REGULATIONS COURSE STRUCTURE AND SYLLABUS

SITE18M REGULATIONS

For

Computer Science and Engineering

With effective from the Academic Year

2020-21

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 2020-21 and they are called as "SITE18M" 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 program in the first year

j. “Lateral entry Students” Means student enrolled into the four year program 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. Computer Science and Technology(CST)
4. Electronics and Communication Engineering(ECE)
5. Electronics and Communication Technology(ECT)
6. Electrical and Electronics Engineering(EEE)
7. Information Technology(IT)
8. Mechanical Engineering(ME)

- 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 fulfill the requirements for conferment of degree.
- Each theory course shall consist of five units.

1.3.2. 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 Program 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.

1.3.3. 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 relations between teachers and students and building of character. Induction program covers:

- Physical activity
- Creative arts
- Universal human values
- Literary and Proficiency modules
- Lectures by Eminent peoples

1.4Admission 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.

2. Award of B. Tech. Degree

a) A student will be declared eligible for the award of B. Tech. Degree if he fulfils the following academic regulations:

i. A student shall be declared eligible for the award of B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall forfeit their seat in B.Tech course and their admission stands cancelled.

ii. The candidate shall register for 160 credits and secure all the 160 credits.

b) The medium of instruction for the entire under graduate program in Engineering &Technology will be in **English** only.

3. Program Pattern:

a) Total duration of the of B. Tech (Regular) Program is four academic years

b) Each Academic year of study is divided into Two Semesters.

c) Minimum number of instruction days in each semester is 90.

d) Grade points, based on percentage of marks awarded for each course will form the basis for calculation of SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average).

e) The total credits for the Program is 160.

f) Three week induction program is mandatory for all first year UG students and shall be conducted as per AICTE/UGC/APSCHE guidelines.

g) Student is introduced to “Choice Based Credit System (CBCS)”.

h) A pool of interdisciplinary and job-oriented mandatory skill courses which are relevant to the industry are integrated into the curriculum of concerned branch of engineering (total five skill courses: two basic level skill courses, one on soft skills and other two on advanced level skill courses)

i) A student has to register for all courses in a semester.

j) All the registered credits will be considered for the calculation of final CGPA.

k) Each semester has - ‘Continuous Internal Evaluation (CIE)’ and ‘Semester End Examination (SEE)’. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC and course structure as suggested by AICTE are followed.

l) A 10 months industry/field mandatory internship, both industry and social, during the summer vacation and also in the final semester to acquire the skills required for job and make engineering graduates to connect with the needs of the industry and society at large.

m) All the students shall be mandatorily registered for NCC, NSS activities and Community Service Project as per the Government and University norms.

n) Each college shall assign a faculty advisor/mentor after admission to each student or group of students from same department to provide guidance in courses registration/career growth/placements/ opportunities for higher studies/GATE/other competitive exams etc.

4. Registration for Courses:

a) In each semester a student shall mandatorily register courses which he/she wishes to pursue within a week from the starting of the class work with the advice of Head of the Department and mentor of the student of the concerned department of the college.

b) If any student wishes to withdraw the registration of the course, he/she shall submit a letter to the Principal of the college through the Head of the Department and mentor within fifteen days.

c) The concerned college shall thoroughly verify and upload the data/courses registered by each student in the university examination center within 20 days. The Principal of the concerned college shall ensure that there no wrong registration courses by the student. The university registration portal will be closed after 20 days.

5. **(a) Award of B. Tech. Degree:** A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

i. A student shall be declared eligible for award of the B. Tech Degree, if he pursues a course of study in not less than four and not more than eight academic years. After eight academic years from the year of their admission, he/she shall **forfeit** their seat in B. Tech course and their admission stands cancelled.

ii. The student shall register for 160 credits and must secure all the 160 credits.

iii. All students shall mandatorily register for the courses like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc., shall be included in the curriculum as non-credit mandatory courses. Environmental Sciences is to be offered compulsorily as mandatory course for all branches. A student has to secure at least 40% of the marks allotted in the internal evaluation for passing the course and shall maintain 75% of attendance in the subject.

iv. All students shall mandatorily register for NCC/NSS activities and will be required to participate in an activity specified by NSS officer during second and third semesters. Grade shall be awarded as Satisfactory or Unsatisfactory in the mark sheet on the basis of participation, attendance, performance and behavior. If a student gets an unsatisfactory Grade, he/she shall repeat the above activity in the subsequent years, in order to complete the degree requirements.

v. Credits are defined as per AICTE norm**(b) Award of B. Tech. (Honor)/B. Tech. (Minor):** B. Tech. with Honors or a B. Tech. with a Minor will be awarded if the student earns 20 additional credits are acquired as per the regulations/guidelines. The regulations/guidelines are separately provided. Registering for an Honors/Minor is optional.

6. Attendance Requirements

a) A student is eligible to write the University examinations if he acquires a minimum of 40% in each subject and 75% of attendance in aggregate of all the subjects.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above, and below 75%) may be granted by the College Academic Committee. However, this Condonation concession is applicable only to any two semesters during the entire program.

c) Shortage of Attendance below 65% in aggregate shall not be condoned.

d) A student who is short of attendance in a semester may seek re-admission into that semester when offered within 4 weeks from the date of commencement of class work.

e) Students whose shortage of attendance is not condoned in any semester are not eligible to write their end semester examination of that class.

f) A stipulated fee of Rs. 1000/- in the concerned semester shall be payable towards Condonation of shortage of attendance. Students availing Condonation on medical ground shall produce a medical certificate issued by the competitive authority.

g) A student will be promoted to the next semester if he satisfies the (i) attendance requirement of the present semester and (ii) minimum required credits.

h) If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission into the same class.

i) For induction program attendance shall be maintained as per AICTE norms.

j) For non-credit mandatory courses the students shall maintain the attendance similar to credit courses

7. Evaluation-Distribution and Weightage of marks

i. Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the University Examination section from time to time.

ii. To maintain the quality, external examiners and question paper setters shall be selected from reputed institutes like IISc, IITs, IIITs, IISERs, NITs and Universities.

iii. For non-credit mandatory courses, like Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge, the student has to secure 40% of the marks allotted in the internal evaluation for passing the course. No marks or letter grade shall be allotted for all mandatory non-credit courses.

iv. A student is deemed to have satisfied the minimum academic requirements if he has earned the credits allotted to each theory/practical design/drawing subject/ project etc by securing not less than 35% of marks in the end semester exam and minimum 40% of marks in the sum total of the internal marks and end semester examination marks together.

v. **Distribution and Weightage of marks:**

The assessment of the student's performance in each course will be as per the details given:

S.No.	Components	Internal	External	Total
1	Theory	30	70	100
2	Engineering	30	70	100
3	Practical	15	35	50
4	Mini Project/Internship/Industrial Training/ Skill Development programs/Research Project	-	50	50
5	Project Work	60	140	200

vi. **Continuous Internal Theory Evaluation:**

a) For theory subjects, during a semester, there shall be two mid-term examinations. Each mid-term examination consists of (i) one online objective examination (20 multiple choice questions) for 10 marks for duration of 20 minutes (ii) one descriptive examination (3 full questions for 5 marks each) for 15 marks for duration of 90 minutes and (iii) one assignment for marks. All the internal exams shall be conducted as per university norms from first 50% of the syllabi.

b) In the similar lines, the second online, descriptive examinations assignment shall be conducted on the rest of the 50% syllabus.

c) The total marks secured by the student in each mid-term examination are evaluated for 30 marks. The first mid marks (Mid-1) consisting of marks of online objective examination, descriptive examination and assignment shall be submitted to the University examination section within one week after completion of first mid examination.

d) The mid marks submitted to the University examination section shall be displayed in the concerned college notice boards for the benefit of the students.

e) If any discrepancy found in the submitted Mid-1 marks, it shall be brought to the notice of university examination section within one week from the submission.

f) Second mid marks (Mid-2) consisting of marks of online objective examination, descriptive examination and assignment shall also be submitted to University examination section within one week after completion of second mid examination and it shall be displayed in the notice boards. If any discrepancy found in the submitted mid-2 marks, it shall be brought to the notice of university examination section within one week from the submission.

g) Internal marks can be calculated with 80% Weightage for better of the two mids and 20% Weightage for other mid exam.

Example:

Mid-1 marks = Marks secured in

(Online examination-1 + descriptive examination-1 +one assignment-1)

Mid-2 marks = Marks secured in

(Online examination-2+descriptive examination-2+one assignment-2)

Final internal Marks = (Best of (Mid-1/Mid-2) marks x 0.8 + Least of (Mid-1/Mid-2) marks x 0.2)

h) With the above criteria, university examination section will send mid marks of all subjects in consolidated form to all the concerned colleges and same shall be displayed in the concerned college notice boards. If any discrepancy found, it shall be brought to the notice of university examination section through proper channel within one week with all proofs. Discrepancies brought after the given deadline will not be entertained under any circumstances.

vii. Semester End Theory Examinations Evaluation:

a) The semester end examinations will be conducted university examination section for 70 marks consists of five questions carrying 14 marks each. Each of these questions is from one unit and may contain sub-questions. For each question there will be an “either” “or” choice, which means that there will be two questions from each unit and the student should answer either of the two questions.

b) For practical subjects there shall be continuous evaluation during the semester for 15 internal marks and 35 end examination marks. The internal 15 marks shall be awarded as follows: day to day work - 5 marks, Record-5 marks and the remaining 5 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the teacher concerned and external examiner appointed.

c) For the subject having design and / or drawing, (such as Engineering Graphics, Engineering Drawing, Machine Drawing) and estimation, the distribution shall be 30 marks for internal evaluation (15 marks for continuous Assessment (day–to–day work) and 15 marks for internal tests) and 70 marks for end examination. There shall be two internal tests in a Semester for 15 marks each and final marks can be calculated with 80%

Weightage for better of the two tests and 20% Weightage for other test and these are to be added to the marks obtained in day to day work.

d) Evaluation of the summer internships: It shall be completed in collaboration with local industries, Govt. Organizations, construction agencies, Industries, Hydel and thermal power projects and also in software MNCs in the area of concerned specialization of the UG program. Students shall pursue this course during summer vacation just before its offering as per course structure. The minimum duration of this course is at least 6 weeks. The student shall register for the course as per course structure after commencement of academic year. A supervisor/mentor/advisor has to be allotted to guide the students for taking up the summer internship. The supervisor shall monitor the attendance of the students while taking up the internship. Attendance requirements are as per the norms of the University. After successful completion, students shall submit a summer internship technical report to the concerned department and appear for an oral presentation before the departmental committee consists of an external examiner; Head of the Department; supervisor of the internship and a senior faculty member of the department. A certificate from industry/skill development center shall be included in the report. The report and the oral presentation shall carry 40% and 60% Weightage respectively. It shall be evaluated for 50 external marks at the end of the semester. There shall be no internal marks for Summer Internship. A student shall secure minimum 40% of marks for successful completion. In case, if a student fails, he/she shall reappear as and when semester supplementary examinations are conducted by the University.

e) The job oriented skill courses may be registered at the college or at any accredited external agency. A student shall submit a record/report on the on the list skills learned. If the student completes job oriented skill course at external agency, a certificate from the agency shall be included in the report. The course will be evaluated at the end of the semester for 50 marks (record: 15 marks and viva-voce: 35 marks) along with laboratory end examinations in the presence of external and internal examiner (course instructor or mentor). There are no internal marks for the job oriented skill courses.

f) Mandatory Course (M.C): Environmental Sciences, Universal Human Values, Ethics, Indian Constitution, Essence of Indian Traditional Knowledge etc non-credit (zero credits) mandatory courses. Environmental Sciences shall be offered compulsorily as mandatory course for all branches. A minimum of 75% attendance is mandatory in these subjects. There shall be an external examination for 70 marks and it shall be conducted by the college internally. Two internal examinations shall be conducted for 30 marks and a student has to secure at least 40% of the marks for passing the course. There is no online internal exam for mandatory courses. No marks or letter grade shall be printed in the transcripts for all mandatory non-credit courses, but only Completed (Y)/Not-completed (N) will be specified.

g) **Procedure for Conduct and Evaluation of MOOC:** There shall be a Discipline Centric Elective Course through Massive Open Online Course (MOOC) as Program Elective course. The student shall register for the course (Minimum of 12 weeks) offered by SWAYAM/NPTEL through online with the approval of Head of the Department. The Head of the Department shall appoint one mentor for each of the MOOC subjects offered. The student needs to register the course in the SWAYAM/NPTEL portal. During the course, the mentor monitors the student's assignment submissions given by SWAYAM /NPTEL. The student needs to submit all the assignments given and needs to take final exam at the proctor center. The student needs to earn a certificate by passing the exam. The student will be awarded the credits given in curriculum only by submission of the certificate. In case if student does not pass subjects registered through SWAYAM/NPTEL, the same or alternative equivalent subject may be registered again through SWAYAM/NPTEL in the next semester with the recommendation of HOD and shall be pass.

h) Major Project (Project - Project work, seminar and internship in industry):

In the final semester, the student should mandatorily register and undergo internship and in parallel he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report. A student shall also be permitted to submit project report on the work carried out during the internship. The project report shall be evaluated with an external examiner.

Evaluation: The total marks for project work 200 marks and distribution shall be 60 marks for internal and 140 marks for external evaluation. The supervisor assesses the student for 30 marks (Report: 15 marks, Seminar: 15 marks). At the end of the semester, all projects shall be showcased at the department for the benefit of all students and staff and the same is to be evaluated by the departmental Project Review Committee consisting of supervisor, a senior faculty and HOD for 30 marks. The external evaluation of Project Work is a Viva-Voce Examination conducted in the presence of internal examiner and external examiner and is evaluated for 140 marks.

8 Results Declaration:

i. Before results declaration, an academic council meeting shall be conducted and results shall be placed before the academic council for approval.

ii. With the approval of academic council, the results shall be submitted to the University to get the Approval from Honourable Vice-Chancellor.

iii. The University may normalize the result, if required, before declaration of the result (Guidelines for normalization will be provided separately)

iv. A copy of approved results in a CD shall be submitted to the University Examination Center.

9. **Academic Audit:** Academic audit in each semester will be conducted as per norms.

10. **Recounting or Re-evaluation of Marks in the End Semester Examination:** A student can request for recounting of revaluation of his/her answer book on payment of a prescribed fee as per norms.

11. **Supplementary Examinations:** A student who has failed to secure the required credits can appear for a supplementary examination, as per the schedule announced by the University.

12. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/End examinations as per the rules framed by the University.

13. **Promotion Rules:** The following academic requirements have to be satisfied in addition to the attendance requirements mentioned in <u>item no.5 for</u> promotion to higher classes

a) A student shall be promoted from first year to second year if he fulfills the minimum attendance requirement as per University norm.

b) A student will be promoted from II year to III year if he fulfills the academic requirement of 40% of credits up to either II year I-Semester or II year II-Semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in II year II semester.

c) A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

14. Course Pattern

a) The entire course of study is for four academic years; all years are on semester pattern.

b) A student eligible to appear for the end semester examination in a subject, but absent from it or has failed in the end semester examination, may write the exam in that subject when conducted next.

c) When a student is detained for lack of credits / shortage of attendance, he may be re-admitted into the same semester/year in which he has been detained. However, the academic regulations under which he was first admitted shall continue to be applicable to him.

15. Earning of Credit:

A student shall be considered to have completed a course successfully and earned the credits if he/she secures an acceptable letter grade in the range A+ to E as given below. Letter grade 'F' in any course implies failure of the student in that course and no credits earned. Absent is also treated as no credits earned. For project same % percentages will be followed for grading.

Marks Range Max:100	**Marks range Max:50**	**Level**	**Letter Grade**	**Grade point**
≥ 90	≥ 45	Outstanding	A+	10
≥80 to <89	≥40 to <44	Excellent	A	9
≥70 to <79	≥35 to <39	Very Good	B	8
≥60 to <69	≥30 to <34	Good	C	7
≥50 to <59	≥25 to <29	Fair	D	6
≥40 to <49	≥20 to <24	Satisfactory	E	5
<40	<20	Fail	F	0
-		Absent	AB	0

16. Award of Class:

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

Class Awarded	**CGPA to be secured**	**Remarks**
First Class with Distinction	≥7.75 (Without any supplementary appearance)	From the

First Class	≥ 6.75	CGPA secured from 160 Credits
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

17. Minimum Instruction Days:

The minimum instruction days for each semester shall be 90 working days. There shall be no branch transfers after the completion of the admission process. There shall be no transfer from one college/stream to another within the Constituent Colleges and Units of Jawaharlal Nehru Technological University Kakinada.

18. Withholding of Results:

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

19. Transitory Regulations

a) Discontinued or detained candidates are eligible for re-admission as and when next offered.

b) The re-admitted candidate will be governed by the rules & regulations under which the candidate has been admitted.

c) In case of transferred students from other Universities, credits shall be transferred to JNTUK as per the academic regulations and course structure of JNTUK.

d) The students seeking transfer to colleges affiliated to JNTUK from various other Universities / Institutions have to obtain the credits of any equivalent subjects as prescribed by JNTUK. In addition, the transferred candidates have to pass the failed subjects at the earlier Institute with already obtained internal/sessional marks to be conducted by JNTUK.

20. Gap – Year:

Gap Year concept of Student Entrepreneur in Residence shall be introduced and outstanding students who wish to pursue entrepreneurship are allowed to take a break of one year at any time after I/II/III year to pursue entrepreneurship full time. This period shall be counted for the maximum time for graduation. An evaluation committee at university level shall be constituted to evaluate the proposal submitted by the student and the committee shall decide on permitting the student for availing the Gap Year.

21. General:

a) Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.

d) The University may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the University.

ACADEMIC REGULATIONS (SITE18M) FOR B. Tech

(LATERAL ENTRY SCHEME)

Applicable for the students admitted into II year B. Tech. from the Academic Year 2021-22 onwards

1. Award of B. Tech. Degree

A student will be declared eligible for the award of B. Tech. Degree if he fulfills the following academic regulations:

a) A student shall be declared eligible for the award of the B. Tech Degree, if he pursues a course of study in not less than three academic years and not more than six academic years. After six academic years from the year of their admission, he/she shall forfeit their seat in B. Tech course and their admission stands cancelled.

b) The candidate shall register for 122 credits and secure all the 122 credits.

2. The attendance regulations of B. Tech. (Regular) shall be applicable to B. Tech (lateral entry)

3. **Promotion Rules:** A student shall be promoted from second year to third year if he fulfills the minimum attendance requirement.

A student shall be promoted from III year to IV year if he fulfills the academic requirements of 40% of the credits up to either III year I semester or III year II semester from all the examinations, whether or not the candidate takes the examinations and secures prescribed minimum attendance in III year II semester.

4. **Award of Class**

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

Class Awarded	CGPA to be secured	Remarks
First Class with Distinction	≥ 7.75 (Without any supplementary appearance)	From the CGPA secured from 121 Credits from II Year to IV Year
First Class	≥ 6.75	
Second Class	≥ 5.75 to < 6.75	
Pass Class	≥ 5.00 to < 5.75	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

5. All the other regulations as applicable to **B. Tech. 4-year degree course (Regular) will hold good for B. Tech. (Lateral Entry Scheme)**

COMMUNITY SERVICE PROJECT

Introduction

1. Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development

2. Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.

3. Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

1. To sensitize the students to the living conditions of the people who are around them,

2. To help students to realize the stark realities of the society.

3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability

4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.

5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.

6. To help students to initiate developmental activities in the community in coordination with public and government authorities.

7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

1. Every student should put in a minimum of **180 hours** for the Community Service Project during the summer vacation

2. Each class/section should be assigned with a mentor.

3. Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc

4. A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded. The log book has to be countersigned by the concerned mentor/faculty in charge.

5. Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.

6. The final evaluation to be reflected in the grade memo of the student.

7. The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.

8. Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.

9. Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

1. A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.

2. The Community Service Project is a two fold one

   a) First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers; rather, it could be another primary source of data.

   b) Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –

      - Agriculture
      - Health
      - Marketing and Cooperation

- Animal Husbandry
- Horticulture
- Fisheries
- Sericulture
- Revenue and Survey
- Natural Disaster Management
- Irrigation
- Law & Order
- Excise and Prohibition
- Mines and Geology
- Energy
- Internet
- Free Electricity
- Drinking Water

EXPECTED OUTCOMES **BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS**

Learning Outcomes

1. Positive impact on students' academic learning.

2. Improves students' ability to apply what they have learned in "the real world".
3. Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
4. Improved ability to understand complexity and ambiguity.

Personal Outcomes

1. Greater sense of personal efficacy, personal identity, spiritual growth, and moral development.
2. Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

1. Reduced stereotypes and greater inter-cultural understanding
2. Improved social responsibility and citizenship skills
3. Greater involvement in community service after graduation

Career Development

1. Connections with professionals and community members for learning and career opportunities
2. Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

1. Stronger relationships with faculty
2. Greater satisfaction with college
3. Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

1. Satisfaction with the quality of student learning
2. New avenues for research and publication via new relationships between faculty and community
3. Providing networking opportunities with engaged faculty in other disciplines or institutions
4. A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

1. Improved institutional commitment
2. Improved student retention
3. Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

1. Satisfaction with student participation
2. Valuable human resources needed to achieve community goals
3. New energy, enthusiasm and perspectives applied to community work
4. Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMS UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects.

The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programs
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture
11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programs and their impact
24. Use of chemicals on fruits and vegetables

25. Organic farming
26. Crop rotation
27. Floury culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases
35. Human genetics
36. Blood groups and blood levels
37. Internet Usage in Villages
38. Android Phone usage by different people
39. Utilization of free electricity to farmers and related issues
40. Gender ration in schooling level- observation.

Complimenting the community service project, the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested lists of programs are;

Programs for School Children:

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially relevant themes.

Programs for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharat
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programs
12. Commemoration and Celebration of important days

Programs for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programs

1. Awareness on RTI
2. Health intervention programs
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

1. Students may not have the expertise to conduct all the programs on their own. The students then can play a facilitator role.

2. For conducting special camps like Health related, they will be coordinating with the Government agencies.

3. As and when required the College faculty themselves act as Resource Persons.

4. Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.

5. And also, with the Governmental Departments. If the program is rolled out, the District Administration could be roped in for the successful deployment of the program.

6. An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. Preliminary Survey (One Week)

a) A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.

b) A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.

c) The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (Two Weeks)

Based on the survey and the specific requirements of the habitation, different awareness campaigns and programs to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Program (Four Weeks)

Along with the Community Awareness Programs, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement program will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

Course Numbering Scheme

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

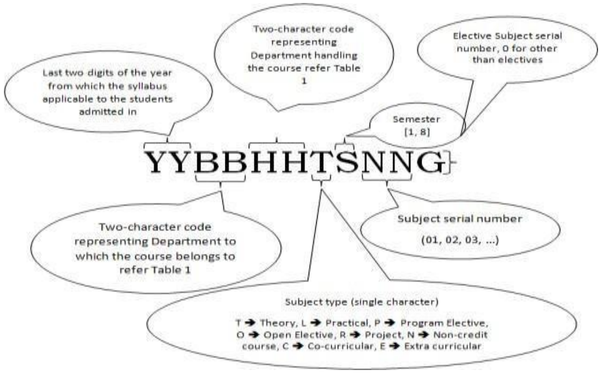

Figure 1: Course Numbering Scheme

The department codes are in given in following table 1.

Table 1: Department Codes

Department	Two-character code
Civil Engineering	CE
Electrical & Electronics Engineering	EE
Mechanical Engineering	ME
Electronics & Communication Engineering	EC
Electronics & Communication Technology	ET
Computer Science and Engineering	CS
Computer Science and Technology	CT
Information Technology	IT

Department	Two-character code
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

Table 2: Comparison of Number of credits given by AICTE and Approved credits

S. No.	Category	No. of Credits									
		ECE/ ECT		EEE		CSE/IT/CST		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	160	160	160	160	160	160	160	160

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	Expulsion from the examination hall and cancellation of the performance in that subject only.

	include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	
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 examination or answer book or additional sheet, during or after the examination.	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.
5.	Uses objectionable, abusive or offensive	Cancellation of the performance

	language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	in that subject.
6.	Refuses to obey the orders of the Chief 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 unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/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.
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.

Ragging

Prohibition of ragging in educational institutions Act 26 of 1997 Salient Features

- Ragging within or outside any educational institution is prohibited.

- Ragging means doing an act which causes or is likely to cause Insult or Annoyance of Fear or Apprehension or Threat or Intimidation or outrage of modesty or Injury to a student.

Department of Computer Science & Engineering

Course Structure

I B. Tech I Semester

S. No.	Code	Title	Hours			Credits
			L	T	P	
01	18CMMAT1010	Engineering Mathematics-I	3	1		4
02	18CSPHT1020	Engineering Physics	3	1		4
03	18CMCST1030	Programming for ProblemSolving	3			3
04	18CMMEL1040	Engineering Graphics	1		4	3
05	18CSPHL1050	Engineering Physics Lab			3	1.5
06	18CMCSL1060	Programming for Problem Solving Lab			4	2
07	18CMMEL1070	Workshop/ManufacturingPractice	0		3	1.5
08	18CMCHN1080	Environmental Science	3			0
Total			**13**	**2**	**14**	**19**

I B. Tech II Semester

S. No.	Code	Title	Hours			Credits
			L	T	P	
01	18CMEGT2010	Technical English	3			3
02	18CMMAT2020	Engineering Mathematics-II	3	1		4
03	18CMCHT2030	Engineering Chemistry	3	1		4
04	18CMEET2040	Basic Electrical Engineering	3	1		4
05	18CMEGL2050	English Communication Skills Lab			2	1
06	18CMCHL2060	Engineering Chemistry Lab			3	1.5
07	18CMEEL2070	Basic Electrical Engineering Lab			3	1.5
08	18CMMSN2080	Indian Constitution, Professional Ethics & Human Rights	3			0
Total			**15**	**3**	**8**	**19**

II B. Tech I Semester

S. No.	Code	Title	Hours			Credits
			L	T	P	
01	18CMMAT3010	Engineering Mathematics- III	3	1		4
02	18CSECT3020	Digital Electronics	3			3
03	18CSECT3030	Analog Electronic Circuits	3			3
04	18CSCST3040	Discrete Mathematics	3	1		4
05	18CSCST3050	Data Structures	3			3
06	18CSECL3060	Analog & Digital Electronics Lab			3	1.5
07	18CSCSL3070	IT Workshop Lab			3	1.5
08	18CSCSL3080	Data Structures Lab			3	1.5
Total			**15**	**2**	**9**	**21.5**

II B. Tech II Semester

S. No.	Code	Title	Hours			Credits
			L	T	P	
01	18CSECT4010	Signals & Systems	3			3
02	18CMCET4020	Engineering Mechanics	3			3
03	18CSCST4030	Computer Organization	3			3
04	18CSCST4040	Algorithm Design and Analysis	3			3
05	18CSCST4050	Java Programming	3			3
06	18CSCSL4060	Computer Organization Lab			3	1.5
07	18CSCSL4070	Algorithm Design and Analysis Lab			3	1.5
08	18CSCSL4080	Java Programming Lab			3	1.5
Total			**15**	**0**	**9**	**19.5**

III B. Tech I Semester

S. No.	Subject			Hours			C
	Code	Type	Title	L	T	P	C
01	18CMMST5010	HS	Management Science	3			3
02	18CSCST5020	PC	Database Management Systems	3			3
03	18CSCST5030	PC	Operating Systems	3			3
04	18CSCSP504X	PE	Professional Elective-I	3			3
05	18CSXX505X	OE	Open Elective-I	3			3
06	18CSCSL5060	PC	Database Management Systems Lab			3	1.5
07	18CSCSL5070	PC	Operating Systems Lab			3	1.5
08	18CMAHS5080	SOC	Soft Skills & Aptitude Builder - 1	2			2
09	18CMBIN5090	MC	Biology for Engineers	2			0
				Total Credits			**20**

III B. Tech II Semester

S. No.	Subject			Hours			
	Code	Type	Title	L	T	P	C
01	18CSCST6010	HS	Engineering Economics & Financial Management	3			3
02	18CSCST6020	PC	Computer Networks	3			3
03	18CSCST6030	PC	Software Engineering	3			3
04	18CSCSP604X	PE	Professional Elective-II	3			3
05	18CSXXO605X	OE	Open Elective-II	3			3
06	18CMMST6060	PC	Automata theory and Compiler Design	3			3
07	18CSCSL6070	PC	Computer Networks Lab			3	1.5
08	18CSCSL6080	PC	Compiler Design Lab			3	1.5
09	18CMAHS6090	SOC	Soft Skills & Aptitude Builder - 2	2			2
				Total Credits			**23**

IV B. Tech I Semester

S. No.	Subject			Hours			C
	Code	Type	Title	L	T	P	
01	18CSCST7010	PC	Data Warehousing and Data Mining	3			3
02	18CSCSP702X	PE	Professional Elective-III	3			3
03	18CSCSP703X	PE	Professional Elective-IV	3			3
04	18CSCSP704X	PE	Professional Elective-V	3			3
05	18CSXXO705X	OE	Open Elective-III	3			3
06	18CSXXO706X	OE	Open Elective-IV	3			3
07	18CSCSL7070	PC	Internet of Things Lab			3	1.5
08	18CSCSL7080	PC	Data Warehousing and Data Mining Lab			3	1.5
09	18CSCSL7090	SOC	MEAN Stack Technologies			4	2
10	18CSCSR7100		Internship				3
				Total Credits			**26**

IV B. Tech II Semester

S. No.	Code	Title	Hours			Credits
			L	T	P	
01	18CSCSR8010	Project Phase -II			24	12
		Total			**24**	**12**

ENGINEERING MATHEMATICS-I			
Subject Code	18CMMAT1010	**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	**Hours**
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.	**10**
Unit -2	
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	**08**
Unit – 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 function of two variables (statement only). Maxima and minima- LaGrange's method of undetermined multipliers	**10**
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 nonlinear (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.	**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 andproblems, surface and volume integrals definition, Green's theorem in a plane, Stokes and Gauss-divergence theorems (without proof) and problems.	**12**

Text(T) / Reference(R) Books:	
T1	Higher Engineering Mathematics, B S Grewal, Khanna Publishers, 44^{th} edition, 2016
T2	Advanced Engineering Mathematics, Erwin Kreyszig, Wiley, 9^{th} edition, 2013
R1	Higher Engineering Mathematics, B V Ramana, Tata Mc Graw-Hill, 2006
R2	A Text Book of Engineering Mathematics, NPBali and Manish Goyal, Laxmi publications
R3	Higher Engineering Mathematics, HKDass and Er. RajnishVerma, S.Chand publishing, 1^{st} edition, 2011.

