Hypertext publishing – Technology and Security on Web – Consumer Oriented Applications – Mercantile Process Model – Mercantile Models from the perspective of Consumer and merchants.

UNIT - III Electronic Payment Systems and EDI

Types of Electronic payment systems – Digital token based system – Smart cards – Credit card based system – Risk factors – Designing Electronic payment systems. EDI – EDI Applications in business – Legal, Security and Privacy issues – Standardization in EDI – EDI software implementation - EDI envelope – VANs – Internet based EDI.

UNIT - IV Inter Organizational E-Commerce and Marketing

Internal Information Systems - Macro forces and Internal Commerce – Work-flow automation – Customization – SCM – Corporate Digital Library: Dimensions, Making a business case, Types of Digital Documents – Advertising on Internet – Charting the online marketing process – Market Research.

UNIT - V On-Demand Education and Software Agents

Computer based Education and Training – Technological Components – Digital Copyrights and E-Commerce – History of software agents – Characteristics and Properties of Agents – Technology behind the Agents – Tele script Agent Language – Safe-Tcl – Software Agents in action –SGML.

TEXT BOOKS :

1. Kenneth C. Laudon, "E -Commerce : Business, Technology", Society, 10th Edition, 2016.

REFERENCES :

1. Ravi Kalakota, Andrew B. Whinston, "Frontiers of Electronic Commerce", Paperback – Addison-Wesley Publishing Company, 1999.
2. Dave Chaffey, "E - Business and E - Commerce Management: Strategy, Implementation and Practice", 2013.
3. Tharam Dillon , Elizabeth Chang, "E-Commerce: Fundamentals and Applications ", Wiley publication 2007.
4. David Whiteley, "E - Commerce: Strategy, Technologies and Applications", Tata Mcgraw Hill, 2001.

Course Outcomes :

At the end of this course, the students will be able to

1. Identify and analyze the construction and working principles of E-Commerce.
2. Develop and implement the Electronic Payment Systems and EDI.
3. Select suitable Computer based Education and Training.
4. Understand Web marketing approaches and elements of branding.
5. Understand the software agents and the technology behind the agents.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1			✓		✓		✓		✓			
CO2		✓	✓	✓		✓	✓				✓	✓
CO3	✓				✓			✓		✓		✓
CO4		✓		✓		✓	✓		✓			
CO5		✓	✓			✓			✓			

CSOESCN	**SUPPLY CHAIN MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives:

- To understand the importance of major decisions in supply chain management.
- To present the vision of supply chain management and their role in enterprise competitiveness.
- To appreciate the current trends in SCM.

UNIT - I Introduction

Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases - Supplier- Manufacturer-Customer chain - Enablers/ Drivers of Supply Chain Performance -Supply chain strategy - Supply Chain Performance Measures.

UNIT - II Different Approaches

Outsourcing – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum - Sourcing strategy: Portfolio Approach - Reconfiguration of the Supply Base -Impact of the internet on Sourcing Strategy.

UNIT - III Design

Distribution Network Design – Role - Factors Influencing Distribution Network Design – Design Option for a Distribution Network – E-Business and the Distribution Network – Network Design in Supply Chain – Role - Factors Influencing Network Design Decisions – Framework for Network Design Decisions - Impact of uncertainty on Network Design.

UNIT - IV Management

Demand Forecasting in a Supply Chain – The Role of Forecasting in a Supply Chain – Characteristics - Components – Risk Management in Forecasting – Managing Economies of Scale in a Supply Chain – Role – Economies of Scale to Exploit Fixed Costs – Estimating Cycle Inventory- Managing supply chain cycle inventory - Uncertainty in the supply chain.

UNIT - V Integration

Supply Chain Integration - Building partnership and trust in SC Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain - SC Restructuring - SC Mapping - SC process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chains -Reverse Supply chain - Agro Supply Chains.

TEXT BOOKS :

1. Janat Shah, "Supply Chain Management – Text and Cases", Pearson Education, 2009.
2. Sunil Chopra and Peter Meindl, "Supply Chain Management-Strategy Planning and Operation", PHI Learning / Pearson Education, 2007.

