REGULATIONS, COURSE STRUCTURE AND SYLLABUS

(Aligned with AICTE Model Curriculum 2018-19)

SITE18 Regulations

For

I & II B.Tech.

Computer Science and Engineering

&

Information Technology

With effective from the Academic Year 2018-19

...Values We Live...

sasi autonomous

INSTITUTE OF TECHNOLOGY & ENGINEERING

Accredited by NAAC with "A" Grade
Recognised by UGC under section 2(f) &12(B)
Approved by AICTE - New Delhi
Permanently Affiliated to JNTUK, SBTET
Ranked as "A" Grade by Govt. of A.P.

Our Management…

VISION

Confect as a premier institute for professional education by creating technocrats who can address the society`s needs through inventions and innovations.

MISSION

- Partake in the national growth of technological, industrial arena with societal responsibilities
- Provide an environment that promotes productive research
- Meet stakeholder’s expectations through continued and sustained quality improvements

QUALITY POLICY

Sasi Institute of Technology and Engineering is committed to achieve global standards and excellence in teaching, research and consultancy by creating conducive environment in the fields of technological, managerial studies with professionalism and global outlook ensuring continuous improvement.

From Chairman's Desk…

I am greatly honored to serve the society as President of Sasi Institute of Technology & Engineering at Tadepalligudem.

At Sasi, students are trained to become not only efficient Engineers but also good people who render great service to the humanity in all aspects. As production, software and service industries are shifting to India, our country needs lakhs of Engineers to fulfill the demand. These Engineers need to be creative in thinking, innovative in execution, proficient in oral and written communication, able to work for longer hours effectively in teams, on multi - disciplinary projects. In fact, these are our core teaching values at our Sasi Institute of Technology & Engineering.

Chairman's Profile

Shri Burugupalli Venu Gopala Krishna, the President, Sasi Educational Society is a well known personality in the field of education for the last 35 years in coastal districts of Andhra Pradesh. He believes in hard work and always says Success is measured not by what you create for yourself but by what you leave behind.

As a man of integrity and honesty, he sets an example for all and loves to stay with the students in the campus, motivating and moulding them into ideal students. In the highly competitive field of education, it may be a glorious dream for many an educationist to see his school as the best and get an award at least once in life. But Mr. B. Venu Gopala Krishna has outsmarted everyone by winning the state best school award four times consecutively. It is testimony for his lifelong devotion for the cause of education.

Mr. B. Venu Gopala Krishna, the son of a small farmer, is now a lord of an educational empire which has more than 15, 000 students. One can understand well, the meaning of commitment and dedication when one walks through the corridors of the schools and the colleges. By starting his school in the small village of Velivennu, he has proved it loud and clear that wherever you work with commitment and dedication, you will make a mark and attract the attention of millions.

The schools he started get the best school awards consecutively, the junior colleges he established produce many national and state level ranks year after year, but his thirst for service in the field of education still remains unquenchable and insatiable. It is no exaggeration to say that he stands as a role model for many young enthusiastic educationists. With his leadership, Sasi English Medium School has bagged state best school award five times in a row!. He received TVN - KIDAO - Outstanding Education Institution- 2014 award for Sasi Institute of Technology & Engineering from National Institution for Quality and Reliability, Chennai.

He is actively involved in social service and generous in donating a lot to CMs Relief Fund, Cargil Relief Fund, Helpage India and other social service organizations. He is keen in rural development and thus in the process he established most of the educational institutions in rural areas.

From Vice Chairman's Desk…

I take great pride in welcoming you to our campus. We assure a climate that encourages learning and personal growth. We value commitment to excellence in all we do.

The aim of institution is to teach how to think, than what to think and how to learn than what to study. Education is the very way of our life and when it improves, life does too. Our motto is to provide a quality education to rural people which we are doing since 1980.

Sasi Educational Institutes is recognized institution offering excellent school, college undergraduate, graduate & professional education through 12 schools and colleges to nearly 10, 000 students. Sasians work every day to advance the common good in uncommon ways. We teach, we explore and We discover. We collaborate and lead. We innovate, inspire, and empower. We achieve our potential and create circumstances that help our students and others achieve theirs.

Our Founder's words are inspiration to us " No riches buy knowledge: but, knowledge owns any riches in the world." I know SASI is still learning to leap. It has many heights to climb up. It has long distances to walk, But I assure you, with the co-operation and faith of that you have laid on us, that we would work for your best satisfaction during the times coming a head.

From Secretary & Correspondent's Desk…

SITE is a proud mission driven community providing a world class education, celebrating the fact that each student is different, as a person and as a learner.

We believe that powerful learning and teaching occurs under a shared spirit of respect which creates a passionate schooling experience recognized for its warmth, energy and excellence.

"I cannot teach anybody anything, I can only make them think"-Socrates. Open mindedness, a multicultural orientation, independence, a global outlook, multiple intelligences and abilities – these are the premium qualities needed today. As a 21st century organization, the institution desires to set an approach to learning that incorporates inquiry, research, analytical thinking and an ethical approach that becomes a lifetime habit. The students are helped to focus on confidence building, while nurturing a strong sense of social and environmental responsibility through academic and co-curricular activities as we believe, like Paul "Bear" Bryant that, “It is not the will to win, but the will to prepare to win that makes the difference”.

I strongly believe that education is a collaborative effort that involves professional administrators, committed teachers and motivated students. We dedicate ourselves as professional administrators in creating a dynamic education programme empowering the students in a global perspective.

From Principal’s Desk…

Teaching & learning process is effective, unparallel and effectively implemented by the dynamic Head of the Departments with the support of the respective faculty members.

Special programs like seminars on improving learning capabilities, continuous training to face the market challenges, industrial visits, arranging guest faculty, seminars to improve the communication, technical skills and guidance for placements, GRE, TOEFL, examinations.

We provides amenities like training for placement, internet(24x7), hostel for boys and girls, medical facility, additional training to the hostel students, transport from every corner of the district, canteen and parent interaction cell for continuous information and guidance.

Principal's Profile

Dr. K.Bhanu Prasad, M.E., Ph.D., The Principal of Sasi Institute of Technology & Engineering, is an eminent achiever in his vast service of 34 years. He is a pathfinder for both the students and for the development of the Institution. He completed his Doctorate in Electronics Engineering - Sri Krishnadevaraya University, Anantapur, Andhra Pradesh. His

Professional Membership in Scientific and Professional Societies are as follows:-

- Fellow - Associate Member of The Institution of Engineers
- Fellow - Institution of Electronics and Telecommunication Engineers
- Senior Member - MICCPI

He has flourished around 14 National & International journal publications and presented in 18 conferences.

Chapter-I

UG Regulations

Chapter – I

B.Tech. Regulations

1.1. Short Title and Commencement

The regulations listed under this head are common for all degree level under graduate programs (B.Tech.) offered by the college with effect from the academic year 2018-19 and they are called as "SITE18" regulations.

The regulations here under are subject to amendments as may be made by the Academic Council of the college from time to time, keeping the recommendations of the Board of Studies in view. Any or all such amendments will be effective from such date and to such batches of candidates including those already undergoing the program, as may be decided by the Academic Council.

1.2. Definitions

a. "Commission" means University Grants Commission (UGC)

b. "Council" means All India Council for Technical Education (AICTE)

c. "University" Means Jawaharlal Nehru Technological

University Kakinada (JNTUK)

d. “College” means Sasi Institute of Technology & Engineering, Tadepalligudem.

e. “Program” Means any combination of courses and /or requirements leading to award of a degree

f. “Course” Means a subject either theory or practical identified by its course title and code number and which is normally studied in a semester.

g. For example, (Data Structures) is a course offered at third semester of B.Tech (CSE) and its code is (18CSCST3020)

h. “Degree” means an academic degree conferred by the university upon those who complete the undergraduate curriculum

i. “Regular Student” means student enrolled into the four year programme in the first year

j. “Lateral entry Students” Means student enrolled into the four year programme in the second year

1.3. Academic Programs

1.3.1. Nomenclature of Programs

The nomenclature and its abbreviation given below shall continue to be used for the degree programs under the University, as required by the Council and Commission. The name of specialization shall be indicated in brackets after the abbreviation. For e.g. UG engineering degree in Mechanical Engineering program is abbreviated as B.Tech. (ME). Bachelor of Technology (B.Tech.) degree program offered in:

1. Civil Engineering (CE)
2. Computer Science and Engineering (CSE)
3. Electronics and Communication Engineering (ECE)
4. Electrical and Electronics Engineering (EEE)
5. Information Technology (IT)
6. Mechanical Engineering (ME)

1.3.2. Duration of the Programs

- **Normal Duration**
  - The duration of program for regular students shall be four years consisting of eight semesters
  - The duration of the program for lateral entry students who are admitted in second year shall be three years consisting of six semesters.
- **Maximum Duration**
  - The maximum period which a student can take to complete a full time program shall be double the

normal duration of the program, i.e., for regular students eight years.

- For lateral entry students the maximum duration is six years.

- **Minimum Duration of a Semester**
  - Each semester consists of a minimum of 90 instruction days with about minimum 25 and maximum 35 contact periods per week

1.4. Admission Criteria

The eligibility criteria for admission into UG engineering programs are as per the norms approved by government of Andhra Pradesh from time to time. The sanctioned seats in each program in the college are classified into CATEGORY-A and CATEGORY-B at first year level and Lateral Entry at second year level.

- **CATEGORY – A Seats:** These seats will be filled as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – B Seats:** These seats will be filled by the College as per the norms approved by the Government of Andhra Pradesh.
- **CATEGORY – Lateral Entry Seats**: Lateral entry

candidates shall be admitted into the Third semester directly as per the norms approved by government of Andhra Pradesh. The percentages of Category-A, Category-B and Lateral Entry Seats are decided time to time by the Government of Andhra Pradesh.

1.5. Credit System

Credit means quantifying and recognizing learning. Credit is measured in terms of contact hours per week in a semester.

1.5.1. Credit Structure

A typical Credit Structure for course work (B.Tech Program) based on the above definition is given in the Table 1.

Table 1: Typical Credit Allocation Scheme for Course

Lectures (L)	Tutorials (T)	Practical (P)	Total Periods	Total Credits
3	1	0	4	3
0	0	3	3	1.5

1.5.2. Semester Course Load

The average course load shall be fixed at 20 credits per semester with its minimum and maximum limits being set at 17.5 and 23 credits, respectively.

1.5.3.Grade Points and Letter Grade for a Course

The grade points and letter grade will be awarded to student in each course based on his/her performance as per the grading system shown in the Table 2.

Table 2: Grade points and letter grade scheme for a course

Theory	Lab/Project	Grade Points	Letter Grade
85-100%	85-100%	10	Ex
75-84%	75-84%	9	A+
70-74%	70-74%	8	A
65-69%	65-69%	7	B+
60-64%	60-64%	6	B
50-59%	55-59%	5	C
40-49%	50-54%	4	D
< 40%	< 50%	0	F (Fail)

1.5.4.Semester Grade Points Average (SGPA)

The performance of each student at the end of the each semester is indicated in terms of SGPA. The SGPA is calculated as shown in eq.1

$$\text{SGPA}= \frac{CR*GP}{\text{CR (for all courses offered in semester)}} \quad \text{--- (1)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

SGPA is calculated for the candidates who passed all the courses in that semester.

1.5.5.Cumulative Grade Point Average (CGPA)

The Cumulative Grade Point Average is a calculation of the average of all courses required for obtaining the degree. The CGPA is calculated as shown in eq.2

$$\text{CGPA}= \frac{CR*GP}{\text{CR (for all courses offered in semester)}} \quad \text{--- (2)}$$

Where CR = Credits of a course

GP = Grade points awarded for a course

1.6. Curriculum Framework

1.6.1. General Issues

- Curriculum framework is important in setting the right direction for a Degree program as it takes into account the type and quantum of knowledge necessary to be acquired by a student to qualify for a award in his/her chosen branch or specialization.
- Besides, this also helps in assigning the credits for each course, sequencing the courses semester-wise and finally arriving at the total number of courses to

be studied and the total number of credits to be earned by a student to fullfil the requirements for conferment of degree.

- Each theory course shall consist of five units.

1.6.2. Curriculum Structure

The curriculum structure is designed in such a way that it facilitates the courses required to attain the expected knowledge, skills and attitude by the time of their graduation as per the needs of the stakeholders. The curriculum structure consists of various course categories (as described in 1.6.3 to 1.6.9) to cover the depth and breadth required for the program and for the attainment of program outcomes of the corresponding program. Each Programme of study will be designed to have 40-45 theory courses and 16-18 laboratory courses. The distribution and types of courses offered from the above is indicated in the following table 3.

1.6.3. Induction Program

The Induction Program for two weeks is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing competition and making them work for excellence, promote bonding within them, build

Table 3: Comparison of Number of credits given by AICTE and Approved credits

S. No.	Category	No. of Credits									
		ECE		EEE		CSE/IT		ME		CE	
		AICTE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approved	AICTE	Approved
1	Humanities and Social Sciences	12	11	12	11	12	11	12	11	12	08
2	Basic Science courses	25	23	26	25	24	26	25	26	26	26
3	Engineering Science courses	24	23	20	20	29	29.5	24	23	29	24.5
4	Professional Core courses	48	56	53	62	49	48.5	48	55	47	56.5
5	Professional Elective Courses	18	20	18	15	18	18	18	18	23	21
6	Open elective courses	18	12	18	12	12	12	18	12	11	9
7	Project work , Seminar and Internship	15	15	11	15	15	15	15	15	12	15
8	Mandatory Courses	-	-	-	-	-	-	-	-	-	-
	Total Credits	**160**	**160**	**158**	**160**	**159**	**160**	**160**	**160**	**160**	**160**

relations between teachers and students and building of character. The Universal Human Values component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college. It also connects students with each other and with teachers so that they can share any difficulty they might be facing and seek help. Induction Program covers

- Physical activity
- Creative arts
- Universal human values
- Literary and Proficiency modules
- Lectures by Eminent People
- Visits to local Areas & Familiarization to Dept./Branch & Innovations

1.6.4. Institutional Core

Institutional Core courses give the knowledge, skills and attitude expected in UG engineering graduates of all programs. The courses offered under this category are:

1. **Humanities and Social Sciences**

   Humanities and Social Science Courses shall include Technical English, Constitution of India, Professional Ethics and Human Rights, Environmental Studies, Personality Development & Professional Communication, Management Science, Engineering Economics and Financial Management and English Language Communication Skills Lab.

2. **Basic Sciences**

   Science courses shall include Engineering Physics, Engineering Chemistry, Engineering Physics Lab, Engineering Chemistry Lab, Engineering Mathematics and Biology for engineers

3. **Engineering Sciences**

   Engineering Science courses shall include Programming for Problem Solving, Basic Electrical Engineering, Basic Electronics Engineering, Basic Electronics, Engineering Mechanics, Programming for Problem Solving Lab, Basic Electrical Engineering Lab, Engineering Drawing and Workshop / Manufacturing Practice

1.6.5. Program Core

The program core consists of set of courses considered necessary for the students of the specific program. The courses under this category should satisfy the programs specific criteria prescribed by the appropriate professional societies.

1.6.6. Program Electives

The program electives are set of courses offered in the program which covers depth and breadth to further strengthen their knowledge. The students may register for appropriate electives offered in the program based on their area of interest.

1.6.7. Open Electives

The students are expected to learn the course offered under this category under interdisciplinary.

1.6.8. Industry Interaction

- Internships/Mini Project
  - The students are expected to do internship of minimum 3 weeks duration in the industry approved by respective Head of the Department. It carries two credits.

1.6.9. Student Practice

Student Practice Courses are aimed at improving their professional competency. Student will have to participate successfully in the activities listed below.

Student shall participate in any two events from (a) one and any one activity from [b – d], before completion of 6th semester

a) Co-curricular participation
   - Student should have participated in Technical Quizzes/Student paper contest/ Seminars/ Conferences etc., approved by the department.

b) National Service Scheme (NSS)/ National cadet Corps(NCC)/Yoga Practice
   - Student should have enrolled as a member of NSS at least for one year.

c) Games and Sports
   - Participation in the university level and above competitions.

d) Art and Cultural
   - Participation in the university level and above competitions.

1.7. Course Numbering Scheme

The Course number code consists of 11 alphabets. A typical course number code is illustrated in the following Figure-1.

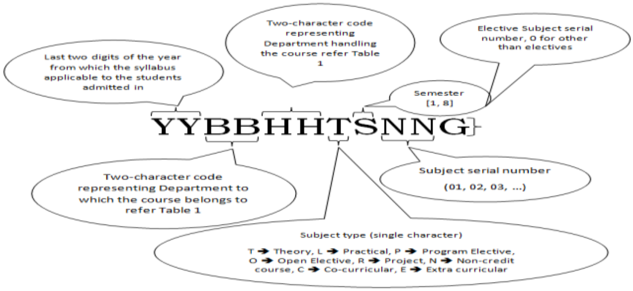


Figure 1: Course Numbering Scheme

The department codes are in given in following table 4.

Table 4: Department Codes

Department	Two-character code
Civil Engineering	CE
Electrical & Electronics Engineering	EE
Mechanical Engineering	ME
Electronics & Communications Engineering	EC
Computer Science Engineering	CS
Information Technology	IT
Management Science	MS
Mathematics	MA
Physics	PH
Chemistry	CH
English	EG
Biology	BI
Common to All Branches	CM

Example: STLD in 3rd semester for ECE with S.No 2

Course Code: 18ECECT3020

1.8. Examinations and Scheme of Evaluation

- **Continuous Evaluation (CE),** to be conducted by the course faculty/course coordinator all through the semester, and, to include midterm test, assignments, seminar, project and other means covering the entire syllabus of the course.
- **Semester End Examination (SE)**, to be conducted by chief controller of examinations at the end of a semester, as per the academic calendar and to include a written examination for theory courses and practical/project examination with built-in oral part for laboratory/project courses.

1.9. Continuous Evaluation (CE)

1.9.1. Theory Courses

- **Internal Evaluation**
  - For each theory course there shall be continuous evaluation for 30 marks. Continuous evaluation for theory courses consists of three components, namely, home assignment, mid-term examination and Class test.
  - 5 marks in each theory course shall be allotted for home assignments and Class tests. The home assignments are to be decided by the course

coordinators. There shall not be an overlap or repetition of questions/problems of home assignments with those of class tests. Separate problems are to be given for the home assignments for five marks to provide broadened exposure to the subject.

- Two midterm examinations each for 20 (15 marks for conventional paper and 5 marks for objective paper carrying 20 questions through online) will be conducted 90 minutes of theory and 20 minutes of online exam.
- The question paper shall be given in the following pattern.
  - ➢ For each midterm examination 50% syllabus should be completed. There shall be five questions considering two questions from each unit. Student should answer one question from each unit.
  - ➢ Average of two midterm exams + average of two home assignments + average of two class tests will be the final midterm examination marks.
- For the drawing subjects (such as Engineering

Graphics, Machine Drawing), the distribution shall be 30 marks for internal evaluation (15 marks for day – to – day work, 10 marks for mid term examinations and 5 marks for Class test)

- **External Evaluation**
  - The Semester end examinations shall be conducted for 3 hours duration at the end of the semester for 70 marks. The question paper shall be given in the following pattern:
  - **Part-A:** Shall contain 10 questions of one mark each. A minimum of two Questions will be given from each unit of the syllabus out of five units.
  - **Part-B:** There shall be two questions from each unit with internal choice. Each question carries 12 marks. Each course shall consist of five units of syllabus.

1.9.2. Laboratory Courses

- **Internal Evaluation**
  - For Laboratory courses there shall be continuous evaluation during the semester for 50 marks and semester end examination for 50

marks. The distribution of continuous evaluation is given in the Table 5:

Table 5: Continuous Evaluation for laboratory courses

S.No.	Criteria	Marks
1	Day to Day work	20
2	Record	10
3	Internal Examination	20
	Total	50

- **External Evaluation**

  - The semester end examination for laboratory courses shall be conducted for three hour duration at the end of semester for 50 marks. The distribution of marks shall be as shown in Table 6.

Table 6: Scheme of Evaluation of laboratory

S.No.	Criteria	Marks
1	Procedure / Algorithm & Program	15
2	Experiment/ Program Execution	15
3	Result Analysis	10
4	Viva-Voce	10
	Total	50

  - Each semester end lab examination shall be evaluated by an external examiner along with an internal examiner. The average of the marks awarded by internal and external examiners shall be taken into consideration.

1.9.3. Term Paper and Mini Project

- **Internal Evaluation**

For Term Paper / Mini Project there shall be continuous evaluation during the semester for 50 marks and semester end evaluation for 50 marks. The distribution of continuous evaluation is given in the Table 7:

Table 7: Continuous Evaluation

S.No.	Criteria	Marks
1	Day to Day Assessment	20
2	Two Seminars	15+15
	Total	50

- **External Evaluation**

The distribution of Semester end examination marks for Term Paper and Mini Project is given in the Table 8. The semester end examination shall be evaluated by program coordinator and senior faculty nominated by the chief controller of examinations.

Table 8: Semester end evaluation of Term Paper and Mini Project

S.No.	Criteria	Marks
1	Report	30
2	Seminar/Project Demonstration	20
	Total	50

1.9.4. Major Project Phase-I

- **Internal Evaluation**

  For major Project phase-I there shall be continuous evaluation during the semester for 100 marks. The student has to complete problem formation, literature survey and analysis and design of the project. The continuous evaluation for the Major Project shall be on the basis of two seminars by each student on the topic of his/her project. These seminars are evaluated by project review committee. In addition to this the project guide will evaluate for day to day performance. The project review committee shall consist of Head of Department, program coordinator and one senior faculty member of department. The distribution of marks is given in the Table 9:

Table 9: Continuous Evaluation for major project Phase-I

S.No.	Criteria	Marks
1	Two Seminars	15+15
2	Day to Day Assessment	20
3	Project Review Committee	50
	Total	100

1.9.5.Major Project Phase-II

- **Internal Evaluation**

  For major Project Phase -II there shall be continuous evaluation during the semester for 100 marks and semester end evaluation for 100 marks. The student has to complete software/Hardware implementation, Testing and calibration and final report. The continuous evaluation for the Major Project phase-II shall be on the basis of two seminars by each student on the topic of his/her project. These seminars are evaluated by project review committee. In addition to this the project guide will evaluate for day to day performance. The project review committee shall consist of Head of Department, program coordinator and one senior faculty member of department. The distribution of marks is given in the Table 10

Table 10: Continuous Evaluation for major project

S.No.	Criteria	Marks
1	Two Seminars	30+30
2	Day to Day Assessment	40
	Total	100

- **External Evaluation**
  - The Semester end examination for major project work shall be evaluated for 100 marks by a committee consisting of an external examiner, Head of the Department and project guide. The evaluation of project work shall be conducted at the end of the VIII Semester.
  - The average of the marks awarded by the committee members shall be taken into consideration in case of variation among the members.
  - The evaluation of 100 marks is distributed as given in Table 11:

Table 11: Semester end evaluation of Major Project

S.No.	Criteria	Marks
1	Report	30
2	Presentation	35
3	Project Demonstration/Execution	35
	Total	100

1.9.6. Self-Learning Courses

If none of the program offering program elective or open elective or if few students opt an elective then that subject will be considered as self learning course with the prior approval of the Head of the department and principal.

The semester end examinations for courses under this category are evaluated for 70 marks. The question paper shall be set as described in theory courses by course coordinator and same is to be given to the controller of examinations. The evaluation of the semester end examination will be carried by the course coordinator.

1.9.7. Industry Interaction / Industry offered Courses/ Internships

The candidate shall submit the comprehensive report to the department. The report will be evaluated for 100 marks by the project review committee.

1.10. Conditions for Pass

A candidate shall be declared to have passed in individual theory/drawing course if he/she secures a minimum of 40% aggregate marks (Continuous Evaluation and semester end examination marks put together), subject to a minimum of 35% marks in semester end examination.

A candidate shall be declared to have passed in individual lab/project course if he/she secures a minimum of 50% aggregate marks (Continuous Evaluation and semester end examination marks put together), subject to a minimum of 40% marks in semester end examination.

The student has to pass the failed course by appearing the supplementary examination as per the requirement for the award of degree. On passing a course of a program, the student shall earn assigned credits for that Course.

1.10.1 Withholding of Results

If the student has not paid any dues to the college or if any case of malpractice or indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester. His/her degree will be withheld in such cases.

1.11. Criteria to Attend Semester End Examination and Promotion to Higher Semester

1.11.1 Eligibility for Semester End Examinations

- **Attendance**

  Regular course of study means a minimum average attendance of 75% in all the courses computed by totaling the number of periods of lectures, tutorials. Drawing, practical, Personality development courses and project work as the case may be, held in every course as the denominator and the total number of periods attended by the student in all the courses put together as the numerator.

  Condonation of shortage in attendance may be recommended by respective Heads of Departments on genuine medical grounds, provided the student puts in at least 65% attendance as calculated above and provided the Principal is satisfied with the genuineness of the reasons and the conduct of the student. Students, having more than 65% and less than 75% of attendance, shall have to pay requisite fee towards condonation.

1.11.2 Conditions for Promotion

A student shall be eligible for promotion to next Semester of B.Tech program, if he/she satisfies the conditions as stipulated in section 1.11.1

- Eligible candidate who failed to register for the semester-end examinations shall not be permitted to continue the subsequent semester, and has to repeat the semester for which he/she has not registered for semester end examinations.
- Student admitted to 5^{th} sem should clear all the 1^{st} sem subjects
- Student admitted to 6^{th} sem should clear all the 1^{st} & 2^{nd} sem subjects
- Student admitted to 7^{th} sem should clear all the 1^{st}, 2^{nd} & 3^{rd} sem subjects
- Student admitted to 8^{th} sem should clear all the 1^{st}, 2^{nd}, 3^{rd} & 4^{th} sem subjects

1.12. Eligibility for award of B.Tech. Degree

The B.Tech. Degree shall be conferred on a candidate who has satisfied the following requirements.

- **Regular Students**
  - A Regular student (4 year program) should

register himself/herself for 160 Credits from the categories 1.6.4 to 1.6.8, and shall secure 160 credits.

- Student shall register for courses categories 1.6.9 and successfully complete as given in 1.9

- **Lateral Entry Students**
  - A lateral entry student (3 year program) should register himself for 122 credits from the categories 1.6.5 to 1.6.9 and shall secure 122 credits.
  - A lateral entry Student shall register for courses categories 1.6.9 and successfully complete as given in 1.9

- **Award of Division**

The criteria for award of division, after completion of program are as shown in Table 12.

Table 12: Criteria for award of division

S.No.	CGPA	Division
1	> = 7.75	First class With Distinction
2	> = 6.5 - <7.75	First Class
3	> = 5.5 - <6.5	Second Class
4	> = 4 -< 5.5.	Pass Class
5	< 4	Fail

For the purpose of awarding First Class with Distinction CGPA obtained

- **Within 4 years –** in case of candidates admitted through EAMCET and Management Quota
- **Within 3 years** – in case of Lateral Entry candidates admitted through ECET
- Detained and break –in study candidates are not eligible for the award of First Class with Distinction.
- For the purpose of awarding First, Second and pass Class. CGPA obtained in the examinations appeared within the maximum period allowed for the completion of course shall be considered.

1.12.1.Consolidated Grade Card

A consolidated grade card containing credits and grades obtained by the candidates and the average semester attendance will be issued after completion of the four year B.Tech Program.

1.12.2. Improvement of Cumulative Grade Point Average

A candidate, after becoming eligible for the award of the Degree, may reappear for the semester end Examination in any of the theory courses as and when conducted, for the purpose of improving the aggregate and the class. But this reappearance shall be within a period of two academic years after becoming eligible for the award of the Degree.However, this facility shall not be availed of by a candidate who has taken the Provisional Certificate, Candidate shall be permitted to reappear for semester end examinations only for theory courses. Modified Grade Cards and New Consolidated Grade Card will be issued after incorporating new Grades and Credits.

1.13.Amendments to Regulations

The Academic Council may, from time to time, revise, amend or change the regulations, schemes of examination and/or syllabi.

DISCIPLINARY ACTION FOR MALPRACTICES/IMPROPER CONDUCT IN EXAMS

S. No.	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
1. (b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered

		against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year.The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated , shall be cancelled in all the subjects of the

		examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the	Expulsion from the examination hall and cancellation of performance in that subject and all the

	examination or answer book or additional sheet, during or after the examination.	other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6.	Refuses to obey the orders of the Chief	In case of students of the college, they shall

	Superintendent / Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of	be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

	unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with

		forfeiture of seat.
8.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the

		subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and

		project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

MALPRACTICES

- The Principal shall refer the cases of malpractices in Continuous Evaluation and Semester-End Examinations, to Malpractice Enquiry Committee, constituted by him/her for the purpose. Such committee shall follow the approved scales of punishment. The Principal shall take necessary action, against the erring students based on the recommendations of the committee.
- Any action on the part of student at an examination trying to get undue advantage in the performance or trying to help another, or derive the same through unfair means is punishable according to the provisions contained hereunder. The involvement of the Staff, who are in charge of conducting examinations, valuing

examination papers and preparing/keeping records of documents relating to the examinations in such acts (inclusive of providing incorrect or misleading information) that infringe upon the course of natural justice to one and all concerned at the examination shall be viewed seriously and recommended for award of appropriate punishment after thorough enquiry.

COURSE STRUCTURE AND DETAILED SYLLABUS

for

B.Tech.

Computer Science and Engineering

&

Information Technology

With Effective from the academic year

2018-2019

Program Outcomes for an Engineering Graduates:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent

responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

I B. Tech I Semester Course structure for the Academic Year 2018-2019

Common for ECE/CSE/IT

S. No.	Subject Code	Subject title	L	T	P	C
1	18CMMAT1010	Engineering Mathematics-I	3	1	0	4
2	18ECPHT1020, 18CSPHT1020, 18ITPHT1020	Engineering Physics	3	1	0	4
3	18CMCST1030	Programming for problem solving	3	0	0	3
4	18CMMEL1040	Engineering Graphics	1	0	4	3
5	18ECPHL1050, 18CSPHL1050, 18ITPHL1050	Engineering Physics Lab	0	0	3	1.5
6	18CMCSL1060	Programming for problem solving lab	0	0	4	2
7	18CMMEL1070	Work Shop/ Manufacturing practice	0	0	3	1.5
8	18CMCHN1080	Environmental Science (Non - Credit course)	3	0	0	0
Total Credits						**19**

I B. Tech II Semester Course structure for the Academic Year 2018-2019

Common for ECE/CSE/IT

S. No.	Subject Code	Subject title	L	T	P	C
1	18CMEGT2010	Technical English	3	0	0	3
2	18CMMAT2020	Engineering Mathematics II	3	1	0	4
3	18CMCHT2030	Engineering Chemistry	3	1	0	4
4	18CMEET2040	Basic Electrical Engineering	3	1	0	4
5	18CMEGL2050	English Communication skills lab	0	0	2	1
6	18CMCHL2060	Engineering Chemistry Lab	0	0	3	1.5
7	18CMEEL2070	Basic Electrical Engineering Lab	0	0	3	1.5
8	18CMMSN2080	Constitution of India, professional ethics & human rights (Non - Credit course)	3	0	0	0
Total Credits						**19**

<table>
<tr><td colspan="4" align="center">ENGINEERING MATHEMATICS-I
SEMESTER - I</td></tr>
<tr><td>Subject Code</td><td>18CMMAT1010</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3+ 1(T)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 04</td></tr>
<tr><td colspan="4">Course Objectives:
To enable the students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following:
1. To solve first order differential equations.
2. To solve linear differential equations with constant coefficients.
3. To find the extrema of a function.
4. To solve partial differential equations
5. To evaluate multiple integrals
6. To verify vector integral theorems</td></tr>
<tr><td colspan="3">Unit -1</td><td></td></tr>
<tr><td colspan="3">First order and first degree Ordinary Differential Equations
Exact, reducible to exact, linear and Bernoulli’s differential equations. Orthogonal trajectories in Cartesian and polar form. Simple problems on Newton's law of cooling. Law of natural growth and decay.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Linear differential equations with constant coefficients: Solutions of second and higher order differential equations - inverse differential operator methods, Method of variation of parameters. Application: LCR Circuits</td><td>Hours – 8</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Partial derivatives – Definition and Euler’s theorem (without proof), total derivatives, partial differentiation of composite functions. Jacobian - Functional dependence. Taylor’s and Maclaurin’s theorems for</td><td>Hours – 10</td></tr>
</table>

function of two variables (statement only). Maxima and minima- Lagranges method of undetermined multipliers	
Unit – 4	
First order Partial differential equations: Formation of Partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and non linear (standard type) equations **Higher order Partial differential equations:** Solutions of Homogeneous and Non Homogeneous partial differential equations with constant coefficients – Classification of partial differential equations.	**Hours – 10**
Unit – 5	
Double and triple integrals: Evaluation of double and triple integrals. Evaluation of double integrals by changing the order of integration and by changing into polar co-ordinates. Beta and gamma functions and their properties **Vector Calculus** – Gradient – Divergence - Curl **-** Line integrals-definition and problems, surface and volume integrals definition, Green's theorem in a plane, Stokes and Gauss-divergence theorems (without proof) and problems.	**Hours – 12**
Course outcomes: On completion of this course, students are able to 1. Solve first order differential equations. 2. Solve linear differential equations with constant coefficients. 3. Find the extrema of a function. 4. Solve partial differential equations 5. Evaluate multiple integrals 6. Verify vector integral theorems	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question carrying 1 mark each. 2. Two questions from each unit should present.	

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B.S. Grewal, **“Higher Engineering Mathematics”**, Khanna publishers, 44th edition, 2016.

2. Erwin Kreyszig, **“Advanced Engineering Mathematics**, Wiley, 9th edition, 2013.

Reference Books:

1. B.V. Ramana, **“Higher Engineering M athematics”**, Tata Mc Graw-Hill, 2006

2. N.P.Bali and Manish Goyal, **“A text book of Engineering mathematics”**, Laxmi publications, latest edition.

3. H.K. Dass and Er. RajnishVerma, **“Higher Engineerig Mathematics”**, S.Chand publishing, 1st edition, 2011.

Course outcomes to program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Cou rse	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td colspan="4">ENGINEERING PHYSICS
Semiconductor Physics & Semiconductor Optoelectronics
SEMESTER - I</td></tr>
<tr><td>Subject Code</td><td>18CSPHT1020, 18ITPHT1020</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3+1(T)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 04</td></tr>
<tr><td colspan="4">Course objectives:
The objectives of this course, help the students
• To impart the knowledge of Quantum mechanics for understanding the conducting mechanism in solids
• To understand the physics of semiconductors and their working mechanism for their utility.</td></tr>
<tr><td colspan="3">Unit -1</td><td></td></tr>
<tr><td colspan="3">Electronic materials
Free electron theory , Classical &Quantum theory, Density of states, Fermi level, Occupation probability, Bloch theorem, Kronig-Penny model (to introduce origin of band gap), E-k diagram and Effective mass. Types of electronic materials: metals, semiconductors, and insulators.</td><td>Hours – 12</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Semiconductors
Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Hall effect and its applications.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Light-semiconductor interaction
Types of Semiconductor materials of interest for optoelectronic devices, band gap modification, Hetero structures; Optical transitions in bulk semiconductors:</td><td>Hours –10</td></tr>
</table>

absorption, spontaneous emission, and stimulated emission; Joint density of states, Density of states for photons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect.	
Unit – 4	
Semiconductor light emitting diodes (LEDs) Direct and indirect band gap semiconductors, Injection Electro luminescence, LED: Device structure, materials, characteristics, Laser diode, Quantum well, wire, and dot based lasers.	**Hours – 9**
Unit – 5	
Unit-5: Photodetectors & Low-dimensional optoelectronic devices General properties of Photo detectors, Photo conductors, Types of semiconductor photo detectors -p-n junction, PIN, and Avalanche and their structure, materials, working principle, and characteristics, Noise limits on performance; Solar cells.	**Hours – 9**
COURSE OUTCOMES: On completion of the course student will able to 1. Understanding the conducting mechanism in metals using free electron theory and quantum mechanics 2. Estimate the concentration of charge carriers using Fermi level in semiconductors. 3. Understanding light-semiconductor interaction 4. Illustrate the working function of LEDs and diode lasers. 5. Illustrate the working function of photo detectors. 6. Illustrate the working function of solar cells.	
QUESTION PAPER PATTERN: **SECTION A:** 1. This section contains ten one sentence answer questions, each carrying 1 mark. 2. Two questions from each unit should be designed. **SECTION B:** 1. This section will have 5 questions with internal choice.	

2. Each question carries 12 marks.

Each full question comprises sub questions covering all topics under a unit.

TEXT BOOKS:

1. S.O. Pillai, Solid state physics, New age publications.
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons,

REFERENCE BOOKS:

1. Ch. Srinivas, Ch. Seshubabu, Engineering Physics, Cengage learning publications.
2. P. Bhattacharya, Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
3. Online course: “Semiconductor Optoelectronics” by M R Shenoy on NPTEL
4. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL

Course outcomes to program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PS O 2	PSO 3
1	**3**	**2**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**2**	**1**	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**1**	**1**	-	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**1**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**1**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**1**	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**2**	**2**	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td colspan="4" align="center">PROGRAMMING FOR PROBLEM SOLVING
SEMESTER - I</td></tr>
<tr><td>Subject Code:</td><td>18CMCST1030</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3</td><td>EA Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits - 03</td></tr>
</table>

<table>
<tr><td>Unit-I: Introduction to computer systems and programming</td><td>Hours</td></tr>
<tr><td>History & Hardware: Computer Hardware, components, Types of Software, Memory units.
Introduction to Problem solving: Algorithm, characteristics of Algorithms, Basic operations of algorithms, Pseudocode, Flowchart, Types of languages, Relation between Data, Information, Input and Output.
Basics of C: History and Features of C, Importance of C, Procedural Language, Compiler versus Interpreter, Structure of C Program, Program development steps, programming errors.</td><td>Hours- 08</td></tr>
<tr><td colspan="2">Unit-II: C Expressions, evaluation and control statements</td></tr>
<tr><td>Overview of C: Character Set, C-Tokens, Data Types, Variables, Constants, Operators, Operator precedence and Associativity, converting mathematical expressions to C-expressions, evaluation of C-expressions, Input/output functions.
Conditional Branching: if statement, if...else statement, Nested if...else statement, if…else…if ladder, switch statement.
Unconditional Branching: goto.
Control flow statements: break, continue.
Looping Constructs: do-while statement, while statement, for statement.</td><td>Hours- 12</td></tr>
<tr><td colspan="2">Unit-III: Arrays and Functions</td></tr>
</table>

Arrays: Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays (Matrix), Multi-Dimensional Arrays. **Functions**: Basics, necessity and advantages, Types of functions, Parameter passing mechanisms, Recursion, Storage Classes, Command Line Arguments, Conversion from Recursion to Iteration and vice-versa. **Strings:** Working with strings, String Handling Functions (both library and user defined).	**Hours -10**
Unit-IV: Derived and User Defined Data types	
Pointers: Understanding Pointers, Pointer expressions, Pointer and Arrays, Pointers and Strings, Pointers to Functions. **Dynamic Memory Allocation:** Introduction to Dynamic Memory Allocation malloc, calloc, realloc, free. **Structures and Unions:** Defining a Structure, typedef, Advantage of Structure, Nested structures, Arrays of Structures, Structures and Arrays, Structures and Functions, Structures and Pointers, Defining Unions, Union within union, Structure within union, Union within structure, self-referential structures, bitfields, enumerations.	**Hours -12**
Unit-V: Preprocessing and File Handling	
Preprocessing Directives: Macro Substitution, File Inclusion, conditional compilation and other directives **File Management in C:** Introduction to File Management, Modes and Operations on Files, Types of files, Error Handling During I/O Operations.	**Hours -08**
Text Books: 1. Computer Programing ANSI C, E Balagurusamy, Mc Graw Hill Education(Private), Limited (TB1) 2. Programming in C, Reema Thareja, Second Edition, Oxford Higher Education (TB2) **Reference Books:** 1. Computer Basics and C Programming, V Raja Raman, Second	

Edition, PHI (RB1)

Course Outcomes:

Student can able to

1) formulate algorithms, translate them into programs and correct program errors.
2) choose right control structures suitable for the problem to be solved.
3) decompose reusable code in a program into functions.
4) make use of arrays, pointers, structures and unions effectively.
5) store and retrieve data from permanent storage.
6) learn file operations

Question paper pattern:

Section A:

1. This section contains ten
2. one or two-line answer question carrying 1 mark each.
3. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. **The** student will have to answer 5 full questions selecting one full question from each unit.

COs VS POs MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	2	3	1		3									
2	2	3	3		1									
3	3	2	3		1									
4	2	2	3		1									
5	2	2	2											
6	2	2	2		1									
Course	2	2	3		2									

ENGINEERING GRAPHICS

SEMESTER - I

Subject Code	18CMMEL1040	Internal Marks	30
Number of Lecture Hours/Week	1(L)+04(P)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

COURSE OBJECTIVES:

1. Students should be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students should be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student should be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students are should be able to apply various concepts to solve practical problems related to engineering.
4. Student should be able to draw sections and sectional views of Solids
5. Student should be able to draw isometric view of lines, plane figures and simple solids. Student should be able to convert given isometric views into orthographic views. Students should be able to apply various concepts to solve practical problems related to engineering
6. Student should be able to draw objects using draw and modify toolbars of AutoCAD

Unit -1	
Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections – Ellipse, Parabola, Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;	**Hours– 10**

Unit -2	
Projections of Points and lines inclined to both planes; Projections of planes inclined to one plane	**Hours–08**
Unit – 3	
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes	**Hours–10**
Unit – 4	
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone	**Hours–10**
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 **Introduction to AUTOCAD**-The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows	**Hours–12**

COURSE OUTCOMES:

1. Students will be able to construct Polygons using general methods, inscribe and describe polygons on circles, draw curves (parabola, ellipse and hyperbola, cycloids, involutes by general methods
2. Students will be able to read, interpret and construct plain scales, diagonal scales and vernier scales
3. Student will be able to draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane. Students will be able to apply various concepts to solve practical problems related to engineering.
4. Student will be able to draw sections and sectional views of Solids
5. Student will be able to draw isometric view of lines, plane figures and simple solids. Student will be able to convert given isometric views into orthographic views. Students will be able to apply various concepts to solve practical problems related to

engineering 6. Student will be able to draw objects using draw and modify toolbars of AutoCAD
QUESTION PAPER PATTERN: **SECTION A: (14M)** 1. This section contains four questions carrying different weightage. **SECTION B:** (4x14=56M) 1. This section will have 5 questions with internal choice. 2. Each full question carries 14 marks. 3. Each full question will have sub question covering all topics under a unit.
Text/Reference Books: 1. Engineering Drawing by N.D. Bhatt, Chariot Publications 2. Engineering Drawing by Agarwal & Agarwal, Tata McGraw Hill Publishers 3. Engineering Drawing by K.L.Narayana & P. Kannaiah, Scitech Publishers 4. Engineering Graphics for Degree by K.C. John, PHI Publishers

Course outcomes to Program outcomes mapping:

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	2		3							3		2			
2	2		3							3		2			
3	2		3							3		2			
4	2		3							3		2			
5	2		3							3		2		2	
6	2		3							3		2		2	
Over all	2		3							3		2		2	

ENGINEERING PHYSICS LABORATORY SEMESTER - I			
Subject Code	18CSPHL1050, 18ITPHL1050	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

The objectives of this course, help the students

- To apply the theoretical knowledge of Physics through hands on the experimental instruments
- To improve the experimental knowledge in the later studies
- To understand the basic need of experiments.
- To know how to measure the different physical quantities.
- To gain the knowledge about different electrical components and basic electrical circuits.

List of Experiments

1. To study atomic levels in Neon- Argon gasses-Franc hertz experiment.
2. To determine resistivity of wire using four probe methods.
3. To determine the Boltzmann constant using PN junction diode.
4. To determine the Energy band gap of P-N junction diode.
5. To determine the Hall coefficient-Hall effect
6. To study the spectral response of photo diode-Planck’s constant
7. To draw the LED current-voltage characteristics.
8. To draw the diode laser (LD) current-voltage characteristics.
9. To draw the Photo diode current-voltage characteristics.
10. To measure the current-voltage characteristics of a solar cell (Photovoltaic cell) at different light intensities.

COURSE OUTCOMES:

On completion of the course student will able to

1. Understand the existence of the energy levels in gasses
2. Study the resistivity variation with temperature in conductor
3. Determine the energy band gap of semiconductor diode.
4. Understand the phenomenon of Hall effect
5. Understand the interaction of the light with semiconductor
6. Study the characteristic curves of the LEDs, LD & Solar cells.