Course Outcomes: On completion of this course, students can	
CO1	Solve first order differential equations
CO2	Solve linear differential equations with constant coefficients
CO3	Find the extrema of a function
CO4	Solve partial differential equations
CO5	Evaluate multiple integrals
CO6	Verify vector integral theorems

<table>
<tr><td colspan="5">ENGINEERING PHYSICS
Semiconductor Physics & Semiconductor Optoelectronics</td></tr>
<tr><td>Subject Code</td><td>18CSPH1020</td><td>IA Marks</td><td colspan="2">30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3(L) + 1(T)</td><td>Exam Marks</td><td colspan="2">70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>50</td><td>Exam Hours</td><td colspan="2">03</td></tr>
<tr><td colspan="5">Credits – 04</td></tr>
<tr><td colspan="4">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="4">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>10</td></tr>
<tr><td colspan="5">Unit -2</td></tr>
<tr><td colspan="4">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>10</td></tr>
<tr><td colspan="5">Unit – 3</td></tr>
<tr><td colspan="4">Light-semiconductor interaction
Types of Semiconductor materials of interest for optoelectronic devices, band gap modification, Hetero structures, Optical transitions in bulk semiconductors: 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.</td><td>10</td></tr>
<tr><td colspan="5">Unit – 4</td></tr>
</table>

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.	**10**
Unit – 5	
Photo detectors & 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.	**10**

Text(T) / Reference(R) Books:	
T1	Solid State Physics, S O Pillai, New Age Publications
T2	Fundamentals of Photonics, B E A Saleh and M C Teich, John Wiley & Sons
R1	Engineering Physics, Ch Srinivas, Ch Seshubabu, Cengage learning publications
R2	Semiconductor Optoelectronic Devices, P Bhattacharya, Prentice Hall of India, 1997
R3	Semiconductor Optoelectronics, M R Shenoy, NPTEL Course
R4	Optoelectronic Materials and Devices, Monica Katiyar and Deepak Gupta, NPTEL Course

Course Outcomes: On completion of this course, students can	
CO1	Explain the conducting mechanism in metals
CO2	Estimate the concentration of charge carriers
CO3	Describe light-semiconductor interaction
CO4	Illustrate the working function of LEDs and diode lasers
CO5	Illustrate the working function of photo detectors
CO6	Illustrate the working function of solar cells

PROGRAMMING FOR PROBLEM SOLVING (Common for all programs)			
Subject Code	18CMCST1030	**IA Marks**	30
Number of Lecture Hours/Week	03	**EA Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits - 03			
Unit-I: Introduction to computer systems and programming			**Hours**
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.			**08**
Unit-II: C Expressions, evaluation and control statements			
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. Unions, Union within union, Structure within union, Union within structure, self-referential structures, bitfields, enumerations.			**12**
Unit-III: Arrays and Functions			
Arrays Introduction, 1-D Arrays, Character arrays and string representation, 2-D Arrays(Matrix), Multi-Dimensional Arrays.			**10**

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)	
Unit-IV: Derived and User Defined Data types	
Pointers Understanding Pointers, Pointer expressions, Pointer and Arrays, Pointers andStrings, 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	**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.	**08**

Text(T) / Reference(R) Books:	
T1	Computer Programing ANSI C, E Balagurusamy, McGraw Hill Education
T2	Programming in C, Reema Thareja, Second Edition, Oxford Higher Education
R1	Computer Basics and C Programming, V Raja Raman, Second Edition
Course Outcomes: On completion of this course, students can	
CO1	Formulate algorithms, translate them into programs and correct program errors
CO2	Choose right control structures suitable for the problem to be solved
CO3	Decompose reusable code in a program into functions (Iterative and recursive)
CO4	Use arrays, pointers, structures and unions appropriately
CO5	Explain Memory allocation strategies

ENGINEERING GRAPHICS			
Subject Code	18CMMEL1040	**IA Marks**	30
Number of Lecture Hours/Week	1(L)+4(P)	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

Unit -1	**Hours**
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;	**10**
Unit -2	
Projections of Points and lines inclined to both planes; Projections of planes inclined to one plane	**08**
Unit – 3	
Projections of Solids – Prisms, Pyramids, Cones and Cylinders with the axis inclined to one of the planes	**10**
Unit – 4	
Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone	**10**
Unit – 5	

Isometric Projections 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	**12**

Text(T) / Reference(R) Books:	
T1	Engineering Drawing, NDBhatt, Chariot Publications
T2	Engineering Drawing + AutoCAD, K Venugopal, V. Prabhu Raja, New Age Publishers
R1	Engineering Drawing, Agarwal & Agarwal, Tata McGraw Hill Publishers
R2	Engineering Drawing, KLNarayana& P Kannaiah, SciTech Publishers
R3	Engineering Graphics for Degree, KC John, PHI Publishers
R4	Engineering Graphics, PI Varghese, McGrawHill Publishers

Course Outcomes: On completion of this course, students can	
CO1	Construct Polygons using general methods, inscribe and describe polygons oncircles,draw curves (parabola, ellipse and hyperbola, cycloids, involutes) by general methods
CO2	Read, Interpret and Construct plain scales, diagonal scales and Vernier scales
CO3	Draw orthographic projections of points, lines, Planes & Solids inclined to one reference plane and apply these concepts to solve practical problems related to engineering
CO4	Draw sections and sectional views of Solids
CO5	Draw isometric view of lines, plane figures and simple solids, Convert given isometricviews into orthographic views, and apply these concepts to solve practical problems related to engineering
CO6	Draw objects using draw and modify toolbars of AutoCAD

ENGINEERING PHYSICS LABORATORY			
Subject Code	18CSPHL1050	**IA Marks**	15
Number of Practice Hours/Week	3(P)	**Exam Marks**	35
Total Number of Practice Hours	36	**Exam Hours**	03
Credits – 1.5			

List of Experiments

Exercise 1 Study the atomic levels in Neon- Argon gases-Franck- Hertz experiment.

Exercise 2 Determine the resistivity of wire using four probe methods.

Exercise 3 Determine the Boltzmann constant using PN junction diode.

Exercise 4 Determine the Energy band gap of P-N junction diode.

Exercise 5 Determine the Hall coefficient-Hall effect.

Exercise 6 Study the spectral response of photo diode-Planck's constant.

Exercise 7 Draw the LED current-voltage characteristics.

Exercise 8 Draw the diode laser (LD) current-voltage characteristics.

Exercise 9 Draw the Photo diode current-voltage characteristics.

Exercise 10 Measure the current-voltage characteristics of a solar cell (Photovoltaic cell) at differentlight intensities.

Course Outcomes: On completion of this course, students can	
CO1	Understand the existence of the energy levels in gases
CO2	Study the resistivity variation with temperature in conductor
CO3	Determine the energy band gap of semiconductor diode
CO4	Understand the phenomenon of Hall Effect
CO5	Understand the interaction of the light with semiconductor
CO6	Study the characteristic curves of the LEDs, Laser diode & Solar cells

PROGRAMMING FOR PROBLEM SOLVING LAB

(Common for all branches)

Subject Code	18CMCSL1060	**IA Marks**	15
Number of Practice Hours/Week	4(P)	**Exam Marks**	35
Total Number of Practice Hours	48	**Exam Hours**	03

Credits - 02

List of Experiments Exercise 1 (Familiarization with programming environment)

a) Familiarization of CODE BLOCKS C++ Editor to edit, compile, execute, test anddebugging 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 formulaarea = 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 bitwiseoperator, 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 givennumber.

b) Write a C program to generate all the prime numbers between two numbers suppliedby the user.

c) Write a C Program to print the multiplication table corresponding to number suppliedas 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

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 errormessage “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 its 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: On completion of this course, students can	
CO1	Attain knowledge on using CODE BLOCKS and RAPTOR tools in solving problems
CO2	Examine and analyze alternative solutions to a problem
CO3	Design asolution to a problem using problem decomposition and step-wise refinement
CO4	Demonstrate conversion of iterative functions to recursive and vice-versa

CO5	Demonstrate usage of arrays, structures and unions
CO6	Demonstrate reading from and writing to files along with simple file operations

WORKSHOP/MANUFACTURING PRACTICE			
Subject Code	18CMMEL1070	**IA Marks**	15
Number of Practice Hours/Week	3(P)	**Exam Marks**	35
Total Number of Practice Hours	36	**Exam Hours**	03
Credits – 1.5			

List of Experiments

Exercise 1 (lectures & Videos)

Manufacturing Methods: casting, forming, machining, Joining, Advanced methods

CNC machining, Additive manufacturing

Exercise 2 (lectures & Videos)

Fitting operations & power tools

Electrical & Electronics c) Carpentry

Exercise 3(lectures & Videos)

Plastic molding, glass cutting

Metal casting

Welding (arc welding & gas welding), brazing

Exercise 4(Black smithy)

S-Hook b) Square Rod to Round Rod

Exercise 4(Carpentry)

T-Lap Joint

Cross Lap Joint

Exercise 6(Foundry)

Mold for solid

Mold for split pattern

Exercise 7(Fitting)

Square fitting

V-fitting

Exercise 8(Welding)

Butt Joint

Lap Joint

Exercise 9(Machine Tools) Turning Knurling **Exercise 10(Plastic Molding)** Key Chain Molding

Course Outcomes: On completion of this course, students can	
CO1	Make use of basic carpentry joints to make furniture
CO2	Fabricate mechanical engineering assemblies using fitting joints
CO3	Produce various machine components by using foundry, black smithy, machining and plastic molding techniques

<table>
<tr><td colspan="4">ENVIRONMENTAL SCIENCE</td></tr>
<tr><td>Subject Code</td><td>18CMCHN1080</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>04</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 – 00</td></tr>
<tr><td colspan="3">Unit -1 (MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES)</td><td>Hours</td></tr>
<tr><td colspan="3">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, Structure and function, Producers, consumers and decomposers, Energyflow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure andfunction of the different ecosystems</td><td>10</td></tr>
<tr><td colspan="4">Unit -2 (RESOURCES)</td></tr>
<tr><td colspan="3">Natural Resources Renewable and non-renewable resources, Natural resources and associatedproblems
Forest resources Use and over exploitation, deforestation, Timber extraction, Mining, dams andother effects on forest and tribal people
Water resources Use and over utilization of surface and ground water, Floods, drought, conflictsover water, dams – benefits and problems
Mineral resources Use and exploitation, environmental effects of extracting and using mineralresources.
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 ofalternate energy sources.
Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.</td><td>12</td></tr>
</table>

Endangered andendemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.	
Unit – 3 (BIODIVERSITY AND ITS CONSERVATION)	
Introduction, Definition, genetic, species and ecosystem diversity,	**06**
Bio geographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aestheticand option values, Biodiversity at global, National and local levels. India as a mega-diversity nation, Hot-spots ofbiodiversity, Threats to biodiversity: habitat loss,	
Unit – 4	
Environmental Pollution Definition, Cause, effects and control measures of :Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards **Solid waste Management** Causes, effects and control measures of urban and industrial wastes, Role of an individual in prevention of pollution, Pollution case studies.	**12**
Unit – 5	
Social Issuesand 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 Acts** 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.	**10**

Text(T) / Reference(R) Books:	
T1	Environmental Studies, E Bharucha, University Publishing Company, New Delhi, 2003
T2	Environmental Science and Engineering, JG Henry and GW Heinke, 2^{nd} edition, Prentice Hall of India, New Delhi, 2004
T3	Introduction to Environmental Engineering and Science, G M Masters, 2^{nd} edition, Prentice Hall of India, New Delhi, 2004
R1	Environmental Studies, Deeshita Dave & P Udaya Bhaskar, Cengage Learning
R2	Environmental Studies, KVSGMurali Krishna, VGS Publishers, Vijayawada
R3	Environmental Studies, PNPaliniswamy, P Manikandan, A Geeta and K Manjula Rani, Pearson Education

Course Outcomes: On completion of this course, students can	
CO1	Explain importance of Environmental studies and the measures to be taken to overcome global environmental challenges
CO2	Describe the concept of ecosystem and its diversity
CO3	Describe knowledge on natural resources
CO4	Explain concept of biodiversity
CO5	Explain knowledge on environmental pollution
CO6	Debate knowledge on environmental legislation and global treaties

II SEMESTER (I-II)

<table>
<tr><th colspan="4">TECHNICAL ENGLISH</th></tr>
<tr><td>Subject Code</td><td>18CMEGT2010</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/ Week</td><td>2(T)</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>30</td><td>Exams Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits -02</td></tr>
<tr><td colspan="3">Unit-1 (Principles of Scientific Vocabulary)</td><td>Hours</td></tr>
<tr><td colspan="3">short and simple words, compact substitutes for wordy phrases, redundant words and expressions, Avoid hackneyed and stilted phrases, verbosity and incorrect use of words, role of roots in word building, prefixes and suffixes, confusing words and expressions. 1-4 chapters of Karmayogi non-detail text book (N1)</td><td>10</td></tr>
<tr><td colspan="4">Unit-2 (Writing Skills)</td></tr>
<tr><td colspan="3">Distinguishing between academic and personal styles of writing, use of clauses in technical phrases and sentences, Techniques of Sentence and paragraph writing, Measuring the clarity of a text through Fog Index or Clarity Index 5-8 chapters of Karmayogi non-detail text book (N1)</td><td>10</td></tr>
<tr><td colspan="4">Unit-3 (Common Errors in Writing)</td></tr>
<tr><td colspan="3">Subject-verb agreement, 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 9-12 chapters of Karmayogi non-detail text book (N1)</td><td>10</td></tr>
<tr><td colspan="4">Unit-4 (Nature and Style of Sensible Technical Writing)</td></tr>
<tr><td colspan="3">Academic Writing Process, Describing, processes</td><td>10</td></tr>
<tr><td colspan="4">Unit-5 (Report writing and Letter writing)</td></tr>
<tr><td colspan="3">Writing Technical Reports, Précis writing, Letter Writing, Essay writing 17-20 chapters of Karmayogi non-detail text book (N1)</td><td>10</td></tr>
</table>

Text(T) / Reference(R) Books:	
T1	Effective Technical Communication by Barun K Mitra, Oxford University Publication
N1	Karmayogi: A Biography of E Sreedharan, M S Ashokan

R1	Communication Skills, Sanjay Kumar &PushpaLatha, OUP
R2	Study Writing, Liz Hamp-Lyons and Ben Heasly, Cambridge University Press
R3	Remedial English Grammar, F T Wood, Macmillan 2007
R4	Practical English Usage, Michael Swan, Oxford University Press
R5	English Collocations in Use, Michael McCarthy & Felicity O'Dell
R6	Effective Technical Communication, Arsahf Rizvi
R7	Essential English Grammar, Raymond Murphy, CUP, 2017

Course Outcomes: On completion of this course, students can	
CO1	Use scientific vocabulary confidently
CO2	Apply basic principles of writing clear sentences and paragraphs
CO3	Writeerror free simple technical passages
CO4	Frame sentences corresponding to different writing styles
CO5	Confidently write clear and coherent letters and technical reports
CO6	Convert inspirations in the form of achievements and values upheld by renowned technocrats to write-ups

ENGINEERING MATHEMATICS-II			
Subject Code	18CMMAT2020	**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 (Linear Algebra)	**Hours**
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, Diagonalization of a square matrix. Cayley-Hamilton theorem (without proof), Reduction of Quadratic form to Canonical form.	**10**
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) Applications: Solving ordinary differential equations (initial value problems) using Laplace transforms	**10**
Unit – 3 (Numerical Methods-I)	
Numerical solution of algebraic and transcendental equations 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**
Unit – 4 (Numerical Methods-II)	
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, Euler's method, Modified Euler's method, Runge-Kutta method	**10**
Unit – 5 (Fourier Series and Transforms)	

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.	**10**

Text(T) / Reference(R) Books:	
T1	Higher Engineering Mathematics, B S Grewal, 44th Edition, Khanna publishers, 2016
T2	Advanced Engineering Mathematics, Kreyszig, 9th Edition, Wiley, 2013
R1	Higher Engineering Mathematics, B V Ramana, Tata McGrawHill, 2006
R2	A text book of Engineering Mathematics, N P Bali and Manish Goyal, 7th edition, Laxmi publications
R3	Higher Engineering Mathematics, H. K Dass and Er. Rajnish Verma, 1st edition, S. Chand publishing, 2011
R4	Engineering Mathematics, Volume II, Dr.KVNageswara Reddy and Dr.BRamaBhupal Reddy, Scitech Publications, 2017

Course Outcomes: On completion of this course, students can	
CO1	Solve system of linear equations and find eigen values and eigen vectors of a matrix
CO2	Solve initial value problems by using Laplace transforms
CO3	Find the solution of algebraic/transcendental equations and also interpolate the functions
CO4	Evaluate numerical integration and to solve ordinary differential equations by using numerical methods
CO5	Find Fourier series of a periodic function and to determine the Fourier transform of a function

ENGINEERING CHEMISTRY			
Subject Code	18CMCHT2030	**IA Marks**	30
Number of Lecture Hours/Week	3(T) + 1(T)	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 04			
Unit -1			**Hours**
Periodic Properties Effective nuclear charge of chlorine 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.			**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 Calomelelectrodes, 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.			**10**
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.			**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.	**10**
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.	
Unit – 5	
Spectroscopic Techniques Regions of electromagnetic spectrum, Principles of vibrational and rotational spectroscopy, Vibrational and 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.	**10**

Text(T) / Reference(R) Books:	
T1	Stereochemistry of Carbon Compounds, Ernest Eliel, McGraw Hill Education
T2	Fundamentals of Molecular Spectroscopy, C N Banwell
T3	Concise Inorganic Chemistry, J.D.Lee, 5th Edition; Wiley India
T4	Engineering Chemistry – Fundamentals and applications, Shikha Agarwal, CUP
T5	Organic Chemistry: Structure and Function, K P C Volhardt and N E Schore, 5^{th}Edition
T6	Engineering Chemistry, Jain &Jain,Dhanpat Rai Publishing Company
R1	Engineering Chemistry (NPTEL Webbook), B L Tembe, Kamaluddin and MSKrishnan
R2	Physical Chemistry, P. W. Atkins
R3	Physical Chemistry, Glasstone S
R4	Advanced Inorganic Chemistry, Wilkinson G and Cotton FA

Course Outcomes: On completion of this course, students can	
CO1	Rationalize periodic properties like ionization potential, electro negativity and oxidation states
CO2	Describe the nature and working of various electrodes
CO3	Analyze bulk properties and processes using thermodynamic considerations
CO4	Synthesize organic molecules using different types of chemical reactions
CO5	Explain the concepts of atomic and molecular orbitals
CO6	Gain knowledge on spectroscopic techniques and the ranges of the electromagnetic spectrum used for exciting different molecular energy levels

BASIC ELECTRICAL ENGINEERING			
Subject Code	18CMEET2040	**IA Marks**	30
Number of Lecture Hours/week	3(L) +1(T)	**Exam Marks**	70
Total Number of Lecture Hours	60	**Exam Hours**	03
Credits – 04			

Unit -1	**Hours**
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, Thevenin and Norton Theorems (Simple numerical problems). Time-domain analysis of first-order RL and RC circuits.	**12**
Unit – 2	
AC Circuits: Representation of sinusoidal waveforms, peak and rms values, phasorrepresentation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLCcombinations (series and parallel), resonance. Three- phase balanced circuits, voltage and current relations in star and delta connections.	**12**
Unit – 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.	**12**
Unit – 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.	**14**
Unit – 5	
Power Converters and Electrical Installations DC Buck and boost converters, duty ratio control, PWM techniques, single phase voltage source inverters. Classification of batteries and Low Voltageswitch gear.	**10**

Text(T) / Reference(R) Books:	
T1	Electrical and Electronics Technology, E Hughes, Pearson, 2010
T2	Basic Electrical Engineering, DC Kulshreshtha, McGraw Hill, 2009
T3	Basic Electrical Engineering, DP Kothari, IJ Nagrath
T4	Basic Electrical Engineering, J P Tewari, New Age International Publishers, 2003
R1	Power Electronics, M D Singh, 2nd Edition
R2	Battery Energy Storage for Smart Grid Applications, Eurobat, 2013
R3	Fundamentals of Electrical Engineering, L S Bobrow, OUP, 1996
R4	Electrical Engineering Fundamentals, V D Toro, PHI, 1989
R5	Understanding Batteries, RM Dell, DAJ Rand, 2001
R6	Protection and Switchgear, Bhavesh Bhalja, RP Maheshwari, Nilesh G Chothani, 5th impression, OUP, 2014

Course Outcomes: On completion of this course, students can	
CO1	Analyze DC circuits by using KCL, KVL and Network theorems
CO2	Analyze AC circuits
CO3	Explain the operation and compute performance of transformer
CO4	Explain the construction and working of rotating electrical machines
CO5	Describe DC-DC and DC-AC converters
CO6	Explain about types of LV switch gear and types of batteries

ENGLISH & COMMUNICATION SKILLS LABORATORY			
Subject Code	18CMEGL2050	**IA Marks**	15
Number of Practice Hours/Week	2(P)	**Exam Marks**	35
Total Number of Practice Hours	24	**Exam Hours**	03
Credits – 1			

List of Experiments

Exercise 1

Listening Comprehension.

Exercise 2

Pronunciation, Stress, Intonation & Rhythm.

Exercise 3

Common Everyday Situations: Conversations & Dialogues.

Exercise 4

Communication at Workplace: Job Application letter, Email & Resume.

Exercise 5

Interpersonal Communication Skills.

Exercise 6

Formal Presentations.

Learning Resources:	
R1	Interact – English Lab Manual for Undergraduate Students by Orient BlackSwan
R2	Ted Talks, Interviews with Achievers and select movies, https://www.ted.com/talk
R3	Toastmaster's speeches and table topics
R4	Book Reviews and movie reviews
R5	Exercises in Spoken English Parts: I-III, CIEFL, Hyderabad
R6	Oxford Guide to Effective Writing and Speaking by John Seely

Course Outcomes: On completion of this course, students can	
CO1	Improve listening comprehension
CO2	Pronounce words and sentences correctly
CO3	Dialogue with others
CO4	Upgrade interpersonal communication skills
CO5	Present ideas/concepts to audience

ENGINEERING CHEMISTRY LABORATORY			
Subject Code	18CMCHL2060	**IA Marks**	15
Number of Practice Hours/Week	3(P)	**Exam Marks**	35
Total Number of Practice Hours	36	**Exam Hours**	03
Credits – 1.5			

List of Experiments

(Any 10 experiments must be conducted)

Exercise 1

Determination of surface tension

Exercise 2

Determination of viscosity of a liquid by Ostwald viscometer

Exercise 3

Thin layer chromatography

Exercise 4

Determination of chloride content of water

Exercise 5

Determination Hardness of water by EDTA

Exercise 6

Determination of the rate constant of first order reaction (Ester hydrolysis)

Exercise 7

Determination of strength of strong acid using conduc tometric titration.

Exercise 8

Determination of strength of weak acid using conduct ometric titration.

Exercise 9

Determination of Ferrous iron using potentiometer.

Exercise 10

Synthesis of a drug – Aspirin

Exercise 11

Determination of the partition coefficient of a substance between two immiscibleliquids

Exercise 12

Determination of strength of acetic acid using charcoal adsorption.

Exercise 13

Preparation of lattice structure and determination of atomic packing factor.

Exercise 14 Chemical oscillations- Iodine clock reaction **Exercise 15** Synthesis of Phenol formaldehyde resin. **Exercise 16** Saponification of oil

Course Outcomes: On completion of this course, students can	
CO1	Measure molecular properties like surface tension and viscosity
CO2	Determine chloride content of water of given water sample
CO3	Synthesize a drug
CO4	Determine rate constant as a function of time
CO5	Determine strength of acids using conductivity meter
CO6	Determine amount of Fe (II) using potentiometer

BASIC ELECTRICAL ENGINEERING LAB			
Subject Code	18CMEEL2070	**IA Marks**	15
Number of Practice Hours/Week	2(P)	**Exam Marks**	35
Total Number of Practice Hours	24	**Exam Hours**	03
Credits – 01			

List of Experiments

(Any 12 experiments must be conducted)

Exercise 1

Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors andinductors.

Exercise 2

Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscillo scope).

Exercise 3

Series and Parallel resonance of RL and RC circuits.

Exercise 4

No-load and load test on single phase Transformer (measurement of primaryand secondary voltages and currents, and power).

Exercise 5

Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phasecurrents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.

Exercise 6

Torque Speed Characteristic of dc shuntmotor.

Exercise 7

Break test on single phase induction motor.

Exercise 8

Field excitation control of Synchronous Machine.

Exercise 9

OC & SC tests on a single-phase transformer.

Exercise 10

characteristics of PN junction diode. **Exercise 11** Half and Full wave rectifier with and without filter. **Exercise 12** Demonstration of dc-dc converters dc-ac converters – PWM waveform the use of dc-ac converter for speed control of an induction motor Components of LTswitchgear.

Course Outcomes: On completion of this course, students can	
CO1	Know the importance of measuring instruments
CO2	Determine the response and resonance of given RL, RC and RLC circuits
CO3	Determine the voltage, current and performance characteristics of a single-phasetransformer
CO4	Determine the speed torque characteristics of dc shunt motor
CO5	Determine the breakdown voltage of PN junction diode
CO6	Determine the ripple factor for half wave and full wave rectifier with and without filter

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & HUMAN RIGHTS

(Common to all)

Subject Code	18CMMSN2080	**IA Marks**	30
Number of Lecture Hours/Week	3(L)	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03

Credits – 00

Unit -1	**Hours**
Lesson: Introduction to the Constitution of India, The Making of the Constitutionand Salient features of the Constitution. Preamble to the Indian Constitution Fundamental Rights & its limitations.	**10**
Unit -2	
Lesson: Directive Principles of State Policy & Relevance of Directive PrinciplesState Policy Fundamental Duties. Union Executives – President, Prime Minister Parliament Supreme Court of India.	**10**
Unit – 3	
Lesson: State Executives – Governor, Chief Minister, State Legislature HighCourt of State. Electoral Process in India, Amendment Procedures, 42nd, 44th, 74th, 76th, 86th &91st Amendments.	**10**
Unit – 4	
Lesson: Special Provision for SC & ST Special Provision for Women, Children& Backward Classes 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, Panchayats and Co-Operative Societies.	**10**
Unit – 5	

Lesson: Scope & Aims of Engineering Ethics, Responsibility of EngineersImpediments to Responsibility. Risks, Safety and liability of Engineers, Honesty, Integrity & Reliability in Engineering.	**10**

Text(T) / Reference(R) Books:	
T1	Introduction to the Constitution on India, Durga Das Basu, (Students Edn.) Prentice –Hall EEE, 19th / 20th Edn., 2001
T2	Engineering Ethics, Charles E. Haries, Michael S Pritchard and Michael J. Robins Thompson Asia, 2003-08-05.
R1	An Introduction to Constitution of India, M.V.Pylee, Vikas Publishing, 2002.
R2	Engineering Ethics, M.Govindarajan, S.Natarajan, V.S.Senthilkumar, Prentice –Hall of India Pvt. Ltd. New Delhi, 2004
R3	Introduction to the Constitution of India, Brij Kishore Sharma, PHI Learning Pvt. Ltd., New Delhi, 2011.
R4	Latest Publications of Indian Institute of Human Rights, New Delhi

Course Outcomes: On completion of this course, students can	
CO1	Have general knowledge and legal literacy and thereby to take up competitive examinations.
CO2	Understand state and central policies, fundamental duties
CO3	Understand Electoral Process, special provisions
CO4	Understand powers and functions of Municipalities, Panchayats and Co-operative Societies
CO5	Understand Engineering ethics and responsibilities of Engineers
CO6	Understand Engineering Integrity & Reliability

III SEMESTER (II-I)

Engineering Mathematics – III Common to all the branches			
Subject Code	18CMMAT3010	**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	**Hours**
Function of a complex variable Introduction –continuity –differentiability- analyticity – properties – Cauchy –Riemann equations in Cartesian and polar coordinates. Harmonic andconjugate harmonic functions – Milne – Thompson method.	**08**
Unit -2	
Integration and series expansions Complex integration: Line integral – Cauchy's integral theorem, Cauchy's inintegral formula, generalized integral formula (all without proofs) Radius of convergence – expansion in Taylor's, Maclaurin's 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, Evaluation of real definite integrals: Integration around the unit circle, Integration around semi-circle, Indenting contours having poles on real axis.	**10**
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 (- known) t-distribution- Sampling distribution of means(-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	**12**

Text(T) / Reference(R) Books:	
T1	Higher Engineering Mathematics, B.S. Grewal, Khanna publishers, 44^{th} edition, 2016.
T2	Advanced Engineering Mathematics I, Erwin Kreyszig, Wiley, 9^{th} Edition, 2013.
R1	Higher Engineering Mathematics, B.V. Ramana, Tata Mc Graw-Hill, 2006
R2	A text book of Engineering mathematics, N.P.Bali and Manish Goyal, Laxmipublications, 7^{th} Edition.
R3	Higher Engineering Mathematics, H.K.publishing, 1st edition, 2011. Dass and Er. RajnishVerma, S.Chand
R4	Probability and Statistics for Engineers, Dr. B.RamaBhupal Reddy, Research IndiaPublications (DELHI), 2015.
W1	https://nptel.ac.in/courses/122107037/
W2	https://www.udemy.com/mathematics-for-engineering/

Course Outcomes: On completion of this course, students can	
CO1	Find the function of a complex variable
CO2	Evaluate complex integration
CO3	Expand functions using Taylor & Maclaurin's series
CO4	Evaluate integrals using Residues

CO5	Find the statistical parameters for distributions
CO6	Test the hypothesis

DIGITAL ELECTRONICS			
Subject Code	18CSECT3020	**Internal Marks**	30
Number of Lecture Hours/Week	3(L)	**External Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

Unit -1 (Fundamentals of Digital Systems and logic families)	**Hours**
Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic	**12**
Unit -2 (Combinational Digital Circuits)	
Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.	**07**
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), readand 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 Programmablelogic devices (CPLDS), Field Programmable Gate Array (FPGA).	**12**

Text(T) / Reference(R) Books:	
T1	Modern Digital Electronics, R P Jain, McGraw Hill Education, 2009.
T2	Digital logic and Computer design, M MMano,Pearson Education India, 2016.
T3	Digital Design Principles & Practices, John F Wakerly, PHI/ Pearson Education Asia,3rd Ed., 2005.
T4	Switching Theory and Logic Design, Hill and Peterson Mc-Graw Hill TMH edition.
R1	Fundamentals of Digital Circuits, A Kumar, Prentice Hall India, 2016.
R2	Fundamentals of Logic Design, Charles H Roth Jr, Jaico Publishers
W1	https://www.coursera.org/learn/digital-systems
W2	https://onlinecourses.nptel.ac.in/noc19_ee09/preview

Course Outcomes: On completion of this course, students can	
CO1	State and explain fundamental gates in digital circuits
CO2	Apply Boolean algebra simplification methods to build basic combinatorial circuits

CO3	Construct the sequential circuits & systems
CO4	Explain converters especially basic operation of A/D and D/A converters
CO5	Describe Semiconductor memories and Programmable logic devices

Analog Electronic Circuits			
Subject Code	18CSECT3030	**Internal Marks**	30
Number of Lecture Hours/Week	3(L)	**External Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

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-gateand 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 toDigital Conversion. **Nonlinear applications:** Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular- wave generators. Precision rectifier, peak detector. Monoshot.	**12**

Text(T) / Reference(R) Books:	
T1	Microelectronic Circuits, A S Sedra and K C Smith, OUP, 1998.
T2	Introduction to Operational Amplifier theory and applications, J V Wait, L P Huelsmanand G A Korn, McGraw Hill, 1992.
R1	Microelectronics, J Millman and A Grabel,McGraw Hill Education, 1988.
R2	The Art of Electronics, P Horowitz and W Hill, Cambridge University Press, 1989
R3	Analysis and Design of Analog Integrated Circuits, P R Gray, R G Meyer and S Lewis,John Wiley & Sons, 2001.
W1	https://onlinecourses.nptel.ac.in/noc18_ee45/preview
W2	https://swayam.gov.in/course/3835-analog-circuits

Course Outcomes: On completion of this course, students can	
CO1	Apply the characteristics of Diodes to various applications
CO2	Distinguish the characteristics of transistors.
CO3	Design and analyze various rectifier and amplifier circuits
CO4	Design sinusoidal and non-sinusoidal oscillators.
CO5	Design OP-AMP based circuits

DISCRETE MATHEMATICS			
Subject Code	18CSCST3040	**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: 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 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.	**10**
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 primesbelow 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, EulerTheorem. **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 Unionsand 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, roundfunctions, Partial Function. **Cardinality with Applications to Computability** (TB2:428-437)	**08**

Properties of Cardinality, Finite and Infinite Sets, Countable and Uncountable Sets, Cantor Diagonalization Process.	
Unit-4: Basic Counting and Combinatorics	
The Basics of Counting (TB1 : 385-399) Introduction, Basic Counting Principles, More Complex Counting Problems, TheSubtraction Rule, The Division Rule, Tree Diagrams **The Pigeonhole Principle** (TB1: 399-407) Introduction, The Generalized Pigeonhole Principle, Some Elegant Applicationsof 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 InvolvingBinomial Coefficients **Generalized Permutations and Combinations** (TB1: 423-434) Introduction, Permutations with Repetition, Combinations with Repetition,Permutations with Indistinguishable Objects, Distributing Objects into Boxes **Generating Permutations and Combinations** (TB1: 434-439) Introduction, Generating Permutations, Generating Combinations	**10**
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, SubSemigroups 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**

Text(T) / Reference(R) Books:	
T1	Discrete Mathematics and Its Applications, Kenneth H Rosen, 7^{th} edition, MHP, 2012.
T2	Discrete Mathematics with Applications, Susanna SEpp, 4^{th} Edition, CENGAGE
T3	Discrete Mathematical Structures with Applications to Computer Science, J PTremblay, R Manohar, TMH, 1997.
R1	Discrete Mathematics, Seymour Lipschutz, Marc Lars Lipson, SCHAUM's outlines.
R2	Discrete Mathematical Structures, U S Gupta, Pearson Publications.
W1	https://www.coursera.org/learn/discrete-mathematics
W2	https://swayam.gov.in/course/1396-discrete-mathematics

Course Outcomes: On completion of this course, students can	
CO1	Distinguish between Statement Logic and Predicate Logic.
CO2	Apply mathematical proving techniques in order to solve recurrences and elementaryalgebra problems.

CO3	Illustrate by examples terminology, operations and mathematical models using theories of sets, relations and functions.
CO4	Apply permutations & Combinations in problem solving
CO5	Explain basic properties of algebraic structures

DATA STRUCTURES			
Subject Code	18CSCST3050	**IA Marks**	30
Number of Lecture Hours/Week	3(L)	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

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, mastermethod **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, SparseMatrix Addition and Multiplication. **Stacks and Queues** (TB1:099-109) The Stack Abstract Data Type, The Queue Abstract Data Type, Circular QueueAbstract Data Type **Stack Applications** (TB1:116-126) Introduction, Evaluating Postfix Expressions, Infix to Postfix, Multiple Stacksand 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, ThreadedBinary 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: search, insert and delete	**08**

Text(T) / Reference(R) Books:	
T1	Fundamentals of Data Structures in C, Second Edition by Ellis Horowitz, Sartaj Sahni,Anderson – Freed, Universities Press.
T2	Interdiction to Algorithms, Thomas H Coremen,CharlesELeiserson, Clifford Stein,Third Edition, MIT Press/McGraw-Hill
R1	Algorithms, Data Structures, and Problem Solving with C++, Illustrated Edition by MarkAllen Weiss, Addison-Wesley Publishing Company
R2	How to Solve it by Computer, 2nd Impression by R. G. Dromey, Pearson Education.
W1	https://www.coursera.org/specializations/data-structures-algorithms
W2	https://www.edx.org/course/foundations-of-data-structures-2
W3	https://swayam.gov.in/course/1407-programming-and-data-structures

Course Outcomes: On completion of this course, students can	
CO1	Analyze algorithms' time and space complexity and justify the correctness.
CO2	Implement Stack and Queue ADT.
CO3	Implement Linked List ADT.
CO4	Implement Binary Tree ADT and traversal algorithms.
CO5	Implement Graph ADT and BFS and DFS traversal algorithms.