REFERENCES :

1. Ballou Ronald H, "Business Logistics and Supply Chain Management", Pearson Education, 5th Edition, 2007.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, "Designing and Managing the Supply Chain: Concepts, Strategies, and Cases", Tata McGraw-Hill, 2005.
3. Altekar Rahul V, "Supply Chain Management-Concept and Cases", PHI, 2005.
4. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, "Principles of Supply Chain Management- A Balanced Approach", South-Western, Cengage Learning, 2008.

Course Outcomes :

At the end of this course, the students will be able to

1. Acquire fundamental concepts in Supply Chain Management.
2. Build a competitive supply chain using strategies, models, techniques and information technology
3. Know about current trends in Supply Chain Management
4. Manage a competitive supply chain using models, techniques and information technology
5. How to align the management of a supply chain with corporate goals and strategies.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓		✓	✓			✓	✓			
CO2		✓	✓			✓	✓				✓	
CO3			✓	✓		✓	✓	✓		✓		✓
CO4											✓	
CO5		✓			✓						✓	✓

CSOESCN	**CYBER FORENSICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To study the fundamentals of Computer Forensics.
- To learn, analyse and validate Forensics Data.
- To study the tools and tactics associated with Cyber Forensics.

UNIT – I Introduction

Computer Forensics Fundamentals – Types of Computer Forensics Technology – Types of Computer Forensics Systems - Vendor and Computer Forensics Services.

UNIT – II Computer Forensics Evidence and Capture

Data Recovery – Evidence Collection and Data Seizure – Duplication and Preservation of Digital Evidence – Computer Image Verification and Authentication.

UNIT – III Computer Forensic Analysis

Discover of Electronic Evidence – Identification of Data – Reconstructing Past Events - Fighting against Macro Threats – Information Warfare Arsenal - Tactics of the Military - Tactics of Terrorist and Rogues – Tactics of Private Companies.

UNIT – IV Information Warfare

Arsenal – Surveillance Tools - Hackers and Theft of Components - Contemporary Computer Crime - Identity Theft and Identity Fraud - Organized Crime & Terrorism - Avenues Prosecution and Government Efforts - Applying the First Amendment to Computer Related Crime - The Fourth Amendment and other Legal Issues.

UNIT – V Computer Forensic Cases

Developing Forensic Capabilities - Searching and Seizing Computer Related Evidence -Processing Evidence and Report Preparation - Future Issues.

TEXT BOOKS :

1. John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", Cengage Learning, 2nd Edition, 2005.
2. Marjie T Britz, "Computer Forensics and Cyber Crime: An Introduction", Pearson Education, 2nd Edition, 2008.

REFERENCES :

1. Marie-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", Jones & Bartlett Learning; 2nd Edition, 2014.
2. Chad Steel, "Windows Forensics", Wiley, 1st Edition, 2006.
3. Majid Yar, "Cybercrime and Society", SAGE Publications Ltd, Hardcover, 2nd Edition, 2013.
4. Robert M Slade, "Software Forensics: Collecting Evidence from the Scene of a Digital Crime", Tata McGraw Hill, Paperback, 1st Edition, 2004.

Course Outcomes :

At the end of this course, the students will be able to

1. Identify the present indicators that a Cyber Security incident has occurred.
2. Collect, Process, Analyze, and present Computer Forensic Evidence.
3. Apply Criminal Justice Methods to Cyber Security and Computer Forensic Investigations.
4. Work in teams to analyze and resolve Cyber Security issues.
5. To identify methods for data recovery and to apply the methods for preservation of digital evidence.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓		✓	✓		✓			
CO2				✓	✓			✓		✓		
CO3	✓	✓	✓	✓		✓					✓	
CO4		✓			✓	✓	✓	✓				✓
CO5		✓	✓		✓						✓	✓

CSOESCN	**SYSTEM MODELING AND SIMULATION**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives :

- To understand the system concept and apply functional modeling method to model the activities of a static system.
- To understand the behavior of a dynamic system and create an analogous model for a dynamic system.
- To understand and simulate the operation of a dynamic system and make improvement according to the simulation results.