Course outcomes to Program outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
2	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
3	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
4	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
5	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
6	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**1**	-	**3**	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td colspan="4" align="center">PROGRAMMING FOR PROBLEM SOLVING LAB
SEMESTER - I</td></tr>
<tr><td>Subject Code</td><td>18CMCSL1060</td><td>Internal Marks</td><td>50</td></tr>
<tr><td>Number of Practice Hours/Week</td><td>04</td><td>External Marks</td><td>50</td></tr>
<tr><td>Total Number of Practice Hours</td><td>36</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits - 02</td></tr>
</table>

Objectives:

- To apply programming for basic mathematical functions
- To design and program mathematical concepts.
- To create and use the functions and library functions
- Able to apply the theoretical knowledge of formatting of documents
- To create and apply user defined types to the real world problems.
- To create files and shapes of the concepts.

List of Experiments

Exercise 1 (Familiarization with programming environment)

a) Familiarization of CODE BLOCKS C++ Editor to edit, compile, execute, test and debugging C programs.
b) Familiarization of RAPTOR Tool to draw flow charts and understand flow of control.
c) Acquittance with basic LINUX commands.

Exercise 2 (Simple computational problems using arithmetic expressions)

a) Write a C Program to display real number with 2 decimal places.
b) Write a C Program to convert Celsius to Fahrenheit and vice versa.
c) Write a C Program to calculate the area of triangle using the formula

$$\text{area} = \sqrt{s(s-a)(s-b)(s-c)} \text{ where } s = \frac{a+b+c}{2}$$

d) Write a C program to find the largest of three numbers using ternary operator.
e) Write a C Program to swap two numbers without using a

temporary variable.

Exercise 3 (Problems involving if-then-else structures)

a) Write a C Program to check whether a given number is even or odd using bitwise operator, shift operator and arithmetic operator.
b) Write a C program to find the roots of a quadratic equation.
c) Write a C Program to display grade based on 6 subject marks using if…else…if ladder.
d) Write a C program, which takes two integer operands and one operator form the user, performs the operation and then
e) prints the result using switch control statement. (Consider the operators +, -, *, /, %)

Exercise 4 (Iterative problems)

a) Write a C Program to count number of 0's and 1's in a binary representation of a given number.
b) Write a C program to generate all the prime numbers between two numbers supplied by the user.
c) Write a C Program to print the multiplication table corresponding to number supplied as input.

Exercise 5 (Iterative problems)

a) Write a C Program to Find Whether the Given Number is i) Armstrong Number ii) Palindrome Number
b) Write a C Program to print sum of digits of a given number

Exercise 6 (Series examples)

a) Write a C Program to calculate sum of following series
b) 1+2+3+…. N b)1+1/2+1/3+……+1/n c)$1+x+x^2+x^3……+x^n$

Exercise 7 (1D Array manipulation)

a) Write a C program to interchange the largest and smallest numbers in the array.
b) Write a C program to search an element in an array (linear search).
c) Write a C Program to print the following pattern using a character array

S
SA
SAS
SASI

Exercise 8 (Matrix problems, String operations)

a) Write a C program to add two matrices.
b) Write a C program to multiply two matrices if they are compatible or print an error message “incompatible matrix sizes” otherwise.
c) Write a C program to check given matrix is symmetric or not.
d) Implement the following string operations with and without library functions.
   i) copy ii) concatenate iii) length iv) compare

Exercise 9 (Simple functions)

a) Write a C Program demonstrating the following function types
   i. With arguments and with return value.
   ii. With arguments and without return value
   iii. Without arguments and without return value.
   iv. Without arguments and with return value.
b) Write a C Program illustrating call by reference

Exercise 10 (Recursive functions)

Write a C Program illustrating the following with Recursion without Recursion

a) Factorial b) GCD c) Power d) Fibonacci

Exercise 11(Pointers and structures)

a) Write a C program to find sum of n elements entered by user. To perform this program,
   allocate memory dynamically using malloc () function.
b) Write a C program to find sum of n elements entered by user. To perform this program,
   allocate memory dynamically using calloc () function.
   Note: Understand the difference between the above two programs.
c) Write a C Program to read and print student details using structures.

Exercise 12 (File operations)

a) Write a C program to open a file and to print it contents on screen.
b) Write a C program to copy files

c) Write a C program merges two files onto a new file.
d) Write a C program to delete a file.

COURSE OUTCOMES:

1. Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems.
2. Examine and analyze alternative solutions to a problem.
3. Design an algorithmic solution to a problem using problem decomposition and step-wise refinement.
4. Demonstrate conversion of iterative functions to recursive and vice-versa.
5. Implement the concepts of arrays.
6. Implement the structures, Unions and files.

Course outcomes to Program outcomes mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	3		3									
2	2	3	3		2									
3	2	3	3		2									
4	2	3	3		2									
5	2	3	3		2									
6	2	3	3		2									
Course	2	3	3		2									

WORKSHOP/MANUFACTURING PRACTICE SEMESTER - I			
Subject Code	18CMMEL1070	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

1. Students should be able to learn the basic manufacturing processes, study the various tools and equipment used and gain hands-on experience in different trades.
2. Students should be able to learn the engineering and technology involved in carpentry, fitting, black smithy, foundry, welding, machining and plastic moulding.
3. Students should understand the workmanship required, working of machinery or equipment necessary.

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)**

ii. Workshop Practice:

Sl. NO.	**Name of Shop floor**	**Exercises**
1.	Blacksmithy	1. S-Hook
		2. Square Rod To Round Rod
2.	Carpentry	1. T-Lap Joint
		2. Cross Lap Joint
3.	Foundry	1. Mould for a Solid
		2. Mould for a Split Pattern.

4.	Fitting	1. Square Fitting
		2. V-Fitting
5.	Welding	1. Butt Joint
		2. Lap Joint
6.	Machine Tools	1. Turning
		2. Knurling
7.	Plastic Moulding	1. Key chain

COURSE OUTCOMES:

1. Students will be able to make use of basic carpentry joints to make furniture.
2. Students will be able to fabricate mechanical engineering assemblies using fitting joints.
3. Students will be able to produce various machine components by using foundry, black smithy, machining and plastic moulding techniques.

Course outcomes to Program outcomes mapping:

CO \ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	3														
2	3														
3	2				1				1						
Course	3				1				1						

ENVIRONMENTAL SCIENCE
SEMESTER - I

Subject Code	18CMCHN1080	Internal Marks	30
Number of Lecture Hours/Week	04	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 00

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Understand the concept of ecosystem and its diversity.
3. Gain knowledge on natural resources.
4. Understand the concept of biodiversity.
5. Gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

Unit -1

MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES — **Hours – 10**

Environment - Definition, Introduction - Scope and Importance - Global environmental challenges, global warming & climate change - Acid rains, ozone layer depletion - Carbon credits - Sustainability, Stockholm & Rio Summit - Population growth & explosion - Role of Information Technology in Environment and human health.

Ecosystem - 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 different ecosystems	
Unit -2	
NATURAL RESOURCES Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation - Timber extraction – Mining, dams and other 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, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.	**Hours – 12**
Unit – 3	
BIODIVERSITY AND ITS CONSERVATION Introduction - Definition: genetic, species and ecosystem diversity. – Biogeographical 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 - Endangered and endemic species of India – Conservation of biodiversity: In-situ	**Hours – 6**

and Ex-situ conservation of biodiversity.	
Unit – 4	
ENVIRONMENTAL POLLUTION Definition, Cause, effects and control measures of : a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution. - Pollution case studies.	**Hours – 12**
Unit – 5	
SOCIAL ISSUES AND THE ENVIRONMENT Urban problems related to energy -Water conservation, rain water harvesting, watershed management - Resettlement and rehabilitation of people its problems and concerns. 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. -Public awareness. **Field work:** Visit to a local area to document environmental assets River /forest grassland/hill/mountain -Visit to a local polluted site Urban/Rural/industrial/ Agricultural Study of common plants, insects, birds. - Study of simple ecosystems - pond, river, hill slopes, etc.	**Hours – 10**
COURSE OUTCOMES: On completion of the course student will be	

1. Able to know the importance of Environmental studies and the measures to be taken to overcome global environmental challenges.
2. Able to understand the concept of ecosystem and its diversity.
3. Able to gain knowledge on natural resources.
4. Able to understand the concept of biodiversity.
5. Able to gain knowledge on environmental pollution.
6. Gain knowledge on environmental legislation and global treaties.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer question carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

1. E. Bharucha (2003), "Environmental Studies", University Publishing Company, New Delhi.
2. J.G. Henry and G.W. Heinke (2004), "Environmental Science and Engineering", Second Edition, Prentice Hall of India, New Delhi
3. G.M. Masters (2004)" Introduction to Environmental Engineering and Science", Second Edition, Prentice Hall of India, New Delhi

REFERENCE BOOKS:

1. Text Book of Environmental Studies by Deeshita Dave & P. Udaya Bhaskar, Cengage Learning.
2. Environmental Studies by K.V.S.G. Murali Krishna, VGS

Publishers, Vijayawada.

3. Environmental Studies, P.N. Paliniswamy, P. Manikandan, A. Geeta and K. Manjula Rani, Pearson Education, Chennai.

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-
2	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-
4	**3**	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	-	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-	-
6	-	**3**		-	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**3**	**3**	-	-	-	**3**	-	-	-	-	-	-	-	-

TECHNICAL ENGLISH
SEMESTER - II

Subject Code	18CMEGT2010	Internal Marks	30
Number of Lecture Hours/ Week	03	External Marks	70
Total Number of Lecture Hours	50	Exams Hours	03

Credits -03

Course Objectives:

To enable the students to learn and apply fundamental principles in Technical English & Communication by focusing on:

1. Technical English Vocabulary
2. Writing Skills
3. Common Errors in Writing
4. Nature and Style of Sensible Technical Writing
5. Writing Technical Reports and Letters
6. Providing an inspiring reading experience from the biography of a renowned technocrat.

Unit I

Principles of Scientific Vocabulary • **Principles of Scientific vocabulary**: short and simple words-compact substitutes for wordy phrases-redundant words and expressions-Avoid hackneyed and stilted phrases, verbosity and incorrect use of words • The role of roots in word building,prefixes and suffixes, confusing words and expressions. Non-detailed text-Karmayogi: 1-4 chapters, Page No 1-53	10 hours

Unit II

Writing Skills • Distinguishing between academic and personal styles of writing • Use of clauses in technical phrases and sentences • Techniques of Sentence and paragraph writing	10 hours

• Measuring the clarity of a text through Fog Index or Clarity Index Non-detailed text- Karmayogi: 5-8 chapters, Page No 54-100	
Unit III	
Common Errors in Writing • Subject-verb agreement and concord of nouns, pronouns and possessive adjectives • Common errors in the use of articles, prepositions, adjectives and adverbs • Punctuation • Technical Guidelines for Communication • **Avoiding the pitfalls** Non-detailed text-Karmayogi: 9-12 chapters, Page No101-151	10 hours
Unit IV	
Nature and Style of Sensible Technical Writing • Academic Writing Process • Describing, processes and products • Defining, Classifying • Effective use of charts, graphs, and tables Non-detailed text- Karmayogi: 13-16 chapters, Page No 152-203	10 hours
Unit V	
Report writing and Letter writing • Writing Technical Reports • Précis writing • Letter Writing • Essay writing Non-detailed text- Karmayogi: 13-16 chapters, Page No 204-250	10 Hours
Course Outcomes On Completion of the course student will acquire 1. Ability to understand Scientific vocabulary and use them	

confidently
2. Familiarity with the basic principles of writing clear sentences and paragraphs
3. Ability to write error free simple technical passages
4. Knowledge of writing different writing styles
5. Confidence to write letters and technical reports clearly and coherently
6. Get inspired by achievements and values upheld by a renowned technocrat.

Question Paper Pattern

Section –A

1. 10 questions carrying one mark each
2. Five questions each from Units I and III

Section –B

1. 5 questions carrying 12 marks each (one compulsory question from non-detailed text)
2. Each question will have two or three sub questions covering all the units

Text Books

1. Effective Technical Communication by Barun K Mitra, Oxford University Publication

Non-detailed Text

1. Karmayogi: A Biography of E Sreedharan by M S Ashokan

Reference Books

1. *Communication Skills* by Sanjay Kumar &PushpaLatha, OUP
2. Study Writing by Liz Hamp-Lyons and Ben Heasly, Cambridge University Press.
3. Remedial English Grammar by F T Wood, Macmillian 2007
4. *Practical English Usage* by Michael SwanOxford University Press
5. *English Collocations in Use* by Michael McCarthy & Felicity O'Dell
6. *Effective Technical Communication* by Arsahf Rizvi,
7. *Essential English Grammar by Raymond Murphy, CUP, 2017*

Course outcomes to Program outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
2	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
3	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
5	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-
6	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-

ENGINEERING MATHEMATICS-II SEMESTER - II			
Subject Code	18CMMAT2020	Internal Marks	30
Number of Lecture Hours/Week	3(L)+ 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course objectives:

To enable students to apply the knowledge of Mathematics in various engineering fields by making them to learn the following

- To solve system of linear equations
- To find eigen values and eigen vectors of a matrix
- To solve initial value problems by using Laplace transforms
- To find the solution of algebraic/ transcendental equations and also interpolate the functions.
- To evaluate numerical integration and to solve ordinary differential equations by using numerical methods.
- To find Fourier series of a periodic function and to determine the Fourier transform of a function

Unit -1	
Linear Algebra: Rank of a matrix by elementary transformations, solution of system of linear equations - Gauss-elimination method, Gauss-Jordan method – Jacobi method and Gauss-Seidel method – Eigen values and Eigen vectors, Properties of Eigen values and Eigen vectors - Linear transformation, Diagonalisation of a square matrix. Cayley-Hamilton theorem (without proof) - Reduction of Quadratic form to Canonical form.	**10 Hours**
Unit -2	
Laplace Transforms: Laplace transforms of standard functions-Shifting theorems - Transforms of derivatives and integrals – Unit step function –Dirac's delta function Inverse Laplace transforms– Convolution theorem (without proof).	**10 Hours**

Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms	
Unit – 3	
Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method. Finite differences: Error functions – Forward, backward and central differences, Newton's forward and backward interpolation formulae. Gauss`s forward and backward interpolation formulae - Lagrange's interpolation formula (all formulae without proof)	**10 Hours**
Unit – 4	
Numerical integration: Trapezoidal rule - Simpson's (1/3)rd and (3/8)th rules. Numerical solutions of ordinary differential equations-Taylors series method-Picard's method-Eulers method-Modified Eulers method-Runge-Kutta methods	**8 Hours**
Unit – 5	
Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period. Fourier series of even and odd functions, Half range Fourier Series. **Fourier Transforms**: Infinite Fourier transforms, Fourier sine and cosine transforms, Inverse Fourier transforms.	**12 Hours**
Course outcomes: On completion of this course, students are able to, 1. Solve system of linear equations 2. Find eigen values and eigen vectors of a matrix 3. Solve initial value problems by using Laplace transforms 4. Find the solution of algebraic/ transcendental equations and also interpolate the functions. 5. Evaluate numerical integration and to solve ordinary differential equations by using numerical methods. 6. Find Fourier series of a periodic function and to determine the Fourier transform of a function	

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. B. S. Grewal," Higher Engineering Mathematics", Khanna publishers, 44th Edition, 2016.
2. Kreyszig, "Advanced Engineering Mathematics " - Wiley, 9th Edition, 2013.

Reference Books:

1. B.V.Ramana "Higher Engineering M athematics" Tata Mc Graw-Hill, 2006
2. N P Bali and Manish Goyal, "A text book of Engineering mathematics", Laxmi publications, 7th edition.
3. H. K Dass and Er. Rajnish Verma ,"Higher Engineerig Mathematics", S. Chand publishing,1st edition, 2011.
4. Dr.K.V.Nageswara Reddy and Dr.B.Rama Bhupal Reddy, “Engineering Mathematics, Volume II” Scitech Publications, 2017.

Course outcomes to Program outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	2	3	-	-	-	-	-	-	-	-	-	-
2	2	3										
3	2	3	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-

ENGINEERING CHEMISTRY SEMESTER - II			
Subject Code	18CMCHT2030	Internal Marks	30
Number of Lecture Hours/Week	3(L) + 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Rationalize periodic properties like ionization potential, electronegativity and oxidation states.
2. Apply the concepts of electrochemistry.
3. Analyze bulk properties and processes using thermodynamic considerations.
4. List major chemical reactions that are used in the synthesis of molecules.
5. Understand the concepts of atomic and molecular orbitals.
6. Know various spectroscopic techniques.

Unit -1	
PERIODIC PROPERTIES Effective nuclear charge of fluorine and magnesium, 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 electro negativity, oxidation states, coordination numbers 2 & 3 and geometries, hard soft acids and bases.	**Hours – 10**
Unit -2	
USE OF FREE ENERGY IN CHEMICAL EQUILIBRIA **Thermodynamic functions:** State and Path functions, First and second laws of thermodynamics, Gibbs Helmholtz Equation, concept of entropy and enthalpy. **Electro chemistry:** Introduction, electrode potential, standard electrodes – Hydrogen and Calomel electrodes,	**Hours – 10**

Nernst equation and applications. **Water chemistry:** Surface and subsurface water quality parameters – turbidity, pH, total dissolved salts, chloride content, break point chlorination. **Corrosion:** Wet chemical theory, control methods – proper designing, cathodic protection- Sacrificial anodic and impressed current cathodic protection.	
Unit – 3	
STEREOCHEMISTRY Principles of stereochemistry, representations of 3 dimensional structures of organic compounds, geometrical and stereoisomers, configuration and symmetry, enantiomers. **ORGANIC REACTIONS AND SYNTHESIS OF A DRUG MOLECULE** Introduction to reactions involving Substitution – SN^1 & SN^2 with mechanism, Addition – Free radical, Elimination – E1 & E2 with examples (mechanism is not involved), Synthesis of aspirin drug molecule.	**Hours – 10**
Unit – 4	
ATOMIC, MOLECULAR STRUCTURE AND ADVANCED MATERIALS Schrodinger equation. Particle in a box solution and their applications for conjugated molecules. **Nanoparticles**: Introduction, preparation methods – Sol-gel method, Chemical reduction method – properties and applications. **Surface properties:** Determination of surface tension and viscosity of liquids. **Ceramics:** Classification, examples and applications. Crystal field theory and the energy level diagrams for transition metal ions.	**Hours – 10**
Unit – 5	
SPECTROSCOPIC TECHNIQUES Regions of electromagnetic spectrum - Principles of vibrational and rotational spectroscopy. Vibrational and	**Hours – 10**

rotational spectroscopy of diatomic molecules: Rigid diatomic molecules - selection rule - simple Harmonic Oscillator - diatomic vibrating rotator. Nuclear magnetic resonance – Principle and Instrumentation. Principles of chromatography – TLC & Paper.

COURSE OUTCOMES:

On completion of the course student will be

1. Able to rationalise periodic properties like ionization potential, electro negativity and oxidation states.
2. Able to know the nature and working of various electrodes.
3. Able to analyze bulk properties and processes using thermodynamic considerations.
4. Able to synthesize organic molecules using different types of chemical reactions.
5. Able to understand the concepts of atomic and molecular orbitals.
6. Able to gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels.

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

1. Stereochemistry of Carbon Compounds by Ernest Eliel; McGraw Hill Education.
2. Fundamentals of Molecular Spectroscopy, by C. N. Banwell.
3. Concise Inorganic Chemistry, J.D.Lee, 5^{th} Edition; Wiley India.

4. Engineering Chemistry – Fundamentals and applications by Shikha Agarwal; Cambridge University Press
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp
6. Engineering Chemistry by Jain & Jain; Dhanpat Rai Publishing Company

REFERENCE BOOKS:

1. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan.
2. Physical Chemistry, by P. W. Atkins.
3. Physical Chemistry, by Glasstone, S
4. Advanced inorganic chemistry by Wilkinson G and Cotton FA

Course outcomes to Program outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-

BASIC ELECTRICAL ENGINEERING

SEMESTER - II

Subject Code	18CMEET2040	Internal Marks	30
Number of Lecture Hours/week	3(L)+1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:

This course will enable student to :

- Describe the basics electrical circuit concepts and how to apply the various theorems for given electrical network
- Describe the representation of sinusoidal waveform and also analysis of single phase ac circuit with various elements
- Describe the principle and operation of ac and dc electrical machines
- Describe the basic operation of different converters circuits
- Describe the necessity of the batteries and importance of the basic switch gear unit

Module -1	
DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenins and Norton Theorems (Simple numerical problems). Time-domain analysis of first-order RL and RC circuits.	**Hours-10**

Module – 2	
AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.	**Hours-10**

Module – 3	
Transformers Magnetic materials, BH characteristics, ideal and practical transformer , equivalent circuit , losses in transformers,OC and SC tests, regulation and efficiency. Auto transformer and three-phase transformer connections.	**Hours-10**
Module – 4	
Electrical Machines: Ac machines- Generation of rotating magnetic fields, construction details and working of 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 and working of synchronous generators. **DC machines-** Construction, working, torque- speed characteristics and speed control of dc shunt motor.	**Hours-10**
Module – 5	
Power Converters and Electrical Installations DC – DC Buck and boost converters, duty ratio control, PWM techniques, single phase voltage source inverters. Classification of batteries and Low Voltage switch gear.	**Hours-10**
Course outcomes: On completion of the course student will be 1. Able to analyze DC circuits by using KCL, KVL and Network theorems 2. Able to analyze AC circuits 3. Able to explain the operation and compute performance of transformer 4. Able to explain the construction and working of rotating electrical machines 5. Able to describe DC-DC and DC-AC converters 6. Able to explain about types of LV switch gear and types of batteries	

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.(Two questions from each unit)
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under unit
4. The student will have to answer 5 full questions selecting one full question from each unit.

Test books.

T1. E. Hughes, *"Electrical and Electronics Technology"*, Pearson, 2010.

T2.D.C. Kulshreshtha, *"Basic Electrical Engineering"*, McGraw Hill, 2009.

T3.D.P. Kothari, I.J. Nagrath, *"Basic Electrical Engineering"*, Tata McGraw Hill, 2010.

T4. J.P. Tewari, *"Basic Electrical Engineering"*, New Age International Publishers, 2003.

References

R1. M.D. Singh, *"Power Electronics"*, 2nd edition.

R2. *"Battery Energy Storage for Smart Grid Applications"*, Eurobat 2013.

R3. L.S. Bobrow, *"Fundamentals of Electrical Engineering"*, Oxford University Press, 1996.

R4. V.D. Toro, *"Electrical Engineering Fundamentals"*, Prentice Hall India, 1989.

R5. R.M. Dell, D.A.J. Rand, *"Understanding Batteries"*, 2001.

R6. Bhavesh Bhalja, R.P., Maheshwari, Nilesh G. Chothani, *"Protection and Switchgear"*, Oxford University Press, 5th impression, 2014.

Course Outcomes to Program Outcomes mapping

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
1	3	3	3	1	0	0	0	0	0	0	0	0	0	0	0
2	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
3	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
5	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Course	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0

English Language Communication Skills Lab
SEMESTER - II

Subject Code	18CMEGL2050	Internal Marks	50
Number of Practical Hours/Week	02	External Marks	50
Total Number of Practical Hours	32	Exam Hours	03

Credits – 01

Objectives: To enable the students to learn communication skills of Listening, Speaking, Reading and Writing by focusing on:

- Listening Comprehension
- Pronunciation
- Functional English in formal and Informal Situations
- Interpersonal Communication Skills
- Presentation Skills

List of Experiments

UNIT I

Listening Comprehension

UNIT II

Pronunciation , Stress, Intonation & Rhythm

UNIT III

Common Everyday Situations: Conversations & Dialogues, Communication at Workplace

UNIT IV

Interpersonal Communication Skills- Group discussions and debates

UNIT V

Formal Presentations

Outcomes:

By the end of the course the students will be able to acquire basic Proficiency in English by practicing the following:

- Listening Comprehension
- Pronunciation
- Dialogues
- Interpersonal Communication Skills

- Presentation Skills
- Discussions and Debates

Learning Resources:

- Interact – English Lab Manual for Undergraduate Students by Orient BlackSwan
- Ted Talks, Interviews with Achievers and select movies
- Toastmaster’s speeches and table topics
- Book Reviews and movie reviews
- Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad.
- Oxford Guide to Effective Writing and Speaking by John Seely
- https://www.ted.com/talk

Course Outcomes Vs Program Outcomes Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	-	-	-	-	-	-	-	-	-	2	-	-
2	-	-	-	-	-	-	-	-	-	3	-	-
3	-	-	-	-	-	-	-	-	-	3	-	-
4	-	-	-	-	-	-	-	-	-	2	-	-
5	-	-	-	-	-	-	-	-	-	3	-	-
6	-	-	-	-	-	-	-	-	-	2	-	-

ENGINEERING CHEMISTRY LABORATORY SEMESTER - II			
Subject Code	18CMCHL2060	Internal Marks	50
Number of Practice Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

COURSE OBJECTIVES:

The objectives of this course, help the students to

1. Measure molecular properties like surface tension and viscosity
2. Determine chloride content of water of given water sample.
3. Familiarize the synthesis of a simple drug.
4. Determine rate constant as a function of time.
5. Determine the strength of acids using conductivity meter.
6. Determine amount of Fe (II) using potentiometer.

List of Experiments

(Any 10 experiments must be conducted)

1. Determination of surface tension
2. Determination of viscosity of a liquid by Ostwald viscometer
3. Thin layer chromatography
4. Determination of chloride content of water
5. Determination hardness of water by EDTA.
6. Determination of the rate constant of first order reaction (Ester hydrolysis)
7. Determination of strength of strong acid using conductometeric titration.
8. Determination of strength of weak acid using conductometeric titration .
9. Determination of Ferrous iron using potentiometer.
10. Synthesis of a drug – Aspirin
11. Determination of the partition coefficient of a substance

between two immiscible liquids

12. Determination of strength of acetic acid using charcoal adsorption.

Demonstration Experiments:

1. Preparation of lattice structure and determination of atomic packing factor.
2. Chemical oscillations- Iodine clock reaction
3. Synthesis of Phenol formaldehyde resin
4. Saponification of oil

COURSE OUTCOMES:

On completion of the course student will be

1. Able to measure molecular properties like surface tension and viscosity
2. Able to determine chloride content of given water sample.
3. Able to synthesize a drug.
4. Able to determine rate constant as a function of time.
5. Able to determine strength of acids using conductivity meter.
6. Able to determine amount of Fe (II) using potentiometer.

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
1	-	3	-	-	-	-	-	-	-	-	-	-
2	-	3	-	-	-	-	-	-	-	-	-	-
3	-	3	-	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	-	-	-	-	-	-
5	-	3	-	-	-	-	-	-	-	-	-	-
6	-	3	-	-	-	-	-	-	-	-	-	-
Course	2	3	-	-	-	-	-	-	-	-	-	-

BASIC ELECTRICAL ENGINEERING LAB SEMESTER - II			
Subject Code	18CMEEL2070	Internal Marks	50
Number of Practice Hours/Week	3P	External Marks	50
Total Number of Practice Hours	32	Exam Hours	03
Credits – 1.5			

The objectives of this course, help the students to

1. Learn how to find the frequency response and resonance of RL & RC circuits
2. Learn how to verify the given networks using theorems
3. Learn how to measure the power and determination of efficiency of a single phase transformer and how to measure the power in three phase transformer
4. Learn how to determine the Torque-slip characteristics of a dc shunt and induction motors.
5. Learn how to find the regulation of an alternator
6. Learn the operation of different converter circuits and know about the switch gear system

List of Experiments (Any Ten experiments must be conducted)

1. Study of R-L,R-C,R-L-C circuits.
2. Verification of superposition theorem.
3. Verification of Thevenin's and Norton's theorems.
4. Series and Parallel resonance of RL and RC circuits.
5. Open circuit & Short circuit tests on a single phase transformer.
6. 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 side. Cumulative three-phase power in balanced three-phase circuits.
7. Speed control of DC shunt motor.
8. Torque Speed Characteristic on single phase induction motor
9. Regulation of Alternator.
10. Demonstration of Buck and Book converter
11. Demonstration of Voltage Source Inverter

12. Demonstration of Low Voltage Switch gear.

COURSE OUTCOMES:

On completion of this course, students are

1. Able to determine the time response and resonance of given RL, RC and RLC circuits
2. Able to determine the response using Superposition, Norton and Thevinins.
3. Able to determine the power , efficiency and regulation of ac machines
4. Able to determine the speed torque characteristics of dc and induction motors
5. Able to analyze the operation of Buck and boost converter and voltage source inverter.
6. Able to analyze the operation of LV Switch gear system.

Course outcomes to Program outcomes mapping:

COs / POs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**	**PSO 3**
1	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0
2	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0
3	2	2	1	0	0	0	0	0	0	0	0	0	0	0	0
4	3	3	2	0	0	0	0	0	0	0	0	0	0	0	0
5	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Course	2	2	1	1	0	0	0	0	0	0	0	0	0	0	0

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS

SEMESTER - II

Subject Code	18CMMSN2080	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 00

COURSE OBJECTIVES:

The objectives of this course help the students to

1. To provide basic information about Indian constitution.
2. To identify individual role and ethical responsibility towards society.
3. To understand human rights and its implications.

Unit -1	
Lesson: Introduction to the Constitution of India, The Making of the Constitution and Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**Hours – 10**
Unit -2	
Lesson: Directive Principles of State Policy & Relevance of Directive Principles State Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**Hours – 10**
Unit – 3	
Lesson: State Executives – Governor, Chief Minister, State Legislature High Court of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**Hours – 10**
Unit – 4	
Lesson: Special Provision for SC & ST Special Provision for Women, Children & Backward Classes	**Hours –10**

Emergency Provisions. Human Rights –Meaning and Definitions, Legislation Specific Themes in Human Rights- Working of National Human Rights Commission in India Powers and functions of Municipalities, Panchyats and Co - Operative Societies.	
Unit – 5	
Lesson: Scope & Aims of Engineering Ethics, Responsibility of Engineers Impediments to Responsibility.Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**Hours – 10**

COURSE OUTCOMES:

On completion of the course student will

1. Have general knowledge and legal literacy and thereby to take up competitive examinations.
2. Understand state and central policies, fundamental duties.
3. Understand Electoral Process, special provisions.
4. Understand powers and functions of Municipalities, Panchayats and Co-operative Societies, and
5. Understand Engineering ethics and responsibilities of Engineers
6. Understand Engineering Integrity & Reliability

QUESTION PAPER PATTERN:

SECTION A:

1. This section contains ten one answer questions carrying 1 mark each.
2. Two questions from each unit should present.

SECTION B:

1. This section will have 5 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.

TEXT BOOKS:

Text Books:

1. Durga Das Basu: **"Introduction to the Constitution on India",** (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn.,

2001

2. Charles E. Haries, Michael S Pritchard and Michael J. Robins **"Engineering Ethics"** Thompson Asia, 2003-08-05.

REFERENCE BOOKS:

1. M.V.Pylee, "An Introduction to Constitution of India", Vikas Publishing, 2002.
2. M.Govindarajan, S.Natarajan, V.S.Senthilkumar, **"Engineering Ethics",** Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
3. Brij Kishore Sharma,**" Introduction to the Constitution of India"**, PHI Learning Pvt. Ltd., New Delhi, 2011.
4. Latest Publications of Indian Institute of Human Rights, New Delhi

Website Resources

1. www.nptel.ac.in
2. www.hnlu.ac.in
3. www.nspe.org
4. www.preservearticles.com

Course outcomes to Program outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
1	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-
2	-	-	-	-	-	**3**	-	-	-	-	-	-	-	-	-
3	-	-	-	-	-	**1**	-		-	-	-	-	-	-	-
4	-	-	-	-	-	**2**	-	-	-	-	-	-	-	-	-
5						**3**									
6	-	-	-	-	-	-	-	**5**	-	-	-	-	-	-	-
Course	-	-	-	-	-	**3**	-	**5**	-		-	-	-	-	-

Course Structure for

B.Tech.

(Computer Science and Engineering & Information Technology)

Semester III (Second year)

S. No	Course Code	Course Title	L	T	P	C
1	18CMMAT3010	Engineering Mathematics-III	3	1	0	4
2	18CSECT3020 18ITECT3020	Digital Electronics	3	0	0	3
3	18CSECT3030 18ITECT3030	Analog Electronic Circuits	3	0	0	3
4	18CSCST3040 18ITITT3040	Discrete Mathematics	3	1	0	4
5	18CSCST3050 18ITITT3050	Data Structures	3	0	0	3
6	18CSECL3060 18ITECL3060	Analog & Digital Electronics Lab	0	0	3	1.5
7	18CSCSL3070 18ITITL3070	IT Workshop Lab	0	0	3	1.5
8	18CSCSL3080 18ITITL3080	Data Structures Lab	0	0	3	1.5
Total Credits						**21.5**

Course Structure for
B.Tech.
(Computer Science and Engineering & Information Technology)
Semester IV (Second year)

S. No	Course Code	Course Title	L	T	P	C
1	18CSECT4010 18ITECT4010	Signals & Systems	3	0	0	3
2	18CMCET4020 18CMCET4020	Engineering Mechanics	3	0	0	3
3	18CSCST4030 18ITITT4030	Computer Organization	3	0	0	3
4	18CSCST4040 18ITITT4040	Algorithm Design and Analysis	3	0	0	3
5	18CSCST4050 18ITITT4050	Java Programming	3	0	0	3
6	18CSCSL4060 18ITITL4060	Computer Organization Lab	0	0	3	1.5
7	18CSCSL4070 18ITITL4070	Algorithm Design and Analysis Lab	0	0	3	1.5
8	18CSCSL4080 18ITITL4080	Java Programming Lab	0	0	3	1.5
Total Credits						**19.5**

ENGINEERING MATHEMATICS – III
SEMESTER - III

Subject Code	18CMMAT3010	Internal Marks	30
Number of Lecture Hours/Week	3(L) + 1(T)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 04

Course Objectives:
This course will enable students to:

- find the function of a complex variable
- evaluate complex integration and expand functions using Taylor & Maclaurin's series
- evaluate integrals using Residues
- find the statistical parameters for distributions
- test the hypothesis

Unit -1	**Hours**
Function of a complex variable Introduction –continuity –differentiability- analyticity – properties – Cauchy –riemann equations in Cartesian and polar coordinates. Harmonic and conjugate harmonic functions – Milne – Thompson method.	**10**
Unit -2	
Integration and series expansions Complex integration: Line integral – Cauchy's integral theorem, Cauchy's in integral formula, generalized integral formula (all without proofs) Radius of convergence – expansion in Taylor's series, Maclaurin's series and Laurent series	**10**
Unit – 3	
Singularities and Residue Theorem Zeros of an analytic function, Singularity, Isolated singularity, Removable singularity, Essential singularity, pole of order m, simple pole, Residues, Residue theorem, Calculation of residues, Residue at a pole of order m**,**	**10**

Evaluation of real definite integrals: Integration around the unit circle**,** Integration around semi circle, Indenting the contours having poles on the real axis.	
Unit – 4	
Discrete Random variables and Distributions: Introduction-Random variables- Discrete Random variable-Distribution function- Expectation. Discrete distributions: Binomial, Poisson and Geometric distributions and their fitting to data. **Continuous Random variable and distributions:** Introduction-Continuous Random variable-Distribution function- Expectation-Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution	**10**
Unit – 5	
Test of Significance: Introduction - Population and samples- Sampling distribution of means (σ-known) t-distribution- Sampling distribution of means(σ-unknown), chi-square and F- test Hypothesis-Null and Alternative Hypothesis- Type I and Type II errors –Level of significance - One tail and two-tail tests- Tests concerning one mean and proportion, two means- Proportions and their differences - ANOVA for one – way and two – way classified data	**10**
Course outcomes: On completion of this course, students are able to 1. Find the function of a complex variable 2. Evaluate complex integration and expand functions using Taylor & Maclaurin‟s series 3. Evaluate integrals using Residues 4. Find the statistical parameters for discrete distributions 5. Find the statistical parameters for continuous distributions 6. Test the hypothesis	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question	

carrying 1 mark each.

2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. B.S. Grewal, **"Higher Engineering Mathematics"**, Khanna publishers, 44th edition, 2016.
2. Erwin Kreyszig, **"Advanced Engineering Mathematics**, Wiley, 9th Edition, 2013.

Reference Books:

1. B.V. Ramana, **"Higher Engineering Mathematics"**, Tata Mc Graw-Hill, 2006
2. N.P.Bali and Manish Goyal, **"A text book of Engineering mathematics"**, Laxmi publications, 7th Edition.
3. H.K. Dass and Er. RajnishVerma, **"Higher Engineerig Mathematics"**, S.Chand publishing, 1st edition, 2011.
4. Dr. B.Rama Bhupal Reddy**, "Probability and Statistics for Engineers",** Research India Publications, 2015.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Course	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

<table>
<tr><td colspan="4">DIGITAL ELECTRONICS
(Common to CSE & IT)
SEMESTER - III</td></tr>
<tr><td>Subject Code</td><td>18CSECT3020
18ITECT3020</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:
This course will enable students to:
Learn fundamental gates in digital circuits
Learn the simplification methods of Boolean algebra
Study the sequential circuits & systems
Understand operation of A/D and D/A converters and different types of converters
Study about the Semiconductor memories and Programmable logic devices</td></tr>
<tr><td colspan="3">Unit -1 Fundamentals of Digital Systems and logic families</td><td>Hours</td></tr>
<tr><td colspan="3">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 ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic</td><td>12</td></tr>
<tr><td colspan="4">Unit -2 Combinational Digital Circuits</td></tr>
<tr><td colspan="3">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</td><td>07</td></tr>
</table>

MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.	
Unit – 3 Sequential circuits and systems	
1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K-T and D-types 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.	**07**
Unit – 4 A/D and D/A 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	**12**
Unit – 5 Semiconductor memories and Programmable logic devices	
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).	**12**
Course Outcomes: On completion of the course, student will be able to • Understand fundamental gates in digital circuits	

- Understand different logic families
- Understand the simplification methods of Boolean algebra
- Understand the sequential circuits & systems
- Demonstrate operation of A/D and D/A converters and different types of converters
- Understand Semiconductor memories and Programmable logic devices

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. Digital Design Principles & Practices – John F. Wakerly, PHI/ Pearson Education Asia, 3rd Ed., 2005.
4. Switching Theory and Logic Design by Hill and Peterson Mc-Graw Hill TMH edition.

References:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. Fundamentals of Logic Design by Charles H. Roth Jr, Jaico Publishers

Web References:

1. https://www.coursera.org/learn/digital-systems
2. https://onlinecourses.nptel.ac.in/noc19_ee09/preview

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	-	-	-	-	-	-	-	-	-	-	-	-
2	3	3	3	-	-	-	-	-	-	-	-	-	-	-
3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
4	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	3	3	3	-	-	-	-	-	-	-	-	-	-	-
6	3	3	3	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	-	-

ANALOG ELECTRONIC CIRCUITS
(Common to CSE & IT)
SEMESTER - III

Subject Code	18CSECT3030 18ITECT3030	Internal Marks	30
Number of Lecture Hours/Week	3(L)	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:
This course will enable students to:

- Understand semiconductor diodes, special purpose diodes.
- introduce the construction and operation of BJT and MOSFET and their biasing techniques.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Unit -1 Diode Circuits	**Hours**
P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits	**08**
Unit -2 BJT circuits	
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	**12**
Unit – 3 MOSFET Circuits	
MOSFET structure and 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.	**10**

Unit – 4 Differential, multi-stage and operational 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)	**08**
Unit – 5 Applications of op-amp	
Linear applications: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter using op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion. **Nonlinear applications:** Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.	**12**

Course Outcomes:

On completion of the course, student will be able to

1. Understand the basic concepts of semiconductor physics.
2. Understand the construction and operating principle of p-n junction diode and special semiconductor diodes
3. Understand the construction and principle of operation of BJT and MOSFET w.r.t V-I characteristics.
4. Analyze various op-Amp parameters
5. Design sinusoidal and non-sinusoidal oscillators.
6. Design OP-AMP based circuits.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all

topics under a unit.

4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Microelectronic Circuits, A S Sedra and K C Smith, OUP, 1998.
2. Introduction to Operational Amplifier theory and applications, J V Wait, L P Huelsman and G A Korn, McGraw Hill, 1992.

References:

1. Microelectronics, J Millman and A Grabel, McGraw Hill Education, 1988.
2. The Art of Electronics, P Horowitz and W Hill, Cambridge University Press, 1989
3. Analysis and Design of Analog Integrated Circuits, P R Gray, R G Meyer and S Lewis, John Wiley & Sons, 2001.

Web References:

1. https://onlinecourses.nptel.ac.in/noc18_ee45/preview
2. https://swayam.gov.in/course/3835-analog-circuits

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	-	-	-	-	-	-	-	-	-	-	-
3	2	1	3	-	-	-	-	-	-	-	-	-	-	-
4	3	3	3	-	-	-	-	-	-	-	-	-	-	-
5	2	2	1	-	-	-	-	-	-	-	-	-	-	-
6	2	2	1	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-

DISCRETE MATHEMATICS (Common to CSE & IT) SEMESTER III			
Subject Code	18CSCST3040 18ITITT3040	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Course Objectives:
This course will enable the students to:

- Simplify and Evaluate basic logic statements
- Solving Congruence problems by using Number theory
- Apply the operations of sets and use Ven diagrams to solve applied problems
- Solve Counting Problems by applying elementary counting techniques
- Presenting the concepts of groups and rings. Also, aim at describing the application of groups to error detection and correction.

Unit -1: Propositions and Predicates	**Hours**
Propositional Logic (TB1:001-012) Propositions, Variables, Connectives, Truth tables, Converse, Contrapositive, Inverse of a conditional statement, Compound Propositions, Precedence rules. **Applications of Propositions Logic** (TB1:016-022) **Propositional Equivalences** (TB1:025-034) Logical Equivalences, Tautology, Contradiction, De Morgan's Law, Satisfiability, Applications of Satisfiability, Complexity in solving satisfiability problems. **Predicates and Quantifiers** (TB1:036-051) Predicates, Quantifiers, Binding Variables, Logical equivalences involving quantifiers, Negating Quantified Expressions (De Morgan's Law), Translating English into	**10**

Logical Expressions, Using quantifiers in System Specifications. **Nested Quantifiers** (TB1:057-064) Statements involving nested quantifiers, Order of Quantifiers, translating to and from Mathematical/English statements to statements involving nested quantifiers. Negating Nested Quantifiers. **Inference Rules** (TB1:069-078) Valid Arguments in Propositional Logic, Rules of Inference for propositional logic, Checking Arguments validity, Rules of Inference for Quantified statements, Combining rules of Inference for propositions and quantified statements.	
Unit-2: Number Theory and Theorem Proving Methods	
Divisibility and Modular Arithmetic (TB1:237-244) Division, Division Algorithm, Modulo Division, Arithmetic modulo M **Integers and Primes** (TB1:246-249, 257-272) Integer Representations, Conversions, Primes, check for primality, finding primes below a given value, Twin primes, Relative Primes, GCD Algorithm, Euclidean Algorithm, GCD as linear combination. **Solving Congruences** (TB1:275-283) Linear Congruences, The Chinese Remainder Theorem, Fermat's Theorem, Euler Theorem. **Introduction to Proofs** (TB1:82-88) Direct Proof, Proof by Contraposition, Contradiction, Counter Example. **Mathematical Induction** (TB1:311-329) Why Mathematical Induction, Good and Bad of Mathematical Induction, Examples of Proofs, Guidelines.	**12**
Unit-3: Sets, Relations and Functions	
Sets (TB1:115-124): Introduction, Subsets, Equality,Venn	

Diagrams, Cardinality, Power sets, Cartesian Product. **Set Operations** (TB1:127-134) Union, Intersection, Disjoint Sets, Difference, Set Identities, Generalized Unions and Intersections. **Relations** (TB2:442-445, 449-457) Binary Relation, Inverse Relation, Properties of Relations, Transitive closure. **Equivalence Relations** (TB2:459-474) Partition of a set, Relation induced by a partition of a set, Equivalence Relation, Equivalence classes. **Partial Order Relations** (TB2:498-507) Antisymmetric, POSET, Hasse Diagrams, Total Ordering, Maximal, Minimal, Greatest, Lowest elements. **Functions** (TB1:138-152) Function, One-to-One functions, Onto Functions, Bijection Functions, Identity function, Inverse Functions, Composition of functions, Floor, Ceiling, round functions, Partial Function. **Cardinality with Applications to Computability** (TB2:428-437) Properties of Cardinality, Finite and Infinite Sets, Countable and Uncountable Sets, Cantor Diagonalization Process.	**08**
Unit-4: Basic Counting and Combinatorics	
The Basics of Counting (TB1 : 385-399) Introduction, Basic Counting Principles, More Complex Counting Problems, The Subtraction Rule, The Division Rule, Tree Diagrams **The Pigeonhole Principle** (TB1: 399-407) Introduction, The Generalized Pigeonhole Principle, Some Elegant Applications of the Pigeonhole Principle **Permutations and Combinations** (TB1: 407-415) Introduction, Permutations, Combinations **Binomial Coefficients and Identities** (TB1: 415-423) The Binomial Theorem, Pascal's Identity and Triangle, Other Identities Involving Binomial Coefficients **Generalized Permutations and Combinations**	**10**

Introduction, Permutations with Repetition, Combinations with Repetition, Permutations with Indistinguishable Objects, Distributing Objects into Boxes (TB1: 423-434) **Generating Permutations and Combinations** Introduction, Generating Permutations, Generating Combinations (TB1: 434-439)	
Unit-5: Algebraic Structures	
Algebraic Systems: Examples and General Properties(TB3: 270-281) Definition and Examples, Some Simple Algebraic Systems and General Properties **Semi groups and Monoids** (TB3: 282- 294) Definition and Examples, Homomorphism of Semigroups and Monoids, Sub Semigroups and Sub monoids **Groups** (TB3: 319-342) Definitions and Examples, Subgroups and Homomorphisms, Cosets and Lagrange's Theorem, Normal Subgroups, Algebraic Systems with Two Binary Operations **Lattices as Partially Ordered sets** (TB3 :379-397) Definition and Examples, Some Properties of Lattices, Lattices as Algebraic Systems, Sublattices, Direct Product and Homomorphism, Special Lattices	**10**
Course outcomes: On completion of the course student will be able to: 1. Distinguish between Statement Logic and Predicate Logic. 2. Apply mathematical proving techniques in order to solve recurrences and elementary algebra problems. 3. Illustrate by examples terminology, operations and mathematical models using theories of sets, relations and functions. 4. Apply permutations & Combinations in problem solving. 5. Explain basic properties of algebraic structures	
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question	

carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Discrete Mathematics and Its Applications, Kenneth H Rosen, 7th edition, MHP, 2012.
2. Discrete Mathematics with Applications, Susanna SEpp, 4th Edition, CENGAGE.
3. Discrete Mathematical Structures with Applications to Computer Science, J P Tremblay, R Manohar, TMH, 1997.