ANALOG & DIGITAL ELECTRONICS LAB			
Subject Code	18CSECL3060	**IA Marks**	15
Number of Lecture Hours/Week	3(P)	**Exam Marks**	35
Total Number of Lecture Hours	36	**Exam Hours**	03
Credits – 1.5			

List of Experiments

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

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

Exercise 1

PN Junction Diode V-I Characteristics

Exercise 2

Zener Diode Characteristics

Exercise 3

Transistor Biasing

Exercise 4

BJT Input and Output Characteristics (CE Configuration)

Exercise 5

FET Drain and Transfer Characteristics (CS Configuration)

Exercise 6

BJT-CE Amplifier

Exercise 7

FET-CS Amplifier

Exercise 8

OP AMP Applications – Adder, Subtractor, Comparator Circuits

PART-B:

(Experiments to be done by using MATLAB)

Exercise 9

Represent a signal using MATLAB and perform following

i) Identify even and odd symmetries in a signal

ii) Perform the amplitude scaling, time scaling and time shifting operations

Exercise 10

Determine the Fourier transformation of a signal

Exercise 11

State the sampling theorem and verify it.

Exercise 12

Determine the Laplace transformation of a signal

Exercise 13 Determine the Z - transformation of a signal **Exercise 14** Perform the convolution of two continuous signals

Course Outcomes: On completion of this course, students can	
CO1	Understand the characteristics of semiconductor devices
CO2	Understand the nature of transistor and FET amplifier
CO3	Apply sampling theorem to convert continuous-time signals to discrete-time signal andreconstruct back.
CO4	Analyze the continuous-time signals and systems using Fourier and Laplace transforms
CO5	Apply Z - transformation and convolution of two continuous signals

IT Workshop Lab			
Subject Code	18CSCSL3070	**IA Marks**	15
Number of Tutorial Hours/Week	03(P)	**Exam Marks**	35
Total Number of Practice Hours	36	**Exam Hours**	03
Credits – 1.5			

LIST OF EXPERIMENTS

Exercise1
Study of basic scilab commands

Exercise2
Matrix constructors and operations

Exercise3
Matrix bitwise, relational & logical operations

Exercise4
Control structures (If-Else, If-elseif -else, Select)

Exercise5
Control structures (for, while, break and continue)

Exercise6
Graphics - 2d plots

Exercise7
Computer application program

Exercise8 Civil application program

Exercise9 Electronics application program

Exercise10 Electronics application program

Course Outcomes: On completion of this course, students can	
CO1	Understand the need for simulation/implementation for the verification of mathematicalfunctions.
CO2	Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.
CO3	Understand control flow of the program.
CO4	Implement simple mathematicalenvironment such as SCILAB. functions/equations in numerical computing
CO5	Interpret and visualize simple mathematical functions and operations thereon using plots/display.

DATA STRUCTURES LAB			
Subject Code	18CSCSL3080	**IA Marks**	15
Number of Tutorial Hours/Week	3(P)	**Exam Marks**	35
Total Number of Practice Hours	04	**Exam Hours**	03
Credits – 1.5			

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 usingLinked Lists

Exercise 4 (Applications of Stack) Infix to Postfix Conversion Postfix Expression Evolution

Exercise 5 (Linked List Applications)
Polynomial Addition Polynomial Multiplication

Exercise 6
Doubly Linked List Circular Linked List

Exercise 7 (Search Trees) Binary Search Trees

Exercise 8 (Search Trees)
Binary HeapHeap 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 can	
CO1	analyze time and space complexity and justify them.
CO2	ImplementStacks and Queues and demonstrate applications of stacks.
CO3	Implement different types of lists and operations.
CO4	Implement variety of search trees and traversal algorithms.
CO5	Implement various sorting algorithms.

IV SEMESTER (II-II)

SIGNALS & SYSTEMS			
Subject Code	18CMCET4010	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

Unit -1	**Hours**
Introduction: Definition of Signals and Systems, Signal properties: periodicity, absoluteintegrability, 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.	**12**
Unit -2	
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. 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.	**12**
Unit – 3	
Fourier Transformation: Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplicat 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.	**8**
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	**10**

equations and system behavior. **Z–Transforms:** The z-Transform for discrete time signals and systems, system functions, poles andzeros of systems and sequences, z-domain analysis.	
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 itseffects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	**8**

Text(T) / Reference(R) Books:	
T1	Signals and Systems, 2nd Edn, A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI.
T2	Signals, Systems & Communications, B.P. Lathi, BS Publications.
T3	Signals & Systems, 2nd Edition. Simon Haykin and Van Veen, Wiley.
R1	Principles of Linear Systems and Signals, BP Lathi, Oxford University Press.
R2	Fundamentals of Signals and Systems, International Edition, Michel J. Robert, MGH.
R3	Digital Signal Processing: Principles, Algorithms, and Applications, J. G. Proakis and D. G. Manolakis, Pearson.
R4	Signals and Systems, T K Rawat , Oxford University press.
W1	https://www.coursera.org/courses?query=signals%20and%20systems
W2	https://onlinecourses.nptel.ac.in/noc18_ee02/preview

Course Outcomes: On completion of this course, students can	
CO1	Able to characterize the signals and systems.
CO2	Able to understand the Behavior of continuous and discrete-time LTI systems
CO3	Able to analyze the continuous-time signals and continuous-time systems using Fourierseries, Fourier transform and Laplace transform.
CO4	Able to apply z-transform to analyze discrete-time signals and systems.

CO5	Able to apply sampling theorem to convert continuous-time signals to discrete-timesignal and reconstruct back.

ENGINEERING MECHANICS			
Subject Code	18CMCET4020	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

Unit -1	**Hours**
Systems of Forces: Coplanar Concurrent Forces – Components in Space – Resultant – Moment ofForce and its Application – Couples and Resultant of Force Systems. **Friction:** Introduction, limiting friction and impending motion, coulomb's laws of dryfriction, coefficient offriction, 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. 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.	**8**
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**

Text(T) / Reference(R) Books:	
T1	Engg. Mechanics4th Edn, S.Timoshenko & D.H.Young, Mc Graw Hill publications.
T2	Engineering Mechanics-Statics and Dynamics, A Nelson,Tata McGraw HillEducationPrivate Ltd.
R1	Engineering Mechanics statics and dynamics, 11th Edn, R.C.Hibbeler,Pearson.
R2	Engineering Mechanics, statics, 6th Edn, J.L.Meriam,Wiley India Pvt Ltd.
R3	Engineering Mechanics, statics and dynamics, I.H.Shames, Pearson
R4	Mechanics For Engineers, statics, 5th Edn, F.P.Beer&E.R.Johnston, Mc Graw Hill
R5	Mechanics For Engineers, dynamics, 5th Edn, F.P.Beer&E.R.Johnston, Mc Graw Hill
R6	Theory & Problems of engineering mechanics, statics & dynamics, 5th Edn, E.W.Nelson,C.L.Best& W.G. McLean,Mc Graw Hill.
R7	Singer's Engineering Mechanics: Statics and Dynamics, K. Vijay Kumar Reddy, J. Suresh Kumar, Bs Publications.
R8	Engineering Mechanics, Fedinand . L. Singer, Harper, Collins
W1	https://swayam.gov.in/courses/5241-engineering-mechanics
W2	https://onlinecourses.nptel.ac.in/noc16_ph02/preview

Course Outcomes: On completion of this course, students can	
CO1	Able to Resolve the forces into components, moment of force and its applications

CO2	Construct free body diagrams and develop appropriate equilibrium equations.
CO3	Determine centroid and moment of inertia for composite areas.
CO4	Determine the kinematic relations of particles & rigid bodies.
CO5	Apply equations of motion to particle and rigid body using the principle of energy andmomentum methods.

COMPUTER ORGANIZATION			
Subject Code	18CSCST4030	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits: **03**			

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- Look a head Adder, Integer Multiplication: Array Multiplier, Shift-and-Add, Booth Multiplier, Carry-Save Addition of Summands, Integer Division: Restoring Division, Non-Restoring Division, Floating Point Arithmetic: Representation, Operations, Guard bits and Truncation, Implementation of Operations	**11**
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 RISCInstructions, 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, Micro programmed 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-controlledI/O, Interrupts: Concept, Enabling and Disabling, Handling Multiple Devices, Controlling I/O Devices (Interrupt-driven I/O), Processor Control Registers, Direct MemoryAccess: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, 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	**11**

Text(T) / Reference(R) Books:	
T1	Computer Organization and Embedded Systems, 6th Edition, Carl Hamacher,ZvonkoVranesic, SafwatZaky, NaraigManjikian, McGraw-Hill Publications.
R1	Computer Organization and Design: The Hardware/Software Interface, 5th Edition, David A. Patterson, John L. Hennessy,Morgan Kauffman Publishers (Elsevier).
W1	https://swayam.gov.in/course/3747-computer-organization
W2	https://online.stanford.edu/courses/cs107-computer-organization-and-systems

Course Outcomes: On completion of this course, students can	
CO1	Get familiar with Operating System fundamentals.
CO2	Attain knowledge on processes, threads and the communication between them.
CO3	Understand the mechanism for executing jobs by the underlying processor.
CO4	Comprehend the intricacies of sharing limited available resources among theprocesses and threads.
CO5	Gain insights into the mechanisms for managing memory, disks and I/O devices.

<table>
<tr><td colspan="4">ALGORITHMS DESIGN AND ANALYSIS</td></tr>
<tr><td>Subject Code</td><td>18CSCST4040</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</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">Elements of Dynamic Programming: Optimal sub structure, overlapping sub problems, Reconstructing an optimalsolution, Memorization.
Example Problems: Longest common Subsequence, Optimal Binary search trees, String Editing, 0/1Knap Sack Problem , The Traveling Salesperson Problem,
Elements of Greedy Strategy:Concept, Greedy – Choice property, Optimal sub structure, Greedy vs Dynamicprogramming,
Example Problems: Huffman codes, Knap Sack Problems, Tree Vertex Splitting, Job Sequencing with Dead Lines.</td><td>11</td></tr>
<tr><td colspan="4">Unit -2</td></tr>
<tr><td colspan="3">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, 0/1Knap 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</td><td>09</td></tr>
<tr><td colspan="3">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, SubsetSum Problem</td><td></td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
</table>

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, showingproblems to be NPC, Reductions, **Tractable Problems:** Supporting arguments, Abstract Problems, Encodings, **Polynomial Time Verification:** Hamiltonian Cycles, Verification Algorithms, Complexity	**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**

Text(T) / Reference(R) Books:

T1	Interdiction to Algorithms, Third Edition, Thomas H Coremen, Charles E.Leiserson, Clifford Stein, MIT Press/McGraw-Hill.
T2	Computer Algorithms, Ellis Horowitz, Sartaj Sahni, S Rajasekaran, Computer Science Press
T3	Algorithm Design, First Edition, JON Kleinberg, EVA Tardos, Pearson Addison Wesley
R1	Algorithm Design: Foundation, analysis, and Internet Examples, First Edition, JohnWiley & sons
W1	https://www.coursera.org/specializations/algorithms
W2	https://swayam.gov.in/course/4417-design-and-analysis-of-algorithms

Course Outcomes: On completion of this course, students can	
CO1	For a given algorithms analyze worst-case running times of algorithms based onasymptotic analysis and justify the correctness of algorithms.
CO2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
CO3	Describe the divide-and-conquer paradigm and explain when an algorithmic designsituation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
CO4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
CO5	For a given problems of dynamic-programming an develop the dynamic programmingalgorithms 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.

JAVA PROGRAMMING			
Subject Code	18CSCST4050	**IA Marks**	30
Number of Lecture Hours/Week	3(L)	**Exam Marks**	70
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			

Unit -1: Introduction to OOP	**Hours**
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.	**08**
Unit -2 : Introducing Classes, Methods and Inheritance	
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, dynamic method dispatch, abstract classes.	**10**
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 javautil 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**

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, KRajkumar, 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/java
W2	https://onlineitguru.com/core-java-online-training-placement.html

Course Outcomes: On completion of this course, students can	
CO1	Design classes, interfaces and packages.
CO2	Demonstrate inheritance, polymorphism, encapsulation.
CO3	Demonstrate user defined exceptions.
CO4	Create Threads to parallelize operations.
CO5	Create rich user-interface applications using modern API JavaFX.

COMPUTER ORGANIZATION LAB			
Subject Code	18CSCSL4060	**IA Marks**	15
Number of Tutorial Hours/Week	03(P)	**Exam Marks**	35
Total Number of Practice Hours	48	**Exam Hours**	03
Credits – 1.5			

List of experiments

Exercise 1

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

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

Exercise 2

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

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

Exercise 3

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

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

Exercise 4

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

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

Exercise 5

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

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

Exercise 6

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

Write a Machine Language Program to Perform Linear Search operation.

Exercise 7

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

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

Exercise 8

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

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

Exercise 9

Write a Machine Language Program to generate Fibonacci Series.

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

Exercise 10

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

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

Exercise 11

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

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

Exercise 12

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 this course, students can	
CO1	Get familiar with Operating System fundamentals.
CO2	Attain knowledge on processes, threads and the communication between them.

CO3	Understand the mechanism for executing jobs by the underlying processor.
CO4	Comprehend the intricacies of sharing limited available resources among the processes and threads.
CO5	Gain insights into the mechanisms for managing memory, disks and I/O devices.

ALGORITHMS DESIGN AND ANALYSIS LAB			
Subject Code	18CSCSL4070	**IA Marks**	15
Number of Tutorial Hours/Week	03(P)	**Exam Marks**	35
Total Number of Practice Hours	48	**Exam Hours**	03
Credits – 1.5			

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

Exercise6 (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)** a) Floyd- Warshall Algorithm.

Course Outcomes: On completion of this course, students can	
CO1	For a given algorithms analyze worst-case running times of algorithms based onasymptotic analysis and justify the correctness of algorithms.
CO2	Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
CO3	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.
CO4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it.
CO5	For a given problem of dynamic-programming an develop the dynamic programmingalgorithms and analyze it to determine its computational complexity.

JAVA PROGRAMMINGLAB			
Subject Code	18CSCSL4080	**IA Marks**	15
Number of Tutorial Hours/Week	3(P)	**Exam Marks**	35
Total Number of Practice Hours	36	**Exam Hours**	03
Credits – 1.5			

List of experiments

Exercise 1 (Basics)

c) Write a Java program to display default value of all primitive data type of Java.

Write a Java Program to print the area of the Triangle

d) 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 mayor may not be the same as the other. To qualify the race, the speed of a racer mustbe more than the average speed of all 5 racers. Take as input the speed of each racerand 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 usingbinary 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 andinvoke 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

c) Write a Java program for creation of Illustrating throw, throws and finally Write a Java program to illustrate sub class exception precedence over base class.

d) Write a Java program for creation of User Defined

e) 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 printout 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 aHashMap.

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 this course, students can	
CO1	Understand and Apply Object oriented features and Java concepts.
CO2	Examine and analyze alternative solutions to a given problem using java.
CO3	Apply the concept of multithreading and implement exception handling.
CO4	Implement front end and back end of an application using Java
CO5	Develop applications using Console I/O and File I/O, GUI applications.

V SEMESTER (III-I)

V Semester

S. No.	Subject			Hours			C
	Code	Type	Title	L	T	P	
01	18CMMST5010	HS	Management Science	3			3
02	18CSCST5020	PC	Database Management Systems	3			3
03	18CSCST5030	PC	Operating Systems	3			3
04	18CSCSP504X	PE	Professional Elective-I	3			3
05	18CSXX505X	OE	Open Elective-I	3			3
06	18CSCSL5060	PC	Database Management Systems Lab			3	1.5
07	18CSCSL5070	PC	Operating Systems Lab			3	1.5
08	18CMAHS5080	SOC	Soft Skills & Aptitude Builder - 1	2			2
09	18CMBIN5090	MC	Biology for Engineers	2			0
				Total Credits			**20**

<table>
<tr><td colspan="4" align="center">MANAGEMENT SCIENCE</td></tr>
<tr><td>Subject Code</td><td align="center">18CMMST5010</td><td>IA Marks</td><td align="center">30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td align="center">3</td><td>Exam Marks</td><td align="center">70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td align="center">60</td><td>Exam Hours</td><td align="center">03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
<tr><td colspan="3">Unit -1: Introduction to Management</td><td align="center">Hours</td></tr>
<tr><td colspan="3">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.</td><td align="center">12</td></tr>
<tr><td colspan="4">Unit -2: Operations Management</td></tr>
<tr><td colspan="3">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).</td><td align="center">12</td></tr>
<tr><td colspan="4">Unit – 3: Functional Management &Strategic Management</td></tr>
<tr><td colspan="3">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</td><td align="center">14</td></tr>
<tr><td colspan="4">Unit – 4: Project Management: (PERT/CPM)</td></tr>
<tr><td colspan="3">Development of Network – Difference between PERT and CPM Identifying Critical Path- Probability- Project Crashing (Simple Problems).</td><td align="center">10</td></tr>
<tr><td colspan="4">Unit – 5:Contemporary Management Practices</td></tr>
<tr><td colspan="3">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.</td><td align="center">12</td></tr>
</table>

<table>
<tr><td colspan="2">Text(T) / Reference(R) Books:</td></tr>
<tr><td align="center">T1</td><td>Management Science, Dr. P. Vijaya Kumar & Dr. N. Appa Rao,</td></tr>
<tr><td align="center">T2</td><td>Management Science, Dr. A. R. Aryasri, TMH2011.</td></tr>
<tr><td align="center">R1</td><td>Essentials of Management, Koontz &Weihrich, TMH 2011</td></tr>
<tr><td align="center">R2</td><td>Global Management Systems, Seth &Rastogi, Cengage Learning, 2011</td></tr>
</table>

R3	Organizational Behaviors, Robbins, Pearson Publications, 2011
R4	Production & Operational Management, KanishkaBedi, 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
Web Resources:	
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:	
CO1	Understand the concept and functions of Management, and Theories of Motivation, Styles of Leadership.
CO2	Apply the Statistical Quality Control Techniques, Methods of inspection, the concept of Inventory Management and Control.
CO3	Understand the functional areas of organization i.e., Marketing Management, Human Resource Management, and Strategic Management
CO4	Apply Project Management Techniques.
CO5	Understand the various contemporary issues in Management Practices like TQM and BPO etc.

DATABASE MANAGEMENT SYSTEMS			
Subject Code	18CSCST5020	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	**Hours**
Introduction to Databases: Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications. Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Users , Architecture for DBMS.	**10**
Unit -2: E-R Models	
TheE-R Models,TheRelationalModel,IntroductiontoDatabaseDesign,DatabaseDesign 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.	**10**
Unit - 3: Relational Algebra	
Relational Algebra, Selection and Projection, Set Operation, Renaming, Joins, Division, More Examples of Queries, Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus. 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 - 4: 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).	**08**
Unit - 5: Transaction Management	
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.	**12**

Text(T)/Reference(R)Books:	
T1	Introduction to Database Systems, CJ Date,Pearson.
T2	Database Management Systems,3rd Edition, Raghurama Krishnan, Johannes Gehrke,TATAMcGraw Hill.
T3	Database Systems-The Complete Book, HGMolina, JDUllman, JWidom Pearson.
T4	Database Management Systems, 6/e RamezElmasri, ShamkantB.Navathe, PEA
R1	Database Systems design, Implementation, and Management, 7th Edition, PeterRob&CarlosCoronel
R2	DatabaseSystemConcepts,5th edition, Silberschatz, Korth, TMH
R3	TheDatabaseBookPrinciples&PracticeUsingOracle/MySQL,NarainGehani,UniversityPress.
W1	https://onlinecourses.nptel.ac.in/noc18_cs15/preview
W2	https://www.coursera.org/courses?query=database

Course Outcomes:	
CO1	Understand the basic elements of a relational database management system.
CO2	Draw entity relationship and convert entity relationship diagrams into RDBMS.
CO3	Create, maintain, and manipulate a relational database using SQL.
CO4	Designs and applies normalization techniques for logical schema model.
CO5	Solves concurrent issues and problems through locking mechanism.

OPERATING SYSTEMS			
Subject Code	18CSCST5030	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, Functions Of Operating Systems, Types Of Operating Systems, Process, memory, storage management, Protection and security, Distributed systems, Computing Environments, Open-source operating systems, OS services, User operating-system interface.	**08**
Unit -2:System Calls & IPC	
System calls, Types, System programs, OS structure, OS generation, System Boot Process concept, Operations on processes, Cooperating processes, Inter-process communication, Multi-threading models.	**10**
Unit – 3: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 – 4: Memory Management & Dead lock	
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 – 5: 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.	**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, TMH Education.
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:	
CO1	Demonstrate knowledge on Computer System organization and Operating system services
CO2	Design solutions for process synchronization problems by using System calls and Inter process communication.
CO3	Identify the functionality involved in process management concepts like scheduling and synchronization.
CO4	Design models for handling deadlock and perform memory management.
CO5	Analyze services of I/O subsystems and mechanisms of security & protection.

DATABASE MANAGEMENT SYSTEMS LAB			
Subject Code	18CSCSL5060	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
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 for Creating, Dropping, and Altering Tables, Views, and Constraints

Exercise 7

Queries on Joins and Correlated Sub-Queries

Exercise8

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

PL/SQL

Exercise9

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

Exercise10

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

Exercise11

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

Exercise12

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

Exercise13

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

Exercise14

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

Course Outcomes:	
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

OPERATING SYSTEMS LAB			
Subject Code	18CSCSL5070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
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

Exercise 10 Simulate Paging Technique of memory management.

CourseOutcomes:	
CO1	Analyze different CPU Scheduling algorithms
CO2	Apply various system calls to handle memory tasks
CO3	Apply various File Organization Techniques
CO4	Design models for handling deadlock and perform memory management.
CO5	Analyze various page replacement techniques

Soft Skills & Aptitude Builder – 1			
Subject Code	18CMAHS5080	IA Marks	15+15
Number of Lecture Hours/Week	2	Exam Marks	35+35
Total Number of Lecture Hours	32	Exam Hours	3
Credits – 2			
Section A,Soft Skills			
Unit – 1: Intrapersonal Communication			**Hours**
Introduction to Soft Skills and its Significance **Personal Effectiveness**: Who am I and What am I; My Strengths and Weaknesses; SWOT Analysis; SMART Goal Setting; Being Proactive **Principles of Personal Vision**: Beginning with the End in Mind; Time Management: Understanding Priorities; Put First-Things-First **Activity**: Psychometric Tests and SWOT Analysis, SMART Goal Setting			**6**
Unit 2: Interpersonal Communication			
Principles of Creative Cooperation and Organization Skills: Think Win-Win; Seek First to Understand then to be Understood; Synergize; Life-Long Learning **Emotional Intelligence**: Self-Awareness, Self-Regulation, Empathy,Assertiveness, Adoptability, Managing Emotions **Activity**: Resolving a Conflict with your Friend/Colleague/Family Member; Group Discussions & Debates			**6**
Unit – 3: 21st Century Skills			
What are 21st Century Skills? Learning Skills- Digital Literacy- Life Skills **Critical Thinking**: Active Listening, Observation, Introspection, Analytical Thinking, Open Mindedness **Problem Solving**: Understanding the Complexity of the Problem, Defining the Problem, Cause and Effect Analysis, Exploring Possible Solutions, Planning Actions, Analyzing Results of your Actions, Getting Feedback, Redefining the Problem, The ProblemSolving Cycle **Decision Making**: Managing Conflict, Conflict Resolution, Methods of Decision Making, Effective Decision Making in Teams – Methods & Styles			**6**

Activity: Case Study	
Section B- Aptitude Builder	
Unit – 4: Ratios & Percentages	
Definition of Ratio, Properties of Ratios, Comparison of Ratios, Problems on Ratios, Compound Ratio, Problems on Proportion, Mean Proportional and Continued Proportion. **Partnership:** Introduction, Relation between Capitals, Period of Investments and Shares **Number System:** Classification of Numbers, Divisibility Rules, Finding the Units Digit, Finding Remainders in Divisions Involving Higher Powers, LCM and HCF Models **Percentages:** Introduction, Converting a Percentage into Decimals, Converting a Decimal into Percentage, Percentage Equivalent of Fractions, Problems on Percentages **Profit And Loss:** Problems on Profit and Loss Percentage, Relation between Cost Price and Selling Price, Discount and Marked Price, Two Different Articles Sold at Same Cost Price, Two Different Articles Sold at Same Selling Price Gain% / Loss% on Selling Price **Problems on Ages:** Introduction, Problems based on Ages **Averages:** Definition of Average, Rules of Average, Problems on Average, Problems on Weighted Average, Finding Average using Assumed Mean Method **Alligation and Mixture:** Problems on Mixtures, Alligation Rule, Problems on Alligation	7
Unit – 5: Mental Ability	
Difference Series, Product Series, Squares Series, Cubes Series, Alternate Series Combination Series, Miscellaneous Series, Place Values of Letters **Number and Letter Analogies:** Definition of Analogy, Problems on Number Analogy, Problems on Letter Analogy, Problems on Verbal Analogy **Odd Man Out:** Problems on Number Odd Man Out, Problems on Letter Odd Man Out, Problems on Verbal Odd Man Out **Coding and Decoding:** Coding using Same Set of Letter, Coding using Different Set of Letters, Coding into a Number, Problems on R-Model **Blood relations:** Defining the Various Relations among the Members of a Family, Solving Blood Relation Puzzles, Solving the Problems on Blood Relations using Symbols and Notations	7

Direction Sense: Solving Problems by Drawing the Paths, Finding the Net Distance Travelled, Finding the Direction, Problems on Clocks ,Problems on Shadows	

Section-A: Text (T) / Reference (R) Books:	
For Units 1, 2, & 3	
T1	English and Soft Skills, Dr. S. P. Dhanvel, Orient Blackswan, 2011
R1	Seven Habits of Highly Effective People, Stephen R Covey
R2	Emotional Intelligence, Daniel Goleman, Bantom Book, 2006
R3	21st Century Skills: Learning for Life in our Times, Bernie Trilling, Charles Fadel; John Wiley & Sons
For Units 4&5	
T1	S Agarwal, S Chand, ‘Quantitative Aptitude’
T2	S Agarwal, S.Chand , ‘A Modern Approach to Logical Reasoning’
R1	Quantitative Aptitude for CAT By Arun Sharma
R2	Barrons, Mc Graw Hills, Thorpe’s Verbal Reasoning, LSAT Materials
Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO1	Re-engineer attitude and understand its influence on behavior
CO 2	Develop interpersonal skills and be an effective goal oriented team player
CO 3	Develop holistic personality with a mature outlook to function effectively in different circumstances
Section B: Aptitude Builder	
CO 4	Solve the real-time problems for performing job functions easily
CO 5	Analyze the problems logically and critically

BIOLOGY FOR ENGINEERS			
Subject Code	18CMBIN5090	IA Marks	30
Number of Lecture Hours/Week	2	Exam Marks	70
Total Number of Lecture Hours	30	Exam Hours	03
Credits – 00			

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 thermodynamics by referring to the original observation of Robert Brown and Julius Mayor.	**06**
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	**05**
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	**06**
Unit – 4:Enzymes & Proteins	
Enzymology: How to monitor enzyme catalyzed reactions. How does an enzyme catalyze reactions - Enzyme classification. Mechanism of enzyme	**07**

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 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.	**06**

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:	
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”

VI SEMESTER (III-II)

III B. Tech II Semester

S. No.	Subject			Hours			
	Code	Type	Title	L	T	P	C
01	18CSCST6010	HS	Engineering Economics & Financial Management	3			3
02	18CSCST6020	PC	Computer Networks	3			3
03	18CSCST6030	PC	Software Engineering	3			3
04	18CSCSP604X	PE	Professional Elective-II	3			3
05	18CSXXO605X	OE	Open Elective-II	3			3
06	18CMMST6060	PC	Automata theory and Compiler Design	3			3
07	18CSCSL6070	PC	Computer Networks Lab			3	1.5
08	18CSCSL6080	PC	Compiler Design Lab			3	1.5
09	18CMAHS6090	SOC	Soft Skills & Aptitude Builder - 2	2			2
				Total Credits			**23**

AUTOMATATHEORY&COMPILER DESIGN			
Subject Code	18CSCST6060	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: Data Warehouse and OLAP Technology	**Hours**
Formal Languages and Regular Expressions :Languages, operations on languages, regular expressions (re),languages associated with (re), operations on (re), Identity rules for (re), Finite Automata: DFA, NFA, Conversion of regular expression to NFA, NFA to DFA.	**08**
Unit -2: Context Free Grammars & Introduction to compilers	
Context Free grammars and parsing: Context free Grammars, Leftmost Derivations, Rightmost Derivations, Parse Trees, Ambiguity Grammars, Phases of compiler, Applications of Finite Automata to lexical analysis.	**10**
Unit – 3: Parsers	
Top-DownParsing,RecursiveDescentParsers:LL(1)Parsers.BottomupParsers: Shift Reduce Parser, LR Parsers: SLR,CLR,LALR	**10**
Unit – 4:Intermediate Code Generation & Code Optimization	
Intermediate code generation: Three address code, abstract syntax tree, translation of simple statements and control flow statements. **Code Optimization**: Issues in the design of code optimization, Principal sources of optimization, optimization of basic blocks, Loop optimization, peephole optimization	**10**
Unit – 5: Code Generation	
Code Generation: Issues in the design of code Generation, Machine Dependent Code Generation, object code forms, Register allocation and assignment, DAG representation of basic Blocks,Generating code from	**12**

DAGs	

Text(T) / Reference(R) Books:

T1	A Text Book on Automata Theory, Nasir S.F.B, P.K.Srimani, Cambridge university Press
T2	Introduction to Automata Theory,Formal languages and computation, Shamalendu kandar, Pearson
T3	Compilers Principles, echniques and Tools, Aho, Ullman, RaviSethi, PEA
T4	Introduction to theory of computation, 2nd ed, Michelsipser, CENGAGE
T5	Principles of Compiler Design, A.V. Aho. J.D.Ullman;PEA
R1	Theory of Computer Science, Automata languages and computation, 2/e, Mishra, Chandra Shekaran, PHI
R2	Theory of Computation, a problem solving approach, kaviMahesh,Wiley
W1	https://onlinecourses.nptel.ac.in/noc18_cs14/preview

Course Outcomes:

CO1	Ability to classify machines by their power to recognize languages.
CO2	Design context free grammars for formal languages
CO3	Ability to describe the different types of parsers. i.e. Top-down, Bottom-up parsers, Construction of SLR,CLR and LALR parse table
CO4	Ability to explain code optimization techniques
CO5	Ability to explain code generation techniques to improve the performance of a program in terms of speed &space.

COMPUTER NETWORKS			
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: 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.	**10**
Unit – 3:The Medium Access Control Sub 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).	**10**
Unit – 4:Routing Algorithms	
Routing Algorithms- Shortest-Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast and Distance Vector Routing.	**10**
Unit – 5: 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. 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.	**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:	
CO1	Illustrate the concept of network reference models and classification of multiplexing.
CO2	Explain the design issues and various protocols of data link layer.
CO3	Interpret the use of medium access control sub layer.
CO4	Analyze various routing algorithms.
CO5	Experiment with congestion control algorithms and to illustrate the concept of domain name system.

<table>
<tr><th colspan="4">SOFTWARE ENGINEERING</th></tr>
<tr><td>Subject Code</td><td>18CSCST6030</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><th colspan="4">Credits – 03</th></tr>
<tr><td colspan="3">Unit -1: Software and Software Engineering</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction to Software Engineering: 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, Prescriptive Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models, Product and Process, Process Terminology, Process Assessment and Improvement.</td><td>10</td></tr>
<tr><td colspan="4">Unit -2: Software Requirements & Design</td></tr>
<tr><td colspan="3">Requirements Analysis and Specification: Requirements Gathering and Analysis, Software Requirement Specification (SRS), Formal System Specification.
Overview of the Design Process: How to Characterize 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, overview of Object-Oriented design.</td><td>12</td></tr>
<tr><td colspan="4">Unit – 3: Coding and Testing</td></tr>
<tr><td colspan="3">Coding: Coding Principles, Coding Standards, Code Review, Software Documentation
Testing: Unit Testing, Integration Testing, System Testing, Black-Box Testing, White-Box Testing, Debugging, Program Analysis Tool, Testing Object-Oriented Programs, Some General Issues Associated with Testing.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4: Software Reliability and Quality Management & CASE</td></tr>
<tr><td colspan="3">Software Reliability: 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.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5: Software Maintenance</td></tr>
<tr><td colspan="3">Software Maintenance: Maintenance Process Models, Maintenance Cost, Software Configuration Management. Software Reuse: what can be reused?</td><td>08</td></tr>
</table>

Why Almost No Reuse So Far? Basic Issues in Reuse Approach, Reuse at organization Level.	