UNIT-I Introduction

Simulation Terminologies- Application areas – Model Classification – Types of Simulation- Steps in a Simulation study- Concepts in Discrete Event Simulation – Monte Carlo Simulation - Simulation Examples.

UNIT - II Statistical Models

Concepts – Discrete Distribution- Continuous Distribution – Poisson Process- Empirical Distributions- Queueing Models – Characteristics- Notation – Queueing Systems – Markovian Models- Properties of random numbers- Generation of Pseudo Random numbers- Techniques for generating random numbers-Testing random number generators- Generating Random-Variates- Inverse Transform technique – Acceptance- Rejection technique – Composition and Convolution Method.

UNIT - III Input Modeling

Data collection - Assessing sample independence - Hypothesizing distribution family with data - Parameter Estimation - Goodness-of-fit tests – Selecting input models in absence of data- Output analysis for a Single system – Terminating Simulations – Steady state simulations.

UNIT – IV Model Building

Verification of Simulation Models – Calibration and Validation of Models – Validation of Model Assumptions – Validating Input – Output Transformations.

UNIT – V Simulation Tools

Model Input – High level computer system simulation – CPU – Memory Simulation – Comparison of systems via simulation – Simulation Programming techniques - Development of Simulation models – Simulation Project Management.

TEXT BOOKS :

1. Banks J and John Carson, "Discrete Event System Simulation", Pearson Education, 2010.
2. Geoffrey Gordon, "System Simulation", Second Edition, PHI, 2006.

REFERENCES:

1. Kelton, WD, Sadowski, R, Zupick, Simulation with Arena, McGraw-Hill, 2014.
2. Frank L. Severance, "System Modeling and Simulation", Wiley, 2001.
3. Averill M. Law and W.David Kelton, "Simulation Modeling and Analysis, Third Edition, McGraw Hill, 2006.
4. Jerry Banks, "Handbook of Simulation: Principles, Methodology, Advances, Applications and Practice", Wiley, 1998.

Course outcomes :

At the end of this course, the students will be able to

1. Acquire knowledge of Simulation Terminologies and Classification.
2. Familiarize the idea of Mathematical Models.
3. Familiarize the Simulation Data.
4. Gain experience skills on Verification and Validation of Simulation Models.
5. Familiarize on Simulation Tools and Simulation Project Management.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓			✓	✓				✓			
CO2		✓	✓		✓					✓		
CO3		✓		✓		✓	✓		✓			
CO4						✓	✓	✓			✓	✓
CO5		✓	✓			✓	✓	✓	✓			

CSOESCN	**BIG DATA ANALYTICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course objectives :

- To introduce fundamental techniques and tools required for big data analytics.
- To learn basic tools for statistical analysis, R, and key methods used in machine Learning.
- To learn MapReduce techniques for parallel processing and Hadoop.

UNIT – I Introduction

Data science process – roles, stages in data science project – State of the practice in analytics – Role of data scientists – Key roles for successful analytic project – Main phases of life cycle – Working with data from files – Exploring data – Managing data – Cleaning and sampling for modeling and validation – Challenges of conventional systems – Web data – Evolution of Analytic scalability, analytic processes and tools, Analysis vs reporting – Modern data analytic tools. Introduction to Big Data Platform – Big Data and its importance, Five Vs, Drivers for Big data, Big data analytics, Big data applications.

UNIT – II R Programming

R basics – 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 – Simple programs using R.

UNIT – III Map Reduce

Introduction – Distributed file system – Algorithms using map reduce, Matrix–Vector Multiplication by Map Reduce – Hadoop – Understanding the Map Reduce architecture – Writing Hadoop MapReduce Programs – Loading data into HDFS – Executing the Map phase – Shuffling and sorting – Reducing phase execution.

UNIT – IV Data Analysis Techniques

Linear and logistic regression modeling – Naïve Baye's classifier – Support vector machine – Neural networks – Principal component analysis – Linear Discriminant Analysis – Decision Trees – Fuzzy logic – Clustering Techniques : Hierarchical, agglomerative, K– Means – Associative Rule Mining.