Reference Books:

1. Discrete Mathematics, Seymour Lipschutz, Marc Lars Lipson, SCHAUM's outlines.
2. Discrete Mathematical Structures, U S Gupta, Pearson Publications.

Web References:

1. https://www.coursera.org/learn/discrete-mathematics
2. https://swayam.gov.in/course/1396-discrete-mathematics

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	3	-	-	-	-	-	-	-	-	-	-	2	-
2	2	3	-	-	-	-	-	-	-	-	-	-	2	-
3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
4	2	3	-	-	-	-	-	-	-	-	-	-	2	-
5	2	3	-	-	-	-	-	-	-	-	-	-	2	-
Cours e	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**2**	-

DATA STRUCTURES
(Common to CSE & IT)
SEMESTER III

Subject Code	18CSCST3050 18ITITT3050	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives:
This course will enable the students to:

- impart the basic concepts of data structures and sorting algorithms.
- familiar with the concepts like stacks, queues.
- solve problems using data structures such as linked lists.
- familiar with non linear data structure like trees.
- impart the basic concepts of graphs..

Unit -1	**Hours**
Basic concepts (TB1:001-045) Algorithm Specification – Introduction, Recursive Algorithms, Data Abstraction, Performance Analysis – Space Complexity, Time Complexity, Asymptotic Notation, Comparing Time Complexities, Performance Measurement **Divide and Conquer Technique (**TB2**:**65-97**)** Maximum-subarray problem, Strassen`s algorithm for matrix multiplication, Solving recurrence relations: Substitution method, recursion-tree method, master method **Searching and Sorting** (TB1:317-336, TB1:408-423) Searching – Introduction, Sequential Search, Binary Search, Sorting-Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Optimal Sorting Time	**12**

Unit -2	
Abstract Data Types (TB1:47-70) Abstract Data Type, The Polynomial ADT, The Sparse Matrix ADT, Sparse Matrix Addition and Multiplication. **Stacks and Queues** (TB1:099-109) The Stack Abstract Data Type, The Queue Abstract Data Type, Circular Queue Abstract Data Type **Stack Applications** (TB1:116-126) Introduction, Evaluating Postfix Expressions, Infix to Postfix, Multiple Stacks and Queues	**10**
Unit – 3	
Singly Linked Lists (TB1:138-149) ADT, Operations, Dynamically Linked Stacks and Queues **Polynomials** (TB1:150-155) Representing as SLL, Addition, multiplication and Erase operations **Doubly Linked Lists** (TB1:179, TB1:162-164) ADT, operations	**08**
Unit – 4	
Trees (TB1: 186-190) Introduction Terminology, Representation of Trees **Binary Trees** (TB1: 191-212) ADT, Properties, Representations, Traversals, Additional Operations, Threaded Binary Trees **Binary Search Trees** (TB1: 227-232) Introduction, Search, Insert and Delete operations, Height of BST. **Heaps** (TB1: 218-226) The Heap Abstract Data Type, Priority Queues, Insertion into a max heap, Deletion from a max heap. Heap sort.	**12**
Unit – 5	
Search Trees (TB1:528-617) AVL Trees, 2 – 3 Trees, 2 – 3 – 4 Trees, Red – Black Trees, B-Trees and B+ Trees and their operations:	**08**

search, insert and delete	

Course Outcomes:

On completion of the course student will be able to:

1. Analyze algorithm's time and space complexity and justify the correctness.
2. Implement Stack and Queue ADT.
3. Implement Linked List ADT.
4. Implement Binary Tree ADT and traversal algorithms.
5. Implement Graph ADT and BFS and DFS traversal algorithms.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Fundamentals of Data Structures in C, Second Edition by Ellis Horowitz, Sartaj Sahni, Anderson – Freed, Universities Press.
2. Interdiction to Algorithms, Thomas H Coremen,Charles ELeiserson, Clifford Stein,Third Edition, MIT Press/McGraw-Hill

Reference Books:

1. Algorithms, Data Structures, and Problem Solving with C++, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. How to Solve it by Computer, 2nd Impression by R. G. Dromey, Pearson Education.

Web References:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. https://swayam.gov.in/course/1407-programming-and-data-structures

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	2	3	-	-	-	-	-	-	-	-	-	-	1	-
2	2	3	-	-	-	-	-	-	-	-	-	-	-	2
3	2	3	-	-	-	-	-	-	-	-	-	-	-	2
4	2	3	-	-	-	-	-	-	-	-	-	-	-	2
5	2	3	-	-	-	-	-	-	-	-	-	-	-	2
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**1**	**2**

ANALOG & DIGITAL ELECTRONICS LAB (Common to CSE & IT) SEMESTER III			
Subject Code	18CSECL3060 18ITECL3060	Internal Marks	50
Number of Lecture Hours/Week	03	External Marks	50
Total Number of Lecture Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable the students to make students to

- Understand the concepts of semiconductor devices
- Understand the Transistor and FET amplifier circuits.
- Understand functionality of Digital Circuits

List of Experiments

(Minimum 12 Experiments to be done**)**

PART-A: (Experiments to be done by using Hardware Components)

1. PN Junction Diode V-I Characteristics
2. Zener Diode Characteristics
3. Transistor Biasing
4. BJT Input and Output Characteristics (CE Configuration)
5. FET Drain and Transfer Characteristics (CS Configuration)
6. BJT-CE Amplifier
7. FET-CS Amplifier
8. OP AMP Applications – Adder, Subtractor, Comparator Circuits

PART-B:

9. Design and verify the functionality of BCD to Excess-3 and Excess-3 to BCD code converters
10. Design and verify the functionality of logic gates and Demorgan's Theorem for 2 variables
11. Design and verify the functionality of adders and

subtractors using logic gates

12. Design and verify the functionality of Multiplexers and Demultiplexers
13. Design and verify the functionality of encoders and decoders
14. Design and verify the functionality of R-S,J-K, T and D Flipflops
15. Design and verify the functionality of Decade Counter
16. Design and verify the functionality of 4-bit Ring Counter

Course Outcomes:

On completion of this course, students will be able to

1. Understand the characteristics of semiconductor devices
2. Understand the nature of transistor and FET amplifier
3. Demonstrate the functionality of logic gates
4. Design and Demonstrate the functionality of combinational and sequential logic circuits

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	3	3	1	-	-	-	-	-	-	-	-	-	-	-
2	3	2	3	-	-	-	-	-	-	-	-	-	2	-
3	2	1	3	-	-	-	-	-	-	-	-	-	1	-
4	3	3	3	-	-	-	-	-	-	-	-	-	-	-
Course	**3**	**2**	**3**	-	-	-	-	-	-	-	-	-	**1**	-

IT WORKSHOP LAB **(Common to CSE & IT)** SEMESTER III			
Subject Code	18CSCSL3070 18ITITL3070	Internal Marks	50
Number of Tutorial Hours/Week	03	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable the students to:

- understand the fundamentals of programming and its environment
- write programs using commands and functions
- use various operators, Control Statements
- apply programming skills in their area of specialization
- implement programming skills in their area of specialization
- Learn to work with team members in developing mini projects

LIST OF EXPERIMENTS

1. Study of basic scilab commands
2. Matrix constructors and operations
3. Matrix bitwise, relational & logical operations
4. Control structures (If-Else, If-elseif -else, Select)
5. Control structures (for, while, break and continue)
6. Graphics - 2d plots
7. Computer application program
8. Civil application program
9. Electronics application program
10. Electronics application program

Course Outcomes:

On completion of this course, students will be able to

- Understand the need for simulation/implementation for the verification of mathematical functions.
- Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.
- Understand control flow of the program.
- Implement simple mathematical functions/equations in numerical computing environment such as SCILAB.
- Interpret and visualize simple mathematical functions and operations thereon using plots/display.

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	2	3	-	-	-	-	-	-	-	-	-	-	2	-
2	2	3	-	-	-	-	-	-	-	-	-	-	2	-
3	2	3	-	-	-	-	-	-	-	-	-	-	2	-
4	2	3	-	-	-	-	-	-	-	-	-	-	2	-
5	2	3	-	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**2**	-

<table>
<tr><td colspan="4">DATA STRUCTURES LAB
(Common to CSE & IT)
SEMESTER III</td></tr>
<tr><td>Subject Code</td><td>18CSCSL3080
18ITITL3080</td><td>Internal Marks</td><td>50</td></tr>
<tr><td>Number of Tutorial Hours/Week</td><td>03</td><td>External Marks</td><td>50</td></tr>
<tr><td>Total Number of Practice Hours</td><td>04</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 1.5</td></tr>
<tr><td colspan="4">Course Objectives:
This course will enable the students to:
• impart the basic concepts of data structures and sorting algorithms.
• familiar with the concepts like stacks, queues.
• Solve problems using data structures such as linked lists.
• familiar with non linear data structure like trees.
• impart the basic concepts of graphs.</td></tr>
<tr><td colspan="4">List of Experiments
Exercise 1 (Sorting)
Bubble Sort
Selection Sort
Insertion Sort
Exercise 2 (Sorting)
Quick Sort
Merge Sort
Exercise 3 (Abstract Data Types)
Stacks and Queue using arrays
Stacks and Queue using Linked Lists
Exercise 4 (Applications of Stack)
Infix to Postfix Conversion
Postfix Expression Evolution
Exercise 5 (Linked List Applications)
Polynomial Addition
Polynomial Multiplication</td></tr>
</table>

Exercise 6

Doubly Linked List

Circular Linked List

Exercise 7 (Search Trees)

Binary Search Trees

Exercise 8 (Search Trees)

Binary Heap

Heap Sort

Exercise 9 (Search Trees)

AVL Trees

Exercise 10 (Search Trees)

Red-Black Trees

Exercise 11 (Search Trees)

B- Trees

Exercise 12 (Search Trees)

B+ Trees

Course Outcomes:

On completion of this course, students will be able to

1. analyze time and space complexity and justify them.
2. Implement Stacks and Queues and demonstrate applications of stacks.
3. Implement different types of lists and operations.
4. Implement variety of search trees and traversal algorithms.
5. Implement various sorting algorithms.

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	2	3	-	-	-	-	-	-	-	-	-	-	-	2
2	2	3	-	-	-	-	-	-	-	-	-	-	-	2
3	2	3	-	-	-	-	-	-	-	-	-	-	-	2
4	2	3	-	-	-	-	-	-	-	-	-	-	-	2
5	2	3	-	-	-	-	-	-	-	-	-	-	-	2
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-	**2**

<table>
<tr><td colspan="5" align="center">SIGNALS & SYSTEMS
(Common to CSE & IT)
SEMESTER IV</td></tr>
<tr><td>Subject Code</td><td>18CSECT4010
18ITECT4010</td><td colspan="2">Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td colspan="2">External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td colspan="2">Exam Hours</td><td>03</td></tr>
<tr><td>Pre-requisite</td><td>Engineering Mathematics-II</td><td colspan="3" align="center">Credits – 03</td></tr>
<tr><td colspan="5">Course Objectives:
This course will enable the students to:
Basic concepts of signals and systems and perform operations on LTI systems.
Analyze the signals and systems by using transforms.
Know the process of sampling.</td></tr>
<tr><td colspan="3">Unit -1</td><td colspan="2" align="center">Hours</td></tr>
<tr><td colspan="3">Introduction:
Definition of Signals and Systems, Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.</td><td colspan="2" align="center">12</td></tr>
<tr><td colspan="5">Unit -2</td></tr>
<tr><td colspan="3">Behavior of continuous and discrete-time LTI systems:
Impulse response and step response, convolution, input-output behavior with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations.</td><td colspan="2" align="center">12</td></tr>
</table>

State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	
Unit – 3	
Fourier Transformation: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplicate ion and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete-Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.	**08**
Unit – 4	
Laplace Transforms: Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. **Z–Transforms:** The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	**10**
Unit – 5	
Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	**08**

Course outcomes:

On completion of the course student will be able to:

1. Characterize the signals and systems.
2. Understand the Behavior of continuous and discrete-time LTI systems
3. Analyze the continuous-time signals and continuous-time systems using Fourier series, Fourier transform and Laplace transform.
4. Apply z-transform to analyze discrete-time signals and systems.
5. Apply sampling theorem to convert continuous-time signals to discrete-time signal and reconstruct back.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, **"Signals and Systems"**, 2nd Edition, PHI, 2009.
2. B.P. Lathi, **"Signal Processing & Linear Systems"**, 1st Edition, Oxford University Press, 2006.

Reference Books

1. Simon Haykin and Van Veen, **"Signals & Systems"**, 2nd Edition, John Wiley India, 2011.
2. M. J. Roberts**, "Analysis using Transform methods and MATLAB"**, 1st Edition, TMH, 2005.

Web References:

1. https://www.coursera.org/courses?query=signals%20and%

	20systems
2.	https://onlinecourses.nptel.ac.in/noc18_ee02/preview

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	-	-	-	-	-	-	-	-	-	-	-	-	-
5	3	1	-	-	-	-	-	-	-	-	-	-	-	-
6	3	1	-	-	-	-	-	-	-	-	-	-	-	-
Cours e	**3**	**1**	-	-	-	-	-	-	-	-	-	-	-	-

ENGINEERING MECHANICS **(Common to CSE & IT)** SEMESTER IV			
Subject Code	18CMCET4020	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course Objectives:

This course will enable the students to:

- To develop an understanding of the principles of statics and the ability to analyze problems using static equilibrium equations.
- To introduce the basic principles of mechanics applicable to rigid bodies in equilibrium.
- To teach the basic principles of mechanics applicable to the motion of particles and rigid bodies.
- To introduce with mathematical description of the plane motion of rigid bodies.
- To develop the fundamentals of engineering mechanics and problem solving skills essential for mechanical engineering

Unit -1	**Hours**
Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment of Force and its Application – Couples and Resultant of Force Systems. **Friction:** Introduction, limiting friction and impending motion, coulomb's laws of dry friction, coefficient of friction, cone of friction	**10**
Unit -2	
Equilibrium of Systems of Forces: Free Body Diagrams, Equations of Equilibrium of Coplanar Systems, Spatial Systems for concurrent forces.	**8**

LamisTheorm, Graphical method for the equilibrium of coplanar forces, Converse of the law of Triangle of forces, converse of the law of polygon of forces condition of equilibrium, analysis of plane trusses.	
Unit - 3	
Centroid and Centre of Gravity covering Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; **Mass moment inertia** of circular plate, Cylinder, Cone, Sphere, Hook.	**10**
Unit – 4	
Kinematics: Rectilinear and Curvilinear motions – Velocity and Acceleration – Motion of Rigid Body – Types and their Analysis in Planar Motion. **Kinetics:** Analysis as a Particle and Analysis as a Rigid Body in Translation– Central Force Motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies.	**12**
Unit-5	
Work – Energy Method: Equations for Translation, Work-Energy Applications to Particle Motion, Connected System-Fixed Axis Rotation and Plane Motion. Impulse momentum method.	**10**
COURSE OUTCOMES: On completion of the course student will able to: 1. Resolve the forces into components, moment of force and its applications 2. Construct free body diagrams and develop appropriate equilibrium equations. 3. Determine centroid and moment of inertia for composite areas.	

4. Determine the kinematic relations of particles & rigid bodies.
5. Apply equations of motion to particle and rigid body using the principle of energy and momentum methods.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. Engg. Mechanics 4th Edn, S.Timoshenko&D.H.Young, Mc Graw Hill publications.
2. Engineering Mechanics-Statics and Dynamics, A Nelson, Tata McGraw Hill Education Private Ltd.

Reference Books:

1. Engineering Mechanics statics and dynamics, 11th Edn, R.C.Hibbeler, Pearson.
2. Engineering Mechanics, statics, 6th Edn, J.L.Meriam, Wiley India Pvt Ltd.
3. Engineering Mechanics, statics and dynamics, I.H.Shames, Pearson
4. Mechanics For Engineers, statics, 5th Edn, F.P.Beer & E.R.Johnston, Mc Graw Hill
5. Mechanics For Engineers, dynamics, 5th Edn, F.P.Beer & E.R.Johnston, Mc Graw Hill
6. Theory & Problems of engineering mechanics, statics & dynamics, 5th Edn, E.W.Nelson, C.L.Best& W.G. McLean, Mc Graw Hill.

7. Singer's Engineering Mechanics: Statics and Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Bs Publications.
8. Engineering Mechanics, Fedinand . L. Singer, Harper, Collins

Web References:

1. https://swayam.gov.in/courses/5241-engineering-mechanics
2. https://onlinecourses.nptel.ac.in/noc16_ph02/preview

Course Outcomes to Program Outcomes mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
3	2	2	-	-	-	-	-	-	-	-	-	-	2	-
4	3	2	-	-	-	-	-	-	-	-	-	-	1	-
5	3	2	-	-	-	-	-	-	-	-	-	-	1	-
Course	**3**	**2**	-	-	-	-	-	-	-	-	-	-	**3**	-

<table>
<tr><td colspan="4" align="center">COMPUTER ORGANIZATION
(Common to CSE & IT)
SEMESTER IV</td></tr>
<tr><td>Subject Code</td><td>18CSCST4030
18ITITT4030</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits: 03</td></tr>
</table>

Course Objectives:

This course will enable the students to:

- To understand working of Computer System, data representations and various methods for performing basic operations on computers.
- To know the concepts of Instruction Level Architecture and Instruction Execution.
- To impart knowledge about Hardwired and Microprogrammed control.
- To familiarize with the principles of Memory System Design and accessing I/O Devices.
- To provide knowledge on pipelining techniques and Instruction Level Parallelism.

Unit -1	**Hours**
Functional Units: Input Unit, Memory Unit, Arithmetic Logic Unit, Output Unit, Control Unit, **Number Representations**: Integers (Signed and Unsigned), Addition and subtraction, Sign Extension, Overflow in Integer Arithmetic, Floating-point Numbers, Characters, **Integer Addition and Subtraction**: Ripple-carry adder, Carry-Lookahead Adder, **Integer Multiplication**: Array Multiplier, Shift-and-Add, Booth Multiplier, Carry-Save Addition of Summands,	**11**

Integer Division: Restoring Division, Non-Restoring Division, **Floating Point Arithmetic**: Representation, Operations, Guard bits and Truncation, Implementation of Operations	
Unit -2	
Basic Concepts: Memory Locations and Addresses, Byte Addressability, Big-Endian and Little-Endian Assignments, Word Alignment, Memory Operations, **Instruction Sets**: Notations for Data Transfer, RISC and CISC Instruction Sets,Introduction to RISC Instructions, Logic Instructions, Shift and Rotate, Multiplication and Division, dealing with 32-bit Immediate Values, CISC Instruction Sets, RISC and CISC Styles, **Instruction Execution**: Sequencing, Branching, **Addressing Modes**: Accessing Variables, Indirection and Pointers, Indexing and Arrays, Additional Addressing modes, Condition Codes.	**10**
Unit - 3	
Basic Concepts: Main Hardware Components, Data Processing Hardware**,** **Instruction Execution:** Load Instructions, Arithmetic and Logic Instructions, Store Instructions**,** **Hardware Components:** Register File, ALU, Data Path, Instruction Fetch Section**,** **Instruction Fetch and Execution:** ADD, LOAD, STORE, BRANCH and Subroutine call instructions; instruction encoding, Wait for Memory**,** **Control Unit Design:** Control Signals, Hardwired Control, Microprogrammed Control	**08**

Unit – 4	
Basic Concepts: Basics, Cache Memory, Virtual Memory, Block Transfers**,** **Memory Organization:** Internal Organization of Memory Chips, Static RAMs, Dynamic RAMs, Synchronous DRAMs, Structure of Larger Memories, Read-Only Memories, Memory Hierarchies**, Cache Memories:** Locality of Reference, Cache Hit and Miss, Mapping Techniques: Direct, Associate, Set-associate; Replacement Algorithms, Hit Rate and Miss Penalty, caches on the processor Chip, Enhancing Cache Performance**,** **Peripherals:** Accessing I/O Device, I/O Interface, Program-controlled I/O**,** **Interrupts:** Concept, Enabling and Disabling, Handling Multiple Devices, Controlling I/O Devices (Interrupt-driven I/O), Processor Control Registers**,** **Direct Memory Access:** DMA Controller and registers	**10**
Unit-5	
Pipeline: Ideal Case, Organization, Issues**,** **Data Dependencies:** Concept, Operand Forwarding, Handling Data Dependencies**,** **Effect of Delays:** Memory Delays, Delays due to Unconditional and Conditional Branches, Branch Delay Slot, Static and Dynamic Prediction, Branch Target Buffer for Dynamic Prediction, Resource Limitation**,** **Performance Evaluation:** Effects of Stalls and Penalties, Number of Pipeline Stages**,** **Super Scalar Operation:** Concept, Branches and Data Dependencies, Out-of-order Execution, Execution Completion, Dispatch Operation**,**	**11**

<table>
<tr><td>

Parallel Processing:
Hardware Multithreading, Vector Processing, Graphics Processing Units (GPUs), Shared Memory Multiprocessors**,**
Cache Coherence:
Write-Through protocol, Write Back Protocol, Snoopy Caches, Directory Based Cache Coherence, Message Passing
</td><td></td></tr>
<tr><td colspan="2">

Course Outcomes:
On completion of the course student will able to:
1. Get familiar with Operating System fundamentals.
2. Attain knowledge on processes, threads and the communication between them.
3. Understand the mechanism for executing jobs by the underlying processor.
4. Comprehend the intricacies of sharing limited available resources among the processes and threads.
5. Gain insights into the mechanisms for managing memory, disks and I/O devices.
</td></tr>
<tr><td colspan="2">

Question paper pattern:
Section A:
1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.
Section B:
1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit
</td></tr>
<tr><td colspan="2">

Text Books:
1. Computer Organization and Embedded Systems, 6th Edition, Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, McGraw-Hill Publications.
</td></tr>
</table>

Reference Books:

1. Computer Organization and Design: The Hardware/Software Interface, 5th Edition, David A. Patterson, John L. Hennessy, Morgan Kauffman Publishers (Elsevier).

Web References:

1. https://swayam.gov.in/course/3747-computer-organization
2. https://online.stanford.edu/courses/cs107-computer-organization-and-systems

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	3	3	3	-	-	-	-	-	-	-	-	-	2	-
2	3	3	3	-	-	-	-	-	-	-	-	-	2	-
3	3	3	3	-	-	-	-	-	-	-	-	-	2	-
4	3	3	3	-	-	-	-	-	-	-	-	-	2	-
5	3	3	3	-	-	-	-	-	-	-	-	-	2	-
Course	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	**2**	**-**

ALGORITHMS DESIGN AND ANALYSIS (Common to CSE & IT) SEMESTER IV			
Subject Code	18CSCST4040 18ITITT4040	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits: 03			

Course Objectives:

This course will enable the students to:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for 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 -1	Hours
Elements of Dynamic Programming: Optimal sub structure, overlapping sub problems, Reconstructing an optimal solution, Memorization. **Example Problems:** Longest common Subsequence, Optimal Binary search trees, String Editing, 0/1 Knap Sack Problem , The Traveling Salesperson Problem, **Elements of Greedy Strategy:** Concept, Greedy – Choice property, Optimal sub structure, Greedy vs Dynamic programming, **Example Problems:** Huffman codes, Knap Sack Problems, Tree Vertex Splitting, Job Sequencing with Dead Lines.	**11**

Unit -2	
Back Tracking: Concept, State Space, Solution Space, Tree Organization of State Space and Solution Space, illustration using 4-Queens Problem, Sum of Subsets Problems, **Example Problems:** 8-Queens Problem, Sum of Sub sets, Graph Coloring, Hamiltonian Cycles, 0/1 Knap Sack Problem, **Branch and Bound:** Least Cost (LC) Search, 15-Puzzle Example, Control Abstraction for LC-Search, Bounding, FIFO Branch-and-Bound, LC-Branch-and -Bound, **Example Problems:** 0/1 Knap Sack Problem, Traveling Sales Person Problem	**09**
Unit - 3	
Elementary Graph Algorithms: Concepts, Representation of Graphs, Breadth First Search, Depth First Search, Topological sort, Strongly Connected Components, Biconnected Components, Articulation Points **Minimum Spanning Trees:** Growing Minimum Spanning Tree, Kruskal\`s Algorithm, Prim\`s Algorithms, **Single Source Shortest Paths:** Shortest Path, Edge Weights, Variants of Shortest Path Problems, Optimal Sub Structure of Shortest Path, Negative Edge Weights, Cycles, Representing Shortest Paths, Relaxation, Properties of Shortest path and Relaxation, **All-Pairs Shortest Paths:** Concept, Shortest Path and Matrix Multiplication, **Shortest Path Algorithms:** Bellman Ford Algorithm, Dijkstra\`s Algorithm, Floyd- Warshall Algorithm.	**11**

Unit – 4	
Computability of Algorithms: Tractable and Intractable, Computability Classes – P, NP, NPC, NPH, showing problems to be NPC, Reductions, **Tractable Problems:** Supporting arguments, Abstract Problems, Encodings, **Polynomial Time Verification:** Hamiltonian Cycles, Verification Algorithms, Complexity class NP, **NP Completeness:** Reducibility, NP Completeness, Circuit Satisfiability, Circuit Satisfiability, **NP Completeness Proof:** Formula Satisfiability, 3CNF Satisfiability, **NP-Complete Problems:** Clique, Vertex-cover, Hamiltonian Cycle, Traveling-Salesman Problem, Subset Sum Problem	**10**
Unit - 5	
Approximation Algorithms: Roles and functions, Components, Structure, Operations, Load Balancing Problem, Center Selection Problem, Set Cover, Greedy Heuristics, **Randomized Algorithms:** Contention Resolution, Global Minimum Cut, Random Variables and Their Expectations, A Randomized Approximation Algorithm for MAX 3-SAT, Randomized Divide and Conquer: Median Finding and Quick Sort.	**09**
COURSE OUTCOMES: On completion of the course student will able to: 1. 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. For a given problem develop the greedy algorithms. 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. For a given problems of dynamic-programming an develop the dynamic programming algorithms and analyze it to determine its computational complexity. For a given model engineering problem model it is using graph and write the corresponding algorithm to solve the problems.
Question paper pattern: **Section A:** 1. This section contains ten one or two line answer question carrying 1 mark each. 2. Two questions from each unit should present. **Section B:** 1. This Section will have 10 questions, 2 from each unit 2. Each full question carries 12 marks. 3. Each full question will have sub question covering all topics under a unit. 4. The student will have to answer 5 full questions selecting one full question from each unit
Text Books: 1. Interdiction to Algorithms, Third Edition, Thomas H Coremen,CharlesE.Leiserson, Clifford Stein, MIT Press/McGraw-Hill. 2. Computer Algorithms, Ellis Horowitz, Sartaj Sahni, S Rajasekaran, Computer Science Press 3. Algorithm Design, First Edition, JON Kleinberg, EVA Tardos, Pearson Addison Wesley
Reference Books: 1. Algorithm Design: Foundation, analysis, and Internet

Examples, First Edition, John Wiley & sons

Web References:

1. https://www.coursera.org/specializations/algorithms
2. https://swayam.gov.in/course/4417-design-and-analysis-of-algorithms

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	2	3	-	-	-	-	-	-	-	-	-	-	1	2
2	2	3	-	-	-	-	-	-	-	-	-	-	1	2
3	2	3	-	-	-	-	-	-	-	-	-	-	1	2
4	2	3	-	-	-	-	-	-	-	-	-	-	1	2
5	2	3	-	-	-	-	-	-	-	-	-	-	1	2
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	**1**	**2**

<table>
<tr><td colspan="4">JAVA PROGRAMMING
(Common to CSE & IT)
SEMESTER IV</td></tr>
<tr><td>Subject Code</td><td>18CSCST4050
18ITITT4050</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:
This course will enable the students to:
Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
Be aware of the important topics and principles of software development.
Have the ability to write a computer program to solve specified problems.</td></tr>
<tr><td colspan="3">Unit -1: Introduction to OOP</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction to Object Oriented Programming, Principles of Object-Oriented Languages, Procedural languages Vs OOP, History and Evolution of Java, Java Virtual Machine, Java Features, Program Structure, Variables, Primitive Data Types, Variables, Type Conversion and Casting, Operators, Control Statements, Arrays, String.</td><td>08</td></tr>
<tr><td colspan="4">Unit -2 : Introducing Classes, Methods and Inheritance</td></tr>
<tr><td colspan="3">Class Fundamentals, Declaring Objects, Reference Variables, Methods, Constructors, this keyword, Garbage Collection, finalize() method.
Overloading Methods and Constructors, usage of static and final keywords, Command line arguments.
Inheritance basics, using super, method overriding,</td><td>10</td></tr>
</table>

dynamic method dispatch, abstract classes.	
Unit – 3: Packages, Interfaces, Exception Handling and I/O	
Packages, Access Protection, Interfaces, Exception Handling, Exception types, built in exceptions, user defined exceptions, using try, catch, throw, throws, finally, chained exceptions, assertions I/O Basics, reading console input and writing console output, Reading and Writing Files	**10**
Unit – 4: Multi-Threading and java util Package	
Java Thread Model, creating a thread, Thread priorities, Synchronization, Inter Thread Communication, collections overview, collection interfaces, collection classes, iterator, maps, comparators.	**10**
Unit – 5: Introducing GUI Programming with JavaFX	
JavaFX Basic Concepts, JavaFX Application Skeleton, JavaFX, Control: Label, Button, Image, Image View, Radio Button, Checkbox, List View, Combo Box, Text Field, Scroll Pane, JavaFx Menus, JavaFX Event Handling	**12**

COURSE OUTCOMES:

On completion of the course student will able to:

1. Design classes, interfaces and packages.
2. Demonstrate inheritance, polymorphism, encapsulation.
3. Demonstrate user defined exceptions.
4. Create Threads to parallelize operations.
5. Create rich user-interface applications using modern API JavaFX.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions, 2 from each unit
2. Each full question carries 12 marks.

3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit

Text Books:

1. The complete Reference Java, 9th edition, Herbert Scheldt, TMH.
2. Programming in JAVA, Sachin Malhotra, Saurabh Choudary, Oxford.

Reference Books:

1. JAVA Programming, K Rajkumar, Pearson
2. Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
3. Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
4. Object Oriented Programming Through Java, P. Radha Krishna, Universities Press.

Web References:

1. https://www.edx.org/learn/java
2. https://onlineitguru.com/core-java-online-training-placement.html

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	3	3	3	-	3	-	-	-	-	-	-	-	-	2
2	2	3	3	-	2	-	-	-	-	-	-	-	-	2
3	2	3	3	-	2	-	-	-	-	-	-	-	-	2
4	2	3	3	-	2	-	-	-	-	-	-	-	-	2
5	2	3	3	-	2	-	-	-	-	-	-	-	-	2
Course	**2**	**3**	**3**	-	**2**	-	-	-	-	-	-	-	-	**2**

COMPUTER ORGANIZATION LAB **(Common to CSE & IT)** SEMESTER IV			
Subject Code	18CSCSL4060 18ITITL4060	Internal Marks	50
Number of Tutorial Hours/Week	03(P)	External Marks	50
Total Number of Practice Hours	48	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable the students to:

- To understand working of Computer System, data representations and various methods for performing basic operations on computers.
- To know the concepts of Instruction Level Architecture and Instruction Execution.
- To impart knowledge about Hardwired and Microprogrammed control.
- To familiarize with the principles of Memory System Design and accessing I/O Devices.
- To provide knowledge on pipelining techniques and Instruction Level Parallelism.

List of experiments

Exercise 1

a) Write a Machine Language Program to perform Addition of two numbers.

b) Write a Machine Language Program to perform Subtraction of two numbers.

Exercise 2

a) Write a Machine Language Program to perform Addition of **n** numbers.

b) Write a Machine Language Program to generate **n** numbers.

Exercise 3

a) Write a Machine Language Program to generate **n** Even numbers.

b) Write a Machine Language Program to generate **n** Odd numbers.

Exercise 4

a) Write a Machine Language Program to move data from one block to another block.

b) Write a Machine Language Program to mask 4 high-order bits.

Exercise 5

a) Write a Machine Language Program to read data at location 4400 and unpack data into 07, 0E and store in 4401 & 4402.

b) Write a Machine Language Program to Subtract an array of elements to get positive result

Exercise 6

a) Write a Machine Language Program to Find largest element of an array.

b) Write a Machine Language Program to Perform Linear Search operation.

Exercise 7

a) Write a Machine Language Program to Find smallest element of an array.

b) Write a Machine Language Program to Find largest value among two numbers.

Exercise 8

a) Write a Machine Language Program to Find smallest value among two numbers.

b) Write a Machine Language Program to Find factorial of given number.

Exercise 9

a) Write a Machine Language Program to generate Fibonacci Series.

b) Write a Machine Language Program to Convert a number from Hexadecimal to BCD.

Exercise 10

a) Write a Machine Language Program to separate Even and Odd numbers.

b) Write a Machine Language Program to find 1's Complement and 2's Complement of a number.

Exercise 11

a) Write a Machine Language Program to perform addition of first **n** numbers.

b) Write a Machine Language Program to perform Division of two 8-bit numbers.

Exercise 12

a) Write a Machine Language Program to Convert ASCII to Decimal and vice versa.

Write a Machine Language Program to Convert a number from Hexadecimal to Decimal.

COURSE OUTCOMES:

On completion of the course student will able to:

1. Get familiar with Operating System fundamentals.
2. Attain knowledge on processes, threads and the communication between them.
3. Understand the mechanism for executing jobs by the underlying processor.
4. Comprehend the intricacies of sharing limited available resources among the processes and threads.
5. Gain insights into the mechanisms for managing memory, disks and I/O devices.

Course Outcomes to Program Outcomes mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
1	3	3	3	-	-	-	-	-	-	-	-	-	-	2
2	3	3	3	-	-	-	-	-	-	-	-	-	-	2
3	3	3	3	-	-	-	-	-	-	-	-	-	-	2
4	3	3	3	-	-	-	-	-	-	-	-	-	-	2
5	3	3	3	-	-	-	-	-	-	-	-	-	-	2
Course	**3**	**3**	**3**	-	-	-	-	-	-	-	-	-	-	**2**

ALGORITHMS DESIGN AND ANALYSIS LAB
(Common to CSE & IT)
SEMESTER IV

Subject Code	18CSCSL4070 18ITITL4070	Internal Marks	50
Number of Tutorial Hours/Week	03(P)	External Marks	50
Total Number of Practice Hours	48	Exam Hours	03

Credits – 1.5

Course Objectives:
This course will enable the students to:

- Analyze the asymptotic performance of algorithms.
- Write rigorous correctness proofs for 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

LIST OF EXPERIMENTS:

Exercise 1 (Dynamic Programming Technique)
a) Longest common Subsequence
b) Develop Optimal Binary search trees

Exercise 2 (Dynamic Programming Technique)
a) 0/1 Knap Sack Problem ,
b) The Traveling Salesperson Problem.

Exercise 3 (Greedy Methods)
a) Huffman codes
b) Knap Sack Problems

Exercise 4 (Greedy Methods)
a) Tree Vertex Splitting
b) Job Sequencing with Dead Lines

Exercise 5 (Back Tracking Techniques)
a) 8-Queens Problem
b) Sum of Sub sets

Exercise 6 (Back Tracking Techniques)

a) Graph Coloring.
b) Hamiltonian Cycles

Exercise 7 (Back Tracking Techniques)

a) 0/1 Knap Sack Problem

Exercise 8 (Branch and Bound)

a) 0/1 Knap Sack Problem
b) Traveling Sales Person Problem

Exercise 9 (Graph Algorithms)

a) Breadth First Search
b) Depth First Search

Exercise 10 (Graph Algorithms)

a) Kruskal`s Algorithm
b) Prim`s Algorithms

Exercise 11 (Graph Algorithms)

a) Bellman Ford Algorithm
b) Dijkstra`s Algorithm

Exercise 12 (Graph Algorithms)

Floyd- Warshall Algorithm.

Course Outcomes:

On completion of the course student will able to:

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. For a given problem develop the greedy algorithms.
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. For a given problem of dynamic-programming an develop the dynamic programming algorithms and analyze it to determine its computational complexity.

Course Outcomes to Program Outcomes mapping:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	3	-	-	-	-	-	-	-	-	-	-	-	2
2	2	3	-	-	-	-	-	-	-	-	-	-	-	2
3	2	3	-	-	-	-	-	-	-	-	-	-	-	2
4	2	3	-	-	-	-	-	-	-	-	-	-	-	2
5	2	3	-	-	-	-	-	-	-	-	-	-	-	2
Course	**2**	**3**	-	-	-	-	-	-	-	-	-	-	-	**2**

JAVA PROGRAMMING LAB **(Common to CSE & IT)** SEMESTER IV			
Subject Code	18CSCSL4080 18ITITL4080	Internal Marks	50
Number of Tutorial Hours/Week	3(P)	External Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

Course Objectives:

This course will enable the students to:

- Build software development skills using java programming for real world applications.
- Implement classical problems using java programming.
- Make the students to write programs using multithreading concepts and handle exceptions.
- Develop programs using java collection API as well as java Standard Library.
- make the students to create the Graphical User Interface using JavaFX.

List of experiments

Exercise 1 (Basics)

a) Write a Java program to display default value of all primitive data type of Java.
b) Write a Java Program to print the area of the Triangle
c) Write a Java program to check whether the given number is even or odd.

Exercise 2 (Basics-Continued)

a) Write a Java program to display the Fibonacci sequence
b) Write a Java program that display the roots of a quadratic equation ax2+bx=0. Calculate the discriminate D and basing on value of D, describe the nature of root.
c) Five Bikers Compete in a race such that they drive at a constant speed which may or may not be the same as the other. To qualify the race, the speed of a racer must be

more than the average speed of all 5 racers. Take as input the speed of each racer and print back the speed of qualifying racers.

Exercise 3 (Operations, Expressions, Control-flow, Strings)

a) Write a Java program to search for an element in a given list of elements using binary search.
b) Write a Java program to sort given list of elements using bubble sort
c) Write a Java program using StringBuffer to delete, remove character.

Exercise 4 (Class, Objects, Methods)

a) Write a Java program to implement class mechanism. – Create a class, methods and invoke them inside main method.
b) Write a Java program to implement constructor.
c) Write a Java program to implement constructor overloading.
d) Write a Java program implement method overloading.

Exercise 5 (Inheritance)

a) Write a Java program to implement Single Inheritance
b) Write a Java program to implement multi-level Inheritance
c) Write a Java program to find areas of different shapes using abstract class.

Exercise 6 (Inheritance - Continued)

a) Write a Java program give example for “super” keyword.
b) Write a Java program to implement Interface.
c) Write a Java program that implements Runtime polymorphism

Exercise 7 (Exceptions)

a) Write a Java program that describes exception handling mechanism
b) Write a Java program for creation of Illustrating throw, throws and finally
c) Write a Java program to illustrate sub class exception precedence over base class.
d) Write a Java program for creation of User Defined Exception

Exercise 8 (Packages)

a) Write a Java program to create a package named pl and implement ex1 class in it.

b) Write a Java program to create a package “mypack” and import it in circle class.

c) Write a Java program illustrate class path

Exercise 9 (I/O)

a) Write a Java program to illustrate the concept of I/O Streams.

b) Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.

c) Write a Java program that displays the number of characters, lines and words in a text file.

Exercise 10 (Threads)

a) Write a Java program that creates threads by extending Thread class .First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds ,(Repeat the same by implementing Runnable)

b) Write a Java program to illustrate the concept of Thread synchronization.

c) Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication

Exercise 11 (Collections)

a) Write a Java program to create a new array list, add some colors (string) and print out the collection.

b) Write a Java program to iterate a linked list in reverse order.

c) Write a Java program to iterate through all elements in a hash list.

d) Write a Java program to associate the specified value with the specified key in a HashMap.

Exercise 12 (JavaFX)

a) Write a Java program to demonstrate Mouse and Keyboard event Handling

b) Write a Java program to design a notepad editor.

COURSE OUTCOMES:

On completion of the course student will able to:

1. Understand and Apply Object oriented features and Java concepts.
2. Examine and analyze alternative solutions to a given problem using java.
3. Apply the concept of multithreading and implement exception handling.
4. Implement front end and back end of an application using Java
5. Develop applications using Console I/O and File I/O, GUI applications.