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:	
CO1	Define and develop software applications using different process models.
CO2	Describe the various design concepts to build real world software.
CO3	Interpret various coding and testing Techniques
CO4	Illustrate the Quality measures, Reliability Metrics and CASE Tools
CO5	Describe need of maintenance and reuse activities

ENGINEERING ECONOMICS & FINANCIAL MANAGEMENT			
Subject Code	18CMMST6010	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	60	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-	**14**

Demand forecasting and its Methods.	
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).	**12**
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	**10**
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.	**12**

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:	
CO1	Identify the managerial economics and demand for a product.
CO2	Differentiate the Production and Cost concepts, estimating Cost Break even Analysis.
CO3	Describe the Markets and Pricing methods along with Business Cycles.
CO4	Calculate Accounting Concepts and Prepare Financial Statements- Analysis
CO5	Analyze various investment project proposals with the help of Capital Budgeting techniques.

Computer Networks Lab			
Subject Code	18CSCSL6070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1
Understanding and using of commands like ifconfig, netstat, ping, arp, telnet, ftp, finger, traceroute, whoisetc. 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:	
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
CO4	Discuss some of the enabling technologies e.g. high-speed links and storage

CO5	Build computer grids.

COMPILER DESIGN LAB			
Subject Code	18CSCSL6080	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
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:	
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.

Soft Skills & Aptitude Builder - 2			
Subject Code	18CMAHS6090	IA Marks	15+15
Number of Lecture Hours/Week	2	Exam Marks	35+35
Total Number of Lecture Hours	32	Exam Hours	3
Credits - 2			
Section A, Soft Skills			
Unit – 1: Communicative Competence			**Hours**
Verbal Reasoning: Reading Comprehension-Text Completion- Sentence EquivalenceSpotting Errors, Sequencing of Sentences, Parallelism in StructureE-Mail Etiquette, Reporting NewsActivity: Completing Exercises			**6**
Unit 2: Career and Employability Skills			
What is a Career: Career vs Job, Career Values & Grid, Skills vs Strengths, Spotting Skills/Reflection of Present Skills, Meeting the Expectation of your Employer, Matching your Skills with the Required Skills, Preparing Resume, Preparing for Interviews & Structuring Answers Activity: Resume Building, Interviews			**6**
Section B,Aptitude Builder			
Unit – 3: Time and Work			
Pipes and Cisterns: Problems on Unitary method, Relation between Men, Days, Hours and Work, Problems on Man-Day-Hours Method, Problems on Alternate Days, Problems on Pipes and Cisterns. **Time , Distance and Speed, Problems on Trains, Boats and Streams:** Relation between Speed, Distance and Time, Converting km/h into m/s and vice versa , Problems on Average Speed, Problems on Relative Speed, Problems on Circular Tracks, Problems on Races **Problems on Trains:** Two Trains Moving in Opposite Direction, Two Trains Moving in same Direction, A Train Crossing a Stationary Object of a Given Length like a Platform or Bridge, A Train Crossing a Stationary Object like a Pole or a Man **Boats and Streams:** Time Based, which can be considered as a Point Object Speed Based, Distance Based, Average Speed Based			**6**
Unit – 4: Logical and Analytical Reasoning			
Seating Arrangement: Linear Arrangement, Circular Arrangement, Tabler, Triangular Arrangement, Complex Arrangement**.** **Clocks:** Finding the Angle When the Time is Given, Finding the Time When the Angle is Known, Relation between Angles, Minutes and Hours, Position of Hands of the Clock, Time Gained or Lost by the Clock, Mirror /Water Image-based Time. **Calendars:** Definition of a Leap Year, Finding the Number of Odd Days,			**7**

Framing the Year Code for Centuries, Finding the Day of any Random Calendar Date **Syllogisms:** Finding the Conclusions using Venn Diagram Method, Finding the Conclusions using Syllogism Method **Simple Interest:** Definitions, Problems on Interest and Amount, Problems when Rate of Interest and Time Period are Numerically Equal **Compound Interest:** Definition and Formula for Amount in Compound Interest, Difference between Simple Interest and Compound Interest for 2 Years on the Same Principle and Time Period.	
Unit – 5: Permutations, Probability, Areas and Volumes	
Definition of permutation, Problems on Permutations, Definition of Combinations, problems on Combinations **Probability:** Definition of Probability, Problems on Coins, Problems on Dice, Problems on Deck of Cards, Problems on Years **Mensuration - 2D:**Formulas for Areas, Formulas for Volumes of Different Solids, Problems on Areas **Mensuration - 3D:** Problems on Volumes, Problems on Surface Areas	**7**

Text (T) / Reference (R) Books:	
For Units 1 & 2	
T1	Enhance Your Employability Skills, David Winter and Laura Brammar, University of London
T2	R.S. Agarwal, Verbal & Non-Verbal Reasoning, S. Chand & Co., Latest ed. 2003
R2	How to Prepare for Verbal Ability and Reading Comprehension, Arun Sharma, Meenakshi Upadhay, Mc Graw Hill
For Units 3, 4, & 5	
T1	R S Agarwal, S Chand, ‘Quantitative Aptitude’
T2	R S Agarwal, S.Chand , ‘A modern approach to Logical reasoning’
R1	Quantitative Aptitude for CAT By Arun sharma
R2	GL Barrons, Mc Graw Hills, Thorpe’s verbal reasoning, LSAT Materials
Course Outcomes: On completion of this course, students can	
Section A: Soft Skills	
CO 1	learn and practice effective communication skills
CO 2	develop broad career plans, evaluate the employment market, and become industry ready
Section B: Aptitude Builder	
CO 3	develop accuracy on time and distance and units related solutions
CO 4	solve the real-time problems for performing job functions easily
CO 5	solve problems related to permutations and combinations, probability, areas and volumes

VII SEMESTER (IV-I)

B. Tech VII Semester

S. No.	Subject			Hours			C
	Code	Type	Title	L	T	P	
01	18CSCST7010	PC	Data Warehousing and Data Mining	3			3
02	18CSCSP702X	PE	Professional Elective-III	3			3
03	18CSCSP703X	PE	Professional Elective-IV	3			3
04	18CSCSP704X	PE	Professional Elective-V	3			3
05	18CSXXO705X	OE	Open Elective-III	3			3
06	18CSXXO706X	OE	Open Elective-IV	3			3
07	18CSCSL7070	PC	Internet of Things Lab			3	1.5
08	18CSCSL7080	PC	Data Warehousing and Data Mining Lab			3	1.5
09	18CSCSL7090	SOC	MEAN Stack Technologies			4	2
10	18CSCSR7100		Internship				3
				Total Credits			**26**

<table>
<tr><th colspan="4">DATA WAREHOUSING &DATA MINING</th></tr>
<tr><td>Subject Code</td><td>18CSCST7010</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="4">Course Objectives
• To understand the principles of Data warehousing and Data Mining.
• To be familiar with the Data warehouse architecture and its Implementation.
• To know the Architecture of a Data Mining system.
• To understand the various Data preprocessing Methods.
• To perform classification and prediction of data.</td></tr>
<tr><td colspan="3">Unit -1: Introduction</td><td>Hours</td></tr>
<tr><td colspan="3">Data Warehousing and Business Analysis: - Data warehousing Components –Building a Data warehouse –Data Warehouse Architecture – DBMS Schemas for Decision Support – Data Extraction, Clean-up, and Transformation Tools –Metadata – reporting – Query tools and Applications – Online Analytical Processing (OLAP) – OLAP and Multidimensional Data Analysis.</td><td>08</td></tr>
<tr><td colspan="4">Unit -2: Data Mining</td></tr>
<tr><td colspan="3">Data Mining: - Data Mining Functionalities – Data Pre-processing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization and Concept Hierarchy Generation- Architecture of A Typical Data Mining Systems- Classification of Data Mining Systems.
Association Rule Mining: - Efficient and Scalable Frequent Item set Mining Methods – Mining Various Kinds of Association Rules – Association Mining to Correlation Analysis – Constraint-Based Association Mining.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3: Classification and Prediction</td></tr>
<tr><td colspan="3">Classification and Prediction: - Issues Regarding Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4: Cluster Analysis</td></tr>
</table>

Cluster Analysis: - Types of Data in Cluster Analysis – A Categorization of Major Clustering Methods – Partitioning Methods – Hierarchical methods – Density-Based Methods – Grid-Based Methods – Model-Based Clustering Methods – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis.	**10**
Unit – 5: Mining Object, Spatial, Multimedia, Text, and Web Data	
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.	**12**

Text(T)/Reference®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

CourseOutcomes:	
CO1	Understand stages in building a Data Warehouse
CO2	Understand the need and importance of pre-processing techniques and Analyze and evaluate performance of algorithms for Association Rules.
CO3	Understand the need and importance of Similarity and dissimilarity techniques
CO4	Analyze various Clustering Techniques

CO5	Apply Various kinds of Mining Techniques on different kinds of data.

INTERNET OF THINGS LAB			
Subject Code	18CSCSL7070	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Exercise1

Study on IoT Platform

a) Getting information and study of IOT microcontrollers (Arduino, Raspberry pi)

Exercise2

Study on IoT Platform

a) Getting information about Sensors (IR, temperature, pressure, gas sensor)

b) Getting information about actuators. (Piezoelectric actuator, pneumatic actuator)

Exercise3

Programming with Arduino platform

a) Installation of Arduino in computer and verifying any errors in connection.

b) Control LED using Arduino

c) Traffic Light Control

Exercise4

Programming with Arduino platform and Reading from Sensors

a) Interfacing sensors to Arduino board and getting information from them (any two sensors).

b) Experiment with both analog and digital sensors.

Exercise5

Programming with Raspberry pi

a) Displaying Date on Serial Monitor

b) Automated Door Opening System

Exercise6

Connecting Android Phone with Arduino

a) Connecting Arduino with Mobile Device Using the Bluetooth Module.

b) Control any two actuators connected to the development board using Bluetooth.

Exercise7

Integrating Ethernet Shield

Read data from sensor and send it to a requesting client using socket communication.

Note: The client and server should be connected to same local area network

Exercise 8

Creating Mobile App

a) Create a mobile app to control an actuator.

b) Control Electronic Devices from anywhere across the world using Internet & Mobile App.

Exercise9

Interfacing Cloud

a) Push sensor data to cloud - Use Arduino to Upload data from Environmental Sensors to Cloud Server.

b) Control an actuator through cloud

Exercise10

Data analysis and Visualization

Access the data pushed from sensor to cloud and apply any data analytics or visualization services.

Exercise11

Social media with IoT

Creating Program for Local host Web Server for controlling devices and update status on Twitter through Arduino.

Exercise12

Mini Project

Identify a problem in your local area or college which can be solved by integrating the things you learned so far and create a prototype to solve it.

Course Outcomes:	
CO1	Choose the sensors and actuators for an IoT application
CO2	Select protocols for a specific IoT application
CO3	Utilize the cloud platform and APIs for IoT application
CO4	Experiment with embedded boards for creating IoT prototypes
CO5	Design and develop a solution for a given IoT application

DATA WAREHOUSING AND DATA MINING LAB			
Subject Code	18CSCSL7080	IA Marks	15
Number of Tutorial Hours/Week	03(P)	Exam Marks	35
Total Number of Practice Hours	36	Exam Hours	03
Credits – 1.5			

List of Experiments

Note: Use python library scikit-learn wherever necessary

Exercise1

Demonstrate the following data preprocessing tasks using python libraries.
a) Loading the dataset
b) Identifying the dependent and independent variables c) Dealing with missing data

Exercise2

Demonstrate the following data preprocessing tasks using python libraries.
a) Dealing with categorical data
b) Scaling the features
c) Splitting dataset into Training and Testing Sets

Exercise3

Demonstrate the following Similarity and Dissimilarity Measures using python
a) Pearson's Correlation
b) Cosine Similarity
c) Jaccard Similarity
d) Euclidean Distance
e) Manhattan Distance

Exercise4

Build a model using linear regression algorithm on any dataset.

Exercise5

Build a classification model using Decision Tree algorithm on iris dataset

Exercise6

Apply Naïve Bayes Classification algorithm on any dataset

Exercise7

Generate frequent itemsets using Apriori Algorithm in python and also generate association rules for any market basket data.

Exercise 8

Apply K- Means clustering algorithm on any dataset.

Exercise9

Apply Hierarchical Clustering algorithm on any dataset.

Exercise10

Apply DBSCAN clustering algorithm on any dataset.

Course Outcomes:	
CO1	Apply preprocessing techniques on real world datasets
CO2	Apply apriori algorithm to generate frequent itemsets.
CO3	Apply Classification algorithms on different datasets.
CO4	Apply Clustering algorithms on different datasets.
CO5	Find dissimilarities in data

MEAN STACK TECHNOLOGIES (HTML 5, JAVASCRIPT, EXPRESS.JS, NODE.JS AND TYPESCRIPT)			
Subject Code	18CSCSS7090	IA Marks	15
Number of Lecture hours/Week	4	Exam Marks	35
Total Number of Lecture Hours	48	Exam Hours	3
Credits -2			

List of Exercises	
1.a	**Course Name:** HTML5 - The Language
	Module Name: Case-insensitivity, Platform-independency, DOCTYPE Declaration, Types of Elements, HTML Elements - Attributes, Metadata Element
	Include the Metadata element in Homepage.html for providing description as "IEKart's is an online shopping website that sells goods in retail. This company deals with various categories like Electronics, Clothing, Accessories etc.
1.b	**Course Name:** HTML5 - The Language
	Module Name: Sectioning Elements
	Enhance the Homepage.html of IEKart's Shopping Application by adding appropriate sectioning elements.
1.c	**Course Name:** HTML5 - The Language
	Module Name: Paragraph Element, Division and Span Elements, List Element
	Make use of appropriate grouping elements such as list items to "About Us" page of IEKart's Shopping Application
1.d	**Course Name:** HTML5 - The Language
	Module Name: Link Element
	Link "Login", "SignUp" and "Track order" to "Login.html", "SignUp.html" and "Track.html" page respectively. Bookmark each category to its details of IEKart's Shopping application.
1.e	**Course Name:** HTML5 - The Language
	Module Name: Character Entities
	Add the © symbol in the Home page footer of IEKart's Shopping application.
1.f	**Course Name:** HTML5 - The Language

List of Exercises	
	Module Name: HTML5 Global Attributes
	Add the global attributes such as content editable, spell check, id etc. to enhance the Signup Page functionality of IE Kart's Shopping application.
2.a	**Course Name:** HTML5 - The Language
	Module Name: Creating Table Elements, Table Elements : Colspan/ Rowspan Attributes, border, cell spacing, cell padding attributes
	Enhance the details page of IEKart's Shopping application by adding a table element to display the available mobile/any inventories.
2.b	**Course Name:** HTML5 - The Language
	Module Name: Creating Form Elements, Color and Date Pickers, Select and Datalist Elements
	Using the form elements create Signup page for IEKart's Shopping application.
2.c	**Course Name:** HTML5 - The Language
	Module Name: Input Elements – Attributes
	Enhance Signup page functionality of IEKart's Shopping application by adding attributes to input elements.
2.d	**Course Name:** HTML5 - The Language
	Module Name: Media, Iframe
	Add media content in a frame using audio, video, iframe elements to the Home page of IEKart's Shopping application.
3.a	**Course Name:** Javascript
	Module Name: Type of Identifiers
	Write a JavaScript program to find the area of a circle usingradius (var and let-reassign and observe the difference with var and let) and PI (const)
3.b	**Course Name:** Javascript
	Module Name: Primitive and Non Primitive Data Types
	Write JavaScript code to display the movie details such as movie name, starring, language, and ratings. Initialize the variables with values of appropriate types. Use template literals wherever necessary.
3.c	**Course Name:** Javascript
	Module Name: Operators and Types of Operators
	Write JavaScript code to book movie tickets online and calculate the total price, considering the number of tickets and price per ticket as Rs. 150. Also, apply afestive season discount of 10% and calculate the discounted amount.

List of Exercises	
3.d	**Course Name:** Javascript
	Module Name: Types of Statements, Non - Conditional Statements, Types of Conditional Statements, if Statements, switch Statements
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
3.e	**Course Name:** Javascript
	Module Name: Types of Loops
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
4.a	**Course Name:** Javascript
	Module Name: Types of Functions, Declaring and Invoking Function, Arrow Function, Function Parameters, Nested Function, Built-in Functions, Variable Scope inFunctions
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
4.b	**Course Name:** Javascript
	Module Name: Working With Classes, Creating and Inheriting Classes
	Create an Employee class extending from a base class Person. Hints: (i) Create a class Person with name and age as attributes. (ii) Add a constructor to initialize the values (iii) Create a class Employee extending Person with additional attributes role
4.c	**Course Name:** Javascript
	Module Name: In-built Events and Handlers
	Write a JavaScript code to book movie tickets online and calculate the total price based on the 2 conditions: (a) If seats to be booked are not more than 2, the cost per ticket remains Rs. 150. (b) If seats are 6 or more, booking is not allowed.
4.d	**Course Name:** Javascript
	Module Name: Working with Objects, Types of Objects, Creating Objects, Combining and cloning Objects using Spread operator, Destructuring Objects, Browser Object Model, Document Object Model
	If a user clicks on the given link, they should see an empty cone, a different heading, and a different message and a different background color. If user clicks again, they should see a re-filled cone, a different heading, a different

List of Exercises	
	message, and a different back ground color
5.a	**Course Name:** Javascript
	Module Name: Creating Arrays, Destructuring Arrays, Accessing Arrays, Array Methods
	Create an array of objects having movie details. The object should include the movie name, starring, language, and ratings. Render the details of movies on the page using the array.
5.b	**Course Name:** Javascript
	Module Name: Introduction to Asynchronous Programming, Callbacks, Promises, Async and Await, Executing Network Requests using Fetch API
	Simulate a periodic stock price change and display on the console. Hints: (i) Create a method which returns a random number - use Math.random, floor and other methods to return a rounded value. (ii) Invoke the method for every three seconds and stop When random value is zero.
5.c	**Course Name:** Javascript
	Module Name: Creating Modules, Consuming Modules
	Validate the user by creating a login module. Hints: (i) Create a file login.js with a User class. (ii) Create a validate method with username and password as arguments. (iii) If the username and password are equal it will return "Login Successful" else will return “Login is Failure”.
6.a	**Course Name:** Node.js
	Module Name: How to use Node.js
	Verify how to execute different functions successfully in the Node.js platform.
6.b	**Course Name:** Node.js
	Module Name: Create a web server in Node.js
	Write a program to show the workflow of JavaScript code executable by creating web server in Node.js.
6.c	**Course Name:** Node.js
	Module Name: Modular programming in Node.js
	Write a Node.js module to show the workflow of Modularization of Node application.
6.d	**Course Name:** Node.js
	Module Name: Restarting Node Application
	Write a program to show the workflow of restarting a Node application.
6.e	**Course Name:** Node.js
	Module Name: File Operations
	Create a text file src.txt and add the following data to it. Mongo, Express, Angular, Node.

List of Exercises	
7.a	**Course Name:** Express.js
	Module Name: Defining a route, Handling Routes, Route Parameters, Query Parameters
	Implement routing for the AdventureTrails application by embedding the necessary code in the routes/route.js file.
7.b	**Course Name:** Express.js
	Module Name: How Middleware works, Chaining of Middlewares, Types of Middlewares
	In myNotes application: (i) we want to handle POST submissions. (ii)display customized error messages. (iii) perform logging.
7.c	**Course Name:** Express.js
	Module Name: Connecting to MongoDB with Mongoose, Validation Types and Defaults
	Write a Mongoose schema to connect with MongoDB.
	https://infyspringboard.onwingspan.com/web/en/viewer/web-module/lex_auth_01303558877548544069l_shared?collectionId=lex_3240783 56719 46760000_shared&collectionType=Course
7.d	**Course Name:** Express.js
	Module Name: Models
	Write a program to wrap the Schema into a Model object.
8.a	**Course Name:** Express.js
	Module Name: CRUD Operations
	Write a program to perform various CRUD (Create-Read-Update-Delete) operations using Mongoose library functions.
8.b	**Course Name:** Express.js
	Module Name: API Development
	In the myNotes application, include APIs based on the requirements provided. (i) API should fetch the details of the notes based on a notesID which is provided in the URL. Test URL - http://localhost:3000/notes/7555 (ii) API should update the details based on input notes ID
8.c	**Course Name:** Express.js
	Module Name: Why Session management, Cookies
	Write a program to explain session management using cookies.
8.d	**Course Name:** Express.js
	Module Name: Sessions
	Write a program to explain session management using sessions.
8.e	**Course Name:** Express.js

List of Exercises	
	Module Name: Why and What Security, Helmet Middleware
	Implement security features in myNotes application
9.a	**Course Name:** Typescript
	Module Name: Basics of TypeScript
	On the page, display the price of the mobile-based in three different colors. Instead of using the number in our code, represent them by string values like GoldPlatinum, PinkGold, SilverTitanium.
9.b	**Course Name:** Typescript
	Module Name: Function
	Define an arrow function inside the event handler to filter the product array with the selected product object using the productId received by the function. Pass theselected product object to the next screen.
9.c	**Course Name:** Typescript
	Module Name: Parameter Types and Return Types
	Consider that developer needs to declare a function - getMobileByVendor which accepts string as input parameter and returns the list of mobiles.
9.d	**Course Name:** Typescript
	Module Name: Arrow Function
	Consider that developer needs to declare a manufacturer's array holding 4 objects with id and price as a parameter and needs to implement an arrow function - myfunction to populate the id parameter of manufacturers array whose price is greater than or equal to 100.
9.e	**Course Name:** Typescript
	Module Name: Optional and Default Parameters
	Declare a function - getMobileByManufacturer with two parameters namely manufacturer and id, where manufacturer value should passed as Samsung and id parameter should be optional while invoking the function, if id is passed as 101 then this function should return the name of manfacturer
10.a	**Course Name:** Typescript
	Module Name: Rest Parameter
	Implement business logic for adding multiple Product values into a cart variable which is type of string array.
10.b	**Course Name:** Typescript
	Module Name: Creating an Interface
	Declare an interface named - Product with two properties like productId and productName with a number and string datatype and need to implement logic to populate the Product details.

List of Exercises	
10. c	**Course Name:** Typescript
	Module Name: Duck Typing
	Declare an interface named - Product with two properties like productId and productName with the number and string datatype and need to implement logicto populate the Product details.
10. d	**Course Name:** Typescript
	Module Name: Function Types
	Declare an interface with function type and access its value.
11. a	**Course Name:** Typescript
	Module Name: Extending Interfaces
	Declare a productList interface which extends properties from two other declared interfaces like Category,Product as well as implementation to create a variable of this interface type.
11 b	**Course Name:** Typescript
	Module Name: Classes
	Consider the Mobile Cart application, Create objects of the Product class and place them into the productlist array.
11. c	**Course Name:** Typescript
	Module Name: Constructor
	Declare a class named - Product with the below-mentioned declarations: (i) productId as number property (ii) Constructor to initialize this value (iii) getProductId method to return the message "Product id is <<id value>>".
11. d	**Course Name:** Typescript
	Module Name: Access Modifiers
	Create a Product class with 4 properties namely productId, productName, productPrice, productCategory with private, public, static, and protectedaccess modifiers and accessing them through Gadget class and its methods.
12. a	**Course Name:** Typescript
	Module Name: Properties and Methods
	Create a Product class with 4 properties namely productId and methodsto setProductId() and getProductId().
12. b	**Course Name:** Typescript
	Module Name: Creating and using Namespaces
	Create a namespace called ProductUtility and place the Product class definition in it. Import the Product class inside productlist file and use it.
12. c	**Course Name:** Typescript
	Module Name: Creating and using Modules
	Consider the Mobile Cart application which is designed as part of the functions in a module to calculate the total price of the product using the quantity and

List of Exercises	
	price values and assign it to a totalPrice variable.
12. d	**Course Name:** Typescript
	Module Name: What is Generics, What are Type Parameters, Generic Functions, Generic Constraints
	Create a generic array and function to sort numbers as well as string values.

Text(T) / Reference(R) Books:	
T1	Pro Mean Stack Development, 1st Edition, ELadElrom, ApressO'Reilly.
T2	Full Stack JavaScript Development with MEAN, Colin J Ihrig, Adam Bretz, 1st edition, SitePoint, SitePoint Pty. Ltd., O'ReillyMedia.
R1	Web Technologies, HTML, JavaScript, PHP, Java, JSP, XML and AJAX, Black book, 1stEdition, DreamTech.
R2	An Introduction to Web Design, Programming, 1st Edition, Paul S Wang, Sanda S Katila, Cengage Learning.
W1	https://infyspringboard.onwingspan.com/en/app/toc/lex_17739732834840810000_shared/overview (HTML5)
W2	https://infyspringboard.onwingspan.com/en/app/toc/lex_18109698366332810000_shared/overview (Javascript)
W3	https://infyspringboard.onwingspan.com/en/app/toc/lex_32407835671946760000_shared/overview (Node.js &Express.js)
W4	https://infyspringboard.onwingspan.com/en/app/toc/lex_9436233116512678000_shared/overview(Typescript)

Course Outcomes:	
CO1	Develop professional web pages of an application using HTML elements like lists, navigations, tables, various form elements, embedded media which includes images, audio, video and CSS Styles.
CO2	Utilize JavaScript for developing interactive HTML web pages and validate form .
CO3	Build a basic web server using Node.js and also working with Node Package Manager(NPM).
CO4	Build a web server usingExpress.js

CO5	Make use of Typescript to optimize JavaScript code by using the concept of strict type checking.

IV B. Tech II Semester

S. No.	Subject			Hours			C
	Code	**Type**	**Title**	**L**	**T**	**P**	
01	18CSCSR8010	PROJ	Project Phase -II			24	12
							12

Professional Electives

S.No.	Subject
A	Software Project Management
B	Network Protocols
C	Mobile Application Development
D	Unified Modeling Language
E	Cryptography & Network Security
F	Data Science
G	Design Patterns
H	Cyber Security
I	Artificial Intelligence
J	Software Testing
K	Mobile Computing
L	Machine Learning
M	Software Quality Assurance
N	Ad-hoc & Sensor Networks
O	Hadoop & Big Data

<table>
<tr><th colspan="4">SOFTWARE PROJECT MANAGEMENT
(PROFESSIONAL ELECTIVE)</th></tr>
<tr><td>Subject Code</td><td>18CSCSPX0XA</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: Introduction</td><td>Hours</td></tr>
<tr><td colspan="3">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.</td><td>08</td></tr>
<tr><td colspan="4">Unit -2:Effort estimation & Activity Planning</td></tr>
<tr><td colspan="3">Estimation techniques, Function point analysis, SLOC, COCOMO, Usecase-based estimation, Activity identification approaches, network planning models, critical path analysis.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3:Risk management</td></tr>
<tr><td colspan="3">Risk categories, Identification, Assessment, Planning and management, PERT technique, Monte Carlo approach.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4:Project Management and Control</td></tr>
<tr><td colspan="3">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.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5:Software Quality</td></tr>
</table>

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

Course Outcomes:	
CO1	To match organizational needs to the most effective software development model
CO2	To describe 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

<table>
<tr><th colspan="4">NETWORK PROTOCOLS
(PROFESSIONAL ELECTIVE)</th></tr>
<tr><td>Subject Code</td><td>18CSCSPX0XB</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: IP Addressing</td><td>Hours</td></tr>
<tr><td colspan="3">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.</td><td>08</td></tr>
<tr><td colspan="4">Unit -2:Internet Control Message Protocol</td></tr>
<tr><td colspan="3">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.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3:Transmission Control Protocol</td></tr>
<tr><td colspan="3">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.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4:Telnet & R Login</td></tr>
</table>

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:

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.

MOBILE APPLICATION DEVELOPMENT (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XC	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

Provide knowledge on tools required for Mobile Application Development using Android.

Discuss android User Interface using Views.

Impart Android User Interface for pictures and menus.

Introduce knowledge on android databases.

Unit -1: Started with Android and Android Studio	**Hours**
What Is Android, Required Tools, Launching First Android Application, Exploring the IDE, Debugging Application, Publishing Application.	**08**
Unit -2:Android User Interface	
Understanding the Components of a Screen, Adapting to Display Orientation, Managing Changes to Screen Orientation, Creating the User Interface Programmatically, Basic Views, Picker Views, List Views	**10**
Unit – 3:Activities, Fragments, and Intents	
Understanding Activities, Linking Activities Using Intents, Fragments, Displaying Notifications.	**10**
Unit – 4:Data Persistence	
Saving and Loading User Preferences, Persisting Data to Files, Creating and Using Databases.	**10**
Unit – 5:Messaging and Location-Based Services	
SMS Messaging, Sending Email, Displaying Maps, Getting Location Data, Monitoring a Location.	**12**

Text(T) / Reference(R) Books:	
T1	Beginning Android® Programming with Android Studio, J..F.. DiMarzio, John Wiley & Sons, Inc. (Wrox)
T2	Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox)
R1	Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox)
R2	Android Programming: The Big Nerd Ranch Guide, Bill Phillips, Chris Stewart and Kristin Marsicano, Big Nerd Ranch, LLC.
W1	https://developer.android.com/
W2	https://www.coursera.org/courses?query=mobile%20app%20development

Course Outcomes:	
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.

UNIFIED MODELING LANGUAGE (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XD	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			
Course Objectives: The learning objectives of this course are: • Understand how to solve complex problems and • analyze the problems using object-oriented approach • Design Solutions to the problems using object-oriented approach • Study the notations of unified modelling language			
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 & 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:	
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

CRYPTOGRAPHY & NETWORK SECURITY (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XE	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:	
CO1	To be Summarize with information security awareness and a clear understanding of its importance.
CO2	To Summarize fundamentals of secret and public cryptography
CO3	To Describe master protocols for security services
CO4	To be Summarize with network security threats and countermeasures
CO5	To be Summarize with network security designs using available secure solutions (such as PGP, SSL, IPSec, etc).

<table>
<tr><td colspan="4">DATA SCIENCE
(PROFESSIONAL ELECTIVE)</td></tr>
<tr><td>Subject Code</td><td>18CSCSPX0XF</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: Introduction to artificial intelligence</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction to Data science: Introduction, Terminology, data science process, Types of data classification-data science algorithms (Linear Regression, K-means, support Vector machines, ANN, RNN, Apriori), Example Applications</td><td>08</td></tr>
<tr><td colspan="4">Unit -2: Data collection and management</td></tr>
<tr><td colspan="3">Introduction, Data collections methods, Data collection and APIs, API Categories, Exploring and fixing data, Data storage and management, Using multiple data sources</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3: Data Analysis</td></tr>
<tr><td colspan="3">Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples /CLT, Basic machine learning algorithms, Linea rregression, SVM, Naïve Bayes.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 4: Data visualization</td></tr>
<tr><td colspan="3">Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings. Introduction to matplotlib.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 5: Applications and recent trends of Data Science</td></tr>
<tr><td colspan="3">Applications of data science, Technologies for visualization, Bokeh (Python), Recent trends in various data collection and analysis techniques, various visualization techniques, application Development methods used in data science</td><td>12</td></tr>
</table>

Text(T) / Reference(R) Books:	
T1	RachelSchutt &O'neil, "Doing Data Science",O'REILLY,ISBN:978-1-449-35865-5,1st edition ,October 2013.
T2	JureLeskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets .v2.1,Cambridge University Press
R1	JoelGrus, "Data Science from Scratch: First Principles with Python",O'ReillyMedia,2015
R2	MattHarrison, "Learning the Pandas Library: Python Tools for Data Munging ,Analysis, and Visualization,O'Reilly,2016

Course Outcomes:	
CO1	Identify the types of data in Data science
CO2	Understand about how to collect the data, manage the data
CO3	Classify the data using svm and navie bayesian
CO4	Explore visual analysis techniques
CO5	Explore latest trends in data science techniques.

DESIGN PATTERNS (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XG	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			
Course Objectives: The learning objectives of this course are: 1. Understand the various design patterns and choose design pattern for their problem. 2. Study and design creational design patterns for sloving various software design problems. 3. Study and Construct Structural design patterns for real world reoccurring software problems. 4. Study and build behavioral design patterns for real world reoccurring software problems. 5. To construct design pattern for an application Document Editor.			

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.	**09**
Unit -2:Usage of Design patterns	
How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.	**09**
Unit - 3:Creational Patterns	
Abstract Factory, Builder, Factory Method, Prototype, Singleton.	**10**
Unit - 4:Structural Pattern	
Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy.	**10**
Unit - 5:Behavioral Patterns	
Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer.	**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.javatpoint.com/design-patterns-in-java
W2	https://www.udemy.com/topic/design-pattern/

Course Outcomes: On completion of this course, students can	
CO1	Able to understand the software industries design practices through design patterns.
CO2	Identify the appropriate design patterns to solve object oriented design problems.
CO3	Develop the appropriate Creational Design Patterns solution to the real world software design problems.
CO4	Ability to identify and implement the appropriate Structural Design Patterns for the real world software design problem.
CO5	Choose and Construct the appropriate Behavioral Design Pattern for the real world software design problem.