Case Studies: Social Network Analysis – Text analysis –Marketing analysis.

UNIT – V Data Visualization

Documentation and deployment – Producing effective presentations – Introduction to graphical analysis – plot() function – Displaying multivariate data – Matrix plots – Multiple plots in one window – Exporting graph – Using graphics parameters – Visualizations – Visual data analysis techniques, interaction techniques; Systems and applications.

TEXT BOOKS :

1. Nina Zumel, John Mount, “Practical Data Science with R”, Manning Publications, 2014.
2. Chris Eaton, Dirk Deroos et al. , “Understanding Big data ”, McGraw Hill, 2012.

REFERENCES :

1. Big Data & Hadoop, V.K. Jain, Khanna Publishing House, 1st edition, 2016.
2. Big Data Black Book, DT Editorial Services, Wiley India, Dreamtech Press, 2015
3. Data Science & Analytics, V.K. Jain, Khanna Publishing House,1st edition,2018.
4. Beginner’s Guide for Data Analysis using R Programming, Jeeva Jose Khanna Book Publishing; 1st edition, 2018.

Course Outcomes :

At the end of this course, the students will be able to

1. Understand fundamental techniques and tools required for data analytics.
2. Use basic tools for statistical analysis, R, Hadoop, and key methods used in machine learning.
3. Apply MapReduce techniques for parallel processing.
4. Apply fundamental algorithmic ideas to process data, and apply hypotheses and data into actionable predictions.
5. Document and transfer the results, and effectively communicate the findings using visualization techniques.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓		✓	✓	✓			✓	✓	✓		
CO2		✓				✓						
CO3	✓		✓	✓			✓				✓	✓
CO4					✓	✓		✓				✓
CO5	✓	✓	✓		✓	✓		✓		✓		

CSOESCN	**SOCIAL NETWORK ANALYSIS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Course Objectives :

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behavior in social web and related communities.
- To learn visualization of social networks.

UNIT – I Introduction

Development of Semantic Web - Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis - Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT – II Knowledge Representation

Ontology-based knowledge Representation –Resource Description Framework – Web Ontology Language - Modeling and aggregating social network data: State-of-the-art in network data representation - Ontological representation of social individuals – Ontological representation of social relationships - Aggregating and reasoning with social network data – Advanced representations.

UNIT - III Evolution

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks.

UNIT – IV Data Management

Understanding and predicting human behavior for social communities – User data management - Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness - Privacy in online social networks – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and countermeasures.

UNIT – V Graph Theory

Graph theory – Centrality – Clustering – Node - Edge Diagrams – Matrix representation – Visualizing online social networks, Visualizing social networks with matrix - based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare - Collaboration networks – Co-Citation networks.

TEXT BOOKS :

1. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 1st edition, 2010.
2. Peter Mika, "Social Networks and the Semantic Web", Springer, 1st edition, 2007.

REFERENCES :

1. Guandong Xu, Yanchun Zhang and Lin Li, "Web Mining and Social Networking – Techniques and applications", Springer , 1st edition, 2011.
2. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
3. Max Chevalier,Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling", IGI Global Snippet, 2009.
4. John G Breslin, Alexander Passant and Stefan Decker, "The Social Semantic Web", Springer, 2009.

Course Outcomes :

At the end of this course, the students will be able to

1. Know basic notation and terminology used in network science.
2. Work on the internals components of the social network.
3. Model and visualize the social network.
4. Understand the behaviour of the users in the social network.
5. Be able to visualize social networks through various representations.

Mapping of Course Outcomes with Programme Outcomes												
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	✓	✓	✓			✓	✓		✓			
CO2			✓	✓	✓		✓			✓	✓	✓
CO3	✓				✓	✓					✓	✓
CO4	✓	✓		✓			✓	✓	✓			
CO5	✓				✓	✓					✓	✓

HONOUR SUBJECTS

CSHESCN	**SOFTWARE PROJECT MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**4**

Course Objectives :

- To understand the activities in project management.
- Plan effectively the software projects and create project plans which address the challenges of real-world management.
- To impart knowledge on project monitoring and control.
- To study about managing people and teams.