Course Outcomes to Program Outcomes mapping:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
1	3	3	3	-	3	-	-	-	-	-	-	-	-	2
2	2	3	3	-	2	-	-	-	-	-	-	-	-	2
3	2	3	3	-	2	-	-	-	-	-	-	-	-	2
4	2	3	3	-	2	-	-	-	-	-	-	-	-	2
5	2	3	3	-	2	-	-	-	-	-	-	-	-	2
Course	**3**	**3**	**3**	-	**2**	-	-	-	-	-	-	-	-	**2**

III B. Tech I Semester

S. No.	Subject Code	Title	Hours L	Hours T	Hours P	C
01	18CMBIT5010	Biology for Engineers	3			3
02	18CMEGT5020	Personality Development & Professional Communication	2			2
03	18CMMST5030	Management Science	3			3
04	18CSCST5040	Computer Networks	3			3
05	18CSCST5050	Operating Systems	3			3
06	18CSCSL5060	Computer Networks Lab			3	1.5
07	18CSCSL5070	Operating Systems Lab			3	1.5
08	18CSCSL5080	R Programming Lab			3	1.5
			14		9	**18.5**
			23			

III B. Tech II Semester

S. No.	Subject Code	Title	Hours L	Hours T	Hours P	C
01	18CSCST6010	Formal Languages & Automata Theory	3			3
02	18CSCST6020	Database Systems	3			3
03	18CSCSP603X	Program Elective-I	3			3
04	18CSXXO604Y	Open Elective-I	3			3
05	18CMMST6050	Engineering Economics & Financial Management	3			3
06	18CSCSL6060	Database Systems Lab			3	1.5
07	18CSCSL6070	Python Programming Lab			3	1.5
08	18CSCSR6080	Term Paper + Seminar			4	2
			15		10	**20**
			26			

Program Elective-I	
18CSCSP603**A**	Software Engineering
18CSCSP603**B**	Network Protocols
18CSCSP603**C**	Mobile Application Development

BIOLOGY FOR ENGINEERS			
Subject Code	18CMBIT5010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology. How biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermo dynamics by referring to the original observation of Robert Brown and Julius Mayor.	**08**
Unit -2:Classification	
Plant Hierarchy of life forms at phenomenological level- classification based on (a) cellularity - Unicellular or multicellular (b) ultra- structure- prokaryotes or eukaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophy, lithotrophs (d) Ammonia excretion – ammoniotelic, uricotelic, ureotelic (e) Habitats- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology come from different groups. E. coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. Musculus	**08**
Unit – 3:Genetics & Biomolecules	
Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. **Molecules of life:** Monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.	**12**
Unit – 4:Enzymes& Proteins	
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification. Mechanism of enzyme action. -examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. **Proteins**- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. **Information Transfer:** The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosides. Concept of genetic code. Universality and degeneracy of	**12**

genetic code. Define gene in terms of complementation and recombination	
Unit – 5:Microbiology& Metabolism	
Thermodynamics as applied to biological systems - Exothermic and endothermic versus undergone and exergoinc reactions. Concept of K_{eq} and its relation to standard free energy - Spontaneity - ATP as an energy currency. This should include the breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge **Concept of single celled organisms**. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics	**10**

Text(T) / Reference(R) Books:	
T1	Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
T2	Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons
T3	Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
R1	Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
R2	Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
W1	https://ocw.mit.edu/courses/biological-engineering/
W2	https://onlinecourses.nptel.ac.in/noc16_ge03/preview

Course Outcomes: On completion of this course, students can	
CO1	Describe how biological observations of 18th Century that lead to major discoveries.
CO2	Convey that classification is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
CO3	Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring
CO4	Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine
CO5	Classify enzymes and distinguish between different mechanisms of enzyme action, To convey that “Genetics is to biology what Newton’s laws are to Physical Sciences”

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

PERSONALITY DEVELOPMENT & PROFESSIONAL COMMUNICATION			
Subject Code	18CMEGT5020	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	32	Exam Hours	03
Credits – 02			

Unit -1: Personality Development	**Hours**
a) Personal Effectiveness- being proactive- principles of personal vision, b) Intrapersonal communication- emotional intelligence- beginning with the end in mind- c) Time management: understanding priorities- first things first- time – personal effectiveness	**05**
Unit -2: Emotional Intelligence and Intrapersonal Communication	
a) Principles of Emotional Intelligence – b) Intrapersonal Communication- c) Principles of creative cooperation-organization skills-Think win-win d) Principles of balanced self-renewal- Lifelong learning	**05**
Unit – 3:Career and Employability Skills	
a) Understanding Career values- values grid-career thinking- what is a career? b) Skills vs strengths- spotting skills- reflecting on skills- setting goals for developing skills- c) Meeting the expectations of the employer-understanding job description- - Skills Grid exercises- matching the skills with requirements d) Preparing Resume and Preparing for interviews- Structuring interview questions- CAR- Context, Action and Results	**06**
Unit – 4:Problem Solving Skills	
a) Understanding the complexity at workplace- b) defining the problem- identifying the reasons- c) finding possible solutions- planning actions- analyzing results- feedback d) redefining the problem- the problem solving cycle	**06**
Unit – 5:Professional Communication	
a) Active listening skills- note taking- b) Professional presentation skills- understanding the context- expectations of the people- putting across the message effectively- answering questions- c) Technical writing skills- practical steps for writing- report writing and writing a report free from plagiarism.	**10**

Text(T) / Reference(R) Books:	
T1	English and Soft Skills, Dr. S.P. Dhanvel, Orient Blackswan, 2011
R1	Seven Habits of Highly Effective People, Stephen R Covey
R2	Professional Communication, ArunaKoneru, Mc Graw Hill
R3	Personality Development and Soft Skills, Barun K Mitra OUP
R4	Enhance Your Employability Skills, David Winter and Laura Brammar, University of London.
W1	https://www.coursera.org/browse/personal-development
W2	https://alison.com/courses/personal-development

Course Outcomes: On completion of this course, students can	
CO1	Understand Personality development process and learn to implement effective techniques.
CO2	Understand how people behave and regulate self-behaviors and learn to work in a team.
CO3	Know their career values, identify their skills, set goals for enhancing their career skills and prepare for interviews
CO4	Understand and learn how to deal with problems and practice problem solving skills.
CO5	Learn the principles of professional communication & application of the same

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

MANAGEMENT SCIENCE			
Subject Code	18CMMST5030	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	69	Exam Hours	03
Credits – 03			

Unit -1: Introduction to Management	**Hours**
Concept –nature and importance of Management – Functions of Management – Evaluation of Management thought- Theories of Motivation – Decision making process-Designing organization structure- Principles of organization - Types of organization structure.	**14**
Unit -2: Operations Management	
Principles and Types of Management – Work study- Statistical Quality Control- Control charts (P-chart, R-chart, and C chart). Simple problems- Material Management: Need for Inventory control- EOQ, ABC analysis (simple problems) and Types of ABC analysis (HML, SDE, VED, and FSN analysis).	**13**
Unit – 3: Functional Management & Strategic Management	
Functional Management: Concept of HRM, HRD and PMIR- Functions of HRM - Marketing Management- Functions of Marketing, Marketing Strategies based on product Life Cycle, Channels of distributions. **Strategic Management**: Vision, Mission, Goals, Strategy – Elements of Corporate Planning Process – Environmental Scanning – SWOT analysis- Steps in Strategy Formulation and Implementation, Generic Strategy alternatives	**16**
Unit – 4: Project Management: **(PERT/CPM)**	
Development of Network – Difference between PERT and CPM identifying Critical Path- Probability- Project Crashing (Simple Problems).	**12**
Unit – 5:Contemporary Management Practices	
Basic concepts of MIS, MRP, Justin- Time (JIT) system, Total Quality Management (TQM), Six sigma, Supply Chain Management, Enterprise Resource Planning (ERP), Business Process outsourcing (BPO), Business process Re-engineering and Bench Marking, Balanced Score Card.	**14**

Text(T) / Reference(R) Books:	
T1	*ManagementScience*, Dr. P. Vijaya Kumar & Dr. N. Appa Rao,
T2	*Management Science*, Dr. A. R. Aryasri, TMH2011.
R1	Essentials of Management, Koontz &Weihrich, TMH 2011
R2	Global Management Systems, Seth & Rastogi, Cengage Learning, 2011
R3	Organizational Behaviors, Robbins, Pearson Publications, 2011
R4	Production & Operational Management, Kanishka Bedi, Oxford Publications, 2011
R5	Management Science, Manjunath, Pearson Publications, 2013.
R6	Human Resource Management, Biswajit Patnaik, PHI, 2011
R7	Strategic Management, Hitt and Vijaya Kumar, Cengage Learning
W1	https://msande.stanford.edu/academics/graduate/masters-program/hcp- part-time-ms/online-courses
W2	https://www.coursera.org/browse/business/leadership-and-management

Course Outcomes: On completion of this course, students can	
CO1	Understand the history behind the Java technology, its features and strengths
CO2	Implement the basic principles of Object-Oriented Programming which includes inheritance, polymorphism, encapsulation and abstraction.
CO3	Understand the exception programming techniques by describing and encapsulating exceptions.
CO4	Understand the Thread concepts and Collections Framework in java. N
CO5	Create rich user-interface applications using modern API's such as JAVAFX.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

COMPUTER NETWORKS			
Subject Code	18CSCST5040	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Network Topologies, WAN, LAN, MAN. OSI Reference Model, TCP/IP Reference Model, Multiplexing (Frequency Division, Wavelength Division, Synchronous Time Division and Statistical Time Division Multiplexing Techniques), Switching Techniques (Circuit-switching, Datagram, Virtual Circuit Networks).	**08**
Unit -2:The Data Link Layer	
Design Issues, Services Provided to the Network Layer, Framing, Error Control, Flow Control, Error Detection and Correction, Error Correcting Codes, Error Detecting Codes, A Simplex Stop and Wait Protocol for an Error free channel, A Simplex Stop and Wait Protocol for a Noisy Channel, Sliding Window Protocols (A One Bit Sliding Window Protocol-A Protocol Using Go-Back-NA Protocol Using Selective Repeat), *Data Link Layer in HDLC:* Configuration and transmission modes, frames, control fields, *Point-to-Point Protocol:* Framing transmission phase, multiplexing, multi-link PPP.	**10**
Unit – 3:The Medium Access Control Sub layer & Network Layer	
The Channel Allocation Problem, Static Channel Allocation, Assumptions for Dynamic Channel Allocation, Multiple Access Protocols (Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited Contention Protocols, Wireless LAN Protocols). Routing Algorithms-Shortest-Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast and Distance Vector Routing.	**10**
Unit – 4:Congestion Control	
Congestion Control Algorithms, Approaches to Congestion Control-Traffic Aware Routing-Admission Control-Traffic Throttling-Load Shedding, IP Addressing, Classless and Class full Addressing, Sub-netting, Standard Ethernet (MAC Sub Layer and Physical Layer), Fast Ethernet (MAC Sub Layer and Physical Layer), IEEE-802.11 (Architecture, Mechanism and Frame Structure), IEEE-805.11 Frame Structure and Services.	**10**
Unit – 5:Application Layer	
The Domain Name System- The DNS Name Space, Resource Records, Name Servers, Electronic Mail Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The Wireless Application Protocol.	**12**

Text(T) / Reference(R) Books:	
T1	Computer Networks, 5th Edition, Tanenbaum and David J Wetherall, Pearson Edu, 2010.
T2	Computer Networks: A Top Down Approach, Behrouz A. Forouzan, FirouzMosharraf, McGraw Hill Education.
T3	Computer Networks, Mayank Dave, CENGAGE
T4	Data and Computer Communications, Fifth Edition, William Stallings, PHI, 2005.
R1	Computer Networks, A Systems Approach, Fifth Edition, Peterson & Davie, Harcourt, 2011.
R2	Network Management Standards, Second Edition, Ulysses Black, McGraw Hill, 1994
R3	Computer Networking - A Top-down Approach, Sixth Edition, James F. Kurose, Keith W. Ross, Pearson, 2013.
R4	Computer Networks - A Systems Approach, 5th ed, Larry L. Peterson and Bruce S. Davie, Morgan Kaufmann/ Elsevier, 2011
W1	https://swayam.gov.in/courses/5172-computer-networks
W2	https://www.coursera.org/courses?query=computer%20network

Course Outcomes: On completion of this course, students can	
CO1	Understand OSI and TCP/IP models
CO2	Analyze MAC layer protocols and LAN technologies
CO3	Design applications using internet protocols
CO4	Understand routing and congestion control algorithms
CO5	Understand how internet works.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

OPERATING SYSTEMS			
Subject Code	18CSCST5050	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Operating Systems Overview	**Hours**
Computer system organization, Operating system structure, Process, memory, storage management, Protection and security, Distributed systems, Computing Environments, Open-source operating systems, OS services, User operating-system interface, System calls, Types, System programs, OS structure, OS generation, System Boot Process concept, scheduling (Operations on processes, Cooperating processes, Inter-process communication), Multi-threading models, Thread Libraries, Threading issues.	**08**
Unit -2:Process Management	
Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling, Multiple processor scheduling Operating system, Algorithm Evaluation, The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical regions, Monitors.	**10**
Unit – 3:Deadlocks	
System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from deadlock. *Storage Management:* Swapping, Contiguous memory allocation, Paging, Segmentation Virtual Memory Background, Demand paging, copy on write, Page replacement and various Page replacement algorithms, Allocation of frames,Thrashing.	**10**
Unit – 4:I/O Systems	
File concept, Access methods, Directory structure, File-system mounting, Protection, Directory implementation, Allocation methods, Free-space management, Disk scheduling, Disk management, Swap- space management, Protection.	**10**
Unit – 5:Case Study	
Linux System: Components of LINUX Inter-process Communication, Synchronization, Interrupt, Exception and System Call. *Android Software Platform:* Android Architecture, Operating System Services, Android Runtime Application Development, Application Structure, Application Process management.	**12**

Text(T) / Reference(R) Books:	
T1	Operating System Concepts Essentials, Abraham Silberschatz, Peter B. Galvin, Greg Gagne, John Wiley & Sons Inc., 2010.
T2	Operating System Concepts, 9th Edition, Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, John Wiley and Sons Inc., 2012
T3	Operating Systems, Second Edition, S Halder, Alex A Aravind, Pearson Education, 2016
T4	Operating Systems – Internals and Design Principles, 7th Edition, William Stallings, Prentice Hall, 2011
R1	Modern Operating Systems, Second Edition, Andrew S. Tanenbaum, Addison Wesley, 2001.
R2	Operating Systems: A Design-Oriented Approach, Charles Crowley, Tata McGraw Hill Education, 1996.
R3	Operating Systems: A Concept-based Approach, Second Edition, D M Dhamdhere, Tata McGraw-Hill Education, 2007
R4	Operating Systems: Internals and Design Principles, Seventh Edition, William Stallings, Prentice Hall, 2011
W1	https://www.coursera.org/courses?query=operating%20system
W2	https://onlinecourses.nptel.ac.in/noc16_cs10/preview

Course Outcomes: On completion of this course, students can	
CO1	Design various Scheduling algorithms, Apply the principles of concurrency.
CO2	Design deadlock, prevention and avoidance algorithms.
CO3	Compare and contrast various memory management schemes.
CO4	Design and Implement a prototype file system, Perform administrative tasks on Linux Servers.
CO5	Introduction to Android Operating System Internals.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

COMPUTER NETWORKS LAB			
Subject Code	18CSCSL5060	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Programs

Exercise1

Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, trace route, whois etc. Usage of elementary socket system calls (socket (), bind(), listen(), accept(),connect(),send(),recv(),sendto(),recvfrom()).

Exercise2

Implementation of Connection oriented concurrent service (TCP).

Exercise3

Implementation of Connectionless Iterative time service (UDP).

Exercise4

Implementation of Select system call.

Exercise5

Implementation of gesockopt (), setsockopt () system calls.

Exercise6

Implementation of getpeername () system call.

Exercise7

Implementation of remote command execution using socket system calls.

Exercise8

Implementation of Distance Vector Routing Algorithm.

Exercise9

Implementation of SMTP.

Exercise10

Implementation of FTP.

Exercise11

Implementation of HTTP.

Exercise12

Implementation of RSA algorithm.

Note: Implement programs 2 to 7 in C and 8 to 12 in JAVA.

Course Outcomes: On completion of this course, students can	
CO1	Understand and explain the basic concepts of Grid Computing.
CO2	Explain the advantages of using Grid Computing within a given environment
CO3	Prepare for any upcoming Grid deployments and be able to get started with a potentially available Grid setup.
CO4	Discuss some of the enabling technologies e.g. high-speed links and storage area networks.
CO5	Build computer grids.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO2	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO5	2	2	3	-	-	-	-	-	-	-	-	-	-	2
Course	**2**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

OPERATING SYSTEMS LAB			
Subject Code	18CSCSL5070	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1

Simulate the following CPU scheduling algorithms

a) Round Robin
b) SJF
c) FCFS
d) Priority

Exercise2

Loading executable programs into memory and execute system call implementation for read(), write(), open(), and close().

Exercise3

Implement fork(), wait(), exec() and exit() system calls.

Exercise4

Simulate the following file allocation strategies

a) Sequenced
b) Indexed and
c) Linked

Exercise5

Simulate MVT and MFT

Exercise6

Simulate the following File Organization Techniques

a) Single Level Directory
b) Two Level
c) Hierarchical
d) DAG

Exercise7

Simulate Bankers Algorithm for Deadlock Avoidance

Exercise 8

Simulate Bankers Algorithm for Deadlock Prevention

Exercise9

Simulate the following page replacement algorithms

a) FIFO
b) LRU
c) LFU

Exercise10

Simulate Paging Technique of memory management.

Course Outcomes: On completion of this course, students can	
CO1	Design various Scheduling algorithms, Apply the principles of concurrency.
CO2	Design deadlock, prevention and avoidance algorithms.
CO3	Compare and contrast various memory management schemes.
CO4	Design and Implement a prototype file system, Perform administrative tasks on Linux Servers.
CO5	Introduction to Android Operating System Internals.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

R PROGRAMMING LAB			
Subject Code	18CSCSL5080	IA Marks	50
Number of Tutorial Hours/Week	03 (P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1
Installation of R Software
Exercise2
Implementation of variables.
Exercise3
Implement univariate statistics.
Exercise4
Implement basics of Probability.
Exercise5
Generation of Histograms.
Exercise6
Implement the process of measuring Central Tendency and Dispersion.
Exercise7
Implement the process of calculating Standard Deviations, Standard Scores and Normal Distribution.
Exercise8
Implement the process of sample selection
Exercise9
Implement hypothesis testing: Testing the significance of difference between two means.
Exercise10
Create association or relation among the Nominal variables.
Exercise11
Create association or relation among the Ordinal variables.
Exercise12
Create association or relation among the Interval/Ratio variables.

Course Outcomes: On completion of this course, students can	
CO1	List motivation for learning a programming language
CO2	Access online resources for R and import new function packages into the R workspace
CO3	Import, review, manipulate and summarize data-sets in R
CO4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests
CO5	Perform appropriate statistical tests using R Create and edit visualizations

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

FORMAL LANGUAGES & AUTOMATA THEORY			
Subject Code	18CSCST6010	IA Marks	30
Number of Lecture Hours/Week	3(L)+1(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 04			

Unit -1: Finite Automata & Regular Expressions	**Hours**
The Central Concepts of Automata Theory, Finite Automation, Transition Systems, Acceptance of a String by a Finite Automation, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with E- Transition, Minimization of Finite Automata, Mealy and Moore Machines, Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closers Properties, Applications of Regular Expressions, Regular Expressions and Regular Grammars.	**08**
Unit -2: Context Free Grammars	
Formal Languages, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Context Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.	**10**
Unit – 3: Pushdown Automata	
Definition, Model, Graphical Notation, Instantaneous Description Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars Conversion, Two Stack Pushdown Automata, Application.	**10**
Unit – 4: Turning Machine	
Definition, Model, Representation of Turing Machines-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction, Types of Turing Machines, Church's Thesis, Universal Turing Machine, Restricted Turing Machine.	**10**
Unit – 5: Computability	
Decidable and Un-decidable Problems, Halting Problem of Turing Machines, Post's Correspondence Problem, Modified Post's Correspondence Problem, Classes of P and NP, NP Hard and NP- Complete Problems.	**12**

Text(T) / Reference(R) Books:	
T1	Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
T2	Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekharan, 3rd Edition, PHI, 2007.
T3	A Text Book on Automata Theory, Nasir S.F.B, P.K. Srimani, Cambridge Univeristy Press.
T4	Elements of Theory and Computation, Henry R Lewis, Papdimitriou, PHI
T5	Introduction to Theory of Computation. 2nd ed, Michel Sipser, CENGAGE
R1	Formal Language and Automata Theory, K.V.N.Sunitha and N.Kalyani, Pearson, 2015.
R2	Introduction to Automata Theory, Formal Languages and Computation, ShyamalenduKandar, Pearson, 2013.
R3	Theory of Computation, V.Kulkarni, Oxford University Press, 2013
W1	https://www.coursebuffet.com/sub/computer-science/516/theory-of-automata-formal-languages-and-computation
W2	https://online.stanford.edu/courses/soe-ycsautomata-automata-theory

Course Outcomes: On completion of this course, students can	
CO1	Classify machines by their power to recognize languages.
CO2	Employ finite state machines to solve problems in computing.
CO3	Explain deterministic machines.
CO4	Explain non-deterministic machines.
CO5	Comprehend the hierarchy of problems arising in the computer science

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

DATABASE SYSTEMS			
Subject Code	18CSCST6020	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Database system architecture, Introduction	**Hours**
The Three Levels of Architecture, (External Level, Conceptual Level, Internal Level), Mapping, The Database Administrator, The Database Management Systems, Client/Server Architecture. The E/R Models, The Relational Model, Relational Calculus, Introduction to Database Design, Database Design and Er Diagrams, Entities Attributes, and Entity Sets, Relationship and Relationship Sets, Conceptual Design with the Er Models, The Relational Model Integrity Constraints Over Relations, Key Constraints, Foreign Key Constraints, General Constraints	**08**
Unit -2:Relational Algebra and Calculus	
Relational Algebra, Selection and Projection, Set Operation, Renaming, Joins, Division, More Examples of Queries, Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus. *Queries*, *Constraints*, *Triggers*: The Form of Basic SQL Query, Union, Intersect, and Except, Nested Queries, Aggregate Operators, Null Values, Complex Integrity Constraints in SQL, Triggers and Active Database.	**10**
Unit – 3: Schema Refinement (Normalization)	
Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form (BCNF), Lossless join and dependency preserving decomposition, Fourth normal form(4NF).	**10**
Unit – 4: Transaction Management and Concurrency Control	
Transaction, properties of transactions, transaction log, and transaction management with SQL using commit rollback and save point. Concurrency control for lost updates, Uncommitted data, inconsistent retrievals and the Scheduler. Concurrency control with locking methods: lock granularity, lock types, two phase locking for ensuring serializability, deadlocks, Concurrency control with time stamp ordering: Wait/Die and Wound/Wait Schemes, Database Recovery management: Transaction recovery.	**10**
Unit – 5:Overview of Storages	
Data on External Storage, File Organization and Indexing, Clustered Indexing, Primary and Secondary Indexes, Index Data Structures, *Hashing:* Static Hashing, Hash Table, Hash Functions, Secure Hash Function, Overflow Handling, Theoretical Evaluation of Overflow Techniques, Dynamic Hashing, Motivation for Dynamic Hashing, Dynamic Hashing Using Directories, Directory less Dynamic, Hashing.	**12**

Text(T) / Reference(R) Books:	
T1	Introduction to Database Systems, CJ Date, Pearson
T2	Database Management Systems, 3rd Edition, Raghurama Krishnan, Johannes Gehrke, TATA McGraw Hill.
T3	Database Systems - The Complete Book, H G Molina, J D Ullman, J Widom Pearson
T4	Database Management Systems,6/e RamezElmasri, Shamkant B. Navathe, PEA
R1	Data base Systems design, Implementation, and Management, 7th Edition, Peter Rob & Carlos Coronel
R2	Database System Concepts, 5th edition, Silberschatz, Korth, TMH
R3	The Database Book Principles & Practice Using Oracle/MySQL, NarainGehani, University Press.
W1	https://onlinecourses.nptel.ac.in/noc18_cs15/preview
W2	https://www.coursera.org/courses?query=database

Course Outcomes: On completion of this course, students can	
CO1	Describe a relational database and object-oriented database. Create, maintain and manipulate a relational database using SQL
CO2	Describe ER model and normalization f or database design.
CO3	Examine issues in data storage and query processing and can formulate appropriate solutions.
CO4	Understand the role and issues in management of data like efficiency, privacy, security, ethical responsibility, and strategic advantage.
CO5	Design and build database system for a given real world problem.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

SOFTWARE ENGINEERING (PROGRAM ELECTIVE-I)			
Subject Code	18CSCSP603**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Software and Software Engineering	**Hours**
The Nature of Software, The Unique Nature of Web Apps, Software Engineering, Software Process, Software Engineering Practice, software Myths. *Process Models:* A Generic Process Model, Process Assessment and Improvement, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Process Terminology, Product and Process. *Requirements Analysis and Specification:* Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.	**08**
Unit -2: Software Design	
Overview of the Design Process, How to Characterize of a Design, Cohesion and Coupling, Layered Arrangement of Modules, Approaches to software Design. *Function-Oriented Software Design:* Overview of SA/SD Methodology, Structured analysis, Developing the DFD Model of a System, Structured Design, Detailed Design, Design Review, over view of Object-Oriented design. *User Interface Design:* Characteristics of Good User Interface, Basic Concepts, Types of User Interfaces, Fundamentals of component- based GUI Development, A User Interface Design Methodology.	**10**
Unit – 3: Coding and Testing	
Coding, Code Review, Software Documentation, Testing, Unit Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Integration Testing, Testing Object-Oriented Programs, System Testing, Some General Issues Associated with Testing.	**10**
Unit – 4: Software Reliability and Quality Management	
Software Reliability, Statistical Testing, Software Quality, Software Quality Management System, ISO 9000, SEI Capability Maturity Model. *Computer Aided Software Engineering:* Case and its Scope, Case Environment, Case Support in Software Life Cycle, Other Characteristics of Case tools, Towards Second Generation CASE Tool, Architecture of a Case Environment.	**10**
Unit – 5: Software Maintenance	
Software maintenance, Maintenance Process Models, Maintenance Cost, Software Configuration Management. *Software Reuse:* what can be reused? Why almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at organization Level.	**12**

Text(T) / Reference(R) Books:	
T1	Software engineering A practitioner's Approach, Roger S. Pressman, Seventh Edition McGrawHill International Edition.
T2	Fundamentals of Software Engineering, Third Edition, Rajib Mall, PHI.
T3	Software Engineering, Ian Sommerville, Ninth edition, Pearson education
T4	Software Engineering, Concepts and Practices, Ugrasen Suman, Cengage Learning
R1	Software Engineering A Primer, Waman S Jawadekar, Tata McGraw- Hill, 2008
R2	Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.
R3	Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press
R4	Software Engineering1: Abstraction and modeling, Diner Bjorner, Springer International edition, 2006.
R5	Software Engineering concepts, R. Fairley, TMH.
W1	https://www.edx.org/learn/software-engineering
W2	https://www.coursera.org/courses?query=software%20engineering

Course Outcomes: On completion of this course, students can	
CO1	Define and develop a software project from requirement gathering to implementation.
CO2	Obtain knowledge about principles and practices of software engineering
CO3	Focus on the fundamentals of software project
CO4	Focus on modelling a software project
CO5	Obtain knowledge about estimation and maintenance of software systems

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

NETWORK PROTOCOLS (PROGRAM ELECTIVE-I)			
Subject Code	18CSCSP603**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: IP ADDRESSING	**Hours**
Decimal Notation-Classes, special addresses, A simple Internet- Unicast and Broadcast addresses, Applying for IP addresses, Private networks. *SUBNETTING AND SUPERNETTING:* Subnetting, Masking- Examples of Subnetting, Variable length Subnetting, Super netting. *INTERNET PROTOCOL:* Datagram Fragmentation, Options, Checksum, IP design. ARP, RARP.	**08**
Unit -2:INTERNET CONTROL MESSAGE PROTOCOL	
Types of Messages, Message formats, Error reporting, Query, Checksum, ICMP design. *INTERNET GROUP MANAGEMENT PROTOCOLS:* Multicasting, IGMP, Encapsulation, Multicast Backbone, IGMP design. *USER DATAGRAM PROTOCOL:* Process to process communication, User datagram, Checksum, UDP operation, uses of UDP, UDP design.	**10**
Unit – 3:*TRANSMISSION CONTROL PROTOCOL*	
Process to Process communication, TCP Services, Segment, Options, Checksum, Flow control, Error Control, TCP Timers, Connection, State Transition Diagram, Congestion Control, TCP operation, TCP Design. *APPLICATION LAYER AND CLIENT-SERVER MODEL:* Client- server Model, Concurrency-Processes, BOOTP-DHCP, *DOMAIN NAME SYSTEM:* Name Space, Domain name Space, Distribution of Name space, DNS in the Internet, Resolution, DNS Messages, Types of Records, Compression, DDNS Encapsulation.	**10**
Unit – 4:TELNET AND RLOGIN	
Concept-Network Virtual Terminal, NVT character set , Embedding, Option Negotiation, Sub option Negotiation, Controlling Server, Out of Band signaling, Escape character, Mode of Operation, Examples, User Interface, Rlogin, Security Issue. *FILE TRANSFER PROTOCOL:* Connections, Communication- Command Processing-File, Transfer-User, Interface-Anonymous, FTP. *TRIVIAL FILE TRANSFER PROTOCOL:* Messages, Connection, Data Transfer, UDP ports, TFTP Example, TFTP options, Security, Applications.	**10**

Unit – 5:HYPERTEXT TRANSFER PROTOCOL	
HTTP overview, Proxy, Gateway, Tunnel, Cache, Messages, General Header Fields, Cache Control, Connection, Request Methods, Request Header Fields, Response Messages, Response Header Fields, Entity Header Fields, Client/Server Authentication. *SOCKET INTERFACE:* Definitions, Sockets, Byte ordering, Address Transformation, Byte manipulation, Function-Information about Remote, Host- Socket System Calls, Connectionless Iterative server, UDP Client/Server Programs, Connection oriented Concurrent Server, TCP Client/Server Programs	**12**

Text(T) / Reference(R) Books:	
T1	TCP/IP Protocol Suite. Behrouz A. Forouzan (TMH edition).
R1	Internetworking with TCP/IP. D. E. Comer (PHI publications).
W1	https://www.coursera.org/learn/network-protocols-architecture
W2	https://www.perpetual-solutions.com/training-course/436/hands-on-tcp- ip-and-internet-protocols

Course Outcomes: On completion of this course, students can	
CO1	Create, test and debug Android application by setting up Android development environment
CO2	Implement adaptive, responsive user interfaces that work across a wide range of devices. Infer long running tasks and background work in Android applications.
CO3	Demonstrate methods in storing, sharing and retrieving data in Android applications.
CO4	Analyze performance of android applications and understand the role of permissions and security.
CO5	Describe the steps involved in publishing Android application to share with the world.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

MOBILE APPLICATION DEVELOPMENT (PROGRAM ELECTIVE-I)			
Subject Code	18CSCSP603**C**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Get started, build your first app, Activities, Testing, debugging and using support libraries.	**08**
Unit -2: User Interaction	
User Interaction, Delightful user experience, Testing your UI.	**10**
Unit – 3: Background Tasks	
Background Tasks, Triggering, scheduling and optimizing background tasks.	**10**
Unit – 4: Data	
All about data, Preferences and Settings, storing data using SQLite, sharing data with content providers, loading data using Loaders.	**10**
Unit – 5: Permissions	
Permissions, Performance and Security, Firebase and Ad Mob, Publish.	**12**

Text(T) / Reference(R) Books:	
T1	The complete Reference Java, 9th edition, Herbert Scheldt, TMH.
T2	Programming in JAVA, Sachin Malhotra, Saurabh Choudary, Oxford.
R1	JAVA Programming, K.Rajkumar.Pearson
R2	Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
R3	Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
R4	Object Oriented Programming Through Java, P. Radha Krishna, Universities Press.
W1	https://www.edx.org/learn/app-development
W2	https://www.coursera.org/courses?query=mobile%20app%20develop ment

Course Outcomes: On completion of this course, students can	
CO1	Understand the history behind the Java technology, its features and strengths
CO2	Implement the basic principles of Object-Oriented Programming which includes inheritance, polymorphism, encapsulation and abstraction.
CO3	Understand the exception programming techniques by describing and encapsulating exceptions.
CO4	Understand the Thread concepts and Collections Framework in java. N
CO5	Create rich user-interface applications using modern API's such as JAVAFX.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT			
Subject Code	18CMMST6050	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	69	Exam Hours	03
Credits – 03			

Unit -1: Introduction to Managerial Economics and demand Analysis	**Hours**
Definition of Managerial Economics and Scope-Managerial Economics and its relation with other subjects-Concepts of Demand- Types-Determents-Law of Demand its Exception-Elasticity of Demand-Types and Measurement-Demand forecasting and its Methods.	**16**
Unit -2:Production and Cost Analysis	
Production function-Isoquants and Isocost-Law of Variable proportions- Cobb-Douglas Production Function-Economics of Sale- Cost Concepts- Opportunity Cost-Fixed vs Variable Costs-Explicit Costs vs Implicit Costs- Cost Volume Profit analysis- Determination of Break-Even Point (Simple Problems).	**14**
Unit – 3:Introduction To Markets, Pricing Policies & forms Organizations and Business Cycles	
Market Structures: Perfect Competition, Monopoly and Monopolistic and Oligopoly – Features – Price, Output Determination – Methods of Pricing: Market Skimming Pricing, And Internet Pricing: Flat Rate Pricing. Features and Evaluation of Sole Trader – Partnership – Joint Stock Company – State/Public Enterprises and their forms – Business Cycles – Meaning and Features – Phases of Business Cycle	**13**
Unit – 4:Introduction to Accounting & Financing Analysis	
Introduction to Double Entry Systems – Preparation of Financial Statements-Analysis and Interpretation of Financial Statements-Ratio Analysis – Preparation of Funds flow cash flow statements (Simple Problems)	**12**
Unit – 5:Capital and Capital Budgeting	
Capital Budgeting: Meaning of Capital-Capitalization-Meaning of Capital Budgeting-Need for Capital Budgeting-Techniques of Capital Budgeting-Traditional and Modern Methods.	**14**

Text(T) / Reference(R) Books:	
T1	Managerial Economics and Financial Analysis, Dr. A. R. Aryasri, TMH 2011.
T2	Managerial Economics and Financial Analysis, 1/e, B. Kuberadu, HPH, 2013
T3	Management Science, Dr. P. Vijaya Kumar & Dr. N. Apparao, Cengage, Delhi, 2012
T4	Management Science, Dr. A. R. Arya Sri, TNH, 2011.
R1	Financial Accounting for Management, Ambrish Gupta, Pearson Education, New Delhi.
R2	Managerial Economics, 4th Ed, H. Craig Peterson & W. Cris Lewis, PHI.
R3	Essentials of management, Koontz and weihrich, TMH 2011
R4	Global management systems, Seth& Rastogi, Cengage learning,delhi,2011
R5	Managerial Economics, V. Maheswari, Sultan Chand
R6	Managerial Economics & Financial Analysis, Dr. B. Kuberudu and Dr. T. V. Ramana, Himalaya Publishing House 2011.
W1	https://www.coursera.org/courses?query=financial%20engineering
W2	https://www.mooc-list.com/categories/economics-finance

Course Outcomes: On completion of this course, students can	
CO1	Students are equipped with the knowledge of managerial economics and estimating demand for a product.
CO2	Students understand Production and Cost concepts, estimating Cost Break even Analysis.
CO3	Students are equipped with the knowledge on Markets and Pricing methods along with Business Cycles.
CO4	Students are able to understand Accounting Concepts and Prepare Financial Statements- Analysis
CO5	Students are able to analyze various investment project proposals with the help of Capital Budgeting techniques.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

DATABASE SYSTEMS LAB			
Subject Code	18CSCSL6060	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

SQL

Exercise1

Queries to facilitate acquaintance of Built-In Functions, String Functions, Numeric Functions, Date Functions and Conversion Functions.

Exercise2

Queries using operators in SQL

Exercise3

Queries to Retrieve and Change Data: Select, Insert, Delete, and Update

Exercise4

Queries using Group By, Order By, and Having Clauses

Exercise5

Queries on Controlling Data: Commit, Rollback, and Save point

Exercise6

Queries to Build Report in SQL *PLUS

Exercise7

Queries for Creating, Dropping, and Altering Tables, Views, and Constraints

Exercise 8

Queries on Joins and Correlated Sub-Queries

Exercise9

Queries on Working with Index, Sequence, Synonym, Controlling Access, and Locking Rows for Update, Creating Password and Security features

PL/SQL

Exercise10

Write a PL/SQL Code using Basic Variable, Anchored Declarations, and Usage of Assignment Operation

Exercise11

Write a PL/SQL Code Bind and Substitution Variables. Printing in PL/SQL

Exercise12

Write a PL/SQL block using SQL and Control Structures in PL/SQL

Exercise13

Write a PL/SQL Code using Cursors, Exceptions and Composite Data Types

Exercise14

Write a PL/SQL Code using Procedures, Functions, and Packages FORMS

Exercise15

Write a PL/SQL Code Creation of forms for any Information System such as Student Information System, Employee Information System etc. 18

Exercise16

Demonstration of database connectivity

Course Outcomes: On completion of this course, students can	
CO1	Understand, appreciate and effectively explain the underlying concepts of database technologies.
CO2	Design and implement a database schema for a given problem-domain, Normalize a database
CO3	Populate and query a database using SQL DML/DDL commands.
CO4	Declare and enforce integrity constraints on a database using a state-of- the-art RDBMS
CO5	Programming PL/SQL including stored procedures, stored functions, cursors, packages. Design and build a GUI application using a 4GL

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

PYTHON PROGRAMMING LAB			
Subject Code	18CSCSL6070	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise 1 - Basics

a) Running instructions in Interactive interpreter and a Python Script

b) Write a program to purposefully raise Indentation Error and Correct it

Exercise 2 - Operations

a) Write a program to compute distance between two points taking input from the user (Pythagorean Theorem)

b) Write a program add.py that takes 2 numbers as command line arguments and prints its sum.

Exercise - 3 Control Flow

a) Write a Program for checking whether the given number is a even number or not.

b) Using a for loop, write a program that prints out the decimal equivalents of 1/2, 1/3, 1/4, . . . ,1/10

c) Write a program using a for loop that loops over a sequence. What is sequence?

d) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

Exercise 4 - Control Flow - Continued

a) Find the sum of all the primes below two million.

Each new term in the Fibonacci sequence is generated by adding the previous two terms. By starting with 1 and 2, the first 10 terms will be:

1, 2, 3, 5, 8, 13, 21, 34, 55, 89, ...

b) By considering the terms in the Fibonacci sequence whose values do not exceed four million, find the sum of the even-valued terms.

Exercise - 5 - DS

a) Write a program to count the numbers of characters in the string and store them in a dictionary data structure

b) Write a program to use split and join methods in the string and trace a birthday with a dictionary data structure.

Exercise - 6 DS - Continued

a) Write a program combine_lists that combines these lists into a dictionary.

b) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

Exercise - 7 Files

a) Write a program to print each line of a file in reverse order.

b) Write a program to compute the number of characters, words and lines in a file.

Exercise - 8 Functions

a) Write a function ball_collide that takes two balls as parameters and computes if they are colliding. Your function should return a Boolean representing whether or not the balls are colliding.

Hint: Represent a ball on a plane as a tuple of (x, y, r), r being the radius

If (distance between two balls centers) <= (sum of their radii) then (they are colliding)

b) Find mean, median, mode for the given set of numbers in a list.

Exercise - 9 Functions - Continued

a) Write a function nearly_equal to test whether two strings are nearly equal.
Two strings a and b are nearly equal when a can be generated by a single mutation on b.

b) Write a function dups to find all duplicates in the list.

c) Write a function unique to find all the unique elements of a list.

Exercise - 10 - Functions - Problem Solving

a) Write a function cumulative_product to compute cumulative product of a list of numbers.

b) Write a function reverse to reverse a list. Without using the reverse function.

c) Write function to compute gcd, lcm of two numbers. Each function shouldn't exceed one line.

Exercise 11 - Multi-D Lists

a) Write a program that defines a matrix and prints

b) Write a program to perform addition of two square matrices

c) Write a program to perform multiplication of two square matrices

Exercise - 12 - Modules

a) Install packages requests, flask and explore them. using (pip)

b) Write a script that imports requests and fetch content from the page. Eg. (Wiki)

c) Write a simple script that serves a simple HTTP Response and a simple HTML Page

Exercise - 13 OOP

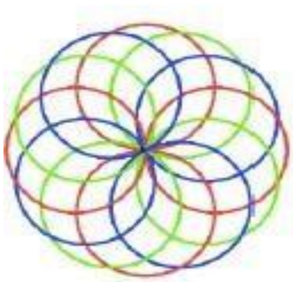
a) Class variables and instance variable

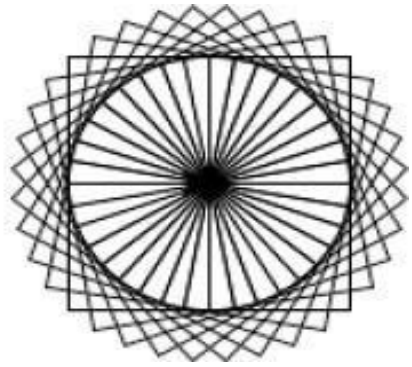
i) Robot

ii) ATM Machine

Exercise - 14 GUI, Graphics

1. Write a GUI for an Expression
2. Write a program to implement





Exercise - 15 - Testing

a) Write a test-case to check the function even_numbers which return True on passing a list of all even numbers

b) Write a test-case to check the function reverse_string which returns the reversed string.