CYBER SECURITY (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XH	IA Marks	30
Number of Lecture Hours/Week	3	Exam Marks	70
Total Number of Lecture Hours	50	Exam Hours	03
Credits – 03			

Course Objectives:
The learning objectives of this course are:
1. The Cyber security Course will provide the students with foundational Cyber Security principles, Security architecture, risk management, attacks, incidents, and emerging IT and IS technologies.
2. Students will gain insight into the importance of Cyber Security and the integral role of Cyber Security professionals.

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 (IDTheft)	**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	**10**

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?	
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, Sunit Belapure, 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

ARTIFICIAL INTELLIGENCE (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XI	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	
Problem solving: state-space search and control strategies: Introduction, general problem solving, characteristics of problem **Search Strategies**: exhaustive searches, heuristic search techniques, iterative-deepening A*, constraint satisfaction	**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: Knowledge Representation	
Knowledge representation: Introduction, approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR **Advanced knowledge representation techniques:** Introduction, conceptual dependency theory, script structure	**10**
Unit – 5: Expert system and applications	
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.	**12**

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

Course Outcomes:	
CO1	Describe about problem spaces and list out various search strategies.
CO2	Identify and trace the different search algorithms.
CO3	Summarize different learning methods used in artificial intelligence.
CO4	Make use of resolution and unification for discovering new facts from existing knowledge base
CO5	Explain about the significance of expert systems in artificial intelligence.

SOFTWARE TESTING (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XJ	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: Purpose of Testing, Dichotomies, Model for Testing, Levels of Testing ,Basicdefinitions,SoftwareTestingPrinciples,TheTester‘sRoleinaSoftwareDevelopment, Consequences of Bugs, Taxonomy of Bugs. **Flow graphs and Path testing:** Basics Concepts of Path Testing, Predicates, Path Predicates and AchievablePaths, Path Sensitizing, Path Instrumentation, Applications of Path Testing.	**10**
Unit -2	
Transaction Flow Testing: Transaction Flows, Transaction Flow Testing Techniques. **Dataflow testing:** BasicsofDataflowTesting,StrategiesinDataflowTesting,ApplicationofDataflow Testing	**08**
Unit – 3	
Paths and Regular expressions: PathExpression,ReductionProcedure,Applications,RegularExpressions&Flow Anomaly Detection. **Syntax Testing:** Grammarforformats,TestCaseGeneration,ImplementationandApplicationand Testability Tips	**10**
Unit – 4	
LogicBasedTesting: Overview,Decision Tables, KV Charts, and Specifications **State, State Graphs and Transition Testing:** State Graphs, Good & Bad State Graphs, State Testing, and Testability Tips. **Graph Matrices and Application: -** Motivationaloverview,matrixofgraph,relations,powerofamatrix,nodereduction algorithm.	**12**

Unit – 5	
Software Testing Tools: Introduction to Testing, Automated Testing, Concepts of Test Automation,skills needed for automation, scope of automation, challenges in automation,Introduction to testing tools like Win runner, Load Runner, Selenium andworking with selenium	**10**

Text(T) / Reference(R) Books:	
T1	“Softwaretestingtechniques”–BorisBeizer,Dreamtech,secondedition.
T2	“Software Testing”- Yogesh Singh, Camebridge
R1	“The Craft of software testing” - Brian Marick, Pearson Education.
R2	“Software Testing”, N.Chauhan, Oxford University Press.
R3	“Introduction to Software Testing”, P.Ammann&J.Offutt, Cambridge Univ.Press.
R4	“Effective methods of Software Testing”, Perry, John Wiley, 2nd Edition, 1999.
R5	“FoundationsofSoftwareTesting”,D.Graham,CengageLearning
W1	https://www.coursera.org/courses?query=software%20testing
W2	https://www.edx.org/course/software-testing-fundamentals-usmx-umuc-stv1-1x-4

Course Outcomes:	
CO1	Discuss basic software testing terminology, concepts of path testing andapplications.
CO2	Discuss Data flow testing and transaction flow testing methods
CO3	Implement and generate test cases in syntax testing
CO4	Develop test cases and test suites by using different testing methods

CO5	Analyzetheapplicationsmanuallybyapplyingdifferenttestingmethodsinstategraphs and transition testing

<table>
<tr><td colspan="5" align="center">MOBILE COMPUTING
(PROFESSIONAL ELECTIVE)</td></tr>
<tr><td>Subject Code</td><td>18CSCSPX0XK</td><td colspan="2">IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>3</td><td colspan="2">Exam 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 colspan="5" align="center">Credits – 03</td></tr>
<tr><td colspan="3">Unit -1: Introduction</td><td colspan="2">Hours</td></tr>
<tr><td colspan="3">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)</td><td colspan="2">08</td></tr>
<tr><td colspan="5">Unit -2: Mobile Network Layer</td></tr>
<tr><td colspan="3">IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Location Management, Registration, Tunnelling and Encapsulation, Route Optimization, DHCP.</td><td colspan="2">10</td></tr>
<tr><td colspan="5">Unit – 3: Mobile Transport Layer</td></tr>
<tr><td colspan="3">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.</td><td colspan="2">10</td></tr>
<tr><td colspan="5">Unit – 4: Data Dissemination and Synchronization</td></tr>
</table>

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
W	https://onlinecourses.nptel.ac.in/noc16_cs13/preview

Course Outcomes:	
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.

MACHINELEARNING			
SubjectCode	18CSCSPX0XL	IAMarks	30
NumberofLectureHours/Week	3	ExamMarks	70
TotalNumberof LectureHours	50	ExamHours	03
Credits–03			

CourseObjectives:
Thelearningobjectivesof thiscourseare:

1. Familiaritywithasetofwell-knownsupervised,unsupervisedandsemi-supervisedlearningalgorithms.
2. Theabilitytoimplementsome basicmachine learningalgorithms.
3. Understandingof how machine learningalgorithms areevaluated.

Unit-1:Theingredientsof machinelearning,Tasks	**Hours**
The problems that can be solved with machine learning, Models: the output of machine learning, Features, the work horses of machine learning .Binary classification and related tasks: Classification, Scoring and ranking, Class probability estimation .Beyond binary classification:Handling more than two classes,Regression,Unsupervisedanddescriptivelearning.	**09**
Unit-2:Conceptlearning	
Thehypothesisspace,Pathsthroughthehypothesisspace,Beyondconjunctiveconcepts. Treemodels: Decisiontrees, Ranking and probability estimation trees, Tree learning as variance eduction. Rulemodels: Learning ordered rule lists, Learning unordered rulesets, Descriptiverulelearning,First-orderrulelearning.	**10**
Unit–3:Linearmodels	
The least-squares method, the perceptron: a heuristic learning algorithm forlinear classifiers, Support vector machines, obtaining probabilities from linearclassifiers, Going beyond linearity with kernel methods. Distance Based Models: Introduction, Neighbors and exemplars,Nearest Neighbors' classification, Distance Based Clustering, HierarchicalClustering.	**10**
Unit–4:Probabilisticmodels	

The normal distribution and its geometric interpretations, Probabilistic modelsforcategoricaldata,Discriminative learning by optimizing conditional Like lihood Probabilistic models with hidden variables. Features: Kinds of feature, Feature transformations, Feature construction andselection. Model ensembles:Baggingand randomforests,Boosting.	**10**
Unit–5:DimensionalityReduction	
PrincipalComponentAnalysis(PCA),Implementationanddemonstration.ArtificialNeuralNetworks:Introduction,Neuralnetworkrepresentation,appropriateproblemsforneuralnetworklearning,Multilayernetworksandthe back-propagationalgorithm.	**11**

Text(T)/Reference®Books:	
T1	MachineLearning:Theartandscienceofalgorithmsthatmakesenseofdata,PeterFlach,Cambridge.
T2	MachineLearning,Tom M.Mitchell,MGH
R1	UnderstandingMachineLearning: From Theoryto algorithms, Shai Shalev-Shwartz,ShaiBen-David,Cambridge.
R2	MachineLearninginAction,PeterHarington,2012,Cengage
W1	https://www.tutorialspoint.com/what-is-machine-learning
W2	https://www.analyticsvidhya.com/machine-learning/
W3	https://www.youtube.com/watch?v=eq7KF7JTinU

CourseOutcomes:	
CO1	Studentshouldbeabletounderstandtheclassificationanditstypesand problemssolved byML.
CO2	Studentshouldbeabletoillustratehypothesisspace,decisiontreesandFirst orderrulelearning.
CO3	StudentshouldbeabletoapplydifferentclassifireslikeSVM,KNNand Clusteringtechniques.

CO4	Studentshould beableto applyclassifiers likeNaïve bayes, random forest.
CO5	Studentshouldbeabletocomparedifferentdimensionalityreductiontechniques.

SOFTWARE QUALITY ASSURANCE (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XM	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 Software Quality &Architecture	**Hours**
Need for Software quality – Quality challenges – Software quality assurance(SQA) – Definition and objectives – Software quality factors-McCall's qualitymodel–SQAsystemandarchitecture–SoftwareProjectlifecycleComponents–Preprojectqualitycomponents–Developmentandqualityplans.	**10**
Unit -2: SQA Components and Project Life Cycle	
Software Development methodologies –Quality assurance activities in the development process-Verification&Validation–Reviews–SoftwareTesting –Software Testing implementations – Quality of software maintenance – Pre-Maintenanceofsoftwarequalitycomponents–Qualityassurancetools–Software maintenance quality – Project Management	**10**
Unit – 3: Software Quality Infrastructure	
Procedures and work instructions – Templates – Checklists – 3S development –Stafftrainingandcertification Correctiveandpreventiveactions–Configuration management–Software changecontrol–Configuration management audit -Documentation control – Storage and retrieval	**08**
Unit – 4: Software Quality Management & Metrics	
Project process control – Computerized tools – Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model	**10**
Unit – 5: Standards, Certifications & Assessments	
Quality management standards–ISO 9001,9003–capabilityMaturityModels CMMandCMMI–Bootstrapmethodology–SQAprojectprocessstandards IEEE st 1012 & 1028 – Organization of Quality Assurance –Departmentmanagement responsibilities – Project management responsibilities-SQA unitsand other actors in SQA systems	**12**

Text(T) / Reference(R) Books:	
T1	“Software Quality Assurance, Daniel Galin, Pearson Publication, 2009
T2	“SoftwareQuality:TheoryandManagement,AlanC.Gillies,InternationalThomsonComputer Press
R1	“SoftwareQuality:ProducingPracticalConsistentSoftware”,MordechaiBen-Menachem International Thompson Computer Press, 1997
R2	“MetricsandModelsinSoftwareQualityEngineering”,StephenHKhanPearsonEducation, Second Edition, 2004
W1	https://www.coursera.org/courses?query=software%20testing
W2	https://www.coursera.org/courses?query=quality%20assurance

Course Outcomes:	
CO1	Describe the basic concepts in SQA, challenges and SQA system architecture
CO2	Explain SQA components and maintenance activities.
CO3	Choose the corrective actions to assess the quality of software product.
CO4	Apply the metrics involved in software development
CO5	Develop the concepts in preparing the quality plan & documents

<table>
<tr><th colspan="4">Ad-Hoc & SENSOR NETWORKS
(PROFESSIONAL ELECTIVE)</th></tr>
<tr><td>Subject Code</td><td>18CSCSPX0XN</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="4">Course Objectives:
The learning objectives of this course are:
● Upon completion of this course, students will be able to know the characteristics of adhoc and sensor networks, study various MAC and routing protocols, and provide security to MANET and WSN.</td></tr>
</table>

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, Multicastrouting, 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, Datadissemination, 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 Ivan Stojmenovic Stefano Basagni, Wiley, Second Edition,2015
T2	Ad Hoc Wireless Networks – Architectures 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 Sebastin Buettrich, 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	Explain the concepts, network architectures and applications of ad hoc and wireless sensor networks
CO2	Explain the various adhoc routing protocols and transport layer mechanisms
CO3	Classify the design issues and different categories of MAC protocols
CO4	Illustrate the issues of routing in wsn and QoS related performance measurements
CO5	Comprehend the various sensor network Platforms, tools and applications

HADOOP & BIG DATA (PROFESSIONAL ELECTIVE)			
Subject Code	18CSCSPX0XO	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: Data structures in Java	**Hours**
Linked List, Stacks, Queues, Sets, Maps; Generics: Generic classes and Type parameters, Implementing Generic Types, Generic Methods, Wrapper Classes, Concept of Serialization	**08**
Unit -2: Working with Big Data	
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.	**10**
Unit – 3: Writing Map Reduce Programs	
A Weather Dataset, Understanding Hadoop API for Map Reduce Framework(Old and New), ***Basic programs of HadoopMapReduce:***Driver code, Mapper code, Reducer code, Record Reader, Combiner, *Partitioned Hadoop I/O:* TheWritable Interface, Writable Comparable and comparators, Writable Classes:Writable wrappers for Java primitives, Text, Bytes Writable, Null Writable, ObjectWritable and GenericWritable, Writable collections, Implementing a Custom Writable: Implementing a RawComparator for speed, Custom comparators.	**10**
Unit – 4: Pig Latin	
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**.**	**10**
Unit – 5: Applying Structure to Hadoop Data with Hive	
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	**12**

Text(T) / Reference(R) Books:	
T1	Big Java, Cay Horstmann, 4thEdition,WileyJohnWiley&Sons,INC
T2	Hadoop: The Definitive Guide by Tom White, 3rdEdition,O'reilly
T3	Hadoop inaction by Chuck Lam, MANNING Publ.
T4	Hadoop for Dummies by Dirkde Roos, PaulC.Zikopoulos, RomanB. Melnyk,Bruce Brown,Rafael Coss
R1	Hadoop in Practice by Alex Holmes, MANNING Publ.
R2	Hadoop Map Reduce Cook book, Srinath Perera, Thilina Gunarathne

Course Outcomes:	
CO1	Preparing for data summarization.
CO2	Preparing for query, and analysis.
CO3	Applying data modeling techniques to large datasets
CO4	Creating applications for Big Data analytics
CO5	Building a complete business data analytic solution

Open Elective

Courses Offered by All the Departments

Open Elective

Courses Offered by Civil to other Departments

S.No	Subject Code	Subject
1	18XXCEOXXXX	Civil Engineering-Societal & Global Impact
2	18XXCEOXXXX	Introduction to Civil Engineering
3	18XXCEOXXXX	Disaster Management
4	18XXCEOXXXX	Environmental Pollution and control
5	18XXCEOXXXX	Building Materials
6	18XXCEOXXXX	Green Buildings and sustainability

CIVIL ENGINEERING -SOCIETAL & GLOBAL IMPACT			
Subject Code	18XXCEOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**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	**Hours**
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	09
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)	10
Unit – 3	
Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River	10

interlinking), 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.	
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	09
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	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 Emission

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.

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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

INTRODUCTION TO CIVIL ENGINEERING			
Subject Code	18XXCEOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

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

Unit -1 History of Civil engineering	**Hours**
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	**10**
Unit -2 Fundamentals of Building Materials	
Stones, bricks, mortars, Plain, Reinforced & Prestressed 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.	**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	**10**
Unit – 4 Surveying & Geomatics	
Surveying & Geomatics: Overview of Surveying, Traditional surveying techniques- , Total Stations; GPS & GIS Applications	**09**
Unit-5 Geotechnical Engineering	
Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunneling	**09**

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

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, 2nd Edn. Avinash Publications Mumbai
2. Avtarsingh (2002), Law of Contract, Eastern Book Co.
3. Dutt (1994), Indian Contract Act, Eastern Law House
4. The National Building Code, BIS, (2017)

DISASTER MANAGEMENT			
Subject Code	18XXCEOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

1. Develop an understanding of why and how the modern disaster manager is involved with pre-disaster and post-disaster activities.
2. 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.
3. Understand the 'relief system' and the 'disaster victim.
4. Describe the three planning strategies use full in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.

Unit -1 Natural Hazards And Disaster Management	**Hours**
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.	**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 aircraft's accidents, and Emerging in factiousdiseases &Aids and their management.	**09**

Unit – 3 RiskAndVulnerability	
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	**09**
Unit – 4 Role Of Technology In Disaster Managements:	
Disaster management for infrastructures, taxonomy of infrastructure–treatment plants and process facilities-electrical substations- roads and bridges- mitigation programme for earthquakes–flow chart, geospatial information in agriculture drought assessment-multimedia technology in disaster risk management and training- transformable indigenous knowledge in disaster reduction.	**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.	**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.

TEXT BOOKS

1. Disaster Management–Global Challenges and Local Solutions ’by Rajib shah & RKrishnamurthy (2009), Universities press.
2. Disaster Science & Management ’by Tushar Bhattacharya, Tata Mc Graw Hill Education Pvt. Ltd., NewDelhi.
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).

ENVIONMENTAL POLLUTION AND CONTROL			
Subject Code	18XXCEOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

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

Unit -1 Introduction	**Hours**
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.	**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.	**09**
Unit – 3SolidWasteManagement	
Solid waste characteristics –basics of on-site handling and collection –separation and processing-Incineration- Composting-Solid waste disposal methods– fundamentals of Land filling.	**09**

Unit – 4 Environmental Sanitation	
Environmental Sanitation Methods for Hostels and Hotels, Hospitals, Swimming pools and public bathing places, social gatherings (mela sand fares),Schools and Institutions, Rural Sanitation-low cost waste disposal methods.	**10**
Unit-5 Hazardous Waste	
Characterization – Nuclear waste– Biomedical wastes– Electronic wastes-Chemical wastes–Treatment and management of hazardous waste-Disposal and Control methods.	**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 standard sand air emission standards.
3. Differentiate the treatment techniques used for sewage and industrial waste water 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 o f environmental sanitation and the management of community facilities without spread of epidemics.

TEXT BOOKS

1. Environmental E n g i n e e r i n g , byRuth F. Weiner andRobin Matthews– 4thEditionElesevier,2003.
2. Environmental Science and Engineering byJ.G.HenryandG.W. Heinke–Pearson Education.
3. Environmental Engineering by Mackenzie L Davis &David A Cornwell.McGrawHillPublishing1. 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.SasiKumar,S.A.GopiKrishna. PHI New Delhi.

3. Environmental Engineering by Gerard Kiley,TataMcGrawHill.
4. Environmental Sanitationby KVSG Murali Krishna, Reem Publications, New Delhi.

BUILDING MATERIALS			
Subject Code	18XXCEOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

1. Initiating the student with the knowledge of basic building materials and their properties
2. Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
3. The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
4. Imparting the students with the techniques of formwork and scaffolding
5. The students should be exposed to classification of aggregates, moisture content of the aggregate.

Unit -1 Introduction	**Hours**
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	**10**
Unit -2Masonry	
Types of masonry, English and Flemish bonds, Rubble and Ashlars 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	**10**

Unit – 3Lime And Cement Lime	
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.	**10**
Unit – 4 Building Components	
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	**09**
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.	**09**

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 finishings.
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

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.

GREEN BUILDINGS AND SUSTAINABILITY			
Subject Code	18XXCEOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits –03			

Course Objectives:

Enable the students to

1. Know the green building and green energy building materials.
2. Familiarize with different rating agencies and features of green buildings.
3. Understand the term sustainability and sustainable development.
4. Learn sources of greenhouse gases and its impact on climate.
5. Understand and Plan land use confirming to zonal regulations

Unit -1	**Hours**
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	**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,	**10**
Unit – 3	

SUSTAINABILITY Introduction, Human development index, Sustainable development and social ethics, definitions of sustainability, populations and consumptions	**09**
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	**09**
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	**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.

TEXT BOOKS

1. Standard for the Design of High-Performance Green Buildings by ASHRAE
2. Engineering Applications in Sustainable Design and Development By Bradley 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.
2. Green Building Hand Book by Tomwoolley and Samkimings, 2009.
3. IGBC - Smart Cities & Green Building Concept in India

Open Elective Courses Offered by CSE,CST & IT

to other Departments

Open Elective Courses offered by CSE

S.No.	Subject Code	Name of the subject	L	T	P	Cr
1.	18XXCSOXXXX	Internet of Things	3	0	0	3
2.	18XXCSOXXXX	Block Chain	3	0	0	3
3.	18XXCSOXXXX	Quantum Computing	3	0	0	3
4.	18XXCSOXXXX	Virtual Reality	3	0	0	3
5.	18XXCSOXXXX	Data Structures through C	3	0	0	3
6.	18XXCSOXXXX	Designing Database Management Systems	3	0	0	3
7.	18XXCSOXXXX	Operating Systems Concepts	3	0	0	3
8.	18XXCSOXXXX	R Programming	3	0	0	3
9.	18XXCSOXXXX	Python Programming	3	0	0	3
10.	18XXCSOXXXX	Java Programming	3	0	0	3
11.	18XXCSOXXXX	App Technologies	3	0	0	3
12.	18XXCSOXXXX	Web Technologies	3	0	0	3
13.	18XXCSOXXXX	Artificial Intelligence	3	0	0	3

Open Electives Courses Offered by CST to other Departments

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18XXCTOXXXX	Internet of Things	3	0	0	3
2	18XXCTOXXXX	Block Chain	3	0	0	3
3	18XXCTOXXXX	Quantum Computing	3	0	0	3
4	18XXCTOXXXX	Virtual Reality	3	0	0	3
5	18XXCTOXXXX	Data Structures Through C	3	0	0	3
6	18XXCTOXXXX	Designing Database Management Systems	3	0	0	3
7	18XXCTOXXXX	Operating Systems Concepts	3	0	0	3
8	18XXCTOXXXX	R Programming	3	0	0	3
9	18XXCTOXXXX	Python Programming	3	0	0	3
10	18XXCTOXXXX	Java Programming	3	0	0	3
11	18XXCTOXXXX	App Technologies	3	0	0	3
12	18XXCTOXXXX	Web Technologies	3	0	0	3
13	18XXCTOXXXX	Artificial Intelligence	3	0	0	3

<table>
<tr><td colspan="4">INTERNET OF THINGS</td></tr>
<tr><td>Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:

The learning objectives of this course are:

1. Identify problems that are amenable to solution by AI methods, and which AI methods may be suited to solving a given problem.
2. 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).
3. Implement basic AI algorithms (e.g., standard search algorithms or dynamic programming).
4. Design and carry out an empirical evaluation of different algorithms on problem formalization, and state the conclusions that the evaluation supports.</td></tr>
</table>

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	**09**
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.	**09**

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.

BLOCK CHAIN TECHNOLOGY			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. To assess blockchain applications in a structured manner.
2. To impart knowledge in block chain techniques and able to present the concepts clearly and structured.
3. To get familiarity with future currencies and to create own crypto token.

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, permissioned 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.	**10**
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, hashcash PoW, 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.	**09**
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.	**09**

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.

QUANTUM COMPUTING			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- This course teaches the fundamentals of quantum information processing, including quantum computation, quantum cryptography, and quantum information theory.

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.	**09**
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	**09**
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, Rigetti PyQuil	**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.

VIRTUAL REALITY			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Understand how the design of VR technology relates to human perception and cognition.
2. Discuss applications of VR to the conduct of scientific research, training, and industrial design.
3. Gain first-hand experience with using virtual environment technology, including 3D rendering software, tracking hardware, and input/output functions for capturing user data.
4. Learn the fundamental aspects of designing and implementing rigorous empirical experiments using VR.
5. Learn about multimodal virtual displays for conveying and presenting information and techniques for evaluating good and bad virtual interfaces.

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.	**10**
Unit -2 :Geometric Modelling	
Introduction, from 2D to 3D, 3D space curves, 3D boundary representation.	**10**

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.	
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	**09**
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.	**09**
Unit – 5:VR Applications	
Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm, IBM Quantum Experience, Microsoft Q, Rigetti PyQuil	**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.

<table>
<tr><td colspan="4" align="center">DATA STRUCTURES THROUGH C</td></tr>
<tr><td>Subject Code</td><td align="center">18XXCSOXXXX</td><td>IA Marks</td><td align="center">30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td align="center">03</td><td>Exam Marks</td><td align="center">70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td align="center">48</td><td>Exam Hours</td><td align="center">03</td></tr>
<tr><td colspan="4" align="center">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:

The learning objectives of this course are:

1. Operations on linear data structures and their applications.
2. The various operations on linked lists.
3. The basic concepts of Trees, Traversal methods and operations.
4. Concepts of implementing graphs and its relevant algorithms.
5. Sorting and searching algorithms.</td></tr>
</table>

<table>
<tr><td>Unit -1: INTRODUCTION TO DATA STRUCTURE</td><td>Hours</td></tr>
<tr><td>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.

Sorting and Searching:

Sorting – Bubble Sort, Selection Sort, Quick Sort, Merge Sort Searching – Sequential Search and Binary Search</td><td align="center">10</td></tr>
<tr><td colspan="2">Unit -2 :LINEAR DATA STRUCTURE</td></tr>
</table>

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. Queue: Representation Of Queue, Operations On Queue, Circular Queue, Double Ended Queue, Applications of Queue.	**10**
Unit – 3: LINKED LIST	
Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	**09**
Unit – 4:NONLINEAR DATA STRUCTURE	
Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Binary search trees, Conversion of General Trees To Binary Trees, Applications of Trees.	**09**
Unit – 5:GRAPH, HASHING AND FILE STRUCTURES	
Graph-Matrix Representation Of Graphs, Elementary Graph operations, (Breadth First Search, Depth First Search, Spanning Trees, Shortest path, Minimal spanning tree) 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 forindex files, hashing for direct files, Multi-Key file organization and accessmethods.	**10**

Text(T) / Reference(R) Books:

T1	Data Structures using C -By Reema Thareja - OXFORD Higher Publication
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
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

DESIGNING DATABASE MANAGEMENT SYSTEMS			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:	
The learning objectives of this course are: 1.To introduce about database management systems 2.To give a good formal foundation on the relational model of data and usage of Relational Algebra 3.To introduce the concepts of basic SQL as a universal Database language 4.To demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization 5. To provide an overview of database transactions and concurrency control.	
Unit -1: Database system architecture	**Hours**
Introduction to Databases: Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications. Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Users , Architecture for DBMS.	**10**
Unit -2 : E-R Models	
The E-R Models,TheRelationalModel,IntroductiontoDatabaseDesign,DatabaseDesign 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.	**10**
Unit - 3: Relational Algebra	
Relational Algebra, Selection and Projection, Set Operation, Renaming, Joins, Division, More Examples of Queries, Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus.	**10**

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.	
Unit - 4: 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).	**09**
Unit - 5: Transaction Management	
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.	**09**

Text(T) / Reference(R) Books:	
T1	In Introduction to Database Systems, CJDate, Pearson.
T2	Database Management Systems,3rdEdition,Raghurama Krishnan, Johannes Gehrke, TATAMcGrawHill.
T3	Database Systems-TheCompleteBook,H GMolina,J DUllman,J WidomPearson.
T4	Database Management Systems,6/e Ramez Elmasri, Shamkant B. Navathe, PEA
R1	DatabaseSystemsdesign,Implementation,andManagement,7thEdition,PeterRob &CarlosCoronel
R2	Database System Concepts, 5th edition, Silberschatz, Korth, TMH

R3	The Database Book Principles & Practice Using Oracle/MySQL, Narain Gehani, 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	Understand the basic elements of a relational database management system.
CO2	Draw entity relationship and convert entity relationship diagrams into RDBMS.
CO3	Create, maintain, and manipulate a relational database using SQL.
CO4	Designs and applies normalization techniques for logical schema model.
CO5	Solves concurrent issues and problems through locking mechanism.

<table>
<tr><td colspan="4">OPERATING SYSTEMS CONCEPTS</td></tr>
<tr><td>Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:

The learning objectives of this course are:

1. Introduce the basic concepts of operating systems, its functions and services.
2. To provide the basic concepts of process management and synchronization.
3. Familiarize with deadlock issues.
4. Understand the various memory management skills.
5. Give exposure over I/O systems and mass storage structures.</td></tr>
<tr><td colspan="3">Unit -1: Operating Systems Overview</td><td>Hours</td></tr>
<tr><td colspan="3">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.</td><td>09</td></tr>
<tr><td colspan="4">Unit -2 :System Calls & IPC</td></tr>
<tr><td colspan="3">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</td><td>09</td></tr>
<tr><td colspan="4">Unit - 3: Process Management</td></tr>
<tr><td colspan="3">Basic concepts, Scheduling criteria, Scheduling algorithms, Thread scheduling, Multiple processor scheduling Operating system, Algorithm</td><td>10</td></tr>
</table>

Evaluation, The critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classic problems of synchronization, Critical regions, Monitors.	
Unit - 4:Memory Management & Dead lock	
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 - 5:I/O Systems	
File concept, Access methods, Directory structure, Filesystem mounting, Protection, Directory implementation, Allocation methods, Free-space management, Disk scheduling, Disk management, Swap-space management, Protection.	**10**

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	Demonstrate knowledge on Computer System organization and Operating system services.
CO2	Design solutions for process synchronization problems by using System calls and Inter process communication.
CO3	Identify the functionality involved in process management concepts like scheduling and synchronization.
CO4	Design models for handling deadlock and perform memory management.
CO5	Analyze services of I/O subsystems and mechanisms of security & protection.

<table>
<tr><td colspan="4">R PROGRAMMING</td></tr>
<tr><td>Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Credits – 03</td></tr>
<tr><td colspan="4">Course Objectives:
The learning objectives of this course are:
1. Use R for statistical programming, computation, graphics, and modeling.
2. Write functions and use R in an efficient way.
3. Fit some basic types of statistical models.
4. Use R in their own research.
5. Be able to expand their knowledge of R on their own.</td></tr>
<tr><td colspan="3">Unit -1: Introduction</td><td>Hours</td></tr>
<tr><td colspan="3">How to run R, R Sessions and Functions, Basic Math, Variables, Data Types,
Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.</td><td>09</td></tr>
<tr><td colspan="4">Unit -2 :</td></tr>
<tr><td colspan="3">R Programming Structures, Control Statements, Loops,-Looping Over Nonvector 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.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3:Math and Simulation in R</td></tr>
<tr><td colspan="3">Doing Math and Simulation in R, Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and</td><td>10</td></tr>
</table>

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 /out put, Accessing the Keyboard and Monitor, Reading and writer Files	
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	**09**

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

<table>
<tr><td colspan="4" align="center">PYTHON PROGRAMMING</td></tr>
<tr><td>Subject Code</td><td>18XXCSOXXXX</td><td>IA Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>03</td><td>Exam Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>48</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:

The learning objectives of this course are:

1. Introduction to Scripting Language.
2. Exposure to various problems solving approaches of computer science.</td></tr>
<tr><td colspan="3">Unit -1: Introduction</td><td>Hours</td></tr>
<tr><td colspan="3">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</td><td>09</td></tr>
<tr><td colspan="4">Unit -2 : Types, Operators and Expressions</td></tr>
<tr><td colspan="3">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 Structures Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.</td><td>10</td></tr>
<tr><td colspan="4">Unit – 3: Functions</td></tr>
<tr><td colspan="3">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. Modules: Creating modules, import statement, from. Import statement, name spacing, Python</td><td>10</td></tr>
</table>

packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages	
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.	**09**

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

JAVA PROGRAMMING			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

1. Understanding the OOP's concepts, classes and objects, threads, files, applets, swings and act.
2. This course introduces computer programming using the JAVA programming language with object-oriented programming principles.
3. Emphasis is placed on event-driven programming methods, including creating and manipulating objects, classes, and using Java for network level programming and middleware development.

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.	**10**
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, nested classes.	**09**

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, userdefined 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.	**09**
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.	**10**

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.

APP TECHNOLOGIES			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- To provide in depth knowledge and hands on experience in application development, the latest trends and features.

Unit -1: Android Programming Environment	**Hours**
Android programming environment, linking activities using intents, calling built-in applications using intents.	**09**
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.	**09**

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

WEB TECHNOLOGIES			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are:

- This course is designed to introduce students with no programming experience to the programming languages and techniques associated with the World Wide Web. The course will introduce web-based media-rich programming tools for creating interactive web pages.