UNIT - I Software Project Planning

Project Definition–Contract Management–Activities Covered By Software Project Management – Overview of Project Planning – Stepwise Project Planning.

UNIT - II Assessment and Evaluation Techniques

Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation.

UNIT - III Project Scheduling and Risk Management

Objectives – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks – Risk Management – Nature Of Risk – Types Of Risk – Managing Risk – Hazard Identification – Hazard Analysis – Risk Planning And Control.

UNIT - IV Monitoring and Managing Contracts

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Priortizing Monitoring – Getting Project Back To Target – Change Control – Managing Contracts – Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms of A Contract – Contract Management – Acceptance.

UNIT - V Organizational Behaviour

Introduction – Understanding Behaviour – Organizational Behaviour: A Background – Selecting The Right Person For The Job – Instruction In The Best Methods – Motivation – The Oldman – Hackman Job Characteristics Model – Working In Groups – Becoming A Team –Decision Making – Leadership – Organizational Structures – Stress –Health And Safety – Case Studies.

TEXT BOOKS :

1. Bob Hughes, Mike Cotterell, Rajib Mall "Software Project Management", 5th edition, Tata McGraw Hill, 2011.
2. Gopalaswamy Ramesh, "Managing Global Software Projects", Tata McGraw Hill, New Delhi, 2006.

REFERENCES :

1. Pankaj Jalote, "Software Project Management in Practice", Pearson Education, reprinted,2009.
2. Walker Royce, "Software Project Management", Pearson Education, 2002.
3. Kelkar Sa, "Software Project Management", PHI Learning, New Delhi, 2013.

CSHESCN	NANO COMPUTING	L	T	P	C
		3	0	0	4

Course objectives :

- To know the structure of Nanocomputing.
- To learn Reliability of Nano computing.
- To understand the concepts of QCA implementation.
- To study the concepts of mobile IP and mobile TCP.

UNIT - I Nano Computing Fundamentals

Introduction - History of Computing – Nano computing - Quantum Computers – Nano computing Technologies - Nano Information Processing - Prospects and Challenges - Physics of Nano computing : Digital Signals and Gates - Silicon Nano electronics - Carbon Nanotube Electronics - Carbon Nanotube Field-effect Transistors – Nanolithography.

UNIT – II Nano Computing with Imperfections

Introduction – Nano computing in the Presence of Defects and Faults - Defect Tolerance - Towards Quadrillion Transistor Logic Systems.

UNIT – III Reliability of Nano Computing

Markov Random Fields - Reliability Evaluation Strategies - NANOLAB - NANOPRISM - Reliable Manufacturing and Behavior from Law of Large Numbers.

UNIT – IV Nano Scale Quantum Computing

Quantum Computers - Hardware Challenges to Large Quantum Computers - Fabrication, Test, and Architectural Challenges - Quantum-dot Cellular Automata (QCA) - Computing with QCA - QCA Clocking - QCA Design Rules.

UNIT-V QCA Designer and QCA Implementation

Basic QCA Circuits using QCA Designer - QCA Implementation - Molecular and Optical Computing: Molecular Computing - Optimal Computing - Ultrafast Pulse Shaping and Tb/sec - Data Speeds.

TEXT BOOKS :

1. Sahni V. and Goswami D., Nano Computing, McGraw Hill Education Asia Ltd., 2008.

REFERENCES :

2. Reza B, Far, "Mobile Computing Principles:, Designing And Developing Mobile Application With UML and XML", Cambridge University Press, 2005.
3. William C.Y.Lee, "Mobile Communication Design Fundamentals", John Wiley, 2010.
4. William Stallings,"Wireless Communications and Networks", Pearson Education, 2009.

CSHESCN	ARTIFICIAL INTELLIGENCE	L	T	P	C
		4	0	0	4

Course Objectives :

- Search and discover intelligent characteristics of existing AI projects.
- Map a new problem and show different search strategies for that problem.
- Program a new game/ problem in Prolog and evaluate different Knowledge
- representation schemes for typical AI problems.
- Design and implement an AI problem to be solved using Machine Learning Techniques.
- Design and implement futuristic AI applications.