Exercise - 16 - Advanced

a) Build any one classical data

b) Write a program to solve knapsack

Course Outcomes: On completion of this course, students can	
CO1	Illustrate scripting and interpreted language by using modern tools to make software easily right out of the box for creating and running programs.
CO2	Identify various problem solving approaches that can manipulate static, structured data using Python.
CO3	Identify the kind of data structure most appropriate for solving a given problem.
CO4	Apply the concepts of functions, modules and packages to build software for real needs
CO5	Analyze the importance and develop applications for real time problems as a team by applying object oriented programming concepts.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

IV B. Tech I Semester

S. No.	Subject Code	Title	Hours L	Hours T	Hours P	C
01	18CSCST7010	Compiler Design	3			3
02	18CSCSP702X	Program Elective-II	3			3
03	18CSCSP703X	Program Elective-III	3			3
04	18CSXXO704Y	Open Elective-II	3			3
05	18CSXXO705Y	Open Elective-III	3			3
06	18CSCSL7060	Compiler Design Lab			3	1.5
07	18CSCSC7070	Internship with Seminar				2
08	18CSCSR7080	Project-I			8	4
			15	0	11	**22.5**
			26			

Program Elective-II	
18CSCSP702**A**	Unified Modeling Language
18CSCSP702**B**	Cryptography & Network Security
18CSCSP702**C**	Data Warehousing & Mining

Program Elective-III	
18CSCSP703**A**	Design Patterns
18CSCSP703**B**	Cyber Security
18CSCSP703**C**	Artificial Intelligence

IV B. Tech II Semester

S. N.	Subject Code	Title	Hours L	T	P	C
01	18CSCSP801X	Program Elective-IV	3			3
02	18CSCSP802X	Program Elective-V	3			3
03	18CSCSP803X	Program Elective-VI	3			3
04	18CSXXO804Y	Open Elective-IV	3			3
05	18CSCSR8050	Project-II			14	7
06		Co-curricular/Extra-curricular Activities	2			1
			14		14	**20**
			28			

Program Elective-IV	
18CSCSP801**A**	Software Testing
18CSCSP801**B**	Mobile Computing
18CSCSP801**C**	Machine Learning

Program Elective-V	
18CSCSP802**A**	Software Quality Assurance
18CSCSP802**B**	Ad-hoc & Sensor Networks
18CSCSP802**C**	Hadoop & Big Data

Program Elective-VI	
18CSCSP803**A**	Software Project Management
18CSCSP803**B**	Cyber Forensics
18CSCSP803**C**	Data Analytics

Open Electives offered by CSE

Open Elective-I	
18XXCSO50M**A**	Data Structures through C
18XXCSO50M**B**	Python Programming
18XXCSO50M**C**	Internet of Things

Open Elective-II	
18XXCSO60M**A**	R Programming
18XXCSO60M**B**	Java Programming
18XXCSO60M**C**	Block Chain

Open Elective-III	
18XXCSO70M**A**	Designing Database Management Systems
18XXCSO70M**B**	App Technologies
18XXCSO70M**C**	Quantum Computing

Open Elective-IV	
18XXCSO80M**A**	Operating Systems Concepts
18XXCSO80M**B**	Web Technologies
18XXCSO80M**C**	Artificial Intelligence
18XXCSO80M**D**	Virtual Reality

COMPILER DESIGN			
Subject Code	18CSCST7010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Introduction to Language Processing, Structure of a compiler the evaluation of Programming language, The Science of building a Compiler application of Compiler Technology, Programming Language Basics. *Lexical Analysis:* The role of lexical analysis buffing, specification of tokens. Recognitions of tokens the lexical analyzer generator, The Role of a parser, Context free Grammars Writing A grammar.	**08**
Unit -2:Parser	
Introduction to LR Parser, More Powerful LR parser (LR1, LALR) Using Armigers Grammars Equal Recovery in LR parser Syntax Directed Transactions Definition, Evolution order of SDTS Application of SDTS. Syntax Directed Translation Schemes.	**10**
Unit – 3:Intermediated Code	
Generation Variants of Syntax trees 3 Address code, Types and Deceleration, Translation of Expressions, Type Checking, use and need of symbol tables	**10**
Unit – 4:*Runtime Environments*	
Runtime Environments, Stack allocation of space, access to Non-Local date on the stack Heap Management code generation – Issues in design of code generation the target Language Address in the target code Basic blocks and Flow graphs. A Simple Code generation	**10**
Unit – 5: Optimization	
Machine Independent Optimization. The principle sources of Optimization peep hole Optimization, Introduction to Date flow Analysis.	**12**

Text(T) / Reference(R) Books:	
T1	Compilers, Principles Techniques and Tools, 2nd edition, Alfred V Aho, Monical S. Lam, Ravi Sethi Jeffery D. Ullman, Pearson, 2007.
T2	Compiler Design, K. Muneeswaran, OXFORD
T3	Principles of Compiler Design, 2nd edition, Nandhini Prasad, Elsevier
R1	Compiler Construction, Principles and Practice, Kenneth C Louden, CENGAGE
R2	Implementations of Compiler, A New approach to Compilers including the algebraic methods, Yunlinsu, SPRINGER
R3	Engineering a Compiler, 2nd edition, Keith D. Cooper & Linda Torezon, Morgan Kaufman.
W1	https://onlinecourses.nptel.ac.in/noc19_cs01/preview
W2	https://www.coursera.org/courses?query=compilers

Course Outcomes: On completion of this course, students can	
CO1	Acquire knowledge in different phases and passes of Compiler, and specifying different types of tokens by lexical analyzer, and also able to use the Compiler tools like LEX, YACC, etc.
CO2	Parser and its types i.e. Top-down and Bottom-up parsers.
CO3	Construction of LL, SLR, CLR and LALR parse table.
CO4	Syntax directed translation, synthesized and inherited attributes.
CO5	Techniques for code optimization.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

UNIFIED MODELLING LANGUAGE (PROGRAM ELECTIVE – II)			
Subject Code	18CSCSP702**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Introduction to OOAD, Activities/ Workflows / Disciplines in OOAD, Introduction to iterative development and the unified process, Introduction to UML, Mapping Disciplines to UML artefacts, why we model, Conceptual model of UML, Architecture, Classes, Relationships, Common Mechanisms, Class diagrams, Object diagrams.	**08**
Unit -2 : Classes and Objects	
Nature of object, Relationships among objects, Nature of a Class, Relationship among Classes, Interplay of Classes and Objects, Identifying Classes and Objects, Importance of Proper Classification, Identifying Classes and Objects, Key abstractions and Mechanisms.	**10**
Unit – 3:Basic Behavioral Modelling	
Interactions, Interaction diagrams, Use cases, Use case Diagrams, Activity Diagrams.	**10**
Unit – 4:Advanced Behavioral Modelling	
Events and signals, state machines, processes and Threads, time and space, state chart diagrams.	**10**
Unit – 5:Architectural Modelling	
Component, Deployment, Component diagrams and Deployment diagrams. *Case Study:* The Unified Library application.	**12**

Text(T) / Reference(R) Books:	
T1	Object- Oriented Analysis and Design with Applications, Grady BOOCH, Robert A. Maksimchuk, Michael W. ENGLE, Bobbi J. Young, Jim Conallen, Kellia Houston, 3rd edition, 2013, PEARSON.
T2	The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, 12th Impression, 2012, PEARSON.
T3	Applying UML and Patterns by CriagLarman, Person
R1	Object-oriented analysis and design using UML, Mahesh P. Matha, PHI.
R2	Head first object-oriented analysis and design, Brett D. McLaughlin, Gary Pollice, Dave West, O"Reilly.
R3	Object-oriented analysis and design with the Unified process John W.
	Satzinger, Robert B. Jackson, Stephen D. Burd, Cengage Learning.
R4	The Unified modelling language Reference manual, James Rumbaugh, Ivar Jacobson, Grady Booch, Addison-Wesley.
W1	https://www.coursera.org/courses?query=uml
W2	https://www.udemy.com/topic/uml/

Course Outcomes: On completion of this course, students can	
CO1	Ability to find solutions to the complex problems using object-oriented approach.
CO2	Represent classes, responsibilities and states using UML notation.
CO3	Identify Classes of problem domain.
CO4	Identify the responsibilities of the problem domain.
CO5	Learn Architectural modelling concepts

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

CRYPTOGRAPHY & NETWORK SECURITY (PROGRAM ELECTIVE – II)			
Subject Code	18CSCSP702**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Basic Principles	**Hours**
Security Goals, Cryptographic Attacks, Services and Mechanisms, Mathematics of Cryptography, *Symmetric Encryption:* Mathematics of Symmetric Key Cryptography, Introduction to Modern Symmetric Key Ciphers, Data Encryption Standard, Advanced Encryption Standard.	**08**
Unit -2 : Asymmetric Encryption	
Mathematics of Asymmetric Key Cryptography, Asymmetric Key Cryptography.	**10**
Unit – 3: Data Integrity, Digital Signature Schemes & Key Management	
Message Integrity and Message Authentication, Cryptographic Hash Functions, Digital Signature, Key Management.	**10**
Unit – 4: Network Security-I	
Security at application layer: PGP and S/MIME, Security at the Transport Layer: SSL and TLS.	**10**
Unit – 5: Network Security-II	
Security at the Network Layer: IPSec, System Security.	**12**

Text(T) / Reference(R) Books:	
T1	Cryptography and Network Security, Behrouz A Forouzan, Debdeep Mukhopadhyay, (3e) Mc Graw Hill.
T2	Cryptography and Network Security, William Stallings, (6e) Pearson.
T3	Everyday Cryptography, Keith M.Martin, Oxford.
R1	Network Security and Cryptography, Bernard Meneges, Cengage Learning.
R2	Hack Proofing your Network, Russell, Kaminsky, Forest Puppy, Wiley Dreamtech.
W1	https://onlinecourses.nptel.ac.in/noc19_cs28/preview
W2	https://www.coursera.org/learn/crypto

Course Outcomes: On completion of this course, students can	
CO1	To be familiarity with information security awareness and a clear understanding of its importance.
CO2	To master fundamentals of secret and public cryptography
CO3	To master protocols for security services
CO4	To be familiar with network security threats and countermeasures
CO5	To be familiar with network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	3	-	-	-	-	-	-	-	-	2	-
CO2	2	2	2	3	-	-	-	-	-	-	-	-	2	-
CO3	2	2	2	3	-	-	-	-	-	-	-	-	2	-
CO4	2	2	2	3	-	-	-	-	-	-	-	-	2	-
CO5	2	2	2	3	-	-	-	-	-	-	-	-	2	-
Course	**2**	**2**	**2**	**3**	-	-	-	-	-	-	-	-	**2**	**-**

DATA WAREHOUSING & MINING (PROGRAM ELECTIVE – II)			
Subject Code	18CSCSP702**C**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Why Data Mining? What Is Data Mining? What Kinds of Data Can Be Mined? What Kinds of Patterns Can Be Mined? Which Technologies Are Used?, Which Kinds of Applications Are Targeted? Major Issues in Data Mining. Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.	**08**
Unit -2: Data Pre-processing	
Data Pre-processing: An Overview, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization	**10**
Unit – 3: Classification	
Basic Concepts, General Approach to solving a classification problem, Decision Tree Induction: Working of Decision Tree, building a decision tree, methods for expressing an attribute test conditions, measures for selecting the best split, Algorithm for decision tree induction. Bayes' Theorem, Naïve Bayesian Classification, Bayesian Belief Networks	**10**
Unit – 4: Association Analysis	
Problem Defecation, Frequent Item Set generation, Rule generation, compact representation of frequent item sets, FP-Growth Algorithm.	**10**
Unit – 5: Cluster Analysis	
What Is Cluster Analysis? Different Types of Clustering, Different Types of Clusters; K-means: The Basic K-means Algorithm, K-means Additional Issues, Bisecting K-means, Strengths and Weaknesses; Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm DBSCAN: Traditional Density Centre-Based Approach, DBSCAN Algorithm, Strengths and Weaknesses.	**12**

Text(T) / Reference(R) Books:	
T1	Introduction to Data Mining: Pang-Ning Tan & Michael Steinbach, Vipin Kumar, Pearson.
T2	Data Mining concepts and Techniques, 3/e, Jiawei Han, Michel Kamber, Elsevier
R1	Data Mining Techniques and Applications: An Introduction, Hongbo Du, Cengage Learning.
R2	Data Mining: Vikram Pudi and P. Radha Krishna, Oxford.
R3	Data Mining and Analysis - Fundamental Concepts and Algorithms; Mohammed J. Zaki, Wagner Meira, Jr, Oxford

R4	Data Warehousing Data Mining & OLAP, Alex Berson, Stephen Smith, TMH.
R5	Data Mining: Introductory and Advanced Topics: Dunham, Pearson.
W1	https://www.edx.org/learn/data-mining
W2	https://www.coursera.org/specializations/data-mining
W3	https://www.coursera.org/courses?query=data%20warehouse

Course Outcomes: On completion of this course, students can	
CO1	Understand stages in building a Data Warehouse
CO2	Understand the need and importance of pre-processing techniques
CO3	Understand the need and importance of Similarity and dissimilarity techniques
CO4	Analyze and evaluate performance of algorithms for Association Rules.
CO5	Analyze Classification and Clustering algorithms

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

DESIGN PATTERNS (PROGRAM ELECTIVE – III)			
Subject Code	18CSCSP703**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
What Is a Design Pattern?, Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalogue of Design Patterns, Organizing the Catalogue, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.	**08**
Unit -2 : Creational Patterns	
Abstract Factory, Builder, Factory Method, Prototype, Singleton.	**10**
Unit – 3: Structural Pattern	
Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.	**10**
Unit – 4: Behavioral Patterns	
Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, Strategy, Template Method, what to expect from Design Patterns.	**10**
Unit – 5:A Case Study	
Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, and Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation.	**12**

Text(T) / Reference(R) Books:	
T1	Design Patterns by Erich Gamma, Pearson Education.
R1	Satzinger: Object Oriented Analysis and Design, CENGAGE.
W1	https://www.coursera.org/courses?query=design%20patterns
W2	https://www.udemy.com/topic/design-pattern/

Course Outcomes: On completion of this course, students can	
CO1	Identify the appropriate design patterns
CO2	To solve object-oriented design problems
CO3	Develop design solutions using creational patterns.
CO4	Apply structural patterns to solve design problems.
CO5	Construct design solutions by using behavioral patterns

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

CYBER SECURITY (PROGRAM ELECTIVE – III)			
Subject Code	18CSCSP703**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction to Cybercrime	**Hours**
Introduction, Cybercrime: Definition and Origins of the Word, Cybercrime and Information Security, Who are Cybercriminals? , Classifications of Cybercrimes, Cybercrime: The Legal Perspectives, Cybercrimes: An Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cybercrime Era: Survival Mantra for the Netizens	**08**
Unit -2 : Cyber offenses	
How Criminals Plan Them –Introduction, How Criminals Plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector Cloud Computing. *Cybercrime Mobile and Wireless Devices:*Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit Card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication Service Security, Attacks on Mobile/Cell Phones, *Mobile Devices:* Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.	**10**
Unit – 3: Tools and Methods Used in Cybercrime	
Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography, DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, *Phishing and Identity Theft:* Introduction, Phishing, Identity Theft (ID Theft)	**10**
Unit – 4: Cybercrimes and Cyber security	
Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Information Security Planning and Governance, Information Security Policy Standards, Practices, The information Security Blueprint, Security education, Training and awareness program, Continuing Strategies?	**10**
Unit – 5: Understanding Computer Forensics	
Introduction, Historical Background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber forensics and Digital evidence, Forensics Analysis of E-Mail, Digital Forensics Life Cycle, Chain of Custody Concept, Network Forensics, Approaching a Computer Forensics Investigation, Computer Forensics and Steganography, Relevance of the OSI 7 Layer Model to Computer Forensics, Forensics and Social Networking Sites: The Security/ Privacy Threats, Computer Forensics from Compliance Perspective, Challenges in Computer Forensics, Special Tools and Techniques, Forensics Auditing, Ant forensics	**12**

Text(T) / Reference(R) Books:	
T1	Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole, SunitBelapure, Wiley.
T2	Principles of Information Security, MichealE.Whitman and Herbert J.Mattord, Cengage Learning.
R1	Information Security, Mark Rhodes, Ousley, MGH.
W1	https://www.edx.org/learn/cybersecurity
W2	https://www.cyberdegrees.org/resources/free-online-courses/

Course Outcomes: On completion of this course, students can	
CO1	Cyber Security architecture principles
CO2	Identifying System and application security threats and vulnerabilities
CO3	Identifying different classes of attacks
CO4	Cyber Security incidents to apply appropriate response
CO5	Describing risk management processes and practices, Evaluation of decision making outcomes of Cyber Security scenarios

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

ARTIFICIAL INTELLIGENCE (PROGRAM ELECTIVE – III)			
Subject Code	18CSCSP703**C**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction to artificial intelligence	**Hours**
Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI.	**08**
Unit -2 : Problem solving: state-space search and control strategies	
Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction, *Problem reduction and game playing:* Introduction, problem reduction, game playing, alphabeta pruning, two-player perfect information games	**10**
Unit – 3: Logic Concepts	
Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic.	**10**
Unit – 4: Advanced Knowledge Representation Techniques	
Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web, *Expert system and applications:* Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools.	**10**
Unit – 5: Uncertainty Measure & Probability Theory	
Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory, *Fuzzy sets and fuzzy logic:* Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.	**12**

Text(T) / Reference(R) Books:	
T1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning
T2	Artificial intelligence, A modern Approach, 2nded, Stuart Russel, Peter Norvig, PEA
T3	Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rded, TMH
T4	Introduction to Artificial Intelligence, Patterson, PHI
R1	Artificial intelligence, structures and Strategies for Complex problem solving, - George F Lugar, 5thed, PEA
R2	Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
R3	Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier

W1	https://www.edx.org/learn/artificial-intelligence
W2	https://www.coursera.org/courses?query=artificial%20intelligence

Course Outcomes: On completion of this course, students can	
CO1	Identify problems that is amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
CO2	Formalize a given problem in the language/framework of different AI methods (e.g., as a search problem, as a constraint satisfaction problem, as a planning problem, as a Markov decision process, etc).
CO3	Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
CO4	Design and carry out an empirical evaluation of different algorithms on problem formalization.
CO5	State the conclusions that the evaluation supports.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

COMPILER DESIGN LAB			
Subject Code	18CSCSL7060	IA Marks	50
Number of Tutorial Hours/Week	03(P)	Exam Marks	50
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1
Design a lexical analyzer for given language and the lexical analyzer should ignore redundant spaces, tabs and new lines.

Exercise2
Simulate First and Follow of a grammar.

Exercise3
Develop an operator precedence parser for given language.

Exercise4
Construct recursive decent parser for an expression.

Exercise5
Construct LL(1) parser for an expression.

Exercise6
Design predictive parser for the given language.

Exercise7
Implementation of shift reduce parsing algorithm.

Exercise8
Design a LALR Bottom-up parser for the given language.

Exercise9
Implement the lexical analyzer using JLex, FLex or Lex or other lexical analyzer generating tools.

Exercise10
Write a program to perform loop unrolling.

Exercise11
Convert the BNF rules into YACC form and write code to generate abstract syntax tree.

Exercise12
Write a program for constant propagation.

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate a working understanding of the process
CO2	Understanding of the process of lexical analysis
CO3	Understanding of the process of Parsing
CO4	Understanding of the process of various design aspects
CO5	Construct code for converting BNF rules into YACC

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO2	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO3	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	-	-	2
CO5	2	3	2	2	-	-	-	-	-	-	-	-	-	2
Course	**2**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**

SOFTWARE TESTING (PROGRAM ELECTIVE – IV)			
Subject Code	18CSCSP801**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Purpose of Testing, Dichotomies, Model for Testing, Consequences of Bugs, Taxonomy of Bugs. *Flow graphs and Path testing:* Basics Concepts of Path Testing, Predicates, Path Predicates and Achievable Paths, Path Sensitizing, Path Instrumentation, Application of Path Testing.	**08**
Unit -2 : Paths, Path products and Regular expressions	
Path Products & Path Expression, Reduction Procedure, Applications, Regular Expressions & Flow Anomaly Detection. *Transaction Flow Testing:* Transaction Flows, Transaction Flow Testing Techniques. *Dataflow testing:* Basics of Dataflow Testing, Strategies in Dataflow Testing, Application of Dataflow Testing.	**10**
Unit – 3: Domain Testing	
Domains and Paths, Nice & Ugly Domains, Domain testing, Domains and Interfaces Testing, Domain and Interface Testing, Domains and Testability. *Syntax Testing:* Why, What and How, A Grammar for formats, Test Case Generation, Implementation and Application and Testability Tips. *Logic Based Testing:* Overview, Decision Tables, Path Expressions, KV Charts, and Specifications.	**10**
Unit – 4: State, State Graphs and Transition Testing	
State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips. *Graph Matrices and Application:* Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm.	**10**
Unit – 5: Software Testing Tools	
Introduction to Testing, Automated Testing, Concepts of Test Automation, Introduction to list of tools like Win runner, Load Runner, JMeter, About Win Runner, Using Win runner, Mapping the GUI, Recording Test, Working with Test, Enhancing Test, Checkpoints, Test Script Language, putting it all together, Running and Debugging Tests, Analyzing Results, Batch Tests, Rapid Test Script Wizard.	**12**

Text(T) / Reference(R) Books:	
T1	Software testing techniques – Boris Beizer, Dreamtech, second edition
T2	Software Testing- Yogesh Singh, Camebridge
R1	The Craft of software testing - Brian Marick, Pearson Education
R2	Software Testing, 3rd edition, P.C. Jorgensen, Aurbach Publications (Dist.by SPD).
R3	Software Testing, N.Chauhan, Oxford University Press.
R4	Introduction to Software Testing, P.Ammann&J.Offutt, Cambridge Univ.Press
R5	Effective methods of Software Testing, Perry, John Wiley, 2nd Edition, 1999
R6	Software Testing Concepts and Tools, P.NageswaraRao, dreamtech Press

R7	Win Runner in simple steps by Hakeem Shittu, 2007Genixpress
R8	Foundations of Software Testing, D.Graham& Others, Cengage Learning.
W1	https://alison.com/courses/software-testing
W2	https://testinginstitute.com/online/online-software-testing-training.php

Course Outcomes: On completion of this course, students can	
CO1	Understand the basic testing procedures.
CO2	To support in generating test cases and test suites.
CO3	To test the applications manually by applying different testing methods
CO4	To test the applications by automation tools.
CO5	Apply tools to resolve the problems in Real time environment.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

MOBILE COMPUTING (PROGRAM ELECTIVE – IV)			
Subject Code	18CSCSP801**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Mobile Communications, Mobile Computing – Paradigm, Promises/Novel Applications and Impediments and Architecture; Mobile and Handheld Devices, Limitations of Mobile and Handheld Devices. GSM – Services, System Architecture, Radio Interfaces, Protocols, Localization, Calling, Handover, Security, New Data Services, GPRS. *(Wireless) Medium Access Control (MAC):*Motivation for a specialized MAC (Hidden and exposed terminals, Near and far terminals), SDMA, FDMA, TDMA, CDMA, Wireless LAN/(IEEE 802.11)	**08**
Unit -2 : Mobile Network Layer	
IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunneling and encapsulation, Route Optimization, DHCP.	**10**
Unit – 3: Mobile Transport Layer	
Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks. *Database Issues:* Database Hoarding & Caching Techniques, Client-Server Computing & Adaptation, Transactional Models, Query processing, Data Recovery Process &QoS Issues.	**10**
Unit – 4: Data Dissemination and Synchronization	
Communications Asymmetry, Classification of Data Delivery Mechanisms, Data Dissemination, Broadcast Models, Selective Tuning and Indexing Methods, Data Synchronization – Introduction, Software, and Protocols.	**10**
Unit – 5: Mobile Ad hoc Networks	
Introduction, Applications & Challenges of a MANET, Routing, Classification of Routing Algorithms, Algorithms such as DSR, AODV, DSDV, etc. , Mobile Agents, Service Discovery. *Protocols and Platforms for Mobile Computing:* WAP, Bluetooth, XML, J2ME, Java Card, PalmOS, Windows CE, SymbianOS, Linux for Mobile Devices, Android.	**12**

Text(T) / Reference(R) Books:	
T1	Mobile Communications, Jochen Schiller, Addison-Wesley, Second Edition, 2009
T2	Mobile Computing, Raj Kamal, Oxford University Press, 2007.
R1	Mobile Computing, Technology Applications and Service Creation, ASOKE K TALUKDER, HASAN AHMED, ROOPA R YAVAGAL, Second Edition, Mc Graw Hill
R2	Principles of Mobile Computing, UWE Hansmann, LotherMerk, Martin S. Nocklous, Thomas Stober, Second Edition, Springer.
W1	https://swayam.gov.in/course/3696-mobile-computing
W2	https://onlinecourses.nptel.ac.in/noc16_cs13/preview

Course Outcomes: On completion of this course, students can	
CO1	To think and develop new mobile application.
CO2	To take any new technical issue related to this new paradigm and come up with a solution(s).
CO3	To develop new ad hoc network applications and/or algorithms/protocols.
CO4	To understand & develop any existing mobile time environment.
CO5	To understand & develop new protocol related to mobile time environment.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

MACHINE LEARNING (PROGRAM ELECTIVE – IV)			
Subject Code	18CSCSP801**C**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: The ingredients of machine learning, Tasks	**Hours**
The problems that can be solved with machine learning, Models: the output of machine learning, Features, the workhorses of machine learning. *Binary classification and related tasks:* Classification, Scoring and ranking, Class probability estimation. *Beyond binary classification:* Handling more than two classes, Regression, Unsupervised and descriptive learning.	**08**
Unit -2 : Concept learning	
The hypothesis space, Paths through the hypothesis space, Beyond conjunctive concepts *Tree models:* Decision trees, Ranking and probability estimation trees, Tree learning as variance reduction. *Rule models:* Learning ordered rule lists, Learning unordered rule sets, Descriptive rule learning, First-order rule learning	**10**
Unit – 3: Linear models	
The least-squares method, The perceptron: a heuristic learning algorithm for linear classifiers, Support vector machines, obtaining probabilities from linear classifiers, Going beyond linearity with kernel methods. *Distance Based Models:* Introduction, Neighbors and exemplars, Nearest Neighbors classification, Distance Based Clustering, Hierarchical Clustering.	**10**
Unit – 4: Probabilistic models	
The normal distribution and its geometric interpretations, Probabilistic models for categorical data, Discriminative learning by optimizing conditional Likelihood Probabilistic models with hidden variables. *Features:* Kinds of feature, Feature transformations, Feature construction and selection. Model ensembles: Bagging and random forests, Boosting	**10**
Unit – 5: Dimensionality Reduction	
Principal Component Analysis (PCA), Implementation and demonstration. *Artificial Neural Networks:* Introduction, Neural network representation, appropriate problems for neural network learning, Multilayer networks and the back-propagation algorithm.	**12**

Text(T) / Reference(R) Books:	
T1	Machine Learning: The art and science of algorithms that make sense of data, Peter Flach, Cambridge.
T2	Machine Learning, Tom M. Mitchell, MGH.
R1	UnderstandingMachine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai BenDavid, Cambridge
R2	Machine Learning in Action, Peter Harington, 2012, Cengage.
W1	https://www.coursera.org/learn/machine-learning
W2	https://www.udacity.com/course/intro-to-machine-learning--ud120

Course Outcomes: On completion of this course, students can	
CO1	To recognize the characteristics of machine learning that make it useful to real-world Problems.
CO2	To Characterize machine learning algorithms as supervised, semi- supervised, and Unsupervised.
CO3	To learn few machine learning tool boxes
CO4	To use support vector machines and regularized regression algorithms
CO5	To Understand the concept behind neural networks for learning non- linear functions

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

SOFTWARE QUALITY ASSURANCE (PROGRAM ELECTIVE – V)			
Subject Code	18CSCSP802**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: FUNDAMENTALS OF SOFTWARE QUALITY ASSURANCE	**Hours**
The Role of SQA, SQA Plan, SQA considerations, SQA people, Quality, Management, Software Configuration Management.	**08**
Unit -2 :MANAGING SOFTWARE QUALITY	
Managing Software Organizations, Managing Software Quality, Defect Prevention, Software Quality Assurance Management.	**10**
Unit – 3:SOFTWARE QUALITY ASSURANCE METRICS	
Software Quality, Total Quality Management (TQM), Quality Metrics, Software Quality Metrics Analysis.	**10**
Unit – 4:SOFTWARE QUALITY PROGRAM	
Software Quality Program Concepts, Establishment of a Software Quality Program, Software Quality Assurance Planning, An Overview, Purpose & Scope.	**10**
Unit – 5:SOFTWARE QUALITY ASSURANCE STANDARDIZATION	
Software Standards–ISO 9000 Quality System Standards, Capability Maturity Model and the Role of SQA in Software Development Maturity, SEI CMM Level 5, Comparison of ISO 9000 Model with SEI's CMM.	**10**

Text(T) / Reference(R) Books:	
T1	Software Quality, Mordechai Ben-Menachem / Garry S Marliss, Vikas Publishing House, Pvt, Ltd., New Delhi.
T2	Managing the Software Process, Watts S Humphrey, Pearson Education Inc.
R1	Handbook of Software Quality Assurance, Gordon G Schulmeyer, Third Edition, Artech House Publishers 2007
R2	Software Quality Assurance: Principles and Practice, Nina S Godbole, Alpha Science International, Ltd, 2004
W1	https://www.udemy.com/software-quality-assurance/
W2	https://www.coursera.org/courses?query=quality%20assurance

Course Outcomes: On completion of this course, students can	
CO1	To learn Software quality factors
CO2	To learn Common software testing methodologies
CO3	To learn about project process control
CO4	To learn about software metrics and standardizations
CO5	To learn about certifications

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	-	-	-	3	-	-	-	-	-	2	-
CO2	2	2	2	-	-	-	3	-	-	-	-	-	2	-
CO3	2	2	2	-	-	-	3	-	-	-	-	-	2	-
CO4	2	2	2	-	-	-	3	-	-	-	-	-	2	-
CO5	2	2	2	-	-	-	3	-	-	-	-	-	2	-
Course	**2**	**2**	**2**	**-**	**-**	**-**	**3**	-	-	-	-	-	**2**	**-**

Ad-Hoc & SENSOR NETWORKS (PROGRAM ELECTIVE – V)			
Subject Code	18CSCSP802**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Ad-HOC Introduction	**Hours**
Issues in Ad-Hoc Wireless Networks, MAC Protocols Issues, Classifications of MAC protocols, Multi-channel MAC & Power control MAC protocol.	**08**
Unit -2 :Ad-HOC Network routing & TCP	
Issues, Classifications of routing protocol, Hierarchical and Power aware, Multicast routing, Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues, TCP Over Ad Hoc, Feedback based, TCP with explicit link, TCP Bus, Ad Hoc TCP, and Split TCP.	**10**
Unit – 3:WSN and MAC	
Introduction, Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols, self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.	**10**
Unit – 4:WSN Routing, Localization & QOS	
Issues in WSN routing, OLSR, AODV. Localization, Indoor and Sensor Network, Localization, QOS in WSN.	**10**
Unit – 5:Mesh Networks	
Necessity for Mesh Networks, MAC enhancements, IEEE 802.11s Architecture, Opportunistic routing, Self-configuration and Auto configuration Capacity, Models, Fairness, Heterogeneous Mesh Networks, Vehicular Mesh Networks.	**12**

Text(T) / Reference(R) Books:	
T1	Mobile Ad hoc Networking, Marco Conti, Silvia Giordano, Ivan IvanStojmenovic Stefano Basagni, Wiley, Second Edition,2015
T2	Ad Hoc Wireless Networks – Architecture and Protocols, C.SivaRamMurthy and B.Smanoj, Pearson Education, 2006.
R1	Ad hoc Networking, Perkins, Pearson Education, 2008.
R2	Wireless Sensor Networks, Feng Zhao and Leonidas Guibas, Morgan Kaufman Publishers, 2004.
R3	Ad Hoc MobileWireless Networks, C.K.Toh,
R4	Wireless Mesh Networking, Thomas Krag and SebastinBuettrich, O'Reilly Publishers, 2007.
W1	https://www.coursera.org/lecture/iot/lecture-3-2-manets-ED6nz
W2	https://nptel.ac.in/courses/106105160/

Course Outcomes: On completion of this course, students can	
CO1	Understand the basic testing procedures
CO2	To support in generating test cases and test suites
CO3	To test the applications manually by applying different testing methods
CO4	To test the applications manually by automation tools
CO5	Apply tools to resolve the problems in Real time environment

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

<table>
<tr><td colspan="5">HADOOP & BIGDATA
(PROGRAM ELECTIVE – V)</td></tr>
<tr><td>Subject Code</td><td colspan="2">18CSCSP802C</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td colspan="2">3</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td colspan="2">50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="5">Credits – 03</td></tr>
<tr><td colspan="4">Unit -1: Data structures in Java</td><td>Hours</td></tr>
<tr><td colspan="4">Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization</td><td>08</td></tr>
<tr><td colspan="5">Unit -2 :Working with Big Data</td></tr>
<tr><td colspan="4">Google File System, Hadoop Distributed File System (HDFS) – Building blocks of Hadoop (Name node, Data node, Secondary Name node, Job Tracker, Task Tracker), Introducing and Configuring Hadoop cluster (Local, Pseudo-distributed mode, Fully Distributed mode), Configuring XML files.</td><td>10</td></tr>
<tr><td colspan="5">Unit – 3:Writing MapReduce Programs</td></tr>
<tr><td colspan="4">A Weather Dataset, Understanding Hadoop API for MapReduce Framework (Old and New), Basic programs of Hadoop MapReduce: Driver code, Mapper code, Reducer code, Record Reader, Combiner, Partitioned Hadoop I/O: The Writable Interface, Writable Comparable and comparators, Writable Classes: Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, Object Writable and Generic Writable, Writable collections, Implementing a Custom Writable: Implementing a Raw Comparator for speed, Custom comparators.</td><td>10</td></tr>
<tr><td colspan="5">Unit – 4:Pig</td></tr>
<tr><td colspan="4">Hadoop Programming Made Easier Admiring the Pig Architecture, Going with the Pig Latin Application Flow, Working through the ABCs of Pig Latin, Evaluating Local and Distributed Modes of Running Pig Scripts, Checking out the Pig Script Interfaces, Scripting with Pig Latin.</td><td>10</td></tr>
<tr><td colspan="5">Unit – 5:Applying Structure to Hadoop Data with Hive</td></tr>
<tr><td colspan="4">Saying Hello to Hive, Seeing How the Hive is Put Together, Getting Started with Apache Hive, Examining the Hive Clients, Working with Hive Data Types, Creating and Managing Databases and Tables, Seeing How the Hive Data Manipulation Language Works, Querying and Analyzing Data</td><td>12</td></tr>
</table>

Text(T) / Reference(R) Books:	
T1	Big Java, Cay Horstmann, 4th Edition, Wiley John Wiley & Sons, INC
T2	Hadoop: The Definitive Guide by Tom White, 3rd Edition, O'reilly
T3	Hadoop in Action by Chuck Lam, MANNING Publ.
T4	Hadoop for Dummies by Dirk deRoos, Paul C.Zikopoulos, Roman B.Melnyk,Bruce Brown, Rafael Coss
R1	Hadoop in Practice by Alex Holmes, MANNING Publ.
R2	Hadoop MapReduce Cookbook, SrinathPerera, ThilinaGunarathne
W1	https://www.edx.org/learn/hadoop
W2	https://intellipaat.com/big-data-hadoop-training/

Course Outcomes: On completion of this course, students can	
CO1	Preparing for data summarization.
CO2	Preparing for query, and analysis.
CO3	Applying data modeling techniques to large data sets
CO4	Creating applications for Big Data analytics
CO5	Building a complete business data analytic solution

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

SOFTWARE PROJECT MANAGEMENT (PROGRAM ELECTIVE – VI)			
Subject Code	18CSCSP803**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Project, Management, Software Project Management activities, Challenges in software projects, stake holders, objectives & goals. *Project Planning:* Step-wise planning, Project scope, Project products & deliverables, Project activities, Effort estimation, Infrastructure. *Project Approach:* Life cycle models, choosing technology, prototyping, life cycle phases, process artefacts, process work flows.	**08**
Unit -2 :Effort estimation & Activity Planning	
Estimation techniques, Function point analysis, SLOC, COCOMO, Usecase-based estimation, Activity identification approaches, network planning models, critical path analysis.	**10**
Unit – 3:Risk management	
Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach.	**10**
Unit – 4:Project management and control	
Creating framework for monitoring and control, progress monitoring, Cost monitoring, Earned value analysis, defects tracking, issues tracking, status reports, Types of resources, Identifying resource requirements, Resource scheduling.	**10**
Unit – 5:Software Quality	
Planning quality, defining quality – ISO 9016, Quality measures, quantitative quality management planning, product quality & process quality metrics, statistical process control capability maturity model, enhancing software quality.	**12**

Text(T) / Reference(R) Books:	
T1	Software Project Management, Bob Hughes & Mike Cotterell, TATA Mc Graw-Hill
T2	Software Project Management, Walker Royce: Pearson Education, 2005
T3	Software Project Management in practice, Pankaj Jalote, Pearson
R1	Software Project Management, Joel Henry, Pearson Education
W1	https://www.coursera.org/courses?query=software%20project%20management
W2	https://www.qaiglobalinstitute.com/product/certificate-program-in-software-project-management/

Course Outcomes: On completion of this course, students can	
CO1	To match organizational needs to the most effective software development model
CO2	To understand basic concepts and issues of software project management
CO3	To effectively plan and implement the projects through managing people
CO4	To effectively plan and implement the projects through communication and change.
CO5	To select and employ mechanisms for tracking the software projects

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

CYBER FORENSICS (PROGRAM ELECTIVE – VI)			
Subject Code	18CSCSP803**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: NETWORK LAYER SECURITY &TRANSPORT LAYER SECURITY	**Hours**
IPSec Protocol, IP Authentication Header, IP ESP, Key Management Protocol for IPSec. Transport layer Security: SSL protocol, Cryptographic Computations, TLS Protocol.	**08**
Unit -2:E-MAIL SECURITY & FIREWALLS	
PGP, S/MIME, Internet Firewalls for Trusted System: Roles of Firewalls, Firewall related Terminology, Types of Firewalls, Firewall designs, SET for E-Commerce Transactions.	**10**
Unit – 3:INTRODUCTION TO COMPUTER FORENSICS	
Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques, Incident and incident response methodology, Forensic duplication and investigation. Preparation for IR: Creating response tool kit and IR team, Forensics Technology and Systems, Understanding Computer Investigation, Data Acquisition.	**10**
Unit – 4:EVIDENCE COLLECTION AND FORENSICS TOOLS	
Processing Crime and Incident Scenes, Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.	**10**
Unit – 5:ANALYSIS AND VALIDATION	
Validating Forensics Data, Data Hiding Techniques, Performing Remote Acquisition, Network Forensics, Email Investigations, Cell Phone and Mobile Devices Forensics.	**12**

Text(T) / Reference(R) Books:	
T1	Internet Security: Cryptographic Principles, Algorithms and Protocols, Man Young Rhee, Wiley Publications, 2003
T2	Computer Forensics and Investigations, Nelson, Phillips, Enfinger, Steuart, Cengage Learning, India Edition, 2008.
R1	Computer Forensics, John R.Vacca, Cengage Learning, 2005
R2	Internet Cryptography, Richard E.Smith, 3rd Edition Pearson Education, 2008
W1	https://www.edx.org/course/computer-forensics-2
W2	https://www.coursera.org/courses?query=forensic

Course Outcomes: On completion of this course, students can	
CO1	Understand the basic theory and concepts of cyber security and privacy including policies, models, and mechanisms, ethics, legal issues, and human factors associated with cyber security and forensics.
CO2	Understand security vulnerabilities and be able to describe threats and risks directed at computer hardware and software and recognize and categorize network vulnerabilities and attacks.
CO3	Be able to explain best practices in giving access to systems and networks and implement proper authentication techniques, familiar with cryptographic techniques, asymmetric key algorithms, and create certificates.
CO4	Describe the requirements for a cyber forensic investigation and demonstrate an understanding of tools, techniques and procedures
CO5	Be conversant in current security-related issues in the fields of cyber security and cyber forensics.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

<table>
<tr><td colspan="4">DATA ANALYTICS
(PROGRAM ELECTIVE – VI)</td></tr>
<tr><td>Subject Code</td><td>18CSCSP803C</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
</table>

Unit -1: Introduction to Big Data	**Hours**
Big Data and its importance, Characteristics, Big data analytics, Basic requirements, Big data applications, Map Reduce framework, Algorithms using map reduce. *NoSQL Databases:* Key-value databases, Column-family databases, Document databases, Graph databases	**08**
Unit -2:Apache Hadoop	
Introduction, System principle, Architecture, Hadoop distributed file system, Hadoop Map Reduce, YARN, Operation modes, Hadoop Installation, Cluster creation, Hadoop commands, HDFS commands, YARN commands, Map Reduce commands, Moving Data in and out of Hadoop, Hadoop programming.	**10**
Unit – 3:Hadoop Ecosystem	
Introduction to Pig, Installation, Execution, Pig Latin: Basics, Data types, Building blocks, Operators, Functions, Example Scripts. Introduction to Hive: Installing and Running Hive, Hive QL, Tables, Querying data, User defined functions, Partitioning, Joins, Simple projects. Overview of Spark: Zookeeper, and other Hadoop Ecosystem tools.	**10**
Unit – 4:Data Analysis Techniques	
Linear and logistic regression modelling, Naive Baye's classifier, Support vector machine, Neural networks, Principal component analysis, Linear Discriminant Analysis, K Nearest Neighbor, Decision Trees, Fuzzy logic, Clustering Techniques : Hierarchical, agglomerative, and K– Means.	**10**
Unit – 5:Introduction to R	
R Installation, Basic statements of R, Importing and exporting data, Ordered and unordered factors, Arrays and matrices, Lists and data frames, Reading data from files, Data visualization, Probability distributions, Statistical models in R, Manipulating objects, Data Pre-processing, Feature selection, Clustering, Classification and regression. Case Studies: Social network analysis, Text analysis, Marketing analysis.	**12**

Text(T) / Reference(R) Books:	
T1	Understanding Big data, Chris Eaton, Dirk deroos et al, McGraw Hill, 2012
T2	Hadoop: The Definitive Guide, Tom White, 3rd Edition, O'reilly, 2012
T3	Beginning R - The Statistical Programming Language, Mark Gardener, John Wiley & Sons, Inc., 2012
R1	Professional Hadoop Solutions, Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, Wiley, 2015
R2	Principles of Data Mining, David Hand, HeikiMannila, Padhria Smyth, PHI 2013
R3	Big Data Analytics: Disruptive Technologies for Changing the Game, Arvind Sathi, 1st Edition, IBM Corporation, 2012.
R4	An Introduction to R, W. N. Venables, D. M. Smith and the R Core Team,
R5	Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeffrey D. Ullman, Cambridge University Press, 2014.
R6	Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber, Morgan Kaufmann Publishers, Third Edition, 2010.
W1	https://www.coursera.org/browse/data-science/data-analysis
W2	https://www.edx.org/learn/data-analysis

Course Outcomes: On completion of this course, students can	
CO1	Categorize and summarize big data and its importance
CO2	Differentiate various big data technologies like Hadoop, MapReduce.
CO3	Differentiate various big data technologies like Hadoop Ecosystem, R, and No-SQL
CO4	Apply tools and techniques to analyze big data
CO5	Earn tips and tricks for big data use cases and solutions.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

Open Elective Courses offered by Civil to other Departments

Open Elective Courses offered by Dept. of CE to other Depts.

1	V Semester	18xxCEO50nA	Civil Engineering - Societal & Global Impact
2		18xxCEO50nB	Introduction to Civil Engineering
3	VI Semester	18xxCEO60nA	Disaster Management
4		18xxCEO60nB	Environmental Pollution and Control
5	VII Semester	18xxCEO70nA	Building Materials
6		18xxCEO70nB	Green Buildings and Sustainability

Open Elective-I

Civil Engineering - Societal & Global Impact SEMESTER - V			
Subject Code	18xxCEO506A	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

- Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
- Awareness of the impact of Civil Engineering for the various specific fields of human endeavour
- Need to think innovatively to ensure Sustainability

Unit -1	
Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering	**Hours – 10**
Unit -2	
Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy)	**Hours – 10**
Unit – 3	
Environment- Traditional & futuristic methods; Solid waste management, Water purification, Waste water treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River inter linking), Multi-purpose water projects, Atmospheric pollution;Global warming phenomena and Pollution Mitigation measures, Stationary and non-stationary; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	**Hours – 10**
Unit – 4	
Built environment – Facilities management, Climate control; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures	**Hours – 10**
Unit-5	
Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Project	**Hours – 10**

Course outcomes:

On completion of this course, students are able to:

1. Understand the role of Civil Engineering in Modern World
2. Understand various constructional Infrastructure and their importance in present environment
3. Interpret modern transportation systems and their advantages
4. Effect of global Warming and mitigation measures
5. Understand the importance of Sustainability and Reduction of Green House Gas Emissions

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

TEXT BOOKS

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.

REFERENCES

1. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
2. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
3. http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx
4. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	-	-	3	-	-	-	-	-	-	-	2	-	-
2	3	-	-	-	-	2		-	-	-	-	-	-	2	-
3	2	3	-	-	2	-		-	-	-	-	-	3	-	-
4	3	2	-	-	-	-		-	1	-	-		-	1	-
5	2	3	-	-	1	-	2	-	-	-	-	1	-	1	-
Course	3	2	-	-	2	1	1	-	1	-	-	1	2	1	-

Introduction to Civil Engineering SEMESTER - V			
Subject Code	18xxCEO506B	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

- To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering
- To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
- To expose the students to the various avenues available for doing creative and
- Innovative work in this field by showcasing the many monuments and inspiring projects of public utility.

Unit -1 History of Civil engineering	
Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers	**Hours – 10**
Unit -2 Fundamentals of Building Materials	
Stones, bricks, mortars, Plain, Reinforced & Pre stressed Concrete, Admixture; Structural Steel, High Tensile Steel, Recycling of Construction & Demolition wastes, Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.	**Hours – 10**
Unit – 3 Basics of Construction Management & Contracts Management	
Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management-Terms in Contract-contract Types	**Hours – 10**
Unit – 4 Surveying & Geomatics	
Surveying & Geomatics: Overview of Surveying, Traditional surveying techniques- , Total Stations; GPS & GIS Applications	**Hours – 10**
Unit-5 Geotechnical Engineering	
Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling	**Hours – 10**

Course outcomes:

On completion of this course, students are able to:

1. Understand the role of Civil Engineering in Modern World
2. Know the details and working of various building materials
3. Understand the concept of various construction management Techniques
4. Know basic surveying methods and their applications
5. Understand the importance of soil mechanics and rock mechanics in various structural designs

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.

The student will have to answer 5 full questions selecting one full question from each unit.

TEXT BOOKS

1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract
2. Soil dynamics and machine foundations by K.R. Arora
3. Surveying vol 1&2 byB.C.Punmia, Laxmi publications, 2005
4. Building Materials by P.C.Verghese, PHI learning pvt. Ltd., 2015
5. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset

REFERENCES

1. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2ndEdn. Avinash Publications Mumbai

2. Avtarsingh (2002), Law of Contract, Eastern Book Co.

3. Dutt (1994), Indian Contract Act, Eastern Law House The National Building Code, BIS, (2017)

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	-	-	-	1	-	-	-	1	-	-	2	-	-
2	2	-	-	-	-	1	-	-	1	-	-	-	3	-	-
3	2	1	-	-	-	-	1	-	-	-	-	-	-	1	-
4	3	3	-	-	-	1	-	-	-	2	-	-	1	-	-
5	3	2	-	-	-	1	-	-	-	1	-	-	2	-	-
Course	3	2	-	-	-	1	1	-	1	1	-	-	2	1	-

Open Elective-II

DISASTER MANAGEMENT SEMESTER -VI			
Subject Code	18xxCEO604A	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

- Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
- Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
- Understand the 'relief system' and the 'disaster victim.
- Describe the three planning strategies useful in mitigation.
- Identify the regulatory controls used in hazard management.
- Describe public awareness and economic incentive possibilities.

Unit -1 Natural Hazards And Disaster Management	
Introduction of DM – Inter Disciplinary -nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: floods, draughts – Earthquakes – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast – landslides.	**Hours – 10**
Unit -2 Man Made Disaster And Their Management Along With Case Study Methods Of The Following	
Fire hazards – transport hazard dynamics– solid waste management – post disaster – bio terrotirism -threat in mega cities, rail and air craft's accidents, and Emerging infectious diseases & Aids and their management.	**Hours – 10**
Unit – 3 Risk And Vulnerability	
Building codes and land use planning – social vulnerability – environmental vulnerability – Macroeconomic management and sustainable development, climate change risk rendition – financial management of disaster – related losses	**Hours – 10**
Unit – 4 Role Of Technology In Disaster Managements:	
Disaster management for infra structures, taxonomy of infra structure – treatment plants and processfacilities- electrical substations- roads and bridges- mitigation programme for earth quakes –flowchart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.	**Hours – 10**

Unit-5 Education And Community Preparedness:	
Education in disaster risk reduction-Essentials of school disaster education-Community capacity and disaster resilience-Community based disaster recovery -Community based disaster management and social capital-Designing resilience- building community capacity for action.	**Hours – 10**

Course outcomes:

On completion of this course, students are able to

1. Affirm the usefulness of integrating management principles in disaster mitigation work
2. Distinguish between the different approaches needed to manage pre- during and post- disaster periods
3. Explain the process of risk management
4. Relate to risk transfer
5. Prepare community for risk reduction

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

TEXT BOOKS

1. Disaster Management – Global Challenges and Local Solutions' by Rajib shah & R Krishnamurthy (2009), Universities press.
2. Disaster Science & Management' by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., New Delhi.
3. Disaster Management – Future Challenges and Opportunities' by Jagbir Singh (2007), I K International Publishing House Pvt. Ltd.
4. http://ndma.gov.in/ (Home page of National Disaster Management Authority).

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	2	3	-	3	-	-	1	-	-	-	-	-	3	-	-
2	2	3	-	3	-	-	3	-	-	-	-	-	3	-	-
3	-	2	-	3	-	-	3	-	-	-	-	-	3	-	-
4	2		-	1	-	-	2	-	-	-	-	-	3	-	-
5	-	3	-	3	-	-	3	-	-	-	-	-	1	-	-
Course	2	3	-	3	-	-	3	-	-	-	-	-	3	-	-

ENVIONMENTAL POLLUTION AND CONTROL SEMESTER -VI			
Subject Code	18xxCEO604B	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

- Impart knowledge on fundamental aspects of air pollution & control, noise pollution, and solid waste management.
- Provide basic knowledge on sustainable development.
- Introduces some basics of sanitation methods essential for protection of community health.
- Differentiate the solid and hazardous waste based on characterization.