Unit-1: HTML	**Hours**
HTML: Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Html styles, Elements, Attributes, Heading, Layouts, Html media, Iframes Images, Hypertext Links, Lists, Tables, Forms, GET and POST method, HTML 5, Dynamic HTML. **CSS:** Cascading style sheets, Levels of Style Sheets, Style Specification Formats, Selector Forms, The Box Model, Conflict Resolution, CSS3.	**10**
Unit -2: JSON	
Introduction to JSON: JSON, Syntax, Data Types, Schema, Security Concerns, JSON Vs XML, the JavaScript XML Http Request and Web APIs, JSON and Client-Side Frameworks, JSON and NoSQL, JSON on the server side.	**09**
Unit –3: YAML	

Introduction to YAML: YAML, Syntax, Structure, indentation in YAML documents, YAML vs JSON and XML, data types, Using advanced features like anchors in a YAML.	**9**
Unit -4: PHP	
PHP Programming: Introduction to PHP, Creating PHP script, Running PHP script. **Working with variables and constants:** Using variables, Using constants, Data types, Operators. **Controlling program flow:** Conditional statements, Control statements, Arrays, functions.	**10**
Unit – 5: Laravel	
Introduction to Laravel, Features, routing, controllers, views, Blade template, migration, Laravel Database.	**10**

Text(T) / Reference(R) Books:	
T1	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013
T2	Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
T3	Introduction to JavaScript by Lindsay Bassett, 2015.
T4	Introduction to YAML: Demystifying YAML Data Serialization Format by Tarun Telang
T5	Full-Stack Vue.Js 2 and Laravel 5: Bring the frontend and backend together with Vue, Vuex, and Laravel

R1	Programming world wide web, Sebesta, Pearson
R2	An Introduction to web Design and Programming, Wang, Thomson
W1	https://www.edx.org/learn/web-development
W2	https://www.javatpoint.com/what-is-json
W3	https://www.javatpoint.com/yaml-scalars
W4	https://www.javatpoint.com/laravel-blade-template

Course Outcomes: On completion of this course, students can	
CO1	To develop a dynamic webpage by the use of HTML
CO2	To develop a dynamic webpage by the use of CSS
CO3	To develop a dynamic webpage by the use of JSON
CO4	To develop a dynamic webpage by the use of YML
CO5	Build web applications using PHP
CO6	To develop a dynamic webpage by the use of Laravel

ARTIFICIAL INTELLIGENCE			
Subject Code	18XXCSOXXXX	**IA Marks**	30
Number of Lecture Hours/Week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

The learning objectives of this course are

1. To have a basic proficiency in a traditional AI language including an ability to write simple to intermediate programs and an ability to understand code written in that language
2. To have an understanding of the basic issues of knowledge representation and blind and heuristic search, as well as an understanding of other topics such as minimax, resolution, etc. that play an important role in AI programs
3. To have a basic understanding of some of the more advanced topics of AI such as learning, natural language processing, agents and robotics, expert systems, and planning.

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.	**09**
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.	**10**

Unit – 3:Problem reduction, Game playing	
Problem Reduction: Introduction, Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem game playing, alpha-beta pruning, two-player perfect information games.	**10**
Unit – 4: Logic Concepts & Knowledge Representation Techniques	
Logic Concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic. Introduction to KR techniques, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.	**10**
Unit – 5: Expert systems and its 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.	**09**

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
R4	AI: A Modern Approach, Stuart Russell and Peter Norvig, Additional Readings: Marr, Bishop, occasionally others
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	To introduce basic concepts of AI with its working principles.
CO2	To understand different kinds of heuristic search algorithms to get feasible solution for AI problems.
CO3	To understand problem reduction concepts using various problem reduction techniques. (Ex: Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem)
CO4	To understand various Knowledge Representation (KR) techniques
CO5	To understand different kinds of Expert Systems.

Open Elective

Courses Offered by ECE

To other Departments

Open Electives Courses Offered by the ECE to other Departments

S.No	Subject Code	Name of the subject	L	T	P	Cr
1.	18XXECOX0XA	VLSI Design	3	0	0	3
2.	18XXECOX0XB	HDL Programming for IC Design	3	0	0	3
3.	18XXECOX0XC	Principles of Communication Systems	3	0	0	3
4.	18XXECOX0XD	Transducers and Sensors	3	0	0	3
5.	18XXECOX0XE	Fundamentals of Microprocessors and Microcontrollers	3	0	0	3
6.	18XXECOX0XF	Fundaments of Internet of Things	3	0	0	3
7.	18XXECOX0XG	Fundamentals of Digital Image Processing	3	0	0	3
8.	18XXECOX0XH	Signals and Systems	3	0	0	3

VLSI DESIGN (Open Elective)			
Subject Code	18XXECOX0XA	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable students to

1. To learn about various fabrication steps of IC and electrical properties of MOSFET.
2. To learn about specific rules to draw the stick diagrams and Layouts.
3. To analyze circuit concepts and to apply Scaling factors for Device parameters.
4. To learn concept of chip I/O and techniques of testability.
5. To learn about different FPGA designs and implementation

Unit -1	**Hours**
Introduction and Basic Electrical Properties of MOS Circuits: Introduction to IC technology, Fabrication process: nMOS, pMOS and CMOS. Ids versus Vds Relationships, Aspects of MOS transistor Threshold Voltage, MOS transistor Trans, Output Conductance and Figure of Merit. nMOS Inverter, Pull-up to Pull-down Ratio for nMOS inverter driven by another nMOS inverter, and through one or more pass transistors. Alternative forms of pull-up, The CMOS Inverter, Latch-up in CMOS circuits, Bi-CMOS Inverter, Comparison between CMOS and BiCMOS technology.	10
Unit -2	
MOS and Bi-CMOS Circuit Design Processes: MOS Layers, Stick	10

Diagrams, Design Rules and Layout, General observations on the Design rules, 2µm Double Metal, Double Poly, CMOS/BiCMOS rules, 1.2µm Double Metal, Double Poly CMOS rules, Layout Diagrams of NAND and NOR gates and CMOS inverter, Symbolic Diagrams Translation to Mask Form.	
Unit -3	
Basic Circuit Concepts: Sheet Resistance, Sheet Resistance concept applied to MOS transistors and Inverters, Area Capacitance of Layers, Standard unit of capacitance, some area Capacitance Calculations, The Delay Unit, Inverter Delays, driving large capacitive loads, Propagation Delays, Wiring Capacitances, Choice of layers. **Scaling of MOS Circuits:** Scaling models and scaling factors, Scaling factors for device parameters, Limitations of scaling, Limits due to sub threshold currents, Limits on logic levels and supply voltage due to noise and current density. Switch logic, Gate logic.	10
Unit – 4	
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.	10
Unit – 5	
FPGA Design: FPGA design flow, Basic FPGA architecture, FPGA Technologies, FPGA families- Altera Flex 8000FPGA, Altera Flex 10FPGA, Xilinx XC4000 series FPGA, Xilinx Spartan XL FPGA, Xilinx Spartan II FPGAs, Xilinx Vertex FPGA.	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Elaborate the fabrication steps of IC and electrical properties of MOSFET.
2. Justify the concepts of design rules during the layout of a circuit.
3. Apply the circuit concepts and scaling factors for device parameters.
4. Analyze the concepts of chip I/O and techniques of testability.
5. Examine commercial architectures of FPGA.

Text Books:

1. Kamran Eshraghian, Douglas and A. Pucknell and Sholeh Eshraghian, Essentials of VLSI Circuits and Systems, Prentice-Hall of India Private Limited,2005 Edition.
2. Sung-Mo Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, Tata McGrawHill Education, 2003.

Reference Books:

1. Michael D. Ciletti, Advanced Digital Design with the Verilog HDL, Xilinx Design Series, Pearson Education
2. Analysis and Design of Digital Integrated Circuits in Deep Submicron Technology, 3rd edition, David Hodges.
3. A. Shanthi and A. Kavita, VLSI Design, New Age International Private Limited, 2006 First Edition.

HDL PROGRAMMING FOR IC DESIGN (Open Elective)			
Subject Code	18XXECOX0XB	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable students to

1. Learn different Verilog programming constructs.
2. Familiarize the different levels of abstraction in Verilog HDL.
3. Construct digital circuits and corresponding RTL modeling using different styles along with test bench based verification.
4. Understand Verilog Tasks, Functions and Directives.
5. Understand timing and delay simulation.

Unit -1	**Hours**
Introduction to Verilog HDL: Verilog as HDL, Typical HDL flow, Top-Down and Bottom-up design methodology. Levels of Design Description, Simulation and Synthesis, Function Verification, Module definition. Difference between module and module instances.	10
Unit -2	
Language Constructs and Conventions: Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.	10
Unit -3	

Gate Level Modeling: Modeling using basic Verilog gate primitives, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution **Modeling at Dataflow Level**: Continuous Assignment Structure, delay specification, expressions, vectors, operators, operands, operator types	10
Unit – 4	
Behavioral Level Modeling: Structured procedures, Initial and Always statements, blocking and non-blocking statements, delay control, generate statement, conditional statement, multiway branching, loops, sequential and parallel blocks.	10
Unit – 5	
Switch Level Modeling: Basic transistor switches, CMOS Switches, bi-directional gates, time delays with switch primitives **Tasks and Functions:** Difference between tasks and functions, declaration, invocation, automatic tasks and functions.	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Demonstrate knowledge on HDL design flow and identify the suitable abstraction level of a particular design
2. Memorizing the constructs and conventions used for Verilog programming
3. Design and develop the combinational and sequential circuits using dataflow modeling
4. Implement sequential logic circuits using behavioral modeling
5. Writing the programs more effectively using tasks and functions

Text Books:

1. Samir Palnitkar, “Verilog HDL: A Guide to Digital Design and Synthesis”,

Pearson Education, Second Edition

2. T.R.Padmanabhan, B Bala Tripura Sundari, “Design Through Verilog HDL”, Wiley 2009

Reference Books:

1. Michael D Ciletti, “Advanced Digital Design with the Verilog HDL”, Xilinx Design Series, PearsonEducation.
2. Stephen Brown, Zvonkoc Vranesic, “Fundamentals of Digital Logic with Verilog Design”, TMH, 2nd Edition.
3. Donald E. Thomas, Philip R. Moorby, “The Verilog Hardware Description Language”, Springer Science + Business Media, LLC, Fifth edition

PRINCIPLES OF COMMUNICATION SYSTEMS (Open Elective)			
Subject Code	18XXECOX0XC	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable students to

1. Analyze the performance of angle modulated signals.
2. Characterize analog signals in time domain as random processes and noise
3. Characterize the influence of channel on analog modulated signals
4. Determine the performance of analog communication systems in terms of SNR
5. Understand the concepts of noise and signal.

Unit -1	Hours
Amplitude modulation: Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector. **Double side band-suppressed carrier modulation:** Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **Single side and vestigial side band methods of modulation**: SSB Modulation, VSB Modulation, Frequency Translation, Frequency-Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television	10
Unit -2	

Angle modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, **Phase–Locked Loop:** Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super-heterodyne Receiver	10
Unit -3	
Random variables & process: Introduction, Probability, Conditional Probability, Random variables, Several Random Variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions. **Noise:** hotNoise,Thermalnoise,WhiteNoise,NoiseEquivalentBandwidth,NoiseFigure	10
Unit – 4	
Noise in analog modulation: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.	10
Unit – 5	
Digital representation of an analog signals: Introduction, Why Digitize Analog Sources? The Sampling process, Pulse Amplitude Modulation, Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves, The Quantization Process, Quantization Noise, **Pulse Code Modulation:** Sampling, Quantization, Encoding, Regeneration, Decoding, Filtering, Multiplexing	8
Total	**48**

Course outcomes: On completion of the course student will be able to 1. Analyze the performance of analog modulation schemes in time and frequency domains. 2. Analyze the performance of angle modulated signals. 3. Characterize analog signals in time domain as random processes and noise 4. Characterize the influence of channel on analog modulated signals 5. Determine the performance of analog communication systems in terms of SNR
Text Books: 1. H Taub& D. Schilling, Gautam Sahe, Principles of Communication Systems –TMH, 2007, 3rd Edition. 2. B.P. Lathi, Communication Systems–BSPublication,20062. 3. Simon Haykin, Principles of Communication Systems –John Wiley, 2 nd Edition
Reference Books: 1. George Kennedy and Bernard Davis, Electronics & Communication System –TMH 2004. 2. R.P. Singh, SPSapre, Communication Systems–SecondEditionTMH,2007

TRANSDUCERS AND SENSORS (Open Elective)			
Subject Code	18XXECOX0XD	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable students to

1. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
2. Predict correctly the expected performance of various sensors
3. Locate different type of sensors used in real life applications and paraphrase their importance
4. Understand and analyze the characteristics of temperature sensors
5. Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers

Unit -1	**Hours**
Introduction: functional elements of an instrument, generalized performance characteristics of instruments – static characteristics, dynamic characteristics. Zero order, first order, second order instruments – step response, ramp response and impulse response. Response of general form of instruments to periodic input and to transient input Experimental determination of measurement system parameters, loading effects under dynamic conditions	10
Unit -2	
Transducers for motion and dimensional measurements: Relative displacement, translation and rotational resistive potentiometers,	10

resistance strain gauges, LVDT, synchros, capacitance pickups, Piezo-electric transducers, electro-optical devices, nozzle – flapper transducers, digital displacement transducers, ultrasonic transducers. Magnetic and photoelectric pulse counting methods, relative acceleration measurements, seismic acceleration pickups, calibration of vibration pickups. Gyroscopic sensors	
Unit -3	
TRANSDUCERS FOR FORCE MEASUREMENT: Bonded strain guage transducers, Photo-electric transducers, variable reluctance pickup, torque measurement dynamometers. **TRANSDUCERS FOR FLOW MEASUREMENT**: Hot wire and hot-film anemometers, Electro-magnetic flow meters, laser Doppler velocity meter TRANSDUCERS FOR PRESSURE MEASUREMENT: Manometers, elastic transducers, liquid systems, gas systems, very high pressure transducers. Thermal conductivity gauges, ionization gauges, microphone	10
Unit – 4	
TRANSDUCERS FOR TEMPERATURE MEASUREMENT: Thermal expansion methods, Thermometers (liquid in glass), pressure thermometers, Thermocouples, Materials configuration and techniques. Resistance thermometers, Thermistors, junction semiconductors, Sensors, Radiation methods, Optical pyrometers, Dynamic response of temperature sensors heat flux Sensors, Transducers for liquid level measurement, humidity, silicon and quartz sensors, fiber optic sensors.	10
Unit – 5	
Smart sensors: Introduction, primary sensors, converters, compensation. Recent trends in sensor technology – film sensors, semiconductor IC technology, MEMS, Nano-sensors	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Use concepts in common methods for converting a physical parameter into an electrical quantity
2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light
3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc
4. Predict correctly the expected performance of various sensors knowledge outside the classroom through design of a real-life instrumentation system
5. Locate different type of sensors used in real life applications and paraphrase their importance

Text Books:

1. Sensors and Transducers Hardcover – Import, 5 December 2000by Ian Sinclai , newness publication.
2. Sensors and Transducers , Author, Department of Cybernetics, University of Reading, UK , M. J. Usher, 1985, Springer

Reference Books:

1. Doebelin, E.O., “Measurement systems – Application and Design”, McGraw Hill.
2. D. Patranabis, “Sensors and Transducers”, PHI, 2nd Edition.

FUNDAMENTALS OF MICROPROCESSORS AND MICROCONTROLLERS (Open Elective)			
Subject Code	18XXECOX0XE	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable students to

1. To Learn the architecture of microprocessor and microcontroller.
2. To know the programming of 8086
3. To understand the interfacing of the processors
4. To know Memory System and I/O Organization and its applications.
5. To develop Microcontroller programming for various applications

Unit -1	**Hours**
8085 PROCESSOR Hardware Architecture, pinouts — Functional Building Blocks of Processor — Memory organization — I/O ports and data transfer concepts, Interrupts. 8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.	10
Unit -2	
8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler,	10

assembly language program development tools.	
Unit -3	
8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDS, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.	10
Unit – 4	
8051 MICRO CONTROLLER Hardware Architecture, pinouts — Functional Building Blocks of Processor — Memory organization — I/O ports and data transfer concepts– Timing Diagram — Interrupts- Data Transfer, Manipulation, Control Algorithms& I/O instructions, Comparison to Programming concepts with 8085.	10
Unit – 5	
MICRO CONTROLLER PROGRAMMING & APPLICATIONS Simple programming exercises- key board and display interface –Control of servo motor stepper motor control- Application to automation systems.	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand the architecture of microprocessor and their operation.
2. Demonstrate programming skills in assembly language for processors and controllers.
3. Analyze various interfacing techniques and apply them for the design of processor/Controller based systems.
4. Understand 8051 architecture.

5. Analyze Microcontroller programming & applications

Text Books:

1. R.S. Gaonkar, Microprocessor Architecture Programming and Application, with 8085, Wiley Eastern Ltd., New Delhi, 2013.
2. A.K Ray, K.M. Bhurchandhi," Advanced Microprocessor and Peripherals", Tata McGraw Hill Publications, 2000.
3. The 8051 Microcontrollers and Embedded systems Using Assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D.McKinlay; Pearson 2-Edition, 2011

Reference Books:

1. Douglas V Hall, SSSP Rao, Microprocessors and Interfacing – Programming and Hardware, Tata Mc Graw Hill Education Private Limited,3rdEdition,1994

FUNDAMENTALS OF INTERNET OF THINGS (Open Elective)			
Subject Code	18XXECOX0XF	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable students to

1. To introduce IoT Fundamentals

2. To know about the IoT Characteristics.

3. To give the understanding of IoT Architecture overview

4. To understand the concepts of IoT Reference Architecture.

5. To know different case studies of IoT.

Unit -1	**Hours**
Introduction to IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-to-Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models &APIs.	10
Unit -2	

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context, A use case example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT.	10
Unit -3	
M2M vs loT An Architectural Overview-Building architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. Reference Architecture and Reference Model of IoT.	10
Unit – 4	
IoT Reference Architecture-Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world-Introduction, Technical design Constraints.	10
Unit – 5	
Developing IoT solutions: Introduction to Python, Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi, Introduction to Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT. Case Studies: Home Automation, Smart Health care.	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand general concepts of Internet of Things (IoT)
2. Understand general concepts of M2M
3. Know the design principals of IoT
4. Recognize the various architectural view IoT

5. Apply the different applications of IoT
Text Books: 1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition,VPT,2014 2. JanHoller, Vlasios Tsiatsis, Catherine Mulligan,StefanAvesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of intelligence",1stEdition,AcademicPress,2014.
Reference Books: 1. Francisda Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",1st Edition, A press Publications,2013 2. CunoPfister, Getting Started with the Internet of Things, O"ReillyMedia, 2011,ISBN:978-1-4493-9357-1

<table>
<tr><td colspan="4">FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING
(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>48</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
1. Know digital signal processing concepts
2. Find the DFT of the given Discrete Time Sequences
3. Impose FFT concept for solving the DFT of a sequence
4. Design Digital filters for the given specifications
5. Know the concepts on Digital Signal Processors</td></tr>
<tr><td colspan="3">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="3">Introduction: Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, Response of LTI systems to arbitrary inputs. Solution of Linear constant coefficient difference equations. Frequency domain representation of discrete time signals and systems.</td><td>10</td></tr>
<tr><td colspan="3">Unit -2</td><td></td></tr>
<tr><td colspan="3">Discrete Fourier Transforms: Introduction, Discrete Fourier transforms of standard signals, Properties of DFT, Linear filtering methods based on DFT.</td><td>10</td></tr>
<tr><td colspan="4">Unit -3</td></tr>
</table>

Fast Fourier transforms (FFT): Introduction, Radix-2 decimation in time FFT Algorithm (DIT-FFT), Radix-2 decimation in frequency FFT Algorithm (DIF-FFT), Inverse FFT.	10
Unit – 4	
Design of IIR Digital Filters: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. **Design of FIR Digital Filters:** Characteristics of FIR Digital Filters, frequency response. Design of FIR Digital Filters using Window Techniques, Comparison of IIR & FIR filters	10
Unit – 5	
DSP Processors: Introduction to programmable DSPs: Multiplier and Multiplier Accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple Access Memory, Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On-Chip Peripherals.	8
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Interpret digital signal processing concepts and solve difference equations for analyzing Discrete Time Systems
2. Apply DFT for Discrete Time Sequences
3. Construct FFT algorithm for solving the DFT of a sequence
4. Construct Digital filters for the given specifications
5. Apply the signal processing concepts on Digital Signal Processors.

Text Books:

1. John G. Proakis, Dimitris G.Manolakis, “Digital Signal Processing, Principles, Algorithms, and Applications”,Pearson Education / PHI, 2007.

2.	A Anand Kumar, “Digital Signal Processing”, 2nd Edition, PHI Publications
3.	B.Venkataramani, M.Bhaskar, “ Digital Signal Processors, Architecture, Programming and Applications”, TATA McGraw Hill, 2002
1.	Andreas Antoniou, **“**Digital Signal Processing”, TATA McGraw Hill , 2006
2.	Robert J. Schilling, Sandra L. Harris, “Fundamentals of Digital Signal Processing using Matlab”,Thomson, 2007.

SIGNALS AND SYSTEMS

(Open Elective)

Subject Code	18XXECOX0XH	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03

Credits – 03

Course Objectives:

This course will enable students to

1. Learn various signals, systems both in continuous time and discrete time.
2. Know the Fourier analysis of continuous-time periodic signals and finite energy signals.
3. Perform signal conversion by applying sampling theorem.
4. Make use of applying various signal and system properties to LTI systems
5. Extend the transform analysis to discrete time sequences

Unit -1	**Hours**
Introduction to Signals and Systems: Definition of Signals and Systems, Singularity functions and related functions. Complex exponential and sinusoidal signals. Classification of Signals, Operations on signals, Classification of Systems.	8
Unit -2	
Fourier Series: Fourier series representation of continuous time periodic signals, Dirichlet's conditions, Trigonometric Fourier series and Exponential Fourier series. **Fourier Transform:** Fourier transform of arbitrary signal, Fourier transform of standard signals, properties of Fourier transforms.	10

Unit -3	
Sampling Theorem: Representation of a CT signal by its samples: The Sampling theorem, impulse sampling, Natural and Flat-top Sampling, Reconstruction of signal from its samples, effect of under sampling–Aliasing. Review of Laplace Transforms, Properties, Inverse Laplace Transform, Relation between L.T and F.T of a signal.	10
Unit – 4	
Analysis of Linear Systems: Linear Time Invariant systems, impulse response, Response of a linear system, Transfer function of a LTI system, Concept of convolution and graphical representation of convolution. Cross-correlation and auto-correlation of signals, Relation between convolution and correlation.	10
Unit – 5	
Z–Transforms: Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence, constraints on ROC for various classes of signals, Properties of Z-transforms, Inverse Z-transform. **Applications of signals and Systems:** Modulation for communication, Filtering of signals and Feedback control systems.	10
Total	**48**

Course outcomes:

On completion of the course student will be able to

1. Understand various signals and systems and demonstrate their properties.
2. Develop Fourier analysis of continuous-time periodic signals and continuous-time finite energy signals.
3. Apply sampling theorem for signal conversion from continuous- time signals to discrete-time.
4. Illustrate various operations on LTI systems.
5. Apply z-transform to analyze discrete-time signals.

Text Books:

1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", 2nd Edition, PHI, 2009.
2. A Anand Kumar, " Signals and Systems", PHI Publications.

Reference Books

1. B.P. Lathi, "Signal Processing & Linear Systems", 1st Edition, Oxford University Press, 2006
2. Simon Haykin and Van Veen, "Signals & Systems", 2nd Edition, John Wiley India, 2011.

Open Elective

Courses Offered by ECT

To other Departments

Open Elective Courses offered by ECT Department

S.No	Subject Code	Name of the subject	L	T	P	Cr
1	18XXETOXXXX	Signals and Systems	3	0	0	3
2	18XXETOXXXX	Principles of Signal Processing	3	0	0	3
3	18XXETOXXXX	Consumer Electronics	3	0	0	3
4	18XXETOXXXX	Transducers and Sensors	3	0	0	3
5	18XXETOXXXX	IOT and Applications	3	0	0	3
6	18XXETOXXXX	IC Applications	3	0	0	3
7	18XXETOXXXX	Principles of Communications	3	0	0	3
8	18XXETOXXXX	Data Communications	3	0	0	3
9	18XXETOXXXX	Digital Logic design	3	0	0	3
10	18XXETOXXXX	Remote Sensing and GIS	3	0	0	3

SIGNALS AND SYSTEMS **(Open Elective)**			
Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite	Engineering Mathematics	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand signals and systems classification
2. Explain convolution and representations of Systems
3. Understand frequency domain representation of systems
4. Explain the applications of Fourier representation

Unit -1	**Hours**
Introduction: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems	10
Unit -2	
Time-domain representations for LTI systems: Convolution, impulse response representation, Convolution Sum and Convolution Integral. Properties of impulse response representation, Differential and difference equation Representations, Block diagram representations.	10
Unit -3	

Frequency-domain representation for signals: Introduction, Discrete-time and continuous time Fourier series (derivation of series excluded) and their properties. **Discrete-time and continuous-time** Fourier transforms (derivations of transforms are excluded) and their properties.	10
Unit – 4	
Applications of Fourier representations: Introduction, Frequency response of LTI systems, Fourier transform representation of periodic signals, Fourier transform representation of discrete time signals.	9
Unit – 5	
LAPLACE & Z-TRANSFORMS: Introduction, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's, Inverse Laplace transform, Relation between L.T's, and F.T. of a signal. Z-Transforms: Introduction, Z-transform, properties of ROC, properties of Z – transforms, inversion Z-transforms. Z-Transform analysis of LTI Systems, unilateral Z-Transform and its application to solve difference equations	9
Course outcomes: Students will be able to 1. Understand signal and its basic operations 2. Understand linear time invariant systems. 3. Apply the concepts of Fourier series representations to analyze continuous and discrete time periodic signals. 4. Understand and apply the continuous time Fourier transform, discrete time Fourier transform, 5. Apply the concepts of Laplace transform, and z-Transform to the analysis and description of LTI continuous and discrete-time systems	
Text Books: 1. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", Pearson, 2 nd Edn.G. Streetman and S. K. Banerjee, "Solid State Electronic Devices", 2nd edition, Pearson, 2014. 2. B. P. Lathi, "Linear Systems and Signals", Second Edition, Oxford University Press 3. Simon Haykin and Van Veen, "Signals & Systems", Wiley, 2nd Edition.	

Reference Books:

1. Michel J. Robert, “Fundamentals of Signals and Systems”, MGH International Edition, 2008.
2. Ramakrishna Rao,“Signals and Systems”, 2008, TMH

PRINCIPLES OF SIGNAL PROCESSING (Open Elective)			
Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite	Signals and Systems	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand discrete signals and systems, DIT algorithms
2. Explain the structures of IIR filters by bilinear transformation
3. Explain the structures of FIR filters by window techniques
4. Explain the concept of multirate signal processing and adaptive filters

Unit -1	Hours
Discrete Signals and Systems- A Review – Introduction to DFT – Properties of DFT – Circular Convolution – Filtering methods based on DFT – FFT Algorithms –Decimation in time Algorithms, Decimation in frequency Algorithms – Use of FFT in Linear Filtering.	10
Unit -2	
Structures of IIR filters – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation.	10
Unit -3	

<table>
<tr><td>Structures of FIR filters – Linear phase FIR filter – Filter design.

Design using windowingtechniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques</td><td>9</td></tr>
<tr><td colspan="2">Unit – 4</td></tr>
<tr><td>Multirate signal processing: Basic building blocks of multirate DSP, Decimation, Interpolation, Sampling rate conversion by a rational factor, Multistage Sampling Rate Converters.</td><td>10</td></tr>
<tr><td colspan="2">Unit – 5</td></tr>
<tr><td>Adaptive Filters: Introduction, LMS and RLS Adaptation Algorithms, Applications of adaptive filtering to equalization, noise cancellation.</td><td>9</td></tr>
<tr><td colspan="2">Course Outcomes:

The student will be able to

1. Use the FFT algorithm for solving the DFT of a given signal
2. Design a Digital filter (FIR&IIR) from the given specifications
3. Realize the FIR and IIR structures from the designed digital filter.
4. Use the Multirate Processing concepts in various applications.
5. Apply the Adaptive signal processing concepts to various signal processing applications</td></tr>
<tr><td colspan="2">Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PH</td></tr>
<tr><td colspan="2">Reference Books:

1. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris,Thomson, 2007.
2. Understanding Digital Signal Processing 2nd Edition by Richard G.Lyons</td></tr>
</table>

CONSUMER ELECTRONICS (Open Elective)			
Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite	Analog Communications	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the significance of audio systems
2. Explain the digital audio fundamentals and operation
3. Explain the operation of digital transmission and reception
4. Understand the need for different type of appliances

Unit -1	**Hours**
Audio Systems: Microphones and Loudspeakers: Carbon, moving coil, cordless microphone, Direct radiating and horn loudspeaker, Multi-speaker system, Hi-Fi stereo and dolby system. Concept to fidelity, Noise and different types of distortion in audio system	10
Unit -2	
Digital Audio Fundamentals: Audio as Data and Signal, Digital Audio Processes Outlined, Time Compression and Expansion.	9
Unit -3	

SCR and Thyristor: Principles of operation and characteristics of SCR, Triggering of Television: Basics of Television: Elements of TV communication system, Scanning and its need, Need of synchronizing and blanking pulses, VSB, Composite Video Signal. **Colour Television:** Primary, secondary colours, Concept of Mixing	10
Unit – 4	
Digital Transmission and Reception: Digital satellite television, Direct-To-Home(DTH) satellite television, Introduction to :Video on demand, CCTV, High Definition(HD)-TV. Introduction to Liquid Crystal and LED Screen Televisions Basic block diagram of LCD and LED Television and their comparison	10
Unit – 5	
Introduction to different type of domestic/commercial appliances: Operation of Micro-wave oven, Food Processors, Digital Electronic Lock, Vacuum cleaner, Xerox Machine, scanner	09

Course Outcomes:

Student will be able to

1. Understand the various type of microphones and loud speakers.
2. To identify the various digital and analog signal.
3. Describe the basis of television and composite video signal.
4. Describe the various kind of colour TV standards and system.
5. Compare the various types of digital TV system.
6. Understand the various type of consumer goods.

Text Books :

1. Modern Television Practice by R. R. Gulai; New Age International Publishers.
2. Audio Video Systems by R. G. Gupta; McGraw Hill Education System.
3. Audio Video Systems Principles Practices and Troubleshooting by Bali & Bali; Khanna Publishing Company

Reference Books:

1. Consumer Electronics by S. P. Bali; Pearson Education, New Delhi

TRANSDUCERS AND SENSORS (Open Elective)			
Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite	EMI	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand measurements and instrumentation and its need.
2. Explain the Characteristics of Transducers.
3. Explain the Characteristics of resistive, inductive and capacitive transducers

Unit -1	Hours
Measurements and Instrumentation of Transducers: Measurements – Basic method of measurement – Generalized scheme for measurement systems – Units and standards – Errors – Classification of errors, error analysis – Statistical methods – Sensor – Transducer – Classification of transducers – Basic requirement of transducers.	10
Unit -2	
Characteristics of Transducers: Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs	10
Unit -3	

Resistive Transducers: Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications **Torque measurement** – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer	9
Unit – 4	
Inductive and Capacitive Transducer: Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.	10
Unit – 5	
Miscellaneous Transducers: Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers	09
Course Outcomes: At the end of the course, a student will be able to: 1. Use concepts in common methods for converting a physical parameter into an electrical quantity 2. Classify and explain with examples of transducers, including those for measurement of temperature, strain, motion, position and light 3. Choose proper sensor comparing different standards and guidelines to make sensitive measurements of physical parameters like pressure, flow, acceleration, etc 4. Predict correctly the expected performance of various sensors 5. Locate different type of sensors used in real life applications and paraphrase their importance 6. Set up testing strategies to evaluate performance characteristics of different types of sensors and transducers 7. develop professional skills in acquiring and applying the knowledge outside the	

classroom through design of a real-life instrumentation system
Text Books: 1. Sawhney. A.K, “A Course in Electrical and Electronics Measurements and Instrumentation”, 18th Edition, Dhanpat Rai & Company Private Limited, 2007. 2. Patranabis. D, “Sensors and Transducers”, Prentice Hall of India, 2003.
Reference Books: 1. Renganathan. S, “Transducer Engineering”, Allied Publishers, Chennai, 2003. 2. Doebelin. E.A, “Measurement Systems – Applications and Design”, Tata McGraw Hill, New York, 2000 3. John. P, Bentley, “Principles of Measurement Systems”, III Edition, Pearson Education, 2000. 4. Murthy. D. V. S, “Transducers and Instrumentation”, Prentice Hall of India, 2001. 4. Sensor Technology Hand Book – Jon Wilson, Newne 2004. 5. Instrument Transducers – An Introduction to their Performance and design – by Herman K. P. Neubrat, Oxford University Press

IOT AND APPLICATIONS (Open Elective)			
Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite		Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the IoT and its role in cloud computing.
2. Understand the elements and application development using IoT.
3. Explain the solution framework for IoT applications
4. Analyze the IoT Case Studies.

Unit -1	**Hours**
Introduction to IoT: Introduction to IoT, Architectural Overview, Design principles and needed capabilities, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service (XaaS), Role of Cloud in IoT, Security aspects in IoT.	10
Unit -2	
Elements of IoT: Hardware Components- Computing- Arduino, Raspberry Pi, ARM Cortex-A class processor, Embedded Devices – ARM Cortex-M class processor, Arm Cortex-M0 Processor Architecture, Block Diagram, Cortex-M0 Processor Instruction Set, ARM and Thumb Instruction Set.	10
Unit -3	

IoT Application Development: Communication, IoT Applications, Sensing, Actuation, I/O interfaces. Software Components-Programming API's (using Python/Node.js/Arduino) for Communication Protocols-MQTT, ZigBee, CoAP, UDP, TCP, Bluetooth. **Bluetooth Smart Connectivity** Bluetooth overview, Bluetooth Key Versions, Bluetooth Low Energy (BLE) Protocol, Bluetooth, Low Energy Architecture, PSoC4 BLE architecture and Component Overview.	9
Unit – 4	
Solution framework for IoT applications: Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.	10
Unit – 5	
IoT Case Studies: IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation. Cloud Analytics for IoT Application :Introduction to cloud computing, Difference between Cloud Computing and Fog Computing: The Next Evolution of Cloud Computing, Role of Cloud Computing in IoT, Connecting IoT to cloud, Cloud Storage for IoT Challenge in integration of IoT with Cloud.	9
Course Outcomes: The student will be able to: 1. Understand internet of Things and its hardware and software components. 2. Interface I/O devices, sensors & communication modules. 3. Remotely monitor data and control devices. 4. Design real time IoT based applications. 5. Design the real case studies.	