UNIT - I Introduction

What is Artificial Intelligence-Problems, Problem spaces and search- Heuristic Search Techniques. Intelligent Agents: Agents and Environments-Rationality-Nature of Environments – Structure of Agents.

UNIT - II Knowledge Representation and Reasoning

Issues in knowledge representation-Predicate logic-Symbolic reasoning under uncertainty-statistical reasoning-weak,strong slot and filter structures. Ontological Engineering-Categories and Objects-Actions, situations and Events.

UNIT - III Problem Solving Methods

Problem solving by searching : Problem solving agents –uninformed search strategies. Informed search: A* search, Heuristic Search - Local search algorithms and optimization problems. Constraint satisfaction problems. Adversarial search: Games, Alpha-beta Pruning.

UNIT - IV Advanced Topics

Planning – understanding – natural language processing – Parallel and distributed AI – Learning – Connectioninst models – Expert Systems – Fuzzy logic systems. Learning: Inductive learning – Learning decision trees – ensemble learning – Explanation based learning – Reinforcement Learning.

UNIT - V Applications

Communication as action – syntactic analysis – augmented grammars – semantic interpretation – ambiguity and disambiguity – induction. Probabilistic language models – information retrieval – information extraction – machine translation – Perception – Robotics.

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach‖, Prentice Hall, Third Edition, 2009.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, 3rd Edition, Tata McGraw Hill, 2010.

REFERENCES:

1. M. Tim Jones, Artificial Intelligence: A Systems Approach, Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, The Quest for Artificial Intelligence‖, Cambridge University Press, 2009.
3. Gerhard Weiss, Multi Agent Systems‖, Second Edition, MIT Press, 2013.
4. David L. Poole and Alan K. Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.

CSHESCN	GRAPH THEORY	L	T	P	C
		3	0	0	3

Course Objectives:

- To comprehend graphs as modeling and analysis tool.
- To introduce various data structures with graph theory.
- To learn fundamentals behind principle of counting and combinatory.

UNIT – I Introduction

Graphs – Introduction – Isomorphism – Sub Graphs – Walks, Paths, Circuits – Connectedness– Components – Euler Graphs – Hamiltonian paths and circuits – Trees – Properties of Trees– Distance and Centers in Tree – Rooted and Binary Trees.

UNIT – II Trees, Connectivity & Planarity

Spanning Trees – Fundamental Circuits – Spanning Trees in a Weighted Graph – Cut Sets – Properties of Cut Set – All Cut Sets – Fundamental Circuits and Cut Sets – Connectivity and Separability – Network Flows – 1-Isomorphism – 2-Isomorphism – Combinational and Geometric Graphs – Planer Graphs – Different Representation of a Planer Graph.

UNIT – III Matrices, Clouring and Directed Graph

Chromatic Number – Chromatic Partitioning – Chromatic Polynomial – Matching – Covering – Four Color Problem – Directed Graphs – Types of Directed Graphs – Digraphs and Binary Relations – Directed Paths and Connectedness – Euler Graphs

UNIT – IV Permutations & Combinations

Fundamental Principles of Counting - Permutations and Combinations - Binomial Theorem - Combinations with Repetition - Combinatorial Numbers - Principle of Inclusion and Exclusion - Derangements - Arrangements with Forbidden Positions.

UNIT –V Generating Functions

Generating Functions - Partitions Of Integers - Exponential Generating Function - Summation Operator - Recurrence Relations - First Order and Second Order – Non- Homogeneous Recurrence Relations - Method of Generating Functions.