Unit -1 Introduction	
Air Pollution: Air pollution Control Methods–Particulate control devices – Methods of Controlling Gaseous Emissions – Air quality standards. **Noise Pollution**: Noise standards, Measurement and control methods – Reducing residential and industrial noise – ISO14000.	**Hours – 10**
Unit -2 Industrial wastewater Management	
Strategies for pollution control - Volume and Strength reduction – Neutralization – Equalization – Proportioning – Common Effluent Treatment Plants - Recirculation of industrial wastes – Effluent standards.	**Hours – 10**
Unit – 3 Solid Waste Management	
Solid waste characteristics – basics of on-site handling and collection separation and processing - Incineration- Composting-Solid waste disposal methods – fundamentals of Land filling.	**Hours – 10**
Unit – 4 Environmental Sanitation	
Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (melas and fares), Schools and Institutions, Rural Sanitation-low cost waste disposal methods.	**Hours – 10**
Unit-5 Hazardous Waste	
Characterization - Nuclear waste – Biomedical wastes – Electronic wastes - Chemical wastes – Treatment and management of hazardous waste-Disposal and Control methods.	**Hours – 10**

Course outcomes:

On completion of this course, students are able to

1. Identify the air pollutant control devices
2. Have knowledge on the NAAQ standards and air emissionstandards.
3. Differentiate the treatment techniques used for sewage and industrial wastewater treatment methods.
4. Understand the fundamentals of solid waste management, practices adopted in his town/village and its importance in keeping the health of the city.
5. Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.

Question paper pattern:
Section A: 1. This section contains ten one or two line answer question carrying 1 mark each. 2. Two questions from each unit should present. **Section B:** 1. This Section will have 10 questions. 2. Each full question carry 12 marks. 3. Each full question will have sub question covering all topics under a unit. 4. The student will have to answer 5 full questions selecting one full question from each unit.
TEXT BOOKS **1.** Environmental Engineering , by Ruth F. Weiner and Robin Matthews – 4th Edition Elesevier, 2003. **2.** Environmental Science and Engineering by J.G. Henry and G.W. Heinke – Pearson Education. **3.** Environmental Engineering by Mackenzie L Davis & David A Cornwell. McGraw Hill Publishing1. Air Pollution and Control by M.N. Rao & H.N. Rao
REFERENCES **1.** Air Pollution and Control by M.N. Rao & H.N. Rao **2.** Solid Waste Management by K. Sasi Kumar, S.A. Gopi Krishna. PHI New Delhi. **3.** Environmental Engineering by Gerard Kiley, Tata McGraw Hill. **4.** Environmental Sanitation by KVSG Murali Krishna, Reem Publications, New Delhi.

Course Outcomes to Program Outcomes Mapping:

8	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
1	2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
2	2	3	-	3	-	-	-	-	-	-	-	-	-	3	-
3	-	2	-	3	-	-	-	-	-	-	-	-	-	3	-
4	2	-	-	3	-	-	-	-	-	-	-	-	-	3	-
5	-	3	-	3	-	-	-	-	-	-	-	-	-	3	-
Course	2	3	-	3	-	-	-	-	-	-	-	-	-	3	-

<u>**Open Elective-III**</u>

<table>
<tr><td colspan="4">BUILDING MATERIALS
SEMESTER – VII</td></tr>
<tr><td>Subject Code</td><td>18xxCEO703A</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:
Initiating the student with the knowledge of basic building materials and their properties
Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams,walls, sloped and flat roofs.
The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
Imparting the students with the techniques of formwork and scaffolding
The students should be exposed to classification of aggregates, moisture content of the aggregate.</td></tr>
<tr><td colspan="3">Unit -1 Introduction</td><td></td></tr>
<tr><td colspan="3">Stones, Bricks And Tiles Properties of building stones – relation to their structural requirements, classification of stones– stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit -2 Masonry</td></tr>
<tr><td colspan="3">Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit – 3 Lime And Cement Lime</td></tr>
<tr><td colspan="3">Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime. Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit – 4 Building Components</td></tr>
<tr><td colspan="3">Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, and Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre fabricated roofs</td><td>Hours – 10</td></tr>
</table>

Unit-5 Finishing's	
Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings.	**Hours – 10**

Course outcomes:

On completion of this course, students are able to

1. Identify different building materials and their importance in building construction.
2. Differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.
3. Importance of building components and finishing.
4. Classification of aggregates, sieve analysis and moisture content usually required in building construction.
5. Understand the role of different floors, paints, Damp Proofing, structural elements

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.

The student will have to answer 5 full questions selecting one full question from each unit.

TEXT BOOKS

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
2. Building Construction, S. S. Bhavikatti, Vices publications House private ltd.
3. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
4. Building Construction, B.C. Punmia, Laxmi Publications (p) ltd

REFERENCES

1. Building Materials, S. K. Duggal, New Age International Publications.
2. Building Materials, P. C. Verghese, PHI learning (P) ltd.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. Building construction, P. C. Verghese, PHI Learning (P) Ltd.

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	2	3	-	-	3	-	-	-	-	-	-	-	-	3	-
2	2	3	-	-	3	-	-	-	-	-	-	-	-	3	-
3	-	2	-	-	3	-	-	-	-	-	-	-	-	3	-
4	2	-	-	-	3	-	-	-	-	-	-	-	-	3	-
5	-	3	-	-	3	-	-	-	-	-	-	-	-	3	-
Course	2	3	-	-	3	-	-	-	-	-	-	-	-	3	-

GREEN BUILDINGS AND SUSTAINABILITY SEMESTER - VII			
Subject Code	18xxCEO703B	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits –03			

Course Objectives:

Enable the students to

- Know the green building and green energy building materials.
- Familiarize with different rating agencies and features of green buildings.
- Understand the term sustainability and sustainable development.
- Learn sources of green house gases and its impact on climate.
- Understand and Plan land use confirming to zonalregulations

Unit	Hours
Unit -1	
INTRODUCTION What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building	**Hours – 10**
Unit -2	
GREEN BUILDING CONCEPTS AND PRACTICES Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,	**Hours –10**
Unit – 3	
SUSTAINABILITY Introduction, Human development index, Sustainable development and social ethics, definitions of sustainability, populations and consumptions	**Hours – 10**
Unit – 4	
THE CARBON CYCLE AND ENERGY BALANCES Introduction, Climate science history, carbon sources and emissions, The carbon cycle, carbon flow pathways, and repositories, Global energy balance, Global energy balance and temperature model, Greenhouse gases and Effects, Climate change projections and impacts	**Hours – 10**
Unit-5	
SUSTAINABILITY AND BUILT ENVIRONMENT Introduction, Land use and land cover change, Land use planning and its role in sustainable development-Zoning and land use planning, smart growth, Environmentally sensitive design- low impact development, green infrastructure and conservation design, Green buildings and land use planning, Energy use and buildings	**Hours – 10**

Course outcomes:

On completion of this course, students are able to:

1. Describe green buildings and green building materials.
2. Acquaint with different rating agencies and energy features of green buildings.
3. Understand the term sustainability and sustainable development.
4. Recognize sources of green house gases emissions and its impact on climate.
5. Plan land use confirming to zonal regulations.

Question paper pattern:

Section A:

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This Section will have 10 questions.
2. Each full question carry 12 marks.
3. Each full question will have sub question covering all topics under a unit.
4. The student will have to answer 5 full questions selecting one full question from each unit.

TEXT BOOKS

1. Standard for the Design of High-Performance Green Buildings by ASHRAE
2. Engineering Applications in Sustainable Design and Development ByBradley A.Striebig, Adebayo A.Ogundipe and Maria Papadakis. First edition, 2016, CENGAGE Learning.

REFERENCES

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
3. IGBC - Smart Cities & Green Building Concept in India

Course Outcomes to Program Outcomes Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	-	-	-	-	2	-	3	-	-	-	-	-	-	-
2		-	-	-	-	2	-	3	-	3	-	-	-	-	-
3	3	-	-	-	-	2	-	3	-	-	-	-	-	-	-
4	3	-	-	-	-	2	-	3	-	-	-	-	-	-	-
5	-	-	3	-	2	2	-	3	-	-	-	-	-	-	-
Course	2	-	1	-	1	2	-	3	-	1	-	-	-	-	-

Open Elective Courses offered by EEE to other Departments

During Semester V

SN	Subject Code	Subject title
1	18XXEEO50XA	Control system design
2	18XXEEO50XB	Optimization techniques
3	18XXEEO50XC	Electrical and Hybrid Vehicles

During semester VI

SN	Subject Code	Subject title
1	18XXEEO60XA	Electrical Energy Conservation and Auditing
2	18XXEEO60XB	Intelligent control & its applications
3	18XXEEO60XC	Electrical Materials

During semester VII

SN	Subject Code	Subject title
1	18XXEEO70XA	Industrial Electrical Systems
2	18XXEEO70XB	Advanced Control Systems

<table>
<tr><td colspan="4" align="center">CONTROL SYSTEM DESIGN
(Open Elective)</td></tr>
<tr><td>Subject Code</td><td>18XXEEO50XA</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/week</td><td>3L</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>45</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:
This course will enable student to :
1. Know the concepts of various designing fundamentals.
2. Understand the basic design in both time and frequency domain
3. Know the concepts of PID controllers
4. Enhance the knowledge of design using state space
5. Understand the basic concepts of nonlinearities and their performance
6. Know the concepts of singular points and performance of system</td></tr>
<tr><td colspan="4">Unit-1</td></tr>
<tr><td colspan="3">Design Specifications
Introduction to design problem and philosophy. Introduction to time domain and frequency domain design specification and its physical relevance. Effect of gain on transient and steady state response. Effect of addition of pole on system performance. Effect of addition of zero on system response.</td><td>Hours – 08</td></tr>
<tr><td colspan="3">Unit – 2</td><td rowspan="2">Hours – 08</td></tr>
<tr><td colspan="3">Design of Classical Control System in the time domain and Frequency domain
Introduction to compensator. Design of Feedback and Feed forward compensators Feedback compensation. Realization of compensators.
Compensator design in frequency domain to improve steady state and transient response. Feedback and Feed forward compensator design using bode diagram.</td></tr>
<tr><td colspan="3">Unit – 3</td><td rowspan="2">Hours – 6</td></tr>
<tr><td colspan="3">Design of PID controllers
Design of P, PI, PD and PID controllers in time domain and frequency domain for first, second and third order systems. Control loop with auxiliary feedback – Feed forward control.</td></tr>
<tr><td colspan="3">Unit – 4</td><td rowspan="2">Hours – 04</td></tr>
<tr><td colspan="3">Control System Design in state space
Review of state space representation. Concept of controllability & observability, effect of pole zero cancellation on the controllability & observability of the system, pole placement design through state feedback.
Ackerman’s Formula for feedback gain design. Design of Observer. Fullorder, Reduced order observer. Separation Principle.</td></tr>
<tr><td colspan="3">Unit – 5</td><td></td></tr>
<tr><td colspan="3">Nonlinearities and its effect on system performance
Various types of non-linearities. Effect of various non-linearities on system performance. Jump resonance, Singular points. Phase plot analysis, Isocline method for constructing phase trajectory.</td><td>Hours – 08</td></tr>
</table>

Course outcomes:

On completion of the course student will be able to:

1. Elaborate the concepts of various designing fundamentals.
2. Know the basic design in both time and frequencydomain
3. Understand the concepts of PID controllers
4. Enhance the knowledge of design using state space
5. Enumerate the basic concepts of nonlinearities and their performance
6. Understand the concepts of singular points and performance of system

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. N. Nise, "Control system Engineering", John Wiley, 2000.
2. I. J. Nagrath and M. Gopal, "Control system engineering", Wiley, 2000.
3. M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.
4. K. Ogata, "Modern Control Engineering", Prentice Hall, 2010.

Reference Books:

1. B. C. Kuo, "Automatic Control system", Prentice Hall,1995.
2. J.J.D'Azzo and C.H.Houpis," Linear control system analysis and design (conventional and modern)" , McGraw Hill,1995.
3. R.T.Stefani and G.H.Hostetter, "Design of feedback ControlSystems",Saunders College Pub, 1994.

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
2	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
3	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
5	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0
Overall Course	1	3	0	0	0	0	0	0	0	0	0	0	0	0	2

<table>
<tr><td colspan="4">OPTIMIZATION TECHNIQUES
(Open Elective)</td></tr>
<tr><td>Subject Code</td><td>18XXEEO50XB</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/week</td><td>3L</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>45</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:
This course will enable student to :
1. To define an objective function and constraint functions in terms ofdesign variables, and then state the optimization problem.
2. To state single variable and multi variable optimization problems, without and with constraints.
3. To explain linear programming technique to an optimization problem, defineslack and surplus variables, by using Simplex method.
4. To study and explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.
5. To introduce evolutionary programming techniques.</td></tr>
<tr><td colspan="4">Unit-1</td></tr>
<tr><td colspan="3">Introduction and Classical Optimization Techniques:
Statement of an Optimization problem – design vector – design constraints – constraint surface – objective function – objective function surfaces – classification of Optimization problems.</td><td>Hours – 08</td></tr>
<tr><td colspan="3">Unit – 2</td><td rowspan="2">Hours – 08</td></tr>
<tr><td colspan="3">Classical Optimization Techniques
Single variable Optimization – multi variable Optimization without constraints – necessary and sufficient conditions for minimum/maximum – multivariable Optimization with equality constraints. Solution by method of Lagrange multipliers – multivariable Optimization with inequality constraints – Kuhn – Tucker conditions.</td></tr>
<tr><td colspan="3">Unit – 3</td><td rowspan="2">Hours – 08</td></tr>
<tr><td colspan="3">Linear Programming
Standard form of a linear programming problem – geometry of linear programming problems – definitions and theorems – solution of a system of linear simultaneous equations – pivotal reduction of a general system of equations – motivation to the simplex method – simplex algorithm - Duality in Linear Programming – Dual Simplex method.</td></tr>
<tr><td colspan="3">Unit – 4</td><td></td></tr>
<tr><td colspan="3">Nonlinear Programming:
Unconstrained cases - One – dimensional minimization methods: Classification, Fibonacci method and Quadratic interpolation method - Univariate method, Powell’s method and steepest descent method.
Constrained cases - Characteristics of a constrained problem, Classification, Basic approach of Penalty Function method; Basic approaches of Interior and Exterior penalty function methods. Introduction to convex Programming Problem.</td><td>Hours – 08</td></tr>
</table>

Unit – 5	
Introduction to Evolutionary Methods: Evolutionary programming methods - Introduction to Genetic Algorithms (GA)– Control parameters –Number of generation, population size, selection, reproduction, crossover and mutation – Operator selection criteria – Simple mapping of objective function to fitness function – constraints – Genetic algorithm steps – Stopping criteria –Simple examples.	**Hours – 13**

Course outcomes:

On completion of the course student will be able to:

1. State and formulate the optimization problem, without and with constraints, by using design variables from an engineering design problem.
2. Apply classical optimization techniques to minimize or maximize a multi-variable objective function, without or with constraints, and arrive at an optimal solution.
3. Formulate a mathematical model and apply linear programming technique by using Simplex method. Also extend the concept of dual Simplex method for optimal solutions.
4. Apply gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.
5. Apply non-gradient methods to nonlinear optimization problems and use interior or exterior penalty functions for the constraints to derive the optimal solutions.
6. Able to apply Genetic algorithms for simple electrical problems.

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. Engineering optimization: Theory and practice"-by S.S.Rao, New Age International (P) Limited, 3rd edition,1998.
2. Soft Computing with Matlab Programming by N.P.Padhy & S.P.Simson, Oxford University Press –2015

Reference Books:

1. Optimization methods in operations Research and systems Analysis" by K.V. Mitaland C. Mohan, New Age International (P) Limited, Publishers, 3rdedition, 1996.
2. Genetic Algorithms in search, optimization, and Machine Learning by David E.Goldberg, ISBN:978-81-7758-829-3,PearsonbyDorlingKindersley(India)Pvt.Ltd.
3. Operations Research: An Introduction" by H.A.Taha, PHI pvt. Ltd., 6thedition.
4. Linear Programming by G. Hadley.

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COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
4	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
5	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Overall Course	2	3	1	0	0	0	0	0	0	0	0	0	0	1	1

ELECTRICAL AND HYBRID VEHICLES (Open Elective)			
Subject Code	**18XXEEO50XC**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**45**	**Exam Hours**	**03**
Credits – 03			

Course Objectives:

This course will enable student to :

1. Understand working of different configurations of electric and hybrid electric vehicles,
2. Understand hybrid vehicle configuration and its components, performance analysis.
3. Understand of electric vehicle drive systems.
4. Understand the properties of energy storage systems.
5. Understand different Energy management strategies

Unit-1	
Introduction Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, mathematical models to describe vehicle performance. Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.	**Hours – 08**
Unit – 2	
Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	**Hours – 08**
Unit – 3	
Electric Trains Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive- train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration	**Hours – 12**
Unit – 4	
Energy Storage Energy Storage: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices. Sizing the drive system: Matching the electric machine and the internal combustion engine(ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems	**Hours – 04**

Unit – 5	
Energy Management Strategies Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).	**Hours – 05**

Course outcomes:

On completion of the course student will be able to:

1. Understand working of different configurations of electric and hybrid electric vehicles,
2. Understand hybrid vehicle configuration and its components, performance analysis.
3. Understand of electric vehicle drive systems.
4. Understand the properties of energy storage systems.
5. Understand different Energy management strategies
6. Design hybrid electric vehicle.

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries 12marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. C. Mi, M. A. Masrur and D. W. Gao, " Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives", John Wiley& Sons,2011.
2. S.Onori,L .Serrao and G.Rizzoni, "Hybrid Electric Vehicles: Energy Management Strategies" , Springer,2015.

Reference Books:

1. M.Ehsani, Y.Gao, S.E. Gayand A.Emadi," Modern Electric, Hybrid Electric, and Fuel Cell Vehicles :Fundamentals, Theory, and Design", CRC Press,2004.
2. T. Denton, "Electric and Hybrid Vehicles", Routledge,2016.

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
4	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	0	0	0	0	0	3	2
Overall Course	2	3	1	0	0	0	0	0	0	0	0	0	0	1	1

ELECTRICAL ENERGY CONSERVATION & AUDITING
(Open Elective)

Subject Code	**18XXEEO60XA**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**45**	**Exam Hours**	**03**
Credits – 03			

Course Objectives:

This course will be able student to understand :

1. To understand energy efficiency, scope, conservation and technologies.
2. To design energy efficient lighting systems.
3. To estimate/ calculate power factor of systems and propose suitablecompensation techniques.
4. To understand energy conservation in HVAC systems.
5. To calculate life cycle costing analysis and return on investment on energy efficient technologies.

Unit-1	
Basic Principles of Energy Audit and management Energy audit – Definitions – Concept – Types of audit – Energy index – Cost index – Pie charts –Sankey diagrams – Load profiles – Energy conservation schemes and energy saving potential – Numerical problems – Principles of energy management – Initiating, planning, controlling, promoting, monitoring, reporting – Energy manager – Qualities and functions – Language – Questionnaire – Check list for top management.	**Hours – 08**
Unit – 2	
Lighting Modification of existing systems – Replacement of existing systems – Priorities**:** Definition of terms and units – Luminous efficiency – Polar curve – Calculation of illumination level – Illumination of inclined surface to beam – Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting–White light LED and conducting Polymers – Energy conservation measures.	**Hours – 12**
Unit – 3	
Power Factor and energy instruments Power factor – Methods of improvement – Location of capacitors – Power factor with non linear loads – Effect of harmonics on Power factor – Numerical problems. Energy Instruments – Watt–hour meter – Data loggers – Thermocouples – Pyrometers – Lux meters – Tong testers – Poweranalyzer.	**Hours – 12**
Unit – 4	
Space Heating and Ventilation Ventilation -Air-Conditioning (HVAC) and Water Heating**:** Introduction - Heating of buildings -Transfer of Heat–Space heating methods -Ventilation and air–conditioning- Insulation-Cooling load -Electric water heating systems- Energy conservation methods.	**Hours – 08**

<table>
<tr><td>Unit – 5</td><td rowspan="2">Hours – 8</td></tr>
<tr><td>Computation of Economic Aspects and Financial Analysis
Understanding energy cost - Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – Energy efficient motors (basic concepts) – Economics of energy efficient motors and systems. Need of investment, appraisal and criteria - Calculation of simple payback period– Return on investment – Net present value – Internal rate of return – numerical examples Applications of life cycle costing analysis – Return on investment – Numerical examples.</td></tr>
</table>

Course outcomes:

On completion of the course student will be able to:

1. To understand energy efficiency, scope, conservation and technologies.
2. To design energy efficient lighting systems.
3. To estimate/ calculate power factor of systems and propose suitablecompensation techniques.
4. To understand energy conservation in HVAC systems.
5. To calculate life cycle costing analysis and return on investment on energy efficient technologies.
6. To calculate different economical aspects related projects election.

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGrawhill
2. Energy efficient electric motors by John. C.Andreas, Marcel Dekker IncLtd–2nd edition, 1995

Reference Books:

1. Energy management byW.R. Murphy& G.Mckay Butterworth,Elsevier publications.2012
2. Electric Energy Utilization and Conservation by SC Tripathy, Tata McGrawhill publishing company Ltd. New Delhi.
3. Energy management by Paulo’ Callaghan, Mc– Graw Hill Book company– 1st edition,1998.
4. Energy management hand book by W.C.Turner, John wiley and sons.
5. Energy management and conservation–kv Sharma and p venkata seshaiah- IK International Publishing House pvt.ltd,2011.
6. http://www.energymanagertraining.com/download/Gazette_of_IndiaPartIISe cI- 37_25-08-2010.pdf

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
2	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0
4	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0
5	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	3	0	0	0	0	0	0	0	0	0	0	0	3	2
Overall Course	2	3	1	0	0	0	0	0	0	0	0	0	0	1	1

INTELLIGENT CONTROL & ITS APPLICATIONS (Open Elective)			
Subject Code	**18XXEEO60XB**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**45**	**Exam Hours**	**03**
Credits – 03			

Course Objectives:

This course will enable student to :

1. Understand the basic intelligent controller concept
2. Understand concepts of feed forward neural networks and learning and understanding of feedback neural networks.
3. Understand and analyze the concept of genetic algorithm.
4. Understand the knowledge of fuzzy logic control.
5. Apply the knowledge of fuzzy logic control, genetic algorithm and neural network to the real problems.

Unit-1	
INTRODUCTION TO INTELLIGENT CONTROL: Introduction and motivation. Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation. Expert systems.	**Hours – 08**
Unit – 2	
ARTIFICIAL NEURAL NETWORKS Concept of Artificial Neural Networks - its basic mathematical model - McCulloch-Pitts neuron model - simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron. Learning and Training the neural network. Introduction, derivation, algorithm, flowchart, limitation-Error Back propagation, Hopfield, Radial bases function	**Hours – 12**
Unit – 3	
GENETIC ALGORITHM Basic concept of Genetic algorithm and detail algorithmic steps, adjustment of free parameters. Solution of typical control problems using genetic algorithm. Concept on some other search techniques like tabu search and ant-colony search techniques for solving optimization problems	**Hours – 08**
Unit – 4	
FUZZY LOGIC SYSTEM Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control. Fuzzification, inferencing and defuzzification. Fuzzy knowledge and rule bases. Fuzzy modeling and control schemes for nonlinear systems. Fuzzy logic control for nonlinear time-delay system. Implementation of fuzzy logic controller.	**Hours – 08**
Unit – 5	
APPLICATIONS GA application to power system optimization problem, Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analyses of Neural- Network inter connection systems. Implementation of fuzzy logic controller using Matlab fuzzy-logic toolbox. Stability analysis of fuzzy control systems	**Hours – 10**

Course outcomes:

On completion of the course student will be :

1. Able to identify knowledge representations applied to artificial intelligence techniques
2. Able to model artificial neuron and identify its use in Perceptron modelsand back propagation algorithm to multilayer feed forward networks
3. Able to develop rule based and decision making with the use of classicaland fuzzy logic systems
4. Able to analyze concept of genetic algorithm.
5. Able design fuzzy logic controller using MATLAB.
6. Able to analyze various applications of neural and fuzzy logic systemsin electrical Engineering

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. Simon Haykins, Neural Networks:A comprehensive Foundation,Pearson Edition, 2003.
2. T.J. Ross, Fuzzy logic with Fuzzy Applications, Mc Graw Hill Inc,1997.
3. David E Goldberg, Genetic Algorithms. Wesley PublishingCompany,1989
4. JohnYen and RezaLangari, Fuzzy logic Intelligence, Control ,and Information, Pearson Education, Indian Edition,2003.
5. Neural Network, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications S. Rajasekaran and G. A. Vijayalakshmi Pai (Prentice Hall India, 2010)

Reference Books:

1. M.T.Hagan, H.B.Demuth and M.Beale, Neural Network Design, Indianreprint, 2008.
2. Fredric M.Ham and IvicaKostanic, Principles of Neuro computing for science and Engineering, McGraw Hill,2001.
3. N.K.Bose and P.Liang, Neural Network Fundamentals with Graphs, Algorithms, and Applications, Mc - Graw Hill, Inc.1996.
4. Yung C.Shin and Chengying Xu, Intelligent System-Modeling, Optimizationand Control, CRC Press,2009.
5. Witold Pedrycz, Fuzzy Control and Fuzzy Systems, Overseas Press, Indian Edition, 2008.

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
2	2	0	0	0	3	0	0	0	0	0	0	0	0	0	0
3	0	0	1	0	3	0	0	0	0	0	0	0	0	0	0
4	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	3	0	0	0	0	0	0	0	0	3	2
Overall Course	2	0	1	0	3	0	0	0	0	0	0	0	0	1	1

ELECTRICAL MATERIALS
(Open Elective)

Subject Code	**18XXEEO60XC**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**45**	**Exam Hours**	**03**

Credits – 03

Course Objectives:

This course will enable student to :

1. To understand the importance conducting materials.
2. To under the importance of semiconducting, dielectric material.
3. To under the importance of magnetic material.

Unit-1	
Conducting Materials: Review of metallic conduction on the basis of free electron theory. Fermi-Dirac distribution – variation of conductivity with temperature and composition, materials for electric resistors- general electric properties; material for brushes of electrical machines, lamp filaments, fuses and solder	**Hours – 08**
Unit – 2	
Semiconductor Materials: Mechanism of conduction in semiconductors, density of carriers in intrinsic semiconductors, the energy gap, types of semiconductors. Hall effect, compound semiconductors, basic ideas of amorphous and organic semiconductors	**Hours – 08**
Unit – 3	
Dielectric Materials: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyro electric materials.	**Hours – 08**
Unit – 4	
Magnetic Materials Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis	**Hours – 08**
Unit – 5	
Materials for Electrical Applications & Special Purpose Materials: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation. Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials, Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.	**Hours – 13**

Course outcomes:

On completion of the course student will be able to:

1. Understand various types of conducting, their properties in variousconditions.
2. Evaluate semiconductor materials and technologies.
3. Understand various types of dielectric materials, their properties in various conditions.
4. Evaluate magnetic materials and their behavior.
5. Acquire Knowledge on Materials used in electrical engineering andapplications.
6. Able to test Transformer oil as per standard.

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. RK Rajput "A course in Electrical Engineering Materials",Laxmi Publications,2009
2. TK Basar, "A course in Electrical Engineering Materials", New Age Science Publications, 2009

Reference Books:

1. TTTI Madras, "Electrical Engineering Materials", Mc Graw Hill Education, 2004.
2. Adrianus J.Dekker, Electrical Engineering Materials, PHI Publication,2006.
3. S.P.Seth, P.V.Gupta"A course in Electrical Engineering Materials" ,Dhanpat Rai & Sons, 2011

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
2	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0
3	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0
4	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
5	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
6	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
Overall Course	**1**	**1**	**2**	**2**	0	0	0	0	0	0	0	0	0	0	0

INDUSTRIAL ELECTRICAL SYSTEMS (Open Elective)			
Subject Code	**18XXEEO70XA**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**45**	**Exam Hours**	**03**
Credits – 03			

Course Objectives:

This course will enable student to :

1. Understand the electrical wiring systems for residential, commercial and industrial consumers, representing the systems with standard symbols and drawings, SLD.
2. Understand various components of industrial electrical systems.
3. Analyze and select the proper size of various electrical system components.

Unit-1	
Electrical System Components LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD)ofawiringsystem,Contactor,Isolator,Relays,MPCB,Electricshockand Electrical safety practices	**Hours – 08**
Unit – 2	
Residential and Commercial Electrical Systems Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.	**Hours – 08**
Unit – 3	
Illumination Systems Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor,depreciationfactor,variousilluminationschemes,Incandescentlampsand modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, floodlighting.	**Hours – 12**
Unit – 4	
Industrial Electrical Systems I HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components. **Module 5: Industrial Electrical Systems II** DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.	**Hours – 04**

Unit – 5	
Industrial Electrical System Automation Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.	**Hours – 05**

Course outcomes:

On completion of the course student will be able to:

1. Acquire Knowledge on Tariff structure and protection components.
2. Understand various types wiring systems and IE rules.
3. Evaluate the Illuminationtechnology.
4. Understand various types ofcables.
5. Acquire Knowledge on PLC applications.
6. Acquire Knowledge to implement SCADA for various applications.

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

Text Books:

1. S.L.Uppaland G.C.Garg,“ Electrical Wiring, Estimating &Costing”, Khanna publishers,2008.
2. K.B.Raina, “Electrical Design, Estimating & Costing” ,New age International, 2007.
3. S.Singh and R.D.Singh,“ Electrical estimating and costing” ,Dhanpat Rai and Co.,1997.

Reference Books:

1. Web site for IS Standards.
2. H.Joshi, “Residential Commercial and Industrial Systems”, Mc Graw Hill Education,2008.

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
1	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
2	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0
3	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0
4	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
5	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
6	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0
Over all-Course	**1**	**1**	**2**	**2**	0	0	0	0	0	0	0	0	0	0	0

ADVANCED CONTROL SYSTEMS (Open Elective)			
Subject Code	**18XXEEO70XB**	**IA Marks**	**30**
Number of Lecture Hours/week	**3L**	**Exam Marks**	**70**
Total Number of Lecture Hours	**45**	**Exam Hours**	**03**
Credits – 03			

Course Objectives:

This course will be able student to understand :

1. Review of the state space representation of a control system**:** Formulation of different models from the signal flow graph, diagonalization.
2. To introduce the concept of controllability and observability. Design by pole placement technique.
3. Analysis of a nonlinear system using Describing function approach and Phase plane analysis.
4. The Lypanov's method of stability analysis of a system. Formulation of Euler Laugrange equation for the optimization of typical functional and solutions.
5. Formulation of linear quadratic optimal regulator (LQR) problem by parameter adjustment and solving riccatti equation

Unit-1	
State space analysis State Space Representation – Solution of state equation – State transition matrix, Canonical forms - Controllable canonical form–Observable canonical form, Jordan Canonical Form.	**Hours – 08**
Unit – 2 **Controllability, observability and design of pole placement** Tests for controllability and observability for continuous time systems – Time varying case – Minimum energy control – Time invariant case – Principle of duality – Controllability and observability form Jordan canonical form and other canonical forms – Effect of state feedback on controllability and observability – Design of state feedback control through pole placement.	**Hours – 12**
Unit – 3 **Describing function analysis** Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane analysis. **Stability analysis** Stability in the sense of Lyapunov – Lyapunov's stability and Lypanov's instability theorems – Direct method of Lyapunov for the linear and nonlinear continuous time autonomous systems.	**Hours – 12**
Unit – 4 **Calculus of variations** Minimization of functional of single function – Constrained minimization – Minimum principle – Control variable inequality constraints – Control and state variable inequality constraints – Euler lagrangine equation.	**Hours – 08**

Unit – 5	
Optimal control	
Linear Quadratic Optimal Regulator (LQR) problem formulation – Optimal regulator design by parameter adjustment (Lyapunov method) – Optimal regulator design by Continuous Time Algebraic Riccatti equation (CARE) - Optimal controller design using LQG framework.	**Hours – 8**

Course outcomes:

On completion of the course student will be able to:

1. Review of the state space representation of a control system**:** Formulation of different models from the signal flow graph, diagonalization.
2. To introduce the concept of controllability and observability. Design by pole placement technique.
3. Analysis of a nonlinear systemusing Describing function approachand Phase plane analysis.
4. Analyse the stability of non linear system using phase plane approach.
5. The Lypanov's method of stability analysis of a system. Formulation ofEuler Laugrange equation for the optimization of typical functional and solutions.
6. Formulation of linear quadratic optimal regulator(LQR) problem by parameter adjustment and solving riccatti equation

Question paper pattern:

Section A :

1. This section contains ten one or two line answer question carrying 1 mark each.
2. Two questions from each unit should present.

Section B:

1. This section will have 10 questions.
2. Each full question carries12 marks.
3. Each full question will have sub question covering all topics under unit.

The student will have to answer 5 full questions selecting one full question from each unit.

TextBooks:

1. Modern Control Engineering–by K.Ogata, Prentice Hall ofIndia,3rdedition,1998
2. Automatic Control Systems by B.C.Kuo, Prentice Hall PublicationS. Onori,
3. L.Serrao and G.Rizzoni, "Hybrid Electric Vehicles :EnergyManagement Strategies" , Springer,2015.

Reference Books:

1. Modern Control System Theory–by M.Gopal, New Age International Publishers, 2nd edition,1996
2. Control Systems Engineering by I.J .Nagarath and M.Gopal, New Age International (P) Ltd.
3. Digital Control and State Variable Methods–by M.Gopal, Tata Mc Graw–Hill Companies,1997.
4. Systems and Control by Stains law H. Zak , Oxford Press,2003.
5. Optimal control theory: an Introduction by Donald E.Kirk by Dover publications.

COURSE OUTCOMES TO PROGRAME OUTCOMES MAPPING:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
2	1	2	2	2	0	0	0	0	0	0	0	0	0	0	0
3	2	0	2	2	0	0	0	0	0	0	0	0	0	0	0
4	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0
5	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
6	2	2	2	2	0	0	0	0	0	0	0	0	0	0	0
Over all-Course	**1**	**1**	**2**	**2**	0	0	0	0	0	0	0	0	0	0	0

Open Elective Courses offered by ME to other Departments

Open Elective Courses offered by Dept. of ME

1	Operations Research	18MEXXON0MA
2	Robotics	18MEXXON0MB
3	Advanced Optimization Techniques	18MEXXON0MC
4	Green Engineering Systems	18MEXXON0MD
5	Production Planning and Control	18MEXXON0ME
6	Nano Technology	18MEXXON0MF

OPERATIONS RESEARCH (OPEN ELECTIVE)			
Subject Code	18XXMEOM0NA	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES: Students Should be able to

1. understand linear programming problem formulation, graphical and simplex solutions
2. develop the linear program and dual program.
3. gain knowledge of formulating optimal solution of transportation problem and assignment model.
4. solve the sequencing problems with n-jobs & m-machines. Compute queue performance characteristics for various queuing models.
5. outline game theory and inventory problems by applying standard solution methods
6. use appropriate OR Techniques for solving real world problems.

Unit -1	**Teaching Hours**
Introduction to Operations Research: Definition, Features, types of OR models, Methodology, Tools, Limitations and applications of Linear Programming. **Linear Programming I:** Introduction, Formulation of Linear Programming Problem (LPP), Assumptions for solving LPP, Applications of LPP, Graphical method of solving LPP.	**Hours – 10**
Unit -2	
Linear Programming II: Introduction, steps in solving problems using simplex method, Principle of simplex method- Maximization and minimization problems, solution by simplex method, two phase simplex method, limitations of LPP simplex method. **Linear Programming III:** Introduction, Concept of primal, dual relationship, formulation of the dual of the primal problem, solution of LP problems using dual simplex method.	**Hours – 10**
Unit – 3	
Transportation Problem: Basics, Solution of Transportation problem with several methods, performing optimality test, degeneracy in transportation problem. **Assignment model:** Definition, Formulation, Different methods of solutions, Hungarian assignment method, unbalanced assignment problems, travelling salesman problems.	**Hours – 10**
Unit – 4	
Sequencing problems: introduction, basics, types of sequencing problems, priority sequencing, sequencing n-jobs through two machines, n-jobs and m-machines, two jobs 3-machines case. **QUEUING THEORY:** Introduction, Queuing system, Elements of queuing system, Operating characteristics of a queuing system, Classification of queuing models: Model-I [M/M/1:∞ /FIFO], Model-III [M/M/1: N/FIFO].	**Hours – 10**
Unit-5	
GAME THEORY: Introduction, Two Person Zero Sum games, Maximin - Minimax principle, Games without saddle points- mixed strategies, Graphical solution of 2Xn, mX2 games. Dominance property,	**Hours – 10**

P-system, S-system, Q-system and Ss-system **Inventory Management:** introduction, objectives, developing the model, EOQ, Selective inventory management.	

COURSE OUTCOMES

Upon completion of this course, students will be able to:

1. **Formulate** and solve mathematical model (linear programming problem) forreal situations like production and distribution of goods.
2. **Apply** the concept of simplex method and dual simplex algorithm to solve decision-making linear programming problems.
3. Build transportation models and assignment models to carry out sensitivity analysis.
4. **Solve the problems of** competitive business world using Sequencing problemand queuing theory **techniques**.
5. **Identify the inventory and game theory problems in** business world.
6. **Classify optimization problems in real world and apply appropriate OR techniques**

Question paper pattern Section A

1. This section contains 10 one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books

1. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.

Reference Books

1. Operations Research / S.D.Sharma-KedarnathRamnath(JNTU)
2. Operation Research /J.K.Sharma/MacMilan.
3. Operations Research / R.Pannerselvam / PHI Publications.
4. Operation Research /Premkumar Gupta, D.S.Hira / S.Chand
5. Operation Research An Introduction / Taha / Pearson
6. Operation Research / KanthiSwarup, P.K Gupta, Man Mohan / Sultan Chand & sons

Web Sources

1. https://onlinecourses.nptel.ac.in/noc18_mg41/preview
2. http://www.cs.toronto.edu/~stacho/public/IEOR4004-notes1.pdf
3. https://drive.google.com/file/d/1wvUeBNBxPVNclTQau9YoGdlh9BT641DN/view
4. https://books.google.co.in/books/about/Operations_Research.html?id=rj6bBMVzfPsC
5. https://www.scribd.com/doc/39100075/Operation-Research-Questions-and-Solutions

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**)**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1	2	2	0	0	0	0	0	0	2	0	0	2	0	0
2	2	2	0	0	0	0	0	0	2	0	0	2	0	0
3	2	2	2	0	0	0	0	0	2	0	0	2	0	0
4	2	2	0	0	0	0	0	0	2	0	0	2	0	0
5	2	2	2	0	0	0	0	0	0	0	1	2	0	0
6	2	2	2	0	0	0	0	0	0	0	1	2	0	0
Overall	2	2	1	0	0	0	0	0	2	0	1	2	0	0

S.No.	**Unit Name**	**Text Book Reference**	**Chapter No.**
1.	Introduction to Operations Research Linear Programming I	T1	1,2,3
		R1	1,2
		R2	1,2,3
2.	Linear Programming II & III	T1	2,3
		R1	2
		R2	4,5,6
3.	Transportation Problem Assignment model	T1	4
		R1	3,4
		R2	9,10
4.	Sequencing problems Queuing Theory	T1	8,11
		R1	9
		R2	16,19
5.	Game Theory Inventory Management	T1	10
		R1	7,12
		R2	12,14,15

ROBOTICS (OPEN ELECTIVE)			
Subject Code	18XXMEOM0NB	IA Marks	30
Number of Lecture Hours/Week	3(T)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

Course objectives: The students should be able to:

1. Gain the knowledge of industrial robots and their configurations.
2. Know the components of industrial robots and actuators.
3. Apply spatial transformations to obtain forward and inverse kinematics.
4. Understand the robot dynamics.
5. Generate trajectory planning for path description and generation.
6. Describe the functioning of sensors and the specific applications of robots in industry.

Unit-I	Teaching Hours
Introduction: An over view of Robotics, Automation and Robotics, CAD/CAM and Robotics — present and future applications – classification by coordinate system. **Components of the industrial robotics:** Architecture, common types of arms, number of degrees of freedom, end effectors, requirements and challenges of end effectors, Actuators-Pneumatic, Hydraulic actuators, electric & stepper motors.	**Hours-10**
Unit-II	
Motion analysis: Homogeneous transformations as applicable to rotation and translation – problems. **Manipulator kinematics:** Specifications of matrices, D-H notation joint coordinates and world coordinates Forward and inverse kinematics – problems.	**Hours-12**
Unit-III	
Differential transformation and manipulators, Jacobians – problems **Dynamics:** Lagrange – Euler formulations – Problems.	**Hours-08**
Unit-IV	
Trajectory planning: General considerations in path description and generation. Trajectory planning, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages.	**Hours-10**
Unit-V	
Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors. **Robot applications in manufacturing:** Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.	**Hours-10**

Course outcomes

Upon successful completion of this course, the students will be able to:

1. Identify various robot configurations and components
2. Select appropriate actuators and sensors for a robot based on specific application.
3. Carry out kinematic and dynamic analysis for simple kinematic chains.
4. Analyze forces in links and joints of a robot.
5. Perform trajectory planning for a robot manipulator.
6. Explain the specific applications of a robot in industry.

Question paper pattern Section A

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books

1. Industrial Robotics / Groover M P /Pearson Edu/ McGraw Hill
2. Robotics and Control / Mittal R K &Nagrath I J / TMH
3. Robotics / Fu K S/ McGraw Hill

Reference Books

1. Robotic Engineering / Richard D. Klafter/ Prentice Hall
2. Introduction of robotics/ John J Craig/ Pearson Edu
3. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley
4. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.

WEB SOURCE REFERENCES

1. https://nptel.ac.in/courses/112101098/
2. http://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html
3. https://nptel.ac.in/downloads/112103174/

COs VS P Os MAPPING (DETAILED; HIGH: 3; MEDIUM: 2; LOW: 1**)**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1	2	1					1					3	2	
2	3	3	3		3		1					2	2	
3	3	3	3		3		1					2	2	
4	3	3	2		2		1					2	2	
5	3	2	2		3		1					3	2	
6	3	3	3		3							2	2	
Overall	3	2	2		2		1					2	2	

S. No.	Unit Name	Text Book Reference	Chapter No.
1.	Introduction& Components of the industrial robotics	T1	1
		T2	1,2&5
		R1	1,2,3& 4
2.	Motion analysis& Manipulator kinematics	T1	2&3
		T2	4
		R1	8
3.	Differential transformation and manipulators & Dynamics	T1	4,5&6
		T2	4
		R1	8
4.	Trajectory planning	T1	7
		T2	8&9
		R1	7
5.	Feedback components& Robot applications in manufacturing	T1	9&10
		T2	6,11&13
		R1	5& 1

Advanced Optimization Techniques (OPEN ELECTIVE)			
Subject Code	18XXMEOM0NC	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

COURSE OBJECTIVES: Students should be able to

1. build the fundamental concepts of classical optimization techniques
2. gain the knowledge of optimization techniques for solving practical problems in engineering systems
3. learn the Principles of genetic Algorithm
4. solve linear, non linear problems by using optimization techniques
5. determine inventory and queuing problems using Simulation techniques
6. identify the real world optimization problems

Unit -1	**Teaching Hours**
Introduction to Optimization Techniques **Linear Programming:** Introduction and formulation of models, Convexity, Simplex method, Big-M method, Two-phase method, duality in LPP only	**Hours – 10**
Unit -2	
Classical Optimization Techniques: Single variable optimization with and without constraints, multi – variable optimization without constraints, multi – variable optimization with constraints – method of Lagrange multipliers, Kuhn-Tucker conditions, merits and demerits of classical optimization techniques.	**Hours – 10**
Unit – 3	
Numerical Methods For Optimization: Nelder Mead's Simplex search method, Steepest descent method, Newton's method, Pattern search methods, conjugate method, types of penalty methods for handling constraints, advantages of numerical methods.	**Hours – 10**
Unit – 4	
Genetic Algorithm (GA) : Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA, **Genetic Programming (GP):** Principles of genetic programming, terminal sets, functional sets, differences between GA & GP.	**Hours – 12**
Unit-5	
Simulation: Definition – types of simulation models – phases of simulation– applications of simulation –inventory and queuing problems – advantages and disadvantages – simulation languages.	**Hours – 08**

COURSE OUTCOMES

On completion of this course, students should be able to:

1. Formulate and solve linear Programming Problems
2. Determine the optimum solution to constrained and unconstrained
3. Use Numerical Methods to Optimize the industrial problems
4. Solve various GA problems
5. Determine inventory and queuing problems using Simulation techniques
6. Identify optimization problems in real world and apply appropriate OR techniques

Question paper pattern Section A

1. This section contains 10 one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books

1. Engineering Optimization – S.S. Rao, New Age Publishers
2. Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers.

Reference Books

1. Operations Research –Theory & publications / S.D.Sharma-Kedarnath/McMillan publishers India Ltd.
2. Introduction to Operations Research, KantiSwarup, Man Mohan and P.K. Gupta, S.Chand& Co., 2006
3. Operations Research-R.Pannerselvam, PHI Publishers.
4. N.S.Kambo: Mathematical Programming Techniques, East-West Pub., Delhi, 1991.