Text Books: 1. Raj Kamal, “Internet of Things: Architecture and Design Principles”, 1st Edition, McGraw Hill Education,2017. 2. The Definitive Guide to the ARM Cortex-M0 by JosephYiu,2011 3. Vijay Madisetti, Arshdeep Bahga, Internet of Things, “A Hands on Approach”, UniversityPress,2015
Reference Books: 1. CypressSemiconductor/PSoC4BLE(BluetoothLowEnergy)ProductTrainingModules. 2. PethuruRajandAnupamaC.Raman,“TheInternetofThings:EnablingTechnologies,Platforms,andUse Cases”,CRCPress,2017.

IC APPLICATIONS

(Open Elective)

Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite	Analog Circuits, DSD	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the ideal op-amp and practical op-amp.
2. Understand 555 timer and IC565 VCO and its application.
3. Explain the DAC and ADC techniques and its specifications.
4. Explain the Use of TTL-74XX Series & CMOS 40XX Series ICs

Unit -1	**Hours**
Ideal and Practical Op-Amp, Op-amp characteristics-DC and AC Characteristics, General Linear Applications of Op-Amp: Adder, Subtractor, Differentiators and Integrators, Active Filters and Oscillators, Nonlinear Applications of OPAMP: Comparators, Schmitt Trigger, Multivibrators	10
Unit -2	
Introduction to 555 Timer, Functional Diagram, Monostable and Astable Operations and Applications, Schmitt Trigger, PLL- Introduction, Block Schematic, Principles and Description of individual Blocks of 565, VCO.	10
Unit -3	

Introduction, Basic DAC Techniques - Weighted Resistor Type. R-2R Ladder Type, inverted R-2R Type. **Different types of ADCs** - Parallel Comparator Type. Counter Type. Successive Approximation Register Type and Dual Slope Type DAC and ADC Specifications.	9
Unit – 4	
Use of TTL-74XX Series & CMOS 40XX Series ICs, TTL ICs - Code Converters, Decoders, Demultiplexer, Encoders, Priority Encoders, multiplexers & their applications. Priority Generators, Arithmetic Circuit ICs-Parallel Binary Adder/Subtractor Using 2's Complement System, Magnitude Comparator Circuits.	10
Unit – 5	
Commonly Available 74XX & CMOS 40XX Series ICs - RS, JK. JK Master-Slave. D and T Type Flip-Flops & their Conversions, Synchronous and asynchronous counters. Decade counters. Shift Registers & applications	09

Course Outcomes:

The student will be able to

1. Analyze the Differential Amplifier with Discrete components
2. Describe the Op-Amp and internal Circuitry: 555 Timer, PLL
3. Discuss the Applications of Operational amplifier: 555 Timer, PLL
4. Design the digital application using digital ICs
5. Use the Op-Amp in A to D & D to A Converters

Text Books:

1. Linear Integrated Circuits -D. Roy Chowdhury, New Age International (p)Ltd, 3" Ed., 2008.
2. Digital Fundamentals - Floyd and Jain, Pearson Education,8th Edition, 2005.

Reference Books:

1. Modern Digital Electronics - RP Jain - 4/e - TMH, 2010.

2. Op-Amps & Linear ICs - Ramakanth A. Gayakwad, PHI, 1987

PRINCIPLES OF COMMUNICATION SYSTEMS **(Open Elective)**			
Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite	Signals and Systems	Credits – 03	

Course Objectives:

This course will enable students to

1. Understand modulation techniques in time and frequency domain
2. Explain angle modulation and signal sampling.
3. Analyze noise in analog modulation systems

4. Understand Transmission of Binary Data in Communication Systems

Unit -1	**Hours**
Amplitude modulation: Introduction, Amplitude Modulation: Time & Frequency – Domain description, switching modulator, Envelop detector. Double side band-suppressed carrier modulation: Time and Frequency – Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. Single side–band and vestigial sideband methods of modulation: SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television	10
Unit -2	
Angle modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of	9

FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing,	
Unit -3	
Signal Sampling and Analog Pulse Communication: Ideal Sampling, Pulse Amplitude Modulation, Pulse Width Modulation, Pulse Position Modulation. **Digital Communication Techniques:** Quantization, Digital Transmission of Data, Parallel and Serial Transmission, Data Conversion, Pulse Code Modulation, Delta Modulation.	9
Unit – 4	
Noise in analog modulation: Introduction, Receiver Model, Noise in DSB-SC receivers, Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.	10
Unit – 5	
Transmission of Binary Data in Communication Systems: Digital Codes, Principles of Digital Transmission, Transmission Efficiency, Modem Concepts and Methods – FSK, BPSK, Error Detection and Correction	10
Course Outcomes: The student will be able to 1. Analyze the performance of analog modulation schemes in time and frequency domains. 2. Analyze the performance of angle modulated signals. 3. Characterize analog signals in time domain as random processes and noise 4. Characterize the influence of channel on analog modulated signals 5. Determine the performance of analog communication systems in terms of SNR 6. Analyze pulse amplitude modulation, pulse position modulation, pulse code modulation and TDM systems	
Text Books: 1. Principles of Communication Systems – H Taub& D. Schilling, GautamSahe,	

TMH, 2007, 3rdEdition. 2. Communication Systems – B.P. Lathi, BS Publication,2006.
Reference Books: 1. Principles of Communication Systems - Simon Haykin, John Wiley,2ndEdition. 2. Electronics & Communication System – George Kennedy and Bernard Davis, TMH 2004. 3. Communication Systems– R.P. Singh, SP Sapre, Second Edition TMH,2007.

<table>
<tr><td colspan="5" align="center">DATA COMMUNICATIONS

(Open Elective)</td></tr>
<tr><td>Subject Code</td><td colspan="2" align="center">18XXETOXXXX</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td colspan="2" align="center">03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td colspan="2" align="center">48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td>Pre-requisite</td><td colspan="2" align="center">Communication</td><td colspan="2">Credits – 03</td></tr>
<tr><td colspan="5">Course Objectives:

This course will enable students to

1. Understand the concept of data communications and network connection.
2. Explain the operation of data link layer and network layer.

3. Understand the operation of transport layer and IP.

4. Explain the application layer and Principles of Networking Applications.</td></tr>
<tr><td colspan="4">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="4">Introduction to Data Communications: Components, Data Representation, Data Flow, Networks Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite, Addressing Introduction, Wireless Links and Network Characteristics, WiFi: 802.11 Wireless LANs -The 802.11 Architecture,</td><td>10</td></tr>
<tr><td colspan="4">Unit -2</td><td></td></tr>
</table>

Data Link Layer: Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame.	10
Unit -3	
The Network Layer: Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane. **The Internet Protocol(IP):** Forwarding and Addressing in the Internet Datagram format, Ipv4 Addressing, Internet Control Message Protocol(ICMP), IPv6	9
Unit – 4	
Transport Layer: Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N(GBN), Selective Repeat(SR), Connection Oriented **Transport:** TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control	10

Unit – 5	
Application Layer: Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.	9

Course Outcomes:

1. Know the Categories and functions of various Data Communication Networks
2. Design and analyze various error detection techniques.
3. Demonstrate the mechanism of routing the data in network layer
4. Know the significance of various Flow control and Congestion control Mechanisms

Text Books:

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6thEdition , Pearson,2017.
2. Data Communications and Networking Behrouz A.Forouzan4th Edition McGraw Hill Education,2017.

Reference Books:

1. Data communication and Networks - Bhusan Trivedi, Oxford university press, 2016
2. Computer Networks -- Andrew S Tanenbaum, 4th Edition, Pearson Education, 2003.
3. Understanding Communications and Networks, 3 rd Edition, W.A.Shay, Cengage Learning, 2003.

<table>
<tr><td colspan="5" align="center">DIGITAL LOGIC DESIGN

(Open Elective)</td></tr>
<tr><td>Subject Code</td><td colspan="2">18XXETOXXXX</td><td>Internal Marks</td><td>30</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td colspan="2">03</td><td>External Marks</td><td>70</td></tr>
<tr><td>Total Number of Lecture Hours</td><td colspan="2">48</td><td>Exam Hours</td><td>03</td></tr>
<tr><td>Pre-requisite</td><td colspan="2"></td><td colspan="2">Credits – 03</td></tr>
<tr><td colspan="5">Course Objectives:

This course will enable students to

1. Understand the number system and codes.
2. Explain the minimization techniques with four variables and single function.
3. Understand the logic circuits design using MSI and LSI

4. Explain the operation of sequential and combinational circuit design.</td></tr>
<tr><td colspan="4">Unit -1</td><td>Hours</td></tr>
<tr><td colspan="4">REVIEW OF NUMBER SYSTEMS & CODES: Representation of numbers of different radix, conversation from one radix to another radix, r-1’s compliments and r’s compliments of signed members, Gray code ,4 bit codes; BCD, Excess-3, 2421, 84-2-1 code etc. Error detection & correction codes: parity checking, even parity, odd parity, Hamming code. BOOLEAN THEOREMS AND LOGIC OPERATIONS: Boolean theorems, principle of complementation & duality, De-Morgan theorems, Logic operations; Basic logic operations -NOT, OR, AND, Universal Logic operations, EX-OR, EX- NOR operations. Standard SOP and POS Forms, NAND-NAND and NOR-NOR realizations, Realization of three level logic circuits. Study the pin diagram and obtain truth table for the following relevant ICs 7400,7402,7404,7408,7432,7486.</td><td>9</td></tr>
<tr><td colspan="4">Unit -2</td><td></td></tr>
</table>

MINIMIZATION TECHNIQUES: Minimization and realization of switching functions using Boolean theorems, K-Map (up to 6 variables)and tabular method(Quine-mccluskey method) with only four variables and single function. COMBINATIONAL LOGIC CIRCUITS DESIGN: Design of Half adder, full adder, half subtractor, full subtractor, applications of full adders; 4-bit adder-subtractor circuit, BCD adder circuit, Excess 3 adder circuit and carry look-a-head adder circuit, Design code converts using Karnaugh method and draw the complete circuit diagrams.	10
Unit -3	
COMBINATIONAL LOGIC CIRCUITS DESIGN USING MSI &LSI : Design of encoder ,decoder, multiplexer and de-multiplexers, Implementation of higher order circuits using lower order circuits . Realization of Boolean functions using decoders and multiplexers, Design of Priority encoder, 4-bit digital comparator and seven segment decoder. . Study the relevant ICs pin diagrams and their functions 7442,7447,7485,74154. **INTRODUCTION OF PLD's :** PLDs: PROM, PAL, PLA -Basics structures, realization of Boolean functions, Programming table.	10
Unit – 4	
SEQUENTIAL CIRCUITS I: Classification of sequential circuits (synchronous and asynchronous) , operation of NAND & NOR Latches and flip-flops; truth tables and excitation tables of RS flip-flop, JK flip-flop, T flip-flop, D flip-flop with reset and clear terminals. Conversion from one flip-flop to another flip- flop, Design of 5ripple counters, design of synchronous counters, Johnson counter, ring counter. Design of registers - Buffer register, control buffer register, shift register, bi-directional shift register, universal shift, register, Study the following relevant ICs and their relevant functions 7474,7475,7476,7490,7493,74121.	10

Unit – 5	
SEQUENTIAL CIRCUITS II : Finite state machine; state diagrams, state tables, reduction of state tables. Analysis of clocked sequential circuits Mealy to Moore conversion and vice-versa, Realization of sequence generator, Design of Clocked Sequential Circuit to detect the given sequence (with overlapping or without overlapping)	9

Course Outcomes:

The student will be able to

1. Classify different number systems and apply to generate various codes.
2. Use the concept of Boolean algebra in minimization of switching functions
3. Design different types of combinational logic circuits.
4. Apply knowledge of flip-flops in designing of Registers and counters
5. The operation and design methodology for synchronous sequential circuits and algorithmic state machines
6. Produce innovative designs by modifying the traditional design techniques

Text Books:

1. Switching and finite automata theory Zvi.KOHAVI, Niraj.K. Jha 3rdEdition, Cambridge UniversityPress,2009
2. Digital Design by M.Morris Mano, Michael D Ciletti,4th edition PHIpublication,2008
3. Switching theory and logic design by Hill and Peterson, Mc-Graw Hill TMH edition, 2012.

Reference Books:

1. Fundamentals of Logic Design by Charles H.RothJr,JaicoPublishers,2006
2. Digital electronics by R S Sedha.S.Chand&companylimited,2010
3. Switching Theory and Logic Design by A.Anand Kumar,PHILearningpvtltd,2016.
4. Digital logic applications and design by John M Yarbough,Cengagelearning,2006.
5. TTL74-Seriesdatabook.

REMOTE SENSING AND GIS

(Open Elective)

Subject Code	18XXETOXXXX	**Internal Marks**	30
Number of Lecture Hours/Week	03	**External Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Pre-requisite		Credits – 03	

Course Objectives:

This course will enable students to

1. Understand the concept of photogrammetry and its significance.
2. Explain the basic concept of remote sensing and limitations.
3. Understand the vector data model and topology rules.
4. Explain the raster data model , elements and importance of source map and data editing

Unit -1	**Hours**
Introduction to Photogrammetry: Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.	09
Unit -2	
Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electromagnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map	10

and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.	
Unit -3	
Remote Sensing: Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. **Electromagnetic Spectrum**, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False color composite, introduction to digital data, elements of visual interpretation techniques.	10
Unit – 4	
Vector Data Model: Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules	10
Unit – 5	
Raster Data Model: Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data. Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing	09

Course Outcomes:

The student will be able to

1. Retrieve the information content of remotely sensed data
2. Analyze the energy interactions in the atmosphere and earth surface features
3. Interpret the images for preparation of thematic maps
4. Apply problem specific remote sensing data for engineering applications
5. Analyze spatial and attribute data for solving spatial problems
6. Create GIS and cartographic outputs for presentation

Text Books:

1. Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.

2. Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.

3. Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

Reference Books:

1. Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications. 2. Principals of Geo physical Information Systems – Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004.

3. Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications

Open Elective

Courses Offered by EEE

To other Departments

Open Electives offered by EEE department

S. No	Subject Code	Subject title
1	18XXEEOM0XA	Control system design
2	18XXEEOM0XB	Optimization techniques
3	18XXEEOM0XC	Electrical Energy Conservation And Auditing
4	18XXEEOM0XD	Electrical and Hybrid Vehicles
5	18XXEEOM0XE	Intelligent control & its applications
6	18XXEEOM0XF	Electrical materials
7	18XXEEOM0XG	Industrial Electrical Systems
8	18XXEEOM0XH	Advanced Control Systems

CONTROL SYSTEM DESIGN (Open Elective)			
Subject Code	18XXEEOM0XA	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable student to

1. Explain the concepts of design problem and various design specifications.
2. Discuss the design of compensator for both time and frequencydomain specifications.
3. Explain the design of various controllers.
4. Understand the concept on feed-forward control.
5. Apply the knowledge of design using statespace
6. Understand the methods of solving Non-linear system of equations.

Unit 1: Design Specifications	**Hours**
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.	**10**
Unit 2: Design of Classical Control System in the time domain and Frequency domain	**10**
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.	
Unit 3: Design of PID controllers	**09**
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.	
Unit 4: Control System Design in state space	**10**
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. Full order, Reduced order observer. Separation Principle.	
Unit 5: Design of control for Non LinearSystems	**09**
Introduction, Methods of solving Non-linear systems of equations. Pseudo- composition, weight function procedure, Technique for extending scalar methods to the multidimensional case in a nontrivial way	

Course outcomes:

On completion of the course student will be able to:

1. Elaborate the concepts of various designing fundamentals.
2. Apply the basic design in both time and frequency domain
3. Understand the concepts of PID controllers
4. Apply the knowledge of design using state space
5. Illustrate the basic concepts of nonlinearities and their performance
6. Discuss the concepts of singular points and performance of system

Text Books: 1. N.Nise,“ControlsystemEngineering”,JohnWiley,2000. 2. I.J.NagrathandM.Gopal,“Controlsystemengineering”,Wiley,2000. 3. M.Gopal,“DigitalControlEngineering”,WileyEastern,1988. 4. K.Ogata,“ModernControlEngineering”,PrenticeHall,2010.
Reference Books: 1. B. C. Kuo, “ Automatic Control system”, PrenticeHall,1995. 2. J. J. D’Azzo and C. H. Houpis, “ Linear control system analysis anddesign (conventional and modern)” , McGrawHill,1995. 3. R. T. Stefani and G. H. Hostettler, “Design of feedback Control Systems”, Saunders CollegePub,1994.

OPTIMIZATION TECHNIQUES Open Elective			
Subject Code	18XXEEOM0XB	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits -3			

Course Objectives:

This course will enable student to:

1. Explain the objective and constraint functions in terms of design variables, and then state the optimization problem.
2. Solve single variable and multi variable optimization problems with and without constraints.
3. Explain linear programming technique to an optimization problem, slack and surplus variables, by using Simplex method.
4. Explain nonlinear programming techniques, unconstrained or constrained, and define exterior and interior penalty functions for optimization problems.
5. Discuss evolutionary programming techniques.

Unit 1: Introduction	**Hours**
Statement of an Optimization problem, design vector, design constraints, constraint surface, objective function, objective function surfaces, classification of Optimization problems.	**09**
Unit 2: Classical Optimization Techniques	**10**

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, multivariableOptimizationwithinequalityconstraints,Kuhn,Tuckerconditions.	
Unit 3: Linear Programming	**09**
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.	
Unit 4: 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.	**10**
Unit 5: Introduction to Evolutionary Methods	**10**
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.	
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 and non-gradient methods to nonlinear optimization problems.
5. Apply interior or exterior penalty functions for the constraints to derive the optimal solutions.
6. Able to apply Genetic algorithms for simple electrical problems.

Text Books:

1. "Engineering optimization: Theory and practice"-by S. S.Rao, NewAge 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, 3rd edition,1996.
2. Genetic Algorithms in search, optimization, and Machine Learning by DaviE.Goldberg, ISBN:978-81-7758-829-3, Pearsonby Dorling Kindersley (India) PvtLtd.
3. "Operations Research: An Introduction" by H.A.Taha, PHI Pvt. Ltd., 6thedition.
4. Linear Programming byG.Hadley.

ELECTRICAL ENERGY CONSERVATION AND AUDITING (Open Elective)			
Subject Code	18XXEEOM0XC	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits-03			

Course Objectives:

This course enable student to:

1. Explain energy efficiency, scope, conservation and technologies.
2. Discuss energy efficient lighting systems.
3. Calculate power factor of systems and propose suitable compensation techniques.
4. Explain the working of energy instruments.
5. Discuss energy conservation in HVAC systems.
6. Calculate life cycle costing analysis and return on investment on energy efficient technologies.

Unit 1: Basic Principles of Energy Audit and International Acts on Energy	Hours

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 – Indian energy scenario and consumption, energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, National action plan on climate change Energy and environment, air pollution, climate change United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties	**10**
Unit 2: Energy conservation opportunities in lighting	
Modification of existing systems – Replacement of existing systems – Priorities Definition of terms and units – Luminous efficiency –Luminance or brightness – Types of lamps – Types of lighting – Electric lighting fittings (luminaries) – Flood lighting – White light LED and conducting Polymers –Energy conservation measures, lighting energy audit,case studies.	**10**
Unit 3: Power Factor and energy instruments	
Power factor – Methods of improvement – Location of capacitors – Power factor with nonlinear loads – Effect of harmonics on Power factor – Numerical problems Energy Instruments – Watt–hour meter – Data loggers –Thermocouples– Pyrometers – Lux meters – Tong testers – Power analyzer.	**09**
Unit 4: HVAC Systems and ECBC	
Heating, ventilation, air conditioning (HVAC), fenestrations Energy Conservation Building Codes (ECBC), building envelope, insulation, lighting, water pumping, inverter and energy storage/captive generation, elevators and escalators, star labeling for existing buildings, Energy Service Companies based case studies.	**09**

Unit 5: Energy Efficient Motors and Financial Aspects of Conservation Technologies Energy Efficient motors Design, construction, Gorilla fan case study(Additional practical topic) Understanding energy cost, Economics Analysis – Depreciation Methods – Time value of money – Rate of return – Present worth method – Replacement analysis – Life cycle costing analysis – – 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.	**10**

Course outcomes:

On completion of the course student will be able to:

1. Explain energy efficiency, conservation and various technologies
2. Design energy efficient lighting system
3. Calculate power factor of systems and propose suitable compensation techniques
4. Explain the working of Energy Instruments.
5. Explain energy conservation techniques in HVAC Systems
6. Calculate life cycle costing analysis and return on investment on energy efficiency technologies.

Text Books:

1. Hand Book of Energy Audit by Sonal Desai- Tata McGrawhill
2. Energy efficient electric motors by John .C. Andreas, Marcel Dekker Inc. Ltd–2nd edition, 1995

Reference Books:

1. Energy management by W.R. Murphy & G. Mckay Butter worth, Elsevier publications.2012

2. Electric Energy Utilization and Conservation by S C Tripathy, Tata McGraw hill publishing company Ltd. NewDelhi.

3. Energy management by Paul o' Callaghan, Mc–Graw Hill Book company– 1st edition, 1998.

4. Energy management hand book by W.C.Turner, John wileyandsons.

5. Energy management and conservation –k v Sharma and pvenkataseshaiah-I K International Publishing Housepvt.ltd,2011.

6. http://www.energymanagertraining.com/download/Gazette_of_IndiaPartIISecI- 37_25-08- 2010.pdf

ELECTRICAL AND HYBRID VEHICLES (Open Elective)			
Subject Code	18XXEEOM0XD	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits-03			

Course Objectives:

This course will enable student to:

1. Explain working of hybrid and electric vehicles, its performance and characteristics.
2. Discuss hybrid vehicle configuration and its components.
3. Explain electric vehicle drive systems.
4. Discuss the properties of energy storage systems.
5. Compare different Energy management strategies

Unit 1: Introduction	**Hours**
Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and 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.	**10**
Unit 2: Hybrid Electric Drive Trains	**10**

Architecture of Hybrid Electric Vehicles (HEV), analysis of drive trains, energy use in conventional vehicles, energy saving potential of hybrid drive trains, various HEV configurations and their operation model. Power flow in HEV: Power flow control in series, parallel, series-parallel hybrid system. Torque and Speed coupling.	
Unit 3: Electric Drive Trains	**09**
Architecture of electric drive train, electric vehicle configuration, electric drive trains, EV power source configurations. Single and Multi-Motor drives, In wheel drives, requirements of different electric motors used in EVs, Power-Torque-Speed characteristics, electric propulsion systems.	
Unit 4: 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.	**09**
Unit 5: Energy Management Strategies	**10**
Introduction to energy management strategies used in hybrid and electric vehicles, classification, comparison of different energy management strategies, implementation issues of energy management strategies. Functions of control system in HEVs & EVs, Elementary control theory, Electronic control unit, control area network, control variables, classifications of Hybrid electronic control unit, fuzzy logic based control system	
Course outcomes: On completion of the course student will be able to:	

1. Illustrate the working of hybrid and electric vehicles, its performance and characteristics. 2. Analyze hybrid vehicle configuration and its components. 3. Discuss electric vehicle drive systems. 4. Illustrate electric propulsion systems. 5. Infer the properties of energy storage systems. 6. Distinguish different energy management strategies.
Question paper pattern: The question paper will have 10questions. 1. Each full question carries 14marks. 2. 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. Gay and A. Emadi, "Modern Electric,HybridElectric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design", CRC Press, 2004. 2. T. Denton, "Electric and Hybrid Vehicles", Routledge,2016.

INTELLIGENT CONTROL & ITS APPLICATIONS (Open Elective)			
Subject Code	18XXEEOM0XE	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable student to:

1. Explain the basic intelligent controller concepts
2. Understand concepts of feed forward neural networks and learning and understanding of feedback neural networks.
3. Discuss the concept of genetic algorithm.
4. Understand the basic 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	**Hours**
Introduction and motivation. Approaches to intelligent control. Architecture for intelligent control. Symbolic reasoning system, rule-based systems, the AI approach. Knowledge representation, Expert systems.	**09**
Unit 2: Artificial Neural Networks	**10**

Concept of Artificial Neural Networks, its basic mathematical model, McCulloch- Pitts neuron model, simple perception, Adeline and Madeline, Feed-forward Multilayer Perception. Learning and Training the neural network. Introduction, derivation, algorithm, flowchart, limitation-Error Back propagation, Hopfield, Radial bases function	
Unit 3: Genetic Algorithm	**10**
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 tab search and ant-colony search techniques for solving optimization problems	
Unit 4: Fuzzy Logic System	**10**
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.	
Unit 5: Applications	**09**
Aerospace and data mining applications of Genetic Algorithm - Neural Network and Fuzzy Logic Control applications in Smart grid, Electric drives and Distributed generation.	

Course outcomes:

On completion of the course student will be able to :

1. Infer representations applied to artificial intelligence techniques
2. Illustrate the use of artificial neuron in perceptron models and back propagation algorithm to multilayer feed forward networks
3. Develop rule based and decision making with the use of classical and fuzzylogic systems
4. Analyze the concept of geneticalgorithm.
5. Analyze the fuzzy logic controller using MATLAB.
6. Discover various applications of neural and fuzzy logic systems inelectrical Engineering

Text Books:

1. Simon Haykins, Neural Networks: A comprehensive Foundation, Pearson Edition,2003.
2. T.J. Ross, Fuzzy logic with Fuzzy Applications, McGraw Hill Inc,1997.
3. David E Goldberg, Genetic Algorithms. Wesley PublishingCompany,1989
4. John Yen and Reza Langari, Fuzzy logic Intelligence, Control, and Information, Pearson Education, Indian Edition,2003.
5. Neural Network, Fuzzy Logic and Genetic Algorithm : Synthesis and Applications.

   Rajasekaran and G. A. VijayalakshmiPai (Prentice Hall India, 2010)

Reference Books:

1. M.T. Hagan, H. B. Demuth and M. Beale, Neural Network Design, Indian reprint,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 ChengyingXu, Intelligent System, Modeling, Optimization and Control, CRC Press,2009.
5. N. K. Sinha and Madan M Gupta, Soft computing & Intelligent Systems, Theory &Applications, Indian Edition, Elsevier,2007.
6. WitoldPedrycz, Fuzzy Control and Fuzzy Systems, Overseas Press, Indian Edition,2008.

ELECTRICAL MATERIALS (Open Elective)			
Subject Code	18XXEEOM0XF	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	45	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable student to:

1. Describe the formation and properties of conducting material.
2. Explain the formation and properties of Semiconductor Materials.
3. Infer the formation and properties of Dielectric Materials.
4. Explain the formation and properties of Magnetic Materials.
5. Describe the formation and properties of Special Purpose Materials.

Unit 1: Conducting Materials	**Hours**
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.	**10**
Unit 2: Semiconductor Materials	**09**
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.	
Unit 3: Dielectric Materials	**10**
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.	
Unit 4: Magnetic Materials	**10**
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	
Unit 5: Materials for Electrical Applications & Special Purpose Materials	**10**
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	

Course outcomes:

On completion of the course student will be able to:

1. Understand various types of conducting, their properties in various conditions.
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 and applications.

6. Able to test Transformer oil as per standard.

Text Books:

1. R K Rajput", " A course in Electrical Engineering Materials", Laxmi Publications, 2009
2. "T K Basak", " A course in Electrical Engineering Materials", New Age Science Publications 2009

Reference Books:

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", DhanpatRai& Sons, 2011.

INDUSTRIAL ELECTRICAL SYSTEMS (Open Elective)			
Subject Code	18XXEEOM0XG	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits – 03			

Course Objectives:

This course will enable student to:

Explain Tariff structure and protection components.
Compare various types wiring systems and IE rules.
Describe the Illumination technology.
Compare various types of cables.
Discuss on PLC applications.
Explain the implementation of SCADA for various applications.

Unit 1: Electrical System Components	**Hours**
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) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices	**10**
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.	**10**
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, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.	**10**

Unit 4: Industrial Electrical Systems	**10**
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. DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.	
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.	

Course outcomes:

On completion of the course student will be able to:

Illustrate Tariff structure and protection components.
Discuss various types wiring systems and IE rules.
Explain the Illumination technology.
Distinguish various types of cables.
Discover PLC applications.
Choose various applications to implement SCADA.

Text Books:

S. L. Uppal and G. C. Garg, “ Electrical Wiring, Estimating & Costing”, Khannapublishers,2008.
K. B. Raina, “Electrical Design, Estimating & Costing”, New age International,2007.
S. Singh and R. D. Singh, “Electrical estimating and costing”,DhanpatRai and Co.,1997.

Reference Books:

Web site for IS Standards.

H. Joshi, “Residential Commercial and Industrial Systems”, McGrawHill Education,2008.

ADVANCED CONTROL SYSTEMS (Open Elective)			
Subject Code	18XXEEOM0XH	**IA Marks**	30
Number of Lecture Hours/week	03	**Exam Marks**	70
Total Number of Lecture Hours	48	**Exam Hours**	03
Credits -03			

Course Objectives:

The objectives of this course is to acquire knowledge on

1. formulation of different models using state space analysis
2. analysis of state feedback control through pole placement technique.
3. analysis of a nonlinear system using Lypanov's method of stability
4. formulation of Euler Lagrange equation to optimize typical functional and solutions.
5. optimal controller design using LQG framework

Unit 1: State Space Analysis	**Hours**
State Space Representation –Solution of state equation –State transition matrix, –Canonical forms –Controllable canonical form –Observable canonical form, Jordan Canonical Form.	**09**
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.	**10**
Unit 3: Describing Function and Stability Analysis	**10**

Introduction to nonlinear systems, Types of nonlinearities, describing functions, Introduction to phase–plane 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.	
Unit 4: Calculus of variations	**09**
Minimization of functional of single function –Constrained minimization –Minimum principle –Control variable inequality constraints –Control and state variable inequality constraints –Euler lagrangine equation	
Unit 5: Optimal Control Design	**10**
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.	

Course outcomes:

1. Able to design the state space model of control system and formulate different state models
2. Able to design of control system using the pole placement technique
3. Able to analyse of nonlinear system using the describing function technique and phase plane analysis.
4. Able to analysis the stability analysis using lypnov method.
5. Able to minimize the function using calculus of variation studied.
6. Able to design optimal controller using LQG framework.

Text Books:

1. Modern Control Engineering by K. Ogata, Prentice Hall of India, 3rd edition, 1998.
2. Automatic Control Systems by B.C. Kuo, Prentice Hall Publication

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 McGraw–Hill Companies, 1997

OPEN ELECTIVES OFFERED
BY IT
to other Departments

S. No.	Subject Code	Subject
1.	18XXITOXXXA	Block Chain
2.	18XXITOXXXB	Data Structures
3.	18XXITOXXXC	Designing Database Management Systems
4.	18XXITOXXXD	Operating Systems
5.	18XXITOXXXE	R Programming
6.	18XXITOXXXF	Python Programming
7.	18XXITOXXXG	Java Programming
8.	18XXITOXXXH	Web Technologies
9.	18XXITOXXXI	Artificial Intelligence
10.	18XXITOXXXJ	Computer Graphics

BLOCK CHAIN			
Subject Code	18XXITOXXXA	**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, permissioned 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, hashcash PoW, 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 use cases, 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	
Hyper ledger fabric- architecture, identities and policies, membership and access control, channels, transaction validation, writing smart contract using Hyper ledger 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.

DATA STRUCTURES			
Subject Code	18XXITOXXXB	**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 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. Array: Representation of arrays, Applications of arrays, sparse matrix and its representation	**10**
Unit -2 :Stack and Queue	
Stack: Stack-Definitions & Concepts, Operations On Stacks, Applications of Stacks, Polish Expression, Reverse Polish Expression and their Compilation, Recursion. Queue: Representation Of Queue, Operations On Queue, Circular Queue, Applications of Queue.	**10**
Unit – 3: LINKED LIST	
Linked List: Singly Linked List, Doubly Linked list, Circular linked list ,Linked implementation of Stack, Linked implementation of Queue, Applications of linked list.	**08**
Unit – 4:NONLINEAR DATA STRUCTURE	

Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Binary search trees, Conversion of General Trees To Binary Trees, Applications of Trees.	**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	Data Structures using C -By Reema Thareja - OXFORD Higher Publication
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	Analyze algorithms' time and space complexity and justify the correctness.
CO2	Implement Stack and Queue ADT.
CO3	Implement Linked List ADT.
CO4	Implement Binary Tree ADT and traversal algorithms.
CO5	Implement Searching and sorting algorithms.