TEXT BOOKS :

1. Narsingh Deo, Graph theory, Prentice Hall India, 2008.
2. Douglas B. West, Introduction to Graph Theory, Prentice Hall India Ltd., 2001

REFERENCES :

1. H. Cormen, C. E. Leiserson and R. L. Rivest, "Introduction to Algorithms," McGraw-Hill, 2007
2. Baase, Computer algorithms, Pearson India 2008.
3. "Graph Theory" by Frank Harary

CSHESCN	DEEP LEARNING	L	T	P	C
		3	0	0	3

Course Objectives:

- To present the mathematical, statistical and computational challenges of building neural networks.
- To study the concepts of deep learning.
- To introduce dimensionality reduction techniques.
- To enable the students to know deep learning techniques to support real-time applications.
- To examine the case studies of deep learning techniques.

UNIT - I Introduction

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression) - Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates

UNIT - II Concepts of Deep Learning

History of Deep Learning- A Probabilistic Theory of Deep Learning- Backpropagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep vs Shallow Networks- Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning

UNIT - III Metric Learning

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyper parameter optimization

UNIT - IV Optimization

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization- Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience

UNIT - V Advanced Techniques

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection- BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions

TEXT BOOKS :

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.

REFERENCES :

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
2. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

CSHESCN	OPERATION RESEARCH	L	T	P	C
		3	0	0	3

Course objectives:

- To introduce the basic concepts of linear programming.
- To educate on the advancements in Linear programming techniques.
- To introduce non-linear programming techniques.
- To introduce the interior point methods of solving problems.
- To introduce the dynamic programming method.

UNIT-I Linear Programming

Introduction-formulation of linear programming model -Graphical solution– solving LPP using simplex algorithm –Revised Simplex Method.

UNIT-II Advances in LPP

Dualit theory-Dual simplex method-Sensitivity analysis–-Transportation problems–Assignment problems-Traveling sales man problem-Data Envelopment Analysis

UNIT-III Non-linear Programming

Classification of Non Linear programming –Lagrange multiplier method– Karush –Kuhn Tucker conditions–Reduced gradient algorithms –Quadratic programming Method –Penalty and Barrier method.

UNIT-IV Interior Point Methods

Karmarkar' algorithm –Projection Scaling method–Dual affine algorithm–Primal affine algorithm Barrier algorithm.

UNIT-V Dynamic programming

Formulation of Multi stage decision problem–Characteristics–Concept of sub - optimization and the principle of optimality –Formulation of Dynamic programming –Backward and Forward recursion –Computational procedure –Conversion of final Value problem in to Initial value problem

TEXT BOOKS :

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2000.
2. R.Panneerselvam, "Operations Research", PHI, 2006 3. Hamdy ATaha, "Operations – Research–An Introduction", Prentice Hall India, 2003.

REFERENCES:

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley, 2002.
2. Ronald L.Rardin,"Optimization in Operation Research" Pearson Education Pvt.Ltd., New Delhi, 2005.

CSHESCN	PARALLEL AND DISTRIBUTED ALGORITHMS	L	T	P	C
		3	0	0	3

Course objectives :

- To understand the need and fundamentals of parallel computing paradigms.
- To learn the nuances of parallel algorithm design.
- To understand the programming principles in parallel and distributed
- computing Architectures.
- To learn few problems those are solved using parallel algorithms.

UNIT – I Introduction to Parallel Computing

Scope of Parallel Computing –Parallel Programming Platforms –Implicit Parallelism –Limitations of Memory System Performance –Control Structure of Parallel platforms –Communication Model of Parallel Platforms –Physical Organization of Parallel Platforms –Communication Costs in Parallel Machines – Impact of Process - Processor Mapping and Mapping Techniques .

UNIT – II Parallel Algorithm Design

Preliminaries –Decomposition Techniques –Characteristics of Tasks and Interactions –Mapping Techniques for Load Balancing –Methods for Containing Interaction Overheads –Parallel Algorithm Models –Basic Communication Operations –One -to-All Broadcast and All-to-One Reduction –All to -All Broadcast and Reduction –All -Reduce and Prefix Sum Operations –Scatter and Gather –All - to-All Personalized Communication -Circular Shift –Improving the Speed of some Communication Operations.