Web Source References

1. https://nptel.ac.in/courses/Webcourse-contents/IISc BANG/OPTIMIZATION%20METHODS/pdf/Module_1/M1L4slides.pdf
2. https://www.iare.ac.in/sites/default/files/lecture_notes/OT_LECTURE_NOTES_0.pdf

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**)**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
1	3	2	0	0	0	0	0	0	0	2	0	1	0	0
2	3	2	0	0	0	0	0	0	0	2	0	1	0	0
3	3	2	0	0	0	0	0	0	0	2	0	1	0	0
4	3	2	0	0	0	0	0	0	0	2	0	1	0	0
5	3	2	0	0	0	0	0	0	0	2	0	1	0	0
6	3	2	0	0	0	0	0	0	0	2	0	1	0	0
Overall	3	2	0	0	0	0	0	0	0	2	0	1	0	0

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction to Optimization Techniques Linear Programming	T1	1,3.4
		T2	1,6
		R1	1,2
		R3	1,2
2	Classical optimization techniques	T1	2
		T2	3,4
		R1	3
		R3	2,17
3	Numerical methods for optimization	T1	2
		T2	4
		R1	4,5
		R3	2,3,5
4	Genetic algorithm (ga) Genetic programming (gp)	T1	8,12
		T2	5
		R1	6,7
		R3	15
5	Simulation	T1	12
		T2	6
		R1	9
		R3	17

<table>
<tr><td colspan="4">GREEN ENGINEERING SYSTEMS
(OPEN ELECTIVE)</td></tr>
<tr><td>Subject Code</td><td>18XXMEOM0ND</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">COURSE OBJECTIVES: Students should be able to
1. Understand the principles of applications and uses of non conventional energy resources.
2. Learn the basic principles of conversion technologies of non conventional energy
3. resources in to electric power.
4. Acquire concepts of energy efficient systems
5. Gain knowledge of Energy efficient processes
6. Obtain knowledge about features of green buildings</td></tr>
<tr><td colspan="3">Unit -1</td><td>Teaching Hours</td></tr>
<tr><td colspan="3">Introduction to Solar Radiation: Role and potential of new and renewable sources, the solar energy option, solar power, structure of the sun, the solar constant, sun-earth relationships, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine. Photo voltaic energy conversion – types of PV cells, I-V characteristics.
Solar Energy Collection: Flat plate and concentrating collectors, classification of concentrating collectors.
Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Wind Energy: Sources and potentials, horizontal and vertical axis wind mills, performance characteristics, betz criteria, types of winds, wind data measurement.
Bio-Mass: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, combustion characteristics of bio- gas, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.
Geo-Thermal Energy: Resources, types of wells, methods of harnessing the energy.
Ocean Energy: OTEC, Principles of utilization, setting of OTEC plants, Tidal and wave energy: conversion techniques, mini-hydel power plants.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
</table>

Energy Efficient Systems: Electrical systems: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation and air conditioning), demand site management. Mechanical systems: Fuel cell principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells	**Hours – 10**
Unit – 4	
Energy Efficient Processes: Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmental friendly machining, vegetable based cutting fluids, alternate casting and Joining techniques, zero waste manufacturing	**Hours – 10**
Unit-5	
Green Buildings: Definition features and benefits. Sustainable site selection and planning of buildings for maximum comfort. Environmental friendly building materials like bamboo, timber, rammed earth, hollow blocks, lime & lime pozzolana cement, agro materials and industrial waste ,Ferro cement and Ferro-concrete, alternate roofing systems, paints to reduce heat gain of the buildings. Energy management	**Hours – 10**

COURSE OUTCOMES: Students will be able to:
1. Explain the principles, applications and uses of non conventional energy resources.
2. Apply the basic principles of conversion technologies of nonconventional energy resources in to electric power.
3. Develop energy efficient systems
4. Demonstrate the concepts of energy efficient process
5. Outline features of an green buildings

Question paper pattern Section A
1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B
1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books

1. Sukhatme S.P. and J.K.Nayak, Solar Energy – Principles of Thermal Collectionand Storage, TMH.
2. Khan B.H., Non-Conventional EnergyResources, Tata McGrawHill, New Delhi, 2006
3. Green Manufacturing Processes and Systems, Edited by J. PauloDavim, Springer 2013
4. Alternative Building Materials and Technologies / K.S Jagadeesh,B.VVenkata Rama Reddy and K.S Nanjunda Ra.

Reference Books

1. Principles of Solar Energy / Frank Krieth& John F Kreider.
2. Non-Conventional Energy / Ashok V Desai /Wiley Eas
3. Renewable Energy Technologies /Ramesh & Kumar /Narosa tern
4. Renewable Energy Technologies/ G.D Roy

Web Source References
http://nptel.iitm.ac.in
https://en.wikipedia.org/wiki/Green_engineering
https://www.informationvine.com/index?q=green+engineering&ad=semD&af=&qsrc=999&askid=7ebb488a-

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**)**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1		3	2			2	2						3	
2		3	1			2	2						3	
3			1			1	1						3	
4				1	1	1	1						3	
5				2	2	2	2						3	
6				2	2	2	2						3	
Overall		1	1	1	1	2	2						3	

S.No.	**Unit Name**	**Text Book Reference**	**Chapter No.**
1.	Introduction: Solar Radiation, Solar Energy Collection, Solar Energy Storage and its Applications	T1	1,2,3,4,5,6
		T2	1,2,3,4,5,6
		R1	1,2,4
2.	Wind Energy, Bio Mass Energy, Geothermal Energy, Ocean Energy.	T1	7,8,9
		T2	7,8,9,10,11
		R1	2,3,4
		T2	12
		T3	1,2
		T3	3,4
3.	Green Buildings	T4	1,2,3

PRODUCTION PLANNING AND CONTROL (OPEN ELECTIVE)			
Subject Code	18XXMEOM0NE	IA Marks	30
Number of Lecture Hours/Week	3(L)	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits - 03			

COURSE OBJECTIVES: Students should be able to:

1. Understand the concepts of production and service systems
2. Acquire knowledge on the concepts of production planning and control
3. Apply forecasting techniques for various firms, namely qualitative & quantitative methods to optimize/make best use of resources in achieving their objectives.
4. Identify different strategies employed in manufacturing and service industries to plan inventory and Impart knowledge on the Materials Requirement Planning and Kanban, LOB and JIT Methods.
5. Determine the exact routing and scheduling which will be followed in production. And apply different scheduling policies in planning and control and make best use of resources.
6. Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.

Unit -1	**Teaching Hours**
Introduction: Definition – objectives and functions of production planning and control – elements of production control – types of production – organization of production planning and control department – internal organization of department. **Product Design:** Identification of product ideas and selection, product development and design	**Hours – 08**
Unit -2	
Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.	**Hours – 10**
Unit – 3	
Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ model – Inventory control systems – P–Systems and Q-Systems Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.	**Hours – 10**
Unit – 4	
Routing & Scheduling– definition – routing procedure –route sheets – bill of material – factors affecting routing procedure, schedule –definition – difference with loading, Scheduling policies – techniques, standard scheduling methods, line balancing, aggregate planning.	**Hours – 12**
Unit-5	

Dispatching– activities of dispatcher – dispatching procedure – follow up – definition – reason for existence of functions – types of follow up, expediting, controlling aspects. Applications of computer in production planning and control.	**Hours – 10**

COURSE OUTCOMES

On completion of this course, students will be able to:

1. Illustrate the systems concept for the design of production and service systems.
2. Explain the elements of Production Planning and control and discuss the role of internal organization
3. Develop forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques
4. Discuss the importance and function of inventory and to be able to apply selected techniques for its control and management under dependent and independent demand circumstances.
5. Select and use an appropriate principles/methods/ techniques/ modern concepts with reference to given application/situation in the preparation of route sheets with scheduling and loading in manufacturing systems.
6. Create and engage in life-long learning in the context of technological change in Operations Management and also able to identify dispatching, follow-up activities in the system

Question paper pattern Section A

1. This section contains ten one or two line answer questions carrying 1 mark each.
2. Two questions from each unit will be set.

Section B

1. This Section will have 05 questions with internal choice.
2. Each full question carries 12 marks.
3. Each full question comprises sub question covering all topics under a unit.

Text Books

1. Elements of Production Planning and Control / Samuel Eilon/Universal Book Corp.
2. Manufacturing, Planning and Control/Partik Jonsson Stig-Arne

Reference Books

1. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice- Hall
2. Production Planning and Control/Mukhopadyay/PHI
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall

Web references

1. http://nptel.ac.in/courses/112102106/
2. http://nptel.ac.in/courses/112107143/
3. http://nptel.ac.in/courses/112107142/33
4. http://nptel.ac.in/courses/112107142/31
5. https://nptel.ac.in/courses/112107142/36

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**)**

PO / CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
1		2	1						1		1		1	
2		2	1								3		1	
3		2									3		2	
4			1	1	1		3						1	
5				1	1		3				1	1	1	
6				1	1		3				2	2	1	
Overall		1	1	1	1		3		1		2	1	2	

S.No.	**Unit Name**	**Text Book Reference**	**Chapter No.**
1.	Introduction to PPC	T1	1,2,3,4,5
		T2	1,2
		R1	1,2
2.	Forecasting	T1	6
		T2	2,3&4
		R1	3,5
		R2	2
3.	Inventory management	T1	17
		T2	6,7
		R1	4,7&10
		R2	8
4.	Routing & Scheduling	T1	10,11,12,13,14
		T2	7,8
		R1	5,6
		R2	7,3
5.	Dispatching	T1	15,16
		T2	7,10
		R1	5,8

<table>
<tr><td colspan="4" align="center">NANOTECHNOLOGY
(OPEN ELECTIVE)</td></tr>
<tr><td>Subject Code</td><td>18XXMEOM0NF</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L)</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
<tr><td colspan="4">COURSE OBJECTIVES: Students should be able to
1. acquire knowledge on importance of Nano science & Nanotechnology
2. identify the properties of nano materials & their applications in material science.
3. familiarize the synthesis & fabrication of nano materials.
4. understand the various characterization techniques of nano materials.
5. discuss the concept of carbon nanotechnology & its applications.
6. evaluate the properties of nano materials in various applications</td></tr>
<tr><td colspan="3">Unit -1</td><td>Teaching Hours</td></tr>
<tr><td colspan="3">Introduction to Nanotechnology: Importance of nano-technology, Emergence of Nanotechnology, History of nanoscience, Definition of nanometer, nanomaterial & nanotechnology, classification of nanomaterials, basic applications of nanotechnology in field of science & technology.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Properties of Materials: Mechanical, thermal, and magnetic properties of nanomaterials, effect of size reduction on properties. Applications of nanotechnology in surface science, energy & environment.</td><td>Hours – 8</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Synthesis and Fabrication: Synthesis of bulk polycrystalline samples, growth of single crystals, preparation of nanoparticle - bottom-up approach - sol gel synthesis, hydro thermal growth, thin film growth, PVD and CVD, top-down approach- Ball milling, micro fabrication, lithography, requirements for realizing semiconductor nanostructures.</td><td>Hours – 10</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Charecterization Techniques: X-Ray diffraction and Scherrer method, scanning electron microscopy, transmission electron microscopy, scanning probe microscopy, atomic force microscopy, piezoresponse microscopy, X-ray photoelectron spectroscopy, angle resolved photoemission spectroscopy, diffuse reflectance spectra, photoluminescence spectra, Raman spectroscopy. Applications of nano structured thin films, applications of quantum dots.</td><td>Hours – 12</td></tr>
<tr><td colspan="4">Unit-5</td></tr>
<tr><td colspan="3">Carbon Nanotechnology: Allotropes of Carbon, Characterization of carbon allotropes, synthesis of diamond – nucleation of diamond, growth and morphology. Applications of nano crystalline diamond films, grapheme, and applications of carbon nano tubes, applications of carbon nanotechnology in biology and medicine.</td><td>Hours – 10</td></tr>
</table>

COURSE OUTCOMES: Students will be able to:
1. Explain the importance of Nanotechnology & its emergence in various fields 2. Identify various properties of nano materials in different applications. 3. Select manufacturing methods, techniques and process parameters for processing of nano materials. 4. Evaluate the properties of nano materials using different characterization tools &equipments. 5. Apply the concept of carbon allotropes in Nano Technology industrial applications. 6. Analyze the properties of nano materials in various applications
Question paper pattern Section A 1. This section contains ten one or two line answer questions carrying 1 mark each. 2. Two questions from each unit will be set. **Section B** 1. This Section will have 05 questions with internal choice. 2. Each full question carries 12 marks. 3. Each full question comprises sub question covering all topics under a unit.
Text Books 1. Nanoscience and nanotechnology: M.S.Ramachandra Rao & Shubra singh/ Wiley publishers.
Reference Books 1. Introduction to nanotechnology by Charles P.Poole.,J.Owens/ Wiley publishers 2. Nanotechnology by Jermy J Ramsden, Elsevier publishers 3. Nano Essentials- T Pradeep/TMH
Web Source References https://nptel.ac.in/courses/118102003/ https://nptel.ac.in/courses/103103033/module9/lecture1.pdf https://nptel.ac.in/courses/103103026/13

COs VS POs MAPPING (DETAILED; HIGH:3; MEDIUM:2; LOW:1**):**

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	3	3	2	1	3	2			2			1		
2	1	2	2	3	1				2		1	1		
3	3	1	1	1	3		2	2	2			3		
4	3	3	3	2	3		1	2	2			2		
5					2		2					1		
6							2					2		
Overall	3	3	3	2	3	2	2	2	2		1	2		

Unit	**Topic**	**Text Book Reference**	**Page No.**
1	Introduction to Nanotechnology	T1	1, 10
		T4	1,3
2	Properties of Materials	T1	2, 10
		T2	4,6
		T4	3,7
3	Synthesis and fabrication	T1	4
		T4	6,7
4	Characterization Techniques	T1	8, 10
		T2	3, 9
		T4	2,7,9
5	Carbon Nanotechnology:	T1	10
		T2	5,12
		T4	4,13,11

Open Elective Courses offered by ECE to other Departments

Open Elective Courses offered by ECE Department

Open Electives	18XXECOX0XA	Microcontroller Programming
	18XXECOX0XB	Internet of Things and its Applications
	18XXECOX0XC	Digital Signal Processing
	18XXECOX0XD	Digital Image Processing
	18XXECOX0XE	Antennas & Wave Propagation
	18XXECOX0XF	Cellular Mobile Communication
	18XXECOX0XG	VLSI Design
	18XXECOX0XH	VLSI Physical Design Automation

<table>
<tr><td colspan="4" align="center">MICROCONTROLLERS PROGRAMMING
(Open Elective)</td></tr>
<tr><td>Subject Code</td><td>18XXECOX0XA</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
<tr><td colspan="4">Course Objective: This course will enable students to:
• Understand internal architecture and functional description of 8051 microcontroller.
• Learn the programming models of 8051 Microcontroller using embedded C.
• Interpret the concept of 8051 microcontroller internal architecture like Timer/Counter, I/O ports interfacing.
• Discuss the operational aspects of advanced Processors.</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Intel 8051 Microcontroller: Architecture, Hardware concepts, input/output ports and circuits, external memory, counters/timers, serial data input/output, Interrupts.
Assembly language programming: Instructions, addressing modes, simple programs.</td><td>9</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Embedded C Programming for 8051: Introduction to Embedded C Programming, Example Programs with switch and LED interfacing. Introduction to Object-oriented programming with C, The Project Header (MAIN.H), The Port Header (PORT.H), Example: structuring the ‘Hello Embedded World’ example and goat-counting example using MAIN.H and PORT.H.</td><td>11</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">8051I/O Interfacing& Embedded C Programming module 1: Keypad interfacing, Seven Segment Display interfacing, ADC & DAC interfacing.
Case Studies: Two digit up down counter, LM 35 Temperature sensor interfacing and programming</td><td>9</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">8051I/O Interfacing& Embedded C Programming module 2: 2X16 LCD interfacing, stepper motor interfacing, serial port interfacing, high power devices.
Case Studies: Password based door locking system, Controlling Stepper motor through serial port communication.</td><td>9</td></tr>
<tr><td colspan="4">Unit – 5</td></tr>
<tr><td colspan="3">ARM: Advanced Processors: Introduction to RISC & CISC Processors, features of32-Bit processors. Advanced processor Architectures: Introduction to ARM Processor Families, ARM Pipelining operation, ARM 7 (LPC2148) architecture and organization, ARM / Thumb instruction set & programming model.</td><td>12</td></tr>
<tr><td colspan="4">Course outcomes:
On completion of the course student will be able to
1. Understand the internal operations of 8051microcontroller
2. Apply the programming model of 8051 Microcontroller using embedded C.
3. Apply the interfacing concepts of 8051 with I/O ports and other peripherals.
4. Demonstrate the data communication issues of 8051 microcontroller.
5. Discuss the operational aspects of advanced Processors.
6. Interpret the architectural concept of ARM 7 (LPC2148)</td></tr>
</table>

Question paper pattern:

Section A:

1. This section contains 10 one-mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. The 8051 Microcontroller and Embedded Systems Using Assembly and C by Muhammad Ali Mazidi, Rolin mckinlay Janice Gillispie Mazidi, Pearson, Second Edition
2. A.Sloss, D.Symes, C.Wright, (2003), "ARM system Developers Guide: Designing and Optimizing System Software", Morgan Kaufmann publishers.

Reference Books:

1. Michael J Pont-Embedded C-Addison-Wesley Professional (2002)
2. Kenneth J. Ayala, The 8051 Microcontroller, Penram International Publishing, 1996.
3. R. S. Gaonkar, Microprocessor Architecture: Programming and Applications with the 8085/8080A, Penram International Publishing, 1996

S.No.	Unit Name	Text Book Reference	Chapter No.
1	8086 Architecture&8086 Programming	T1	1,2
2	8086 Interfacing	T1	3, 4 &5
3	Intel 8051 Microcontroller	T2	1,2,3& 4
4	8051 I/O Interfacing & Embedded C Programming	T2	7,12&13
5	Advanced Processors	T1	9,10,12
		T3	2,3,4,5

INTERNET OF THINGS AND ITS APPLICATIONS (Open Elective)			
Subject Code	18XXECOX0XB	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives: This course will enable students to

- Understand the Architectural Overview of IoT.
- Understand the IoT Reference Architecture and Real World Design Constraints.
- Understand the various IoT Protocols (Data link, Network, Transport, Session, Service).

Unit -1	**Hours**
Overview: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.	**12**
Unit -2	
Reference Architecture: IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT reference Model - IoT Reference Architecture. Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.	**12**
Unit – 3	
IoT Data Link Layer & Network Layer Protocols: PHY/MAC Layer(3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART,Z-Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN. Case Studies: Remote monitoring and controlling applications like Structural health Monitoring, Agriculture, etc	**8**
Unit – 4	
Transport, Session Layer and Service Layer Protocols: Transport Layer (TCP, MPTCP, UDP)-(TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, MQTT. Service Layer -oneM2M, ETSI M2M, OMA. Case study: Home Automation, Examples on Smart cities.	**8**
Unit – 5	
Protocols & Security: Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer; Data Analytics: Apache Storm for Real Time Data Analysis. Hardware platforms for IoT applications: Features and applications of IoT supported hardware platforms such as: raspberry pi, ARM Cortex processors, Arduino and Intel Galileo Board. Case Studies on Industrial IoT 4.0 applications.	**10**

Course outcomes:

On completion of the course student will be able to

1. Understand fundamentals of IoT systems.
2. Describe the functions of IoT architectures.
3. Apply real world design constraints on IoT architectures.
4. Analyze IoT data link and Network layer protocols.
5. Demonstrate transport and Session layer services and protocols of Iot.
6. Interpret Service layer and network security protocols.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1 st Edition, Academic Press, 2014.
2. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI

Reference Books:

1. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet ofThings", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
2. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, WillyPublications
3. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-onApproach)", 1 st Edition, VPT, 2015.
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

Unit No	Unit Description	Text book	Chapter No
1	Overview	T1	4, 5
2	Reference Architecture	T1	6, 7, 8, 9
3	IoT Data Link Layer & Network Layer Protocols	R2	5, 6, 7, 8, 9
4	Transport & Session Layer Protocols	T2	2, 4, 5, 6
5	Service Layer Protocols & Security	R4	7

<table>
<tr><td colspan="5" align="center">DIGITAL SIGNAL PROCESSING
(Open Elective)</td></tr>
<tr><td>Subject Code</td><td colspan="2">18XXECOX0XC</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td colspan="2">3</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td colspan="2">50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="3">Pre requisite: Signals and Systems</td><td colspan="2">Credits – 03</td></tr>
<tr><td colspan="5">Course Objectives:
This course will enable students to
Analyze the Discrete Time Signals and compute different FFT algorithms
Learn the FIR and IIR filter design procedures
Understand the basics of DSP Processors and architectures</td></tr>
<tr><td colspan="2">Unit -1</td><td colspan="3">Hours</td></tr>
<tr><td colspan="2">Introduction: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Invertability, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems. Review of Z-transforms, solution of difference equations using Z-transforms, System function.</td><td colspan="3">8</td></tr>
<tr><td colspan="5">Unit -2</td></tr>
<tr><td colspan="2">Discrete Fourier Series & Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.</td><td colspan="3">12</td></tr>
<tr><td colspan="5">Unit – 3</td></tr>
<tr><td colspan="2">Design of IIR Digital Filters& Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems.</td><td colspan="3">12</td></tr>
<tr><td colspan="5">Unit – 4</td></tr>
<tr><td colspan="2">Design of FIR Digital Filters & Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques and Frequency Sampling technique, Comparison of IIR & FIR filters, Basic structures of FIR systems.</td><td colspan="3">10</td></tr>
<tr><td colspan="5">Unit – 5</td></tr>
<tr><td colspan="2">DSP Processors: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs ,Multiple Access Memory, Multiported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary Register ALU, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, On- chip memory, On-chip peripherals.</td><td colspan="3">8</td></tr>
</table>

Course outcomes:

On completion of the course student will be able to

1. Apply the difference equations concept for analyzing the Discrete Time Systems
2. Understand the DFT of a discrete time signal
3. Use the FFT algorithm for solving the DFT of a given signal
4. Design a Digital IIR filter for the given specifications
5. Design a Digital FIR filter for the given specifications
6. Understand the programmable DSPs and their architectures.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications",Pearson Education / PHI, 2007.
2. A.V.Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", PHI
3. B.Venkataramani, M.Bhaskar, " Digital Signal Processors, Architecture, Programming and Applications", TATA McGraw Hill, 2002

Reference Books:

1. A Anand Kumar, "Digital Signal Processing", PHI.
2. Robert J. Schilling, Sandra L. Harris, "Fundamentals of Digital Signal Processing using MATLab",Thomson, 2007.

Web References:

1. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring 2011/video-lectures/
2. https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/study-materials/
3. https://nptel.ac.in/courses/117102060/

S.No.	Unit Name	Text Book/ Reference	Chapter No.
1	Introduction	T1	1 & 2
		T2	1 & 2
2	Discrete Fourier Series & Fourier Transforms	T1	7 & 8
		T2	3 & 6
3	Design of IIR Digital Filters& Realizations	T1	10
		T2	5
4	Design of FIR Digital Filters & Realizations	T1	10
		T2	5
5	Digital Signal Processors	T3	2 & 3

DIGITAL IMAGE PROCESSING (Open Elective)			
Subject Code	18XXECOX0XD	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Familiarize with fundamentals of digital image processing and different transforms
- Understand image processing concepts of enhancement, restoration, color image processing , compression, segmentation and wavelets

Unit -1	Hours
Introduction: Introduction to Image Processing, Fundamental steps in digital image processing, components of an image processing system, image sensing and acquisition, image sampling and quantization, some basic relationships between pixels, an introduction to the mathematical tools used in digital image processing. **Image Transforms:** Need for image transforms,2-d Discrete Fourier transform (DFT) and its properties, Importance of Phase, Walsh Transform. Hadamard transform, Haar Transform, Slant transform, Discrete Cosine transform, KL Transform, SVD , Comparison of different image transforms	**12**
Unit -2	
Intensity Transformations and Spatial Filtering: Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, Combining spatial enhancement methods **Filtering in the Frequency Domain:** Preliminary concepts, The Basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering Implementation	**10**
Unit – 3	
Image Restoration: A model of the image degradation / Restoration process, Noise models, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering, constrained least squares filtering, geometric mean filter **Color image processing:** Color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.	**7**
Unit – 4	
Image compression: Fundamentals, Basic compression methods: Huffman coding, Golomb coding, Arithmetic coding, LZW coding, Run-Length coding, Symbol-Based coding, Bit-Plane coding, Block Transform coding, Predictive coding **Image segmentation:** Fundamentals, point, line, edge detection, thresholding, region – based segmentation.	**12**

Unit – 5	
Wavelets: Image pyramids, sub band coding & Haar transforms multi resolution expressions, wavelet transforms in one dimensions. The fast wavelets transform, wavelet transforms in two dimensions, wavelet packets. **Case Studies:** Feature Detection, Face Recognition, Image Cryptography	**9**

Course outcomes:

On completion of the course student will be able to

1. Understand the fundamentals and transforms of digital image processing
2. Apply image enhancement and filtering concepts in spatial and frequency domains.
3. Apply image restoration and understand color image processing techniques.
4. Apply different segmentation algorithms on digital images
5. Analyze digital images using compression algorithms
6. Analyze digital images using wavelets

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", 3rd edition, Prentice Hall, 2008.
2. Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 7th Edition, Indian Reprint, 1989

Reference Books:

1. R. C. Gonzalez, R. E. Woods and Steven L. Eddins , "Digital Image Processing Using MATLAB" , 2nd edition, Prentice Hall, 2009.
2. S.Sridhar, "Digital Image Processing", oxford publishers, 2011
3. M.C. Trivedi, "Digital Image Processing", Khanna Book Publishing House

Web References:

1. https://nptel.ac.in/courses/117105079/
2. http://www.cs.rug.nl/~roe/courses/ip.html

S.No.	Unit Name	Text Book	Chapter No.
1	Introduction and Image Transforms	T1	1 & 2
		T2	4 & 5
2	Intensity Transformations and Spatial Filtering and Filtering in the Frequency Domain	T1	3 & 4
		T2	7
3	Image Restoration and Color Image Processing	T1	5 & 6
		R2	5
4	Image compression and Image segmentation	T1	8 & 10
		T2	11
5	Wavelets and Multi-resolution Processing	T1	7

ANTENNAS AND WAVE PROPAGATION (Open Elective)			
Subject Code	18XXECOX0XE	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to

- Understand the concepts of radiation mechanism and antenna parameters
- Apply the knowledge of electromagnetic radiation for wire antennas and loop antennas
- Analyze and compare the characteristics of various antenna arrays
- Analyze non-resonant and broadband antennas and differentiate wave propagation modes and their propagation characteristics

Unit -1	Hours
Fundamental Concepts: Introduction, Radiation Mechanism – single wire, 2 wire, dipoles, Current Distribution on a thin wire antenna. Antenna Parameters - Radiation Patterns, Patterns in Principal Planes, Main Lobe and Side Lobes, Beam widths, Polarization, Beam Area, Radiation Intensity, Beam Efficiency, Directivity, Gain and Resolution, Antenna Apertures, Aperture Efficiency, Effective Height, illustrated Problems.	**08**
Unit -2	
Radiation from Wires and Loops: Fields of a short dipole, Radiation resistance of short electric dipole, Thin linear antenna, Radiation resistance of λ/2 antenna, Fields of thin linear antenna with uniform travelling wave, Loop antenna general case and Radiation resistance of loop antenna.	**10**
Unit – 3	
Antenna Arrays : Array of two isotropic point sources, non isotropic point sources and principle of multiplication of patterns, Linear array of n point sources (Broad side array, End-fire array) , Linear array with non-uniform amplitude distribution, array of two driven λ/2 elements broad side case, array of two driven λ/2 elements end fire case. Horizontal and vertical antennas above a plane ground. Binomial Array	**12**
Unit – 4	
Micro Strip Antennas: Basic characteristics of micro strip antennas, feeding methods, methods of analysis, design of rectangular and circular patch antennas. **VHF and UHF Antennas:** Broadband Antennas-Helical antenna, Practical design considerations, Principle of operation. Reflector antennas, parabolic reflector, corner reflector, Feed methods for parabolic reflectors, Horn Antennas – Types, Optimum Horns, Design Characteristics of Pyramidal Horns; Lens Antennas – Geometry, Features, Dielectric Lenses and Zoning, Applications. Smart Antennas-Basic concepts and benefits.	**12**
Unit – 5	
Radio Wave Propagation: Ground Wave Propagation, Space Wave Propagation: Field Strength Relation, Effect of Earth, Super Refraction, Tropospheric Propagation. Sky Wave Propagation: Structural details of the Ionosphere, Wave propagation Mechanism, Refraction and Reflection of Sky waves by Ionosphere, Ray Path, Critical frequency, MUF,LUF,OF, virtual Height	**08**

and Skip distance, Relation between MUF and the Skip Distance, Multi-Hop propagation.

Course outcomes:

On completion of the course student will be able to

1. Understand the concepts of radiation mechanism and antenna parameters
2. Apply electromagnetic radiation for wire antennas and loop antennas
3. Analyze and compare the characteristics of various antenna arrays
4. Analyze non-resonant and broadband antennas
5. Design VHF, UHF and Microwave antennas
6. Differentiate wave propagation modes and their propagation characteristics

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. C.A. Balanis, "Antenna Theory", 2nd Edition, John Wiley and Sons, 2001.
2. K.D. Prasad, Satya Prakashan, "Antennas and Wave Propagation", Tech India Publications, New Delhi, 2001.

Reference Books:

1. John D. Kraus and Ronald J. Marhefka, "Antennas for All Applications", 3rd Edition, TMH, 2003.
2. E.C. Jordan and K.G. Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2000.

Web References:

1. https://nptel.ac.in/courses/108101092/
2. https://nptel.ac.in/courses/117107035/

S.No.	Unit Name	Text Book	Chapter
1	Fundamental Concepts	T1	1 & 2
		T2	6
		R1	2
2	Radiation From Wires And Loops	T1	4 & 5
		T2	5
		R1	5 & 6
3	Antenna Arrays	T1	6
		T2	7
		R1	4
4	Micro Strip, VHF & UHF Antennas	T1	9, 14 & 15
		T2	9 & 10
		R1	7
5	Radio Wave Propagation	T2	15
		R2	17

CELLULAR AND MOBILE COMMUNICATIONS (Open Elective)			
Subject Code	18XXECOX0XF	Internal Marks	30
Number of Lecture Hours/Week	3	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

This course will enable students to:

- Design and analyze Basic Cellular System
- Know of frequency reuse and Co-channel Interference, Non co-channel Interference
- Know the concepts Cell coverage for signal and Antennas
- Apply the different methods of Channel Assignment and Handoff mechanisms
- Explore the implementing of these wireless technologies in cellular and mobile communications

Unit -1	Hours
Cellular Mobile Radio Systems: Introduction to Cellular Mobile System, Why Cellular Mobile Telephone Systems, History Of 800mhz Spectrum Allocation, Trunking Efficiency, A Basic Cellular System, Performance Criteria, Uniqueness of Mobile Radio Environment, Operation of Cellular Systems, Marketing Image of Hexagonal Shaped Cells, Planning a Cellular system, Analog cellular Systems. **Elements of Cellular Radio System Design :** General Description of The Problem, Concept of Frequency Channels, Co-Channel Interference Reduction Factor, Desired C/I From a Normal Case in a Omni-directional Antenna System, Handoff Mechanism, Cell Splitting, Consideration of The Components of Cellular System.	**12**
Unit -2	
Interference: Co-Channel Interference, Exploring Co-Channel Interference areas in a system, Real Time Co-Channel Interference Measurement at mobile radio transceivers, Design of an Omni Directional Antenna System in the worst case, Design of a Directional Antenna System, Lowering the Antenna height, Reduction of Co-channel Interference by means of a notch in the tilted antenna pattern, Umbrella-pattern effect, use of parasitic elements, power control, Diversity Receiver. **Non Co-Channel Interference:** Subjective test Vs objective test, Adjacent-channel interference, near-end-far-end interference, effect on near-end mobile units, cross talk-A unique characteristics of voice channels, effects on coverage and interference by applying power decrease, antenna height decrease, beam tilting, effects of cell-site components, interference between systems, UHF TV interference, long-distance interference.	**10**
Unit – 3	
Cell Coverage for Signal and Traffic: General Introduction, Obtaining the Mobile Point-to-Point Model (Lee Model), Propagation over Water or Flat Open Area, Foliage Loss, Propagation in Near-in Distance, Long –Distance Propagation, Obtain Path Loss from a Point-to-Point Prediction Model-A General Approach, Form of a Point-to-Point Model. **Cell Site and Mobile Antennas:** Sum and Difference Patterns and their Synthesis, Antennas at Cell Site, Omni-directional Antennas, Directional Antennas for Interference Reduction, Unique Situations of Cell-Site Antennas, Mobile	**9**

Antennas.	
Unit – 4	
Frequency Management and Channel Assignment: Frequency Management, Frequency –Spectrum Utilization, Set-up Channels , Channel Assignments to Cell Sites and Mobile Units, Fixed Channel Assignment, Adjacent Channel Assignment, Channel Sharing and Borrowing, Sectorization, Underlay-Overlay arrangement, Non fixed Channel Assignment Algorithms. **Handoff:** Value of Implementing Handoffs, Why handoffs, Types of Handoff, Initiation of a Handoff, Delaying a Handoff, Forced Handoffs, Queuing of Handoffs, Power-Difference Handoffs, Mobile Assisted Handoff(MAHO) and Soft Handoff, Cell-Site Handoff, Intersystem Handoff, Introduction to Dropped Call Rate, Formula of Dropped Call Rate.	**11**
Unit – 5	
Digital Cellular Networks: GSM- Architecture, Channels, Multiple-access scheme, Radio resource management, Mobility management, Communication management, Network management, North American TDMA-History, Architecture, CDMA.	**8**

Course outcomes:

On completion of the course student will be able to

1. Learn Basic concepts of Cellular System
2. Identify Co-channel and Non co-channel Interference
3. Know the concepts Cell coverage for signal
4. Choose proper cell site antenna
5. Apply the different methods of Channel Assignment and Handoff mechanisms
6. Plan wireless technologies in cellular and mobile communications

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. William C. Y. Lee (2006), Mobile Cellular Telecommunications, 2nd edition, Tata McGraw Hill, India.
2. Theodore S. Rappaport (2002), Wireless Communications, 2nd edition, Pearson education, India.

Reference Books:

1. Gordon L. Stuber (2007), Principles of Mobile Communication, 2nd edition, Springer International, India.
2. William C. Y. Lee (2006), Wireless and Cellular Telecommunications, 3rd edition, McGraw Hill, New Delhi.

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Cellular mobile radio systems &Elements of cellular radio system design	T1 R2	1 &2 2
2	Interference & Non Co-channel interference	T1 R2	6 & 7 9 & 10
3	Cell coverage for signal &Traffic- Cell site & Mobile Antennas	T1 R2	4 & 5 8
4	Frequency Management & Channel assignment & Handoff	T1 R2	8 & 9 11
5	Digital cellular networks	T1 R2	14 & 15 4, 5, 6 & 7

<table>
<tr><td colspan="4">VLSI DESIGN
(Open Elective)</td></tr>
<tr><td>Subject Code</td><td>18XXECOX0XG</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives: The students are able to
• Learn about the various fabrication steps of IC and electrical properties of MOSFET.
• Learn about the Specific rules to draw the stick diagrams and Layouts.
• Analyze the circuit concepts and to apply Scaling factors for Device parameters.
• Learn about VLSI design trends and testing methods.
• Know about FPGA architecture and Low power VLSI design.</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction: Introduction to IC Technology, MOS and related VLSI Technology, Basic MOS Transistors, Enhancement and Depletion modes of transistor action, IC production and MOS fabrication process.
Basic Electrical Properties of MOS and Bi-CMOS Circuits: Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit, Pass transistor, NMOS Inverter, Pull-up to Pull-down Ratio for NMOS inverter driven by another NMOS inverter, Alternative forms of pull-up, CMOS Inverter.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">MOS Circuit Design Processes: MOS Layers, Stick Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly CMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, Delay Unit, Inverter Delays, Propagation Delays, Wiring Capacitances, Fan-in and fan-out characteristics, Choice of layers, Transistor switches, Realization of gates using NMOS, PMOS and CMOS technologies, Scaling models, Scaling factors for device parameters.</td><td>11</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="3">Chip Input and Output circuits: ESD Protection, Input Circuits, Output Circuits and L(di/dt) Noise, On-Chip clock Generation and Distribution.
Design for Testability: Fault types and Models, Controllability and Observability, Ad Hoc Testable Design Techniques, Scan Based Techniques and Built-In Self Test techniques.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5</td></tr>
<tr><td colspan="3">FPGA Design: Basic FPGA architecture, FPGA configuration, configuration modes, FPGA design process- FPGA design flow, FPGA families.
Introduction to Low Power VLSI Design: Introduction to Deep submicron</td><td>9</td></tr>
</table>

digital IC design and Low Power CMOS, Overview of low power design through voltage scaling, switching activity, and switching capacitance. Interconnect Design and Clock Design.

Course outcomes:

By the end of this course, students should be able to:

1. Understand the fabrication steps of IC and electrical properties of MOSFET.
2. Apply the concepts of design rules during the layout of a circuit.
3. Apply circuit concepts for Device parameters.
4. Apply Scaling factors for Device parameters
5. Identify the VLSI design trends and testing methods.
6. Understanding FPGA and Low power techniques.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. Kamran Eshraghian, Douglas and A. Pucknell and SholehEshraghian, "Essentials of VLSI Circuits and Systems", Prentice-Hall of India Private Limited, 2005 Edition.
2. CMOS Digital Integrated Circuits Analysis and Design- Sung-Mo Kang, Yusuf Leblebici, Tata McGraw-Hill Education, 2003.

Reference Books:

1. Advanced Digital Design with Verilog HDL, Michael D.Ciletti, Xilinx Design Series, Pearson Education.
2. Analysis and Design of Digital Integrated Circuits in Deep submicron Technology, 3'rd edition, David Hodges.

S.No.	Unit Name	Text Book Reference	Chapter No.
1	Introduction, Basic Electrical Properties of MOS and Bi-CMOS Circuits	T1	1 & 2
2	MOS and Bi-CMOS Circuit Design Processes	T1	3
3	Basic Circuit Concepts, Scaling of MOS Circuits	T1	4 & 5
4	VLSI Design Issues	T2	1
5	FPGA Design	R1	2 & 3

VLSI PHYSICAL DESIGN AUTOMATION
(Open Elective)

Subject Code	18XXECOX0XH	Internal Marks	30
Number of Lecture Hours/Week	03	External Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Course Objectives: Students are able to

- Understand the concepts of EDA methodologies for IC design.
- Understand the process of transforming structural representation of VLSI system into its layout representation.
- Carry out the transformation efficiently using computers to optimize topological, geometric, timing and power-consumption constraints of the design
- Understand the concepts of design automation for FPGAs and MCMs.

Unit -1	Hours
VLSI Design Methodologies: New Trends in Physical Design Cycle, Issues related to the Fabrication Process, Review of Data structures and algorithms, Complexity Issues and NP-hardness, Graph Algorithms for Physical design, Review of VLSI Design automation tools.	**9**
Unit -2	
Partitioning, Floorplanning and Pin Assignment: Introduction to Partitioning, Problem Formulation, Kernighan-Lin Algorithm, Fiduccia-Mattheyses Algorithm, Introduction to Floorplanning, Problem Formulation, Integer Programming Based Floorplanning, Rectangular Dualization, General Pin Assignment and Channel Pin Assignment.	**10**
Unit – 3	
Placement and Routing: Problem Formulation, Simulated Annealing Algorithm, Breuer's Algorithm, Force Directed Algorithm, Terminal Propagation Algorithm, Routing problem formulation, Maze Routing Algorithms: Lee's Algorithm, Soukup's Algorithm, Hadlock's Algorithm, Line-Probe Algorithms, Shortest Path Based Algorithms, Steiner Min-Max Tree based Algorithm, Detailed Routing Problem Formulation, Greedy Channel Routing Algorithm, Greedy Routing Algorithm for Switch Box.	**11**
Unit – 4	
Clock and Power Routing: Clocking Schemes, Design Considerations for the Clocking System, Delay Calculation for Clock Trees, Clock Routing Algorithms: H-tree Based Algorithm, The MMM Algorithm, Geometric Matching based Algorithm, Weighted Center Algorithm, Exact Zero Skew Algorithm, Multiple Clock Routing, Power and Ground Routing, Compaction and Review of Compaction Algorithms.	**11**
Unit – 5	
Physical Design Automation of FPGAs: FPGA Technologies, Physical Design Cycle for FPGAs, Partitioning, Routing Algorithm for the Non-Segmented Model, Routing Algorithms for the Segmented Model. **Physical Design Automation of MCMs:** MCM Technologies, MCM Physical Design Cycle, Partitioning, Placement, Routing, Maze Routing, Multiple Stage Routing, Topological Routing.	**9**

Course outcomes:

By the end of this course, students should be able to:

1 Understand the basics of design cycle stages.
2 Retrieve the graph theory concepts and relate to VLSI physical design.
3 Learn partitioning and floor planning algorithms.
4 Learn different placement and routing algorithms.
5 Differentiate routing algorithms for clock and power sources.
6 Understand design automation for FPGAs and MCMs.

Question paper pattern:

Section A:

1. This section contains 10 one mark questions.
2. Two questions are given from each unit.

Section B:

3. This Section contains 10 questions, 02 from each unit.
4. Each question carries 12 marks and a full question may have sub questions covering all topics in a unit.
5. The student has to answer 05 questions, one from each unit with internal choice.

Text Books:

1. N.A. Sherwani, Algorithms for VLSI Physical Design Automation, Kluwer Academic Publishers, 2002.
2. S.H. Gerez, Algorithms for VLSI Design Automation, John Wiley & Sons, 2002.

Reference Books:

1. Sadiq M. Sait, Habib Youssef, VLSI Physical Design automation: Theory and Practice, World scientific 1999.
2. Steven M.Rubin, Computer Aids for VLSI Design, Addison Wesley Publishing 1987.