DESIGNING DATABASE MANAGEMENT SYSTEMS			
Subject Code	18XXITOXXXC	**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	**Hours**
Introduction to Databases: Characteristics of the Database Approach, Advantages of using the DBMS Approach, A Brief History of Database Applications. Overview of Database Languages and Architectures: Data Models, Schemas and Instances, Three-Schema Architecture and Data Independence, Database Users , Architecture for DBMS.	**10**
Unit -2 : E-R Models	
The E-R Models, The Relational Model, 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.	**10**
Unit - 3: Relational Algebra	
Relational Algebra, Selection and Projection, Set Operation, Renaming, Joins, Division, More Examples of Queries, Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus. 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 - 4: 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).	**08**
Unit - 5: Transaction Management	
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.	**12**

Text(T) / Reference(R) Books:	
T1	roduction to Database Systems, CJDate ,Pearson.
T2	Database Management Systems,3rd Edition , Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill.
T3	tabase Systems-The Complete Book, H GMolina,J DUllman,J WidomPearson.
T4	tabase Management Systems,6/e Ramez Elmasri, Shamkant B. Navathe, PEA
R1	tabaseSystemsdesign,Implementation,andManagement,7th Edition,PeterRob&Carl osCoronel
R2	tabase System Concepts, 5th edition, Silberschatz, Korth, TMH
R3	The Database Book Principles & Practice Using Oracle/MySQL, Narain Gehani, University Press.

W 1	https://onlinecourses.nptel.ac.in/noc18_cs15/preview
W 2	https://www.coursera.org/courses?query=database

Course Outcomes: On completion of this course, students can	
CO1	Recognize the basic elements of a relational database management system.
CO2	Design entity relationship and convert entity relationship diagrams into RDBMS.
CO3	Design relational algebra and calculus to create, maintain, and manipulate a relational database using SQL.
CO4	Implement normalization techniques for logical schema models.
CO5	Estimate concurrent issues and problems through locking mechanism.

OPERATING SYSTEMS			
Subject Code	18XXITOXXXD	**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.	**10**
Unit -2 :System Calls & IPC	
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	**10**
Unit - 3: 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 - 4:Memory Management & Dead lock	
System model, Deadlock characterization, Methods for handling deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock detection, Recovery from deadlock. Storage Management: Swapping, Contiguous memory allocation, Paging,	**10**

Segmentation Virtual Memory Background, Demand paging, copy on write, Page replacement and various Page replacement algorithms, Allocation of frames, Thrashing.	
Unit - 5:I/O Systems	
File concept, Access methods, Directory structure, Filesystem mounting, Protection, Directory implementation, Allocation methods, Free-space management, Disk scheduling, Disk management, Swap-space management, Protection.	**10**

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	Demonstrate the evolution of Computer System organization and Operating system services.
CO2	Design solutions for process synchronization problems by using System calls and Inter process communication.
CO3	Identify the functionality involved in process management concepts like scheduling and synchronization.
CO4	Design models for handling deadlock and perform memory management.
CO5	Analyze services of I/O subsystems and mechanisms of security & protection.

R PROGRAMMING			
Subject Code	18XXITOXXXE	**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 Nonvector 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 /out put, Accessing the Keyboard and Monitor, Reading and writer Files	**10**
Unit – 4: Graphics	
Creating Graphs, The Workhorse of R Base Graphics, the plot() Function –	**10**

Customizing Graphs, Saving Graphs to Files, Probability Distributions, Normal Distribution- Binomial Distribution- Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,-ANOVA.	
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	Identify the data types in R Programming Language.
CO2	Implement the control and functions with recursion and without recursion.
CO3	Implement the statistical and probabilistic functions to review, manipulate and summarize data-sets in R

CO4	Perform appropriate statistical tests using R Create and edit visualizations
CO5	Interpret data-sets to create testable hypotheses and identify appropriate statistical tests

PYTHON PROGRAMMING			
Subject Code	18XXITOXXXF	**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	**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	Describe the basic elements of Python Programming Language
CO2	Apply various operators and Control statements to solve the real world problems

CO3	Implement modularity and reusability by using functions
CO4	Employ Various OOPS Concepts for real world applications
CO5	Use Standard Libraries to develop applications

JAVA PROGRAMMING			
Subject Code	18XXITOXXXG	**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, nested classes.	**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	**10**

and writing data to files, random access file.	
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	Describe OOP principles, and basic structure of a Java program
CO2	Implement reference data type like class and arrays
CO3	Demonstrate inheritance, user defined packages and exception handling.
CO4	Design the applications with Interprocess Communication using multithreading.
CO5	Demonstrate the applications using GUI elements and event handling.

WEB TECHNOLOGIES			
Subject Code	18XXITOXXXH	**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: HTML	**Hours**
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 BoxModel, Conflict Resolution	**10**
Unit -2: Java Script	
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	**10**
Unit -3 Bootstrap	
Gird basics, Bootstrap Text/Typography, Tables, Images, Jumbotron, Wells, Alerts, Button groups, Glyphicons, Progress Bars, List Groups, Panels, Dropdowns, Tabs and Pills, Navigation Bar, Forms, input sizing, Media Objects, Carousel Plugin, Popover Plugin, Scrollspy Plugin.	**10**

Unit –4: XML	
Working with XML: Document type Definition, XML schemas, Document object model, XSLT, DOM and SAX.	**08**
Unit -5: PHP	
PHP Programming: Introduction to PHP, Creating PHP script, Running PHP script. **Working with variables and constants:** Using variables, Using constants, Data types, Operators. **Controlling program flow:** Conditional statements, Control statements, Arrays, functions.	**12**

Text(T) / Reference(R) Books:	
T1	Programming the World Wide Web, 7th Edition, Robet W Sebesta, Pearson, 2013
T2	Web Technologies, 1st Edition 7th impression, Uttam K Roy, Oxford, 2012.
R1	Programming world wide web, Sebesta, Pearson
R2	An Introduction to web Design and Programming, Wang, Thomson
W1	https://www.edx.org/learn/web-development

Course Outcomes: On completion of this course, students can	
CO1	Design static webpages using HTML and CSS elements.
CO2	Design interactive webpages using Java Script

CO3	Design web responsive webpages suitable for multiple device user friendly view
CO4	Develop a webpages by the use of XML
CO5	Develop web applications using PHP

ARTIFICIAL INTELLIGENCE			
Subject Code	18XXITOXXXI	**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.	**10**
Unit – 3:Problem reduction, Game playing	
Problem Reduction: Introduction, Problem reduction using AO* algorithm, Towers of Hanoi problem, Matrix Multiplication problem game playing, alpha-beta pruning, two-player perfect information games.	**10**
Unit – 4: Logic Concepts & Knowledge Representation Techniques	
Logic Concepts: Introduction, propositional calculus, propositional logic, natural deduction system, axiomatic system, semantic tableau system in proportional logic, resolution refutation in proportional logic, predicate logic. Introduction to KR techniques, conceptual dependency theory, script structure, cyc theory, case grammars, semantic web.	**10**
Unit – 5: Expert systems and its 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.	**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
R4	AI: A Modern Approach, Stuart Russell and Peter Norvig, Additional Readings: Marr, Bishop, occasionally others
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	Describe the evolution of of AI and its working principles.
CO2	Estimate different kinds of heuristic search algorithms and get feasible solution

	for AI problems.
CO3	Classify optimized concepts of using various problem reduction techniques.
CO4	Express various Knowledge Representation (KR) techniques
CO5	Implement different kinds of Expert Systems.

COMPUTER GRAPHICS			
Subject Code	18XXITOXXXJ	**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: Application areas of computer graphics, overview of graphic system, video display devices, raster scan systems, random scan systems, graphics monitors and work stations, input devices.	10
Unit -2 :	
OUTPUT PRIMITIVES: Points and lines, line drawing algorithms, mid-point circle algorithm. **FILLED AREA PRIMITIVES:** scan-line polygon fill algorithm, boundary fill and flood fill algorithm.	10
Unit – 3:	
2-D GEOMETRICAL TRANSFORMATIONS: Translation, scaling, rotation, reflection and shear, transformation matrix representations and homogeneous co-ordinates, composite transformations, transformations between coordinates. **2-D VIEWING:** The viewing pipe-line, viewing coordinate reference frame, window to view-port co-ordinate transformations, viewing function, Cohen-Sutherland and Cyrus-beck line clipping algorithms.	12
Unit – 4:	

3-D GEOMETRIC TRANSFORMATIONS: Translation, rotation, scaling, reflection and shear transformation and composite transformations. **VISIBLE SURFACE DETECTION METHODS:** Classification, back-face detection, depth-buffer, scan-line, depth sorting.	10
Unit – 5:	
COMPUTER ANIMATION: Introduction to animation, Color models, Design of animation sequence, general computer animation functions, raster animation, computer animation language, key frame system, motion specification methods.	8

Text(T) / Reference(R) Books:	
T1	. Computer Graphics *C* version, Donald Hearn, M.Pauline Baker, Pearson
T2	Computer Graphics with Virtual Reality Systems, Rajesh K Maurya, Wiley
T3	Introduction to Computer Graphics, Using Java 2D and 3D, Frank Klawonn, Springer
T4	Computer Graphics, Steven Harrington, TMH
T5	Computer Graphics, Amarendra N Sinha, ArunUdai, TMH
R1	Computer Graphics Principles & practice, 2/e, Foley, VanDam, Feiner, Hughes, Pearson
R2	Computer Graphics, Peter, Shirley, CENGAGE
R3	Principles of Interactive Computer Graphics, Neuman , Sproul, TMH
R4	The Computer Graphics manual, Vol 2, David, Soloman, Springer
W2	Procedural elements for Computer Graphics, David F Rogers, 2/e, TMH

Course Outcomes: On completion of this course, students can	
CO1	Recognize the basic elements and applications of computer graphics.
CO2	Discuss various algorithms for basic output primitives
CO3	Use of geometric transformations on graphics objects.
CO4	Describe 3-D transformations and Visible Surface Detection techniques.
CO5	Interpret the layout of the animation steps and color models

Open Elective

Courses Offered by ME

To other Departments

Open Elective Courses Offered by Mechanical Engineering to other Departments

S. No.	Subject Code	Name of the subject	L	T	P	Cr
1.	18XXMEOX0XA	Operations Research	3	0	0	3
2.	18XXMEOX0XB	Fundamentals of Mechanical Engineering	3	0	0	3
3.	18XXMEOX0XC	Industrial Robotics	3	0	0	3
4.	18XXMEOX0XD	Engineering Materials	3	0	0	3
5.	18XXMEOX0XE	Introduction to Material Handling	3	0	0	3
6.	18XXMEOX0XF	Production Planning and Control	3	0	0	3
7.	18XXMEOX0XG	Non-Conventional Sources of Energy	3	0	0	3
8.	18XXMEOX0XH	Fluid Mechanics and Fluid Machinery	3	0	0	3

Operations Research SEMESTER - XX			
Subject Code	18XXMEOX0XA	**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:

Enable the students to

1. Understand the definition, scope, objectives, phases, models and limitations of operations research and developing the ability to formulate the linear programming problems for minimizing the project cost and maximizing its profit.
2. Solve linear programming problems using various techniques based on the constraints
3. Understand about different application areas of operations research like transportation problem, assignment model, sequencing models.
4. Suggest optimal sequence and replacement policy and economic order quantities to be maintained for better and economic growth of the industry.
5. Suggest optimal game strategies and estimation of waiting times in waiting line problems in the competitive business world.

Unit -1	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,	**10**

Graphical method of solving LPP.	
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, 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.	**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. **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.	**10**
Unit – 4	
Replacement: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement. **Inventory Control:** Introduction, Types of Inventories, Costs associated with inventories, the concept of EOQ, Deterministic inventory problems with no shortages, with shortage.	**10**
Unit – 5	

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]. **Game Theory**: Introduction, Two Person Zero sum games, Maximin - Minimax principle, Games without saddle points- mixed strategies, Graphical solution of 2Xn, mX2 games, and Dominance property, P-system, S-system, Q-system and Ss-system	**10**

Course outcomes:

1. Formulate and solve mathematical model (linear programming problem) for real situations like production and distribution of goods using basic linear programming techniques li graphical methods
2. Apply the concepts of linear programming for decision making like simplex and dual simplex algorithms in production industries.
3. Calculate the optimal values of cost, job distribution and placement using transportation, assignment and sequencing methods
4. Select the best optimal inventory and replacement time for the goods produced in an industry for its better and economic growth using inventory and replacement techniques.
5. Select the best optimal time and strategy to be followed by any organization to identify the waiting times and strategies to be implemented using waiting lines and game theory techniques for a continuous and successful growth of an industry.

TEXT BOOKS:

1. Operation Research /Premkumar Gupta, D.S.Hira / S.Chand
2. Operations Research / S.D.Sharma-KedarnathRamnath(JNTU)

REFERENCES:

1. Operations Research / R. Pannerselvam / PHI Publications.
2. Operation Research /J.K.Sharma/MacMilan.
3. Operation Research An Introduction / Taha / Pearson
4. Operations Research / A.M.Natarajan, P. Balasubramani, A. Tamilarasi / Pearson Education.

Question paper pattern:

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome

	(Internal Choice)
2.	All questions carries 14 marks each
3.	Each full question will have sub question covering all topics under a course outcome

Fundamentals of Mechanical Engineering

SEMESTER - XX

Subject Code	18XXMEOX0XB	**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:

Enable the students to

1. Understand the concepts of fluid properties like specific gravity, viscosity, density, surface tension
2. To study the classification of turbines and work done and efficiency of the different turbines and also study about draft tube theory and to determine the function efficiency.
3. To study about specific speed and performance characteristics of different types of turbines.
4. To study automobile engine working, valve timing and associated systems such as lubricating system, cooling system, fuel feed system, ignition system etc., their necessity, requirements, construction details, different types and their working
6. To study the construction, working principles and advantages of belt and rope drives, selection of belt drive- types of belt drives, V-belts, types of coupling.

Unit -1	**Hours**
Fluid Mechanics: Dimensions and units: physical properties of fluids- specific gravity, viscosity and its significance, surface tension, capillarity, and vapor pressure. Atmospheric gauge and vacuum pressure – Measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers.	**10**

Unit -2	
Impact of jets: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.	**10**
Unit – 3	
Hydraulic Turbines and Governing systems: Classification of turbines; Working principle, Efficiency calculation and Design principles for Pelton Wheel, Francis and for Kaplan turbines; Governing of turbines; Performance and characteristic curves..	**10**
Unit – 4	
I. C. Engines: Classification, working principles – valve and port timing diagrams – air standard cycles –fuel injection system, carburetion, ignition, cooling and lubrication – Engine performance evaluation. **Spark Ignition and Combustion Ignition engines** –Classification, working principles, Types of engines.	**10**
Unit – 5	
Belt drives: Introduction, Belt and rope drives, selection of belt drive- types of belt drives, V-belts, velocity ratio of belt drives, slip of belt, creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, **Coupling:** Brief introduction of coupling, Rigid couplings - muff, split muff and flange couplings, flexible couplings - flange coupling	**10**
Course outcomes: 1. Understand the concepts of fluid properties like specific gravity, viscosity, density, surface tension. 2. To study the classification of turbines and work done and efficiency of the different turbines and also study about draft tube theory and to determine the function efficiency.	

3. This study is also used for the estimation of efficiency and performance of the turbine with the study of characteristics curves.
4. To study automobile engine working, valve timing and associated systems such as lubricating system, cooling system, fuel feed system, ignition system etc., their necessity, requirements, construction details, different types and their working
5. To study the construction, working principles and advantages of belt and rope drives, selection of belt drive- types of belt drives, V-belts, types of coupling.

TEXT BOOKS:

1. Basic Mechanical Engineering / Pravin Kumar/ Pearson
2. Thermal Engineering-R.S Khurmi/JS Gupta/S.Chand.
3. Introduction to Engineering Materials / B.K. Agrawal/ McGraw Hill

REFERENCES:

1. Fundamental of Mechanical Engineering/ G.S. Sawhney/PHI
2. Thermal Science and Engineering / Dr. D.S. Kumar/ Kataria

Question paper pattern:

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

<table>
<tr><td colspan="4" align="center">Industrial Robotics</td></tr>
<tr><td align="center">Subject Code</td><td>18XXMEOX0XC</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 align="center">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:

Enable the students to

1. Understand various applications of robotics and classification of coordinate system and control systems
2. Build the concepts of components of industrial robotics.
3. Determine kinematic analysis with D-H notation, forward and inverse kinematics
4. Model trajectory planning for a manipulator by avoiding obstacles
5. Understand different types of actuators and importance of application of robots in manufacturing</td></tr>
</table>

Unit -1	Hours
Introduction: Automation and Robotics, CAD/CAM and Robotics – An overview of Robotics –present and future applications – classification by	10

coordinate system and control system.	
Unit -2	
Components of the Industrial Robotics: Function line diagram representation of robot arms, common types of arms. Components, Architecture, number of degrees of freedom – Requirements and challenges of end effectors, determination of the end effectors, comparison of Electric, Hydraulic and Pneumatic types of locomotion devices.	10
Unit – 3	
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.	10
Unit – 4	
Trajectory Planning: General considerations in path description and generation. Trajectory planning and avoidance of obstacles, path planning, Skew motion, joint integrated motion –straight line motion – Robot programming, languages and software packages-description of paths with a robot programming language.	10
Unit – 5	

Robot Actuators and Feed Back Components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. 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.	10

Course outcomes:

Understand various applications of robotics and classification of coordinate system and control systems
Build the concepts of components of industrial robotics.
Apply kinematic analysis with D-H notation, forward and inverse kinematics
Model trajectory planning for a manipulator by avoiding obstacles.
Understand different types of actuators and various applications of robots in manufacturing

TEXT BOOKS:

1.Industrial Robotics / Groover M P /Mc Graw Hill

2. Introduction to Robotics / John J. Craig/ Pearson

REFERENCES:

1.Introduction to Robotics/ Saeed B Niku / Wiely Publications.

Question paper pattern:

Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
All questions carries 14 marks each
Each full question will have sub question covering all topics under a course outcome

ENGINEERING MATERIALS

SEMESTER XX

Subject Code	18XXMEOX0XD	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:

1. Classify different bonds in solids and understand crystallization of the metals, for the formation of the solid solutions and compounds.
2. Understand different phase diagrams .
3. Recorgnize the property requirements of a given application and suggest a suitable ferrous and non ferrous metal and their alloys.
4. Illustrate the property requirements of a given application and suggest appropriate heat treatment
5. Identify the property requirements of a given application and suggest a suitable ceramics, composite materials
6. Identify the relationships between structure, composition and properties of different engineering materials.

Unit -1	Hours
Structure of Metals and Constitution of alloys: Bonds in Solids – Metallic bond - crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rothery's rules, intermediate alloy phases, and electron compounds. Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery.	**10**

Unit -2

Equilibrium Diagrams: Experimental methods of construction of equilibrium diagrams, Isomorpous alloy systems, equilibrium cooling and heating of alloys, lever rule, coring, miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys.	**8**
Unit - 3	
Ferrous & non-ferrous metals and their alloys Structure and properties of white cast iron, malleable cast iron, grey cast iron, spheroid graphite cast iron, alloy cast irons. Classification of steels, structure and properties of plain carbon steels, low alloy steels, Hadfield manganese steels, tool and die steels. Structure and properties of copper and its alloys, Aluminum and its alloys, Titanium and its alloys	**12**
Unit – 4	
Heat treatment of Alloys: Annealing, normalizing, hardening, TTT diagrams, tempering, hardenability, surface-hardening methods (carburizing, carbo-nitriding, cyaniding, induction hardening and flame hardening), age hardening treatment, and cryogenic treatment of alloys. vacuum and plasma hardening	**8**
Unit-5	
Ceramic and composite materials: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterial's – definition, properties and applications of the above. Classification of composites, various methods of component manufacture of composites, particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal – matrix composites and C – C composites.	**12**
Course outcomes: On completion of the course, student will be able to 1. Classify different bonds in solids and understand crystallization of the	

metals, for the formation of the solid solutions and compounds.
2. Different phase diagrams and study of binary phase diagrams
3. Recorgnize the property requirements of a given application and suggest suitable ferrous & non ferrous alloys
4. Analyze the property requirements of a given application and suggest appropriate heat treatment
5. Identified the property requirements of a given application and suggest a suitable ceramics, composite materials
6. Understand the relationships between structure, composition and properties of different engineering materials

Text Books:

1. Introduction to Physical Metallurgy - Sidney H. Avener - McGrawHill
2. Essential of Materials science and engineering - Donald R.Askeland – Thomson

Reference Books:

1. Material Science and Metallurgy – V.D.Kodgire and S.V.Kodgire
2. Materials Science and engineering - Callister & Baalasubrahmanyam
3. Material Science for Engineering students – Fischer – Elsevier Publishers.
4. Material science and Engineering - V. Rahghavan
5. Introduction to Material Science and Engineering – Yip-Wah Chung CRC Press.
6. Material Science and Metallurgy – A V K Suryanarayana – B S Publications.
7. Material Science and Metallurgy – U. C. Jindal – Pearson Publication

Web Source References:

1. https://www.iitm.ac.in/mmresearch
2. http://nptel.ac.in/courses/113106032/3
3. https://en.wikipedia.org/wiki/Materials_science

Question paper pattern:

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. All questions carries 14 marks each
3. Each full question will have sub question covering all topics under a course

outcome	

INTRODUCTION TO MATERIAL HANDLING SEMESTER - XX			
Subject Code	18XXMEOX0XE	**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:

Students should be able

1. To understand the classification of material handling equipment
2. To explain the usage of different material handling equipment in industry
3. To know how to connect loading stations to the different discharge conditions.
4. To explain the usage of cranes at industries
5. To explain the usage of hoists and monorails at industries

Unit -1	**Hours**
Introduction to materials handling, examples of materials equipment, examples of materials handling equipment, continuous conveying, intermittent conveying, examples, lifting, hoisting, handling of bulk goods and piece goods, cranes and conveyors, principles of calculation of conveying equipment, cycle time, bulk materials and bulk density, angle of repose, example for a belt conveyor and a simple hoist.	**10**
Unit -2	
Belt conveyors, constructional details, toughing angle, idlers, belt specifications, chutes, skirt boards, ploughs, belt conveyor layouts, belt trippers and typical examples, roller conveyors, overhead conveyors, apron conveyors, component parts and operational details and applications with	**10**

typical layouts.	
Unit – 3	
Unit materials handling and storage: Unit load concept (platform sheet industrial hand trucks, self contained unit load, palletless handling, introduction only), industrial hand trucks, powered industrial trucks, automated guided vehicles, basic storage and equipment system, Automated storage and retrieval systems (AS/RS), carosel storage system and its applications.	**10**
Unit – 4	
Cranes Jib cranes like wall mounted and travelling type, stability criteria, wheel loads, wheel trucks and bogeys, number of mechanisms in jib cranes, jib construction. Harbour cranes, luffing and level luffing cranes, shipyard gantry cranes,	**10**
Unit – 5	
Hoists and monorails Portal frames and slewing rings and bearings typical stability, calculations of portal cranes, types of hoists	**10**

Course outcomes:

1. Classify the material handling equipment
2. Explain the usage of different material handling equipment in industry
3. Discuss how to connect loading stations to the different discharge conditions
4. Associate the usage of cranes at industries
5. Associate the usage of hoists and monorails at industries

TEXT BOOKS

1. Material handling handbook, 2nd edition, ASME, 1985
2. Automation production systems and computer integrated manufacturing, Mikell P Groover, Prentice Hall of India, 2002.

REFERENCE BOOK

1. R.O. Bailey, "Bulk material handling by conveyor belt I and II" M.A. Al
2. Frutchbaum, " Bulk solids handling

Question paper pattern:

1. Question paper contains 12 Questions, 2 from each course outcome. The student must answer 6 full questions by selecting one question from each course outcome (Internal Choice)
2. CO1- CO5 questions carries 12 marks each
3. Each full question will have sub question covering all topics under a course outcome

PRODUCTION PLANNING AND CONTROL SEMESTER - XX			
Subject Code	118XXMEOX0XF	**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:

Enable the students to

1. Understand the concepts of production design concepts for production and service systems
2. Apply forecasting techniques for various firms, namely qualitative & quantitative methods to optimize/make best use of resources in achieving their objectives.
3. Identify different strategies employed in manufacturing and service industries to plan inventory
4. Apply different scheduling policies in planning and control and make best use of resources.
5. Measure the effectiveness, identify likely areas for improvement, develop and implement improved planning and control methods for production systems.

Unit -1	**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.	**10**
Unit -2	

Forecasting – importance of forecasting – types of forecasting, their uses – general principles of forecasting – forecasting techniques – qualitative methods and quantitative methods.	**10**
Unit – 3	
Inventory management – functions of inventories – relevant inventory costs – ABC analysis – VED analysis – EOQ models – Inventory control systems – P–Systems and Q-Systems **Material Management Techniques:** Introduction to MRP I, MRP II, ERP, LOB (Line of Balance), JIT and KANBAN system.	**12**
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	**10**
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.	**8**

Course outcomes:

On completion of this course, students will be be able to:

1. **Choose** the acceptable production planning and control system for designing and development of a product.
2. **Examine** the forecasts made in the manufacturing and service sectors by using selected quantitative and qualitative techniques.
3. **Categorize** the production systems based on the inventory principles and techniques to optimize/make best use of resources.

4. **Select and use** an appropriate principles/methods/ techniques/ modern concept with reference to given application/situation in the preparation of route sheets with scheduling and loading in manufacturing systems
5. **Illustrate** the role of a dispatching and follow-up necessary at various stages of manufacturing in an industry.

1.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Manufacturing, Planning and Control, Partik Jonsson Stig-Arne Mattsson, Tata Mc Graw Hill.
3. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran, GK Vijaya Raghavan & MS Balasundaram/WILEY India Edition

Reference Books:

1. Production Planning and Control, Mukhopadyay, PHI.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller/Prentice- Hall
3. Production Control A Quantitative Approach / John E. Biegel/Prentice-Hall

Question paper pattern:

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full questions by selecting one question from each course outcome (Internal Choice)
2. CO1- CO5 questions carries 14 marks each.
3. Each full question will have a sub question covering all topics under a course outcome.

<table>
<tr><td colspan="4" align="center">NON-CONVENTIONAL SOURCES OF ENERGY

SEMESTER-XX</td></tr>
<tr><td>Subject code</td><td>18XXMEOX0XG</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 No 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:

Enable the students to:

1. Understand the principles and working of solar and solar energy collection.
2. Apply the principles of solar energy storage, applications in generation of electric power.
3. Apply the knowledge of Wind energy and Biomass, in generation of electric power production.
4. Apply the Principles and working of Geothermal energy power plant, OTEC plants, tidal, wave energy and Mini hydel power plants in generation of the electric power
5. Apply the principles of direct energy conversion systems like Thermoelectric generators, MHD generators and fuel cells, in generation of electric power production

Unit-1	Hours
Principles of Solar Radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power - the solar constant, extra-terrestrial and terrestrial solar radiation, Solar radiation on titled surface, Instruments for measuring solar radiation and sun shine, solar radiation data. **Solar Energy Collection:** Flat plate and concentrating collectors, classification of concentrating collectors, advanced collectors..	**8**

Unit-2	
Solar Energy Storage and Applications: Different methods, sensible, latent heat and stratified storage, solar ponds. Solar applications - solar heating/cooling techniques, solar distillation and drying, photovoltaic energy conversion.	**6**
Unit-3	
Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria **Bio-Mass:** Principles of Bio-Conversion, Anaerobic /aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of biogas, utilization for cooking, I.C. Engine operation, and economic aspects.	**10**
Unit-4	
Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India. Ocean Energy – OTEC, Principles, utilization, setting of OTEC plants, thermodynamic cycles. **Tidal and Wave energy:** Potential and conversion techniques, mini-hydel power plants, their economics.	**10**
Unit-5	
Direct Energy Conversion: Need for DEC, Carnot cycle, limitations, Principles of DEC. Thermoelectric generators, Seebeck, Peltier and Joule Thompson effects, figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cells, principle, faraday's laws, thermodynamic aspects, selection of fuels and operating conditions.	**16**
Course outcomes:	

1. The student understands the principles and working of solar and solar energy collection.
2. The students apply the principles of solar energy storage, applications in power generation.
3. The students Apply the knowledge of Wind energy and Biomass, in generation of power
4. The students Apply the Principles and working of Geothermal energy power plant, OTEC plants, tidal, wave energy and Mini hydel power plants in generation of the electric power.
5. Apply the principles of direct energy conversion systems like Thermoelectric generators, MHD generators and fuel cells, in generation of electric power.

Text books:

1. Renewable Energy Resources / Tiwari and Ghosal / Narosa
2. Non- conventional Energy Sources / G.D. Rai/ Khanna Publishers
3. Biological Energy Resources/ Malcolm Fleischer & Chris Lawis/ E&FN Spon

Reference books:

1. Renewable Energy Sources / Twidell& Weir
2. Solar Power Engineering / B.S. Magal Frank Kreith& J.F. Kreith
3. Principles of Solar Energy / Frank Krieth& John F Kreider
4. Non-Conventional Energy / Ashok V Desai / Wiley Eastern

Question paper pattern:

1. Question paper contains 10 questions,2 from each course outcomes, the student must answer 5 full questions by selecting one question from each course outcome (Internal choice)
2. All question carries 14 marks each
3. Each full question will have sub question covering all topics under a course outcome

FLUID MECHANICS AND FLUID MACHINERY

SEMESTER -XX

Subject Code	18XXMEOX0XH	**Internal Marks**	30
Number of Lecture	3(L)	**External Marks**	70

Hours/Week			
Total Number of Lecture Hours	50	**Exam Hours**	03
Credits – 03			
1. Understand the fundamental properties of fluid and calculate fluid pressure using the manometer. 2. Apply the differential conservation equations of mass, momentum, and energy to fluid flow problems. 3. Evaluate major and minor losses in pipes and also discuss boundary layer concepts. 4. Solve problems on the turbo machines like turbines using analytical method and velocity triangles. 5. Discuss the Classification and working principles of pumps and evaluate the performance of hydraulic machines.			

Unit -1	**Hours**
Fluids: Definition of fluid, Fluid properties, Atmospheric gauge and vacuum pressure – measurement of pressure. Manometers- Piezometer, U-tube, inverted and differential manometers. Pascal's law, hydrostatic law. Buoyancy, forces on submerged bodies, stability of floating bodies.	**10**
Unit -2	
Fluid Kinematics: Introduction, flow types. Equation of continuity for one dimensional flow. Stream line, path line and streak lines and stream tube. Stream function and velocity potential function. **Fluid Dynamics:** surface and body forces –Euler's and Bernoulli's equations for flow along a stream line, momentum equation and its applications, force on pipe bend.	**10**

Unit – 3	
Closed Conduit Flow: Reynold’s experiment- Darcy Weisbach equation, Minor losses in pipes- pipes in series and pipes in parallel- total energy line hydraulic gradient line. **Basics of Turbo Machinery:** Hydrodynamic force of jets on stationery and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.	**10**
Unit – 4	
Turbines: Hydraulic Turbines: classification of turbines, Working and efficiencies of Pelton wheel, Francis and Kaplan turbines. Importance of Draft Tube. **Hydraulic Quantities:** Unit and specific quantities, characteristic curves, governing of turbines, selection of type of turbine, cavitation, surge tank, water hammer.	**10**
Unit – 5	
Pumps: Centrifugal Pumps: Classification, working, work done – manometric head losses and efficiencies- specific speed- pumps in series and parallel performance characteristic curves, cavitation & NPSH. Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.	**10**

Course outcomes:

1.Demonstrate various properties of fluids, pressure measurement devices and their applications.

2.Identify the kinematics and dynamics properties of fluids flowing in different conditions and its effects on the bodies.

3.Estimate the effect of various losses in fluids due to flowing and obstructions and understand using the concepts of pipe losses and Boundary layer theory.

4. Analyze the performance of hydraulic turbines, units and specific quantities based on the design by applying the knowledge of turbomachinery using analytical methods and velocity triangles.

5. Analyze the performance of various hydraulic pumps based on workings and design.

TEXT BOOKS

1. Hydraulics, fluid mechanics and Hydraulic machinery Modi and Seth

2. Fluid Mechanics and Hydraulic Machines/ RK Bansal/Laxmi Publications (P) Ltd.

REFERENCE BOOKS

1. Fluid Mechanics and Hydraulic Machines by Rajput

2. Fluid Mechanics & Turbo machinery by Dixon, 7th Edn, Elesvier

3. Fluid Mechanics and Machinery by D. Rama Durgaiah, New Age International

4. Fluid Mechanics- Fundementals and Applications by Y.A. Cengel, J.M.Cimbala, 6th Edn, McGrawHill

5. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, Kotaria& Sons.

Question paper pattern:

1. Question paper contains 10 Questions, 2 from each course outcome. The student must answer 5 full Questions by selecting one question from each course outcome (Internal Choice)

2. All questions carries 14 marks each

3. Each full question will have sub question covering all topics under a course outcome