UNIT – III Programming using Message Passing and Shared Address Space

Principles of Message Passing Programming –Building Blocks –Send and Receive Operations –MPI –Message Passing Interface –Topologies and Embedding – Overlapping Communication with Computation –Collective Communication and Computation Operations –Groups and Communicators –POSIX thread API –

OpenMP: a Standard for Directive based Parallel Programming –Applications of Parallel Programming -Matrix-Matrix Multiplication –Solving Systems of Equations– Sorting Networks -Bubble Sort Variations –Parallel Depth First Search.

UNIT – IV Distributed Computing Paradigm

Paradigms for Distributed applications–Basic algorithms in Message passing Systems–Leader Election in Rings –Mutual Exclusion in Shared Memory.

UNIT – V Fault Tolerant Design

Synchronous Systems with Crash Failures–Byzantine Failures–Impossibility in Asynchronous Systems -Formal Model for Simulation –Broadcast and Multicast– Specification of a Broadcast Service –Implementing a Broadcast Service –Multicast in Groups -Distributed Shared Memory–Linearizable–Sequentially Consistent Shared Memory –Algorithms.

TEXT BOOKS :

1. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, ―Introduction to Parallel Computing‖, 2nd Edition, Pearson Education, 2009.
2. Haggit Attiya and Jennifer Welch, ―Distributed Computing – Fundamentals, Simulations and Advanced Topics‖, 2nd Edition, Wiley, 2012.

REFERENCES :

1. Michael Quinn, ―Parallel Computing -Theory and Practice‖, Second Edition, Tata McGraw Hill, 2002.
2. Norman Matloff, ―Parallel Computing for Data Science –With Examples in R, C++ and CUDA‖, Chapman and Hall/CRC, 2015.
3. Wan Fokkink, ―Distributed Algorithms: An Intuitive Approach‖, MIT Press, 2013.
4. M.L. Liu, ―Distributed Computing –Principles and Applications‖, 1st Edition, Pearson Education, 2011.

CSHESCN	DIGITAL WATERMARKING AND STEGANOGRAPHY	L	T	P	C
		3	0	0	3

Course Objectives :

- To provide the basic knowledge of various methods in watermarking.
- To know the current watermarking techniques.
- To understand the types of watermarking and optimization techniques.
- To understand the basic principles and different types of steganography.
- To make them understand the steganalysis.

UNIT-I Watermarking

Watermarking techniques– History and terminology – Basic Principles – Applications –Requirements of algorithmic design issues: Imperceptibility, Robustness, Security– Evaluation and benchmarking of watermarking system.

UNIT-II Survey of Current Watermarking Techniques

Cryptographic and psycho visual aspects – Choice of a workspace – Formatting the watermark bits – Merging the watermark and the cover – Optimization of the watermark receiver – Extension from still images to video.

UNIT-III Steganography

Principles of Steganography – Frameworks for secret communication – Security of Steganography systems – Information hiding in noisy data – Adaptive versus non-Adaptive Algorithms – Active and Malicious Attackers – Examples of Invisible communications.

UNIT-IV Techniques for Steganography

Stegnographic techniques – Substitution system and bit plane tools – Transform domain techniques – Spread spectrum and information hiding – Statistical Steganography – Distortion and cover generation techniques.

UNIT-V Steganalysis

Overview of steganalysis- Statistical Properties of Images - Visual Steganalytic System -IQM-Based Steganalytic System - Learning Strategies - Frequency-Domain Steganalytic System.

Text books :

1. Stefan Katzenbelsser and Fabien A. P. Petitcolas, "Information Hiding Techniques for Steganography and Digital Watermarking", Artech House Publishers, 2004.
2. Frank Y. Shih, "Digital Watermarking and Steganography: fundamentals and techniques", CRC Press, 2007.

REFERENCES :

1. Jessica Fridrich, "Steganography in Digital Media: Principles, Algorithms, and Applications", Cambridge University Press, 2010.
2. Abbas Cheddad, Vdm Verlag and Dr. Muller, "Digital Image Steganography: Concepts, Algorithms and Applications", Aktienge sells Chaft & Co. Kg, 2009.
3. Ingemar Cox, Matthew Miller, Jeffrey Bloom, Jessica Fridrich and Ton Kalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, 2007.