Unit No	Unit Description	Text book	Chapter No
1	VLSI Design Methodologies	T1	4
2	Partitioning, Floor planning and Pin Assignment	T1	5 & 6
3	Placement and Routing	T1	7, 8 & 9
4	Clock and Power Routing	T1	11 & 12
5	Physical Design Automation of FPGAs and MCMs	T1	13 & 14

Open Elective Courses offered by CSE to other Departments

(except CSE & IT)

Open Electives offered by CSE

Open Elective-I	
18XXCSO50M**A**	Data Structures through C
18XXCSO50M**B**	Python Programming
18XXCSO50M**C**	Internet of Things

Open Elective-II	
18XXCSO60M**A**	R Programming
18XXCSO60M**B**	Java Programming
18XXCSO60M**C**	Block Chain

Open Elective-III	
18XXCSO70M**A**	Designing Database Management Systems
18XXCSO70M**B**	App Technologies
18XXCSO70M**C**	Quantum Computing

Open Elective-IV	
18XXCSO80M**A**	Operating Systems Concepts
18XXCSO80M**B**	Web Technologies
18XXCSO80M**C**	Artificial Intelligence
18XXCSO80M**D**	Virtual Reality

DATA STRUCTURES THROUGH C			
Subject Code	18XXCSO50M**A**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: INTRODUCTION TO DATA STRUCTURE	**Hours**
Data Management concepts, Data types – primitive and non- primitive, Performance Analysis and Measurement (Time and space analysis of algorithms-Average, best- and worst-case analysis), Types of Data Structures- Linear & Non-Linear Data Structures.	**08**
Unit -2 :LINEAR DATA STRUCTURE	
Array: Representation of arrays, Applications of arrays, sparse matrix and its representation Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression And Their Compilation, Recursion, Tower of Hanoi Queue: Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	**10**
Unit – 3:NONLINEAR DATA STRUCTURE	
Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees, Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Graph- Matrix Representation Of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree)	**10**
Unit – 4:HASHING AND FILE STRUCTURES	
Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods.	**10**
Unit – 5:SORTING AND SEARCHING	
Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search	**12**

Text(T) / Reference(R) Books:	
T1	An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill.
T2	Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International
R1	Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed
R2	Fundamentals of Data Structures in C++-By Sartaj Sahani.
R3	Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher Thomson Learning
W1	https://www.coursera.org/specializations/data-structures-algorithms
W2	https://online-learning.harvard.edu/course/data-structures-and-algorithms

Course Outcomes: On completion of this course, students can	
CO1	Choose appropriate data structure as applied to specified problem definition.
CO2	Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures
CO3	Apply concepts learned in various domains like DBMS
CO4	Apply concepts learned in various domains like compiler construction
CO5	Use linear and non-linear data structures like stacks, queues , linked list

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

PYTHON PROGRAMMING			
Subject Code	18XXCSO50M**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation	**08**
Unit -2 : Types, Operators and Expressions	
Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if- elif-else, for, while, break, continue, pass. Data Structure**s** Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.	**10**
Unit – 3: Functions	
Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. Module**s**: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages	**10**
Unit – 4: Object Oriented Programming in Python	
Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error and Exceptions**:** Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions	**10**
Unit – 5: Brief Tour of the Standard Library	
Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing:Why testing is required?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.	**12**

Text(T) / Reference(R) Books:	
T1	Python Programming: A Modern Approach, Vamsi Kurama, Pearson
T2	Learning Python, Mark Lutz, Orielly
R1	Think Python, Allen Downey, Green Tea Press
R2	Core Python Programming, W.Chun, Pearson
R3	Introduction to Python, Kenneth A. Lambert, Cengage
W1	https://www.coursera.org/courses?query=python
W2	https://www.edx.org/learn/python

Course Outcomes: On completion of this course, students can	
CO1	Making Software easily right out of the box
CO2	Experience with an interpreted Language
CO3	To build software for real needs.
CO4	Prior Introduction to testing software
CO5	Experience with implementation in current technologies

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

INTERNET OF THINGS			
Subject Code	18XXCSO50MC	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: The Internet of Things	**Hours**
An Overview of Internet of things, Internet of Things Technology, behind IoTs Sources of the IoTs, M2M Communication, Examples OF IoTs, Design Principles for Connected Devices	**08**
Unit -2 :Business Models	
Business Processes in the Internet of Things ,IoT/M2M systems LAYERS AND designs standardizations ,Modified OSI Stack for the IoT/M2M Systems ,ETSI M2M domains and High-level capabilities, Communication Technologies, Data Enrichment and Consolidation and Device Management Gateway Ease of designing and affordability	**10**
Unit – 3:Design Principles for the Web Connectivity	
Design Principles for the Web Connectivity for connected-Devices, Web Communication protocols for Connected Devices, Message Communication protocols for Connected Devices, Web Connectivity for connected-Devices.	**10**
Unit – 4:Internet Connectivity Principles	
Internet Connectivity Principles, Internet connectivity, Application Layer Protocols: HTTP, HTTPS, FTP, Telnet. Data Acquiring, Organizing and Analytics in IoT/M2M, Applications/Services/Business Processes, IOT/M2M Data Acquiring and Storage, Business Models for Business Processes in the Internet of Things, Organizing Data, Transactions, Business Processes, Integration and Enterprise Systems.	**10**
Unit – 5:Data Collection	
Data Collection, Storage and Computing Using a Cloud Platform for IoT/M2M Applications/Services, Data Collection, Storage and Computing Using cloud platform Everything as a service and Cloud Service Models, IOT cloud-based services using the Xively (Pachube/COSM), Nimbits and other platforms Sensor, Participatory Sensing, Actuator, Radio Frequency Identification, and Wireless, Sensor Network Technology, Sensors Technology, Sensing the World.	**12**

Text(T) / Reference(R) Books:	
T1	Internet of Things: Architecture, Design Principles And Applications,
	Rajkamal, McGraw Hill Higher Education
T2	Internet of Things, A.Bahgya and V.Madisetti, Univesity Press, 2015
R1	Designing the Internet of Things, Adrian McEwen and Hakim Cassimally, Wiley
R2	Getting Started with the Internet of Things CunoPfister ,Oreilly
W1	https://www.coursera.org/specializations/internet-of-things
W2	https://alison.com/course/internet-of-things-and-the-cloud

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate knowledge and understanding of the security and ethical issues of the Internet of Things
CO2	Conceptually identify vulnerabilities in Internet of Things
CO3	Conceptually identify recent attacks, involving the Internet of Things
CO4	Develop critical thinking skills
CO5	Compare and contrast the threat environment based on industry and/or device type.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

R PROGRAMMING			
Subject Code	18XXCSO60MA	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
How to run R, R Sessions and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.	**08**
Unit -2 :R Programming Structures, Control Statements, Loops	
- Looping Over NonvectorSets,- If-Else, Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.	**10**
Unit – 3:Math and Simulation in R	
Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /output, Accessing the Keyboard and Monitor, Reading and writer Files	**10**
Unit – 4:Graphics	
Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlationand Covariance, T-Tests,-ANOVA.	**10**
Unit – 5:Linear Models	
Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests	**12**

Text(T) / Reference(R) Books:	
T1	The Art of R Programming, Norman Matloff, Cengage Learning
T2	R for Everyone, Lander, Pearson
R1	R Cookbook, PaulTeetor, Oreilly
R2	R in Action, Rob Kabacoff, Manning
W1	https://www.edx.org/learn/r-programming
W2	https://www.coursera.org/learn/r-programming

Course Outcomes: On completion of this course, students can	
CO1	List motivation for learning a programming language
CO2	Access online resources for R and import new function packages into the R workspace
CO3	Import, review, manipulate and summarize data-sets in R
CO4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests
CO5	Perform appropriate statistical tests using R Create and edit visualizations

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

JAVA PROGRAMMING			
Subject Code	18XXCSO60M**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction to OOP	**Hours**
procedural programming language and object-oriented language, principles of OOP, applications of OOP, history of java, java features, JVM, program structure. Variables, primitive data types, identifiers, literals, operators, expressions, precedence rules and associativity, primitive type conversion and casting, flow of control.	**08**
Unit -2 :Classes and objects	
Classes and objects, class declaration, creating objects, methods, constructors and constructor overloading, garbage collector, importance of static keyword and examples, this keyword, arrays, command line arguments, nestedclasses.	**10**
Unit – 3:Inheritance	
Inheritance, types of inheritance, super keyword, final keyword, overriding and abstract class. Interfaces, creating the packages, using packages, importance of CLASSPATH and java. lang package. Exception handling, importance of try, catch, throw, throws and finally block, user defined exceptions, Assertions	**10**
Unit – 4:Multithreading	
Introduction, thread life cycle, creation of threads, thread priorities, thread synchronization, communication between threads. Reading data from files and writing data to files, random access file.	**10**
Unit – 5:Applet	
Applet class, Applet structure, Applet life cycle, sample Applet programs. Event handling: event delegation model, sources of event, Event Listeners, adapter classes, inner classes. AWT: introduction, components and containers, Button, Label, Checkbox, Radio Buttons, List Boxes, Choice Boxes, Container class, Layouts, Menu and Scrollbar.	**12**

Text(T) / Reference(R) Books:	
T1	The complete Reference Java, 8th edition, Herbert Schildt, TMH
T2	Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford
R1	Introduction to java programming, 7th edition by Y Daniel Liang, Pearson
W1	https://www.coursera.org/courses?query=java
W2	https://www.udemy.com/java-tutorial/

Course Outcomes: On completion of this course, students can	
CO1	Understand Java programming concepts and utilize Java Graphical User Interface in Program writing.
CO2	Write, compile, execute and troubleshoot Java programming for networking concepts.
CO3	Build Java Application for distributed environment.
CO4	Design and Develop multi-tier applications.
CO5	Identify and Analyze Enterprise applications.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**2**	**3**	-	-	-	-	-	-	-	-	-	**2**	**-**

BLOCK CHAIN			
Subject Code	18XXCSO60MC	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction	**Hours**
Overview of Block chain, public ledgers, bitcoin, smart contracts, block in a block chain, transactions, distributed consensus, public vs private block chain, understanding crypto currency to block chain, permission model of block chain, overview of security aspects of block chain, cryptographic hash function, properties of a hash function, hash pointer and Merkle tree, digital signature, public key cryptography, a basic crypto currency.	**08**
Unit -2 :Understanding block chain with crypto currency	
: Creation of coins, payments and double spending, bitcoin scripts, bitcoin P2P network, transaction in bitcoin network, block mining, block propagation and block relay, distributed consensus in open environments, consensus in a bitcoin network, Proof of Work (PoW)- Basic Introduction, hashcashPoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of burn and proof of elapsed time, the life of a bitcoin miner, Mining- Difficulty, mining pool.	**10**
Unit – 3:Permissioned Block Chain	
Permissioned model and usecases, design issues for permissioned block chains, execute contracts, state machine replication, overview of consensus models for permissioned block chain, Distributed consensus in closed environment, paxos, RAFT consensus, Byzantine general problem, Byzantine fault tolerance system, Lamport-Shostak-Pease BFT algorithm, BFT over Asynchronous systems.	**10**
Unit – 4:Enterprise application of Block chain	
Cross border payments, Know Your Customer, Food security, Mortgage over block chain, Block chain enabled trade, trade finance network, supply chain financing, identity on block chain.	**10**
Unit – 5:Block chain application development	
Hyperledger fabric- architecture, identities and policies, membership and access control, channels, transaction validation, writing smart contract using Hyperledger fabric, writing smart contract using Ethereum, overview of Ripple and Corda.	**12**

Text(T) / Reference(R) Books:	
T1	Block Chain: Blueprint for a new economy, Melanie Swan, O'Reilly, 2015.
T2	Block Chain: The Block Chain for Beginners- Guide to Block Chain Technology and Leveraging Block Chain Programming, Josh Thompsons
R1	Block Chain Basics, Daniel Drescher, Apress; 1st edition, 2017
R2	Block Chain and Crypto Currencies, Anshul Kaushik, Khanna Publishing House, Delhi.
R3	Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, Imran Bhashir, Packt Publishing.
W1	https://www.edx.org/learn/blockchain
W2	https://www.coursera.org/courses?query=blockchain

Course Outcomes: On completion of this course, students can	
CO1	Understand block chain technology.
CO2	Develop block chain-based solutions
CO3	Write smart contract using Hyperledger Fabric and Ethereum frameworks.
CO4	Build and deploy block chain application for on premise and cloud- based architecture.
CO5	Integrate ideas from various domains and implement them.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

DESIGNING DATABASE MANAGEMENT SYSTEMS			
Subject Code	18XXCSO70MA	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction to Databases	**Hours**
Traditional file-based systems and their limitations, Database approach (DBMS) and its components, Roles in the database environment, Advantages and disadvantages of database systems, Distributed databases.	**08**
Unit -2 :The Relational Model	
Definition of relational data structures, database relations and keys, Representation of relational database schemas, Relational Algebra, Relational integrity (entities and relationships), Views.	**10**
Unit – 3:Structured Query Language	
Introduction, objectives, terminology, Data manipulation- Querying, sorting, grouping of data, logical and list operators, Single row numeric and string functions, Group functions, Joins, Sub-queries, Inserting, deleting and updating data. Data definition- Creating, altering and dropping database objects: tables, views, indexes, synonyms, constraints, users. Creating Procedures and Functions, Creating Database Triggers.	**10**
Unit – 4:Entity–Relationship Modelling and Logical Database Design	
Entity and Relationship Types, Attributes (single, composite and derived), Structural Constraints (1:1, 1:*, *:* relationships), Multiplicity, Cardinality and participation.	**10**
Unit – 5:Normalization	
Update anomalies, Functional dependencies, First, second, and third normal forms.	**12**

Text(T) / Reference(R) Books:	
T1	The Semantic Web, Berners-Lee, T., Hendler, J. and Lassila, Scientific American, 279, 2001.
T2	Extending the database relational model to capture more meaning, Codd, E.F., ACM Transactions on Database Systems (TODS), v.4 n.4, p.397-434
T3	Fundamentals of database systems, Elmasri, R., &Navathe, S., Pearson Addison Wesley.
R1	Database systems: a practical approach to design, implementation, and management, Connolly, T. &Begg, C, Addison-Wesley
W1	https://onlinecourses.nptel.ac.in/noc18_cs15/preview
W2	https://www.edx.org/learn/databases

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate understanding of the fundamental concepts of the relational database model and utilize database management systems to organize, store and retrieve data.
CO2	Make use of SQL (Structured Query Language) for database definition and manipulation, use of a conventional programming language to implement database connections.
CO3	Apply conceptual database modelling methods such as entity- relationship to model business requirements.
CO4	Make use of a step-by-step approach from conceptual and logical to a physical model to design databases.
CO5	Identify functional dependencies and apply normal forms to evaluate the quality of a relational database design.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

APP TECHNOLOGIES			
Subject Code	18XXCSO70M**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Android Programming Environment	**Hours**
Android programming environment, linking activities using intents, calling built-in applications using intents.	**08**
Unit -2:User Interface	
Creating the user interface programmatically, Listening for UI notifications, build basic views, build picker views, build list views, Using image views, Using menus with views, Saving and loading user preferences	**10**
Unit – 3:Data	
Persisting data to files, Creating and using databases, Study Session, sharing data in android, Using a content provider, Creating a content provider	**10**
Unit – 4: Networking	
SMS messaging, sending emails, Networking, displaying maps, Getting location data	**10**
Unit – 5: Services	
Creating your own services, communicating between a service and an Activity, Binding Activities to Services, A complete lab work for Android service development, Deploy APK files.	**12**

Text(T) / Reference(R) Books:	
T1	Beginning Android Application Development, Wei-Meng Lee, 1st Ed, Wiley Publishing.
T2	Android: A Programmers Guide, J. F. DiMarzio, McGraw Hill Education (India) Private Limited.1st Edition.
R1	Android for Programmers: An App-Driven Approach, Paul Deitel, 1st Edition, Pearson India
R2	Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India Pvt Ltd
W1	https://www.coursera.org/browse/computer-science/mobile-and-web-development
W2	https://in.udacity.com/course/new-android-fundamentals--ud851

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate their understanding of the fundamentals of Android operating systems
CO2	Demonstrate their skills of using Android software development tools
CO3	Demonstrate their ability to develop software with reasonable complexity on mobile platform
CO4	Demonstrate their ability to deploy software to mobile devices
CO5	Demonstrate their ability to debug programs running on mobile devices

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

QUANTUM COMPUTING			
Subject Code	18XXCSO70MC	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1:Introduction to Quantum computing	**Hours**
Motivation for studying Quantum computing,,Mojor players in industry, Origin of Quantum Computing, overview of major concepts in Quantum Computing.	**08**
Unit -2 :Math Foundation for Quantum Computing	
Matrix algebra- Basic vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, dirac notation, Eigen values and Eigen vector	**10**
Unit – 3: Building Blocks for Quantum Program	
Architectures of a Quantum Computing Platform, Details of q-bit system of information representation- Block sphere, Multi-qubits states, Quantum superposition of qubits, Quantum entanglement, Useful states from quantum algorithmic perceptive, Operations on qubits, Quantum Logic gates and circuits, Programming model for a Quantum Computing Program- Steps performed on classical computer, steps performed on Quantum computer, Moving data between bits and qubits.	**10**
Unit – 4: Quantum Algorithms	
Amplitude amplification, Quantum Fourier Transform, Phase Kick- back, Quantum Phase estimation, Quantum Walks	**10**
Unit – 5: Algorithms	
Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm, IBM Quantum Experience, Microsoft Q, RigettiPyQuil	**10**

Text(T) / Reference(R) Books:	
T1	Quantum Computation and Quantum Information, Michael A. Nielsen, Cambridge University Press.
R1	Quantum Computation Explained, David Mc Mahon, Wiley
W1	https://quantumcurriculum.mit.edu/
W2	https://www.coursera.org/courses?query=quantum%20computing

Course Outcomes: On completion of this course, students can	
CO1	To explain the working of Quantum computing program.
CO2	To explain architecture and program model.
CO3	Develop Quantum logic gate circuits
CO4	Develop quantum algorithm
CO5	Program Quantum algorithm on major toolkits.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)														
	PO												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-	2	-
Course	**2**	**2**	**3**	-	-	-	-	-	-	-	-	-	**2**	**-**

OPERATING SYSTEMS CONCEPTS			
Subject Code	18XXCSO80MA	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Evolution of Operating Systems	Hours
Types of operating systems, Different views of the operating systems, Principles of Design and Implementation, The process concept, system programmer's view of processes, operating system's views of processes, operating system services for process management, Process scheduling, Schedulers, Scheduling Algorithms.	**08**
Unit -2 : Process synchronization	
Structural overview, Concept of process and Process synchronization, Process Management and Scheduling, Hardware requirements: protection, context switching, privileged mode, Threads and their Management.	**10**
Unit – 3: Deadlock	
Tools and Constructs for Concurrency, Detection and Prevention of deadlocks, Mutual Exclusion: Algorithms, semaphores, concurrent programming using semaphores.	**10**
Unit – 4:Memory Management	
Memory Management paging, virtual memory management, Contiguous allocation: static, dynamic partitioned memory allocation, segmentation. Non-contiguous allocation: Paging, Hardware support: Virtual Memory, Dynamic Resource Allocation.	**10**
Unit – 5:File Systems	
A Simple file system, General model of a file system, Symbolic file system, Access control verification, Logical file system, Physical file system, allocation strategy module, Device strategy module, I/O initiators, Device handlers, Disk scheduling, Design of IO systems, File Management.	**12**

Text(T) / Reference(R) Books:	
T1	Operating System Concepts – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 8th edition, Wiley-India, 2009.
T2	Modern Operating Systems – Andrew S. Tanenbaum, 3rd Edition, PHI
T3	Operating Systems: A Spiral Approach – Elmasri, Carrick, Levine, TMH Edition
R1	Operating Systems – Flynn, McHoes, Cengage Learning
R2	Operating Systems – Pabitra Pal Choudhury, PHI
R3	Operating Systems – William Stallings, Prentice Hall
R4	Operating Systems – H.M. Deitel, P. J. Deitel, D. R. Choffnes, 3rd Edition, Pearson
W1	https://www.coursera.org/courses?query=operating%20system
W2	https://onlinecourses.nptel.ac.in/noc16_cs10/preview

Course Outcomes: On completion of this course, students can	
CO1	Demonstrate knowledge in fundamental operating system abstractions such as processes, threads, and process management
CO2	Demonstrate knowledge in semaphores, monitors, conditions, deadlocks, IPC abstractions, shared memory regions, etc.
CO3	Demonstrate knowledge in principles of memory management
CO4	Demonstrate knowledge in file abstraction and storage management
CO5	Apply knowledge outlines in the above to design and develop system

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

WEB TECHNOLOGIES			
Subject Code	18XXCSO80M**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: Introduction to HTML	**Hours**
HTML Common tags- Block Level and Inline Elements, Lists, Tables, Images, Forms, Frames; Cascading Style sheets, CSS Properties; Java Script: Introduction to Java Script, Objects in Java Script, Dynamic HTML with Java Script	**08**
Unit -2: JDBC	
Data Base, Database Schema, A Brief Overview Of The JDBC Process, JDBC Driver Types, JDBC Packages, Database Connection, Associating The JDBC-ODBC Bridge With Database, Creating, Inserting, Updating And Deleting Data In Database Tables, Result Set, Metadata.	**10**
Unit – 3:Web Servers and Servlets	
Tomcat web server, Introduction to Servlets: Servlets, the Advantage of Servlets over "Traditional" CGI, Basic Servlet Structure, Simple Servlet Generating Plain Text, Compiling and Installing the Servlet, Invoking the Servlet, Lifecycle of a Servlet, The Servlet API, Reading Servlet parameters, Reading Initialization parameters, Context Parameters, Handling Http Request & Responses, Using Cookies- Session Tracking, Servlet with JDBC.	**10**
Unit – 4: Introduction to JSP	
The Problem with Servlet. The Anatomy of a JSP Page, JSP Processing, JSP Application Development: Generating Dynamic Content, Using Scripting Elements, Implicit JSP Objects, Declaring Variables and Methods, Sharing Data Between JSP pages, Users Passing Control and Data between Pages, JSP application design with JDBC, JSP Application Design with MVC.	**10**
Unit – 5: Introduction to PHP	
Basics of PHP, Functions, Error Handling, Interaction between PHP and MySQL, Database using Forms, Using PHP to manipulate and Retrieve Data in MySQL.	**12**

Text(T) / Reference(R) Books:	
T1	Beginning Web Programming, Jon Duckett, WROX
T2	Core Servlets and Java Server pages Vol. 1: Core Technologies, Marty Hall and Larry Brown, Pearson
R1	Open Source for the Enterprise: Managing Risks, Reaping Rewards, DanWoods and Gautam Guliani, O'Reilly, Shroff Publishers and Distributors,
R2	Programming world wide web, Sebesta, Pearson
R3	Internet and World Wide Web – How to program, Dietel and Nieto, PHI/Pearson Education Asia
R4	Murach's beginning JAVA JDK 5, Murach, SPD

R5	An Introduction to web Design and Programming, Wang, Thomson
W1	https://www.edx.org/learn/web-development
W2	https://www.coursera.org/courses?query=web%20development

Course Outcomes: On completion of this course, students can	
CO1	To develop a dynamic webpage by the use of java script and DHTML
CO2	To write a well formed / valid XML document
CO3	To connect a java program to a DBMS and perform insert, update and delete operations on DBMS table
CO4	To write a server-side java application called Servlet to catch form data sent from client, process it and store it on database
CO5	To write a server-side java application called JSP to catch form data sent from client and store it on database

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

ARTIFICIAL INTELLIGENCE			
Subject Code	18XXCSO80MC	IA Marks	40
Number of Lecture Hours/Week	3	Exam Marks	60
Total Number of Lecture Hours	48	Exam Hours	03
Credits – 03			

Unit -1	**Hours**
Introduction to artificial intelligence Introduction, history, intelligent systems, foundations of AI, applications, tic-tac-tie game playing, development of ai languages, current trends in AI	**08**
Unit -2	
Problem solving: state-space search and control strategies Introduction, general problem solving, characteristics of problem, exhaustive searches, heuristic search techniques, iterative deepening a*, constraint satisfaction **Problem reduction and game playing :**Introduction, problem reduction, game playing, alpha beta pruning, two-player perfect information games	**10**
Unit – 3	
Logic concepts Introduction, propositional calculus, proportional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic	**08**
Unit – 4	
Knowledge representation Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, knowledge representation using frames **Advanced knowledge representation techniques :**Introduction, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web	**10**
Unit – 5	
Expert system and applications Introduction phases in building expert systems, expert system versus traditional systems, rule-based expert systems blackboard systems truth maintenance systems, application of expert systems, list of shells and tools **Uncertainty measure: probability theory** Introduction, probability theory, Bayesian belief networks, certainty factor theory, dempster-shafer theory **Fuzzy sets and fuzzy logic** Introduction, fuzzy sets, fuzzy set operations, types of membership functions, multi valued logic, fuzzy logic, linguistic variables and hedges, fuzzy propositions, inference rules for fuzzy propositions, fuzzy systems.	**12**

Text(T) / Reference(R) Books:	
T1	Artificial Intelligence- Saroj Kaushik, CENGAGE Learning
T2	Artificial intelligence, A modern Approach , 2nded, Stuart Russel, Peter Norvig, PEA
T3	Artificial Intelligence- Rich, Kevin Knight, Shiv Shankar B Nair, 3rded, TMH
T4	Introduction to Artificial Intelligence, Patterson, PHI
R1	Artificial intelligence, structures and Strategies for Complex problem solving, -George F Lugar, 5thed, PEA
R2	Introduction to Artificial Intelligence, Ertel, Wolf Gang, Springer
R3	Artificial Intelligence, A new Synthesis, Nils J Nilsson, Elsevier
W1	https://www.edx.org/course/artificial-intelligence-ai-columbiax-csmm- 101x-0
W2	https://academy.microsoft.com/en-us/professional-program/tracks/artificial-intelligence/

Course Outcomes: On completion of this course, students can	
CO1	Understand the history behind the Java technology, its features and strengths
CO2	Implement the basic principles of Object-Oriented Programming which includes inheritance, polymorphism, encapsulation and abstraction.
CO3	Understand the exception programming techniques by describing and encapsulating exceptions.
CO4	Understand the Thread concepts and Collections Framework in java. N
CO5	Create rich user-interface applications using modern API's such as JAVAFX.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

VIRTUAL REALITY			
Subject Code	18XXCSO80M**D**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1:Virtual reality and Virtual Environment	**Hours**
Introduction, Computer graphics, Real time computer graphics, flight simulation, virtual environment requirement, benefits of virtual reality, historical development of VR, scientific landmark. 3D Commuter Graphics: Introduction, virtual world space, positioning the virtual observer, perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, simple 3D modelling, Illumination models, reflection models, shading algorithms, radiosity, hidden surface removal, realism- stereographic image.	**08**
Unit -2 :Geometric Modelling	
Introduction, from 2D to 3D, 3D space curves, 3D boundary representation. Geometric transformation: Introduction, frames to reference, modelling transformations, instances, picking, flying, scaling the VE, Collision and detection. Generic VR system: Virtual environment, computer environment, VR technology- models of interaction, VR systems.	**10**
Unit – 3:Animating the Virtual Environment	
Introduction, the dynamics of numbers, linear and non-linear and non-linear interpolation, the animation of objects, linear and non- linear translation, shape & object in between, free from deformation, particle system. Physical Simulation: Objects falling in a gravitational field, rotating wheels, elastic collisions, projectiles, simple pendulum, springs, flight dynamics of an aircraft	**10**
Unit – 4:Human Factors	
The eye, the ear, the somatic senses. VR Hardware: Sensor hardware, head-coupled displays, acoustic hardware, integrated VR systems. VR Software: Modelling virtual world, physical simulation, VR toolkits, Introduction to VRML.	**10**
Unit – 5:VR Applications	
Shor’s Algorithm, Grover’s Algorithm, Deutsch’s Algorithm, Deutsch-Jozsa Algorithm, IBM Quantum Experience, Microsoft Q, RigettiPyQuil	**12**

Text(T) / Reference(R) Books:	
T1	Virtual Reality Systems, John Vince, Pearson Education Asia, 2007.
T2	Augmented and Virtual Reality, Anand R, Khanna Publishing House. Delhi
R1	Visualizations of Virtual Reality, Adams, Tata Mc Graw Hill, 2000
R2	Virtual Reality Technology, Grigore C. Burdea, Philippe Coieffet, Wiley Inter Science, 2nd edition, 2006.
W1	https://www.coursera.org/courses?query=virtual%20reality
W2	https://www.classcentral.com/tag/virtual-reality

Course Outcomes: On completion of this course, students can	
CO1	Understand geometric modelling
CO2	Understand Virtual environment
CO3	Study about Virtual Hardware and Software
CO4	Study about Software needed for developing virtual reality environment.
CO5	Develop Virtual Reality applications.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

Open Elective Courses offered by IT to other Departments (except CSE & IT)

Open Electives (offered by IT chosen by Students other than IT Department)

Open Elective-I	
18XXITO60MA	Office Automation
18XXITO60MB	Internet & Web Hosting

Open Elective-II	
18XXITO70MA	Open Source software
18XXITO70MB	E-Commerce
18XXITO70MC	Statistics and R Programming

Open Elective-III	
18XXITO80MA	Cloud Computing
18XXITO80MB	Mobile Application Development

<table>
<tr><td colspan="4">OFFICE AUTOMATION</td></tr>
<tr><td>Subject Code</td><td>18XXITO60MA</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Computer & Internet:
Desktop computers, Block diagram of a computer, Input and output devices, memory and storage devices, Different ports and its uses, Types of printers. Software: OS, Windows OS, Application software. Types of Networks, connecting to a network, testing connection, Internet, IP address, Hypertext, URL, Web Browsers, IP Address, Domain Name, Internet Services Providers, Internet Security, Internet Requirements, Web Search Engine, Net Surfing, Internet Services.
Windows XP:
Windows concepts, Features, Windows Structure, Desktop, Taskbar, Start Menu, MyComputer, Recycle Bin, Windows Accessories- Calculator, Notepad, Paint, Wordpad, Character Map, Windows Explorer, Entertainment, Installation of Hardware & Software, Scanner, System Tools, Sharing Information.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">Word Processing; MS Word:
Features, Creating, Saving and Opening Documents in Word, Toolbars, Ruler, Menus, Keyboard Shortcut, Editing, Previewing, Printing & Formatting a Document, Advanced Features of MS Word, Find & Replace, Mail Merge, Handling Graphics, Tables & Charts, Converting a word document into various formats.
Worksheet- MS-Excel:
Worksheet basics, creating worksheet, entering into worksheet, heading information, data, text, dates, alpha numeric values, saving & quitting worksheet, Opening and moving around in an existing worksheet, Toolbars and Menus, Keyboard shortcuts, Working with single and multiple workbook, cell referencing, Setting formula, Absolute & relative addressing, formatting , Previewing & Printing worksheet, Graphs and charts, Database, Creating and Using macros.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="3">MS Power Point:
Introduction to presentation – Opening new presentation, Different presentation templates, Setting backgrounds, Selecting presentation</td><td>10</td></tr>
</table>

layouts. Creating a presentation, Formatting a Presentation, Adding Effects to the Presentation. **Database Basics & MS ACCESS :** Database Basics: Databases, Records · Fields, data types, Database Types , Library Catalogues. Introduction to Microsoft Access: Starting Up Microsoft Access, Creating New, and Opening Existing Databases, Creating a database with and without using wizard, Creating Tables, Working with Forms, Creating queries, Finding Information in Databases Creating Reports, Types of Reports, Printing& Print Preview – Importing data from other databases.	
Unit – 4	
Intranet: Intranet tools: E-mail: Anatomy of e-mail, e-mail address, finding e-mail address, adding signature, attaching files, opening attachments, managing e-mail account, Web mail ,Case study: Yahoo Mail, Outlook express. FTP: ftp commands, ftp software, Telnet, Web pages, HTML, basics of HTML. MS Front page: Page Properties, Text, Hyperlinks, Tables, Graphics and Pictures, Shared borders, Navigation bars, CSS, Themes, Frames, Components, Forms, Creating web site, Uploading and downloading files. Portals, Creating portals, digital signature, computer virus and antivirus software.	**10**
Unit – 5	
E-governance: Need of E-governance, E-assistance, E-democracy, E- administration, citizen services, E-procurement, Mobile government, Law and policies, IT Act, Right for Information Act, Introduction to various TAX Payable, Purchase & Tender procedures and E-filing of Information. **E-governance implementations:** Software and Hardware required for E-governance Implementation, E-governance in a Small Office, Web Portal for E-governance, E- governance for Public utilities, E-governance in a Medium Enterprise, E-governance & Finance, E-Tender & Web E- governance efforts of State Government of Rajasthan, Andhra Pradesh Model.	**10**

Text(T) / Reference(R) Books:	
T1	Professional Office Procedure by Susan H Cooperman, Printice Hall.
T2	Public Information Technology and E-Governance: Managing the Virtual State (Paperback) by G. David Garson
R1	Information Technology: Principles , Practices and Opportunities by James A Senn, Printice Hall
R2	Technology And Procedures for Administrative Professionals by Patsy Fulton-Calkins, Thomson Learning
W1	http://beta.nielit.gov.in/content/data-entry-and-office-automation
W2	https://compufield.com/office_automation_courses.html

Course Outcomes: On completion of this course, students can	
CO1	Summarize importance of cloud computing in real world.
CO2	Identify applications that can be integrated using cloud services.
CO3	Evaluate cloud-based applications.
CO4	Understand the security issues in cloud services
CO5	Identify the cloud services managing.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

INTERNET & WEB HOSTING			
Subject Code	18XXITO60M**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1	**Hours**
Introduction to Internet, Growth of Internet, Owners of the Internet, Anatomy of Internet, ARPANET, basic Internet Terminology, Net etiquette. Internet Applications – Commerce on the Internet, Governance on the Internet, Impact of Internet on Society – Crime on/through the Internet. **Introduction to World Wide Web:** WWW, Browser, Web Page – Contents, Web Clients, Web Servers, Web Applications, Websites – Home Pages, Web Site Development – How to Builds Web Sites?, Web Programming, Webserver Administration, Protocols – HTTP.	**10**
Unit -2	
HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext, Links, Lists, Tables, Forms, HTML5 **CSS:** Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution	**10**
Unit – 3	
Javascript: Introduction, Where to, Variables, Operators, Screen Output and Keyboard Input, Control Statements, Objects, Events, Arrays, Functions, Object Creation and Modification, Constructors, Pattern Matching using Regular Expressions **DHTML:** Positioning Moving and Changing Elements.	**10**
Unit – 4	
PHP Programming: Introducing PHP: Creating PHP script, Running PHP script, variables, constants, Data types, Operators. Controlling program flow: Conditional statements, Looping statements, Arrays, functions. Files & I/O, Cookies, Sessions, Working with forms and Databases such as MySQL, Object oriented, Sending email.	**10**

Unit – 5	
Internet Services & Internet Security:	**10**
Electronic Mail, FTP, Newsgroups, Other Internet Services, Security and the Internet, Security Tools, E-commerce Security Issues, TCP/IP, Domain Names and IP addressing, Host Names, Domain Names, Addressing – Reserved IP addresses. **Web Publishing and Browsing**: Overview, SGML, Web hosting – Hosting a web site, HTML, CGI, Documents Interchange Standards, Components of Web Publishing, Document management, Web Page Design Consideration and Principles, Search Engines & Meta Search Engines, Publishing Tools.	

Text(T) / Reference® Books:	
T1	Fundamentals of Internet and www, Greenlaw R and Hepp E, 2nd EL, Tata McGrawHill,2007.
T2	Web Technologies, Black book, Dream Tech.
T3	The Complete reference to Internet, M. L. Young, Tata McGraw Hill, 2007.
R1	The Internet Book, D. Comer
R2	Programming PHP, O'Reilly 2002 RamsusLerdof and Levin Tatroe
R3	PHP:The Complete Reference, Steven Holzner, 2nd Edition, Tata McGrawHill
R4	MYSQL: The Complete Reference, VikramVaswani, 2nd Edition, Tata McGrawHill
W1	https://www.udemy.com/web-hosting-for-beginners/
W2	https://www.coursera.org/lecture/web-development/what-is-a-web- hosting-company-uGePI

Course Outcomes: On completion of this course, students can	
CO1	Understand the basic structure of the Internet, web page, website and protocols.
CO2	Apply HTML tags and CSS to develop static web pages with styles.
CO3	Develop a dynamic webpage by the use of JavaScript and DHTML.
CO4	Make use of PHP code to write simple client and server-side programs.
CO5	Understand tools related to security and web publishing.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

OPEN SOURCE SOFTWARE

Subject Code	18XXITO70MA	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03

Credits – 03

Unit -1	**Hours**
Introduction to Open source: Need of Open sources, Advantages and Applications of open sources, Open Source Operating Systems: Linux Introduction, General overview - Kernel and user Mode, Linux: Process, Advanced Concepts, scheduling, Personalities, Cloning, Signals, Development with Linux.	**10**
Unit -2	
Open Source Database: Introduction to MYSQL, Setting up account, starting, writing own sql Programs, Record selection, working with strings, date and Time, Sorting query Results, generating summary, Working with metadata, Using Sequences, Mysql and web.	**08**
Unit – 3	
Introduction to PHP: Programming In web environment, Variable, constants, data types, Operators, statements, Functions and Arrays, OOP, string manipulation, Regular expression, File handling & Data Storage, PHP and SQL database, PHP and LDAP, PHP Connectivity - sending and receiving mails, Debugging and Error handling, Security and Templates.	**10**
Unit – 4	
PYTHON: Syntax and Style, Python objects, Numbers, Sequences, Strings, Lists, Tuples, Dictionaries, Conditionals, Loops, Files –Input and Output, Errors and Exceptions, Functions, Modules, Classes and OOP, Execution Environment.	**10**
Unit – 5	
PERL: Overview, Variables - scalars, arrays and hashes, Operators, Control Structures - Conditional and looping statements, Subroutines, Packages and Modules, Working with files, Working with Database, Data manipulation. **RUBY:** Overview, Variables - arrays and hashes, Control Structures - conditional and looping statements, Methods, Blocks, Modules, Iterators, Working with files, Working with Database.	**12**

Text(T) / Reference(R) Books:	
T1	The Linux Kernel Book Wiley Publications,2003:Remy card, Eric Dumas,frankmevel
T2	MySQL Bible John Wiley,2002:SteveSuchring
T3	Learning Python, Mark Lutz, Orielly
T4	Programming Perl, 4ed, Tom Christiansen, Jonathan Orwant, Oreilly (2012)
T5	Ruby on Rails Up and Running, Lightning fast Web development, Bruce Tate, Curt Hibbs, Oreilly (2006)
R1	Programming PHP, O'Reilly 2002 RamsusLerdof and Levin Tatroe
R2	PHP:The Complete Reference, Steven Holzner, 2nd Edition, Tata McGrawHill
R3	Wesley J.Chun, Core PhythonProgramming,Prentice hall, 2001
R4	Python Programming, ReemaThareja, Oxford
R5	Perl :The Complete Reference, Martin C. Brown, 2nd Edition, Tata McGrawHill
R6	MYSQL: The Complete Reference, VikramVaswani, 2nd Edition, Tata McGrawHill
W1	https://www.class-central.com/tag/open-source
W2	https://www.udemy.com/topic/open-source-tools/

Course Outcomes: On completion of this course, students can	
CO1	Make use of advanced concepts like scheduling, signals to work with processes efficiently.
CO2	Outlines how open source DB like MYSQL works using different Commands in real-time applications.
CO3	Make use of simple and large-scale real-time applications using OSS programming language like PHP.
CO4	Apply the concepts of Python functions, modules and packages to build software for real needs.
CO5	Develop programs using concepts of PERL and RUBY

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

E-COMMERCE			
Subject Code	18XXITO70M**B**	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1:	**Hours**
Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications. Consumer Oriented Electronic commerce– Mercantile Process models.	**10**
Unit -2:	
Electronic payment systems – Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems. Inter Organizational Commerce – EDI, EDI Implementation, Value added networks.	**10**
Unit – 3:	
Intra Organizational Commerce – work Flow, Automation Customization and internal Commerce, Supply chain Management.	**08**
Unit – 4:	
Corporate Digital Library – Document Library, digital Document types, corporate Data Warehouses. Advertising and Marketing – Information based marketing, Advertising on Internet, on-line marketing process, market research.	**10**
Unit – 5:	
Consumer Search and Resource Discovery – Information search and Retrieval, Commerce Catalogues, Information Filtering. Multimedia –key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing’s, Desktop video conferencing.	**12**

Text(T) / Reference(R) Books:	
T1	Frontiers of electronic commerce, Kalakata, Whinston, Pearson.
R1	E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth Chang, John Wiley.
R2	E-Commerce, S.JaiswalGalgotia.
R3	E-Commerce, Efrain Turbon, Jae Lee, David King, H.Michael Chang.
R4	Electronic Commerce Gary P.Schneider — Thomson.
R5	E-Commerce — Business, Technology, Society, Kenneth C.Taudon, Carol GuyericoTraver
W1	https://www.edx.org/learn/ecommerce
W2	https://www.coursera.org/courses?query=e-commerce

Course Outcomes: On completion of this course, students can	
CO1	Ability to identify the business relationships between the organizations and their customers
CO2	Ability to perform various transactions like payment, data transfer.
CO3	Evaluate Knowledge with Supply Chain Management.
CO4	Understand the Desktop video processing and Video Conferencing
CO5	Identify the Importance of Advertising and Marketing in on line processing

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

STATISTICS AND R PROGRAMMING			
Subject Code	18XXITO70MC	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1:Introduction	**Hours**
How to run R, R Sessions and Functions, Basic Math, Variables, Data Types,Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.	**08**
Unit -2:R Programming Structures, Control Statements, Loops	
Looping Over Non-vector Sets,- If-Else,Arithmetic and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree.	**10**
Unit – 3: Math and Simulation in R	
Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima-Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input/output, Accessing the Keyboard and Monitor, Reading and writer Files	**10**
Unit – 4: Graphics	
Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.	**10**
Unit – 5: Linear Models	
Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, - Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests	**12**

Text(T) / Reference(R) Books:	
T1	The Art of R Programming, Norman Matloff, Cengage Learning
T2	R for Everyone, Lander, Pearson
R1	R Cookbook, PaulTeetor, Oreilly.
R2	R in Action,RobKabacoff, Manning
W1	https://www.edx.org/learn/r-programming
W2	https://www.coursera.org/learn/r-programming

Course Outcomes: On completion of this course, students can	
CO1	List motivation for learning a programming language
CO2	Access online resources for R and import new function packages into the R workspace
CO3	Import, review, manipulate and summarize data-sets in R
CO4	Explore data-sets to create testable hypotheses and identify appropriate statistical tests
CO5	Perform appropriate statistical tests using R Create and edit visualizations

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

CLOUD COMPUTING			
Subject Code	18XXITO80MA	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Unit -1: INTRODUCTION	**Hours**
Where Are We Today, What Is Cloud Computing, Cloud Deployment Models, Private vs. Public Clouds, Business Drivers for CloudComputing, Introduction to Cloud Technologies. *INFRASTRUCTURE AS A SERVICE*: Storage as a Service: Amazon Storage Services, Compute as a Service: Amazon Elastic Compute Cloud (EC2), HP Cloud System Matrix, Cells-as-a-Service.	**10**
Unit -2: PLATFORM AS A SERVICE	
Windows Azure, A "Hello World" Example, Example: Passing a Message, Azure Test and Deployment, Technical Details of the Azure Platform, Azure Programming Model, Using Azure Cloud Storage Services, Handling the Cloud Challenges, Designing Pustak Portal in Azure, Google App Engine, Platform as a Service: Storage Aspects, Apache Hadoop, Mashups. *SOFTWARE AS A SERVICE:*CRM as a Service, Salesforce.com, Social Computing Services, Document Services: Google Docs.	**10**
Unit – 3: PARADIGMS FOR DEVELOPING CLOUD APPLICATIONS	
Scalable Data Storage Techniques, MapReduce Revisited, Rich Internet Applications. *ADDRESSING THE CLOUD CHALLENGES:*Scaling Computation, Scale Out versus Scale Up, Amdahl's Law, Scaling Cloud Applications with a Reverse Proxy, Hybrid Cloud and Cloud Bursting: Open Nebula, Scaling Storage, CAP Theorem, Implementing Weak Consistency, Consistency in No SQL Systems, Multi-Tenancy, Multi-Tenancy Levels, Tenants and Users, Authentication, Implementing Multi-Tenancy: Resource Sharing, Case Study: Multi-Tenancy in Salesforce.com, Multi-Tenancy and Security in Hadoop.	**10**
Unit – 4: DESIGNING CLOUD SECURITY	
Cloud Security Requirements and Best Practices, Physical Security, Virtual Security, Risk Management, Risk Management Concepts, Risk Management Process, Security Design Patterns, Defense in Depth, Honeypots, Sandboxes, Network Patterns, Common Management Database, Example: Security Design for a PaaS System, Security Architecture Standards, SSE-CMM, Legal and Regulatory Issues, Selecting a Cloud Service Provider, Cloud Security Evaluation Frameworks.	**10**

Unit – 5: MANAGING THE CLOUD	
Managing IaaS, Managing PaaS, Managing SaaS, Other Cloud- Scale Management Systems, *RELATED TECHNOLOGIES*: Server Virtualization, Two Popular Hypervisors, Storage Virtualization, Grid Computing, Other Cloud- Related Technologies.	**10**

Text(T) / Reference(R) Books:	
T1	Moving to the Cloud:Developing Apps in the New World of Cloud Computing, DinkarSitaram, GeethaManjunath, 1stEdition, Elsevier,2012
R1	“Cloud Computing Bible” Barrie Sosinsky ,1stEdition,Wiley India Pvt Ltd, 2011
R2	“Cloud Computing: A Practical Approach”, Robert Elsenpeter, Toby J. Velte, Anthony T. Velte, ”, 1st Edition, TataMcGraw Hill Education, 2011
W1	https://www.edx.org/learn/cloud-computing
W2	https://www.coursera.org/courses?query=cloud%20computing

Course Outcomes: On completion of this course, students can	
CO1	Summarize importance of cloud computing in real world.
CO2	Identify applications that can be integrated using cloud services.
CO3	Evaluate cloud-based applications.
CO4	Understand the security issues in cloud services.
CO5	Identify the cloud services managing

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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

MOBILE APPLICATION DEVELOPMENT			
Subject Code	18XXITO80MB	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			
Unit -1: Introduction			**Hours**
Get started, build your first app, Activities, Testing, debugging and using support libraries.			**08**
Unit -2: User Interaction			
User Interaction, Delightful user experience, Testing your UI.			**10**
Unit – 3: Background Tasks			
Background Tasks, Triggering, scheduling and optimizing background tasks.			**10**
Unit – 4: Data			
All about data, Preferences and Settings, storing data using SQLite, sharing data with content providers, loading data using Loaders.			**10**
Unit – 5: Permissions			
Permissions, Performance and Security, Firebase and Ad Mob, Publish.			**12**

Text(T) / Reference(R) Books:	
T1	The complete Reference Java, 9th edition, Herbert Scheldt,TMH.
T2	Programming in JAVA, Sachin Malhotra, SaurabhChoudary, Oxford.
R1	JAVA Programming, K.Rajkumar.Pearson
R2	Core JAVA, Black Book, Nageswara Rao, Wiley, Dream Tech
R3	Core JAVA for Beginners, Rashmi Kanta Das, Vikas.
R4	Object Oriented Programming Through Java, P. Radha Krishna, Universities Press.
W1	https://www.edx.org/learn/app-development
W2	https://www.coursera.org/courses?query=mobile%20app%20develop ment

Course Outcomes: On completion of this course, students can	
CO1	Understand the history behind the Java technology, its features and strengths
CO2	Implement the basic principles of Object-Oriented Programming which includes inheritance, polymorphism, encapsulation and abstraction.
CO3	Understand the exception programming techniques by describing and encapsulating exceptions.
CO4	Understand the Thread concepts and Collections Framework in java. N
CO5	Create rich user-interface applications using modern API's such as JAVAFX.

Course Outcomes to Program Outcomes Mapping: (1: Low, 2: Medium, 3: High)

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